Revisions to the Steller Sea Lion Protection Measures for the Aleutian Islands Atka Mackerel and Pacific Cod Fisheries

Council Review Draft Environmental Assessment/Regulatory Impact Review

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Abstract: This environmental assessment/regulatory impact review (EA/RIR) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternatives to the Steller sea lion protections measures for the Aleutian Islands Atka mackerel and Pacific cod fisheries. The western distinct population segment (WDPS) of Steller sea lion is listed as endangered under the Endangered Species Act, and the species population in the Aleutian Islands is declining. Atka mackerel and Pacific cod are principal prey species for Steller sea lions in the Aleutian Islands. This proposed action would revise management of the Atka mackerel and Pacific cod fisheries to ensure the effects of these fisheries are not likely to result in jeopardy of extinction or adverse modification or destruction of critical habitat for the WDPS of Steller sea lions. This document addresses the requirements of the National Environmental Policy Act and Executive Order 12866.

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TABLE OF CONTENTS

Executive Summary ..... **i**
Purpose and Need i
Alternatives ii
Alternative 1: Status quo ii
Alternative 2: Enhanced Conservation Approach ii
Alternative 3: RPA Specific Approach iii
Summary of the Environmental Consequences of the Alternatives vi

1.0 Introduction **1-1**
1.1 Proposed Action 1-1
1.1.1 Reasonable and Prudent Alternative Objective and Performance Standards 1-1
1.1.2 Meeting ESA Requirements 1-2
1.2 Purpose and Need 1-3
1.3 Action Area 1-4
1.4 Statutory Authority and Relationship of this Action to Federal Law 1-5
1.4.1 Endangered Species Act Consultation History 1-6
1.4.2 Magnuson-Stevens Fishery Conservation and Management Act 1-7
1.5 Public Process 1-9
1.6 Related Documents 1-9
1.7 References 1-12
1.8 Preparers and Persons Consulted 1-14

2.0 Alternatives **2-1**
2.1 Description of Alternatives 2-1
2.1.1 Alternative 1: Status quo 2-1
2.1.2 Alternative 2: Enhanced Conservation Approach 2-9
2.1.3 Alternative 3: RPA Specific Approach 2-14
2.1.4 Preferred Alternative 2-21
2.2 Comparison of Alternatives 2-21
2.3 Alternatives Considered and Not Further Analyzed 2-23
2.4 References 2-23
2.5 Preparers and Persons Consulted 2-23

3.0 Target species **3-1**
3.1 Target Species Status 3-1
3.2 Atka mackerel 3-1
3.2.1 Atka mackerel stock status 3-1
3.2.2 Atka mackerel biomass distribution 3-3
3.3 Target Species Significant Criteria 3-3
3.3.1 Effects on Atka mackerel 3-6
3.4 Pacific cod 3-6
3.4.1 Pacific cod stock status 3-7
3.4.2 Pacific cod biomass distribution 3-7
3.4.3 Effects on Pacific Cod 3-8
3.5 Other Target species 3-9
3.5.1 Pacific Ocean perch 3-9
3.5.2 Greenland turbot 3-9

3.5.3 Arrowtooth Flounder....3-9
3.5.4 Sablefish....3-10
3.5.5 IFQ Program....3-10
3.5.6 Effects on Other target species....3-11
3.5.7 Cumulative Effect....3-12
3.5.8 Summary of Effects....3-12
3.6 References....3-13
3.7 Preparers and Persons Consulted....3-14

4.0 NON-TARGET SPECIES....4-1
4.1 BSAI Halibut Prohibited Species Catch Limits....4-1
4.1.1 Halibut Prohibited Species Catch Management....4-1
4.2 BSAI Crab....4-2
4.3 BSAI Salmon....4-4
4.4 Forage Fish Description....4-5
4.5 Non-specified Species Description....4-5
4.6 Effects on Non-target Species....4-6
4.6.1 Significant Criteria for Non-target species....4-6
4.6.2 Effects on Non-target species....4-6
4.6.3 Cumulative Effect....4-7
4.6.4 Summary of Effects....4-7
4.7 References....4-7
4.8 Preparers and Persons Consulted....4-8

5.0 Marine Mammals....5-1
5.1.1 Marine Mammals Status....5-3
5.2 Steller Sea Lions....5-8
5.2.1 Western Distinct Population Segment Population Trend....5-8
5.2.2 Terrestrial Sites and Usage....5-8
5.3 Effects on Marine Mammals....5-9
5.3.1 Significant Criteria for Marine Mammals....5-9
5.3.2 Incidental Take Effects....5-10
5.3.3 Harvest of Prey Species....5-15
5.3.4 Disturbance....5-25
5.3.5 Cumulative Effects....5-28
5.3.6 Summary of Effects....5-31
5.4 References....5-33
5.5 Preparers and Persons Consulted....5-35

6.0 Seabirds....6-1
6.1 Seabird Species and Status....6-1
6.1.1 ESA-Listed Seabirds in the Aleutian Islands....6-1
6.1.2 Status of Endangered Species Act Consultations on Groundfish and Halibut Fisheries....6-3
6.1.3 Seabird Distribution in the Aleutian Islands....6-4
6.1.4 Other Seabird Species of Conservation Concern....6-9
6.2 Effects on Seabirds....6-11
6.2.1 Significance Criteria for Seabirds....6-11
6.2.2 Incidental Take of Seabirds in Hook-and-Line Fisheries....6-12
6.2.3 Incidental Take of Seabirds in Trawl Fisheries....6-13
6.2.4 Prey Availability – Disturbance of Benthic Habitat....6-13

6.2.5 Alternative 1 – Status Quo 6-15
6.2.6 Alternative 2 6-17
6.2.7 Alternative 3 6-18
6.2.8 Cumulative Effects 6-18
6.2.9 Summary of Effects 6-19
6.3 References 6-20
6.4 Preparers and Persons Consulted 6-23

7.0 Habitat 7-1
7.1 Status of Habitat 7-1
7.2 Effects on Habitat 7-1
7.3 Significant Criteria for Habitat 7-2
7.4 Long Term Effects Indices 7-3
7.5 Effects of Alternative 2 and 3 7-5
7.6 Cumulative Effect 7-6
7.7 Summary of Effects 7-6
7.8 References 7-7
7.9 Preparers and Persons Consulted 7-8

8.0 Aleutian Islands Ecosystem 8-1
8.1 Description of the Ecosystem 8-1
8.1.1 Recent Ecosystem Trends 8-1
8.2 Effects on Ecosystem Relationships 8-3
8.2.1 Significant Criteria for Ecosystem Relationships 8-3
8.2.2 Effects on the Ecosystem 8-5
8.2.3 Cumulative Effect 8-5
8.2.4 Summary of Effects 8-5
8.3 References 8-5
8.4 Preparers and Persons Consulted 8-6

9.0 Environmental Conclusions 9-1

10.0 Regulatory impact review 10-1
10.1 Introduction 10-1
10.1.1 What is a Regulatory Impact Review? 10-1
10.1.2 Statutory Authority 10-2
10.1.3 Purpose and Need 10-2
10.1.4 Alternatives 10-3
10.1.5 History of this Action 10-6
10.2 Background 10-6
10.2.1 Atka mackerel and Pacific cod sector allocations 10-7
10.2.2 Amendment 80 Trawl Catcher/Processors 10-9
10.2.3 Fixed Gear Catcher/Processor sector 10-21
10.2.4 Catcher vessel sector 10-22
10.2.5 State of Alaska fishery 10-23
10.2.6 CDQ Program 10-25
10.2.7 Subsistence use of Steller sea lions 10-27
10.3 Impact on Fleet Activity and Fish Harvests 10-28
10.3.1 Introduction 10-28
10.3.2 The Amendment 80 Trawl Catcher/Processors 10-30
10.3.3 Catcher Vessels 10-42

10.3.4 Fixed Gear Catcher/Processors 10-47
10.3.5 State Managed Pacific Cod Fishery in State Waters 10-51
10.3.6 Kanaga Island and HLA Repeal 10-52
10.3.7 Summary Points 10-53
10.4 Social Benefits Associated with the Protection of the Western Stock of Steller Sea Lions 10-54
10.4.1 Introduction 10-54
10.4.2 Stated Preference Economic Values and Steller Sea Lions 10-58
10.4.3 Subsistence Values 10-62
10.5 Impacts on other ecosystem resources 10-63
10.6 Costs Incurred by the fishing and processing industries 10-65
10.6.1 Introduction 10-65
10.6.2 Adverse Impacts on Revenues in the Aleutian Islands 10-67
10.6.3 Potential Offsetting Revenue Impacts 10-73
10.6.4 Net Impacts 10-76
10.6.5 Present Value of Gross Revenue Changes 10-78
10.6.6 CDQ Revenues 10-79
10.7 Employment and income impacts 10-81
10.7.1 Introduction 10-81
10.7.2 Income and employment effects 10-82
10.8 Impacts on consumers 10-84
10.9 Implementation issues 10-86
10.10 Summary 10-87
10.11 References 10-90
10.12 Preparers and Persons Consulted 10-95

List of Figures

Figure 1-1 Map of the Aleutian Islands Management Areas (541, 542, and 543) Showing Designated Critical Habitat for Steller Sea Lions 1-5
Figure 2-1 Aleutian Islands rookeries with 3-nm groundfish fishing closures.....2-2
Figure 2-2 Alternative 1 Aleutian Islands Atka mackerel trawl closures. 2-4
Figure 2-3 Harvest Limit Area for Atka mackerel trawling in Area 543 and western portion of Area 542. 2-5
Figure 2-4 Aleutian Islands Pacific cod trawl closures. 2-7
Figure 2-5 Aleutian Islands Pacific cod nontrawl closures. 2-8
Figure 2-6 Aleutian Islands Habitat Conservation Area and Aleutian Island Coral Habitat Protection Area in relation to Steller sea lion critical habitat closures.....2-9
Figure 2-7 Changes in the use of Steller sea lion rookeries and haulouts in the Aleutian Islands. 2-12
Figure 2-8 Steller sea lion new rookery at Kanaga Island/Ship Rock. Note the proposed 3-nm groundfish directed fishery closure.....2-13
Figure 2-9 Atka mackerel fishery area closures in the Aleutian Islands under Alternative 3. 2-16
Figure 2-10 Pacific cod fishery closures in Area 541 under Alternative 3.....2-17
Figure 2-11 Pacific cod fishery closures in Area 542 under Alternative 3.....2-18
Figure 2-12 Rookery cluster zones. 2-19
Figure 5-1 Steller sea lion terrestrial sites with changed usage. 5-9
Figure 5-2 2006–2009 Pacific cod nonpelagic trawl locations in the Aleutian Islands subarea. 5-17
Figure 5-3 2006–2009 Atka mackerel nonpelagic trawl locations in the Aleutian Islands. 5-18
Figure 5-4 Nontrawl Pacific Cod Harvests in the Aleutian Islands 2006-2009 5-19
Figure 5-5 Kanaga Island/Ship Rock area groundfish harvest 2006–2009. 5-20
Figure 6-1 Colonies of the Beringian Seabird Colony Catalog 6-1
Figure 6-2 Observations of seabird species with conservation status and/or likely to interact with hook-and-line gear in the Aleutian Islands. (NPPSD 2004) 6-5
Figure 6-3 Observations and takes of short-tailed albatrosses in the Aleutian Islands and Bering Sea. Blue shaded background shows results from interpolation of satellite tagging data. Darker blue areas are where short-tailed albatross spent more time than lighter blue areas. 6-6
Figure 8-1 Ecosystem trends – Aleutian Islands. 8-2
Figure 8-2 Fishing and fisheries – Aleutian Islands. 8-3
Figure 10-1 Location of Atka mackerel harvests in Area 541.....10-11
Figure 10-2 Location of Atka mackerel harvests in Area 542.....10-12
Figure 10-3 Location of Atka mackerel harvests in Area 543.....10-13
Figure 10-4 First wholesale price per pound of Atka mackerel, 2000 through 2009 10-16
Figure 10-5 Primary target areas for Amendment 80 species (Atka mackerel, Pacific cod, Pacific ocean perch, flathead sole, rock sole, and yellowfin sole) and Arrowtooth flounder. Source: NMFS AKR Catch Accounting System. 10-42

List of Tables

Table 2-1 Final 2010 gear shares and seasonal allowances of the BSAI Pacific cod TAC. (75 FR 11778, March 12, 2010) 2-6
Table 2-2 Incidental catch of Atka mackerel in other groundfish fisheries. 2-11
Table 2-3 Comparison of alternatives. 2-22
Table 3-1 BSAI Atka mackerel ABC, TAC, and Catch by Area (NPFMC 2009 and NMFS Catch Accounting). 3-2
Table 3-2 2009 Atka mackerel Biomass distribution 3-3
Table 3-3 Criteria Used to Estimate the Significance of Effects on the FMP Managed Target Stocks. 3-4
Table 3-4 BSAI Pacific cod ABC, TAC, and Total catch 1981 to current 3-7
Table 4-1 Non-trawl sector halibut PSC allocations by season in metric tons 4-1
Table 4-2 2004-2009 non-trawl halibut PSC use (not including CDQ) 4-2
Table 4-3 2004-2009 trawl halibut PSC use (not including CDQ) 4-2
Table 4-4 Crab PSC in the Aleutian Islands 4-4
Table 4-5 2004-2009 Salmon PSC use by gear in the Aleutian Islands (not including CDQ) 4-5
Table 4-6 Criteria Used to Estimate the Significance of Impacts on Non-target and Prohibited Species 4-6
Table 5-1 Marine mammals likely to occur in the Aleutian Islands subarea. 5-2
Table 5-2 Status of Pinnipedia and Carnivora stocks potentially affected by the action. 5-5
Table 5-3 Status of Cetacea stocks potentially affected by the action. 5-6
Table 5-4 Criteria for determining significance of impacts to marine mammals. 5-10
Table 5-5 Documented takes for marine mammals that may occur in the Aleutian Islands from the Draft List of Fisheries for 2011 for the Atka mackerel and Pacific cod fisheries 5-10
Table 5-6 Estimated mean annual mortality of marine mammals from observed BSAI nonpelagic trawl flatfish and Pacific cod fishery compared to the total mean annual human-caused mortality and potential biological removal. 5-12
Table 5-7 Aleutian Islands marine mammals dependent on benthic habitat or potentially compete with Atka mackerel or Pacific cod fisheries. 5-15
Table 5-8 Listing of benthic dependent marine mammals and location and diving depths. 5-16
Table 5-9 Summary of alternatives and effects on marine mammals. 5-32
Table 6-1 Seabird species in the BSAI. 6-2
Table 6-2 Seabirds with conservation status under the ESA occurring in the Aleutian Islands. 6-3
Table 6-3 Reported takes of short-tailed albatross in Alaska fisheries. 6-7
Table 6-4 Criteria used to determine significance of impacts on seabirds. 6-12
Table 6-5 Seabird species groups and risk of hook-and-line fishery interactions. 6-13
Table 6-6 Seabirds in Aleutian Islands: foraging habitats and common prey species. 6-14
Table 6-7 Seabird bycatch estimates in the 2006 Alaskan groundfish demersal longline fishery in the Aleutian Islands on vessels greater than or equal to 60 feet length overall. The point estimate for short-tailed albatross was zero. 6-16
Table 6-9 Stressors on seabird species of concern in Alaska. 6-19
Table 6-10 Summary of impacts to seabirds from alternatives in this analysis. 6-20
Table 7-1 Criteria used to determine significance of effects on habitat. 7-3
Table 7-2 2005 Groundfish Fisheries LEI (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types. 7-4
Table 8-1 Significance Thresholds for Fishery-induced Effects on Ecosystem Relationships. 8-4
Table 10-1 Gear Shares, CDQ Reserve, Incidental Catch Allowance, and Amendment 80 Allocations of the BSAI Atka Mackerel TAC 10-8
Table 10-2 Gear and Sector Allowances of the BSAI Pacific Cod TAC 10-8

Table 10-3 Number of Active Amendment 80 vessels 10-10
Table 10-4 Atka mackerel catches by year, season, area, and relationship to critical habitat.....10-14
Table 10-5 Pacific cod catches by year, season, area, and relationship to critical habitat 10-15
Table 10-6 Estimated First wholesale gross revenues from Atka mackerel, 2003-2009. 10-16
Table 10-7 Estimated gross revenues for Amendment 80 vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009.....10-17
Table 10-8 Final 2011 GOA Groundfish Sideboard Limits for Amendment 80 Program Vessels 10-19
Table 10-9 Final 2010 and 2011 Halibut PSC Limits for Amendment 80 Program Vessels in the GOA.....10-20
Table 10-10 Percent of the Pacific cod catch made as targeted harvests, by fleet segment and management area, 2003-2009 10-21
Table 10-11 Number of Active Fixed Gear Catcher/Processors 10-21
Table 10-12 Estimated gross revenues for fixed gear (hook-and-line and pot) catcher/processor vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009. 10-22
Table 10-13 Number of Active Catcher Vessels.....10-22
Table 10-14 Estimated ex-vessel gross revenues for catcher vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009. 10-23
Table 10-15 Estimated first wholesale gross revenues associated with catcher vessel deliveries of Aleutian Islands Pacific cod, 2003 through 2009. 10-23
Table 10-16 Summary information on the state waters Pacific cod fishery in the Aleutian Islands..... 10-25
Table 10-17 Harvests by gear type in state-waters Pacific cod fishery in the Aleutian Islands (millions of whole pounds) 10-25
Table 10-18 Proportional allotments of Amendment 80 species CDQ allocations among CDQ Groups in 2010 10-26
Table 10-19 Selected provisions affecting Amendment 80 trawl catcher/processors in the Aleutian Islands (expressed as changes from status quo).....10-30
Table 10-20 Estimated 2011 Atka mackerel catch under Alternative 1 (status quo and no action alternative) in Areas 542 and 543. 10-31
Table 10-21 Estimated changes in catches of species in 2011 by Amendment 80 trawl catcher/processors targeting Atka mackerel in the Aleutian Islands under Alternatives 2 and 3.....10-32
Table 10-22 Estimated species catch rates per ton of Amendment 80 Aleutian Island groundfish harvest in the Atka mackerel fishery, and rates of prohibited species catch (averages for 2003 to 2009).....10-33
Table 10-23 Estimated aggregate reductions in Amendment 80 trawl catcher/processor Pacific cod harvests in the Aleutian Islands, had Alternatives 2 or 3 been in effect, by year, from 2003 through 2009. 10-34
Table 10-24 Estimated changes in catches of species by Amendment 80 trawl catcher/processors targeting Pacific cod in the Aleutian Islands under Alternatives 2 and 3. 10-34
Table 10-25 Estimated species catch rates per ton of Amendment 80 trawl catcher/processor groundfish harvest in the Aleutian Island Pacific cod fishery, and rates of prohibited species catch (averages for 2003–2009). 10-35
Table 10-26 Harvests by 80 trawl catcher/processor fishing Bering Sea yellowfin sole at a rate of 445 mt a week, and Bering Sea rock sole at a rate of 204 mt a week.....10-36
Table 10-27 Estimated species catch rates per ton in the Amendment 80 Bering Sea rock sole and yellowfin sole trawl catcher/processor harvests, and rates of prohibited species catch..... 10-36
Table 10-28 Hypothetical Incidental catch and PSC bycatch if Amendment 80 trawl catcher/processors catching as much Pacific cod in the Bering Sea as they caught in the Aleutian Islands under Alternatives 2 and 3. 10-37

Table 10-29 Estimated species catch rates per ton of Amendment 80 trawl catcher/processor groundfish harvest in the Bering Sea Pacific cod fishery, and rates of prohibited species catch (averages for 2003–2009). 10-37
Table 10-30 Potential halibut bycatch changes estimated in this section. 10-38
Table 10-31 Impact of Alternative 2 on Pacific perch catches in the BSAI. 10-40
Table 10-32 Key provisions affecting Pacific cod catcher vessel operations (expressed as changes from status quo). 10-43
Table 10-33 Estimated aggregate Pacific cod reductions for catcher vessels delivering to motherships or shoreside processors in the Aleutian Islands had Alternatives 2 and 3 been in effect, by year, from 2003 through 2009. 10-44
Table 10-34 Changes in Aleutian Island catcher vessel Pacific cod harvests, and possible changes for the same fleet in the Bering Sea if it completely offsets its Pacific cod harvests there. 10-46
Table 10-35 Estimated species catch rates per ton of catcher vessel groundfish harvest, and rates of prohibited species catch (averages for 2003–2009). 10-47
Table 10-36 Key provisions affecting fixed gear catcher/processors catching Pacific cod (expressed as changes from status quo). 10-47
Table 10-37 Estimated aggregate reductions for fixed gear catcher/processors in Pacific cod harvests in the Aleutian Islands, had Alternatives 2 and 3 been in effect, by year, from 2003 through 2009. 10-49
Table 10-38 Summary of harvest impacts associated with regulation of the fixed gear catcher/processor vessels. 10-50
Table 10-39 Estimated species catch rates per ton of fixed gear catcher/processor groundfish harvest, and rates of prohibited species catch (averages for 2003–2009). 10-51
Table 10-40 Possible additional incidental groundfish catch and PSC bycatch by fixed gear vessels if the trawl catcher vessel allotments in the Bering Sea are rolled over to the vessels in the sector. 10-51
Table 10-41 Expected Average Annual Growth Rate, Population Size, and ESA Status of Growth Scenarios 10-62
Table 10-42 Model Estimation Results for LLR Models 10-63
Table 10-43 Growth Scenario Descriptions 10-64
Table 10-44 Estimated Mean Annual Household Willingness to Pay for Improvements to the Western Stock by Version. 95% Confidence Intervals in Parentheses. 10-65
Table 10-45 Present Value of Mean Household Willingness to Pay for Improvements to Western Stock with 1.4% Discount Rate 10-67
Table 10-46 Present Value of Mean Household Willingness to Pay for Improvements to Western Stock with 5.5% Discount Rate 10-67
Table 10-47 Sample Sizes and Respondents Used for Estimation 10-60
Table 10-48 First wholesale and ex-vessel values per metric ton round weight (2009 unless otherwise noted). 10-68
Table 10-49 Estimated reduction in the Amendment 80 Atka mackerel harvest value due to the reduction in harvest in Areas 542 and 543. 10-69
Table 10-50 Estimated annual reduction in the Amendment 80 Pacific cod harvest value due to the reduction in harvest in Areas 542 and 543. 10-69
Table 10-51 Impacts of Alternatives 2 and 3 on catcher vessel first wholesale gross revenues from targeted Pacific cod fishing in the Aleutian Islands. 10-70
Table 10-52 Impacts of Alternatives 2 and 3 on catcher vessel ex-vessel gross revenues from targeted Pacific cod fishing in the Aleutian Islands. 10-70
Table 10-53 Impacts of Alternatives 2 and 3 on fixed gear catcher/processor gross revenues from targeted Pacific cod fishing in the Aleutian Islands. 10-71

Table 10-54 Summary of estimated potential first wholesale gross revenues from restricted fisheries in the Aleutian Islands (in millions).....10-71
Table 10-55 Estimated reductions in average gross revenue per vessel in the Aleutians due to the restrictions (in millions of dollars).....10-72
Table 10-56 Possible Impacts of Alternatives 2 and 3 on Amendment 80 rock sole harvest values in the Bering Sea.....10-74
Table 10-57 Possible Impacts of Alternatives 2 and 3 on Amendment 80 yellowfin sole harvest values in the Bering Sea.....10-74
Table 10-58 Possible gross revenues from fixed gear catcher/processor from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3.....10-75
Table 10-59 Possible catcher vessel first wholesale gross revenues from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3. 10-75
Table 10-60 Possible catcher vessel ex-vessel gross revenues from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3. 10-75
Table 10-61 Present values for alternatives and different harvest scenarios within alternatives. 10-79
Table 10-62 CDQ group exposure to Steller sea lion protection measure Impacts. 10-80

Executive Summary

In April 2006, National Marine Fisheries Service (NMFS) Alaska Region, Sustainable Fisheries Division (SFD, action agency), reinitiated Endangered Species Act (ESA) Section 7 consultation with NMFS Alaska Region, Protected Resources Division (PRD, consulting agency), on the potential effects of the Alaska groundfish fisheries on ESA-listed species and their designated critical habitat. Consultation was reinitiated in consideration of new scientific information and changes to the fisheries since the last biological opinion on the groundfish fisheries was supplemented in 2003. After reviewing all ESA-listed species within NMFS's jurisdiction that may be affected by the Alaska groundfish fisheries and after consulting with PRD, SFD determined that the Alaska groundfish fisheries were likely to adversely affect Steller sea lions and their designated critical habitat, humpback whales, and sperm whales; therefore, formal consultation was required. In formal Section 7 consultations, PRD reviews the status information for the species and designated habitat, environmental baseline information, and the potential effects of the action on the species and develops a biological opinion. If the biological opinion concludes that the action is likely to jeopardize the continued existence or adversely destroy or modify designated critical habitat (JAM) for an ESA-listed species, the opinion would include a reasonable and prudent alternative (RPA) that must be implemented to avoid JAM.

In July 2010, PRD completed a draft biological opinion on the Alaska groundfish fisheries (FMP biop). The FMP biop found that additional changes to the Pacific cod and Atka mackerel fisheries in the Aleutian Islands are necessary to avoid the likelihood of JAM for the western distinct population segment (WDPS) of Steller sea lions and their designated critical habitat. The RPA to mitigate the effects of the groundfish fisheries on the WDPS of Steller sea lions is specific to the Atka mackerel and Pacific cod fisheries in Areas 543, 542, and 541 of the Aleutian Islands.

The proposed action is based on the RPA contained in the FMP biop. The RPA is focused on the locations in the Aleutian Islands with declining population growth rates, which may be due to declining survival or decreasing birth rates. The features of the RPA were developed considering the evidence of potential impacts of the groundfish fisheries on Steller sea lions, including Steller sea lion foraging behavior, fish removals, prey energetic density, and available prey biomass. Based on the information in the FMP biop, the action is focused in the location where Steller sea lions are experiencing the greatest population growth rate decline and where the groundfish fisheries are likely to be adversely impacting the animals.

Purpose and Need

The purpose of this action is to implement revisions to the management of Aleutian Islands Atka mackerel and Pacific cod fisheries to ensure these fisheries are not likely to cause JAM for the WDPS of Steller sea lions and their critical habitat in consideration of existing fishery management programs. Consideration of the existing fishery management programs will ensure that any revisions implemented would provide the most efficient and effective solutions to meeting the requirements of the ESA. If more than one alternative accomplishes the primary purpose of this action, a secondary objective of the action would be to modify the fisheries in a way that minimizes the economic and social costs that will be imposed on the commercial fishing industry and associated coastal communities.

The need for this federal action stems from several sources. First, NMFS has a responsibility to ensure that fishing activities authorized under the groundfish fishery management plans (FMPs) and implementing regulations are not likely to jeopardize the continued existence of any ESA-listed species or

adversely modify or destroy its critical habitat. Second, in order for the Pacific cod and Atka mackerel fisheries to commence on January 1, 2010, NMFS must implement revisions to the fisheries that avoid the likelihood of JAM. The commencement of a new fishing year and implementation of new harvest specifications must be done in compliance with the ESA. Without any action by NMFS, the Aleutian Islands Pacific cod and Atka mackerel fisheries prosecuted under the current Steller sea lion protection measures are likely to result in JAM, as determined by the FMP biop.

Finally, this action also is needed to meet the North Pacific Fishery Management Council's (Council's) objective in its groundfish FMPs to maintain or adjust current protection measures as appropriate to avoid jeopardy of extinction or adverse modification to critical habitat for ESA-listed Steller sea lions. New information about potential interaction between Steller sea lions and the groundfish fisheries and new trend information have been taken into account in the draft FMP biop allowing for adaptive management of the groundfish fisheries.

Alternatives

The alternatives for the proposed action are described in detail in Chapter 2.

Alternative 1: Status quo

Under this alternative, no changes would be made to the current groundfish fisheries management in the Aleutian Islands as implemented by 50 CFR part 679. This includes the continuing implementation of the Steller sea lion protection measures, Amendment 80, habitat protection and conservation areas, and the Atka mackerel Harvest Limit Area (HLA) management programs.

Alternative 2: Enhanced Conservation Approach

This alternative would use management measures for the Aleutian Islands Atka mackerel and Pacific cod fisheries to remove most of the potential adverse effects on Steller sea lions and their critical habitat. Alternative 2 would provide protection measures for Steller sea lions and their critical habitat no less stringent than currently implemented and provide additional measures at least as protective as the RPA in the FMP biop. The protection is greater in the areas where population growth has been the most negative (Areas 543 and 542 compared to Area 541). The enhanced conservation approach would facilitate NMFS's implementation by simplifying the area closures and seasonal management measures in Area 542 and 541 compared to critical habitat zone specific measures described in Alternative 3. Except for the changes described below, the current Steller sea lion protection measures (e.g., Pacific cod trawl season dates, no Atka mackerel directed fishing in critical habitat in Area 541) would remain unchanged.

Alternative 2 would—

<u>In Areas 542 and 543</u>:

- Prohibit retention of Atka mackerel and Pacific cod by federally permitted vessels, including those operating in State waters 0–3 nm.
- Establish TACs for Atka mackerel sufficient to support incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the HLA (Area 543 and western portion of Area 542).
- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

In Area 541 and the Bering Sea:

- Close critical habitat in Area 541 to directed fishing for Pacific cod by federally permitted vessels.
- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Prohibit Pacific cod directed fishing in Area 541 November 1 through December 31. (This extends the current trawl season restriction to the nontrawl fishery.)

Under this alternative, the TAC for Atka mackerel in Areas 543 and 542 would be set at a level sufficient to support incidental catch in other directed groundfish fisheries (e.g., Pacific ocean perch). Pacific cod in Areas 543 and 542 would be placed on prohibited species status and closed to directed fishing. Currently, Pacific cod is managed under a single TAC for the BSAI so no area specific TAC to support incidental catch can be specified. Any retention of Atka mackerel or Pacific cod would be prohibited to remove any incentive to retain these species by operators of vessels targeting other groundfish species. Because no directed fishery for Atka mackerel would be allowed in Areas 543 and 542, the HLA program would be removed from the regulations. Unless otherwise restricted by the State, vessels not federally permitted may participate in the State-managed Pacific cod fisheries in waters 0–3 nm in those areas closed to directed fishing for Pacific cod by federally permitted vessels.

Alternative 3: RPA Specific Approach

Alternative 3 is a more specific application of fishery restrictions based on the management of the fisheries and the Steller sea lion foraging behavior, population trends, and the potential competition between the Atka mackerel and Pacific cod fisheries and Steller sea lions. This alternative is the same as the RPA described in the 2010 FMP biop, providing only the level of fishery restrictions necessary to ensure that JAM is not likely to occur for Steller sea lions and their designated critical habitat. Development of Alternative 3 considered current management of vessels under Amendment 80, historical harvest activities, and gear specific area closures and seasonal apportionments to disperse fishing over area and time. Unless otherwise specified in the alternative, all current Steller sea lion protection measures would continue to be implemented in the Aleutian Islands (e.g., Pacific cod seasonal apportionments; and pollock, Pacific cod, and Atka mackerel closures around rookeries and haulouts and in the Seguam foraging areas). Restrictions in State waters from 0–3 nm apply to federally permitted vessels. State-managed Pacific cod fisheries for vessels not federally permitted may occur in waters 0–3 nm unless otherwise restricted by the State.

Alternative 3 would—

In Area 543:

- Prohibit retention of Atka mackerel and Pacific cod.
- Establish a TAC for Atka mackerel sufficient to support the incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the HLA.

In Area 542:

Groundfish

- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

Pacific cod

- Close 0–10 nm zone of critical habitat to directed fishing by federally permitted vessels using nontrawl gear year round. Close critical habitat10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
- Close 0–20 nm zone of critical habitat year round to directed fishing by federally permitted vessels using trawl gear.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 542. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Set TAC for Area 542 to no more than 47 percent of acceptable biological catch (ABC).
- Close 0–20 nm critical habitat to directed fishing by federally permitted vessels year round.
- Change the Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Eliminate the Atka mackerel platoon management system in the HLA.

<u>In Area 541 and the Bering Sea</u>:

Pacific cod

- Close 0–10 nm of critical habitat to directed fishing for Pacific cod by all federally permitted vessels year round.
- Limit the amount of catch that can be taken in the 10–20 nm area of critical habitat based on gear type used:
    - Close critical habitat 10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
    - Close critical habitat 10–20 nm to directed fishing by for Pacific cod using trawl gear by federally permitted vessels June 10 through November 1.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 541. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.

Comparison of Alternatives								
		Alternative 1			**Alternative 2**		**Alternative 3**	
		Atka mackerel	**Pacific cod**		**Atka mackerel**	**Pacific cod**	**Atka mackerel**	**Pacific cod**
			trawl	**nontrawl**				
Area 543	**Inside CH**	HLA Fishery	After HLA, mostly 10 nm closures	Mostly 3 nm closures	No retention	No retention	No retention	No retention
	Outside CH	Directed fishing Jan 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, jig 3 seasons inside and outside CH				
Area 542	**0–10 miles**	HLA Fishery	Western 542, After HLA, mostly 10 nm closures	3 nm closures			No directed fishing	No directed fishing
	10–20 miles		Eastern 542, 3–10 nm closures,	Open to directed fishing				No directed fishing with trawl gear. No directed fishing with nontrawl gear Jan. 1 to June 10
	Outside CH	Directed fishing Jan. 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, through Dec. 31, jig 3 seasons inside and outside CH			Set Area 542 TAC to 47% of ABC. Extend seasons to Jan. 20–June 10 and June 10–Nov. 1.	No directed fishing Nov. 1–Dec. 31
Area 541	**0–10 miles**	No directed fishing	0–3 nm and 0–10 nm closures	3 nm closures west of Seguam, closed east of Seguam.	No directed fishing	No directed fishing	No directed fishing	Closed to directed fishing
	10–20 miles		Open except 0–20 nm at Agligadak	Open to directed fishing west of Seguam, closed east of Seguam				No directed fishing with trawl gear from June 10 to Nov. 1. No directed fishing with nontrawl gear Jan. 1 to June 10.
	Outside CH	Directed fishing Jan. 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, jig 3 seasons through Dec. 31, inside and outside CH	Extend Area 541/BS seasons Jan. 20–June 10 and June 10–Nov. 1	No nontrawl directed fishing Nov. 1–Dec. 31	Extend Area 541/BS seasons Jan. 20–June 10 and June 10–Nov. 1	No nontrawl directed fishing Nov. 1–Dec. 31.

CH = critical habitat

Summary of the Environmental Consequences of the Alternatives

Target Species

The impacts of the alternatives on target species are described in detail in Chapter 3. Under all alternatives, the stock biomass of all target species is expected to be above their MSST. The probability that overfishing would occur is low for all of the stocks. The expected changes that would result from harvest at the levels proposed are not substantial enough to expect that the genetic diversity or reproductive success of these stocks would change. None of the alternatives would allow overfishing of the spawning stock. Therefore, the genetic integrity and reproductive potential of the stocks should be preserved.

The alternatives are not expected to: (1) jeopardize the capacity of the stock to produce maximum sustainable yield on a continuing basis; (2) alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold or experience overfishing; (3) decrease reproductive success in a way that jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (4) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold or experience overfishing, and (5) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold or prevent overfishing. For these reasons, impacts to target species stocks, species, or species groups, are predicted to be insignificant for all target fish evaluated under Alternatives 1, 2, and 3.

Nontarget Species

The impacts of the alternatives on nontarget species are described in detail in Chapter 4.

Marine Mammals

The impacts of the alternatives on marine mammals are described in detail in Chapter 5. The groundfish fisheries may impact marine mammals through incidental take, reductions in prey availability and disturbance. Of the marine mammals and alternatives analyzed, only Steller sea lions are likely to experience significant adverse impacts from the Aleutian Islands Pacific cod and Atka mackerel fisheries under Alternative 1 through the reduction of prey availability. The impacts of Alternatives 2 and 3 on marine mammals are not likely to result in adverse population level effects, and therefore were determined to be insignificant.

Seabirds

The impacts of the alternatives on seabirds are described in detail in Chapter 6. Many seabird species use the marine habitat of the Aleutian Islands, including several species of conservation concern. Some species are taken by hook-and-line gear, some are occasionally taken by cable or vessel strikes or become entangled in trawl nets, and some species depend on benthic habitat that is disrupted by pelagic and non-pelagic trawling. However, the Alaska Fisheries Science Center estimates that seabird takes are few and infrequent in relation to seabird population total estimates. The spatial and temporal effects of non-pelagic trawling on benthic habitat are not yet well understood, although undisturbed areas seem to produce more clam species on which eider species are dependent than disturbed areas. Although the Alternatives 2 and 3 may affect seabirds, all effects (both positive and negative) would be insignificant.

Habitat

The impacts of the alternatives on habitat are described in detail in Chapter 7. Previous analyses of the Alaska groundfish fisheries found no substantial adverse effects to habitat in the Aleutian Islands due to fishing activities; Alternatives 2 and 3 would remove a substantial portion of any localized effects that were occurring under the status quo alternative. The potential effects on an area to which fishing may shift would be constrained by the amount of TAC available (particularly for Atka mackerel) and by the existing habitat conservation and protection measures. It is possible that impacts may increase slightly in other areas due to displaced fishing effort, but in context of the entire Aleutian Islands and Bering Sea, the effects of either Alternatives 2 or 3 on habitat are beneficial in the Aleutian Islands subarea, but not substantially so. Alternative 3 would result in more potential for bottom habitat impacts in Areas 542 and 541 as more fishing would be allowed under this alternative compared to Alternative 2. For these reasons, effects to habitat complexity for both living and non-living substrates, benthic biodiversity, and habitat suitability are predicted to be insignificant for all habitat types evaluated under Alternatives 2 and 3.

Ecosystem

The impacts of the alternatives on the ecosystem are described in detail in Chapter 8.

Social and Economic

The socioeconomic impacts of the alternatives are described in detail in Chapter 10.

Atka mackerel and Pacific cod harvests from Federal fisheries in the Aleutian Islands have had an average wholesale value of about $84 million in recent years. In 2009, they were targeted by 8 trawl catcher/processors, 7 hook-and-line catcher/processors, 3 pot catcher/processors, and 28 catcher vessels. In recent years catcher vessels have used trawl, jig, hook-and-line, and pot gears.

Alternative 2 prohibits retention of Atka mackerel and Pacific cod in Areas 542 and 543 and prohibits directed fishing for Pacific cod in 0 nm to 10 nm of critical habitat in Area 541. Alternative 3 prohibits retention of Atka mackerel and Pacific cod in Area 543, prohibits directed fishing for these species inside most critical habitat in Areas 542 and 541, and limits the Atka mackerel TAC in Area 542 to no more than 47 percent of the ABC. There are a number of other elements to the alternatives, however these are the main components.

Four fleets were defined for the analysis: the Amendment 80 fleet of trawler catcher/processors, fixed gear (hook-and-line and pot) catcher processors, catcher vessels (including vessels using jig, pot, hook-and-line, and trawl gear), and vessels fishing in the state waters fishery.

The potential costs to industry are the producers' surplus and factor rents that may be lost because of the restrictive measures in the Aleutian Islands. The information that would make it possible to estimate the value of the lost producers' surplus and factor rents is not available. It is possible to approximate the annual gross revenues that would be lost in the directly regulated fisheries.

In general the alternatives will reduce Atka mackerel and Pacific cod harvests. The industry is likely to respond to the restrictions in the Aleutian Islands by redeploying its fleets in an effort to minimize the losses the restrictions will impose. The Amendment 80 fleet may spend more time fishing for rock sole and yellowfin sole in the Bering Sea, and may fish more Pacific cod in the Bering Sea. It is not clear how effectively it may fish for Pacific cod in the Bering Sea. Halibut bycatch is higher there, the fleet doesn't

have a history of Bering Sea Pacific cod fishing, and only a few of the vessels focused on Pacific cod in the Aleutian Islands. The fixed gear catcher/processors and catcher vessels catch Pacific cod, not Atka mackerel in the Aleutian Islands, and may switch to fishing Pacific cod in the Bering Sea.

Despite likely redeployment, the industry will incur losses. These size of these losses cannot currently be estimated. However, it is possible to estimate the approximate reduction in gross revenues in the Aleutian Islands:

- The Amendment 80 Atka mackerel reductions in gross revenues are estimated to be in the neighborhood of $47 million under Alternative 2, and of $34 million a year under Alternative 3.
- The Amendment 80 Pacific cod reductions in gross revenues are estimated to be in the neighborhood of $7 million to $19 million under Alternative 2, and $4 million to $11 million under Alternative 3
- The fixed gear catcher/processor reductions in gross revenues are estimated to be in the neighborhood of $13 million to $23 million a year under Alternative 2 and $4 million to $12 million a year under Alternative 3.
- The catcher vessel reductions in gross revenues are estimated to be in the neighborhood of $12 million to $13 million a year under Alternative2 and $8 million to $9 million a year under Alternative 3.
- Aggregate reductions in gross revenues are estimated to be in the neighborhood of $79 million to $102 million a year under Alternative 2, and $50 million to $66 million a year under Alternative 3.
- The state waters Aleutian Island Pacific cod fishery may not be affected in the short run, but may be in the long run, if proposed FFP regulatory changes interact with the Steller sea lion protection measures to discourage fishing operations from entering the State fishery.

These estimates for forgone revenues overstate the industry's net losses. First, gross revenues ignore fishing costs; the actual net loss in the Aleutians, caused by the restrictions, will be less than the gross loss. Second, a reduction in Atka mackerel production may lead to increased prices for the remaining Atka mackerel harvest. Third, industry will respond to these changes by taking steps to reduce its losses. These may involve redeployment of vessels to fisheries in the Bering Sea. Other steps, such as efforts to reduce trawl halibut bycatch in the Bering Sea, are also possible.

The three different federal fishery fleets are estimated to employ about 700 to 900 persons. Estimates of indirect and induced employment associated with these fleets are not available. Estimates of direct, indirect, and induced incomes are not available. Changes in these, associated with the action alternatives, have not been estimated.

Neither the RPA nor the EA project that the action will necessarily lead to an increase in the rate of population growth of Steller sea lion populations although the Biological Opinion implies that this would be one reasonable outcome. Although survey estimates of the public's willingness to pay for improved Steller sea lion population trajectories are discussed, the large element of uncertainty about the impact of the proposed action on Steller sea lion population trajectories, makes it impossible to apply the survey results to this action.

Benefits or costs may accrue from this action because of impacts on other elements of the ecosystem (aside from Steller sea lions) such as other marine mammals, seabirds, fish stock impacts, habitat impacts, and ecosystem impacts. Impacts from these sources are likely to be small in relation to impacts to the industry or the values accruing from sea lion stock health. Benefits and costs may accrue to fish consumers. These also appear likely to be small relative to other impacts. Much of the harvest is

exported, and Pacific cod, rock sole, and yellowfin sole production changes may be small in comparison with current consumption and normal variations in production. Management costs appear to be effectively zero. Enforcement issues will be evaluated in a future draft. A shift in the fleet's center of gravity to the east, brings it closer to USCG search and rescue resources and to potential "good Samaritan" assistance. Reduced profits may reduce investments in safety, and a reduction in the distance between fishing vessels may encourage a derby fishery mentality.

A part of this action that closes waters within three miles of Kanaga Island to groundfish fishing should have small costs to industry. Elimination of the HLA will have little impact, given other measures to restrict fishing in the HLA areas. The emergence of cooperatives under Amendment 80 provides an alternative way of slowing harvest.

Because the impact of this action on the Steller sea lion population trajectory cannot be estimated, it is impossible to determine whether or not this action will have a net benefit in terms of cost-benefit accounting measures. This action is necessary, however, to ensure the effects of the groundfish fisheries are not likely to result in jeopardy of extinction or adverse modification or destruction of critical habitat, as required by the Endangered Species Act (NMFS 2010).

1.0 INTRODUCTION

In April 2006, National Marine Fisheries Service (NMFS) Alaska Region, Sustainable Fisheries Division (SFD, action agency), reinitiated Endangered Species Act (ESA) Section 7 consultation with NMFS Alaska Region, Protected Resources Division (PRD, consulting agency), on the potential effects of the Alaska groundfish fisheries on ESA-listed species and their designated critical habitat (NMFS 2006a). Consultation was reinitiated in consideration of new scientific information and changes to the fisheries since the last biological opinion on the groundfish fisheries was supplemented in 2003 (NMFS 2003). After reviewing all ESA-listed species within NMFS's jurisdiction that may be affected by the Alaska groundfish fisheries and after consulting with PRD, SFD determined that the Alaska groundfish fisheries were likely to adversely affect Steller sea lions and their designated critical habitat, humpback whales, and sperm whales; therefore, formal consultation was required. In formal Section 7 consultations, PRD reviews the status information for the species and designated habitat, environmental baseline information, and the potential effects of the action on the species and develops a biological opinion. If the biological opinion concludes that the action is likely to jeopardize the continued existence or adversely destroy or modify designated critical habitat (JAM) for an ESA-listed species, the opinion would include a reasonable and prudent alternative (RPA) that must be implemented to avoid JAM.

In July 2010, PRD completed a draft biological opinion on the Alaska groundfish fisheries (FMP biop) (NMFS 2010). The FMP biop found that additional changes to the Pacific cod and Atka mackerel fisheries in the Aleutian Islands are necessary to avoid the likelihood of JAM for the western distinct population segment (WDPS) of Steller sea lions and their designated critical habitat. This finding is based on the biological information of the WDPS of Steller sea lions and the potential effects of the groundfish fisheries on the WDPS of Steller sea lions and their critical habitat. The effects of the Alaska groundfish fisheries that are likely to result in JAM are located in the Western and Central sub-regions of the Aleutian Islands, as described in the 2008 Steller sea lion recovery plan (NMFS 2008). The RPA to mitigate the effects of the groundfish fisheries on the WDPS of Steller sea lions is specific to the Atka mackerel and Pacific cod fisheries in Areas 543, 542, and 541 of the Aleutian Islands. This RPA provides the baseline for consideration of changes that could be implemented to ensure the WDPS of Steller sea lions are not likely to experience JAM because of the groundfish fisheries.

1.1 Proposed Action

The proposed action is based on the RPA contained in the FMP biop (NMFS 2010). This RPA is built on the indicators of Steller sea lion population trends and the reproductive capacity of Steller sea lions in sub-regions identified in the Steller sea lion recovery plan (NMFS 2008). The RPA is focused on those sub-regions with declining population growth rates, which may be due to declining survival or decreasing birth rates. The features of the RPA were developed considering the evidence of potential impacts of the groundfish fisheries on Steller sea lions, including Steller sea lion foraging behavior, fish removals, prey energetic density, and available prey biomass. This evidence is detailed in Chapter 8 of the FMP biop (NMFS 2010) and is adopted here by reference.

1.1.1 Reasonable and Prudent Alternative Objective and Performance Standards

The RPA is based on an objective and performance standards, which account for the potential adverse impacts of the groundfish fisheries on Steller sea lions and the types of changes in the fisheries needed to mitigate the potential adverse impacts (NMFS 2010). The objective of the RPA is to:

> conserve the overall forage availability for Steller sea lions and the value of critical habitat by limiting harvest of important prey species in the times and areas where Steller sea lions forage;

focused on sub-regions where the combined sea lion and fishery signals indicate the likelihood of a compromised prey field under the status quo.

The following performance standards are stated in the FMP biop and are used to develop the RPA (NMFS 2010).

Fishery management measures should:

- Be commensurate with rate of population declines with more stringent measures in sub-regions, as described in the Steller sea lion recovery plan (NMFS 2008), with greater population declines.
- Conserve the value of critical habitat zones and offshore foraging areas that are used most extensively by foraging Steller sea lions.
- Conserve overall forage biomass for Steller sea lions by limiting fishery removals in areas with low forage biomass availability.
- Disperse fishery removals in time and space to prevent fishery removals from resulting in local depletion of the prey field.
- Consider distributional effects of time and area closures that are not combined with reductions in total allowable catch such that fishery removals are not concentrated in another time and space that may be deleterious to foraging Steller sea lions.
- Conserve prey availability inside trawl exclusion zones in areas where Atka mackerel tagging studies indicate high movement of fish from inside to outside of trawl exclusion zones (e.g., Amchitka North in Area 542).
- Consider fishery removals in State of Alaska (State) waters.
- Maintain or establish 3 nm (nautical miles) groundfish fishing closures around rookeries in Aleutian Islands.

The objective and the performance standards are the foundation of the RPA in the FMP biop. NMFS has determined that considering these performance standards is necessary to modify the groundfish fisheries in a manner that would ensure the groundfish fisheries impacts are not likely to result in JAM for Steller sea lions and their designated critical habitat. These performance measures allow for the focused application of revised Steller sea lion protection measures, particular to area, fishery, and Steller sea lion behavior. Based on the information in the FMP biop, the action is focused in the location where Steller sea lions are experiencing the greatest population growth rate decline and where the groundfish fisheries are likely to be adversely impacting the animals.

1.1.2 Meeting ESA Requirements

NMFS is responsible for implementing the requirements of the ESA for most ESA-listed marine mammals, including Steller sea lions. The WDPS of Steller sea lions is listed as endangered. Each federal agency, in consultation with NMFS, is required to "insure that any action authorized, funded, or carried out by that agency is not likely to jeopardize the continued existence of [endangered Steller sea lions] or result in the destruction or adverse modification of [critical] habitat." Consultation was reinitiated by NMFS in 2006 on the groundfish fisheries off Alaska (NMFS 2006a). In the FMP biop (NMFS 2010), NMFS determined that the groundfish fisheries, when considered with aggregate effects of the factors analyzed under the environmental baseline and the cumulative effects, are likely to jeopardize the continued existence of endangered Steller sea lions and result in destruction or adverse modification of critical habitat. Based on that determination, and consistent with requirements of the ESA, NMFS has provided an RPA that would not violate the ESA. Therefore, NMFS must manage the groundfish

fisheries in a manner that ensures that those fisheries are not likely to jeopardize the continued existence of endangered Steller sea lions or result in destruction or adverse modification of critical habitat.

1.2 Purpose and Need

The purpose of this action is to implement revisions to the management of Aleutian Islands Atka mackerel and Pacific cod fisheries to ensure these fisheries are not likely to cause JAM for the WDPS of Steller sea lions and their critical habitat in consideration of existing fishery management programs. Consideration of the existing fishery management programs will ensure that any revisions implemented would provide the most efficient and effective solutions to meeting the requirements of the ESA. The proposed action would modify the Aleutian Islands Pacific cod and Atka mackerel fisheries such that the fisheries are not likely to jeopardize the continued existence of Steller sea lions or adversely modify or destroy their designated critical habitat. If more than one alternative accomplishes the primary purpose of this action, a secondary objective would be to modify the fisheries in a way that minimizes the economic and social costs that will be imposed on the commercial fishing industry and associated coastal communities.

The need for this federal action stems from several sources. First, NMFS has a responsibility to ensure that fishing activities authorized under the groundfish fishery management plans (FMPs) and implementing regulations are not likely to jeopardize the continued existence of any ESA-listed species or adversely modify or destroy its critical habitat. Second, in order for the Pacific cod and Atka mackerel fisheries to commence on January 1, 2010, NMFS must implement a suite of Steller sea lion protection measures—the RPA from the 2010 draft FMP biop or a different alternative that meets the same requirement to avoid the likelihood of JAM. The commencement of a new fishing year and implementation of new harvest specifications must be done in compliance with the ESA. Without any action by NMFS, the Aleutian Islands Pacific cod and Atka mackerel fisheries prosecuted under the current Steller sea lion protection measures are likely to result in JAM, as determined by the FMP biop (NMFS 2010).

Finally, this action also is needed to meet the North Pacific Fishery Management Council's (Council's) objective in its groundfish FMPs to maintain or adjust current protection measures as appropriate to avoid jeopardy of extinction or adverse modification to critical habitat for ESA-listed Steller sea lions (section 2.2.1 in NPFMC 2009). New information about potential interaction between Steller sea lions and the groundfish fisheries and new trend information have been taken into account in the draft FMP biop allowing for adaptive management of the groundfish fisheries.

This action is focused on the Aleutian Islands based on the population trends of the animals in sub-regions, as identified in the Steller sea lion recovery plan (NMFS 2008). The recovery plan divides Alaska waters into sub-regions for purposes of determining recovery. Area 543 is the Western Aleutian Islands sub-region and Areas 542 and 541 are the Central Aleutian Islands sub-regions. The recovery plan concluded that to achieve recovery, no two adjacent subareas may have significantly declining population trends for non-pups (NMFS 2008).

Steller sea lions occurring in the Aleutian Islands have experienced negative population trends (NMFS 2010). The negative population trends for non-pups in Areas 543, 542, and 541 would prevent the population from meeting the recovery criterion (NMFS 2008). The negative growth rates and counts in Areas 543, 542, and 541 indicate that the Steller sea lions in these areas are having difficulty maintaining or increasing their populations, and removal of potential fisheries effects is needed to ensure fisheries are not likely to result in JAM.

The remaining statistical areas for the groundfish fisheries in the Bering Sea and Gulf of Alaska (GOA) have positive or stable annual growth rates and positive counts for pups and non-pups. Therefore, additional Steller sea lion protection measures for the groundfish fisheries in the Bering Sea and GOA are not required in the RPA to ensure effects from the remaining groundfish fisheries are not likely to result in JAM for Steller sea lions and their designated critical habitat. Because of the overlap of Atka mackerel management between the Aleutian Islands and Bering Sea subareas, a minor change to the seasonal harvest of Atka mackerel in the Bering Sea subarea is included in the RPA. The total allowable catch for Atka mackerel in Area 541 is combined with the Bering Sea subarea so that this allocation is managed as a unit. Any adjustments to the Atka mackerel fishery management in Area 541 potentially would need to be applied to the Bering Sea subarea. This concurrent change in the Bering Sea subarea is not necessary to prevent JAM, but is necessary to facilitate management. Because this seasonal change in the Bering Sea for Atka mackerel harvest could further distribute fishing effort in a manner beneficial to Steller sea lions and involves only a minor component of the Atka mackerel fishery, it is not considered a substantial change with discernable environmental effects. Thus, the action area analyzed in this Environmental Assessment/Regulatory Impact Review (EA/RIR) is focused on the Aleutian Islands subarea.

1.3 Action Area

This action predominately occurs in the Aleutian Islands subarea. This area is a subarea of the Bering Sea and Aleutian Islands Management Area (BSAI). The Aleutian Islands Subarea (AI) of the BSAI means that portion of the exclusive economic zone (EEZ) off Alaska contained in Statistical Areas 541, 542, and 543 (Figure 1-1). These waters are 3 nm to 200 nm off the coast of Alaska.

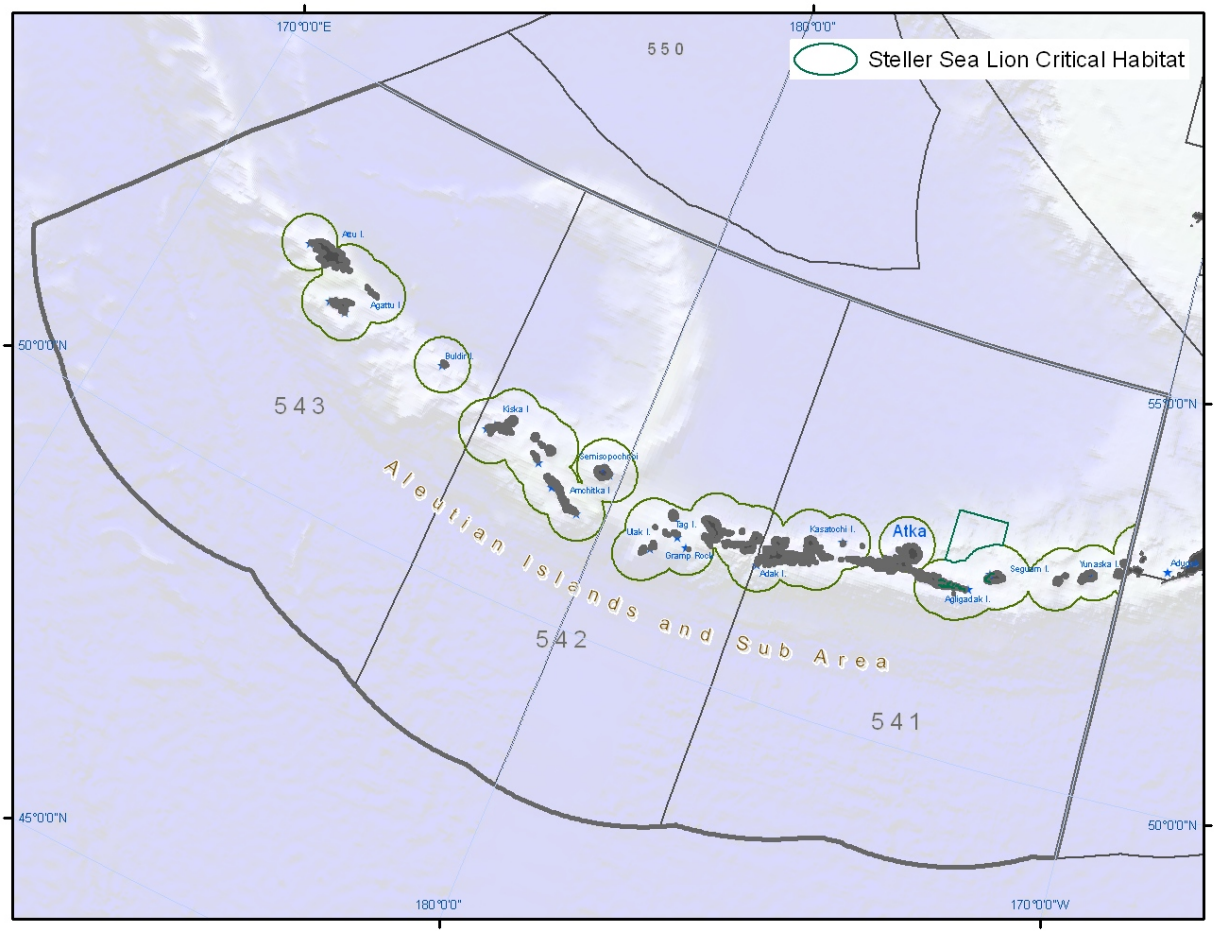

Figure 1-1 **Map of the Aleutian Islands Management Areas (541, 542, and 543) showing designated critical habitat for Steller sea lions. (Steve Lewis, NMFS Alaska Region, Analytical Team)**

The action area also includes State waters 0 nm to 3 nm off the Alaska coast in the AI for federally permitted vessels (those named on a federal fisheries permit, as defined at 50 CFR 679.2).

1.4 Statutory Authority and Relationship of this Action to Federal Law

NMFS manages the U.S. groundfish fisheries of the BSAI in the EEZ under the FMP for Groundfish of the BSAI (NPFMC 2009). The Council prepared, and the Secretary of Commerce (Secretary) approved, the FMP under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801, *et seq*.).

A variety of federal laws and policies require environmental, economic, and socio-economic analysis of proposed federal actions. This document contains the required analysis of the proposed federal action to ensure that the action complies with these federal laws and executive orders (EOs):

- Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), including Sustainable Fisheries Act of 1996, and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006

- National Environmental Policy Act
- Endangered Species Act
- Marine Mammal Protection Act
- Administrative Procedure Act
- Information Quality Act
- E.O. 12866

The Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (FEIS) provides details on the laws and executive orders directing this analysis (NMFS 2007). Additional information related to the Magnuson-Stevens Act and the ESA is provided in the following sections.

1.4.1 Endangered Species Act Consultation History

A history of recent, relevant consultations and actions leading up to this action is presented in the 2010 draft FMP biop (NMFS 2010). The most recent previous biological opinions on the effects of the Alaska groundfish fisheries on Steller sea lions were issued in 2000 (NMFS 2000 [FMP-level biological opinion]), in 2001 (Appendix A [project-level biological opinion] in NMFS 2001), and supplemented in 2003 (NMFS 2003). The 2001 biological opinion and its supplement implemented Steller sea lion protection measures for the GOA and the BSAI groundfish fisheries. The protection measures implemented in the BSAI have remained unchanged since the 2001 biological opinion. The 2006 reinitiation of ESA Section 7 consultation on the Alaska groundfish fisheries and major activities following this reinitiation are described below.

On October 18, 2005, the Council requested that NMFS SFD reinitiate consultation on the BSAI and GOA groundfish FMPs. The Council's request was based on the recognition that a substantial amount of new research on Steller sea lions had been published since NMFS completed the biological opinion in 2000 (NMFS 2000), such that an evaluation of the FMPs, in light of that new information, would be prudent. NMFS agreed and on April 19, 2006, SFD requested re-initiation of formal ESA Section 7 consultation on the Alaska groundfish FMPs and the State parallel groundfish fisheries.

On March 7, 2006, NMFS notified Alaska Department of Fish and Game (ADF&G) that the Council had recommended that NMFS reinitiate formal consultation on the effects of the FMPs for groundfish under Section 7 of the ESA. NMFS requested that the State respond regarding its intention to participate in the consultation. Participation in the consultation would allow the State an opportunity to ensure that any decisions in the opinion that may affect State fisheries are based on the most recent information regarding the action and potential effects.

On March 31, 2006, ADF&G notified NMFS of its desire to participate in the consultation and to have the State parallel groundfish fisheries included in the consultation.

On April 19, 2006, SFD sent PRD a written request to re-initiate formal ESA Section 7 consultation on the Alaska groundfish FMPs. The request specified that the purpose of this reinitiation was to evaluate the effects of current fisheries actions and management measures on listed species, in light of any new information gained since completion of the previous consultations in 2000 and 2001. The request for re-initiation was accompanied by a biological assessment (NMFS 2006a). PRD concurred with this request and formally re-initiated consultation on June 21, 2006. Because of the complexity of the analysis, the consulting agency and the action agency agreed to an extended timeline beyond the statutory deadline of 135 days for completion of the consultation.

On April 9, 2009, following receipt of a letter from the Marine Conservation Alliance (MCA), public comment at the Council meeting, and the Council's concurrence with issues raised in the MCA letter, the Council requested that NMFS incorporate specific new information, including information which had yet to be collected, into the draft biological opinion before its release. The new information which the Council recommended be included in the opinion was (1) information from Steller sea lion pup surveys that were scheduled to be conducted in the summer of 2009; (2) information from Steller sea lion non-pup surveys that were to be conducted in the summer of 2009; and (3) new information on reproductive rates, with reference to a recently released report from researchers at the Alaska SeaLife Center. The Council wrote that it believed "…strongly that it is critical to include this new information in the biological opinion as it has the potential to significantly affect the findings within that BiOp…The Council recognizes that incorporation of this information could potentially delay release of the draft BiOp…" and it requested that NMFS provide the Council with its best indication of how the biological opinion schedule might be affected.

On May 6, 2009, NMFS (2009) notified the Council that NMFS had concluded that the new surveys could potentially reduce uncertainty and controversy about important elements in the analysis in the opinion, and thus, that NMFS was extending the schedule for release of the opinion to allow for incorporation of this information. NMFS informed the Council that it planned to have the opinion available for Council consideration in March of 2010.

On January 25, 2010, SFD sent a memo to PRD requesting a change in the description of the action for the FMP biop that would expand the parallel State fisheries to include all groundfish species (Salveson 2010). This change was requested because the original description of the action limited consideration of the State parallel fisheries to pollock, Pacific cod, and Atka mackerel. Because the action is the program-wide management of the federal groundfish fisheries, it is important to include all of the State parallel groundfish fisheries. The State-managed parallel groundfish fisheries are managed under the federal total allowable catch (TAC) inside State waters consistent with the federal fisheries management for the same groundfish in the adjacent EEZ. These parallel fisheries are managed through an emergency order issued each year by ADF&G. Except for sector allocations, State management of the parallel fisheries applies the same requirements as used for federal fisheries management, including applying State water harvests against the federal TACs, federal seasons, bycatch limits, allowable gear types, and closure areas for Steller sea lion and habitat protection.

The release of the draft FMP biop was further postponed to July 2010, to provide sufficient time for incorporation and analysis of the latest scientific and fisheries catch information as well as incorporation of agency comments on the draft document. The Council scheduled a special meeting in August 2010, to review the draft FMP biop and to provide recommendations to NMFS on the alternatives for this EA/RIR.

1.4.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act is the primary domestic legislation governing management of marine fishing activities in federal waters (those waters extending seaward from the edge of coastal state waters to the 200-mile limit). This area became known as the EEZ in 1983. First passed in 1976, the Magnuson-Stevens Act was reauthorized in 1996 by the U.S. Congress to include, among other things, a new emphasis on the precautionary approach in U.S. fishery management policy.

The Magnuson-Stevens Act created eight regional fishery management councils that are primarily charged with preparing FMPs and plan amendments. The Councils are authorized to prepare and submit to the Secretary for approval, disapproval or partial approval, FMPs and any necessary amendments, for each fishery under their authority that require conservation and management. The Councils conduct public meetings so as to allow all interested persons an opportunity to be heard in the development of

FMPs and amendments, and review and revise, as appropriate, the assessments and specifications with respect to the optimum yield from each fishery (16 U.S.C. 1852(h)). The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 amended the Magnuson-Stevens Act to include requirements for annual catch limits, accountability measures, and other provisions related to both ending and preventing overfishing as well as rebuilding fisheries. To date, the Council has prepared, and NMFS has approved and implemented, six FMPs, most now with numerous amendments. These FMPs must comply with the Magnuson-Stevens Act and with the requirements of other federal laws, such as the ESA.

The Magnuson-Stevens Act contains provisions for taking into account the requirements of other laws, as well as provisions related to the protection of marine ecosystems and the environment, some of which are contained in the definitions of optimum yield and "conservation and management":

In the Magnuson-Stevens Act, the term "optimum, with respect to the yield from a fishery, means the amount of fish which—

> (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, taking into account the protection of marine ecosystems;
> (B) is prescribed as such on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and
> (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY of such fishery" (16 U.S.C. 1802(3)(33)).

The term "conservation and management" in the Magnuson-Stevens Act "refers to all of the rules, regulations, conditions, methods, and other measures (A) which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resources and the marine environment; and (B) which are designed to assure that—

> (i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;
> (ii) irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and
> (iii) there will be a multiplicity of options available with respect to future uses of these resources" (16 U.S.C 1802(3)(5)).

Fishery management councils have considerable autonomy but must prepare FMPs, recommend regulations, and generally make decisions that are consistent with the provisions of the Magnuson-Stevens Act (Goodman et al. 2002). Section 301(a) of the Magnuson-Stevens Act sets forth national standards for conservation and management with which FMPs and regulations must be consistent. In addition, NMFS established guidelines based on the national standards to assist in the development and review of FMPs, amendments, and regulations prepared by the fishery management councils and the Secretary (50 CFR 600 Subpart D). The national standards are as follows:

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry.
2. Conservation and management measures shall be based upon the best scientific information available.
3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

4. Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
5. Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.
8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.
9. Conservation and management measures shall, to the extent practicable (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

All fisheries management actions need to be developed with consideration of the Magnuson-Stevens Act national standards, including the proposed action analyzed in this EA.

1.5 Public Process

The initial draft of this EA/RIR was provided, to the Council for review by its Scientific and Statistical Committee (SSC), by its Advisory Panel (AP) and by the Council at a special August 2010 meeting. The Council, SSC, and AP provided opportunity for public comment during their review of the documents, and these comments were considered as each body developed their recommendations for NMFS's consideration.

The final draft of the EA/RIR is scheduled for Council review and recommendation of a preferred alternative at its October 2010 meeting. This Council meeting also will provide for public testimony for Council consideration in developing its recommendations on this action.

1.6 Related Documents

The documents listed below have detailed information on the groundfish fisheries, Steller sea lions, and other marine resources, and the economic and social activities and communities affected by the groundfish fisheries. These documents contain valuable background for the action under consideration in this EA/RIR. The Council on Environmental Quality (CEQ) regulations encourages agencies preparing National Environmental Policy Act (NEPA) documents to incorporate, by reference, the general discussion from a broader environmental impact statement (EIS) and concentrate solely on the issues specific to the EA subsequently prepared. According to the CEQ regulations, whenever a broader EIS has been prepared and a NEPA analysis is then prepared on an action included within the entire program or policy, the subsequent analysis shall concentrate on the issues specific to the subsequent action. The subsequent EA need only summarize the issues discussed and incorporate discussions in the broader EIS by reference (see 40 CFR 1502.20).

This EA will analyze alternatives to avoid JAM for Steller sea lions and their designated critical habitat in the AI. This proposed action derives from the policy established in the preferred alternative in the Alaska groundfish programmatic supplemental EIS (PSEIS) (NMFS 2004). The supplemental EIS for Steller sea lion protection measures (NMFS 2001) contains detailed information regarding the protection measures used in the groundfish fisheries to spatially, temporally, and globally protect Steller sea lions and their designated critical habitat. This action would modify some of these protection measures, primarily in the AI.

Two ESA documents also contain detailed information that supports this EA/RIR. The final revised recovery plan for the Steller sea lion (NMFS 2008) and the draft FMP biop (NMFS 2010) contain recent biological and fisheries interaction information that is crucial to this analysis. This EA incorporates, by reference, information from the NEPA and ESA documents described below, when applicable, to focus the analysis on the issues ripe for decision, and to eliminate repetitive discussions.

Alaska Groundfish Programmatic Supplemental EIS (PSEIS)

In June 2004, NMFS completed the PSEIS that disclosed the direct, indirect, and cumulative impacts from alternative groundfish fishery management programs on the human environment (NMFS 2004). The following provides information on the relationship between this EA/RIR and the PSEIS. NMFS issued a Record of Decision on August 26, 2004, with the simultaneous approval of Amendments 74 and 81 to the groundfish FMPs to implement the preferred alternative in the PSEIS. This decision implemented a policy for the groundfish fisheries management programs that is ecosystem-based and is more precautionary when faced with scientific uncertainty. For more information on the PSEIS, see the NMFS Alaska Region website at:
http://www.alaskafisheries.noaa.gov/sustainablefisheries/seis/default.htm.

The PSEIS brings the decision-maker and the public up to date on the current state of the human environment, while describing the potential environmental, social, and economic consequences of alternative policy approaches and their corresponding management regimes for management of the groundfish fisheries off Alaska. In doing so, it serves as the overarching analytical framework that is used to define future management policy with a range of potential management actions. Future amendments and actions derive from the chosen policy direction set for the PSEIS's preferred alternative.

As stated in the PSEIS, any specific FMP amendments or regulatory actions proposed in the future are evaluated by subsequent EAs or EISs that incorporate by reference information from the PSEIS but stand as case-specific NEPA documents, offering more detailed analyses of the specific proposed actions. As a comprehensive foundation for management of the GOA and BSAI groundfish fisheries, the PSEIS functions as a baseline analysis for evaluating subsequent management actions and for incorporation by reference into subsequent EAs and EISs, focusing on specific federal actions.

Alaska Groundfish Harvest Specifications EIS

In January 2007, NMFS completed the EIS analyzing the impacts of various harvest strategies for the Alaska groundfish fisheries (NMFS 2007). Except for the no action alternative, the alternatives analyzed would implement the preferred management strategy contained in the PSEIS. This document contains an analysis of the effects of the alternative harvest strategies on target groundfish species, non-target species, prohibited species, marine mammals, seabirds, habitat, ecosystem relationships, and social and economic concerns. The analysis is based on the latest information at that time regarding the status of each of these environmental components and provides the most recent consideration of reasonably foreseeable future actions to consider in the cumulative effects analysis of other NEPA documents. This EIS provides the

latest overall analysis of the impacts of the groundfish fisheries on the environment and provides a substantial amount of reference material for this EA/RIR.

Essential Fish Habitat EIS

In 2005, NMFS and the Council completed the EIS for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS) (NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify habitat areas of particular concern (HAPC) within EFH, and (3) minimizing to the extent practicable the adverse effects of fishing on EFH. The Council's preferred alternatives from the EFH EIS are implemented through Amendments 78/65 to the BSAI groundfish FMP. A Record of Decision was issued on August 8, 2005. NMFS approved the amendments on May 3, 2006. Regulations implementing the EFH/HAPC protection measures were effective July 28, 2006 (71 FR 36694, June 28, 2006). The final EIS may be found on the NMFS Alaska Region website at: http://alaskafisheries.noaa.gov/habitat/seis/efheis.htm.

Several management analytical tools and measures are contained in appendices to the EFH EIS and are summarized below.

Appendix B - Evaluation of Fishing Activities that May Adversely Affect EFH. Appendix B of the EFH EIS addresses the requirement to conserve and protect fish habitats from adverse fishing activities. Appendix B includes a model that evaluates current fishing activities on areas specifically described as EFH, incorporates the most accurate and up-to-date fishing gear descriptions, and formulates an effects index. Index values provide a range of fishing gear effects on habitat.

Based on the best available scientific information, NMFS concluded that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the EFH EIS found no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The EFH EIS concluded that no Council managed fishing activities have more than minimal and temporary adverse effects on EFH for any FMP species, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act (50 CFR 600.815(a)(2)(ii)). Additionally, the analysis indicated that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH.

EFH EIS, Section 3.4.1 Magnuson-Stevens Act Managed Fisheries. For five of the FMPs (GOA groundfish, BSAI groundfish, BSAI crab, scallops, and salmon), a subsection accurately describes the fisheries and gear types used within that particular fishery. These descriptions are a product of a workshop held between fisheries managers and fishermen regarding specific gear types currently used. This information was used in the fishing effects model to assess gear impacts on different habitat types.

Because the proposed action analyzed in this EA may change fishing locations, the information in the EFH EIS may be used to identify potential impacts to EFH and bottom habitat. Information specific to gear types and locations can be used to characterize potential impacts. Extensive habitat area closures currently exist in the Aleutian Islands (50 CFR 679.22). The EFH EIS contains recent information on fishing effects on habitat and may be referenced to describe the potential impacts on habitat by the proposed action analyzed in this EA.

BSAI and GOA Harvest Specifications for 2006–2007 EA/Final Regulatory Flexibility Analysis (FRFA)

Harvest specifications for the Alaska groundfish fisheries for 2006 and 2007 were analyzed in an EA to determine significance of the potential effects of alternative harvest strategies (NMFS 2006b). This EA/FRFA provided recent, applicable methods of determining significance of effects of groundfish fisheries on environmental components. These significance criteria will be incorporated in whole or in part in this EA to provide the basis for the significance conclusions for each environmental component.

2008 Revised Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*)

Section 4(f) of the ESA directs the responsible agency to develop and implement a recovery plan, unless such a plan will not promote the conservation of a species. NMFS determined that a recovery plan would promote the conservation of the eastern DPS and WDPS of Steller sea lions. NMFS released the revised recovery plan in 2008 (NMFS 2008). The recovery plan contains a description of the eastern DPS and WDPS of Steller sea lions, including population status and trends, habitat, vital rates, feeding ecology, conservation measures, factors influencing the populations, threats, and the recovery criteria needed to remove the DPSs from the ESA list. Information in the recovery plan informed the 2010 draft FMP biop, particularly the aspect of recovery. Information in the recovery plan will be incorporated by reference in this EA in the section on Steller sea lions (chapter 5) and in the description of the alternatives (chapter 2).

2010 Draft Biological Opinion on the Effects of the Alaska Groundfish Fisheries on ESA-listed Species

The draft FMP biop details the groundfish fisheries management, status of the eastern DPS and WDPS of Steller sea lions and their designated critical habitat, human and natural effects on Steller sea lions and their habitat, response of Steller sea lions and their habitat to the environmental baseline and to human effects, and non-federal cumulative impacts (NMFS 2010). The incidental take statement describes the amount of take of Steller sea lions expected by the action and the amount of take of Steller sea lions that would require reinitiation of Section 7 formal consultation.

Because the draft FMP biop determined that the groundfish fisheries are likely to result in JAM for the WDPS of Steller sea lions and their designated critical habitat, an RPA is included, which must be implemented to avoid JAM for Steller sea lions. This RPA is the basis for the alternatives in this EA/RIR. This EA/RIR also references much of the Steller sea lion biological and status information and fisheries effects descriptions provided in the draft FMP biop. These sections of the FMP biop are the best available scientific information regarding Steller sea lions, their critical habitat, and fisheries interactions. This information is incorporated by reference as appropriate throughout the EA/RIR.

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1.8 Preparers and Persons Consulted

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2.0 ALTERNATIVES

2.1 Description of Alternatives

2.1.1 Alternative 1: Status quo

Under this alternative, no changes would be made to the current groundfish fisheries management in the Aleutian Islands. The following sections describe the management measures for those portions of the groundfish fisheries that are proposed to be changed by this action (primarily the Atka mackerel and Pacific cod fisheries in the Aleutian Islands). A recent, detailed description of the entire Alaska groundfish fisheries management program is in the draft biological opinion on the Alaska groundfish fisheries (FMP biop) (NMFS 2010) and is incorporated by reference. Management measures that extend into State of Alaska (State) waters from 0–3 nautical miles (nm) apply to federally permitted vessels. For the groundfish fisheries, federally permitted vessels are vessels named on a federal fisheries permit (50 CFR 679.2).

2.1.1.1 General Aleutian Islands Groundfish Fisheries Management

The current Steller sea lion protection measures apply to the pollock, Atka mackerel, and Pacific cod fisheries in the Aleutian Islands subarea. The details of the Steller sea lion protection measures in the Aleutian Islands are in the environmental impact statement (EIS) for that action (NMFS 2001) and are incorporated by reference in the environmental assessment (EA). A summary of the management measures and changes to the fisheries management since 2003 are further described below. The protection measures are intended to spatially, temporally, and globally disperse fishing to mitigate potential competition for prey resources between the Pacific cod, pollock, and Atka mackerel fisheries and Steller sea lions. Groundfish fishery closures from 0 nm to 3 nm around rookeries are the only protection measures that apply to the entire groundfish fisheries (Figure 2-1). These closures prevent disturbance and potential competition for prey in the near shore area where young and reproductive female Steller sea lions may forage.

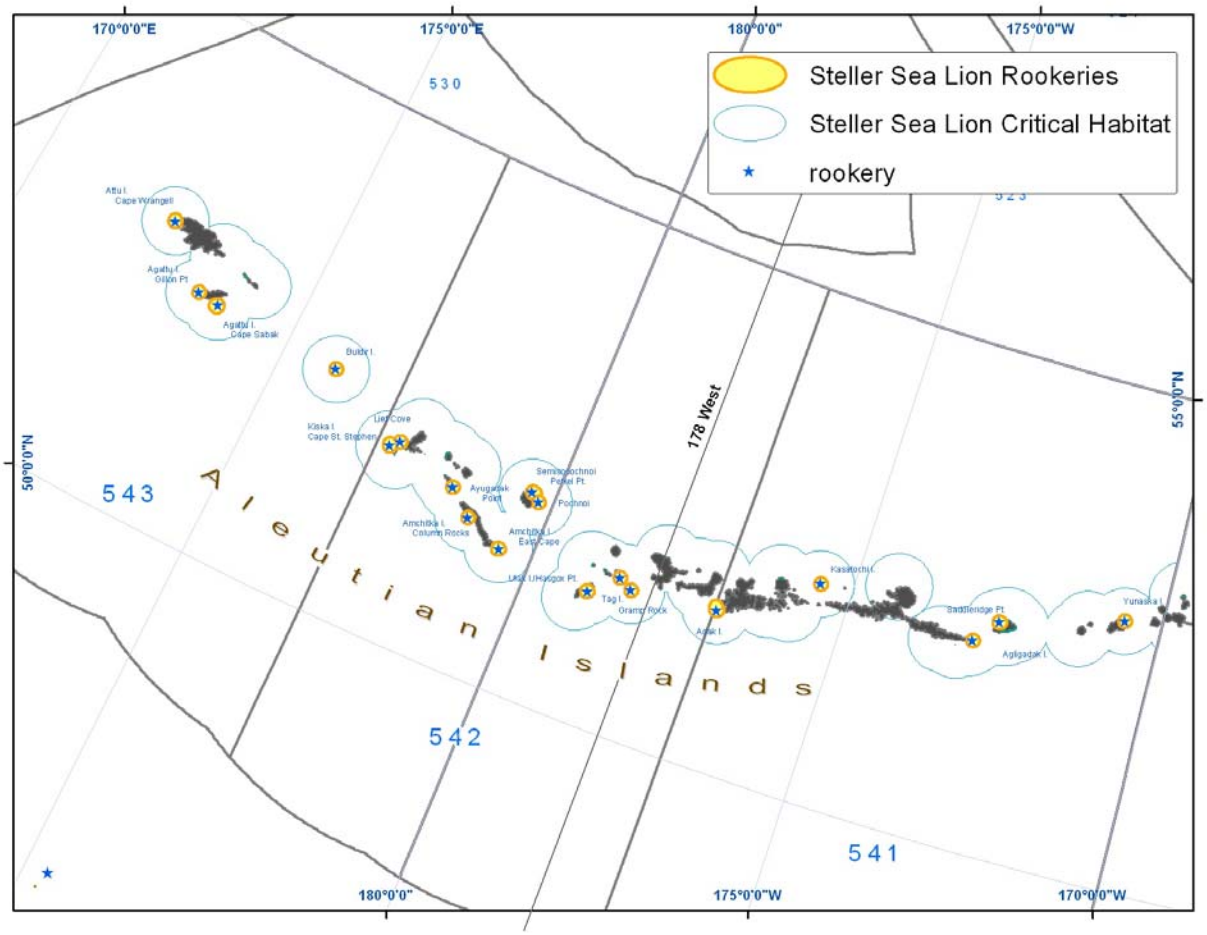

Figure 2-1 Aleutian Islands rookeries with 3-nm groundfish fishing closures. (Steve Lewis, NMFS Alaska Region, Analytical Team)

Because the pollock fishery in the Aleutian Islands is currently prohibited in critical habitat and little of the Aleutian Islands pollock total allowable catch (TAC) is harvested, management of this fishery does not need to be changed to provide additional protection to Steller sea lions (NMFS 2010). The description of the status quo and the action analyzed in this environmental assessment/regulatory impact review (EA/RIR) focuses on the Pacific cod and Atka mackerel fisheries, the target fisheries that are included in the reasonable and prudent alternative (RPA).

The pollock, Pacific cod, and Atka mackerel harvest is limited globally by prohibiting directed fishing if the projected spawning biomass of the fish stock falls below 20 percent of the unfished spawning biomass (50 CFR 679.20(d)(4)). None of these fisheries have experienced this type of directed fishing closure since this regulation became effective in 2003 (68 FR 204, January 2, 2003). The spatial and temporal dispersal of the Atka mackerel and Pacific cod fisheries is dependent on the target species, location, and gear type. Management measures affecting the spatial and temporal dispersal of the Atka mackerel and Pacific cod fisheries in the Aleutian Islands are explained in the following sections.

2.1.1.2 Amendment 80 Fisheries

The Amendment 80 Program allocates several Bering Sea and Aleutian Islands Management Area (BSAI) non-pollock trawl groundfish species (including Atka mackerel and Pacific cod) among trawl fishery sectors and facilitates the formation of harvesting cooperatives in the non-American Fisheries Act (AFA) trawl catcher/processor sector (72 FR 52668, September 14, 2007 and corrected 72 FR 61214, October 29, 2007). The Program allocates fishery resources among BSAI trawl harvesters in consideration of historic and present harvest patterns and future harvest needs, establishes a limited access privilege program (LAPP) for the non-AFA trawl catcher/processors, authorizes the allocation of groundfish species to harvesting cooperatives to encourage fishing practices with lower discard rates and to improve the opportunity for increasing the value of harvested species while lowering costs; and limits the ability of non-AFA trawl catcher/processors to expand their harvesting capacity into other fisheries not managed under a LAPP.

Each year, the program allocates an amount of Amendment 80 species available for harvest, called the initial total allowable catch (ITAC), and crab and halibut prohibited species catch amounts (PSC) to two defined groups of trawl fishery participants: (1) the Amendment 80 sector, and (2) the BSAI trawl limited access sector. The ITAC is the amount of the TAC remaining after allocations to the Western Alaska Community Development Quota Program (CDQ). The BSAI trawl limited access sector comprises all trawl participants who are not part of the Amendment 80 sector (i.e., AFA trawl catcher/processors, AFA trawl catcher vessels, and non-AFA trawl catcher/vessels). Allocations made to one sector are not subject to harvest by participants in the other fishery sector except under a specific condition: fish that are allocated to the BSAI trawl limited access sector and projected to be unharvested can be reallocated to Amendment 80 cooperatives by National Marine Fisheries Service (NMFS) throughout the year to ensure a more complete harvest of the TAC.

The amount of ITAC assigned to the Amendment 80 and the BSAI trawl limited access sectors was based on a review of historic catch patterns during 1998 through 2004, with consideration given to various socioeconomic factors. One exception to this rule applies to Pacific cod. Pacific cod ITAC is allocated to the Amendment 80 sector under the criteria that the North Pacific Fishery Management Council (Council) adopted for Amendment 85 in April 2006. NMFS published a final rule implementing Amendment 85 in September 2007 (72 FR 50788), and Amendment 85 and Amendment 80 were fully implemented in 2008. The rationale for Pacific cod allocation to the Amendment 80 sector is described under the analysis prepared for Amendment 85 (NPFMC 2007) and is not repeated here.

Annually, NMFS determines the division of the Amendment 80 sector's ITAC within the sector, based on quota share (QS) holdings of sector members. NMFS could issue QS for up to 28 permits for the originally qualifying vessels. Depending on a QS holder's choice, the portion of the TAC associated with that person's QS is assigned to either a cooperative or a limited access fishery. A vessel owner may choose to assign a vessel to either a cooperative or the limited access fishery, but owners of multiple vessels may choose to assign each vessel independently to a cooperative or to the limited access fishery depending on the perceived benefits of those choices for each specific vessel. In general, if a person who holds one percent of the Amendment 80 QS for a given species assigns that QS to a cooperative, one percent of that species TAC would be assigned to that cooperative for that year. Crab and halibut PSC limits in the BSAI are allocated to the Amendment 80 and BSAI trawl limited access sectors and within the Amendment 80 sector in a similar manner. The PSC limits assigned to the Amendment 80 sector are lowered in a stepwise fashion over a period of years to provide additional reductions in PSC use over time.[1]

[1] See Tables 35 and 36 to 50 CFR 679 at: alaskafisheries.noaa.gov/regs/default.htm

2.1.1.3 Aleutian Islands Atka Mackerel Harvest Limit Area and Seasons

Atka mackerel is harvested in the Aleutian Islands with nonpelagic trawl gear. The harvest of Atka mackerel is evenly divided between an A season (January 20 through April 15) and a B season (September 1 through November 1). These seasonal apportionments are applied for the TACs in Area 543, Area 542 and in the combined Area 541/Bering Sea. Directed fishing for Atka mackerel with trawl gear in critical habitat is prohibited in Area 541 and the eastern portion of Area 542 (Figure 2-2). In Area 543 and the western portion of Area 542, Atka mackerel trawling may occur in critical habitat under the Harvest Limit Area (HLA) platoon system, which is intended to distribute and disperse fishing effort and was implemented by final rule in 2003 (68 FR 204, January 2, 2003).

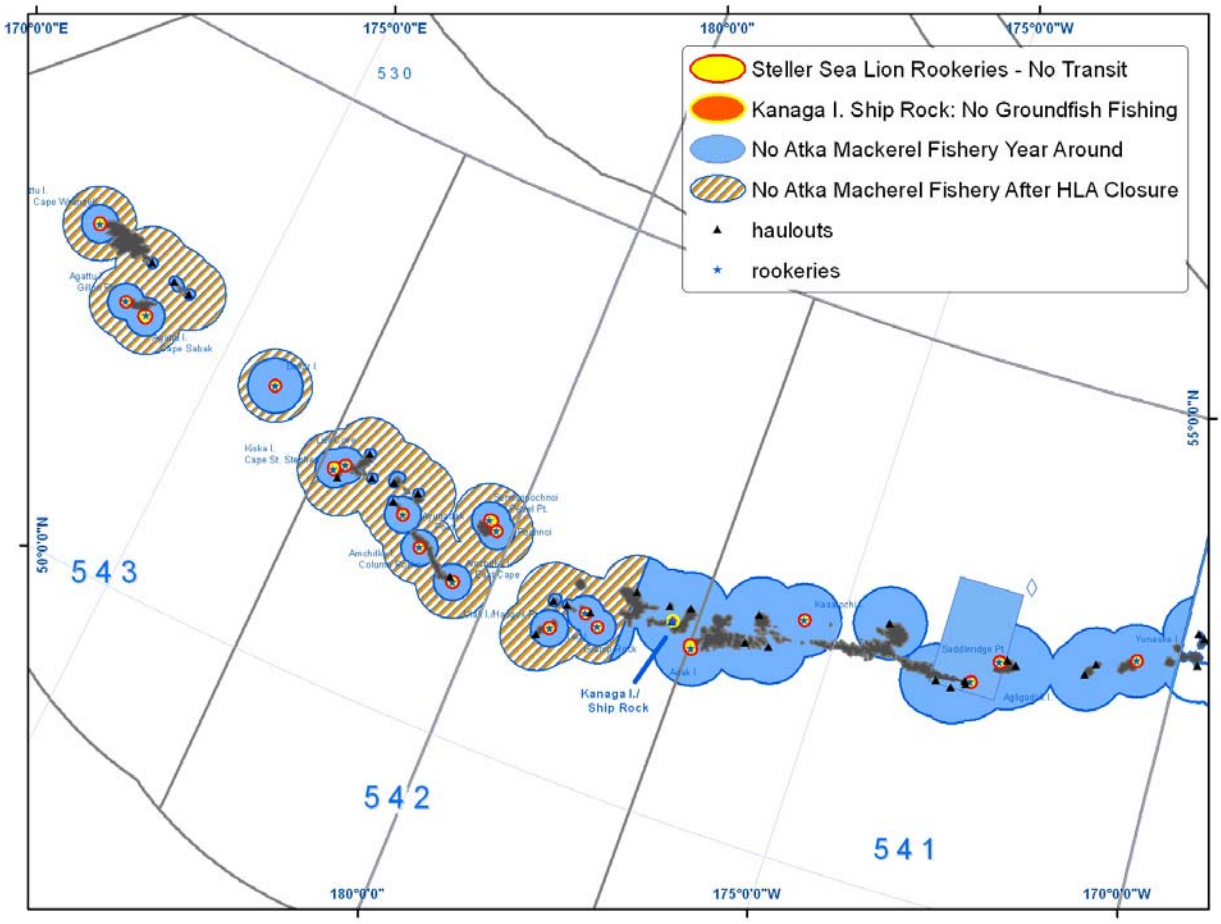

Figure 2-2 Alternative 1 Aleutian Islands Atka mackerel trawl closures. (Steve Lewis, NMFS Alaska Region, Analytical Team)

The HLA is 20-nm areas around Steller sea lion rookeries and haulouts in Area 543 and the western portion of Area 542 (Figure 2-3). The HLA includes critical habitat and additional 20-nm areas around haulouts that were identified in the 2001 biological opinion (NMFS 2001). The amount of Atka mackerel harvest in the HLA is limited to no more than 60 percent of the seasonal apportionment. The harvest of Atka mackerel in the HLA is further dispersed by dividing the Atka mackerel fleet into platoons that are limited to fishing in one area (either 543 or 542) at a time. Vessels in a platoon fish in their assigned area for the estimated number of days for the vessels to take the available TAC and then switch to the other

HLA area. Because Pacific cod trawling is prohibited in the HLA when the HLA is open to Atka mackerel trawling, the HLA fishery is limited to 14 days. Since the implementation of Amendment 80, the fleet has demonstrated an ability to modify their fishing patterns to reduce catch rates. The ability to tailor fishing operations to the specific allocation of quota allows vessel operators to avoid the concentration of harvests that may occur under a race for fish. The HLA fishery, however, requires Atka mackerel to be harvested during discrete time period. HLA management may result in a greater concentration of Atka mackerel harvest than would be likely under cooperative management without the HLA.

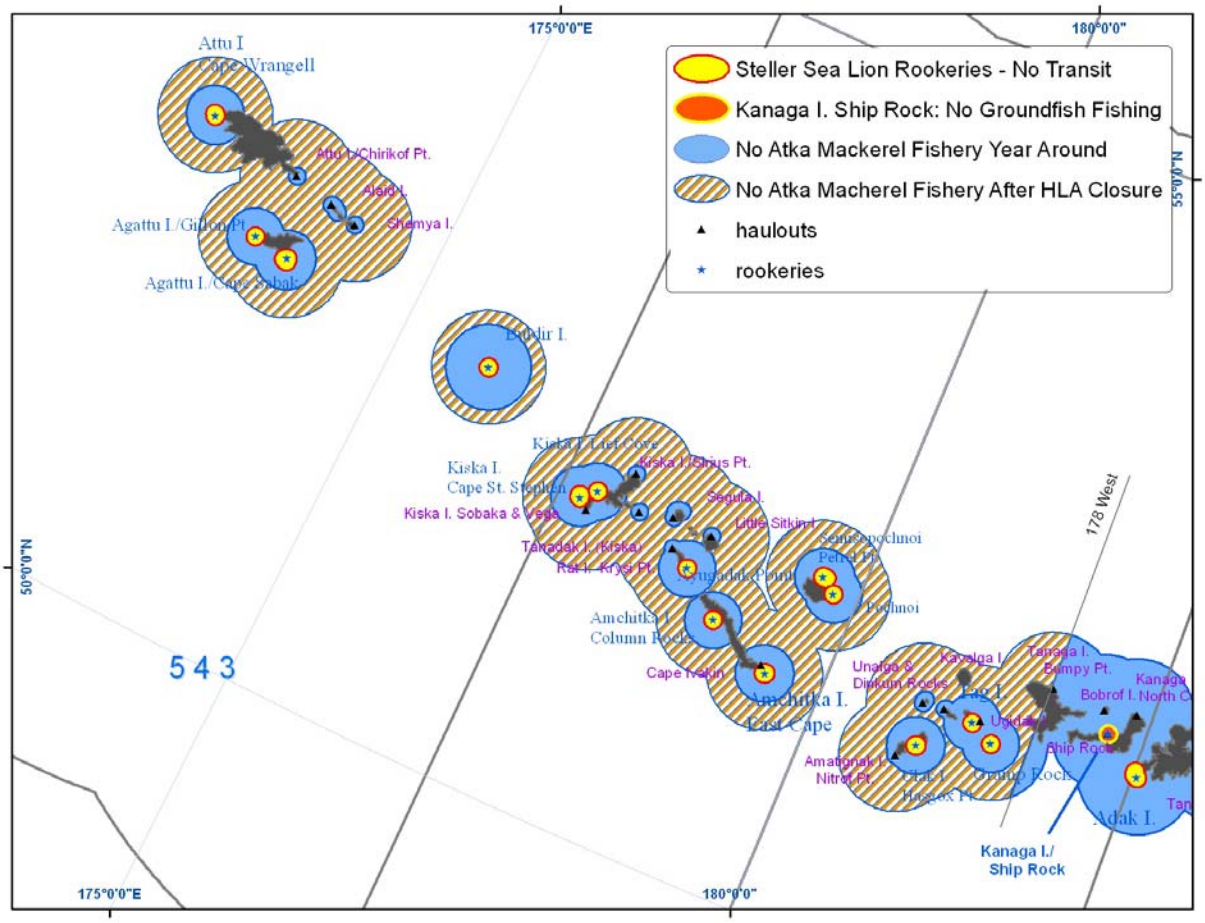

Figure 2-3 Harvest Limit Area for Atka mackerel trawling in Area 543 and western portion of Area 542. (Steve Lewis, NMFS Alaska Region, Analytical Team)

2.1.1.4 Pacific Cod Fisheries Management

Pacific cod is harvested in the Aleutian Islands subarea by nontrawl gears. The nontrawl gears are jig, pot, and hook-and-line. The Steller sea lion protection measures implemented seasonal apportionments for the BSAI Pacific cod fishery specific to gear types. The seasonal apportionments and gear allocations are annually established in the harvest specifications, as shown in Table 2-1 for 2010 (75 FR 11778, March 12, 2010). The allocations and seasonal apportionments are BSAI-wide.

Table 2-1 Final 2010 gear shares and seasonal allowances of the BSAI Pacific cod TAC. (75 FR 11778, March 12, 2010)

[Amounts are in metric tons]

Gear sector	Percent	2010 share of gear sector total	2010 share of sector total	2010 seasonal apportionment	
				Dates	Amount
Total TAC	100	168,780	n/a	n/a	n/a
CDQ	10.7	18,059	n/a	see § 679.20(a)(7)(i)(B)	n/a
Total hook-and-line/pot gear	60.8	91,638	n/a	n/a	n/a
Hook-and-line/pot ICA[1]	n/a	500	n/a	see § 679.20(a)(7)(ii)(B)	n/a
Hook-and-line/pot sub-total	n/a	91,138	n/a	n/a	n/a
Hook-and-line catcher/processor	48.7	n/a	73,000	Jan 1–Jun 10	37,230
				Jun 10–Dec 31	35,770
Hook-and-line catcher vessel ≥ 60 ft length overall (LOA)	0.2	n/a	300	Jan 1–Jun 10	153
				Jun 10–Dec 31	147
Pot catcher/processor	1.5	n/a	2,248	Jan 1–Jun 10	1,147
				Sept 1–Dec 31	1,102
Pot catcher vessel ≥ 60 ft LOA	8.4	n/a	12,591	Jan 1–Jun 10	6,422
				Sept 1–Dec 31	6,170
Catcher vessel < 60 ft LOA using hook-and-line or pot gear	2	n/a	2,998	n/a	n/a
Trawl catcher vessel	22.1	33,309	n/a	Jan 20–Apr 1	24,649
				Apr 1–Jun 10	3,664
				Jun 10–Nov 1	4,996
AFA trawl catcher/processor	2.3	3,467	n/a	Jan 20–Apr 1	2,600
				Apr 1– Jun 10	867
				Jun 10–Nov 1	0
Amendment 80	13.4	20,197	n/a	Jan 20–Apr 1	15,147
				Apr 1– Jun 10	5,049
				Jun 10–Nov 1	0
Amendment 80 limited access	n/a	n/a	3,319	Jan 20–Apr 1	2,489
				Apr 1– Jun 10	830
				Jun 10–Nov 1	0
Amendment 80 cooperatives	n/a	n/a	16,878	Jan 20–Apr 1	12,658
				Apr 1– Jun 10	4,219
				Jun 10–Nov 1	0
Jig	1.4	2,110	n/a	Jan 1–Apr 30	1,266
				Apr 30–Aug 31	422
				Aug 31–Dec 31	422

[1] The incidental catch allowance (ICA) for the hook-and-line and pot sectors will be deducted from the aggregate portion of Pacific cod TAC allocated to the hook-and-line and pot sectors. The Regional Administrator approved an ICA of 500 mt for 2010 based on anticipated incidental catch in these fisheries.

The Aleutian Islands Pacific cod fishery is spatially dispersed by the Steller sea lion protections measures by closing habitat areas depending on the gear type used to harvest the Pacific cod, whether or not the HLA Atka mackerel fishery is open, and the location. Figure 2-4 and Figure 2-5 show the trawl and nontrawl closures for Pacific cod in the Aleutian Islands subarea. Most of the nontrawl Pacific cod fishing in the Aleutian Islands is with pot and hook-and-line gear. There was increased effort from jig gear in the Aleutian Islands in 2008, but most of the jig effort in the BSAI is in Area 519 of the Bering Sea. In 2009, and to date in 2010, most of the jig effort is in the Gulf of Alaska State waters guideline harvest level fisheries (Mary Furuness, NMFS Inseason Management, July 10, 2010).

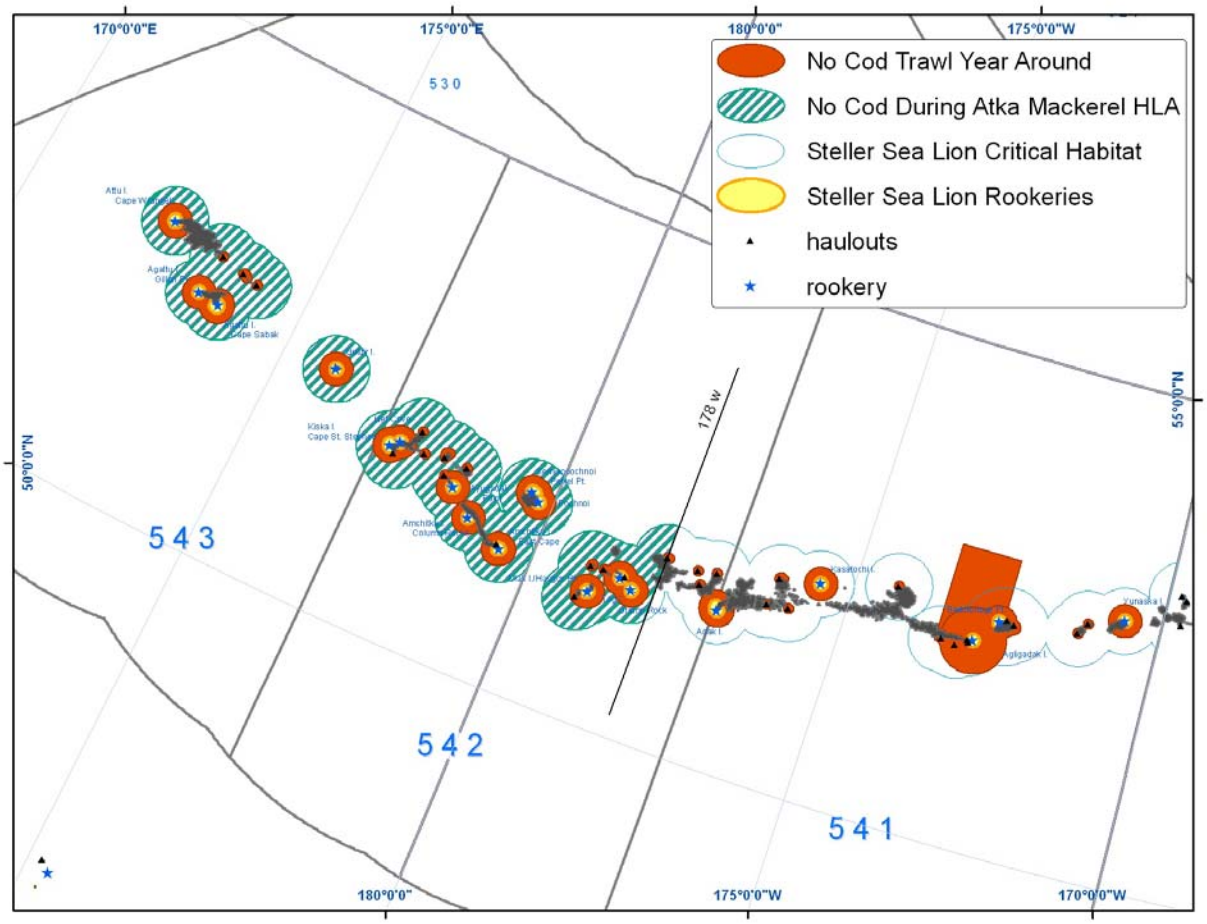

Figure 2-4 Aleutian Islands Pacific cod trawl closures. (Steve Lewis, NMFS Alaska Region, Analytical Team)

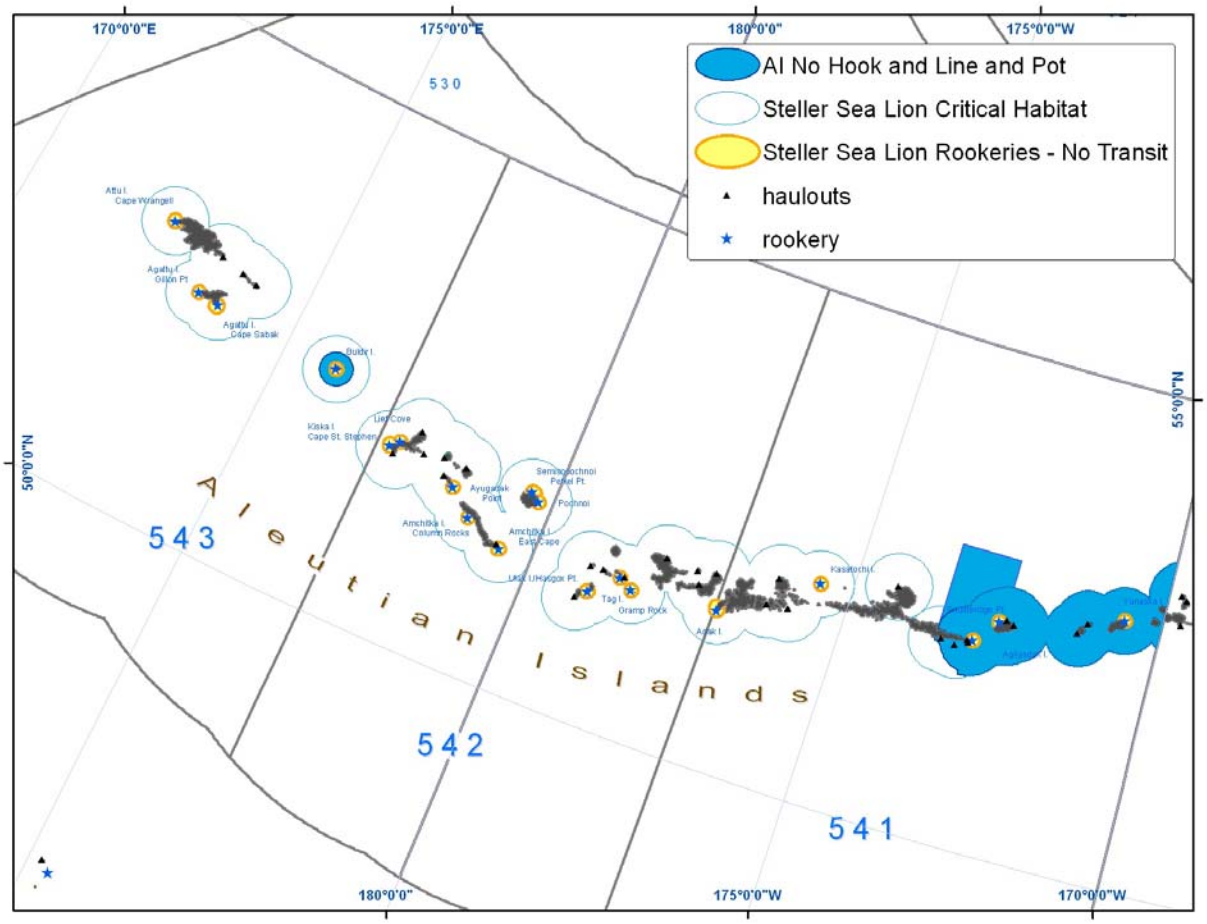

Figure 2-5 Aleutian Islands Pacific cod nontrawl closures. (Steve Lewis, NMFS Alaska Region, Analytical Team)

2.1.1.5 Aleutian Islands Habitat Protection and Conservation Areas

A large portion of the Aleutian Islands subarea is closed to nonpelagic trawling. Nonpelagic trawl gear is used for harvesting Atka mackerel and Pacific cod. The closures to nonpelagic trawling include the Aleutian Islands Habitat Conservation Area (AIHCA), which is nearly the entire Aleutian Islands subarea; the Aleutian Islands Coral Habitat Protection Areas and the Bowers Ridge Habitat Conservation Zone, located in the northern portion of Area 542 and 543 (Figure 2-6 and http://www.fakr.noaa.gov/habitat/efh/aihca.pdf). These closures areas were implemented in July 28, 2006 (71 FR 36694, June 28, 2006) and revised March 20, 2008 (73 FR 9035, February 19, 2008). The AIHCA closed most of the Aleutian Islands subarea to nonpelagic trawling (279,114 nm^2), while most fishing areas that have been trawled repeatedly in the past remain open. The Bowers Ridge Habitat Conservation Zone is closed to mobile bottom contact gear, including nonpelagic trawling. The Aleutian Islands Coral Habitat Protection Areas are relatively small, discrete areas closed to bottom contact gear. Even though an area may be open to nonpelagic trawling, the area may be closed to Atka mackerel or Pacific cod trawling based on Steller sea lion protection measures, leaving discrete locations throughout the Aleutian Islands subarea that are open to nonpelagic trawl fishing, as shown on Figure 2-6.

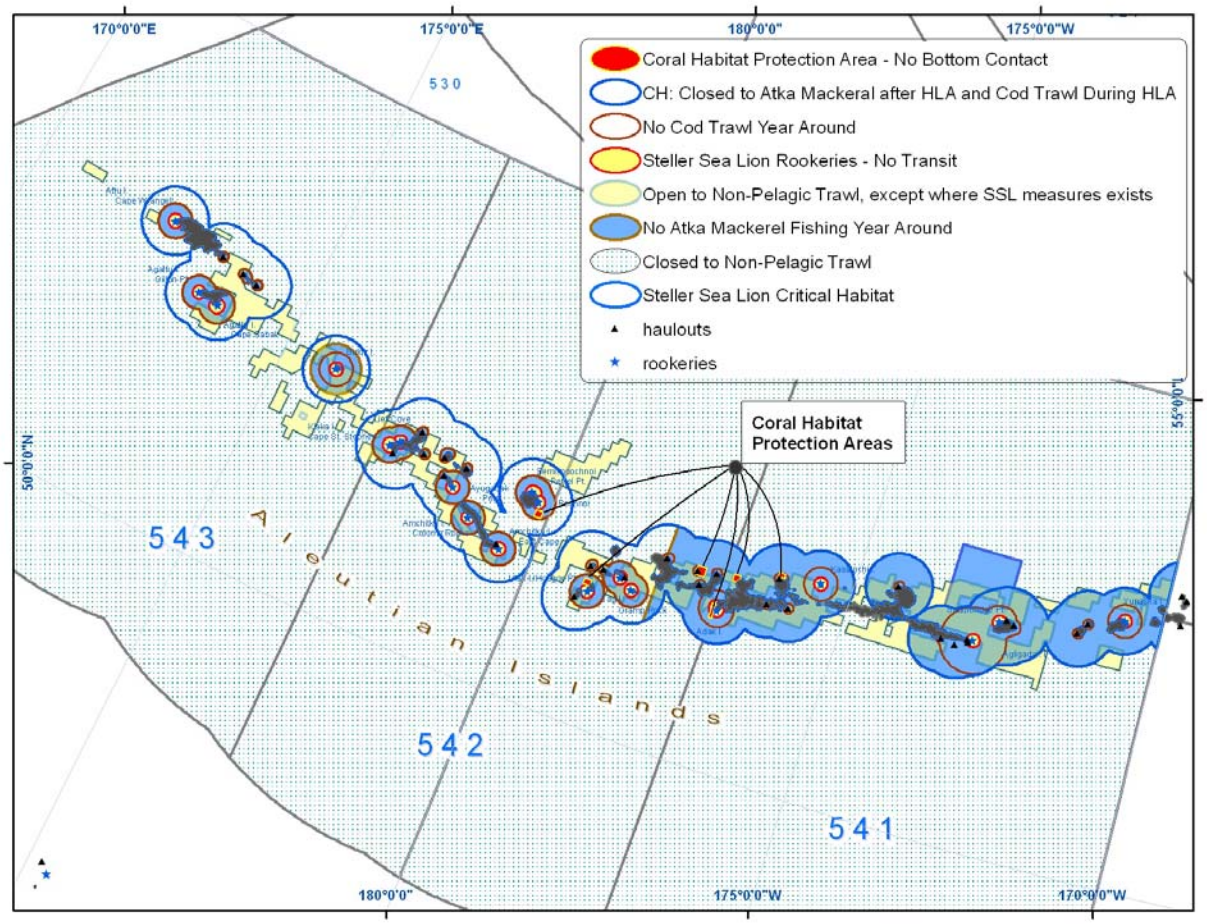

Figure 2-6 **Aleutian Islands Habitat Conservation Area and Aleutian Island Coral Habitat Protection Area in relation to Steller sea lion critical habitat closures. (Steve Lewis, NMFS Alaska Region, Analytical Team)**

2.1.2 Alternative 2: Enhanced Conservation Approach

This alternative would use management measures for the Aleutian Islands Atka mackerel and Pacific cod fisheries to remove most of the potential adverse effects on Steller sea lions and their critical habitat. Alternative 2 would provide protection measures for Steller sea lions and their critical habitat no less stringent than currently implemented and provide additional measures at least as protective as the RPA in the FMP biop (NMFS 2010). The protection is greater in the areas where population growth has been the most negative (Areas 543 and 542 compared to Area 541). The enhanced conservation approach would facilitate NMFS's implementation by simplifying the area closures and seasonal management measures in Area 542 and 541 compared to critical habitat zone specific measures described in Alternative 3. Except for the changes described below, the current Steller sea lion protection measures (e.g., Pacific cod trawl season dates, no Atka mackerel directed fishing in critical habitat in Area 541) would remain unchanged.

Alternative 2 would—

In Areas 542 and 543:

- Prohibit retention of Atka mackerel and Pacific cod by federally permitted vessels, including those operating in State waters 0–3 nm.
- Establish TACs for Atka mackerel sufficient to support incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the HLA (Area 543 and western portion of Area 542) (Figure 2-3).
- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

In Area 541 and the Bering Sea:

- Close critical habitat in Area 541 to directed fishing for Pacific cod by federally permitted vessels.
- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Prohibit Pacific cod directed fishing in Area 541 November 1 through December 31. (This extends the current trawl season restriction to the nontrawl fishery.)

Under this alternative, the TAC for Atka mackerel in Areas 543 and 542 would be set at a level sufficient to support incidental catch in other directed groundfish fisheries (e.g., Pacific ocean perch) (Table 2-2). Pacific cod in Areas 543 and 542 would be placed on prohibited species status and closed to directed fishing. Currently, Pacific cod is managed under a single TAC for the BSAI so no area specific TAC to support incidental catch can be specified. Any retention of Atka mackerel or Pacific cod would be prohibited to remove any incentive to retain these species by operators of vessels targeting other groundfish species. Because no directed fishery for Atka mackerel would be allowed in Areas 543 and 542, the platoon management system and HLA would be removed from the regulations. Unless otherwise restricted by the State, vessels not federally permitted may participate in the State-managed Pacific cod fisheries in waters 0–3 nm in those areas closed to directed fishing for Pacific cod by federally permitted vessels.

Table 2-2 Incidental catch of Atka mackerel in other groundfish fisheries. (NMFS Catch Accounting System, July 12, 2010)

542/543 Atka Mackerel Catch by Target

	Atka Mackerel Target		Pacific Cod Target		Pacific Ocean Perch Target	
2003	42,683	83.6%	497	5.2%	139	1.7%
2004	49,406	83.0%	138	1.4%	179	2.5%
2005	54,610	85.7%	134	2.1%	68	1.3%
2006	54,318	86.5%	123	1.7%	32	0.5%
2007	35,513	83.2%	216	2.4%	91	0.8%
2008	37,430	83.1%	109	1.0%	1,431	12.6%
2009	43,926	83.5%	441	3.3%	2,022	19.8%

Other targets combined account for less than 1 mt of Atka Mackerel in all years

542 Atka Mackerel catch by Target

	Atka Mackerel Target		Pacific Cod Target		Pacific Ocean Perch Target	
2003	25,197	86.1%	206	3.0%	32	1.3%
2004	29,892	83.5%	135	2.3%	143	4.9%
2005	34,928	89.6%	84	2.9%	58	2.8%
2006	39,715	88.2%	114	4.2%	6	0.3%
2007	26,625	84.3%	78	2.1%	20	0.5%
2008	22,041	84.1%	92	2.5%	337	8.2%
2009	29,430	84.2%	64	1.4%	576	17.1%

Other targets combined account for less than 1 mt of Atka Mackerel in all years

543 Atka Mackerel catch by Target

	Atka Mackerel Target		Pacific Cod Target		Pacific Ocean Perch Target	
2003	17,486	80.2%	291	10.5%	107	1.9%
2004	19,514	82.3%	4	0.1%	36	0.8%
2005	19,682	79.5%	51	1.4%	11	0.3%
2006	14,603	81.9%	9	0.2%	26	0.6%
2007	8,888	80.3%	138	2.6%	71	0.9%
2008	15,389	81.7%	17	0.2%	1,094	15.0%
2009	14,496	82.1%	377	4.3%	1,445	21.1%

Other targets combined account for less than 1 mt of Atka Mackerel in all years

Critical habitat sites for purposes of fisheries management measures include sites designated as critical habitat under the Endangered Species Act (50 CFR 226.202) and sites identified as important for Steller sea lion use based on the FMP biop (Table 3.31 in NMFS 2010). Steller sea lion use of Alaska terrestrial sites has changed since designation of critical habitat over 10 years ago (Figure 2-7). In the 2003 Steller sea lion protection measures (68 FR 204, January 2, 2003), all rookeries were protected 0–3 nm from directed fishing for groundfish. This protection was applied regardless of whether the rookery was designated as critical habitat under 50 CFR 226.202. Kanaga Island/Ship Rock was used as a haulout at the time the 2003 protection measures were implemented and presently does not have a 3-nm groundfish fishing closure. Based on new information in the 2010 FMP biop, this site meets the criteria to be a Steller sea lion rookery (Table 3.31 in NMFS 2010). To ensure all sites currently used as rookeries are provided the same level of protection from the potential effects of groundfish fishing, Alternative 2 would include a 0–3-nm directed groundfish fishing closure around Kanaga Island/Ship Rock (Figure 2-8). This closure would ensure this new rookery is protected from disturbance and potential competition for prey in the 0–3 nm waters around this site. Sites on Figure 2-7 that have changed from rookeries to haulouts will continue to have 3 nm groundfish closures because these sites already have 3 nm no transit closures under 50 CFR 223.202, ESA regulations for critical habitat restrictions. Therefore, groundfish fishing cannot take place in these areas regardless of the 50 CFR 679.22 closures, which are under the authority of the Magnuson-Stevens Act. Even with the groundfish fishing closures under Alternative 2, vessels will continue to be able to transit waters 0–3 nm from Kanaga Island/Ship Rock.

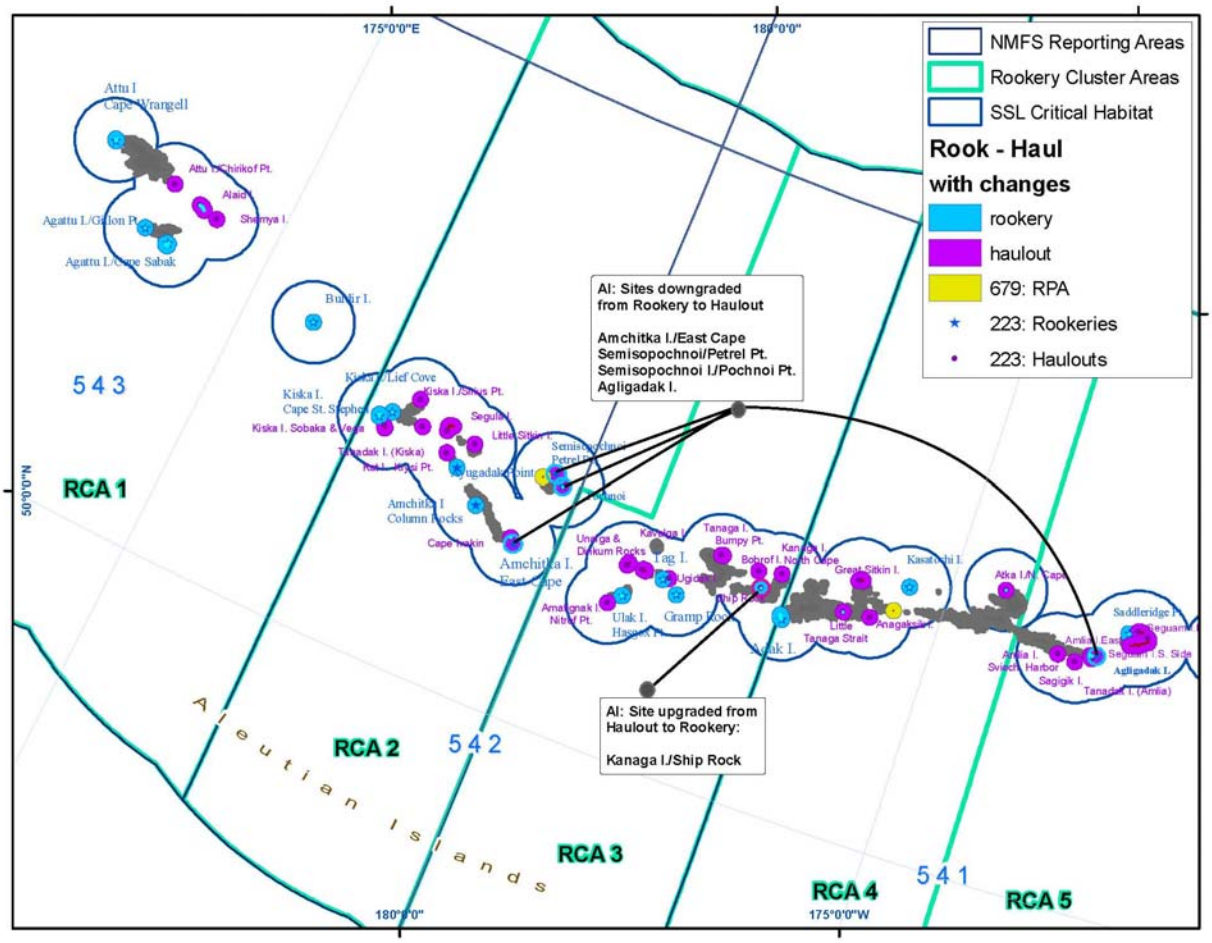

Figure 2-7 Changes in the use of Steller sea lion rookeries and haulouts in the Aleutian Islands. (Steve Lewis, NMFS Alaska Region, Analytical Team)

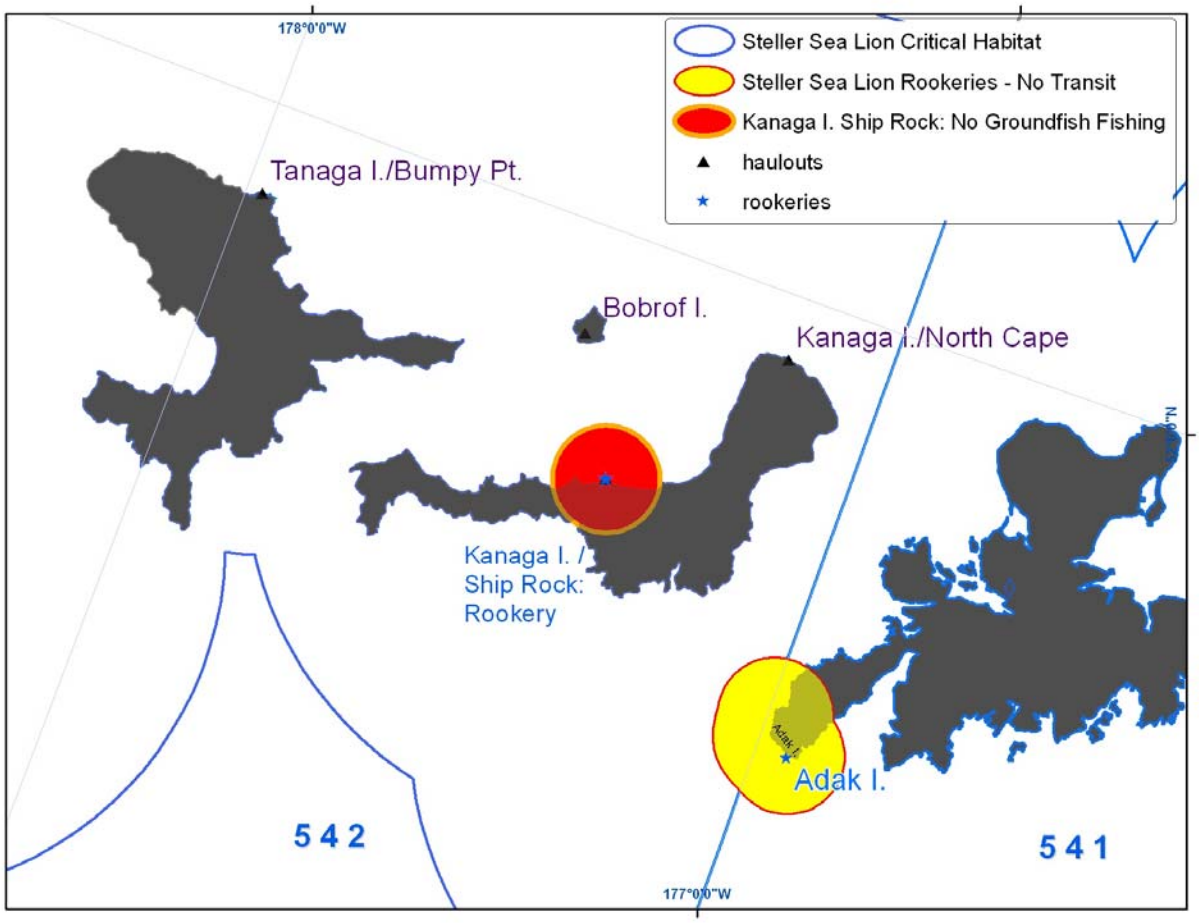

Figure 2-8 Steller sea lion new rookery at Kanaga Island/Ship Rock. Note the proposed 3-nm groundfish directed fishery closure. (Steve Lewis, NMFS Alaska Region, Analytical Team)

All gear types are treated the same under Alternative 2. The protection measures are intended to protect overall available biomass, prevent the potential for localized depletion, and prevent disturbance of Steller sea lions by all types of vessels that may harvest Atka mackerel or Pacific cod. Even though a gear type may harvest at a slower rate, the presence of the vessel may cause disturbance, and the vessel would be removing prey species. The Atka mackerel closures would apply to trawl and jig gears. Jig fishing for Atka mackerel primarily occurs in the Bering Sea and extending the closures to jig gear would prevent an increase in jig harvesting in Areas 542 and 543. Prohibiting Pacific cod directed fishing and retention also applies to all gear types to meet the Alternative 2 objective to remove most of the potential adverse effects on Steller sea lions in Areas 542 and 543. This level of protection is indicated based on the severity of decline and the limited prey availability in Areas 542 and 543 (chapter 8 in NMFS 2010). Even though the gear types harvest with different methods, the levels of hook-and-line or pot fishing harvests can be similar to trawl fishing (based on information from the NMFS Catch Accounting System). These prohibitions would remove effects and prevent future expansion of Pacific cod fishing into Areas 542 and 543, regardless of gear types.

Alternative 2 would extend the Atka mackerel fishing season in Area 541 and in the Bering Sea. Seasonal dates for Atka mackerel in Area 541 also are applied to the Bering Sea because the TAC is

allocated as a combined Area 541/Bering Sea for this area (75 FR 11778, March 12, 2010). Extending the Atka mackerel season would allow for harvest to be dispersed over time and allow the Amendment 80 cooperatives to make full use of their management system to efficiently harvest Atka mackerel. This dispersal of harvests over time would be more protective of the Atka mackerel prey field for Steller sea lions. In addition, the Pacific cod nontrawl fishery would be ended November 1, which is the same date that the trawl fishery closes (50 CFR 679.23). This would provide additional time for the Pacific cod prey field to recover from any potential fishing effects and remove potential disturbance of Steller sea lions by nontrawl vessels in the November 1 through December 31 time period.

The changes applied to the fisheries in Areas 543 and 542 under this alternative are not needed for Area 541. The no retention requirements applied to the Atka mackerel and Pacific cod fisheries in Areas 543 and 542 are more stringent than the no directed fishing for these species in critical habitat in Area 541. This is based on the more severe decline of Steller sea lions in Areas 543 and 542 compared to Area 541, which indicates that more protection of prey species may be warranted. Critical habitat in Area 541 is already closed to directed fishing for Atka mackerel, and the annual growth rate for pup counts in Area 541 is increasing. Some additional protection from status quo is warranted in Area 541 because the non-pup population trend in the western portion of Area 541 is negative, and the Pacific cod fishery occurs primarily inside critical habitat. The closure of critical habitat to directed fishing for Pacific cod would remove potential effects of the Pacific cod directed fishery inside critical habitat, providing more protection from the potential effects of federally permitted vessels in waters 0–20 nm from Steller sea lion sites.

The protection measures under Alternative 2 apply to all areas that have experienced negative annual growth rates for non-pups, with more restrictive measures applied to areas with larger declines and pup and non-pup declines. Compared to the other alternatives in this analysis, this alternative would provide the greatest amount of protection to Steller sea lions and their critical habitat inside and outside critical habitat in areas with the most severe decline (Areas 543 and 542). This alternative would provide additional protection to critical habitat in Area 541, which based on non-pup and pup annual growth rates, has not experienced as severe a decline in population as Areas 542 and 543 (NMFS 2010). Reductions in the potential fisheries interaction and competition for prey species with Steller sea lions in each area are commensurate with the severity of decline in non-pup and pup population.

2.1.3 Alternative 3: RPA Specific Approach

Alternative 3 is a more specific application of fishery restrictions based on the management of the fisheries and the Steller sea lion foraging behavior, population trends, and the potential competition between the Atka mackerel and Pacific cod fisheries and Steller sea lions. This alternative is the same as the RPA described in the 2010 FMP biop (NMFS 2010), providing only the level of fishery restrictions necessary to ensure that JAM is not likely to occur for Steller sea lions and their designated critical habitat. Development of Alternative 3 considered current management of vessels under Amendment 80, historical harvest activities, and gear specific area closures and seasonal apportionments to disperse fishing over area and time. Unless otherwise specified in the alternative, all current Steller sea lion protection measures would continue to be implemented in the Aleutian Islands (e.g., Pacific cod seasonal apportionments; and pollock, Pacific cod, and Atka mackerel closures around rookeries and haulouts and in the Seguam foraging areas). Restrictions in State waters from 0–3 nm apply to federally permitted vessels. State-managed Pacific cod fisheries for vessels not federally permitted may occur in waters 0–3 nm unless otherwise restricted by the State.

Alternative 3 would—

In Area 543:

- Prohibit retention of Atka mackerel and Pacific cod.
- Establish a TAC for Atka mackerel sufficient to support the incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the HLA (Figure 2-3).

In Area 542:

Groundfish

- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

Pacific cod

- Close 0–10 nm zone of critical habitat to directed fishing by federally permitted vessels using nontrawl gear year round. Close critical habitat10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
- Close 0–20 nm zone of critical habitat year round to directed fishing by federally permitted vessels using trawl gear.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 542. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Set TAC for Area 542 to no more than 47 percent of acceptable biological catch (ABC).
- Close 0–20 nm critical habitat to directed fishing by federally permitted vessels year round.
- Change the Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Eliminate the Atka mackerel platoon management system in the HLA (Figure 2-3).

In Area 541 and the Bering Sea:

Pacific cod

- Close 0–10 nm of critical habitat to directed fishing for Pacific cod by all federally permitted vessels year round.
- Limit the amount of catch that can be taken in the 10–20 nm area of critical habitat based on gear type used:
    - Close critical habitat 10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
    - Close critical habitat 10–20 nm to directed fishing by for Pacific cod using trawl gear by federally permitted vessels June 10 through November 1.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 541. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.

Figure 2-9, Figure 2-10, and Figure 2-11 show the Atka mackerel and Pacific cod area closures under Alternative 3. Note that the prohibition on retention for Pacific cod in Area 543 is shown in Figure 2-9 for the Atka mackerel fishery.

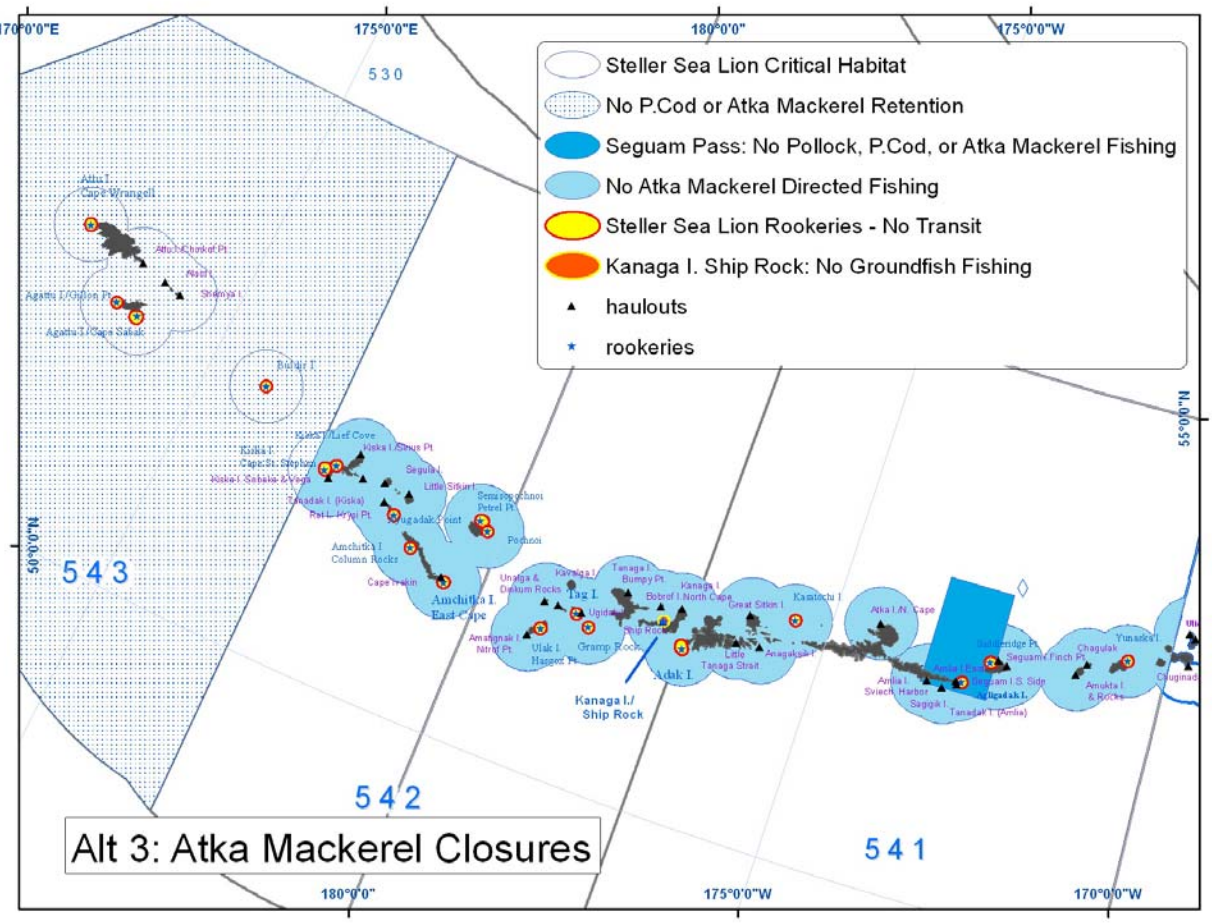

Figure 2-9 Atka mackerel fishery area closures in the Aleutian Islands under Alternative 3. (Steve Lewis, NMFS Alaska Region, Analytical Team)

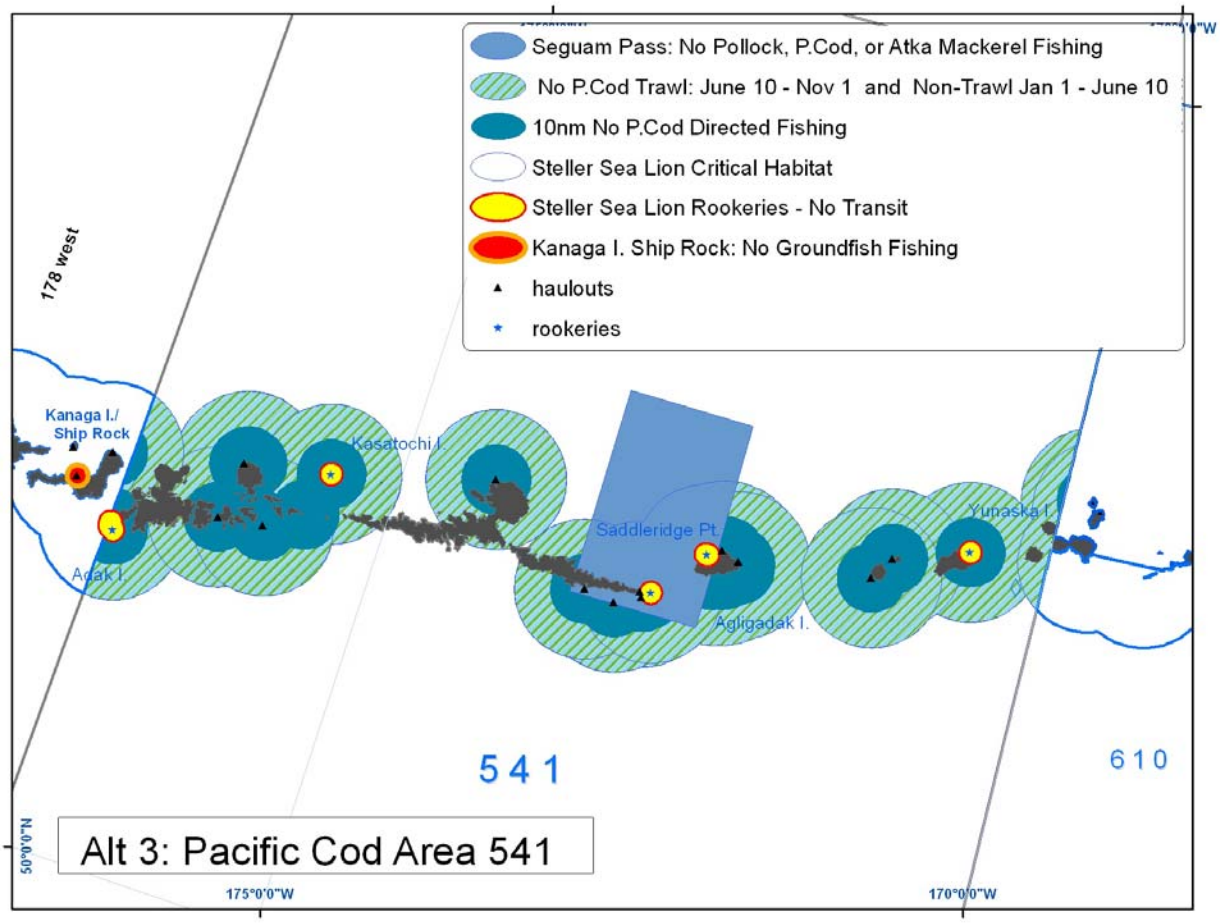

Figure 2-10 Pacific cod fishery closures in Area 541 under Alternative 3. (Steve Lewis, NMFS Alaska Region, Analytical Team)

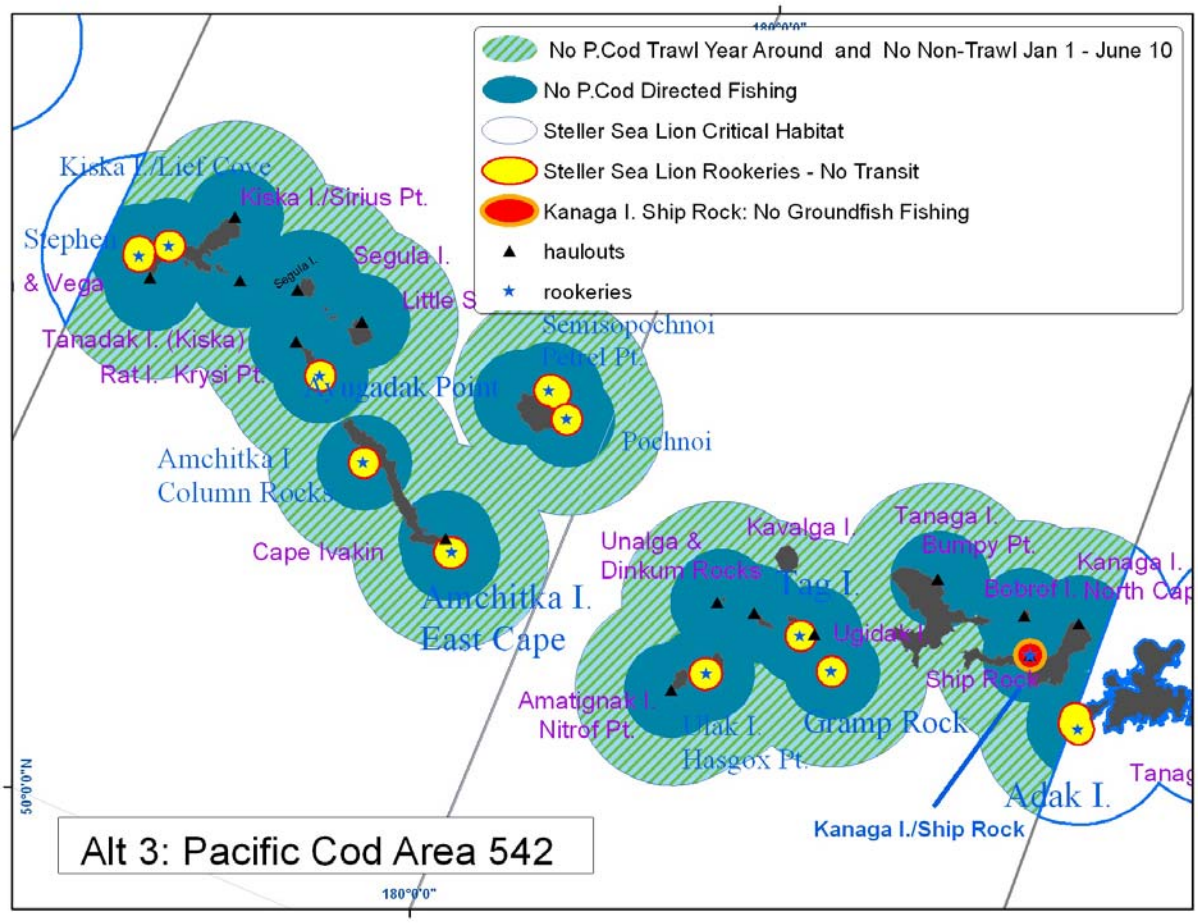

Figure 2-11 **Pacific cod fishery closures in Area 542 under Alternative 3. (Steve Lewis, NMFS Alaska Region, Analytical Team)**

Alternative 3 differs from Alternative 2 in how specific fisheries are managed in time and place. Because Alternative 2 is at least as restrictive as Alternative 3, several features of these alternatives are the same. The reasons for these same features are detailed in section 2.1.2. As in Alternative 2, Alternative 3 would eliminate the platoon management of Atka mackerel harvest in the HLA (Area 543 and western portion of Area 542 (Figure 2-3). This type of management of Atka mackerel harvest no longer would be needed based on the changes to harvest management under Amendment 80 and because of the Atka mackerel fishery management revisions under Alternative 3. Alternative 3 also would establish a 0–3 nm groundfish fishing closure around Kanaga Island/Ship Rock. The protection measures under Alternatives 2 and 3 are the same for Area 543 because this area is experiencing the largest declines in pups and non-pups annual growth rates and counts, warranting greater restrictions on the fisheries to ensure the groundfish fisheries would not be the cause of continued population declines. The November 1 through December 31 restriction on Pacific cod fishing also is part of Alternative 3. The extension of the Atka mackerel seasons in Area 541/Bering Sea under Alternative 2 also is applied to Area 542 under Alternative 3. Directed fishing for Atka mackerel would be allowed in Area 542 outside of critical habitat under Alternative 3, and the application of the seasonal extension to Area 542 would provide consistent seasonal management of Atka mackerel harvest in the Aleutian Islands. A comparison of all the

alternatives in this EA/RIR is in section 2.2.

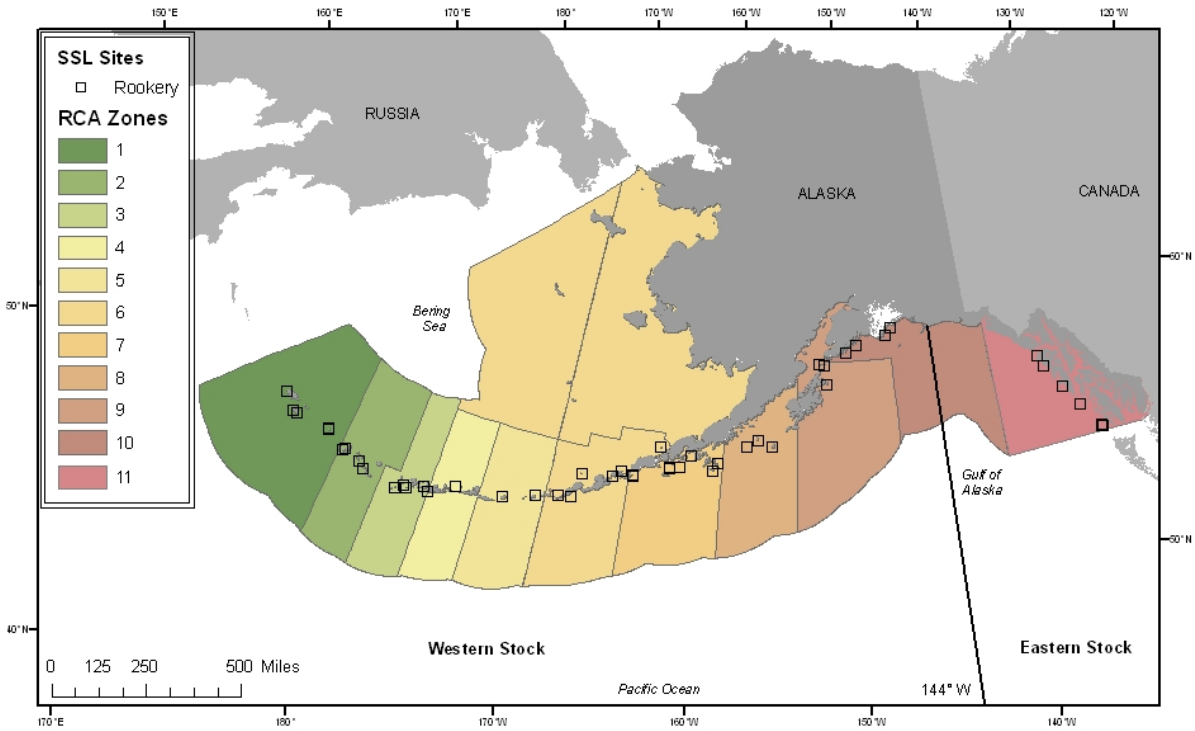

Figure 2-12 Rookery cluster zones. (Steve Lewis, NMFS Alaska Region Analytical Team)

In the FMP biop, information on annual growth rates and counts for pups and non-pups from 2000 to 2008 were considered in determining which areas needed further protection from the potential effects of fisheries (NMFS 2010). This information was applied to Rookery Cluster Areas (RCAs) (Figure 2-12), which are explained in the FMP biop (NMFS 2010) and are used to determine fisheries effects and potential Steller sea lion responses at a smaller spatial scale than the sub-regions used in the Steller sea lion recovery plan (NMFS 2008). Compared to other RCAs, Area 543 (RCA 1) has the steepest declines in pup and non-pup growth rate trends, and the greatest drop in Steller sea lion counts from 2000 to 2008 (Tables 5.1a, Table 3.1B, and Table 3.2 in NMFS 2010). Area 542 (RCAs 2 and 3) has less declining growth rate trends for pups and non-pups and for Steller sea lion counts from 2000 to 2008 compared to Area 541 (Table 5.1a, Table 3.1B, and Table 3.2 in NMFS 2010). Because the annual growth rates and counts in Areas 543 and 542 are negative for both pups and non-pups, the types of protection measures are similar for each area, with more protective measures applied to Area 543, where the largest declines are seen. Negative non-pup annual growth rates also have occurred in Area 541 (RCA 4), but the annual pup growth rates are positive in this area.

Directed fishing for Atka mackerel inside of critical habitat would be prohibited in Area 542 under Alternative 3. This would provide protection to Atka mackerel prey fields for Steller sea lions foraging within the 0–20 nm areas around rookeries and haulouts. Directed fishing for Atka mackerel would be allowed outside of critical habitat in Area 542 in limited amounts. Reducing the Area 542 TAC to 47 percent of the Area 542 ABC would allow for continued fishing outside of critical habitat at an amount similar to the harvest in RCA 2 outside of critical habitat.

The proposed reduction approximates the relative proportion of the total catch in Area 542 outside RCA 2 critical habitat since the implementation of Amendment 80 in 2008. The implementation of Amendment 80 has drastically changed the nature of the Atka mackerel fishery allocations and provided the fleet additional tools to manage catch. Comparisons of catch inside and outside of critical habitat prior to the implementation of Amendment 80 do not reflect current operational patterns. In 2008, 38 percent of Area 542 total catch was taken in RCA 2 critical habitat. In 2009, 55 percent of the total catch was taken in RCA 2 critical habitat. On average, 47.6 percent of the Area 542 catch has been taken in RCA 2 critical habitat. In combination with the first proposed measure to close RCA 2 critical habitat, the fleet would have the same proportion of the overall TAC available for harvest outside of critical habitat as it had on average in 2008 and 2009 (NMFS Catch Accounting System, June 2010).

Time and area closures in Area 542 for directed fishing for Pacific cod by nontrawl and trawl gear categories are intended to conserve the value of critical habitat for Steller sea lions. In 2008, 78 percent of the Pacific cod harvested by nontrawl gear vessels was harvested within the 3–10 nm zone of Steller sea lion critical habitat and approximately 20 percent was harvested within the 10–20 nm zone (2008 fixed gear harvest = 3,357 metric tons [mt]). Trawl gear fisheries harvested 36 percent and 42 percent of Pacific cod within 3–10 and 10–20 nm zones, respectively. Closing the 0–10 nm zone year-round to Pacific cod nontrawl gear vessels, and the 0–20 nm zone year-round to Pacific cod trawl gear vessels, is intended to reduce the amount of catch that has historically been taken within Steller sea lion critical habitat.

Seasonal closures will protect the prey field by ensuring that fisheries do not expand into seasons they have not typically fished in order to offset harvest foregone by area closures. For example, the 10–20 nm zone of critical habitat will be closed to nontrawl gear in the A season. The nontrawl gear fishery is traditionally a B season fishery. Preventing fishing by nontrawl gear in the A season will preclude an intensification of fishing effort in times and areas the fishery has not historically operated. Fishing intensity is not expected to increase to a large extent in the 10–20 nm zone critical habitat when it is open to nontrawl gear in the B season as gear types (pot and hook-and-line) are expected to be self-limiting in the small area of remaining fishable habitat available to nontrawl gear in Area 542. Moreover, Pacific cod are not as important a prey species for Steller sea lions in the B season (June 10- Sept 30), which should further buffer sea lions from effects of B season harvest of Pacific cod in 10–20 nm of critical habitat.

The Pacific cod trawl fishery in Area 542 occurs in the A season, which coincides with the time of year in which Steller sea lion energetic needs are high. The 10–20 nm zone of critical habitat would be closed to trawl gear in the B season to prevent the trawl fishery from expanding into a season they have not traditionally fished in Area 542. Therefore, a year-round closure of 0–20 nm to trawl gear is intended to conserve the value of critical habitat and prevent an intensification of harvest, especially in the 10–20 nm zone of critical habitat.

In Area 541, directed fishing for Atka mackerel is already prohibited in critical habitat, and the overall harvest of Atka mackerel in this area is a very small fraction of available biomass (.09 to .01 percent) (Table IV-12 in NMFS 2010). Atka mackerel is harvested in the eastern portion of Area 541, which corresponds with RCA 5. Steller sea lions have been increasing in abundance in this RCA (NMFS 2010), harvests are a small portion of available biomass, and critical habitat is protected from the potential effects of Atka mackerel harvest inside critical habitat. For these reasons, no additional restrictions are needed on the Atka mackerel fishery in Area 541 to reduce potential effects on Steller sea lions.

In 2008, 84 percent of the Pacific cod harvested in Area 541 by trawl gear was caught inside of critical habitat (13,768 mt); the majority of the trawl catch in critical habitat was taken within the 10–20 nm zone. Nontrawl gear fisheries harvested 73 percent of their Pacific cod inside critical habitat (1,506 mt) with approximately equal proportions in the 3–10 and 10–20 nm zones. Though Steller sea lion annual growth rates are positive in RCA 5, they are not experiencing the same level of growth in RCA 4 (Table 5.1(a) in

NMFS 2010); and Pacific cod harvest has largely been from critical habitat. For these reasons, Alternative 3 would prohibit fishing for Pacific cod with all gear types within the 0–10 nm zone around all rookeries and haulouts to preserve the prey field for Steller sea lions foraging in this area.

Available telemetry data indicate that sea lions may utilize the nearshore zone of critical habitat in Area 541 to a greater extent than to the west of Area 541 (AFSC 2010); however, recent analyses of the Platform of Opportunity database show extensive sightings of Steller sea lions outside of 20 nm in the Aleutian Basin in winter (Boor 2010). Based on these sources of information, it appears that STeller sea lions in Area 541 are likely to use critical habitat and areas outside of critical habitat for foraging. Alternative 3 protects prey resources inside the nearshore zone of critical habitat as the primary objective, ensuring foraging resources may be available with less energetic costs to travel longer distances.

Gear-specific seasonal closures in critical habitat are designed to prevent fisheries from expanding into seasons that have not been fished historically. This would prevent intensification of fishing effort to harvest TAC displaced from closures in Areas 543 and 542 because the BSAI Pacific cod TAC is not allocated to specific fishery management areas.

2.1.4 Preferred Alternative

Complete after Council meeting

2.2 Comparison of Alternatives

Table 2-3 shows the features of the alternatives that are different for the Atka mackerel and Pacific cod fisheries. These differences are primarily management measures based on the location, gear type, and timing of fishing for Atka mackerel and Pacific cod.

Table 2-3 Comparison of alternatives.

		Alternative 1			Alternative 2		Alternative 3	
		Atka mackerel	Pacific cod		Atka mackerel	Pacific cod	Atka mackerel	Pacific cod
			trawl	nontrawl				
Area 543	Inside CH	HLA Fishery	After HLA, mostly 10 nm closures	Mostly 3 nm closures	No retention	No retention	No retention	No retention
	Outside CH	Directed fishing Jan 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, jig 3 seasons inside and outside CH				
Area 542	0–10 miles	HLA Fishery	Western 542, After HLA, mostly 10 nm closures	3 nm closures			No directed fishing	No directed fishing
	10–20 miles		Eastern 542, 3–10 nm closures,	Open to directed fishing				No directed fishing with trawl gear. No directed fishing with nontrawl gear Jan. 1 to June 10
	Outside CH	Directed fishing Jan. 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, through Dec. 31, jig 3 seasons inside and outside CH			Set Area 542 TAC to 47% of ABC. Extend seasons to Jan. 20–June 10 and June 10–Nov. 1.	No directed fishing Nov. 1–Dec. 31
Area 541	0–10 miles	No directed fishing	0–3 nm and 0–10 nm closures	3 nm closures west of Seguam, closed east of Seguam.	No directed fishing	No directed fishing	No directed fishing	Closed to directed fishing
	10–20 miles		Open except 0–20 nm at Agligadak	Open to directed fishing west of Seguam, closed east of Seguam				No directed fishing with trawl gear from June 10 to Nov. 1. No directed fishing with nontrawl gear Jan. 1 to June 10.
	Outside CH	Directed fishing Jan. 20–April 15, Sept. 1–Nov. 1	3 seasons inside and outside CH, Jan. 20–April 1, April 1–June 10, June 10–Nov. 1	Hook-and-line and pot 2 seasons, jig 3 seasons through Dec. 31, inside and outside CH	Extend Area 541/BS seasons Jan. 20–June 10 and June 10–Nov. 1	No nontrawl directed fishing Nov. 1–Dec. 31	Extend Area 541/BS seasons Jan. 20–June 10 and June 10–Nov. 1	No nontrawl directed fishing Nov. 1–Dec. 31.

CH = critical habitat

2.3 Alternatives Considered and Not Further Analyzed

NMFS considered ways to allow fishing inside critical habitat by Atka mackerel vessels participating in an industry agreement to limit total daily catch rate to a level reflecting a single vessel operation (e.g., 200 mt/day). NMFS thought this may be possible for these vessels because of the existing Amendment 80 Program that allocates catch shares to cooperatives. However, allowing any fishing for Atka mackerel inside critical habitat would not meet the requirements of the RPA in the FMP biop and, therefore, would not meet the purpose and need of this action.

2.4 References

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2.5 Preparers and Persons Consulted

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3.0 TARGET SPECIES

3.1 Target Species Status

In the Aleutian Island subarea of the BSAI there are five major targeted fisheries: Atka mackerel, Pacific cod, Pacific Ocean perch, IFQ sablefish and halibut, Greenland turbot, and a developing arrowtooth flounder fishery. Atka mackerel is the largest targeted fishery in the Aleutian Islands, accounting for approximately 60 percent of all groundfish catch (average yearly amount from 2004 to 2009). The next largest fishery is Pacific cod. Though effort varies among the three subareas, overall the Pacific cod fishery accounts for 25 percent of all groundfish catch in the Aleutian Islands. The Pacific Ocean perch fishery accounts for an average of 11 percent of the groundfish catch per year. The remaining targeted fisheries, including IFQ sablefish and halibut, Greenland turbot, arrowtooth flounder, and a small pollock fishery, account for the remaining 4 percent of groundfish catch. (NMFS Catch Accounting System)

3.2 Atka mackerel

Atka mackerel (*Pleurogrammus monopterygius*) are widely distributed along the continental shelf across the North Pacific Ocean and Bering Sea from Asia to North America. In the BSAI, Atka mackerel is only targeted in the Aleutian Islands.

3.2.1 Atka mackerel stock status

The Atka mackerel biomass increased from 1977 to a peak in 1992. Prior to 1992, ABCs were allocated to the entire Aleutian management district with no additional spatial management. However, because of increases in the ABC beginning in 1992, the Council recognized the need to disperse fishing effort throughout the range of the stock to minimize the likelihood of localized depletions. In mid-1993, Amendment 28 to the Bering Sea and Aleutian Islands (BSAI) Fishery Management Plan became effective, dividing the Aleutian Islands subarea into three districts for the purposes of spatially apportioning TACs. Since 1994, the BSAI Atka mackerel TAC has been allocated to the three districts based on the average distribution of biomass estimated from the Aleutian Islands bottom trawl surveys. Table 3-1gives the time series of BSAI Atka mackerel catches, corresponding ABC and TAC by region. (NPFMC 2009)

Table 3-1 BSAI Atka mackerel ABC, TAC, and Catch by Area (NPFMC 2009 and NMFS Catch Accounting).

	Eastern (541 & EBS)			Central (542)			Western (543)		
	ABC	TAC	Catch	ABC	TAC	Catch	ABC	TAC	Catch
1994	13,475	13,475	15,106	55,125	44,525	28,871	53,900	10,000	21,383
1995	13,500	13,500	14,201	55,900	50,000	50,386	55,600	16,500	16,967
1996	26,700	26,700	28,173	33,600	33,600	33,523	55,700	45,857	42,246
1997	15,000	15,000	16,315	19,500	19,500	19,990	32,200	32,200	29,537
1998	14,900	14,900	12,271	22,400	22,400	20,209	27,000	27,000	24,617
1999	17,000	17,000	17,453	25,600	22,400	22,419	30,700	27,000	16,366
2000	16,400	16,400	14,344	24,700	24,700	22,383	29,700	29,700	10,503
2001	7,800	7,800	8,424	33,600	33,600	32,829	27,900	27,900	20,309
2002	5,500	5,500	4,920	23,800	23,800	22,291	19,700	19,700	18,077
2003	10,650	10,650	10,725	29,360	29,360	25,435	22,990	19,990	17,885
2004	11,240	11,240	10,838	31,100	31,100	30,169	24,360	20,660	19,554
2005	24,550	7,500	7,200	52,830	35,500	35,069	46,620	20,000	19,743
2006	21,780	7,500	7,421	46,860	40,000	39,836	41,360	15,500	14,637
2007	23,800	23,800	22,943	29,600	29,600	26,723	20,600	9,600	9,097
2008	19,500	19,500	19,118	24,300	24,300	22,329	16,900	16,900	16,643
2009	27,000	27,000	26,417	33,500	32,500	30,071	23,300	16,900	16,319

Atka mackerel are an important prey for Steller sea lions, and management measures have been taken to reduce the impacts of an Atka mackerel fishery on Steller sea lions. Since June 1998, the Atka mackerel fishery has been dispersed, both temporally and spatially, to reduce localized depletions of Atka mackerel. The TAC is now equally split into two seasons, and the amount taken within sea lion critical habitat is limited. (NPFMC 2009)

Amendment 80 to the BSAI Groundfish FMP was adopted by the Council in June 2006 and implemented for the 2008 fishing year. This action allocates several BSAI non-pollock trawl groundfish species among trawl fishery sectors, and facilitates the formation of harvesting cooperatives in the non-American Fisheries Act (non-AFA) trawl catcher/processor sector. BSAI Atka mackerel is one of the groundfish species directly affected by Amendment 80. (NPFMC 2009)

The Atka mackerel fishery takes place primarily with bottom trawl gear at depths of less than 200 m. The fishery is highly localized and takes place in the same few locations each year (Lowe et al. 2004). Atka mackerel are not commonly caught as bycatch in other targeted fisheries; however, small amounts occur in the trawl Pacific cod and Pacific Ocean perch fisheries in the Aleutian Islands. (Catch Accounting)

Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. Further information on Atka mackerel may be found in the Atka mackerel chapter of the annual *Stock Assessment and Fishery Evaluation* report (Lowe et al. 2004), and in the Groundfish PSEIS (NMFS 2004b) and the EFH EIS (NMFS 2005).

3.2.2 Atka mackerel biomass distribution

The center of abundance for Atka mackerel is in the Aleutian Islands, with a geographical range extending to the waters off Kamchatka, the eastern Bering Sea, and the Gulf of Alaska (Table 3-2). Tag capture information from Alaska suggests that Atka mackerel populations are localized and do not travel long distances. (2009 SAFE)

Amendment 28 of the Bering Sea and Aleutian Islands Fishery Management Plan divided the Aleutian Islands subarea into three districts at 177° E and 177° W longitude, providing the mechanism to apportion the Aleutian Islands Atka mackerel TACs. The Council uses survey data from the biennial Aleutian Islands bottom trawl surveys to apportion the ABC. This is done using a weighted average of the past four surveys. In 2009 the council used the 2000, 2002, 2004, and 2006 surveys to apportion the 2010 ABC. The data used to derive the percentages for the weighting scheme are given below. (NPFMC 2009)

Table 3-2 2009 Atka mackerel Biomass distribution

Area	2000	2002	2004	2006	2009 and recommended 2010 and 2011 ABC apportionment
541	0.20%	24.70%	27.50%	48.04%	32.20%
542	64.60%	42.30%	30.40%	38.14%	40.00%
543	35.20%	33.00%	42.00%	13.81%	27.80%
Weights	8	12	18	27	

3.3 Target Species Significant Criteria

For direct and indirect impacts, the baseline is the fishery and resource status as they were in 2009. This is the fishery status quo. In instances where 2009 information is unavailable or incomplete, the 2009 baseline has been approximated with the most recent appropriate information available. The direct and indirect impact analysis examines the significance of impacts on resource components by comparing the incremental impacts of the preferred alternative, and of each reasonable alternative, to the condition of the resource components in 2009. Past actions, such as past harvest specifications, actions placing spatial or temporal restrictions on fishing activity, actions restricting the types and characteristics of allowable fishing gear, actions specifying prohibited species catch (PSC) limits, and other actions, are accounted for, since they are incorporated into the 2009 baseline for the fishery.

The significance criteria used to evaluate the effects of the action on target species is in Table 3-3. These criteria are adopted from the significance criteria used in the 2006–2007 Groundfish Harvest Specifications EA (NMFS 2006b). The ratings use a minimum stock size threshold (MSST) as a basis for beneficial or adverse impacts of each alternative.

Table 3-3 Criteria Used to Estimate the Significance of Effects on the FMP Managed Target Stocks.

	Level of mortality	Genetic structure	Reproductive success	Prey availability	Habitat
		Genetic structure and reproductive success provide indicators of the effect of the alternative on spatial and temporal concentration of the species.			
No impact	No change in sustainable target fishery biomass.	No fishery induced changes in genetic structure of the stock.	No fishing impact on level of recruitment success or adult fecundity.	No fishing impact on prey availability for target species.	No fishing impact on target fishery habitat.
Adverse impact	Substantial reduction in the level of the sustainable biomass because of fishing activity.	Fishing activity has differential impact on substocks in the population.	Reduced level of recruitment success due to fishing related disturbance of fish stocks during life cycle stages important to recruitment or to dispensatory impacts of fishing activity.	Current harvest levels and distribution of harvest reduce prey available for target stocks.	Fishing activity will have an adverse impact on sustainable target fishery biomass because of its impact on habitat.
Beneficial impact	There is no beneficial impact from this action.	There is no beneficial impact from this action.	Increased level of recruitment success associated with density dependent or compensatory mechanisms.	Current harvest levels and distribution of harvest increase prey available to target stocks.	There is no beneficial impact from this action.
Table continues on next page					

Significantly adverse impact	Level of mortality likely to exceed the maximum fishing mortality threshold (MFMT or OFL) or to decrease abundance below minimum stock size threshold (MSST).	Evidence of genetic subpopulation structure and evidence that the distribution of harvest leads to a detectible reduction in genetic diversity that jeopardizes the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.	Evidence that the distribution of harvest leads to a detectable decrease in reproductive success such that it jeopardizes the ability of the stock to sustain itself at or above MSST or increases the potential for overfishing.	Evidence that current harvest levels and distribution of harvest lead to a change in prey availability that jeopardizes the ability of the target stock to sustain itself at or above MSST or increases the potential for overfishing.	Evidence that current levels of habitat disturbance are sufficient to lead to a decrease in spawning or rearing success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.
Significantly beneficial impact	Not applicable.	Not applicable.	Not applicable. Increased recruitment success due to fishing activity can only be sustained with beneficial fishing activity, and biomass below unfished levels.	Evidence that current harvest levels and distribution of harvest lead to a change in prey availability such that it enhances the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.	Not applicable.
Unknown impact	Unknown fishing mortality rate	OFL or MSST and genetic structure are unknown, therefore no information to evaluate whether distribution of the catch changes the genetic structure of the population such that it jeopardizes or enhances the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.	OFL or MSST are unknown therefore no information regarding the potential impact of the distribution of the catch on reproductive success such that it jeopardizes or enhances the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.	OFL or MSST are unknown therefore no information that current harvest levels and distribution of harvest lead to a change in prey availability such that it enhances or jeopardizes the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.	OFL or MSST are unknown therefore no information that current levels of habitat disturbance are sufficient to lead to a detectable change in spawning or rearing success such that it enhances or jeopardizes the ability of the stock to sustain itself at or above the MSST or increases the potential for overfishing.

3.3.1 Effects on Atka mackerel

3.3.1.1 Alternative 1 effects on Atka mackerel

Alternative 1 is status quo and therefore would have no change from the current stock status discussed in 3.2.1. Under status quo it is expected that fisheries would largely continue to operate as they have in the past and effects would be the same as those described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The impacts of Alternative 1 are not expected to reduce the Atka mackerel stock to below its MSST. The Atka mackerel stock is not overfished or experiencing overfishing. Impacts on prey availability and habitat are not likely to affect the sustainability of the stock. The impacts of Alternative 1 on Atka mackerel are therefore insignificant.

3.3.1.2 Alternative 2 effects on Atka mackerel

Prohibiting directed fishing or retention of Atka mackerel in Area 542 and 543 would reduce overall fishing mortality by approximately 68 percent of current levels. Therefore the biomass of Atka mackerel is expected to increase in Area 542 and 543. Using the method of apportioning biomass as described in section 3.2.2 could result in further reducing fishing mortality. As Atka mackerel biomass increases in 542 and 543 the allocation to each area would be shifted into those areas where fishing is prohibited. In Area 541, fishing inside critical habitat would remain closed and would result in no change from the status quo.

The impacts of Alternative 2 are not expected to reduce the Atka mackerel stock to below its MSST. The Atka mackerel stock would not be overfished or experience overfishing because the current harvest specifications practices for setting TACs and managing harvests within the limits would continue. The shifting of the fishery is not likely to impact prey availability and habitat in a way that would affect the sustainability of the Atka mackerel stock. The impacts of Alternative 2 on Atka mackerel are therefore insignificant.

3.3.1.3 Alternative 3 effects on Atka mackerel

Prohibiting directed fishing or retention of Atka mackerel in 543 and a reduction of the 542 TAC would reduce overall fishing mortality by approximately 55 percent of current levels. In Area 542 the only area open to directed fishing will be the Petrel bank area. The concentration of fishing effort in that area may result in some localized depletion, however the intensity is somewhat mitigated by the reduction in overall TAC. In Area 541, fishing inside critical habitat would remain closed and would result in no change from the status quo.

The impacts of Alternative 3 are not expected to reduce the Atka mackerel stock to below its MSST. The Atka mackerel stock would not be overfished or experience overfishing because the current harvest specifications practices for setting TACs and managing harvests within the limits would continue. The shifting of the fishery is not likely to impact prey availability and habitat in a way that would affect the sustainability of the Atka mackerel stock. The impacts of Alternative 3 on Atka mackerel are therefore insignificant.

3.4 Pacific cod

Pacific cod (*Gadus macrocephalus*) is distributed widely in the North Pacific, including the eastern Bering Sea and Aleutian Islands areas, and occur at depths from shoreline to 500 m. The resource in these two areas (BSAI) is managed as a single unit. (NPFMC 2009)

3.4.1 Pacific cod stock status

The stock assessment model for Pacific cod is configured to represent the portion of the Pacific cod population inhabiting the Bering Sea survey area. The model projections are then adjusted to include biomass in the Aleutian Islands survey area. The best estimate of long-term average biomass distribution is 84 percent in the Bering Sea and 16 percent in the Aleutian Islands. Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. (NPFMC 2009)

From 1980 through 2009, TAC averaged about 80 percent of ABC, and from 1980 through 2009 aggregate commercial catch averaged about 90 percent of TAC. The history of acceptable biological catch (ABC) and total allowable catch (TAC) levels is summarized and compared with the time series of aggregate (i.e., all-gear, combined area) commercial catches in Table 3-4. (NPFMC 2009)

Table 3-4 BSAI Pacific cod ABC, TAC, and Total catch 1981 to current

Year	ABC	TAC	Catch	Year	ABC	TAC	Catch
1981	160,000	78,700	63,941	1996	305,000	270,000	240,676
1982	168,000	78,700	69,501	1997	306,000	270,000	257,765
1983	298,200	120,000	103,231	1998	210,000	210,000	193,256
1984	291,300	210,000	133,084	1999	177,000	177,000	173,998
1985	347,400	220,000	150,384	2000	193,000	193,000	191,060
1986	249,300	229,000	142,511	2001	188,000	188,000	176,749
1987	400,000	280,000	163,110	2002	223,000	200,000	197,356
1988	385,300	200,000	208,236	2003	223,000	207,500	196,495
1989	370,600	230,681	182,865	2004	223,000	215,500	212,155
1990	417,000	227,000	179,608	2005	206,000	206,000	205,632
1991	229,000	229,000	220,038	2006	194,000	194,000	193,019
1992	182,000	182,000	207,272	2007	176,000	170,720	174,145
1993	164,500	164,500	167,362	2008	176,000	170,720	170,619
1994	191,000	191,000	193,802	2009	182,000	176,540	175,728
1995	328,000	250,000	245,033				

Source: NPFMC 2009 and NMFS catch accounting system

Presently, the Pacific cod stock is exploited by a multiple-gear fishery, including trawl, longline, pot, and jig components. Starting in 2007, the Pacific cod TAC is reduced by three percent from the ABC to account for the State of Alaska's (State) guideline harvest level fishery in State waters of the Aleutian Islands. The BSAI Pacific cod TAC is then allocated by regulation according to harvesting sector, gear type, and season. Typically as the harvest year progresses, it becomes apparent that one or more gear types will be unable to harvest their full allocation by the end of the year. This is addressed by reallocating TAC between harvest sectors and gear types in the second half of each year, typically October through December. Most often, such reallocations shift TAC to the hook-and-line catcher/processor sector.

3.4.2 Pacific cod biomass distribution

Tagging studies (e.g., Shimada and Kimura 1994) have demonstrated significant migration both within and between the Bering Sea, Aleutian Islands, and Gulf of Alaska (GOA). Although at least one previous genetic study (Grant et al. 1987) failed to show significant evidence of stock structure within these areas, current genetic research underway at the Alaska Fisheries Science Center is shedding additional light on

the issue of stock structure of Pacific cod within the BSAI (M. Canino, AFSC, personal communication). Pacific cod is not known to exhibit any special life history characteristics that would require it to be assessed or managed differently from other groundfish stocks in the Bering Sea or Aleutian Islands subareas. The best estimate of long-term average biomass distribution is 84 percent in the Bering Sea and 16 percent in the Aleutian Islands. (NPFMC 2009)

3.4.3 Effects on Pacific Cod

3.4.3.1 Alternative 1

Alternative 1 is status quo and therefore would have no change from the current stock status discussed in 3.4. Under status quo it is expected that fisheries would largely continue to operate as they have in the past and effects would be the same as those described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The impacts of Alternative 1 are not expected to reduce the Pacific cod stock to below its MSST. The Pacific cod stock is not overfished or experiencing overfishing. Impacts on prey availability and habitat are not likely to affect the sustainability of the stock. The impacts of Alternative 1 on Pacific cod are therefore insignificant.

3.4.3.2 Alternative 2

Prohibiting directed fishing or retention of Pacific cod in Areas 542 and 543 may reduce overall fishing mortality of the BSAI Pacific cod stock. NMFS expects amounts of Pacific cod harvested in Areas 542 and 543 by trawl catcher vessels, hook-and-line catcher/processors and pot catcher/processors are likely to be harvested in areas of the Bering Sea or outside critical habitat in Area 541. Pacific cod allocations that are projected to remain unharvested will be reallocated to sectors that can harvest it. NMFS expects Amendment 80 vessels may not be able to harvest historical amounts of Pacific cod. Unlike other sectors, due to the nature of the Amendment 80 catch shares program, unused amounts of Pacific cod will remain unharvested. This may result in a small reduction of fishing mortality of the BSAI Pacific cod stock.

The impacts of Alternative 2 are not expected to reduce the Pacific cod stock to below its MSST. The Pacific cod stock would not be overfished or experience overfishing because the current harvest specifications practices for setting TACs and managing harvests within the limits would continue. The shifting of the fishery is not likely to impact prey availability and habitat in a way that would affect the sustainability of the Pacific cod stock. The impacts of Alternative 2 on Pacific cod are therefore insignificant.

3.4.3.3 Alternative 3

The overall effects of Alternative 3 on Pacific cod are very similar to those effects listed under Alternative 2 (section 3.3.3.2). NMFS expects that it will be easier for current fleets to maintain current Pacific cod catch and that the overall reduction of fishing mortality of the BSAI Pacific cod stock will be less.

The impacts of Alternative 3 are not expected to reduce the Pacific cod stock to below its MSST. The Pacific cod stock would not be overfished or experience overfishing because the current harvest specifications practices for setting TACs and managing harvests within the limits would continue. The shifting of the fishery is not likely to impact prey availability and habitat in a way that would affect the sustainability of the Pacific cod stock. The impacts of Alternative 3 on Pacific cod are therefore insignificant.

3.5 Other Target species

3.5.1 Pacific Ocean perch

Pacific Ocean perch (POP), and four other associated species of rockfish (northern rockfish, rougheye rockfish, shortraker rockfish, and sharpchin rockfish) were managed as the POP complex in separate Bering Sea and Aleutian islands subareas from 1979 to 1990. In 1991, the Council separated POP from the other red rockfish to provide protection from possible overfishing. Of the five species in the former POP complex, POP has historically been the most abundant rockfish in this region and has contributed most of the commercial rockfish catch. Starting in 1996, the POP ABC and TAC were subdivided into the three Aleutian Island districts in proportion to the estimated biomass from the Biennial Aleutian Islands trawl survey. Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. Further information on POP may be found in the POP chapter of the annual *Stock Assessment and Fishery Evaluation* report (NPFMC 2009).

Pacific Ocean perch is commonly caught while directed fishing for Atka mackerel. Approximately 4.9 percent of the total groundfish caught in the Atka mackerel fishery is POP.

3.5.2 Greenland turbot

Greenland turbot (*Reinhardtius hippoglossoides*) within the U.S. 200-mile exclusive economic zone are mainly distributed in the eastern Bering Sea and Aleutian Islands. Prior to 1985 Greenland turbot and arrowtooth flounder were managed together. Since then, the Council has recognized the need for separate management quotas given large differences in the market value between these species. Furthermore, the abundance trends for these two species are clearly distinct (e.g., Wilderbuer and Sample 1992 in NPFMC 2009).

Greenland turbot is targeted by longline and trawl gear. From 1990 to 1995 Council set the ABCs (and TACs) to 7,000 t as an added conservation measure citing concerns about recruitment. Since 1996 the ABC levels have varied but averaged 7,660 t (with catch for that period averaging 4,550 t). In 2008 and 2009, trawl-caught Greenland turbot exceeded the level of catch by longline vessels. This shift in the proportion of catch by sector is due to changes arising from Amendment 80. Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. Further information on Greenland turbot may be found in the Greenland turbot chapter of the annual *Stock Assessment and Fishery Evaluation* report (Ianelli, Wilderbuer, and Nichol, 2009).

3.5.3 Arrowtooth Flounder

Arrowtooth flounder (*Atheresthes stomias*) is a relatively large flatfish which occupies continental shelf waters almost exclusively until age four, but at older ages occupies both shelf and slope waters. Two species of Atheresthes occur in the Bering Sea. Arrowtooth flounder and Kamchatka flounder (*A. evermanni*) are very similar in appearance and are not always distinguished in the commercial catches. Arrowtooth flounder are found throughout the BSAI management area, however their abundance in the Aleutian Islands is lower than in the Bering Sea. The resource in the Bering Sea and Aleutian Islands are managed as a single stock although the stock structure has not been studied.

Historically, arrowtooth flounder mostly was caught primarily in pursuit of other high value species and discarded in the Bering Sea and Aleutian Islands. With the development of marketable products and Amendment 80 fishing practices in 2008 the percentage of arrowtooth flounder catch retained has increased to 73 percent. Largest discard amounts still occur in the Pacific cod fishery and the various

flatfish fisheries. An increasing trend of catch and retention is expected in the near future due to Amendment 80. Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. Further information on arrowtooth flounder may be found in the arrowtooth flounder chapter of the annual Stock Assessment and Fishery Evaluation report (Wilderbuer, Nichol, and Aydin 2009).

3.5.4 Sablefish

Distribution: Sablefish (*Anoplopoma fimbria*) inhabit the northeastern Pacific Ocean from northern Mexico to the Gulf of Alaska, westward to the Aleutian Islands, and into the Bering Sea (Wolotira et al. 1993). Adult sablefish occur along the continental slope, shelf gullies, and in deep fjords, generally at depths greater than 200 m. Sablefish observed from a manned submersible were found on or within 1 m of the bottom (Krieger 1997). In contrast to the adult distribution, juvenile sablefish (less than 40 cm) spend their first two to three years on the continental shelf of the Gulf of Alaska, and occasionally on the shelf of the southeast Bering Sea. The Bering Sea shelf is utilized significantly in some years and little used during other years (Shotwell 2007).

The U.S. longline fishery began expanding in 1982 in the Gulf of Alaska and in 1988, harvested all sablefish taken in Alaska except minor joint venture catches. Following domestication of the fishery, the previously year-round season in the Gulf of Alaska began to shorten in 1984. By the late 1980's, the average season length decreased to 1-2 months. In some areas, this open-access fishery was as short as 10 days, warranting the label “derby” fishery.

Season length continued to decrease until Individual Fishery Quotas (IFQ) were implemented for hook-and-line vessels in 1995 along with an 8-month season. From 1995 to 2002 the season ran from approximately March 15-November 15. Starting in 2003 the season was extended by moving the start date to approximately March 1. The sablefish IFQ fishery is concurrent with the halibut IFQ fishery. The expansion of the U.S. fishery was helped by exceptional recruitment during the late 1970's. This exceptional recruitment fueled an increase in abundance for the population during the 1980's. Increased abundance led to increased quotas and catches peaked again in 1988 at about 70 percent of the 1972 peak. Abundance has since fallen as the exceptional late 1970's year classes have dissipated. Catches fell again in 2000 to approximately 42 percent of the 1988 peak. Catches since 2000 have increased modestly, largely due to a strong 1997 year class.

IFQ management has increased fishery catch rates and decreased the harvest of immature fish (Sigler and Lunsford 2001). Catching efficiency (the average catch rate per hook for sablefish) increased 1.8 times with the change from an open-access to an IFQ fishery. The improved catching efficiency of the IFQ fishery reduced the variable costs incurred in attaining the quota from eight to five percent of landed value, a savings averaging US$3.1 million annually. Decreased harvest of immature fish improved the chance that individual fish will reproduce at least once. Spawning potential of sablefish, expressed as spawning biomass per recruit, increased nine percent for the IFQ fishery. The directed fishery is primarily a hook-and-line fishery, and also includes pot gear in the BSAI. Sablefish also are caught during directed trawl fisheries for other species groups such as Greenland turbot, arrowtooth flounder, rockfish, and deepwater flatfish. Model predictions indicate that this stock is neither overfished nor approaching an overfished condition. Further information on sablefish may be found in the sablefish chapter of the annual Stock Assessment and Fishery Evaluation report (Hanselman, Fujioka, Lunsford, and Rodgveller, 2009).

3.5.5 IFQ Program

The halibut and sablefish IFQ program was implemented in 1995. Quota Share (QS) was initially issued to persons who owned or leased vessels that made legal commercial fixed-gear landings of Pacific halibut

or sablefish during 1988-1990 off Alaska. QS is transferable to other initial issuees or to those who have become transferable eligible on NMFS' approval of an application for Transfer Eligibility Certificate. Once issued to a person (at no charge), QS is held by that person until it is transferred, suspended, or revoked. An IFQ permit authorizes participation in fixed-gear harvests of Pacific halibut off Alaska, and most sablefish fisheries off Alaska. Permits are issued annually, at no charge, to persons holding fishable Pacific halibut and sablefish Quota Share (QS); or to those who are recipients of IFQ-only transfers from QS holders. Authorized pounds for annual IFQ permits are determined by the number of QS units held, the total number of QS units in the "pool" for a species and area, and the total amount of halibut or sablefish allocated for IFQ fisheries in a particular year. More information on the IFQ program may be found on the Alaska Region website at http://alaskafisheries.noaa.gov/ram/ifq.htm.

3.5.6 Effects on Other target species

Detailed information on effects to the other target species fisheries can be found in chapter 10.

3.5.6.1 Alternative 1 effects on other target species

Alternative 1 is status quo and therefore would have no change from the current stock status discussed in 3.5. Under status quo it is expected that fisheries would largely continue to operate as they have in the past and effects would be the same as those described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The impacts of Alternative 1 are not expected to reduce the other target groundfish species stocks to below their MSSTs. The other target species stock are not overfished or experiencing overfishing. Impacts on prey availability and habitat are not likely to affect the sustainability of the other target species stocks. The impacts of Alternative 1 on other species stocks are therefore insignificant.

3.5.6.2 Alternative 2 and 3 effects on other target species

Alternative 2 would close two major fisheries in the Aleutian Islands however it will not implement any direct change to other target species. Therefore any effects to other target species are incidental to changes in behavior by fleets that fish in the Atka mackerel fishery and to a small extent the Pacific cod fishery. Some additional harvests of yellowfin sole and rock sole in the Bering Sea is expected as the Atka mackerel fishery is closed in Area 543 under Alternatives 2 and 3. This harvest would be done within the limits established under the harvest specifications so no additional impact on these other species is expected beyond status quo.

With exception to Pacific Ocean perch (POP), incidental catch of other target species occur at low levels and there are no anticipated effects. As noted in section 3.5.1, the incidental catch rate of POP in the Atka mackerel target is approximately 4.9 percent. This is equal to approximately 2,500 mt of POP caught when vessels are targeting Atka mackerel. With the closure of Atka mackerel in 542 and 543, less POP would be caught incidentally. However since POP is a commercially important species to Amendment 80 fleet it is likely to be fully harvested, though targeted, not incidentally. There is also potential for some effort to shift to Greenland turbot and arrowtooth fisheries. The total amount of Greenland turbot harvested is likely to remain the same as the TAC constrains the Aleutian Islands Greenland turbot catch. However, the catch rate may increase.

The impacts of Alternatives 2 and 3 are not expected to reduce the other target species stocks to below their MSSTs. The other target species stocks would not be overfished or experience overfishing because the current harvest specifications practices for setting TACs and managing harvests within the limits would continue. The shifting of the fishery is not likely to impact prey availability and habitat in a way

that would affect the sustainability of the other species stock. The impacts of Alternatives 2 and 3 on other target species are therefore insignificant.

3.5.7 Cumulative Effect

The State may expand State-managed groundfish fisheries. While the State sets its quotas in its State managed fisheries, adjustments are typically made to Federal TACs to keep combined State and Federal harvests of the relevant species below the ABC for the species. State parallel fisheries are conducted within the Federal TACs.

The Council recommended Amendment 83 to the Gulf of Alaska groundfish FMP. This amendment would split the GOA Pacific cod TAC among sectors and include a restriction on the surrender of a federal fisheries permit (FFP). The amendment would require that vessels surrendering an FFP could not obtain a new FFP for three years. This applies to catcher vessels and to catcher processors. This provision would limit these vessels' ability to fish inside State waters in the Aleutian Islands where federally permitted vessels fishing for Pacific cod are prohibited. This restriction would result in potentially less harvest of Pacific cod inside state waters of the Aleutian Islands. How many vessels, quantity of harvest? Potential economic impact in RIR?

--Do we need to discuss harvest specifications in Cumulative effects as other federal actions? Need more here.

3.5.8 Summary of Effects

Under all alternatives, the stock biomass of all target species is expected to be above their MSST. The probability that overfishing would occur is low for all of the stocks. The expected changes that would result from harvest at the levels proposed are not substantial enough to expect that the genetic diversity or reproductive success of these stocks would change. None of the alternatives would allow overfishing of the spawning stock. Therefore, the genetic integrity and reproductive potential of the stocks should be preserved.

The direct, indirect and cumulative effects of the alternatives are not expected to: (1) jeopardize the capacity of the stock to produce maximum sustainable yield on a continuing basis; (2) alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold or experience overfishing; (3) decrease reproductive success in a way that jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (4) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold or experience overfishing, and (5) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold or prevent overfishing. **For these reasons, impacts to target species stocks, species, or species groups, are predicted to be insignificant for all target fish evaluated under Alternatives 1, 2, and 3.** Detailed information may be found in the SAFE documents (NPFMC 2009) and chapter 10.

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3.7 Preparers and Persons Consulted

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4.0 NON-TARGET SPECIES

Non-target species are those species that the industry tries to avoid and are only caught incidentally to the target species listed in chapter 3. These species include forage fish, prohibited species (e.g., salmon and halibut), and non-specified species. The harvest of these species may be managed through quotas (e. g., halibut prohibited species catch limit and forage species maximum retainable amount (Table 10 to 50 CFR part 679)), closure areas (e. g., salmon savings areas), prohibitions on directed fishing, or not managed (e. g., non-specified species). The status of the non-target species is described in the Alaska Groundfish Harvest Specifications EIS and is incorporated by reference (NMFS 2007). For those with stock information (e. g., halibut, crab), none are experiencing overfishing due to the incidental catch in the groundfish fisheries in the Aleutian Islands. The following sections describe the management of non-target species and potential effects on non-target species that may be impacted by the proposed action.

4.1 BSAI Halibut Prohibited Species Catch Limits

4.1.1 Halibut Prohibited Species Catch Management

The BSAI halibut PSC limits are 900 mt for the non-trawl fisheries and 3,675 mt for trawl fisheries. These limits are then allocated to multiple sectors. The first allocation is for the prohibited species quota (PSQ) reserve for use by the groundfish CDQ program. This PSQ allocation is 326 mt of the trawl halibut mortality limit and 7.5 percent, or 67 mt, of the non-trawl halibut mortality limit.

4.1.1.1 Non-Trawl Halibut

The total remaining amount of non-trawl halibut PSC limit for the non-CDQ fisheries is 832 mt. The 832 mt is then apportioned between Pacific cod hook-and-line sectors and other non-trawl fisheries during the annual harvest specifications process. Generally, 775 mt is apportioned to hook-and-line Pacific cod fisheries and 58 mt to other non-trawl. The halibut PSC amount apportioned to non-trawl Pacific cod fishery is further divided between the hook-and-line CP sector and hook-and-line CV sector (for CVs ≥60’ and CVs <60’ combined) and by season. For 2010 and 2011 the sector and seasonal apportionments for non-trawl gear are in Table 4-1.

Table 4-1 Non-trawl sector halibut PSC allocations by season in metric tons

Pacific cod	CP	CV
January 1–June 10	314	10
June 10–August 15	0	3
August 15–December 31	446	2
Total	760	15

The non-trawl sector is not typically limited by halibut PSC when prosecuting non-trawl fisheries. The non-trawl sector typically uses about 66 percent of the halibut PSC allocated to that sector. See Table 4-2

Table 4-2 2004-2009 non-trawl halibut PSC use (not including CDQ)

Year	Non-trawl Halibut PSC	Percentage used
2004	467	56%
2005	559	67%
2006	411	49%
2007	488	59%
2008	712	86%
2009	644	77%
Average	547	66%

NMFS, Alaska Region catch accounting system

4.1.1.2 Trawl Halibut

The trawl halibut PSC is apportioned to two trawl sectors. The amounts of the PSC limits assigned to the Amendment 80 and BSAI trawl limited access sectors are specified in Table 35 to part 679. The Amendment 80 program reduces the amount of halibut PSC allocated to the Amendment 80 sector by 200 mt over four years starting in 2009. The amount of halibut PSC allocated to the Amendment 80 sector is 2,375 mt in 2011 and 2,325 mt in 2012 and each year after. The allocation of halibut PSC to the trawl limited access group is fixed at 875 mt.

Historically, the non-pelagic trawl sector has been limited by halibut when prosecuting non-pelagic trawl fisheries. With the advent of Amendment 80, vessels in Amendment 80 cooperatives were given more tools and flexibility to control halibut PSC and halibut PSC ceased to be a limiting factor to them when prosecuting Amendment 80 fisheries. Cooperatives increase incentives for individual halibut PSC accountability and optimal use of halibut PSC limits. Amendment 80 cooperative vessels now have a direct relationship between careful utilization of halibut PSC and how much of their allocated and non-allocated target species are harvested. Therefore, Amendment 80 cooperative companies have begun discussing how to optimally utilize halibut excluders, reduce halibut PSC through data sharing, and reduce halibut mortality rates through improved fishing practices and halibut handling procedures. Even with these tools, it is still possible that halibut PSC could be a limiting factor in the future. See Table 4-3.

Table 4-3 2004-2009 trawl halibut PSC use (not including CDQ)

Year	Trawl Halibut PSC	Percentage used
2004	3,308	97%
2005	3,465	102%
2006	3,378	99%
2007	3,353	99%
2008	2,705	80%
2009	2,801	84%
Average	3,168	93%

NMFS, Alaska Region catch accounting system

4.2 BSAI Crab

Crab PSC limits for trawl gear are specified annually based on abundance and spawning biomass. The allocation for the crab PSQ reserve for use by the groundfish CDQ program is 10.7 percent from each trawl gear PSC limit specified for crab. The crab PSC limits to the Amendment 80 sector were reduced to 80 percent of the initial allocation. This reduction is 5 percent per year starting in 2009 for a total of four

years to phase in the PSC limit reduction. The PSC limit allocated to the Amendment 80 sector is further divided between the cooperatives and the vessels not in cooperatives. The allocations of crab PSC to the BSAI trawl limited access are fixed percentages in Table 35 to part 679.

PSC assigned to Amendment 80 cooperatives is not allocated to specific fishery categories. The participants in a cooperative may choose which fisheries to use their portion of the cooperative PSC allocations. The apportionment of each trawl PSC limit assigned to the Amendment 80 limited access sector and the BSAI trawl limited access sector are allocated into PSC bycatch allowances for seven specified fishery categories. The two categories for the Atka mackerel, Pacific cod, and pollock are Pacific cod and pollock/Atka mackerel/"other species." The amounts and any seasonal allocation of PSC limits for the seven fishery categories is done in the annual harvest specifications. For the most recent allocations see Table 8 of the final 2010 and 2011 harvest specifications for groundfish of the BSAI (http://alaskafisheries.noaa.gov/sustainablefisheries/specs10_11/bsaitable8.pdf).

In the Aleutian Islands, crab occurs in both the Atka mackerel and Pacific cod targets. See Table 4-4.

Table 4-4 Crab PSC in the Aleutian Islands

Opilio Tanner Crab

Year	Atka Mackerel	Pacific Cod	Total
2003	-	228	228
2004	-	31	31
2005	-	373	373
2006	0	7,614	7,614
2007	-	50,762	50,762
2008	-	102,680	102,680
2009	-	125,759	125,759
Average	**0**	**41,064**	**41,064**

Red King Crab

Year	Atka Mackerel	Pacific Cod	Total
2003	366	7,094	7,460
2004	23	768	790
2005	53	3,050	3,103
2006	-	41	41
2007	312	1,637	1,949
2008	1,571	5,578	7,149
2009	1,124	689	1,813
Average	**493**	**2,694**	**3,186**

Bairdi Tanner Crab

Year	Atka Mackerel	Pacific Cod	Total
2003	-	10,841	10,841
2004	18	7,759	7,777
2005	-	2,694	2,694
2006	-	6,475	6,475
2007	-	19,756	19,756
2008	0	189,359	189,359
2009	-	41,463	41,463
Average	**3**	**39,764**	**39,766**

Golden King Crab

Year	Atka Mackerel	Pacific Cod	Total
2003	216	114	330
2004	8	-	8
2005	177	36	213
2006	4,417	389	4,806
2007	1,528	602	2,130
2008	21,718	689	22,408
2009	3,752	1,193	4,945
Average	**4,545**	**432**	**4,977**

NMFS, Alaska Region catch accounting system

4.3 BSAI Salmon

Salmon are rarely encountered in non-pollock fisheries. Though there has been a pollock quota and opening in the Aleutian Islands, there has been no significant effort in this fishery for several years. Therefore salmon incidental catch in the Aleutian Islands has historically been low. Incidental catch of salmon in the AI can be seen in Table 4-5.

Table 4-5 2004-2009 Salmon PSC use by gear in the Aleutian Islands (not including CDQ)

Chinook salmon					
Year	Hook-and-line	Non-pelagic trawl	Pot	Pelagic trawl	Total
2004	-	990	-	-	990
2005	0	794	-	43	838
2006	3	743	-	99	845
2007	-	1,548	-	260	1,808
2008	-	1,727	-	66	1,793
2009	0	1,056	-	5	1,061
Average	0	1,143	-	79	1,222
Non-Chinook salmon					
Year	Hook-and-line	Non-pelagic trawl	Pot	Pelagic trawl	Total
2004	11	159	-	-	170
2005	0	2,342	-	17	2,360
2006	13	659	-	2	675
2007	10	1,677	-	14	1,701
2008	8	342	-	0	350
2009	1	349	-	10	359
Average	7	921	-	7	936

NMFS, Alaska Region catch accounting system

4.4 Forage Fish Description

Interaction of the primary target fisheries with other fish species

For forage fish, a maximum retainable allowance applies that means that no more than 2 percent of catch onboard may consist of these species. There is little interaction between the Atka mackerel and Pacific cod fisheries and forage fish species. The role of the Atka mackerel and Pacific cod as predators or prey of the forage fish species will not be affected, as the total removals are not likely to change under the proposed action. Further information on these fish species, including abundance trends and stock assessments, may be found in the Ecosystems Considerations chapter of the *Stock Assessment and Fishery Evaluation* report (NPFMC 2009). Forage fish descriptions are also in the Alaska Groundfish PSEIS (NMFS 2004), the EFH EIS (NMFS 2005) and in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The amount of incidental catch of forage fish in the groundfish fisheries is a very small percentage of the available biomass.

4.5 Non-specified Species Description

Non-specified species are defined in the FMP as species of no commercial value, which are discarded. The non-specified species category consists of all species of finfish and marine invertebrates not listed in the target category, “other species” category, prohibited species category, and forage fish category. There may be many hundreds of these species. This category of species is proposed to be removed from the BSAI groundfish FMP under Amendment 96 (75 FR 38454, July 2, 2010) because no management measures are implemented for these species and they do not meet the criteria to warrant management as described by the National Standard 1 guidelines (74 FR 3178, January 16, 2009). The comment period for this proposed action ends August 31, 2010, and the Secretary of Commerce decision on the amendment is scheduled for the end of September.

4.6 Effects on Non-target Species

4.6.1 Significant Criteria for Non-target species

The non-target fish (including invertebrates) and prohibited species catch (PSC) species may be affected by this action. The PSC species most likely to be impacted by this action are halibut and crab based on the incidental catch of these species in the Atka mackerel and Pacific cod fisheries in the Aleutian Islands. Salmon, forage fish, and non-specified species are rarely encountered in Aleutian Islands fisheries, therefore this section focuses on the potential effects on halibut and crab from the alternatives. The significance criteria used to evaluate the effects of the action on non-target species and PSC species is in Table 4-6. These criteria are adopted from the significance criteria used in the HAPC EA (NMFS 2006).

Table 4-6 Criteria Used to Estimate the Significance of Impacts on Non-target and Prohibited Species

No impact	No incidental take of the non-target and prohibited species in question.
Adverse impact	There are incidental takes of the non-target and prohibited species in question.
Beneficial impact	Natural at-sea mortality of the non-target and prohibited species in question would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	Fisheries are subject to operational constraints under PSC management measures. Groundfish fisheries without the PSC management measures would be a significantly adverse effect on prohibited species. Operation of the groundfish fisheries in a manner that substantially increases the take of non-target species would be a significantly adverse effect on non-target species.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the non-target and prohibited species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

4.6.2 Effects on Non-target species

4.6.2.1 Effects on halibut, salmon, and crab

Halibut, salmon, and crab are taken in Atka mackerel and Pacific cod fisheries in the Aleutian Islands. Under all alternatives halibut, salmon, and crab PSC will continue to occur in the Aleutian Islands though at a lower rate primarily due to less harvest of groundfish. It is expected that there may be an increase in halibut and crab PSC in the Bering Sea as vessels shift effort from the Aleutian Islands to the Bering Sea, however the vessels will still be constrained by the PSC limits in place for their sector. For more detailed information see chapter 10.

Under the criteria in Table 4-6, the impact of all alternatives would be adverse. However, under all alternatives, the fisheries will still be under PSC management measures currently in place, therefore the impact is not significant.

4.6.2.2 Effects on Non-specified Species

The effects of the groundfish fisheries on non-specified species is described in the EA for Amendments 96 and 87, and this description is incorporated by reference (NMFS 2010). There is not enough information available about these species to determine appropriate management measures for these species taken in the groundfish fisheries. NMFS continues to collect non-specified species information (observer and survey data) and will work with the Council to address conservation concerns for individual

non-specified species as these concerns are identified. Grenadiers are one non-specified species that is being evaluated for potential inclusion in the BSAI groundfish FMP if management measures are warranted based on fisheries catch and survey information. The Council's Non-target Species Committee continues to review current management practices for non-target species and is including grenadiers in the review process (http://alaskafisheries.noaa.gov/npfmc/current_issues/non_target/NonTargetMinutes310.pdf).

The effects of alternatives 2 and 3 on non-specified species are expected to be similar to status quo. The level of incidental take of non-specified species under Alternatives 2 and 3 is expected to be less than the amount of incidental take under Alternative 1 because of the reduced harvest in the Atka mackerel and Pacific cod fisheries, with more reduction under Alternative 2 compared to Alternative 3. Because the Alternatives are not likely to substantially increase the incidental catch of non-specified species, it is likely that the alternatives would have an insignificant impact on non-specified species.

4.6.2.3 Effects on Forage Fish

For the fish species that are caught incidentally in the primary target species fisheries, the majority are assessed annually, and are managed using conservative catch quotas. The Groundfish PSEIS (NMFS 2004b), and the Harvest Specifications Environmental Assessment (NMFS 2004a) both conclude that these species are at sustainable population levels, and are unlikely to be subject to overfishing under the current, risk-averse management program. Minimal interaction occurs between the primary target species fisheries and forage fish. As a result, impacts on these species under Alternative 1 are not significant. Cooperatives result in longer seasons, and may change the patterns of incidental catch as cooperatives with a fixed allocation have more flexibility to respond to environmental conditions. Such changes will not be of such a degree as to impact the sustainability of managed species, however, as long as the species are managed under conservative quotas or maximum retainable amounts. Therefore the effects of Alternatives 2 and 3 are insignificant.

4.6.3 Cumulative Effect

4.6.4 Summary of Effects

4.7 References

NMFS. 2004. Final Programmatic Supplemental Environmental Impact Statement on the Alaska Groundfish Fisheries. U.S. Dep. Commerce, NOAA, NMFS, Alaska Region, Juneau, Alaska.

NMFS. 2005. Environmental impact statement for essential fish habitat identification and conservation in Alaska. April 2005, U.S.DOC, NOAA, NMFS; Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668.

NMFS. 2006. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Amendments 65/65/12/7/8 to the BSAI Groundfish FMP (#65), GOA Groundfish FMP (#65), BSAI Crab FMP (#12), Scallop FMP (#7), and the Salmon FMP (#8) and regulatory amendments to provide Habitat Areas of Particular Concern. April 2006, U.S. DOC, NOAA, NMFS Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668.

NMFS. 2007. Environmental impact statement for the Alaska groundfish harvest specifications. January 2007. National Marine Fisheries Service, Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668. Available: http://www.alaskafisheries.noaa.gov/index/analyses/analyses.asp.

NMFS 2010 ENVIRONMENTAL ASSESSMENT for Amendment 96 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area and Amendment 87 to the Fishery Management Plan for Groundfish of the Gulf of Alaska to Comply with Annual Catch Limit Requirements. May 2010. U.S. DOC, NOAA, NMFS Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668. Available: http://alaskafisheries.noaa.gov/sustainablefisheries/amds/95-96-87/secrev_ea_amd96-87_0510.pdf

4.8 Preparers and Persons Consulted

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5.0 MARINE MAMMALS

A number of concerns may be related to marine mammals and potential impacts of fishing. For individual species, these concerns include—

- listing as endangered or threatened under the Endangered Species Act (ESA);
- protection under the Marine Mammal Protection Act (MMPA);
- announcement as candidate or being considered as candidates for ESA listings;
- declining populations in a manner of concern to state or federal agencies;
- experiencing large bycatch or other mortality related to fishing activities; or
- being vulnerable to direct or indirect adverse effects from some fishing activities.

Marine mammals have been given various levels of protection under the current fishery management plans (FMPs) of the North Pacific Fishery Management Council (Council), and are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on these species. The Alaska groundfish harvest specifications environmental impact statement (EIS) (NMFS 2007a) and the environmental assessment/regulatory impact review/initial regulatory flexibility analysis (EA/RIR/IRFA) for the Arctic FMP (NMFS 2009) provide the most recent status information on marine mammals that may be impacted by the action. Several marine mammal species occur in the Aleutian Islands and in the Arctic (e.g., ribbon seals). The status descriptions in this EIS and EA are incorporated by reference.

Marine mammals, including those currently listed as endangered or threatened under the ESA, that may be present in the action area are listed in Table 5-1. These species include great whales and pinnipeds. National Marine Fisheries Service (NMFS) is the expert agency for ESA-listed marine mammals, except for northern sea otters. The U.S. Fish and Wildlife Service (USFWS) is the expert agency for northern sea otters. Of the species listed under the ESA and present in the action area, several species may be adversely affected by groundfish commercial fishing. These include Steller sea lions, humpback whales, and sperm whales (NMFS 2006a).

Table 5-1 Marine mammals likely to occur in the Aleutian Islands subarea.

Common Name	Scientific Name	ESA Status
North Pacific Right Whale[2]	*Balaena glacialis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion[1]	*Eumetopias jubatus*	Endangered
Minke Whale	*Balaenoptera acutorostrata*	None
Killer Whale	*Orcinus orca*	None
Dall's Porpoise	*Phocoenoides dalli*	None
Harbor Porpoise	*Phocoena phocoena*	None
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	None
Beaked Whales	*Berardius bairdii* and *Mesoplodon* spp.	None
Northern Fur Seal	*Callorhinus ursinus*	None
Pacific Harbor Seal	*Phoca vitulina*	None
Northern Sea Otter[3]	*Enhydra lutris*	Threatened
Ribbon Seal	*Phoca fasciata*	None

[1] Steller sea lions are listed as endangered west of Cape Suckling.
[2]NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).
[3] Northern sea otters are under the jurisdiction of the USFWS.

Section 7 consultations with respect to the actions of the federal groundfish fisheries have been completed for all the ESA-listed species, either individually or in groups. On November 30, 2000, an FMP-level biological opinion was issued pursuant to Section 7 of the ESA on all NMFS managed ESA-listed species present in the fishery management areas for all groundfish fisheries. That FMP-level biological opinion concluded that the FMPs are likely to jeopardize the continued existence and adversely modify designated critical habitat of the Steller sea lion (NMFS 2000). On October 19, 2001, NMFS released a biological opinion for the Steller sea lion protection measures that concluded that the fisheries conducted according to the protection measures are not likely to jeopardize the Steller sea lion or adversely modify or destroy its designated critical habitat. For additional information, see the Steller sea lion supplemental EIS (NMFS 2001). Additional information on all endangered or threatened species in the BSAI can be found in the Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) and in sections 3.4 and 8.2 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a).

Because of new information regarding Steller sea lions and fisheries management since the last FMP-level consultation, NMFS reinitiated FMP-level Section 7 formal consultations on the effect of the groundfish fisheries on Steller sea lions, humpback whales, and sperm whales (NMFS 2006a). A draft FMP biop was released in July 2010 (NMFS 2010). This opinion found that the effects of the groundfish fisheries may cause jeopardy of extinction or adverse modification or destruction of designated critical habitat (JAM) for Steller sea lions. The draft FMP biop also found that the groundfish fisheries were not likely to jeopardize the continued existence of humpback or sperm whales. Critical habitat is not designated for humpback and sperm whales. Because the FMP biop found that the groundfish fisheries may cause JAM for Steller sea lions, a reasonable and prudent alternative (RPA) was included. The proposed action analyzed in this EA/RIR would implement measures for the groundfish fisheries consistent with the RPA.

5.1.1 Marine Mammals Status

Some marine mammal species are resident throughout the year, while others migrate into or out of Alaska fisheries management areas. The BSAI supports one of the richest assemblages of marine mammals in the world. Twenty-five species are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises). Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry et al. 1982).

The PSEIS (NMFS 2004) provides descriptions of the range, habitat, diet, abundance, and population status for marine mammals. The most recent marine mammal stock assessment reports (SARs) for strategic Bering Sea and Aleutian Islands Management Area (BSAI) marine mammals stocks (Steller sea lions, northern fur seals, harbor porpoise, North Pacific right whales, humpback whales, sperm whales, and fin whales) were based on review of information available in 2008 and 2009 (Allen and Angliss 2010). Northern sea otters were assessed in 2008 (Allen and Angliss 2010). The information from NMFS (2004) and Allen and Angliss (2010) is incorporated by reference. The SARs provide population estimates, population trends, and estimates of the potential biological removal (PBR) levels for each stock.[1] The SARs also identify potential causes of mortality and whether the stock is considered a strategic stock under the MMPA.

The Alaska Groundfish Harvest Specifications EIS provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007a). Direct and indirect interactions between marine mammals and groundfish fishing vessels may occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities. This discussion focuses on those marine mammals that may interact or be affected by the Atka mackerel and Pacific cod fisheries in the Aleutian Islands subarea. These species are listed in Table 5-2 and Table 5-3.

The Steller sea lion inhabits many of the shoreline areas of the BSAI, using these habitats as seasonal rookeries and year-round haulouts. The Steller sea lion has been listed as threatened under the ESA since 1990. In 1997 the population was split into two stocks or distinct population segments (DPS) based on genetic and demographic dissimilarities, the western and eastern stocks. Because of a pattern of continued decline in the western distinct population segment (WDPS), it was listed as endangered on May 5, 1997 (62 FR 30772), while the eastern distinct population segment (EDPS) remained under threatened status. The WDPS inhabits an area of Alaska approximately from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters.

Throughout the 1990s, particularly after critical habitat was designated, various closures of areas around rookeries, haulouts, and some offshore foraging areas affected commercial harvest of pollock, Pacific cod, and Atka mackerel, important components of the WDPS of Steller sea lion diet. In 2001, a biological opinion was released that provided protection measures that would not jeopardize the continued existence of the Steller sea lion or adversely modify its designated critical habitat; that opinion was supplemented in 2003, and after court challenge, these protection measures remain in effect today (NMFS 2001, Appendix A). A detailed analysis of the effects of these protection measures is provided in the *Steller Sea Lion Protection Measures Final Supplemental EIS* (NMFS 2001).

[1]The SARs are available on the NMFS Protected Resources Division website at http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2009.pdf.

The Aleutian Islands subarea has extensive closures in place for Steller sea lions including no transit zones and closures of critical habitat around rookeries and haulouts. Pacific cod and Atka mackerel are important prey species for Steller sea lions (NMFS 2010). The harvest of Pacific cod in the Aleutian Islands subarea is temporally dispersed (§ 679.20). The harvest of Atka mackerel and Pacific cod is spatially dispersed through area closures (§ 679.22). These harvest restrictions on the Atka mackerel, pollock, and Pacific cod fisheries were intended to decrease the likelihood of disturbance, incidental take, and competition for prey to ensure the groundfish fisheries would not be likely to cause JAM for Steller sea lions (NMFS 2000, 2001). Based on the new draft FMP biop, more restrictions on the spatial and temporal harvests of Atka mackerel and Pacific cod in the Aleutian Islands are required to ensure the effects of the groundfish fisheries are not likely to result in JAM for Steller sea lions (NMFS 2010).

An informal consultation with the USFWS on the effects of the groundfish fisheries on the southwest Alaska DPS of northern sea otters was completed in 2006 (Mecum 2006). The southwest Alaska DPS of northern sea otter is listed as threatened under the ESA (70 FR 46365, August 9, 2005). Overall, this DPS has declined by more than half since the 1980s and by 90 percent in some locations. The USFWS is developing a recovery plan for the southwest Alaska DPS of northern sea otters under the ESA. On December 19, 2006, the Center for Biological Diversity sued the USFWS for violation of Section 4 of the ESA for failure to designate critical habitat for the southwest Alaska DPS of northern sea otters. Since 2006, the sea otter recovery team has been developing a recovery plan including identifying the areas and features needed for critical habitat for northern sea otters. The recovery team forwarded the recovery plan to the USFWS for review in April 2010 (Douglas Burns, USFWS, Marine Mammals Management Office, personal communication, July 14, 2010).

The informal consultation concluded that the groundfish fisheries were not likely to adversely affect northern sea otters (Mecum 2006). The USFWS has determined that, based on available data, sea otter abundance is not likely to be significantly affected by commercial fishery interaction at present (Allen and Angliss 2010), and commercial fishing is not likely a factor in the population decline (70 FR 46365, August 9, 2005). Northern sea otters are not likely to interact with groundfish fisheries in the Alaska exclusive economic zone (EEZ) because the areas of fishing and the types of prey preferred by otters do not overlap with the groundfish fisheries. Otters feed primarily in the rocky near shore areas on invertebrates, while groundfish fisheries are conducted further offshore on groundfish species (Funk 2003). Trawl closures where sea otters feed reduce potential interaction between trawl vessels and sea otters and ensures the clam habitat used by sea otters is not disturbed.

Table 5-2 Status of Pinnipedia and Carnivora stocks potentially affected by the action.

Pinnipedia and Carnivora species and stock	*Status under the ESA*	*Status under the MMPA*	*Population trends*	*Distribution in action area*
Steller sea lion – Western (W) and Eastern (E) Distinct Population Segment (DPS)	Endangered (W) Threatened (E)	Depleted & a strategic stock	For the WDPS, regional increases in counts in trend sites of some areas have been offset by decreased counts in other areas so that the overall population of the WDPS appears to have stabilized (Fritz et al. 2008). The EDPS is steadily increasing and has been recommended for delisting consideration (NMFS 2008).	WDPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. EDPS inhabit waters east of Prince William Sound to Dixon Entrance. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Islands, Aleutian Islands, St. Lawrence Island, and off the mainland. Use marine areas for foraging. Critical habitat designated around major rookeries, haulouts, and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted & a strategic stock	Recent pup counts show a continuing decline in the number of pups surviving in the Pribilof Islands. NMFS researchers found an approximately 9% decrease in the number of pups born between 2004 and 2006. The pup estimate decreased most sharply on St. Paul Island.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007b). Forages in the pelagic area of the Bering Sea during summer breeding season, but most leave the Bering Sea in the fall to spend winter and spring in the N. Pacific.
Harbor seal – Gulf of Alaska	None	None	A moderate to large population decline has occurred in the GOA stock.	GOA stock found primarily in the coastal waters and may cross over into the Bering Sea coastal waters between islands.
Ribbon seal – Alaska	None*	None	Reliable data on population trends are unavailable.	Widely dispersed throughout the Bering Sea and Aleutian Islands in the summer and fall. Associated with ice in spring and winter and may be associated with ice in summer and fall.
Northern sea otters – SW Alaska	Threatened	Depleted & a strategic stock	The overall population trend for the southwest Alaska stock is believed to be declining, particularly in the Aleutian Islands.	Coastal waters along the Aleutians within the 40 m depth contour.

Source: Allen and Angliss 2010; Draft List of Fisheries for 2011 (75 FR 36318, June 25, 2010).

Northern fur seal pup data available from http://www.alaskafisheries.noaa.gov/newsreleases/2007/fursealpups020207.htm.

*NMFS determined that ribbon seals were not to be listed on September 23, 2008. The Center for Biological Diversity and Greenpeace filed suit against NMFS regarding this decision on September 3, 2009.

Northern sea otter information from http://www.nmfs.noaa.gov/pr/pdfs/sars/seaotter2008_ak_sw.pdf.

Table 5-3 Status of Cetacea stocks potentially affected by the action.

Cetacea species and stock	*Status under the ESA*	*Status under the MMPA*	*Population trends*	*Distribution in action area*
Killer whale – Eastern North Pacific GOA, AI, and BS transient; and Alaska Resident	None	None	Unknown abundance for the Alaska resident; and Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient stocks. The minimum abundance estimate for the Eastern North Pacific Alaska Resident stock is likely underestimated because researchers continue to encounter new whales in the Alaskan waters.	Transient-type killer whales from the Aleutian Islands and Bering Sea are considered to be part of a single population that includes GOA transients. Killer whales are seen in the northern Bering Sea and Beaufort Sea, but little is known about these whales. Alaska resident killer whales occur in the Aleutian Islands.
Dall's porpoise – Alaska	None	None	Reliable data on population trends are unavailable.	Found in the offshore waters from coastal western Alaska throughout Aleutian Islands.
Pacific white-sided dolphin	None	None	Reliable data on population trends are unavailable.	Found throughout the Aleutian Islands subarea.
Harbor porpoise – Bering Sea	None	Strategic	Reliable data on population trends are unavailable.	Primarily in coastal waters, including the Aleutian Islands, usually less than 100 m.
Humpback whale – Western and Central North Pacific	Endangered and under status review	Depleted & a strategic stock	Increasing. The Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) abundance estimate for the total North Pacific represents an annual increase of 4.9% over the most complete estimate for the North Pacific from 1991–93. Comparisons of SPLASH abundance estimates for Hawaii to estimates from 1991–93 gave estimates of annual increase that ranged from 5.5 % to 6.0% (Calambokidis et al. 2008).	W. Pacific and C. North Pacific stocks occur in Aleutian Island waters and may mingle in the North Pacific feeding area. Humpback whales in the Bering Sea (Moore et al. 2002) cannot be conclusively identified as belonging to the western or Central North Pacific stocks, or to a separate, unnamed stock. High densities of humpback whales are found in the eastern Aleutian Islands, particularly along the north side of Unalaska Island.
North Pacific right whale Eastern North Pacific	Endangered	Depleted & a strategic stock	This stock is considered to represent only a small fraction of its precommercial whaling abundance and is arguably the most endangered stock of large whales in the world. A reliable estimate of trend in abundance is currently not available.	Before commercial whaling on right whales, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). During 1965–99, following large illegal catches by the U.S.S.R., there were only 82 sightings of right whales in the entire eastern North Pacific, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001).
Fin whale – Northeast Pacific	Endangered	Depleted & a strategic stock	Abundance may be increasing but surveys only provide abundance information for portions of the stock in the central-eastern and southeastern Bering and coastal waters of the Aleutian Islands and the Alaska Peninsula. Much of the North Pacific range has not been surveyed.	Found in the Bering Sea and coastal waters of the Aleutian Islands and Alaska Peninsula. Most sightings in the central-eastern Bering Sea occur in a high productivity zone on the shelf break.

Cetacea species and stock	***Status under the ESA***	***Status under the MMPA***	***Population trends***	***Distribution in action area***
Minke whale – Alaska	None	None	There are no data on trends in Minke whale abundance in Alaska waters.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA. Not common in the Aleutian Islands.
Sperm whale – North Pacific	Endangered	Depleted & a strategic stock	Abundance and population trends in Alaska waters are unknown.	Inhabit waters 600 m or more depth, south of 62°N lat. Males inhabit Bering Sea in summer. Feed in the Aleutian Islands.
Baird's, Cuvier's, and Stejneger's beaked whale	None	None	Reliable data on population trends are unavailable.	Occurs throughout the Aleutian Islands subarea

Sources: Allen and Angliss 2010; Draft List of Fisheries for 2011 (75 FR 31618, June 25, 2010); http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm.

North Pacific right whale included based on NMFS (2006a) and Salveson (2008).

5.2 Steller Sea Lions

5.2.1 Western Distinct Population Segment Population Trend

A detailed discussion on the population trend of the Steller sea lions is in chapter 3 of the FMP biop (NMFS 2010) and is incorporated by reference. Based on non-pup counts of Steller sea lions on trend sites throughout the Gulf of Alaska (GOA) and Aleutian Islands, the overall WDPS of Steller sea lion population trend is stable and may be insignificantly increasing. The number of non-pups counted at trend sites between 2000 and 2008 increased 12 percent. The increase in counts between 2004 and 2008 is 1 percent (Demaster 2009). Pup production in the Aleutian Islands has the following trends:

- In the eastern Aleutian Islands increased at rates of +4.2 percent (P=0.004) per year from 1998 through 2009, respectively;
- In the western Aleutian Islands decreased at a rate of -10.4 percent (P=0.001) per year from 1997 through 2008; this includes the 2005 count from Attu/Cape Wrangell;
- In the central Aleutian Islands decreased at a rate of -1.6 percent (P=0.006) per year from 1994 through 2009

Non-pup counts have declined in the Aleutian Islands with the decline being most severe in the west and becoming less of a decline towards the east (-7 percent in Area 543, -1 to -4 percent in Areas 542 and 541) (Table 5.1(a) in NMFS 2010). Pup and non-pup counts in the remainder of the WDPS Steller sea lion range is either stable or increasing, ranging from 0–5 percent increased population growth from 2000 to 2008 (Table 5.1(a) in NMFS 2010).

5.2.2 Terrestrial Sites and Usage

Steller sea lions use terrestrial sites for resting and reproductive activities. These sites may be classified as a haulout or rookery (or both) depending on how the site is used and when. A haulout is a terrestrial area used by adult Steller sea lions during times other than the breeding season (May through August) and by non-breeding adults and subadults throughout the year (NMFS 2010). Sites used as rookeries in the breeding season may also be used as haulouts during other times of year. Some haulouts are used year-around while others only on a seasonal basis. Sites identified as rookeries have more than 200 non-pups present during the breeding season.

As shown in Figure 5-1, Steller sea lions have changed their use of several Aleutian Island sites since the designation of critical habitat in 1993 (58 FR 45278, August 27, 1993). The use of Kanaga Island/Ship Rock has increased in the breeding season sufficient to now consider this site a rookery. The following sites are designated in 50 CFR 226.202 as rookeries, but they now meet the use criteria only for haulouts: Agligadak Island, Semisopochnoi Island/Pochnoi Point, Amchitka East Cape, and Semisopochnoi Island/Petrel Point.

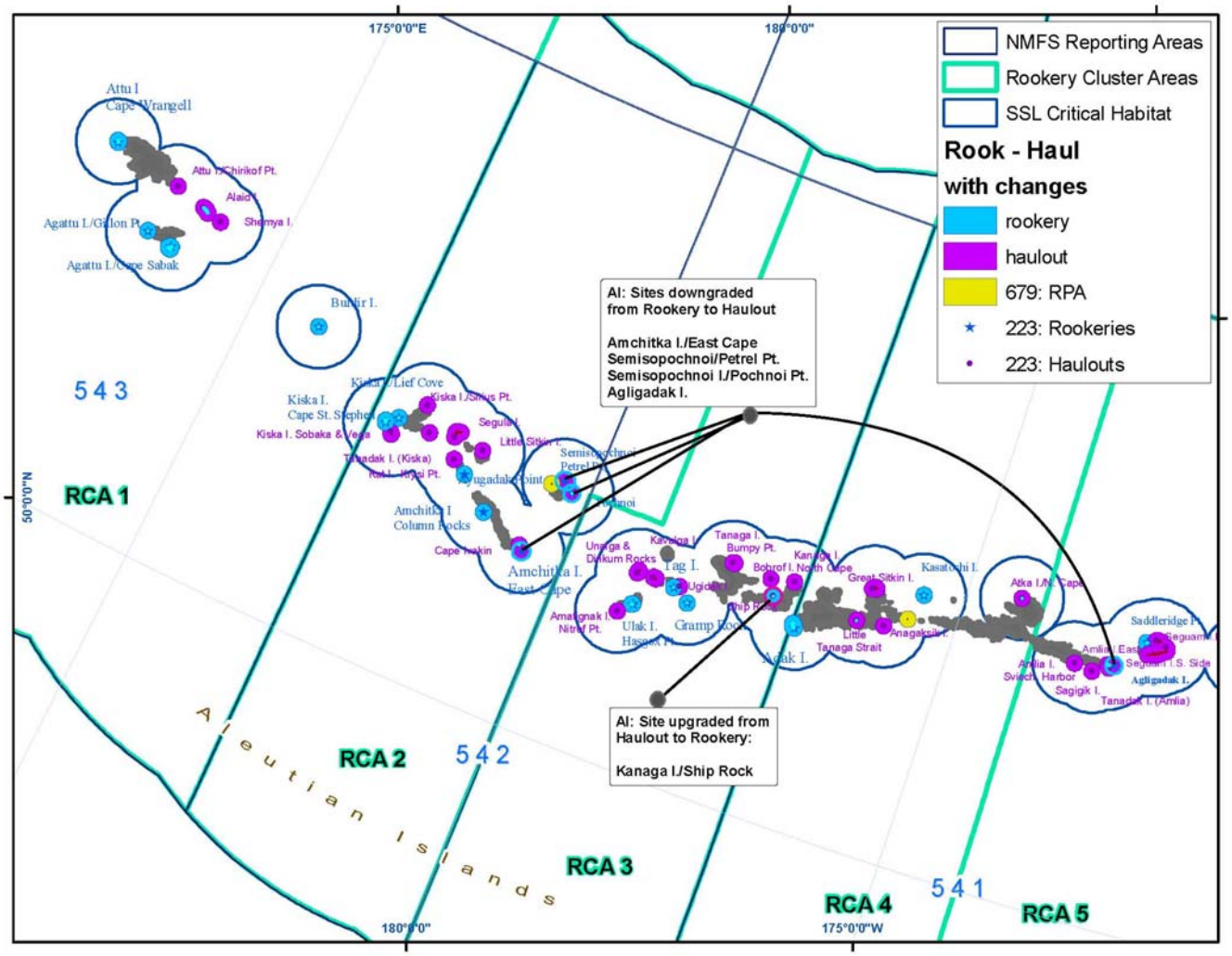

Figure 5-1 **Steller sea lion terrestrial sites with changed usage. (Steve Lewis, NMFS Alaska Region Analytical Team)**

5.3 Effects on Marine Mammals

5.3.1 Significant Criteria for Marine Mammals

Table 5-4 contains the significance criteria for analyzing the effects of the proposed action on marine mammals. These criteria are from the 2006–2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA) (NMFS 2006b). These criteria are applicable to this action because this analysis and the harvest specifications analysis both analyze the effects of groundfish fisheries on marine mammals. That EA/FRFA provided the latest ideas on determining the significance of effects on marine mammals based on similar information that is available for this EA/RIR. The first criterion under the prey species column and the third criterion under the disturbance column in the table were further refined for this analysis from NMFS (2006b) to address impacts on prey species by both harvesting and potential impacts on the habitat that support prey species. Significantly beneficial impacts are not possible with the management of groundfish fisheries as no beneficial impacts to marine

mammals are likely with groundfish harvest. Generally, changes to the fisheries do not benefit marine mammals in relation to incidental take, prey availability, and disturbances; changes increase or decrease potential adverse impacts. The only exception to this may be in instances when marine mammals target prey from fishing gear, as seen with killer whales and sperm whales removing fish from hook-and-line gear. In this example, the prey availability is enhance for these animals because they need less energy for foraging.

Table 5-4 Criteria for determining significance of impacts to marine mammals.

	Incidental take and entanglement in marine debris	Prey availability	Disturbance
Adverse impact	Mammals are taken incidentally to fishing operations or become entangled in marine debris.	Fisheries reduce the availability of marine mammal prey.	Fishing operations disturb marine mammals.
Beneficial impact	There is no beneficial impact.	Generally, there are no beneficial impacts.	There is no beneficial impact.
Significantly adverse impact	Incidental take is more than PBR or is considered major in relation to estimated population when PBR is undefined.	Competition for key prey species likely to constrain foraging success of marine mammal species causing population decline.	Disturbance of mammal is such that population is likely to decrease.
Significantly beneficial impact	Not applicable	Not applicable	Not applicable
Unknown impact	Insufficient information available on take rates.	Insufficient information as to what constitutes a key area or important time of year.	Insufficient information as to what constitutes disturbance.

5.3.2 Incidental Take Effects

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the incidental take effects of the groundfish fisheries on marine mammals (chapter 8 in NMFS 2007a) and is incorporated by reference. Marine mammals can be taken in groundfish fisheries by entanglement in gear (e.g., trawl, longline, and pot) and rarely by ship strikes for some cetaceans. Table 5-5 lists the species of marine mammals taken in the BSAI Pacific cod longline and trawl and the BSAI Atka mackerel trawl fisheries as published in the Draft List of Fisheries for 2011 (75 FR 36318, June 25, 2010).

Table 5-5 Documented takes for marine mammals that may occur in the Aleutian Islands from the Draft List of Fisheries for 2011 for the Atka mackerel and Pacific cod fisheries.

Fishery		Marine Mammal Stocks Taken
Category II	AK Bering Sea, Aleutian Islands Pacific Cod Longline	Killer whale, AK resident Steller sea lions, western U.S.
Category III	AK Bering Sea, Aleutian Islands Atka mackerel trawl	Steller sea lion, western U.S.
	AK Bering Sea, Aleutian Islands Pacific Cod Trawl	Steller sea lion, western U.S. Harbor seals, Bering Sea

Source: 75 FR 36318, June 25, 2010.

Marine mammals that are not listed in Table 5-5 are assumed to be unlikely to be incidentally taken by any of the alternatives due to the absence of incidental take and entanglement records. No records exist of Alaska groundfish fisheries takes of North Pacific right whales.

An analysis of the groundfish fisheries risks of incidental takes of humpback and sperm whales is in the draft FMP biop (NMFS 2010) and is incorporated by reference. Sperm whales are known to pick fish from longline fishing gear primarily in GOA waters, and this depredation has been increasing throughout the last decade (NMFS 2010). Entanglements have occurred in the GOA, although available evidence does not indicate sperm whales are being killed or seriously injured as a result of these interactions although it is possible that whales may break through or carry off trailing gear and become debilitated, injured, or die as a result, with no observation of the event. The incidence of sperm whale entanglement in Alaska appears to be low, and would not be expected to rise to a level that would have population level consequence for sperm whales. While possible, the incidence of ship strikes and/or serious injury from ship strikes involved in the groundfish fisheries to sperm whales are likely to be minimal and not expected to result in an adverse population level effect for sperm whales in Alaska.

Gear entanglements are not uncommon for humpback whales, and are associated with unidentified pot gear fisheries (NMFS 2010). It is unclear to what extent entanglements reported to the stranding network in Alaska involve groundfish fishing gear. Overall, the number of entanglements that might result from interactions with groundfish fisheries appears to be low in contrast to other gear types. For such events that do occur with individual whales, the extent of entanglement from groundfish fisheries is not expected to have negative consequences for humpback whales in the North Pacific. The incidence of ship strikes and/or serious injury from vessels involved in the groundfish fisheries are likely to be negligible, and unlikely to have population level consequences for humpback whales in the North Pacific.

Potential take in the Aleutian Islands Atka mackerel and Pacific cod fisheries is well below the PBR for all marine mammals which have a PBR determined (Table 5-6). This means that predicted take would be below the maximum number of animals that may be removed from these marine mammal stocks while allowing the stocks to reach or maintain their optimum sustainable population. Table 5-6 provides more detail on the levels of take based on the most recent SAR (Allen and Angliss 2010). The BSAI Pacific cod longline fishery is a Category II fishery because it has annual mortality and serious injury of a marine mammal stock greater than 1 percent and less than 50 percent of the PBR level (75 FR 36318, June 25, 2010). The BSAI Pacific cod and Atka mackerel trawl fisheries are Category III fisheries based on annual mortality and serious injury of a stock being less than or equal to 1 percent of the PBR level. More marine mammals are taken in the BSAI Pacific cod longline fishery than in the Pacific cod and Atka mackerel trawl fisheries. Steller sea lions have the highest mean annual incidental take in the Pacific cod longline fishery compared to other marine mammals. Overall, very few marine mammals are reported taken in the BSAI longline and trawl fisheries. The data is not reported in a manner that allows separating takes in the Aleutian Islands from takes in the Bering Sea. Considering the amount of marine mammals taken incidentally in the Atka mackerel and Pacific cod fisheries in relation to the PBR, it is unlikely the incidental takes would impact the subsistence harvest of marine mammals.

Table 5-6 Estimated mean annual mortality of marine mammals from observed BSAI nonpelagic trawl flatfish and Pacific cod fishery compared to the total mean annual human-caused mortality and potential biological removal.

Marine mammal species and stock	5 years of data used to calculate total mean annual human-caused mortality	Mean annual mortality from BSAI Atka mackerel trawl fisheries	Mean annual mortality from BSAI Pacific cod trawl fisheries	Mean annual mortality from BSAI Pacific cod longline fisheries	Total mean annual human-caused mortality*	Potential biological removal
Steller sea lions (western)	2002–2006	0.25	0.85	1.98	232.8	247
Northern fur seal	2002–2006	0	0	1.08	596	14,543
Harbor seal (Bering Sea)	2002–2006	0	1.33	0	99.5	603
Killer whale Eastern North Pacific AK resident	2000–2004	0	0	0.84	1.5	11.2

* Does not include research mortality. Other human-caused mortality is predominantly subsistence harvests for seals and sea lions.

Note: Mean annual mortality is expressed in number of animals and includes both incidental takes and entanglements. The averages are from the most recent 5 years of data since the last SAR update, which may vary by stock. Groundfish fisheries mortality calculated based on Allen and Angliss (2010).

Minke whale have been taken in the BSAI groundfish trawl fishery in 2000, but it is not known which groundfish trawl fishery and whether the take was in the Bering Sea subarea or Aleutian Islands subarea (Allen and Angliss 2010). Mean annual mortality is 0.32 for this stock and PBR is undetermined. No human caused serious injury or mortality have been observed in the Aleutian Islands Atka mackerel and Pacific cod fisheries for beaked whales, blue whales, fin whales, humpback whales, sperm whales, North Pacific right whales, ribbon seals, harbor porpoise, Dall's porpoise, and Pacific white-sided dolphins (NMFS 2007a; Allen and Angliss 2010).

Killer whales also are known to remove fish from hook-and-line gear in the Aleutian Islands (Kenneth Hansen, NOAA Office of Law Enforcement, personal communication, July 29, 2010). It is likely that this behavior leads to an increased potential of entanglement by increasing the interaction of the animals with the gear.

NMFS observers monitored marine mammal incidental take in the 1990–2000 groundfish trawl, longline, and pot fisheries. No mortality or serious injuries to northern sea otters were observed in the EEZ. In 1992, a total of eight sea otters were observed caught in the Pacific cod pot fishery in the Aleutian Islands. Observer records indicate that those takes occurred in nearshore waters that had been closed to fishing, which explains why no additional take of sea otters was observed in pot fisheries through 2006 (Perez 2006, 2007). One sea otter mortality in the trawl fishery of the BSAI was reported in 1997, but no other sea otter mortality in the groundfish fisheries in the EEZ off Alaska has been reported (Funk 2003).

5.3.2.1 Effects on Steller Sea lions

5.3.2.1.1 Incidental Take Effects on Steller Sea Lions under Alternative 2

The potential for incidental takes of Steller sea lions under Alternative 2 in Areas 543 and 542 is expected to be reduced with the prohibition on Pacific cod and Atka mackerel retention. The potential for Atka mackerel and Pacific cod vessels to incidentally take Steller sea lions inside critical habitat in Area 541 also would be reduced under Alternative 2 by prohibiting the Atka mackerel and Pacific cod fisheries in this location.

Assuming the level of incidental takes is in proportion to the amount of Pacific cod and Atka mackerel harvest over all, the reduction of overall harvests described in section 10.3 of this EA/RIR may result in reduced overall incidental takes of Steller sea lions. The overall reduction in potential incidental takes is less likely for the Pacific cod fishery as much of the forgone harvests in the Aleutian Islands for the hook-and-line and pot fisheries is likely to be harvested in the Bering Sea subarea (section 10.3) and the mean annual mortality in the Pacific cod fishery for Steller sea lions is higher than for the trawl Atka mackerel fishery (Table 5-6). The occurrence of Steller sea lions in the Bering Sea is less than in the Aleutian Islands and the Pacific cod fishery is more likely to be dispersed over larger areas so that the overall incidental take is likely to be less than if the Pacific cod was harvested in the Aleutian Islands.

The Pacific cod hook-and-line (longline) fishery has a higher amount of mean annual incidental takes of Steller sea lions than the trawl or pot fisheries (Table 5-6). Alternative 2 would treat hook-and-line and trawl Pacific cod fisheries with the same closures, greatly reducing the amount of area where hook-and-line fishing is permitted in the Aleutian Islands compared to status quo. Much of the Aleutian Islands is currently open to Pacific cod hook-and-line fishing, including in critical habitat where Steller sea lions are more likely to occur.

The groundfish fishing closure at Kanaga Island/Ship Rock rookery would eliminate the potential for incidental takes by fishing vessels, except for the possibility of a vessel strike from vessels transiting the 3 nautical mile (nm) area.

Alternative 2 would reduce the potential adverse effects of incidental takes on Steller sea lions compared to status quo. Under status quo, the amount of incidental takes is well below the PBR and is a very small portion of overall total human caused mortality. Because Alternative 2 would further reduce this mortality, it is not likely to cause adverse population level effects for Steller sea lions. **Because Alternative 2 is not likely to result in adverse population level effects from the incidental take of Steller sea lions, the impacts of Alternative 2 on the incidental takes of Steller sea lions is likely insignificant.**

5.3.2.1.2 Incidental Take Effects on Steller Sea Lions under Alternative 3

The impacts of Alternative 3 on Steller sea lions incidental take is explained in detail in NMFS (2010) and is incorporated by reference. Summarize here Incidental Take Statement in the Biop?

Alternative 3 also would reduce the potential incidental takes of Steller sea lions in the Aleutian Islands compared to status quo by reducing Pacific cod and Atka mackerel harvest in the Aleutian Islands. Alternative 3 would allow for more overall Atka mackerel and Pacific cod fishing than Alternative 2 in the Aleutian Islands and allow such fishing in critical habitat in Areas 542 and 541, where Steller sea lions are more likely to be encountered. This potential additional fishing in critical habitat results in more potential for incidental takes of Steller sea lions under Alternative 3 compared to Alternative 2.

Alternative 3 would reduce the potential adverse effects of incidental takes on Steller sea lions compared to status quo. Under status quo, the amount of incidental takes is well below the PBR and is a very small portion of overall total human caused mortality. Because Alternative 3 would further reduce this mortality, it is not likely to cause adverse population level effects for Steller sea lions. **Because Alternative 3 is not likely to result in adverse population level effects from the incidental take of Steller sea lions, the impacts of Alternative 3 on the incidental takes of Steller sea lions is likely insignificant.**

5.3.2.2 Effects on Other Marine Mammals

5.3.2.2.1 Incidental Take Effects on Other Marine Mammals Under Alternative 2

The incidental takes of other marine mammals occur in the Pacific cod fisheries (Table 5-6). Reducing the Pacific cod trawl harvests in the Aleutian Islands is likely to reduce the potential for incidental takes of harbor seals compared to status quo. Because the forgone trawl harvests in the Aleutian Islands is less likely to be made up for by fishing in the Bering Sea, the overall potential for incidental takes of harbor seals is likely less than that under the status quo. Reducing the Pacific cod hook-and-line harvests may reduce the potential to incidentally take killer whales and northern fur seals. Because the Pacific cod hook-and-line harvest may be made up in the Bering Sea and because killer whales and northern fur seals may be more dispersed in areas where hook-and-line fishing may occur, the overall potential for incidental takes of killer whales and northern fur seals by the Pacific cod hook-and-line fishery is likely the same as status quo.

Alternative 2 would reduce the potential adverse effects of incidental takes on other marine mammals compared to status quo. Under status quo, the amount of incidental takes is well below the PBRs and is a very small portion of overall total human caused mortality. Because Alternative 2 would further reduce this mortality, it is not likely to cause adverse population level effects for other marine mammals. **Because Alternative 2 is not likely to result in adverse population level effects from the incidental take of other marine mammals, the impacts of Alternative 2 on the incidental takes of other marine mammals is likely insignificant.**

5.3.2.2.2 Incidental Take Effects on Other Marine Mammals Under Alternative 3

Alternative 3 also would reduce the potential incidental takes of other marine mammals in the Aleutian Islands compared to status quo by reducing Pacific cod in the Aleutian Islands. Alternative 3 would allow for more overall Atka mackerel and Pacific cod fishing than Alternative 2 in the Aleutian Islands and allow such fishing in critical habitat in Areas 542 and 541, where harbor seals are more likely to be encountered. This results in more potential for incidental takes of harbor seals under Alternative 3 compared to Alternative 2. The potential for incidental takes of killer whales and northern fur seals are likely the same under all three alternatives as these species are not as likely to occur primarily in the nearshore waters in the same way as harbor seals.

Alternative 3 would reduce the potential adverse effects of incidental takes on other marine mammals compared to status quo. Under status quo, the amount of incidental takes is well below the PBRs and is a very small portion of overall total human caused mortality. Because Alternative 3 would further reduce this mortality, it is not likely to cause adverse population level effects for other marine mammals. **Because Alternative 3 is not likely to result in adverse population level effects from the incidental take of other marine mammals, the impacts of Alternative 3 on the incidental takes of other marine mammals is likely insignificant.**

5.3.3 Harvest of Prey Species

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the groundfish fisheries effects on the harvest of prey species and on the disturbance of habitat for prey species for marine mammals (chapter 8 in NMFS 2007a) and is incorporated by reference. BSAI groundfish fisheries' harvests of marine mammal prey species may limit foraging success through localized depletion, overall reduction in prey biomass, and dispersion of prey, making it more energetically costly for foraging marine mammals to obtain necessary prey. Overall reduction in prey biomass may be caused by removal of prey or disturbance of prey habitat. The timing and location of fisheries relative to foraging patterns of marine mammals and the abundance of prey species may be a more relevant management concern than total prey removals. The Aleutian Islands Atka mackerel and Pacific cod fisheries harvest may impact habitat for the key prey species of Steller sea lions, harbor seals, sperm whales, ribbon seals, northern sea otter, and resident killer whales.

Table 5-7 Aleutian Islands marine mammals dependent on benthic habitat or potentially compete with Atka mackerel or Pacific cod fisheries.

Species	Prey	Benthic dependent	Prey competition
Resident killer whale	fish (including herring, halibut, salmon, and cod)		X
Sperm whale	Mostly squid, some fish, shrimp, sharks, skates, and crab (up to 1,000 m depth)	X	
Ribbon seal	Arctic and saffron cods, pollock, capelin, eelpouts, sculpin and flatfish, crustaceans and celphalopods	X	
Harbor seal	crustaceans, squid, fish, and mollusks	X	
Steller sea lion	pollock, Atka mackerel, Pacific herring, Capelin, Pacific sand lance, Pacific cod, and salmon		X
Northern sea otters	Benthic invertebrates including clams, snail, octopus, urchins, crabs, occasionally fish and seabirds	X	

Sources: Lowry et al. 1982; NMFS 2007a; NMFS 2010; 70 FR 46365, August 9, 2005; http://www.afsc.noaa.gov/nmml/education/cetaceans/sperm.php; and http://www.adfg.state.ak.us/pubs/notebook/marine/orca.php.

Several species listed in Table 5-7 are directly dependent on the benthic habitat for prey even though they do not compete for prey directly with the Atka mackerel and Pacific cod fisheries. For example, harbor seals and sea otters may forage on benthic invertebrates, but generally do not eat Atka mackerel and Pacific cod. Marine mammals may be impacted indirectly by any effects that the nonpelagic trawl gear may have on the benthic habitat where marine mammals are dependent on benthic prey. These species include sperm whale, northern sea otter, ribbon seal, and harbor seal. Species that may directly compete with the Atka mackerel and Pacific cod fisheries include Steller sea lions (for Atka mackerel and Pacific cod) and resident killer whale (for cod). Northern fur seals appear to eat a very minor amount of Atka mackerel (less than 6 percent and averaging 2.9 percent for the 16 rookeries sampled, based on Table 2 in NMFS 2007b), so substantive competition with the Aleutian Islands Atka mackerel fishery is not likely.

Whether the benthic prey dependent species are indirectly affected by nonpelagic trawling will depend on the effects of this type of fishing on the benthos, whether the marine mammal forages on benthic species in the impacted area, and their dependence on the benthic prey in that area. The essential fish habitat EIS provides a description of the effects of nonpelagic trawl fishing on bottom habitat in the Appendix (NMFS 2005), including the effects of the nonpelagic trawl fishery in the Aleutian Islands. Nonpelagic trawl gear is used in contact with the bottom and may impact benthic habitat. The fisheries effects analysis in the essential fish habitat EIS determined that the long-term effects indices for Atka mackerel

and Pacific cod trawl fisheries on shallow biostructure hard substrate was 2.5 percent and 4.2 percent, respectively (Table B.2-10 in NMFS 2005).

Table 5-8 shows the marine mammals that may depend on benthic prey and the known depths of diving. Diving activity may be associated with foraging.

Table 5-8 Listing of benthic dependent marine mammals and location and diving depths.

Species	Depth of diving and location
Ribbon seal	Mostly dive < 150 m on shelf, deeper off shore. Primarily in shelf and slope areas.
Harbor seal	Up to 183 m. Generally coastal.
Sperm whale	Up to 1,000 m, but generally in waters > 600 m.
Northern sea otter	Rocky nearshore < 75 m

Sources: Allen and Angliss 2010; Burns et al. 1981; http://www.adfg.state.ak.us/pubs/notebook/marine/harseal.php; http://www.adfg.state.ak.us/pubs/notebook/marine/rib-seal.php; http://alaska.fws.gov/fisheries/mmm/seaotters/pdf/biologue.pdf; http://www.afsc.noaa.gov/nmml/species/species_ribbon.php.

Atka mackerel and Pacific cod fisheries can be conducted in waters up to 1000 m in depth and are generally in waters within the 1000 m contour around the Aleutian Islands (Figure 5-2, Figure 5-3, and Figure 5-4).

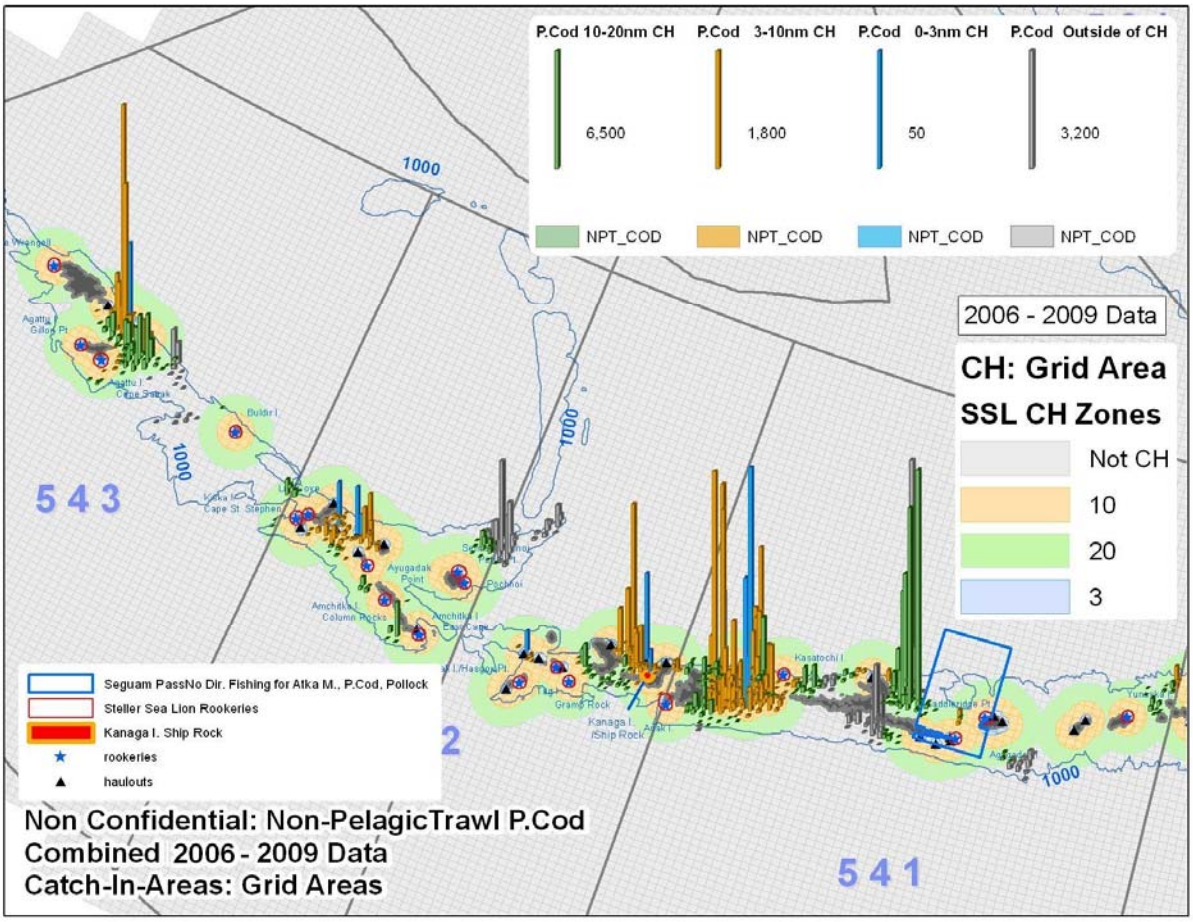

Figure 5-2 **2006–2009 Pacific cod nonpelagic trawl locations in the Aleutian Islands subarea. (Source: Steve Lewis, NMFS Analytical Team, July 2010)**

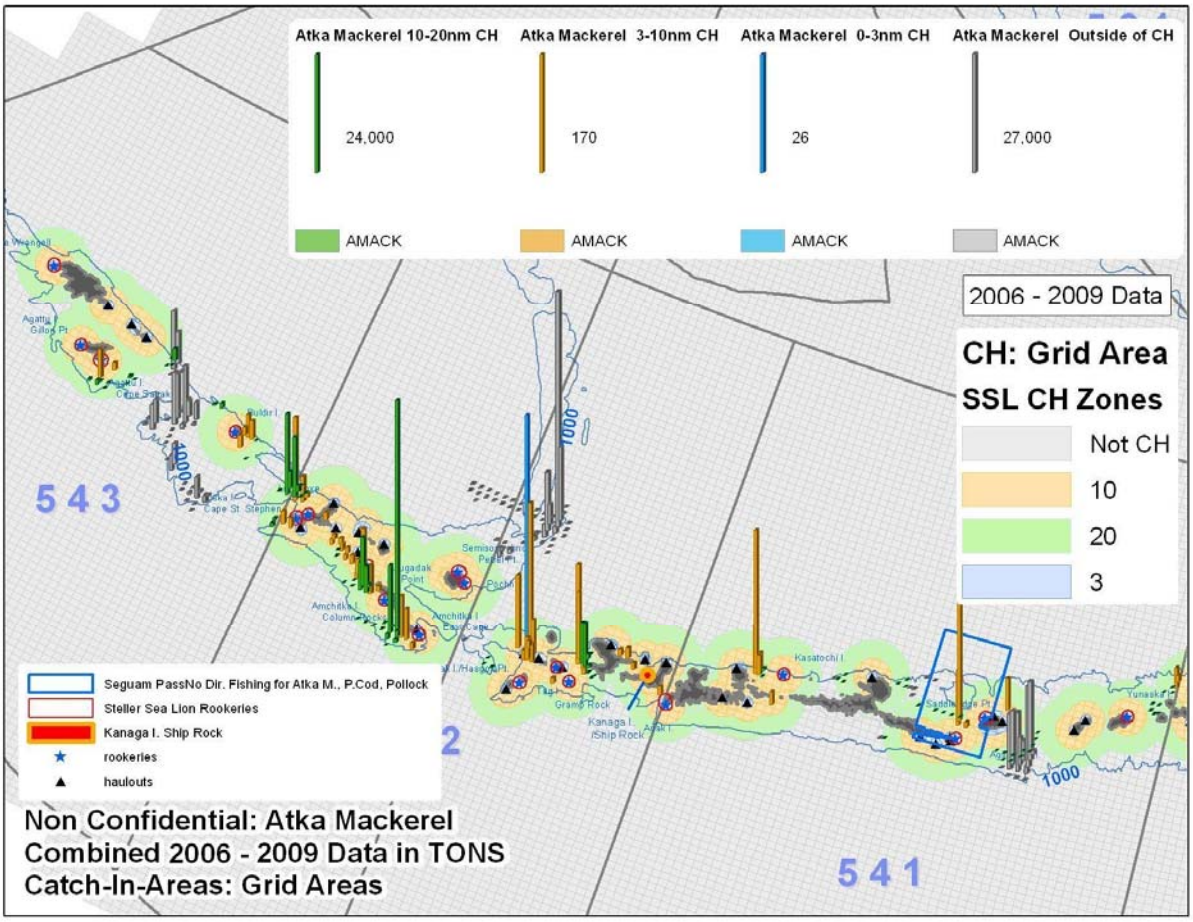

Figure 5-3 **2006–2009 Atka mackerel nonpelagic trawl locations in the Aleutian Islands. (Source: Steve Lewis, NMFS Analytical Team, July 2010)**

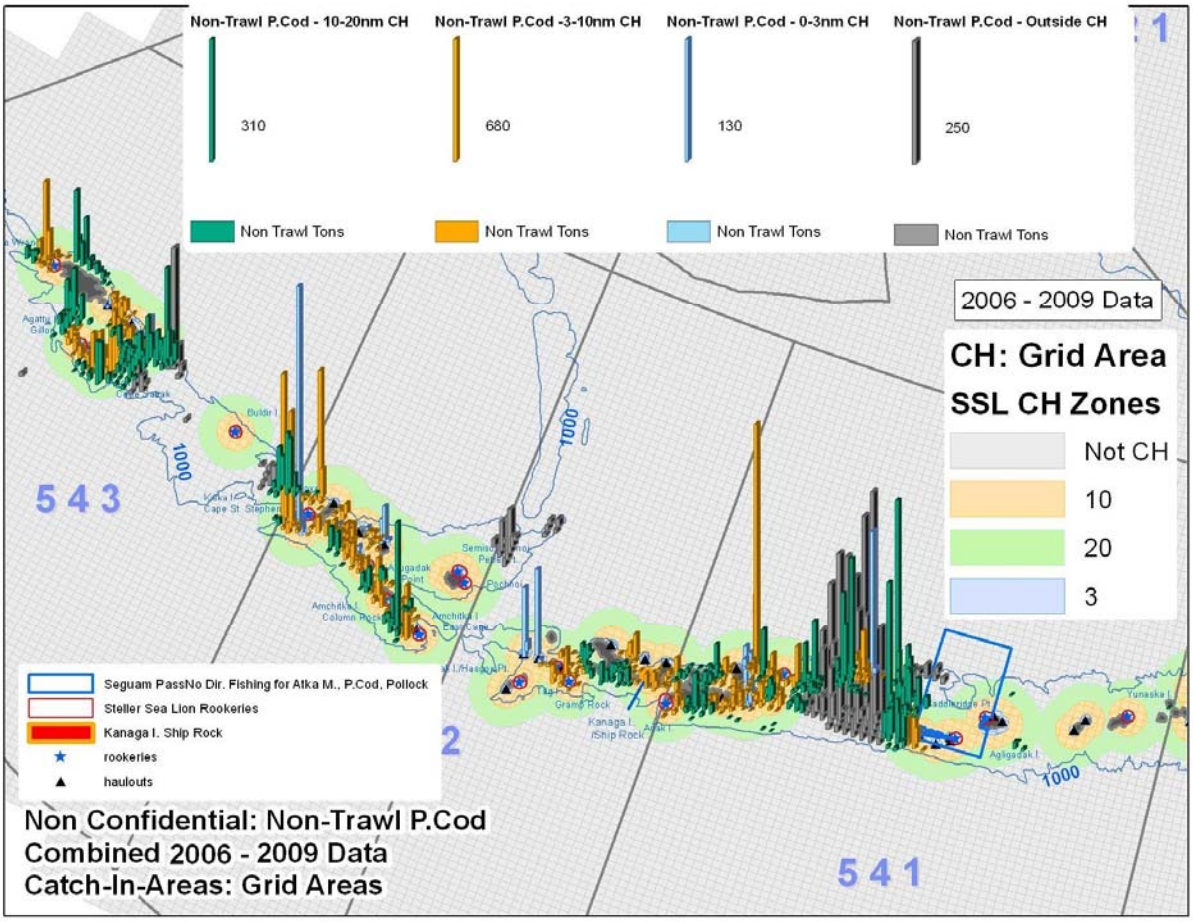

Figure 5-4 Nontrawl Pacific Cod Harvests in the Aleutian Islands 2006-2009 (Source: Steve Lewis, NMFS Analytical Team, July 2010)

Because of the narrow shelf area of the Aleutian Islands, ribbon and harbor seals and sperm whale are likely to have foraging habitat that overlaps with locations for Atka mackerel and Pacific cod trawling.

Sperm whales feed primarily on squid so potential competition with the Atka mackerel and Pacific cod fisheries for prey is not likely. There is potential for competition between sperm whales foraging for prey species and groundfish fisheries in the GOA (hook-and-line sablefish), but this activity has not been observed in the BSAI (NMFS 2010). While the extent of this impact is currently not well understood, there is no evidence that the groundfish fisheries in Alaska compromise sperm whale diet.

Ribbon seals are more likely to experience indirect competition with the Atka mackerel and Pacific cod nonpelagic trawl fisheries because of the overlap of feeding locations, depths, and fishery locations. It is not known what the effects of nonpelagic trawling may be on the benthic habitat supporting prey and the recovery time for the prey species.

Harbor seals and northern sea otters are much more likely to forage in the nearshore waters around islands in the Aleutian Islands and are not as likely to be feeding in areas where nonpelagic trawling occurs due to Steller sea lion and habitat conservation and protection closures. Therefore, these marine mammals are not likely to have benthic prey disturbances occurring from Pacific cod and Atka mackerel nonpelagic trawl fishing.

The catch of groundfish near Kanaga Island/Ship Rock has been very limited from 2006 to 2009 (Figure 5-4; section 10.3). The harvest in this area has been primarily trawl Pacific cod and a small amount of nontrawl Pacific cod and trawl Atka mackerel. Overall groundfish removals have been in very small quantities (average annual harvest in 2003–2009 of 5 mt in the 0–3 nm area) (section 10.3).

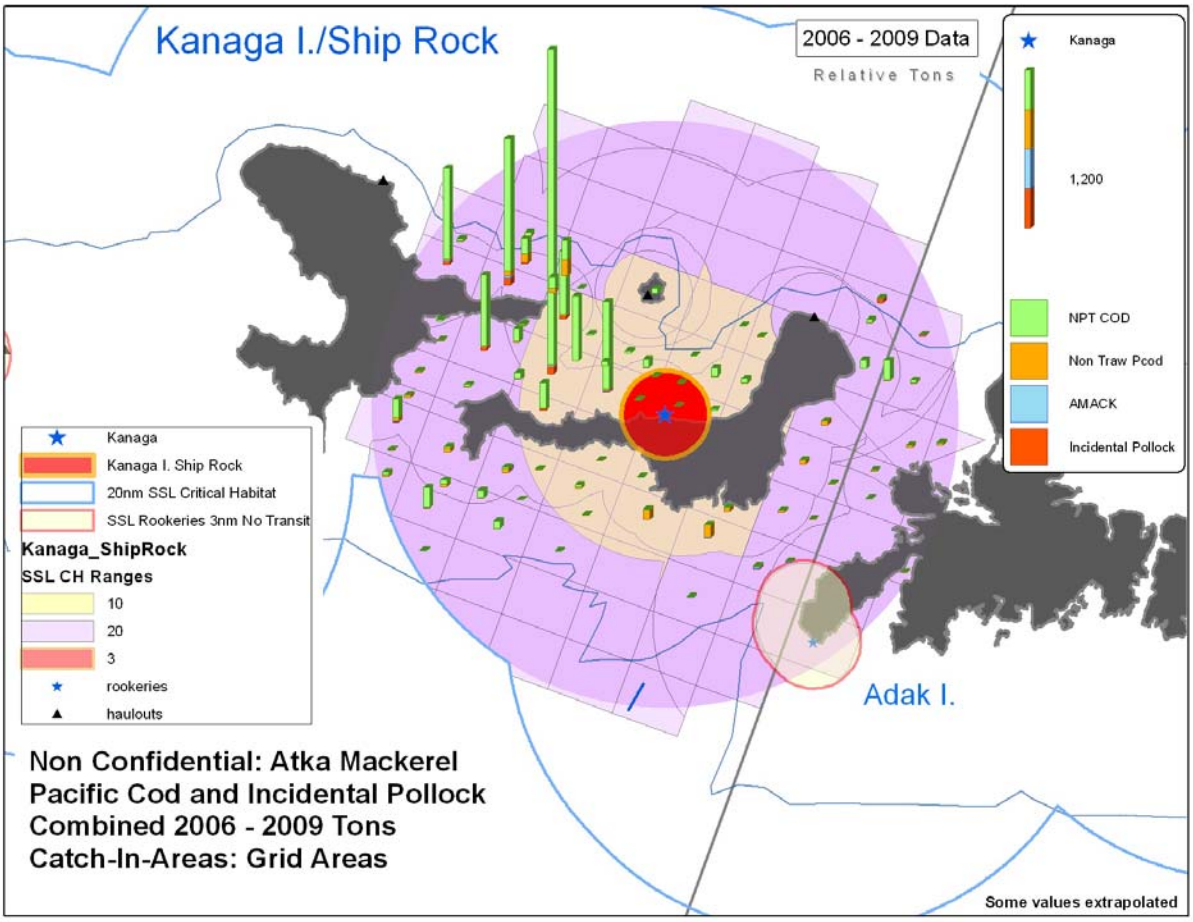

Figure 5-5 Kanaga Island/Ship Rock area groundfish harvest 2006–2009. (Source: Steve Lewis, NMFS Alaska Region, Analytical Team)

Steller Sea Lion Diet

The diet of Steller sea lions in the Aleutian Islands is described in Chapter 3 in NMFS (2010) and is incorporated by reference. Steller sea lion groundfish diet in the Aleutian Islands is primarily Atka mackerel year-round with an average frequency of occurrence in scat samples of 96 percent in the summer and 55 percent in the winter (Table 3.16 in NMFS 2010). Pacific cod and pollock occur in Steller sea lion scat samples less frequently than Atka mackerel. Pacific cod and pollock occur in the scat samples more frequently in the winter than in the summer.

Chapter 7 of the draft FMP biop provides the conclusion for the effects of the current groundfish fisheries on the Steller sea lion population and is incorporated here by reference (NFMS 2010). The potential

response of Steller sea lions to reduced availability of prey in portions of critical habitat left open to fisheries would be chronic nutritional stress (see section 3.1 in NMFS 2010). Reduced prey availability can lead to physiological responses by Steller sea lions that directly (e.g., reduced natality) or indirectly (e.g., increased mortality from predators due to increased foraging) reduce their population growth. A sustained reduction of prey resources across a broad geographic region, or ecosystem, would thus reduce the carrying capacity of Steller sea lions. These impacts have generally been referred to as nutritional stress (see section 3.1.15 in NMFS 2010).

The draft FMP biop concludes that, while fisheries cannot be unequivocally shown to be a causative factor in continued Steller sea lion declines in the western portion of the WDPS of Steller sea lions in Alaska, analysis of available data indicates that these adverse relationships may exist in the western Aleutian Islands and portions of the central Aleutian Islands sub-region where Atka mackerel and Pacific cod fisheries target important Steller sea lion prey, and where biomass levels of these prey species are low relative to other sub-regions in the range of the WDPS. This competition may compromise the availability of food resources of Steller sea lions sufficiently to jeopardize their continued existence or to adversely modify their critical habitat. Fishery removals of prey in the western and central Aleutian Islands sub-region may be adversely affecting the WDPS Steller sea lions in these areas sufficient to stress animals through longer and less successful foraging trips, and foraging trips that require more repetitive dives to acquire prey (NMFS 2010). The possibility that this interaction may be the primary cause of the observed declines in natality rates cannot be eliminated**. It is likely that the Atka mackerel and Pacific cod fisheries effects on prey resources for Steller sea lions under Alternative 1 result in a population level adverse effect (**Table 5-4**) and therefore Alternative 1 effects on prey availability would be significantly adverse for Steller sea lions. Prey availability effects under Alternative 1 for other marine mammals are not likely to cause population level effects and are therefore insignificant.**

5.3.3.1 Prey Availability Effects on Steller Sea lions

5.3.3.1.1 Prey Availability Effects on Steller Sea Lions under Alternative 2

Alternative 2 would eliminate nearly all of the Atka mackerel and Pacific cod removals in Areas 543 and 542. This would provide protection to these prey resources for Steller sea lions foraging throughout these statistical areas. By prohibiting retention of Atka mackerel in Area 543, the Atka mackerel biomass is projected to increase 48 percent in 11 years (Ianelli et al. 2010). Prohibiting Pacific cod retention is expected to result in doubling Pacific cod biomass in Area 543 in 11 years (Ianelli et al. 2010). Increases in Pacific cod and Atka mackerel biomass in Area 542 are likely greater than those expected under Alternative 3 because of the limited directed fishing allowed in Area 542 for Atka mackerel and Pacific cod under Alternative 3.

The Amendment 80 fleet would be restricted from Atka mackerel and Pacific cod retention in Areas 542 and 543 and is likely to shift fishing effort into Area 541. The Atka mackerel total allowable catch (TAC) for Area 541/BS would limit the overall harvest in Area 541, and the fleet has harvested approximately 90 percent of this amount in the past (section 10.3). A portion of the Atka mackerel TAC that had been harvested in the past is expected to not be harvested, potentially leaving more Atka mackerel biomass in the Aleutian Islands subarea, which may improve available foraging biomass. Because of the TAC limit in Area 541 and the critical habitat closure to the Atka mackerel fishery, it is not likely that the shift in harvest would have much impact on the foraging availability for Steller sea lions. The animals most likely to be affected would be those foraging outside of critical habitat. Considering the very small amount of Atka mackerel removed in relation to the foraging biomass in Area 541 (Table IV-12 in NMFS 2010), the small amount of additional harvest up to the TAC is not likely to have a population level effect on Steller sea lions.

The Amendment 80 vessels may switch target species from Pacific cod and Atka mackerel to flatfish (yellowfin sole and rock sole), arrowtooth flounder, or Greenland turbot in the BSAI fisheries (section 10.3). It is not likely this would have any effect on marine mammals dependent on flatfish species because of the small amount of harvest of these species in relation to the acceptable biological catch (ABC) and TAC, and because of the available halibut mortality limits the fishery. Portions of the Bering Sea also have habitat conservation areas closed to nonpelagic trawling, especially in areas where marine mammals may be dependent on benthic habitat. The fleet may also more fully harvest Pacific ocean perch, but this species is not known to be a principal prey species of marine mammals.

Nontrawl gear vessels targeting Pacific cod may be able to offset some of the restricted harvest in Areas 542 and 543 in the Bering Sea or Area 541 (section 10.3). It is possible that not all of the harvesting that was done in Areas 542 and 543 could be made up in Areas 541 outside of critical habitat and in the Bering Sea. Any unharvested Pacific cod may provide for additional biomass that could be available for foraging marine mammals, including Steller sea lions and resident killer whales. The shifting of Pacific cod harvests from Areas 542 and 543, and leaving some Pacific cod unharvested, would remove some of the potential adverse effects of the Pacific cod and Atka mackerel fisheries on marine mammals in Areas 542 and 543 and is not likely to substantially increase adverse effects to where the fisheries shift. Because of the current protection measures and limits on fishing (TACs, ABC, halibut mortality) it is not likely that the increased fishing for Pacific cod in the Bering Sea or in Area 541 would result in population level effects on marine mammals.

The extension of the Atka mackerel season dates in Area 541 would allow for more temporal dispersion of Atka mackerel harvest compared to Alternative 1. The spreading of Atka mackerel harvest over time would reduce the potential to impact the Atka mackerel prey field for Steller sea lions that may forage outside of critical habitat. If Atka mackerel outside of critical habitat also moved inside critical habitat, the dispersed fishing outside of critical habitat also may protect prey resources inside critical habitat.

Closing the nontrawl Pacific cod fishery from November 1 through December 31 in Area 541 would remove the harvesting impact on Pacific cod resources during this time period. This may provide more foraging for Steller sea lions during these winter months.

Little harvest occurs at Kanaga Island/Ship Rock (Figure 5-4; section 10.3) so the groundfish fishing closure here to federally permitted vessels is not likely to make a substantial difference in the amount of groundfish available to foraging Steller sea lions. Closing waters within 3 nm to groundfish fishing would protect the prey field for any marine mammals that may use these waters and prey on groundfish or use benthic habitat that may support prey species that would otherwise be potentially impacted by nonpelagic trawling. These species may include northern sea otters, harbor seals, Steller sea lions, and ribbon seals. This closure is likely to remove potential adverse effects of the groundfish fisheries on Steller sea lions and on other groundfish or benthic habitat dependent marine mammals in this area.

Overall, the closures and fishery restrictions under Alternative 2 mitigate the potential adverse effects of the Atka mackerel and Pacific cod fisheries on prey availability. The restrictions and closures are as stringent as the RPA specified in the draft FMP biop (NMFS 2010) and, therefore, remove the potential population level effect on Steller sea lions that may be a result of the groundfish fisheries. The effects of Alternative 2 are not likely to cause adverse population level effects as described in the significance criteria (Table 5-4). **Because the effects of the fisheries on prey availability for Steller sea lions are not likely to result in adverse population level effects, Alternative 2 would have insignificant impacts on prey availability.**

5.3.3.1.2 Prey Availability Effects on Steller Sea Lions under Alternative 3

The impacts of Alternative 3 on Steller sea lion prey is explained in detail in NMFS (2010) and is incorporated by reference. Alternative 3 would have the same effects on prey resources in Area 543 and at Kanaga Island/Ship Rock as Alternative 2. Prey resources for Steller sea lions would be protected by prohibiting Atka mackerel and Pacific cod retention in Area 543 and by closing directed groundfish fishing within 3 nm of Kanaga Island/Ship Rock.

In Area 542, Atka mackerel and Pacific cod prey resources would be protected in critical habitat by closing the directed fisheries for these species, except for nontrawl Pacific cod, within the 10–20 nm area during June 10 through November 1. Steller sea lions are not as dependent on Pacific cod during the June through September time period of the year (NMFS 2010) so opening this 10–20 nm zone to nontrawl fishing is not expected to have a substantial impact on the foraging capabilities of animals in this area. The Pacific cod restrictions under Alternative 3 in Area 542 are expected to result in an increase in Pacific cod biomass in this area of 59 percent in 11 years after the implementation of these measures (Ianelli et al. 2010).

The proposed closure of critical habitat in Area 542 to Atka mackerel directed fishing would protect Atka mackerel prey resources within the critical habitat area. The reduction of the Atka mackerel Area 542 TAC would reduce the overall amount of Atka mackerel taken from Area 542, leaving more prey available, especially for those animals that may forage inside and outside critical habitat. The combination of the critical habitat closure and the TAC reduction is likely to provide more prey resources in Area 542 for Steller sea lions than Alternative 1 but less prey than under Alternative 2.

The directed fishery for Pacific cod inside 10 nm of critical habitat in Area 541 would protect the Pacific cod prey resources for Steller sea lions foraging in this area. The limitations on trawl and nontrawl fishing in the 10–20 nm area of critical habitat during the first and second halves of the year would prevent increased effort in this area and ensure prey resources would not be impacted with the movement of the fleet that might occur with the fishery closures under the RPA.

Under Alternative 3, the potential movement of the Atka mackerel and Pacific cod fleets out of Area 543 and to areas in 542 and the Bering Sea is described in section 10.3 of this EA/RIR. The impacts on the potential shifting of harvests described under Alternative 2 are expected to be similar under Alternative 3. Less forgone harvest of Pacific cod and Atka mackerel are expected under Alternative 3 compared to Alternative 2 because more fishing is allowed in Areas 542 and 541 under Alternative 3.

Closing the nontrawl Pacific cod fishery from November 1 through December 31 in Areas 542 and 541 would remove the harvesting impact on Pacific cod resources during this time period. This may provide more foraging for Steller sea lions during these winter months.

The limit on the Atka mackerel TAC in Area 542 will ensure fishing shifted out of Area 543 would not be concentrated into Area 542 and would prevent additional harvest of Atka mackerel outside of critical habitat beyond historical harvests. This limit on harvest should preserve the prey availability for Steller sea lions outside of critical habitat.

Overall, the closures, gear restrictions and seasons established under Alternative 3 reduce the potential for the groundfish fisheries, especially Atka mackerel and Pacific cod fisheries, from impacting Steller sea lion prey availability. **Because Alternative 3 would remove the potential reduction in prey resources that are likely to cause a population level effect in Steller sea lions (NMFS 2010) and because the effects of fisheries generally are not beneficial to marine mammals, the effects of Alternative 3 on prey availability are insignificant for Steller sea lions.**

5.3.3.2 Prey Availability Effects on Other Marine Mammals

5.3.3.2.1 Prey Availability Effects on Other Marine Mammals under Alternative 2

The potential for prey competition with resident killer whales is likely to be reduced in Areas 542 and 543 with the restriction on retention of Pacific cod (Table 5-7) and with the groundfish closure around Kanaga Island/Ship Rock for resident killer whales that may occur in this area. As discussed in section 10.3 of this EA/RIR, some of the harvests not occurring in the Aleutian Islands for Atka mackerel and Pacific cod may be shifted into Area 541 and the Bering Sea or shifted to other target species. It is not likely that shifting of these harvests would have a population level effect on resident killer whales by reducing food availability in Area 541 or in the Bering Sea. It also is possible that a shift of fishing effort into Area 541 may provide opportunity for resident killer whales in this area to have more access to fish on hook-and-line gear, reducing the potential adverse effect on prey availability. A number of factors limit the ability of the fleets to shift harvest, including TAC limits and halibut mortality (more so for Atka mackerel than for Pacific cod). **By removing this potentially adverse effect of fishing in Areas 542 and 543 and around Kanaga Island/Ship Rock and the limited increase in harvests of Pacific cod in Area 541 and the Bering Sea or shifting to other groundfish targets, it is likely that the impact of the Aleutian Islands Pacific cod or Atka mackerel fisheries on prey availability for resident killer whales under Alternative 2 is insignificant.**

Marine mammals dependent on benthic habitat may be impacted by the shift of fishing by nonpelagic trawl gear out of Areas 543 and 542 and into the Area 541 and the Bering Sea (Table 5-8). Harbor seals ribbon seals, and northern sea otters that may forage in waters that are currently trawled in Areas 543 and 542 for Atka mackerel and Pacific cod potentially would have less benthic habitat impact under Alternative 2 than under Alternative 1. Benthic foragers in areas where fishing is shifted into, as described in section 10.3 of this EA/RIR, potentially would experience more benthic habitat effects than under Alternative 1. It is likely that Alternative 2 would reduce the potential adverse effect on benthic habitat supporting prey for marine mammals in Areas 543 and 542 and in critical habitat in Area 541. Additional adverse effects on benthic habitat where fishing has shifted are likely reduced by the current Steller sea lion protection measure closures and by the limits on the fisheries (halibut mortality, TACs). **Alternative 2 overall is not likely to have an adverse effect on marine mammals dependent on benthic prey and therefore is likely to have an insignificant effect on prey availability for other marine mammals.**

5.3.3.2.2 Prey Availability Effects on Other Marine Mammals under Alternatives 3

The effects described under Alternative 2 for prey availability for other marine mammals in Area 543 and at Kanaga Island/Ship Rock is the same under Alternative 3. Killer whales that may forage in Steller sea lion critical habitat from 10 nm to 20 nm in Areas 542 and 541 may encounter prey competition with the Pacific cod fishery. This fishery is limited by season dependent on gear type, which is likely to limit the potential prey competition.

More nonpelagic trawling is allowed in Areas 542 and 541under Alternative 3 compared to Alternative 2. This may allow for more potential impact on benthic habitat that supports prey species important to ribbon seals and sperm whales. Harbor seals and northern sea otters are more dependent on the nearshore areas, which are closed to nonpelagic trawling under both alternatives (0–10 nm critical habitat zones).

Less shifting of fishing effort for Atka mackerel and Pacific cod is likely to occur under Alternative 3 compared to Alternative 2 as more fishing is allowed in the Aleutian Islands under Alternative 3 compared to Alternative 2. Because shifting of fishing is less likely under Alternative 3, less competition

for prey resources between the fisheries and other marine mammals in the Bering Sea and Area 541 is likely to occur under Alternative 3 compared to Alternative 2.

The reduction in the Atka mackerel TAC in Area 542 is not likely to affect other marine mammals as Steller sea lions are the only marine mammals identified to be primarily dependent on Atka mackerel in the Aleutian Islands (Table 5-7).

Overall, the prey availability in the Aleutian Islands for other marine mammals is less under Alternative 3 than under Alternative 2 because more Atka mackerel and Pacific cod fishing is allowed in the Aleutian Islands under Alternative 3. The fishing would be done within the harvest specifications issued each year, and the groundfish fisheries as a whole have not been identified to have a significant impact on other marine mammals (NMFS 2006b). Alternative 3 would not change the overall gear types used, amounts of fishing or locations in a manner that would cause adverse population level effects for other marine mammals. **Because Alternative 3 would not cause adverse population level effects on other marine mammal prey availability, the impacts of Alternative 3 on other marine mammal prey availability is likely insignificant.**

5.3.4 Disturbance

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the disturbance of marine mammals by the groundfish fisheries (chapter 8 in NMFS 2007a) and is incorporated by reference. The disturbance of marine mammals would depend on the timing and location of a fishery in relation to the occurrence of the marine mammals. The Alaska Groundfish Harvest Specifications EIS analyzed the potential disturbance of marine mammals by the groundfish fisheries (Section 8.3.3 of NMFS 2007a) and is incorporated by reference. The EIS concluded that the status quo fishery does not cause disturbance to marine mammals that may cause population level effects. Current fishery closures exist to limit the potential interaction between the fishing vessels and marine mammals (e.g. 3-nm no groundfish fishing areas around Steller sea lion rookeries). There is no indication in the draft FMP biop that fishing vessel disturbance is likely to result in population level effects on Steller sea lions (NMFS 2010).

Alternative 1 would maintain the current closures to Atka mackerel and Pacific cod fishing in the Aleutian Islands under the Steller sea lion protection measures (Figures 2-1 through 2-5; 50 CFR 679.22). The new rookery at Kanaga Island/Ship Rock does not have a 3-nm no groundfish fishing closure so federally permitted groundfish fishing vessels operating in this area may disturb Steller sea lions using this rookery (Figure 2-8). Because of the historical occurrence of small amounts of fishing in this area (Figure 5-4; section 10.3) and the increased use of this area by Steller sea lions in the presence of fishing at its current levels, it is not likely that the level of disturbance at Kanaga Island/Ship Rock would cause a population decline.

In Table RCA 1999–2008 Summary in the draft FMP biop, the number of non-pup Steller sea lions in Area 543 is much less than the number of non-pups occurring in Areas 542 and 541 (NMFS 2010). In 2008, only 895 non-pups were counted in Area 543 compared to 2,668 in Area 542 and 2,996 non-pups in Area 541. Fewer animals present in the statistical area are likely to result in fewer animals disturbed by fishing activities when the three areas are compared, assuming all other aspects of the three areas (e.g., location of fishing in relation to the location of animals) are equal.

Foraging locations for Steller sea lions in the Area 543 are likely to occur farther offshore for juvenile animals than in Areas 542 and 541 (section 3.1.6.3 in NMFS 2010). Vessels fishing inside and outside of critical habitat in Area 543 may be more likely to encounter foraging Steller sea lions compared to fishing activities in Areas 542 and 541 where Steller sea lions appear to use locations inside critical habitat more frequently for foraging.

Humpback whales may be disturbed by noise from fishing vessel engines (NMFS 2010). Typical measures of a whale's reaction to the presence of a vessel have been visible changes in behavior, and whales may leave the action area if sufficiently disturbed. However, the effect of such displacement on individual humpback whales, if it were to occur, would not compromise the recovery or survival of the species.

Any impact to sperm whales due to disturbance by vessels is uncertain (NMFS 2010). Given that many individual sperm whales are attracted to the sound of groundfish vessel engines and gear hauling catch, it would appear that they often do not interpret such noise as disturbance. Additionally, as depredation behavior in Alaska is only known to involve male sperm whales, it is unlikely vessel disturbance would present a concern for the species.

Because the disturbance of marine mammals by fishing vessels is not expected to result in population level effects for any marine mammal species, the disturbance of marine mammals by groundfish fishing vessels in the Aleutian Islands is likely insignificant.

5.3.4.1 Disturbance Effects on Steller Sea lions

5.3.4.1.1 Disturbance Effects on Steller Sea Lions under Alternative 2

Alternative 2 reduces the potential for disturbance of Steller sea lions by vessels directly fishing for Atka mackerel and Pacific cod in Areas 542 and 543 compared to status quo. By prohibiting retention, it is also less likely that vessels fishing for other groundfish species would encounter Steller sea lions foraging when the vessel targeting other groundfish species may be harvesting Pacific cod or Atka mackerel up to the maximum retainable amount. Disturbance is also reduced in Area 541 in critical habitat by prohibiting directed fishing for Atka mackerel and Pacific cod compared to Alternative 1.

Shifting of Atka mackerel and Pacific cod fishing into Area 541 and the Bering Sea is not likely to result in additional disturbance for Steller sea lions because of the directed fishing closures for Atka mackerel and Pacific cod that are already in place in critical habitat. If an Atka mackerel vessel was to target a flatfish species, this fishery could be conducted in Steller sea lion critical habitat, which may lead to more potential for disturbance of Steller sea lions under Alternative 2 compared to Alternative 1.

Shortening the fishing season for Pacific cod nontrawl fisheries under Alternative 2 would reduce the potential for disturbance by these vessels during the November through December time period compared to Alternative 1. Lengthening the Atka mackerel fishery season under Alternative 2 would lengthen the time that fishing vessels may be present, but the number of vessels present at a time is likely reduced as fishing is temporally dispersed. The overall amount of disturbance from lengthening the season is likely to be the same as that under Alternative 1.

Steller sea lions using Kanaga Island/Ship Rock rookery would have less potential for disturbance with the 3-nm no groundfish fishing closure around the area compared to Alternative 1. Removing potential disturbance by fishing vessels may be especially important during the reproductive season when females need to forage close to shore and when juveniles are learning to forage and need the near shore waters.

Alternative 2 overall is expected to reduce the potential for Steller sea lion disturbance in the Aleutian Islands subarea and is not expected to result in increased disturbance of Steller sea lions in the Bering Sea from the nontrawl Pacific cod fishery due to the low number of animals relative to the location of fishing activities. **Because the overall level of disturbance is expected to be less than that under Alternative 1, Alternative 2 is not likely to result in disturbance of Steller sea lions that would result in**

population level effects. For this reason, Alternative 2 disturbance on Steller sea lions is likely insignificant.

5.3.4.1.2 Disturbance Effects on Steller Sea Lions under Alternative 3

Disturbance effects from Alternative 3 in Area 543 and at Kanaga Island/Ship Rock rookery are the same as under Alternative 2. By prohibiting retention of Pacific cod and Atka mackerel in Area 543, the potential for disturbance of Steller sea lions in this area from fishing vessels is greatly reduced compared to the status quo and is the same as under Alternative 2. Not as much shifting of Pacific cod nontrawl fishing effort into the Bering Sea is expected under Alternative 3 compared to Alternative 2 so that animals in the Bering Sea would experience less potential for disturbance by nontrawl vessels than animals in Areas 542 and 541 under Alternative 3 compared to Alternative 2 and status quo.

In Area 542, Steller sea lions are more likely to encounter nontrawl Pacific cod fishing vessels in critical habitat outside of 10 nm and encounter Atka mackerel and trawl and nontrawl Pacific cod fishing vessels outside of critical habitat than under Alternative 2. In Area 541, Steller sea lions are more likely to be disturbed by trawl and nontrawl Pacific cod fishing vessels in the 10–20 nm area of critical habitat compared to Alternative 2.

Alternative 3 overall is expected to reduce the potential for Steller sea lion disturbance in the Aleutian Islands subarea and is not expected to result in increased disturbance of Steller sea lions in the Bering Sea from the nontrawl Pacific cod fishery due to the low number of animals relative to the location of fishing activities. **Because the overall level of disturbance is expected to be less than that under Alternative 1, Alternative 3 is not likely to result in disturbance of Steller sea lions that would result in population level effects. For this reason, Alternative 3 disturbance on Steller sea lions is likely insignificant.**

5.3.4.2 Disturbance Effects on Other Marine Mammals

5.3.4.2.1 Disturbance Effects on Other Marine Mammals Under Alternative 2

Alternative 2 would remove the potential for disturbance of other marine mammals in Areas 542 and 543 by prohibiting retention of Atka mackerel and Pacific cod in these areas. Fewer vessels would be fishing in these areas and therefore fewer encounters with marine mammals are likely under Alternative 2 compared to Alternative 1. In Area 541, the directed fishing closure in critical habitat for Atka mackerel and Pacific cod would prevent disturbance of marine mammals foraging in this area by these vessels. Marine mammals in this area may be harbor porpoise, harbor seals, northern sea otters, humpback whales, and killer whales.

Shifting the Atka mackerel and Pacific cod fisheries to the east as described in section 10.3 of this EA/RIR is likely to result in more potential disturbance for other marine mammals in Area 541 and in the Bering Sea. The amount of time fishing and number of vessels may increase, resulting in an increase in the amount of encounters that these vessels have with other marine mammals. This may be more likely with the Pacific cod fleet which is not as constrained by TAC (BSAI-wide) as the Atka mackerel fleet (area-specific TAC).

The closing of the nontrawl Pacific cod fishery on November 1 would remove the potential for disturbance of marine mammals by these vessels at that time. Extending the Atka mackerel season would allow for a longer time period of vessels being present in the Aleutian Islands and Bering Sea but the harvest is likely to be spread out so that fewer vessels would be fishing at any one time. The overall

potential for disturbance of other marine mammals by Atka mackerel vessels with the longer season is likely the same as under Alternative 1.

The 0–3 nm groundfish closure around Kanaga Island/Ship Rock rookery would prevent disturbance of marine mammals that may occur in this area at the same time groundfish fishing would occur. Animals most likely protected from disturbance in these nearshore waters include northern sea otters, harbor porpoise, humpback whales, and harbor seals.

None of the disturbance effects on other marine mammals under Alternative 2 are expected to result in population level effects on marine mammals. Disturbance effects are likely to be localized and limited to a small portion of any particular marine mammal population**. Because the disturbance under Alternative 2 is not likely to result in population level effects, the impacts of Alternative 2 on the disturbance of other marine mammals is likely insignificant.**

5.3.4.2.2 Disturbance Effects on Other Marine Mammals under Alternative 3

The disturbance effects under Alternative 2 for Kanaga Island/Ship Rock rookery, the Pacific cod nontrawl season, and for Area 543 are the same under Alternative 3.

Under Alternative 3, Area 542 allows for directed fishing for Pacific cod within the 10–20 nm zone of critical habitat and outside of critical habitat. Other marine mammals that may use this area may encounter more vessels under Alternative 3 than under Alternative 2 so the potential for disturbance is greater under Alternative 3 than Alternative 2. In Area 541, Alternative 3 allows for Pacific cod directed fishing inside critical habitat which is more likely to cause disturbance to marine mammals in this area than under Alternative 2. Marine mammals in this area may be harbor porpoise, harbor seals, northern sea otters, humpback whales, and killer whales.

The shifting of fishing effort described in section 10.3 of this EA/RIR is not as great under Alternative 3 as under Alternative 2, so other marine mammals in the Bering Sea are less likely to have increased encounters with fishing vessels under Alternative 3 compared to Alternative 2.

Overall the disturbance of other marine mammals under Alternative 3 would be localized and limited to those species that may occur in the same area and time as fishing vessels. As with Alternative 2, the gear types used, location, number of vessels, seasons, and amounts of fishing are not expected to change in a way that would result in disturbance of other marine mammals to the level of causing an adverse population level effect. **Because the disturbance under Alternative 3 is not likely to result in population level effects, the impacts of Alternative 3 on the disturbance of other marine mammals is likely insignificant.**

5.3.5 Cumulative Effects

A discussion of the cumulative effects of the groundfish fisheries is in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a). The past and current cumulative effects are discussed in the Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (NMFS 2004). Both of these discussions are incorporated by reference.

For marine mammals, several future actions were identified as reasonably foreseeable future effects. The discussions for each of these actions are in section 8.4 of NMFS (2007a). The reasonably foreseeable future actions that may impact marine mammals are—

- ecosystem-sensitive management;
- fisheries rationalization;
- traditional management tools;
- actions by other state, federal, and international agencies; and
- private actions.

The Alaska Groundfish Harvest Specifications EIS concluded that continuing fishing activity and continuing subsistence harvest are potentially the most important sources of additional annual adverse impacts on marine mammals (NMFS 2007a). Both of these activities are monitored and are not expected to increase beyond the PBRs for most marine mammals. The extent of the fishery impacts would depend on the size of the fisheries, the protection measures in place, and the level of interactions between the fisheries and marine mammals. However, a number of factors will tend to reduce the impacts of fishing activity on marine mammals in the future. These include the trend towards ecosystem management and fisheries rationalization. Ecosystem-sensitive management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of marine mammal populations. Fisheries rationalization may lead to reduced interactions to the extent that fewer operations remain in a fishery, and the remaining operations are better able to comply with protection measures. The effects of actions of other federal, state, and international agencies are likely to be less important when compared to the direct interaction of the commercial fisheries, subsistence harvests, and marine mammals.

The draft FMP biop reviews the future cumulative effects of nonfederal actions on Steller sea lions (section 6 in NMFS 2010) and is incorporated by reference. The FMP biop uses the 2008 Steller sea lion recovery plan (NMFS 2008) for the potential future threats discussion for Steller sea lions. For the WDPS, the recovery plan threats assessment concluded that the following threats currently pose a relatively minor threat to recovery: (1) Alaska Native subsistence harvest, (2) illegal shooting, (3) entanglement in marine debris, (4) disease, and (5) disturbance from vessel traffic and scientific research. Many factors that have affected Steller sea lions within the action area in the past are likely to continue to affect them in the future (e.g., pollution, disease, predation, competition for prey). However, some factors thought to have contributed to the decline of Steller sea lions have been mitigated so that the level of effects is substantially reduced (e.g., intentional, non-subsistence-related shooting) or eliminated in some cases (e.g., commercial harvests). Given available information, the current level, not the historic level, of effect is that which is anticipated in the foreseeable future.

State-Managed Fisheries

On March 15, 2006, the Alaska Board of Fisheries approved the opening of a new State of Alaska (State) waters Pacific cod fishery in the Aleutian Islands west of 170°W for pot, jig, longline, and non-pelagic trawl gears. This State-managed fishery opens after the parallel trawl catcher vessel fishery closes. The 2008 guideline harvest level (GHL) was 5,280 mt, or 3 percent of the BSAI ABC. The fishery is temporally regulated so that no more than 70 percent of the GHL can be harvested before June 10; however, most of this is taken in March. The remainder of the GHL can be harvested starting June 10. Twenty-six vessels registered for the fishery, including trawlers, pot vessels, and freezer longliners. Two floating processors and two shore-based processors participated. Observer coverage and vessel monitoring systems (VMSs) are not required in this State-waters fishery, but six vessels chose to carry a federal observer, and 23 planned to activate VMSs during the fishery. Steller sea lion rookery closures are enforced.

Sablefish, rockfish, and lingcod are not important in the diet of Steller sea lions, but fisheries for these species could cause indirect impacts to Steller sea lion foraging behavior through disturbance (NMFS

2010). No specific measures to protect Steller sea lions are included in the State management plans for these species. Sablefish landings occurred inside Steller sea lion critical habitat in Prince William Sound, lower Cook Inlet, and the Aleutian islands in 2008. Landings occurred in March through May and August in Prince William Sound, in July in Cook Inlet, and primarily May to August in the western Aleutian Islands. Most rockfish harvest occurred around Kodiak, but harvest occurred inside Steller sea lion critical habitat in Prince William Sound, Cook Inlet, Kodiak, Chignik, South Alaska Peninsula, and the Aleutian islands primarily from March through August.

Soboleff (2005) evaluated State fisheries relative to Steller sea lion trends throughout the range of the WDPS. This study determined that, within 50 nm of rookeries, Steller sea lion counts were both negatively and positively correlated with certain State fisheries, but few were significant and some probably spurious. Soboleff (2005) found a negative correlation between State salmon fisheries and the Steller sea lion decline across all regions for all years, which disappeared at a regional scale, and he felt this could be plausible as salmon fisheries occur near Steller sea lion haulouts and rookeries and salmon are important Steller sea lion prey. The study concluded that among other factors, the concentration of State fisheries outside areas where Steller sea lion declines have been most severe may be a factor that indicates a low likelihood of State-managed fisheries adversely affecting Steller sea lions.

Under Alternatives 2 and 3, there would be restrictions on Pacific cod harvest by federally permitted vessels in critical habitat in Areas 543, 542, and 541. There is a potential that the State may provide for more Pacific cod pot fishing within the State waters under a State-managed fisheries. Any potential increase in the State-managed Pacific cod harvest would be considered through the State Board of Fisheries process and would likely consider the potential impacts on Steller sea lions and the federal groundfish fisheries. If there were to be increase Pacific cod pot fishing inside the 0–3 nm area of Aleutian Islands critical habitat, there would be an increased potential for incidental takes of northern sea otter and humpback whales. Over 100 humpback whale entanglement incidents have been reported to the NMFS Alaska stranding program over the last 30 years, many involving pot gear and/or gill net gear from fisheries in inside waters in southeast Alaska, and areas around Kodiak, Homer, and Seward. For many of these incidents, when disentanglement is not possible or the animal is not re-sighted, the ultimate fate of the animal remains unknown. State-managed fisheries represent an additional source of anthropogenic impact, beyond those posed by the proposed action, through entanglements to the Central North Pacific and Western North Pacific populations of humpback whales. **The amount of fishing and the rarity of the entanglement and incidental take in the Aleutian Islands are not likely to result in population level effects for northern sea otters, harbor seals, and humpback whales that may occur in these near shore waters.**

State-managed salmon, invertebrate, and herring fisheries also occur at the same time and locations where Steller sea lions forage, resulting in the potential for incidental takes, disturbance, or competition for prey species. These fisheries occur in the EDPS of Steller sea lions, were the population is increasing. **Considering the amount of incidental takes (Table 5-6) and the location of these fisheries in relation to where Steller sea lion counts are doing fairly well (locations other than Area 543), it is likely that these fisheries in combination with direct and indirect effects of the Atka mackerel and Pacific cod fisheries in the Aleutian Islands would have an insignificant effect on disturbance, incidental takes, and competition for prey under Alternatives 2 and 3.**

In summary, none of the reasonably foreseeable future actions identified in the FMP biop (NMFS 2010) or in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a) in combination with the direct and indirect impacts of this action are expected to result in population level adverse effects on marine mammals.

5.3.6 Summary of Effects

Table 5-9 summarizes the alternatives and their effects on Steller sea lions and other marine mammals. These results are based on the review of the potential direct and indirect effects of the alternatives and cumulative effects on Steller sea lions and other marine mammals. Except for Alternative 1 effects on prey availability for Steller sea lions, all of the potential effects on marine mammals from the alternatives are insignificant.

Table 5-9 Summary of alternatives and effects on marine mammals.

	Incidental take and entanglement in marine debris	Prey Availability	Disturbance
Alternative 1 Steller sea lions	**Insignificant effect.** Steller sea lions are taken by fisheries at an amount well below the PBR.	**Significant Adverse effect.** Prey availability in the Aleutian Islands is likely reduced by the Atka mackerel and Pacific cod fisheries to result in population level adverse effects for Steller sea lions	**Insignificant effect.** Fishing operations are not likely to disturb Steller sea lions to the point of causing population level effects.
Alternative 1 Other marine mammals	**Insignificant effect.** Marine mammals are taken by fisheries at an amount well below the PBR or in a minor amount compared to population.	**Insignificant effect.** Overall prey availability is not affected by the groundfish fisheries at a level resulting in population level effects for other marine mammals in the Aleutian Islands.	**Insignificant effect.** Fishing operations are not likely to disturb other marine mammals to the point of causing population level effects.
Alternative 2 Steller sea lions	**Insignificant effect.** Steller sea lions potentially taken by fisheries at an amount well below the PBR. Potential for incidental takes are less than Alternatives 1 and 3.	**Insignificant effect.** Overall prey availability is not affected by the groundfish fisheries to result in population level effects for Steller sea lions occurring in the Aleutian Islands. Effects on prey availability are less than Alternatives 1 and 3.	**Insignificant effect.** Fishing operations are not likely to disturb Steller sea lions at a level that causes population level effects. Disturbance effects are likely less than Alternative 1 and 3.
Alternative 2 Other marine mammals	**Insignificant effect.** Other marine mammals are taken by fisheries at an amount well below the PBR or in a minor amount compared to population. Incidental takes are likely less for harbor seals compared to Alternatives 1 and 3.	**Insignificant effect.** Overall prey availability is not affected by the groundfish fisheries at a level resulting in population level effects for other marine mammals in the Aleutian Islands. Potential effects on prey availability likely less than Alternatives 1 and 3.	**Insignificant effect.** Fishing operations are not likely to disturb other marine mammals to the point of causing population level effects. Disturbance of near shore mammals (e. g., harbor seals) is less likely than under Alternatives 1 and 3.
Alternative 3 Steller sea lions	**Insignificant effect.** Steller sea lions potentially taken by fisheries at an amount well below the PBR. Potential for incidental takes are less than Alternative 1 and more than Alternative 2.	**Insignificant effect.** Overall prey availability is not affected by the groundfish fisheries to result in population level effects for Steller sea lions occurring in the Aleutian Islands. Effects on prey availability are less than Alternative 1 and more than Alternative 2.	**Insignificant effect.** Fishing operations are not likely to disturb Steller sea lions at a level that causes population level effects. Disturbance effects are less likely than under Alternative 1 and more likely than under Alternative 2.
Alternative 3 Other marine mammals	**Insignificant effect.** Other marine mammals are taken by fisheries at an amount well below the PBR or in a minor amount compared to population. Incidental takes are likely less for harbor seals compared to Alternative 1 and more than Alternative 2.	**Insignificant effect.** Overall prey availability is not affected by the groundfish fisheries at a level resulting in population level effects for other marine mammals in the Aleutian Islands. Potential effects on prey availability are less likely than under Alternative 1 and are more likely than Alternative 2.	**Insignificant effect.** Fishing operations are not likely to disturb other marine mammals to the point of causing population level effects. Disturbance of nearshore mammals (e.g., harbor seals) is less likely than under Alternative 1 and more likely than under Alternative 2.

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6.0 SEABIRDS

6.1 Seabird Species and Status

The passes between islands in the Aleutian Island chain are areas of strong upwelling that bring nutrients to the surface and therefore attract many species of seabirds. Seabird colonies in the Aleutian Islands (and Bering Sea) are shown in Figure 6-1. Species at colonies in the Aleutian Islands include pelagic cormorant, red-faced cormorant, glaucous gull, black-legged and red-legged kittiwakes, common murre, thick-billed murre, ancient murrelet, pigeon guillemot, parakeet auklet, least auklet, Cassin's auklet, crested auklet, whiskered auklet, and horned and tufted puffins.

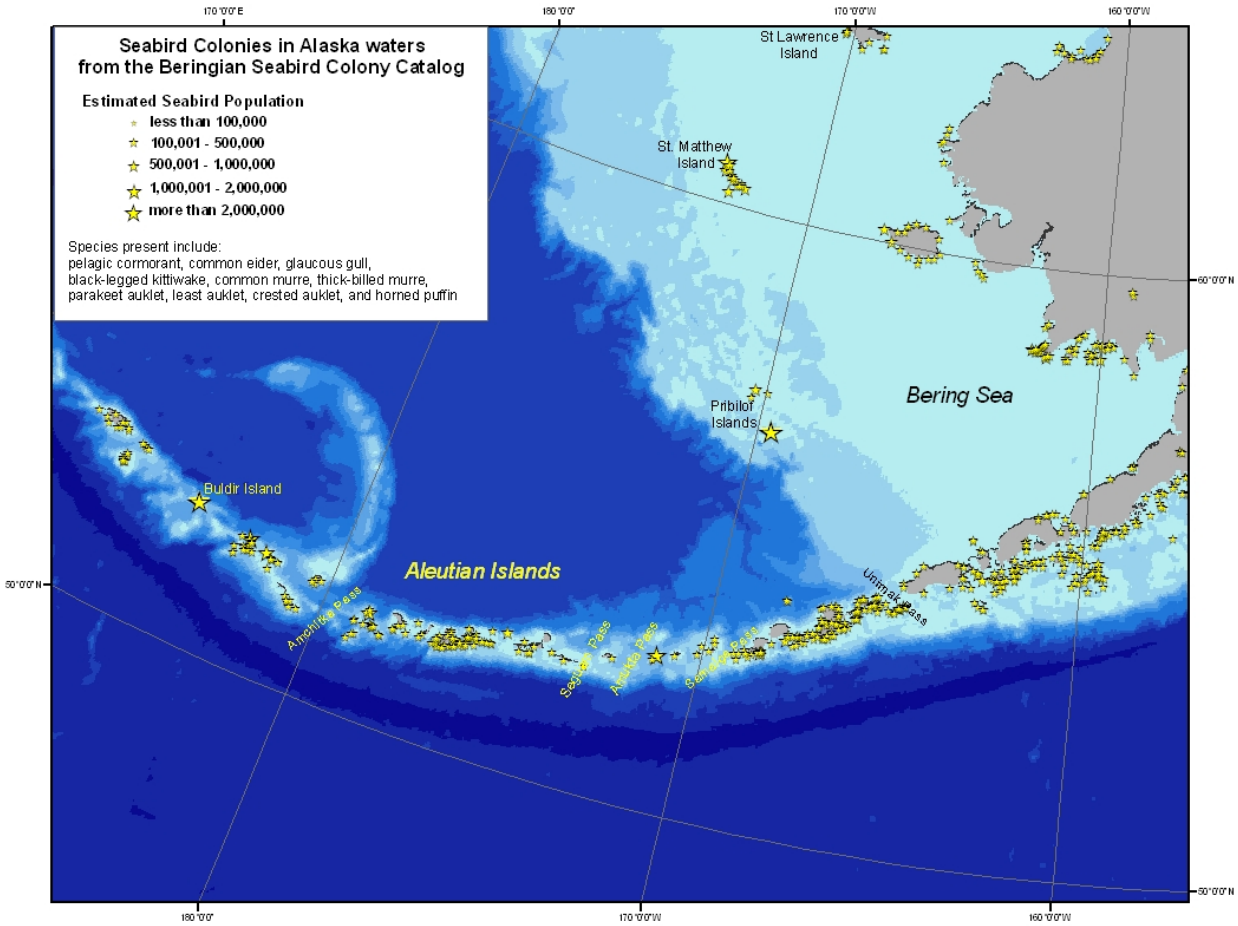

Figure 6-1 Colonies of the Beringian Seabird Colony Catalog (USFWS 1999)

6.1.1 ESA-Listed Seabirds in the Aleutian Islands

Three species of seabirds that range into the Aleutian Islands are listed under the Endangered Species Act (ESA): the endangered short-tailed albatross (*Phoebastria albatrus*), the threatened spectacled eider (*Somateria fischeri*) and the threatened Steller's eider (*Polysticta stelleri*).

Short-tailed albatross populations were decimated by hunters and volcanic activity at nesting sites in the early 1900s, and the species was reported to be extinct in 1949. By 1954 there were 25 total birds seen on Torishima Island. Prohibition of hunting and habitat enhancement work has allowed the population to recover at a 7–8 percent rate based on egg counts from 1990 to 1998. The 2007 world total population was estimated at 2,350 individuals (G. Balogh, USFWS, personal communication). On Torishima Island, an active volcano in Japan, 80–85 percent of nesting occurs at a colony subject to erosion and mudslides, and smaller numbers nest in the Senkaku Islands where political uncertainty and the potential for oil development exist (USFWS 2005). Short-tailed albatross chicks have been translocated from Torishima Island to a new breeding colony without the volcanic threat. No critical habitat has been designated for the short-tailed albatross in the United States, since the population growth rate does not appear to be limited by marine habitat loss (National Marine Fisheries Service [NMFS] 2004b).

Short-tailed albatross feeding grounds are continental shelf breaks and areas of upwelling and high productivity. Recent reliable diet information is not available; however, short-tailed albatross likely feed on squid and forage fish. Although surface foragers, their diet could include mid-water species that are positively buoyant after mortality (e.g., post-spawning for some squid species) or fragments of larger prey floating to the surface after being caught by subsurface predators (R. Suryan, Oregon State University, personal communication).

Spectacled and Steller's eiders are both currently listed as threatened under the ESA. While designated critical habitat for Spectacled and Steller's eiders does overlap with fishing grounds, there has never been an observed take of these species off Alaska (USFWS 2003a and 2003b). Spectacled eider observations are reported in the North Pacific Pelagic Seabird Database (NPPSD 2004) around Unimak Pass in the Aleutian Islands (Figure 6.2), but the species is unlikely to interact with the fisheries in this area. Therefore, impacts to these species are not analyzed in this document.

Table 6-1 and 6-2 show seabird species that occur in the Aleutian Islands and those with conservation status under the ESA. Figures 6.2 and 6.3 show locations of observations of these species.

Table 6-1 Seabird species in the BSAI. (NMFS 2004a)

Albatrosses Black-footed* Short-tailed* Laysan	**Gulls** Glaucous-winged, Glaucous, Herring, Mew, Bonaparte's Sabine	**Murres** Common, Thick-billed
Northern fulmar	**Jaegers** Long-tailed, Parasitic, Pomarine	**Guillemots** Black, Pigeon
Shearwaters Short-tailed, Sooty	**Eiders** Common, King, Spectacled*, Steller's*	**Murrelets** Marbled, Kittlitz's*, Ancient
Storm petrels Leach's, Fork-tailed	**Kittiwakes** Black-legged, Red-legged	**Auklets** Cassin's, Parakeet, Least, Whiskered, Crested
Cormorants Pelagic, Red-faced, Double-crested	**Terns** Arctic, Aleutian	**Puffins** Rhinoceros, Horned, Tufted

* These species are additionally listed in Table 6-2.

Table 6-2 Seabirds with conservation status under the ESA occurring in the Aleutian Islands.

Short-tailed Albatross [1]	*Phoebastria albatrus*	Endangered
Steller's Eider [1]	*Polysticta stelleri*	Threatened
Spectacled Eider[1]	*Somateria fischeri*	Threatened
Kittlitz's Murrelet[1]	*Brachyramphus brevirostris*	Candidate
Black-footed Albatross[1]	*Phoebastria nigripes*	Candidate

[1]These species are under the jurisdiction of USFWS.

6.1.2 Status of Endangered Species Act Consultations on Groundfish and Halibut Fisheries

In 2000, USFWS listed the short-tailed albatross as an endangered species under the ESA throughout its range in the United States (65 FR 46643, July 31, 2000). Although critical habitat has not been established for the short-tailed albatross, USFWS did designate critical habitat for the spectacled eider (66 FR 9146, February 6, 2001) and the Steller's eider (66 FR 8850, February 2, 2001). The current population status, life history, population biology, and foraging ecology of these species, as well as a history of ESA section 7 consultations and NMFS actions carried out as a result of those consultations are described in detail in section 3.7 of the PSEIS (NMFS 2004a).

In 1997, NMFS initiated a section 7 consultation with USFWS on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross. USFWS issued a biological opinion in 1998 that concluded that the Pacific halibut fishery off Alaska was not likely to jeopardize the continued existence of the short-tailed albatross. USFWS issued an Incidental Take Statement of two short-tailed albatross in a 2-year period (e.g., 1998/1999, 2000/2001, 2002/2003), reflecting what the agency anticipated the incidental take could be from the fishery action. Under the authority of ESA, USFWS identified non-discretionary reasonable and prudent measures that NMFS must implement to minimize the impacts of any incidental take.

Two updated USFWS biological opinions were published in 2003:

- Section 7 Consultation - Biological Opinion on the Effects of the Total Allowable Catch (TAC)-Setting Process for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries to the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened Steller's Eider (*Polysticta stelleri*) (USFWS 2003b).
- Section 7 Consultation - Programmatic Biological Opinion on the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries on the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened Steller's Eider (*Polysticta stelleri*) (USFWS 2003a).

Although USFWS has determined that the short-tailed albatross is adversely affected by hook-and-line Pacific halibut and groundfish fisheries off Alaska, both USFWS opinions concurred with NMFS and concluded that the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands Management Area (BSAI) fishery actions are not likely to jeopardize the continued existence of the short-tailed albatross or Steller's eider or result in adverse modification of Steller's eider critical habitat. USFWS also concluded that these fisheries are not likely to adversely affect the threatened spectacled eider. The biological opinion on the TAC-setting process updated incidental take limits to—

- four short-tailed albatross taken every two years in the hook-and-line groundfish fishery off Alaska, and

- two short-tailed albatross taken in the groundfish trawl fishery off Alaska while the biological opinion is in effect (approximately 5 years).

These incidental take limits are in addition to the previous take limit set in 1998 for the Pacific halibut hook-and-line fishery off Alaska of two short-tailed albatross in a 2-year period.

The 2003 biological opinion on the TAC-setting process also included mandatory terms and conditions that NMFS must follow in order to be in compliance with the ESA. One term and condition is the implementation of seabird deterrent measures that preceded this analysis. Additionally, NMFS must continue outreach and training of fishing crews on proper deterrence techniques, continued training of observers in seabird identification, retention of all seabird carcasses until observers can identify and record takes, continued analysis and publication of estimated incidental take in the fisheries, collection of information regarding the efficacy of seabird protection measures, cooperation in reporting sightings of short-tailed albatross, and continued research and reporting on the incidental take of short-tailed albatross in trawl gear.

USFWS also released a short-tailed albatross recovery plan in September of 2008 (USFWS 2008). This recovery plan describes site-specific actions necessary to achieve conservation and survival of the species, downlisting and delisting criteria, and estimates of time and cost required to implement the recovery plan. Because the primary threat to the species recovery is the possibility of an eruption of Torishima Island, the most important recovery actions include monitoring the population and managing habitat on Torishima Island, establishing two or more breeding colonies on non-volcanic islands, monitoring the Senkaku population, and conducting telemetry and other research and outreach. Translocation of chicks to new colonies has begun. USFWS estimates that short-tailed albatross may be delisted in the year 2030, if new colony establishment is successful.

6.1.3 Seabird Distribution in the Aleutian Islands

Piatt et al. (2006) discuss oceanic areas of seabird concentrations and explain that short-tailed albatross hotspots are characterized by vertical mixing and upwelling caused by currents and bathymetric relief and that persist over time. The continual upwelling brings food to the surface, which draws predators back for repeated foraging, especially albatross species which forage at the surface due to their limited diving ability (Hyrenbach et al. 2002). Sightings data were compiled from the following sources: from 1988 to 2004 records from seabird observers on USFWS's research vessel M/V *Tiglax*; from incidental sightings by biologists, fishermen, seamen, fisheries observers and birdwatchers provided to USFWS; from the Alaska Natural Heritage Program; historical sightings documented in published literature; and from the North Pacific Pelagic Seabird Database. Researchers analyzed over 1,400 sightings, the majority of which were located on the continental shelf edge of Alaska, abundance being greatly diminished along the east GOA coast and south to Southeast Alaska. Researchers concluded that the short-tailed albatross most recently is associated consistently with upwelling in Aleutian passes and along continental shelf margins in Alaska. The opportunistic sightings data suggest that the albatrosses appear persistently and predictably in some marine "hotspots." They were closely associated with shelf-edge habitats throughout the northern GOA and Bering Sea. In addition to Ingenstrem Rocks and Seguam Pass, important hotspots for short-tailed albatross in the Aleutians included Near Strait, Samalga Pass, and the shelf-edge south of Umnak/Unalaska Islands. In the Bering Sea, hotspots were located along margins of Zhemchug, St. Matthew, and Pervenets Canyons (Piatt et al. 2006). Similar findings in Byrd et al. (2005) confirm the frequent presence of surface-feeding piscivores near the medium and large passes that create the bathymetric conditions for vertical mixing and upwelling. Researchers surmise that prior to decimation of the short-tailed albatross population by feather hunters around the turn of the century, the albatrosses may have been reasonably common nearshore (thus the term "coastal" albatross) but only where upwelling

"hotspots" occurred near the coast. As short-tailed albatross numbers increase, it is likely that their distribution will shift into areas less utilized currently, including the coastal areas.

Figure 6-2 depicts the observed distributions of several seabird species from the NPPSD (2004). There are many observations of black-footed and Laysan albatrosses in the Aleutian Islands and some Kittlitz's murrelets. Of these species, albatrosses have been incidentally taken in the hook-and-line and trawl fisheries.

Figure 6-3 shows observations of the short-tailed albatross, which is the only endangered seabird (under the ESA) occurring in the Aleutian Islands. Each of the data sources is described below.

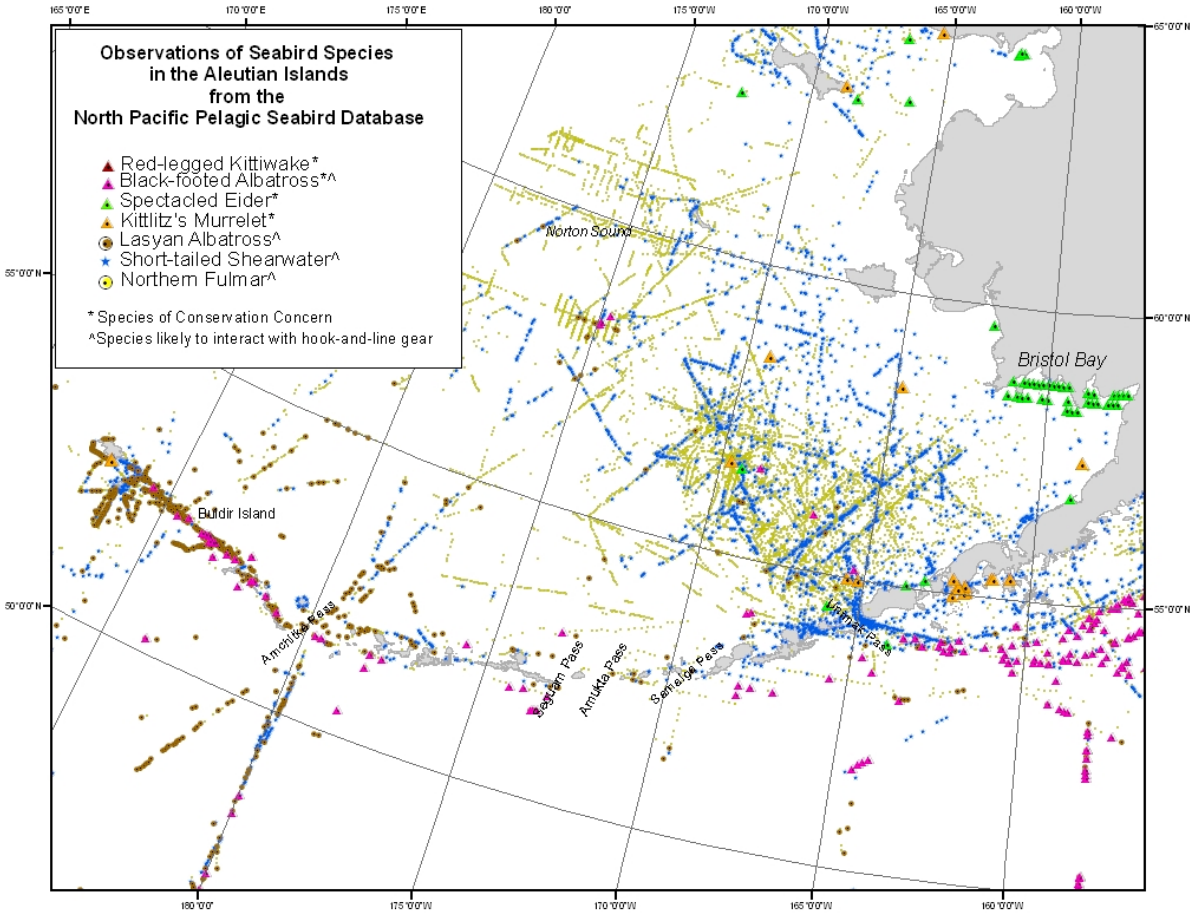

Figure 6-2 Observations of seabird species with conservation status and/or likely to interact with hook-and-line gear in the Aleutian Islands. (NPPSD 2004)

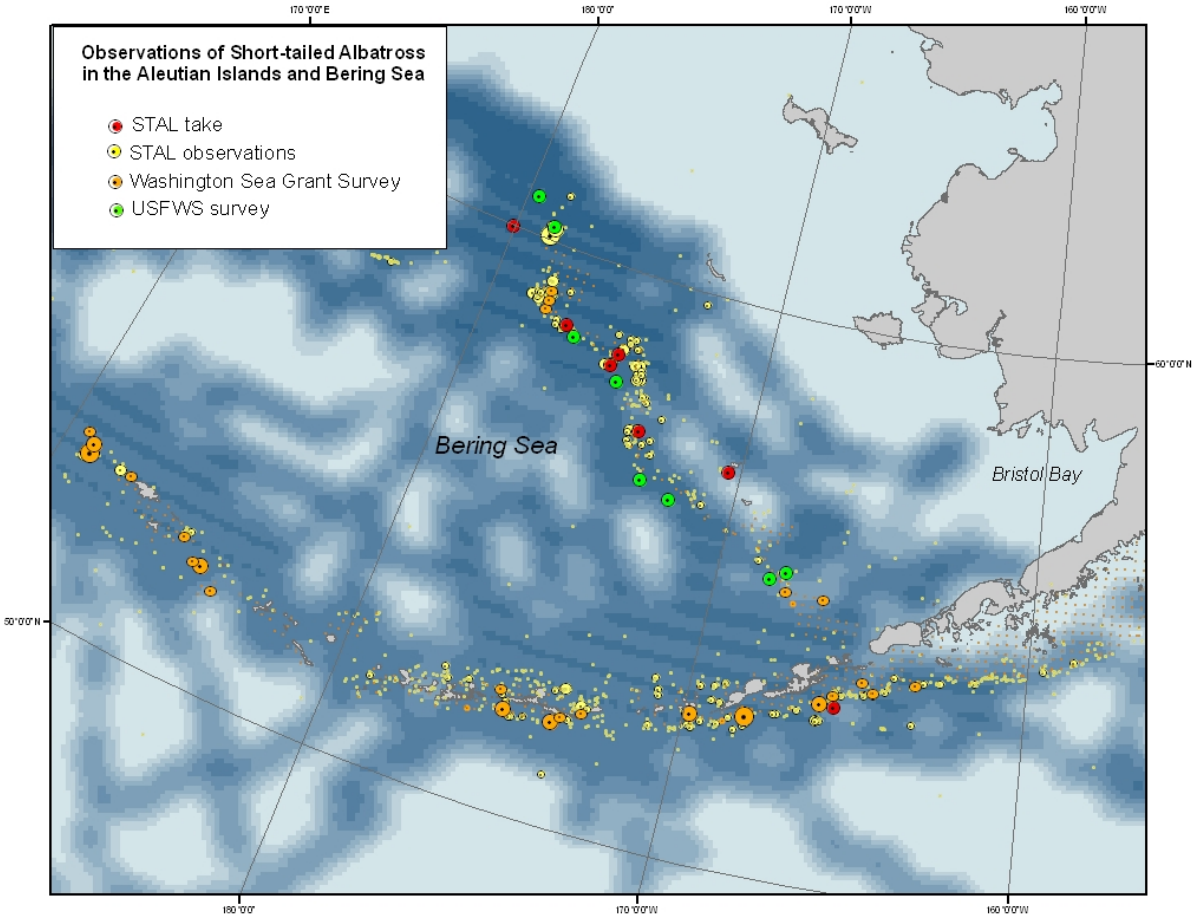

Figure 6-3 Observations and takes of short-tailed albatrosses in the Aleutian Islands and Bering Sea. Blue shaded background shows results from interpolation of satellite tagging data. Darker blue areas are where short-tailed albatross spent more time than lighter blue areas.

Washington Sea Grant Survey Data

Melvin et al. (2006) provide the most current and comprehensive data of seabird distribution patterns in the U.S. exclusive economic zone off Alaska's coast, based on an inter-agency collaborative program that collected seabird distribution data during stock assessment surveys on hook-and-line vessels in the summers of 2002, 2003, and 2004. Seabird data were collected from four summer hook-and-line stock assessment surveys: International Pacific Halibut Commission (IPHC) halibut surveys, NMFS sablefish surveys, Alaska Department of Fish and Game (ADF&G) Southeast Inside sablefish surveys, and ADF&G Prince William Sound sablefish surveys (see Melvin et al. [2006] for survey protocol and description).

Researchers observed a total of 230,452 birds over three years at an average of 1,456 stations surveyed each year. Of all birds sighted, 85 percent were tubenose seabirds, and of these, most were northern fulmars (71 percent of all birds sighted) or albatrosses (13 percent of all birds sighted). Albatrosses occurred throughout the fishing grounds in outside waters. Sightings of the endangered short-tailed albatrosses (Figure 6-3) were extremely rare (0.03 percent of all sightings) and had a similar distribution

to Laysan albatrosses: rare or absent east and south of the Western GOA and most abundant in the Aleutian Islands. Black-footed albatrosses were observed in all outside waters.

North Pacific Pelagic Seabird Observer Program

Between February 1 and October 31, 2007, seabird observers conducted surveys onboard ships of opportunity for a total of 275 days in the Bering, Chukchi, and Beaufort Seas, including some parts of IPHC Area 4E. While short-tailed, black-footed, and Laysan albatrosses were observed in the Bering Sea by surveyors, their distributions were mostly limited to the Bering Sea shelf break.

Short-tailed Albatross Takes in Alaska Fisheries

Table 6-3 details the short-tailed albatrosses reported taken in Alaska fisheries since 1983. Except for the second take in 1998, leg bands were recovered from all of the albatrosses allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa has banded all short-tailed albatross chicks at their breeding colony on Torishima Island, Japan. See Figure 6-3 for a map of the take locations, and note that except for one bird, all takes occurred along the shelf break in the Bering Sea. Because this analysis focuses on the Aleutian Islands, the albatross that was taken in the hook-and-line fishery on August 28, 1995, south of Krenitizin Islands, west of Unimak Island is denoted with * in table. It was a sub-adult, banded on April 16, 1994.

Table 6-3 Reported takes of short-tailed albatross in Alaska fisheries. (NPPSD 2004)

Date of take	Location	Fishery	Age when taken
July 1983	BS	brown crab	juvenile (4 mos)
1 Oct 87	GOA	halibut	juvenile (6 mos)
28 Aug 95*	EAI	hook-and-line	sub-adult (16 mos)
8 Oct 95	BS	hook-and-line	sub-adult
27 Sept 96	BS	hook-and-line	sub-adult (5 yrs)
21 Sept 98	BS	Pacific cod hook-and-line	adult (8 yrs)
28 Sept 98	BS	Pacific cod hook-and-line	sub-adult

.

Opportunistic Sightings of Short-tailed Albatross

Balogh et al. (2006) report opportunistic sightings of short-tailed albatrosses in the Bering Sea and Aleutian Islands. These reported sightings are shown in Figure 6-3. Similar to other reports, more opportunistic sightings occurred over shelf-break areas than on the shelf. This pattern partially reflects where fishing effort occurred and short-tailed albatross observed, and does not equally represent sightings in areas where fishing effort is less common. Large numbers of short-tailed albatross were observed near the Bering Sea canyons.

North Pacific Pelagic Seabird Database (NPPSD)

The NPPSD represents a consolidation of pelagic seabird data collected from the Central and North Pacific Ocean, the Bering Sea, the Chukchi Sea, and the Beaufort Sea. The NPPSD was created to synthesize numerous disparate datasets including at-sea boat based surveys, stations, land-based observations, and fixed-wing and helicopter aerial surveys collected since 1972 (Drew and Piatt 2004).

Satellite Tracking of Short-tailed Albatross (Suryan 2006a and 2006b)

USFWS and Oregon State University have placed 52 satellite tags on Laysan, black-footed, and short-tailed albatrosses in the central Aleutian Islands over the past 4 years (USFWS 2006) to study movement patterns of the birds in relation to commercial fishing activity and other environmental variables. The tagging study has been a collaborative project with Japan. Japanese researchers tag birds at the main breeding colony on Torishima Island. From 2002 to 2006, 21 individual short-tailed albatrosses (representing about 1 percent of the entire population) were tagged, including adults, sub-adults, and hatch-year birds. The data suggest that they move north after the breeding season to the southern tip of the Kamchatka Peninsula, and then east to the western Aleutian Islands.

During 2002 and 2003, satellite transmitters were deployed on birds immediately prior to their departure from a breeding colony at Torishima (n = 11), or at-sea in the Aleutian Islands (n = 3) (Suryan et al. 2006b). Tracking durations ranged from 51 to 138 days for a total of 6,709 locations. The ages of 11 of 14 albatrosses (three were unbanded) tracked during this study ranged from less than 1 year to 18 years, with an unequal sex ratio of nine males to four females, and one individual of undetermined gender. Individuals were tracked from May to November and engaged during area-restricted search patterns along flight paths primarily over shelf break and slope regions. During the non-breeding season, short-tailed albatross ranged along the Pacific Rim from southern Japan through Alaska and Russia to northern California, primarily along continental shelf margins (Suryan et al. 2006a).

Movement patterns differed between gender and age classes. Upon leaving Torishima, females spent more time offshore of Japan and the Kurile Islands and Kamchatka Peninsula, Russia, compared to males, which spent more time within the Aleutian Islands and Bering Sea. Age-specific differences in movement patterns were evident for birds less than 1 year old. These two individuals traveled nearly twice the distance per day and total distance on average than all older albatrosses (Suryan et al. 2006a). Birds spent little time in the western gyre (Kuroshio and Oyashio regions).

Eleven of the 14 birds had sufficient data to analyze movements within Alaska. Within Alaska, albatrosses spent varying amounts of time among NMFS reporting areas, with six of the areas (521, 524, 541, 542, 543, 610) being the most frequently used (Suryan et al. 2006a). Albatrosses arriving from Japan spent the greatest amount of time in the western and central Aleutian Islands (541–543), whereas albatrosses tagged in Alaska were more widely distributed among reporting areas in the Aleutian Islands, Bering Sea, and the Alaska Peninsula. In the Aleutian Islands, area-restricted search patterns occurred within straits, particularly along the central and western part of the archipelago (Suryan et al. 2006b). In the Bering Sea, area-restricted search patterns occurred along the northern continental shelf break, the Kamchatka Current region, and east of the Commander Islands. Non-breeding, short-tailed albatross concentrate foraging in oceanic areas characterized by gradients in topography and water column productivity.

Telemetry data demonstrate that short-tailed albatrosses did not disperse widely throughout the subarctic North Pacific (Suryan et al. 2006b). The primary hot spots for short-tailed albatrosses in the Northwest Pacific Ocean and Bering Sea occur where a variety of underlying physical processes enhance biological

productivity or prey aggregations. In this study, albatrosses made mainly transitory excursions along the northern boundary of the Kuroshio Extension and Oyashio Front while enroute to the Aleutian Islands and Bering Sea. The Aleutian Islands, in particular, were a primary foraging destination for short-tailed albatrosses. Passes within the Aleutian Islands with the greatest albatross area-restricted search pattern activity included Near, Buldir, Shumagin, and Seguam. Currents flowing through these relatively narrow and shallow passes cause localized upwelling, frontal zone formation, and eddies that enhance mixing, nutrient supply, and productivity. The significance of passes as feeding zones for breeding and migratory seabirds is well documented and their use by short-tailed albatrosses have been described from ship-based observations (Piatt et al. 2006).

In late June and early July 2006, USFWS and Oregon State University continued the satellite tagging study with at-sea tagging of six individuals in the Aleutian Islands, south of Amlia Island and in Seguam Pass. The 2006 tagging used the same deployment procedures and methodologies as those birds tagged in 2002 and 2003 (Suryan et al. 2006a and 2006b). Five of these hatching-year and subadult albatrosses were successfully tracked from June to September 2006.

6.1.4 Other Seabird Species of Conservation Concern

The 1988 amendment to the Fish and Wildlife Conservation Act mandates USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." Birds of Conservation Concern (BCC) 2002 (USFWS 2002) identifies the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) with their highest conservation priorities and draws attention to species in need of conservation action. NMFS evaluating bycatch report (NMFS 2004b) says the purpose of the BCC list is to highlight potential conservation issues and concerns before species get listed. The BCC report (USFWS 2002) lists 28 species of birds in Region 7 (Alaska Region). Many of these species do not interact with Alaska hook-and-line fisheries, and thus are not addressed in this analysis.

Black-footed Albatross

The black-footed albatross is a candidate species under the ESA. It is a species of concern because some of the major colony population counts may be decreasing or are of unknown status. World population estimates range from 275,000 to 327,753 individuals (Brooke 2004), with a total breeding population of 58,000 pairs (USFWS 2006). Most of the population (95 percent) breeds in the Hawaiian Islands. Conservation concerns in the last century have included albatross mortalities by feather hunters, the degradation of nesting habitat due to introduced species such as rabbits, and population reduction programs operated by the military. Tuna and swordfish pelagic longline fisheries in the North Pacific, including the Hawaiian longline fishery, and to a lesser extent the Alaska groundfish demersal longline fishery, take black-footed albatrosses incidentally. On October 1st, 2004, USFWS received a petition to list the black-footed albatross (*Phoebastria nigripes*) as a threatened or endangered species, and to designate critical habitat at the time of listing. USFWS's response to the 90-day finding was deferred until October 9th, 2007, due to insufficient resources. At that time, USFWS found that the petition warranted further review. Following the publication of the black-footed albatross population status review, USFWS began developing its 12-month finding indicating whether it believes a proposal to list this species as threatened or endangered is warranted. On October 7, 2007, USFWS announced the decision that there is substantial scientific or commercial data to consider the ESA-listing of black-footed albatross, and the agency has begun a 12-month review (USFWS 2007).

Melvin et al. (2006) states that the World Conservation Union (IUCN) changed its conservation status of the species under the international classification criteria from vulnerable to endangered in 2003. Additionally, USFWS has been working with Dr. Paul Sievert and Dr. Javier Arata of the U.S. Geological Survey to develop a status assessment of Laysan and black-footed albatrosses. This assessment is in response to growing concerns regarding the current status and population trends of these two north Pacific albatrosses, particularly the black-footed.

Black-footed albatrosses occur in Alaska waters mainly in the northern GOA, but do occur in the Aleutian Islands (Figure 6-2).

Red-legged Kittiwake

The red-legged kittiwake is a small gull that breeds at only a few locations in the world, all of which are in the Bering Sea, but outside of IPHC Area 4E (USFWS 2006). Of its worldwide population, 80 percent nest at St. George Island, with the remainder nesting at St. Paul Island, the Otter Islands, and Bogoslof and Buldir Islands. The total population is estimated at around 209,000 birds (USFWS 2006). They are listed as a USFWS bird of conservation concern because recent severe population declines remain unexplained (NMFS 2004b), but could be due to irregular food supplies in the Pribilof Islands. Red-legged kittiwakes are not expected to interact with hook-and-line fishing gear since none are reported as taken by fisheries observers.

Kittlitz's Murrelet

Kittlitz's murrelet is a small diving seabird that forages in shallow waters for capelin, Pacific sandlance, zooplankton, and other invertebrates. It feeds near glaciers, icebergs, and outflows of glacial streams, sometimes nesting up to 45 miles inland on rugged mountains near glaciers. The entire North American population, and most of the world's population, inhabits Alaskan coastal waters discontinuously from Point Lay south to northern portions of Southeast Alaska. Kittlitz's murrelet is a relatively rare seabird. Most recent population estimates indicate that it has the smallest population of any seabird considered a regular breeder in Alaska (9,000 to 25,000 birds). This species appears to have undergone significant population declines in several of its core population centers—Prince William Sound (up to 84 percent), Malaspina Forelands (up to 75 percent), Kenai Fjords (up to 83 percent), and in Glacier Bay. Causes for the declines are not well known, but likely include habitat loss or degradation, increased adult and juvenile mortality, and low recruitment. USFWS believes that glacial retreat and oceanic regime shifts are the factors that are most likely causing population-level declines in this species.

On May 4, 2004, USFWS (2004) gave the Kittlitz's murrelet (*Brachyramphus brevirostris*) a low ESA-listing priority because it has no imminent, high magnitude threats. The listing priority was elevated from 5 to 2 in 2007 in recognition that climate change will have a more immediate effect on this species than previously believed.

USFWS has conducted surveys for Kittlitz's murrelet in the Alaska Maritime National Wildlife Refuge over the past few years (USFWS 2006). These surveys have revealed substantial populations at Attu, Atka, Unalaska, and Adak. Intensive surveys in 2006 found an additional 10 nests in the mountains of Agattu. Biologists are now able to study the species' breeding biology for the first time.

No Kittlitz's murrelets were specifically reported taken in the observed groundfish fisheries between 1993 and 2001 (NMFS 2004a). Their foraging techniques, diet composition, and that they do not follow fishing vessels or congregate around them, reduce the likelihood of incidental take in groundfish fisheries (K. Rivera, NMFS, personal communication).

6.2 Effects on Seabirds

The PSEIS identifies how BSAI groundfish fisheries activities may affect, directly or indirectly, seabird populations (NMFS 2004). A direct effect on some seabird species may include incidental take (in fishing gear and vessel strikes) and is more fully described in section 3.7.1 of the PSEIS (NMFS 2004a). Indirect effects on some species may include prey (forage fish) abundance and availability, benthic habitat, processing waste and offal, contamination by oil spills, nest predators in islands, and plastics ingestion. These indirect effects are more fully described on pages 3.7–12 through 3.7–17 of the PSEIS.

Incidental Take

There is spatial overlap between the distribution of seabirds and fishing grounds in the Aleutian Islands. Suryan et al. (2006) discuss the spatial distribution of 11 tagged short-tailed albatross in the Alaska exclusive economic zone. Birds tagged in Torishima, Japan, spent 45 percent of their time in Alaska waters; those tagged in Alaska spent 60 percent of time in Alaska waters. Of their time in Alaska waters, the Alaska-tagged birds spent approximately 38 percent of their time in NMFS management areas 541, 542, and 543. The Torishima-tagged birds spent 92 percent of their time in Alaska waters, within those areas. Most of the time spent in the Aleutian Islands management areas was in passes and nearshore areas, therefore mostly inside Steller sea lion critical habitat. Birds also transit outside of critical habitat. Direct effects, including incidental take of seabirds, are discussed in more detail below.

Prey Availability

Fisheries may compete with seabirds for prey species and may disturb bottom habitat that supports prey species. These indirect effects are also described below.

6.2.1 Significance Criteria for Seabirds

Table 6-4 explains the criteria used in this analysis to gauge significance of effects on seabird populations in the Bering Sea. These criteria are used in the analysis of alternatives and options that follows. These criteria are from the 2006–2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA) (NMFS 2006). These criteria are applicable to this action because this analysis and the harvest specifications analysis both analyze the effects of groundfish fisheries on seabirds. The EA/FRFA provided the latest ideas on determining the significance of effects on seabirds based on similar information that is available for this environmental assessment/regulatory impact review (EA/RIR); no new information is available. The first criterion in the table was further refined for this analysis from NMFS (2006) to clearly provide a criterion for “insignificant impact” and to be consistent with other analyses of environmental components in this EA/RIR.

Table 6-4 Criteria used to determine significance of impacts on seabirds.

	Incidental take	Prey availability	Benthic habitat
Insignificant	No substantive change in bycatch of seabirds during the operation of fishing gear.	No substantive change in forage available to seabird populations.	No substantive change in gear impact on benthic habitat used by seabirds for foraging.
Adverse impact	Non-zero take of seabirds by fishing gear.	Reduction in forage fish populations, or the availability of forage fish, to seabird populations.	Gear contact with benthic habitat used by benthic feeding seabirds reduces amount or availability of prey.
Beneficial impact	No beneficial impact can be identified.	Availability of offal from fishing operations or plants may provide additional, readily accessible, sources of food.	No beneficial impact can be identified.
Significantly adverse impact	Trawl and hook-and-line take levels increase substantially from the baseline level, or level of take is likely to have population level impact on species.	Food availability decreased substantially from baseline such that seabird population level survival or reproduction success is likely to decrease.	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird population level survival or reproductive success is likely to decrease. (ESA-listed eider impacts may be evaluated at the population level).
Significantly beneficial impact	No threshold can be identified.	Food availability increased substantially from baseline such that seabird population level survival or reproduction success is likely to increase.	No threshold can be identified.
Unknown impacts	Insufficient information available on take rates or population levels.	Insufficient information available on abundance of key prey species or the scope of fishery impacts on prey.	Insufficient information available on the scope or mechanism of benthic habitat impacts on food web.

6.2.2 Incidental Take of Seabirds in Hook-and-Line Fisheries

The presence of "free" food in the form of offal and bait attracts many birds to fishing operations. In the process of feeding, birds sometimes come into contact with fishing gear and are accidentally killed. The probability of a bird being caught is a function of many interrelated factors including type of fishing operation and gear used, length of time fishing gear is at or near the surface of the water, behavior of the bird (feeding and foraging techniques), water and weather conditions, size of the bird, availability of food (including bait and offal), and physical condition of the bird (molt, migration, health).

Surface feeders, such as most *procelliforms* (albatross, fulmars, and shearwaters) and gulls, are most at risk of being taken in hook-and-line fisheries (Table 6-5). They are attracted to the vessels by the bait and the offal discharge. Nearshore foragers—such as cormorants, terns, guillemots, murrelets, Rhinoceros auklet, and puffins—are less likely to interact with offshore groundfish fisheries (NMFS 2004b). Additionally, their nearshore preferences, foraging techniques, diet composition, and that they do not follow fishing vessels or congregate around them, reduce the likelihood of incidental take in groundfish fisheries (K. Rivera, NMFS, personal communication).

In hook-and-line fisheries off Alaska, surface feeders are attracted to the baited hooks when the gear is being set. They are caught from the surface down to a depth of 2 meters (m) (Melvin et al. 2001) and dragged underwater where they drown.

Table 6-5 Seabird species groups and risk of hook-and-line fishery interactions.

Species groups potentially at risk of interaction with hook-and-line gear	Species groups not likely to be at risk of interaction with hook-and-line gear
Albatross*	Cormorants
Fulmars	Terns*
Shearwaters	Guillemots
Gulls	Murrelets*
	Rhinoceros auklet
	Puffins
	Eiders*
	Loons*

* Includes a species that is listed as a bird of conservation concern with USFWS, IUCN, or listed as endangered or threatened under the ESA.

6.2.3 Incidental Take of Seabirds in Trawl Fisheries

Seabirds can interact with trawl fishing vessels in several ways. Birds foraging at the water surface or in the water column are sometimes caught in the trawl net as it is brought back on board. These net-entangled birds are referred to as "bycatch" and are recorded by fisheries observers as discussed below. In addition to getting caught in the fishing nets of trawl vessels, some species get caught in cables attached to the infrastructure of vessels or collide with the infrastructure itself. These direct interactions called strikes are also discussed below.

Estimated incidental take of birds recovered in the nets from trawling operations in the BSAI is approximately 855 birds per year (NMFS 2007a). Gull, shearwaters, and fulmars make up 78 percent of the average annual trawl incidental catch for Alaska waters (NMFS 2007a). The estimated takes of gulls, fulmars, and shearwaters in the entire groundfish fishery are very small percentages of these species' populations (NMFS 2007a).

6.2.4 Prey Availability – Disturbance of Benthic Habitat

As noted in Table 6-6 below, prey species of seabirds in the Aleutian Islands are not usually fish that are targeted by non-pelagic commercial fishing gear. However, seabird species may be impacted indirectly by effects of the non-pelagic trawl gear on the benthic habitat of seabird prey, such as clams, bottom fish, and crab. The essential fish habitat final environmental impact statement provides a description of the effects of trawling on bottom habitat in the appendix (NMFS 2005), including the effects of the commercial fisheries on the Bering Sea slope and shelf.

Table 6-6 Seabirds in Aleutian Islands: foraging habitats and common prey species. (USFWS 2006; Dragoo 2010)

Species	Foraging habitats	Prey
Short-tailed albatross	Surface seize and scavenge	Squid, shrimp, fish, fish eggs
Black-footed albatross	Surface dip, scavenge	Fish eggs, fish, squid, crustaceans, fish waste
Laysan albatross	Surface dip	Fish, squid, fish eggs and waste
Spectacled eider	Diving	Mollusks and crustaceans
Steller's eider	Diving	Mollusks and crustaceans
Red-legged kittiwake	Surface fish feeder	Myctophids, squid, amphipods, euphausids, minor amounts of pollock and sand lance
Black-legged kittiwake	Dip, surface seize, plunge dive	Fish, marine invertebrates
Kittlitz's murrelet	Surface dives	Fish, invertebrates, macroplankton
Short-tailed shearwater	Surface dives	Crustaceans, fish, squid
Northern fulmar	Surface fish feeder	Fish, squid, crustaceans
Murres (thick-billed and common)	Diving fish-feeders offshore	Fish, crustaceans, invertebrates
Cormorants (pelagic and red-faced)	Diving fish-feeders nearshore	Bottom fish, crab, shrimp
Glaucous-winged gull	Surface fish feeder	Fish, marine invertebrates, birds
Parakeet auklet	Surface dives	Crustaceans, fish, jellyfish
Least auklet	Surface dives	zooplankton
Horned and tufted puffins	Surface dives	Fish, squid, other invertebrates

It is not known how much seabird species use benthic habitat directly, although research funded by the North Pacific Research Board has been conducted on foraging behavior of seabirds in the Bering Sea in recent years. Thick-billed murres easily dive to 100 m, and have been documented diving to 200 m; common murres also dive to over 100 m. Since cephalopods and benthic fish compose some of their diet, murres could be foraging on or near the bottom (K. Kuletz, USFWS, personal communication, October 2008).

A description of the effects of prey abundance and availability on seabirds is in section 3.7.1 of the PSEIS (NMFS 2004) and section 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b). Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies. NMFS (2007b) found that the potential impact of the entire groundfish fisheries on seabird prey availability was limited due to little or no overlap between the fisheries and foraging seabirds based on either prey size, dispersed foraging locations or different prey (NMFS 2007a). The majority of bird groups feed in vast areas of the oceans, are either plankton feeders or surface or mid-water fish feeders, and are not likely to have their prey availability impacted by the nonpelagic trawl fisheries. There is no directed commercial fishery for those species that compose the forage fish management group, and seabirds typically target juvenile stages rather than adults for commercial target species. Most of the forage fish bycatch is smelt taken in the pollock fishery, which is not included in this action. The possible exception is sea ducks that depend on benthic habitat. These include Steller's eiders, spectacled eiders, scoters, cormorants, and guillemots, which may feed in areas that could be directly impacted by nonpelagic trawl gear (NMFS 2004b). Additional impacts from nonpelagic trawling may occur, if sand lance habitat is adversely impacted. This would affect a wider array of piscivorous seabirds that feed on sand lance, particularly during the breeding season, when this forage fish is also used for

feeding chicks. Little is known about cormorant and guillemot species in the Bering Sea. No recent data of population trends, breeding status, or diet in the Bering Sea are available for guillemots (Dragoo 2010). Within the nearshore area, guillemots eat primarily fish and pelagic cormorants eat a variety of fish and invertebrates. Productivity data at Pierce and Round Island for pelagic cormorants is available from Dragoo (2010).

In the winter, spectacled eiders congregate in the open leads of ice in their critical habitat area to feed on benthic organisms. These ducks dive 40–70 m to eat clams (exclusively *Nuculana radiata*) in the winter critical habitat area (Lovvorn et al. 2003). In the fall and summer, the birds are more dispersed and vessels are likely to encounter the dispersed population only in October before the sea ice develops. Direct disturbance of the eiders is unlikely because of their dispersed presence in locations of fishing during a limited time of the year.

The important feature of the winter critical habitat area is the presence of clams available to foraging spectacled eiders (Greg Balogh, USFWS, personal communication). Because nonpelagic trawl gear contacts the bottom, nonpelagic trawl gear in the spectacled eider critical habitat may have an impact on their prey, particularly *Nuculana radiata* clams upon which spectacled eiders depend during winter. These impacts on prey could be from uncovering the clams or from exposing the clams to the abundant predators (starfish and crabs) occurring in the area (Lovvorn, University of Wyoming, personal communication). Use of nonpelagic trawl gear has been limited within the spectacled eider critical habitat, and is currently not permitted in the block of critical habitat south of St. Lawrence Island because of the Northern Bering Sea Research Area habitat closure.

New research on the effects of trawling on the seafloor reports the following results. A 3-year otter trawling study in sandy bottom of the Grand Banks showed either no effect or increased abundance in molluscs species after trawling (Kenchington et al. 2001), but clam abundance in these studies was depressed for the first 3 years after trawling occurred. McConnaughey, Mier, and Dew (2000) studied trawling effects using the Bristol Bay area Crab and Halibut Protection Zone. They found more abundant infaunal bivalves (not including *Nuculana radiata*) in the highly fished area compared to the unfished area. In addition to abundance, clam size is of huge importance to these birds. For example, a diet of very small clams is not the same as a lower number of moderate size clams. Handling time is very important to birds foraging in the benthos, and their caloric needs could change if a stable large clam population is converted to a very dense population of small first year clams.

Recovery of fauna after the use of nonpelagic trawl gear may also depend on the type of sediment. A study in the North Sea found biomass and production in sand and gravel sediments recovering faster (2 years) than in muddy sediments (4 years) (Hiddink, Jennings, and Kaiser 2006). The recovery rate may be affected by the animal's ability to rebury itself after disturbance. Clams species may vary in their ability to rebury themselves based on grain size and whether they are substrate generalist, substrate specialist, or substrate sensitive species (Alexander, Stanton, and Dodd 1993). It is not known which category *Nuculana radiata* or other potential spectacled eider prey may occupy. The sediments occurring in the area between St. Matthew Island and St. Lawrence Island appear to be primarily mud mixed with sand and gravel. If the life history of *Nuculana radiata* is similar to bivalves studies in the North Sea, it is possible that recovery from nonpelagic trawl gear may take several years.

6.2.5 Alternative 1 – Status Quo

Alaska groundfish fisheries' impacts on seabirds were analyzed in the Alaska Harvest Specifications EIS (NMFS 2007b). That document evaluates the impacts of the current alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The reader can consult that

document for more information. A summary and updated information, where available, is presented below.

Incidental Take - Estimating Seabird Bycatch in the Aleutian Islands and Bering Sea

The North Pacific Observer Program provides estimates of seabird bycatch in Alaska's groundfish fisheries. They observe and estimate total seabird bycatch on vessels larger than 60 feet length overall and do not include interactions or entanglements with trawl cables or third wires (NMFS 2004b).

Rate of bycatch has decreased dramatically in hook-and-line fisheries since the use of streamer lines and other seabird avoidance measures in 2001. The fleet began voluntarily using these protection measures even before they were legally required. Seabird bycatch in the Aleutian Islands is comparable in total volume to bycatch in the GOA, and much less than the total bycatch in the Bering Sea. However, a higher percentage of albatross species is taken in the Aleutian Islands than either of the other areas.

Overall, hook-and-line gear interacts with a greater number of seabirds than any other type of fishing gear observed in Alaska. Hook-and-line gear took about twice as many seabirds as trawl gear in 2006, but caught about 98 percent of the albatross species taken. Seabird bycatch composition in the 2006 Aleutian Islands hook-and-line fishery was mostly northern fulmars and gull species, with about twenty percent albatross species, mostly Laysan with smaller numbers of black-footed. This is comparable to an average of around seventeen percent albatross species for the period 2000 to 2004. The 2006 Bering Sea hook-and-line fishery incidentally caught a much higher number of total birds including mostly northern fulmars and gull species, but only about two percent albatross species. This is comparable to an average of around two percent albatross species for the period 2000 to 2004. Most of the albatrosses taken with hook-and-line gear in the Aleutian Islands and Bering Sea are taken in the Pacific cod fishery.

Table 6-7 Seabird bycatch estimates in the 2006 Alaskan groundfish demersal longline fishery in the Aleutian Islands on vessels greater than or equal to 60 feet length overall. The point estimate for short-tailed albatross was zero.

Species	Point estimate	95% confidence interval
Laysan albatross	44	24–82
Black-footed albatross	3	1–12
Northern fulmar	89	55–144
Gull spp.	45	25–81
Unidentified albatross	2	1–119
Northern fulmar	8	2–226
Shearwater spp.	127	25–646

The trend in Alaska hook-and-line fisheries (2004–2006) was decreasing Laysan albatross bycatch and increasing black-footed albatross bycatch, although most of the 2006 black-footed albatross bycatch occurred in the GOA sablefish individual fishing quota fishery.

The Aleutian Islands trawl fisheries had very low seabird bycatch in 2006, compared to the Bering Sea, and mostly northern fulmars and shearwater species were caught. The Atka mackerel trawl fishery was only observed to have taken shearwater species. Pacific cod trawl took two unidentified albatross species and some northern fulmars. From 1993 to 2004, northern fulmars and shearwater species made up the majority of seabird bycatch in the Aleutian Islands trawl fisheries, with a smaller amount of Laysan albatrosses. Albatross species were even less commonly taken in the Bering Sea trawl fishery from 1993 to 2004.

As discussed in chapter 2 of this EA/RIR, much of the Aleutian Islands fishing grounds is currently closed to some gear types and fisheries inside Steller sea lion critical habitat and beyond in the status quo alternative, including Sequam Pass. These closures provide protection from interaction with seabirds in near-shore areas and important passes by decreasing the potential for incidental takes of seabirds either through bycatch or vessel/cable strikes and the disruption of benthic habitat and prey availability inside the closures. Additionally, the use of seabird avoidance measures in the hook-and-line fisheries has drastically reduced seabird bycatch (NMFS 2007a). These measures are not anticipated to change, so this protection would continue to be provided under any of the alternatives in this analysis.

The effects of the status quo fisheries on the incidental takes of seabirds are detailed in the 2007 harvest specifications EIS (NMFS 2007b). These take estimates are small in comparison to seabird population estimates, and under the status quo alternative with the significance criteria set in this chapter, it is reasonable to conclude that the impacts would continue to be small and insignificant at the population level.

Prey availability and Benthic habitat

Current groundfish fisheries do not harvest seabird prey species in an amount that would decrease food availability enough decrease survival or reproductive success, nor do they impact benthic habitat enough to decrease seabird prey base to a degree that would decrease survival or reproductive success.

6.2.6 Alternative 2

Alternative 2 prohibits retention of Atka mackerel and Pacific cod in Areas 543, 542, and in critical habitat in area 541. In those areas, seabird interactions would likely decrease due to decreased fishing effort. If the trawl fleet is unable to catch their quota outside critical habitat in Area 541 or in the Bering Sea, the TAC would rollover to the hook-and-line fleet.

If the trawl fleet is not able to harvest their entire allocation as prescribed in Alternative 2, and that TAC is rolled over to the hook-and-line fleet, there could be additional effects to seabirds.

Incidental Take

As discussed earlier, hook-and-line fisheries have a much higher seabird interaction rate than trawl fisheries, and interactions with short-tailed albatross are more likely in the Aleutian Islands than in the Bering Sea. However, given the current take estimates as described above, an increase in effort from a roll-over is unlikely to cause significant effects to seabirds at the population level. Vessels would be required to continue to use seabird avoidance measures which have drastically reduced interactions.
and fish outside closed areas.

Prey availability and Benthic habitat

Decreased fishing effort could further decrease any removals of seabird prey species and further mitigate any effects on benthic habitat. Even if TAC is rolled-over to hook-and-line fleet, these changes are not expected to be very different from the current fisheries and are not likely to cause decreased survival or reproductive success.

6.2.7 Alternative 3

While more conservative than status quo, Alternative 3 closes less fishing grounds than Alternative 2 and has a seasonal component. This alternative closes 543, and closes critical habitat in 542 to all but non-trawl gear in the second half of the year. There is also a seasonal component to the closures in critical habitat in area 541: non-trawl gear can fish in the second half of the year and trawl gear can fish in the first half. Unfortunately, little information is available on the seasonal use of the habitat in the Aleutian Islands by seabirds. All of the tagged short-tailed albatross satellite tagging data is in the months of June through November, so we can use that limited sample size of birds to inform us about their behavior during the time that the hook-and-line fleet would be operating under this alternative.

The effects under this alternative would be similar to those under Alternative 2. Any benefits to seabirds from closing fishing grounds would likely be mitigated by additional effort in other places.

Incidental Take

These changes in fisheries effort are not likely to cause significant changes in the amount of seabird takes, and are not likely to cause a level of take that would population level impact.

Prey availability and Benthic habitat

Decreased fishing effort could further decrease any removals of seabird prey species and further mitigate any effects on benthic habitat. Even if TAC is rolled-over to hook-and-line fleet, these changes are not expected to be very different from the current fisheries and are not likely to cause decreased survival or reproductive success.

6.2.8 Cumulative Effects

Cumulative impacts are defined in federal regulations (40 CFR 1508.7) as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant action taking place over a period of time.

In this case, changes in management of the Alaskan groundfish fisheries represent sequential actions that may, or may not, overlap in time. Each policy change contributes an increment to the total cumulative effect, while working in combination with the effects of other fisheries, other human activities, and natural phenomena. Because this analysis found that effects were limited to those on seabirds, this cumulative effects analysis is also limited to seabirds.

A detailed discussion of cumulative effects of the status quo fisheries on seabirds can be found in section 4.13 of the PSEIS (NMFS 2004a) and section 9.1 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b). The PSEIS's cumulative effects analyses describe the potential direct and indirect effects of groundfish fishing on seabirds, identify external factors that may have additive or synergistic effects, and evaluate the significance of the effects. Section 9.3 of the groundfish EIS has the latest information on potential future actions and the impacts on seabirds.

Section 4.3.3 of the PSEIS (NMFS 2004a) provides a rationale for the consideration of potential direct and indirect fishery effects on different seabird taxonomic groups. This analysis displays only those

effects that are additional and/or attributable to promulgation of revised regulations for seabird avoidance measures in the hook-and-line fisheries off Alaska to reduce incidental take of the short-tailed albatross (*Phoebastria albatrus*) and other seabird species. The environmental issues include direct effects of gear use and entanglement/entrapment of non-target organisms in active fishing gear. The intended effect of the proposed regulatory amendment is to maintain current protections for seabirds by using seabird avoidance measures where they are needed due to known fishery and seabird interactions.

Past effects on seabird species include hunting and harvesting for feathers, eradication of nests, the relocation in military programs of adult birds to reduce the interaction of seabirds with military aircraft, the introduction of new species (such as rabbits) into nesting habitat, and predation by introduced species such as rats. Fisheries outside of Alaska also have likely contributed to population decline. These stressors have affected some species more than others, including black-footed albatross, short-tailed albatross, red-legged kittiwakes, and Kittlitz's murrelet (Table 6-9).

Table 6-8 Stressors on seabird species of concern in Alaska.

Human activity stressor	Species affected
Gillnet fisheries	Kittlitz's murrelet, Steller's eider
Oil spills and leaks	Kittlitz's murrelet, red-legged kittiwake, short-tailed albatross
Other hook-and-line fisheries	black-footed albatross
Tourism/vessel traffic	Kittlitz's murrelet
Feather hunting	short-tailed albatross, black-footed albatross
Ingestion of plastics	short-tailed albatross, black-footed albatross, Laysan albatross
Collisions with fishing vessels	short-tailed albatross, Steller's eider, spectacled eider
Introduced species	black-footed albatross, red-legged kittiwake
Military eradication programs	black-footed albatross, Laysan albatross

The requirement of the use of seabird protection measures in previous regulations on hook-and-line fisheries in Alaska has decreased fishery bycatch rates substantially since 2001.

The 2007 Alaska Groundfish Harvest Specifications EIS identified the following future actions that could impact seabirds: ecosystem-sensitive management, fisheries rationalization; traditional management tools; actions by other federal, state, and international agencies; and private action (NMFS 2007b). In nearly all cases, future actions were likely to reduce the impacts on seabirds, except for subsistence harvest.

Current and future threats to seabirds other than those analyzed in this document include collisions with aircrafts, vessels, and cables on fishing vessels, plastics ingestion, oil spills, ship bilge dumping, high seas driftnet and gillnet fisheries, and increased flightseeing near glaciers and tour boat traffic (specifically for Kittlitz's murrelets).

The effects of the past, present, and reasonably foreseeable future actions on seabirds in combination with the potential effects of the alternatives and options for this action are not likely to result in substantial changes in seabird populations; therefore, the cumulative impacts are insignificant.

6.2.9 Summary of Effects

Many seabird species use the marine habitat of the Aleutian Islands, including several species of conservation concern. Some species are taken by hook-and-line gear, some are occasionally taken by cable or vessel strikes or become entangled in trawl nets, and some species depend on benthic habitat that is disrupted by pelagic and non-pelagic trawling. However, Alaska Fisheries Science Center estimates

that seabird takes are few and infrequent in relation to seabird population total estimates. Moreover, recent modeling suggests that even a large increase in incidental takes of short-tailed albatross by interactions with trawl cables would have negligible effects on the recovery of the species. The spatial and temporal effects of non-pelagic trawling on benthic habitat are not yet well understood, although undisturbed areas seem to produce more clam species on which eider species are dependent.

The impacts on seabirds from each of the alternatives are summarized below in Table 6-10. Although the action alternatives may affect seabirds, NMFS has determined that all effects (both positive and negative) would be insignificant.

Table 6-9 Summary of impacts to seabirds from alternatives in this analysis.

Alternative	Impact on seabird populations in Alaska waters
Alternative 1	Seabird takes and disruptions to benthic habitat and prey availability are at low levels and are mitigated (to some degree) by current spatial restrictions on the fisheries in the Aleutian Islands. Insignificant effects.
Alternative 2	Little if any insignificant impacts to seabirds from additional closures and potential shifting of effort.
Alternative 3	Similar insignificant effects to Alternative 2.

6.3 References

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7.0 HABITAT

7.1 Status of Habitat

Descriptions of the Aleutian Islands habitat are in the EIS for Essential Fish Habitat Identification and Conservation (NMFS 2005) and in the Habitat Areas of Particular Concern (HAPC) EA (NMFS 2006) and are incorporated by reference. Habitat of the Aleutian Islands has complicated mixes of substrates, including a significant proportion of hard substrates (pebbles, cobbles, boulders, and rock), but data are not available to describe the spatial distribution of these substrates. Therefore, it is difficult to assess habitat complexity in terms of specific substrates. Some information on vulnerable or fragile habitats can be surmised through the NMFS groundfish surveys and from observer data from the Alaska Fisheries Science Center. NMFS conducts groundfish surveys in the Aleutian Islands every three years, and also samples catch from commercial vessels. During the course of these surveys and commercial sampling any sponge or corals are documented, if possible, at the genus level. However, survey and observer data are not intended specifically to sample these species or their habitats.

7.2 Effects on Habitat

The issues of primary concern with respect to the effects of fishing on benthic habitat are the potential for damage or removal of fragile biota used by fish as habitat and the potential reduction of habitat complexity, benthic biodiversity, and habitat suitability. Habitat complexity is a function of the structural components of the living and nonliving substrate and could be affected by a potential reduction in benthic diversity from long-lasting changes to the species mix. Many factors contribute to the intensity of these effects, including the type of gear used, the type of bottom, the frequency and intensity of natural disturbance cycles, and the history of fishing in an area. This process is presented in more detail in section 3.2 in the HAPC EA (NMFS 2006). A specific description of the effects of bottom trawling on habitat is in section 3.2.1 of the HAPC EA and is incorporated by reference.

Based on the information available to date, the predominant direct effects caused by bottom trawling include smoothing of sediments, moving and turning of rocks and boulders, resuspension and mixing of sediments, removal of seagrasses, damage to corals and sponges, and damage or removal of epibenthic organisms (ICES 1973; Hutchings 1990; Auster et al. 1996; Heifetz 1997; Lindeboom and de Groot 1998; McConnaughey et al. 2000). Trawls affect the seafloor through contact of the doors and sweeps, footropes and footrope gear, and the net sweeping along the seafloor (Goudey and Loverich 1987). Trawl doors leave furrows in the sediments that vary in depth and width depending on the shoe size, door weight, and seabed composition. The sweeps, footropes, and net can disrupt benthic biota and dislodge rocks. Larger seafloor features or biota are more vulnerable to fishing contact, so larger diameter, lighter footropes may reduce damage to some epifauna and infauna (Moran and Stephenson 2000). An Alaska-based fishery impacts assessment model analyzes the effect of fishing gears on habitats, including fragile biota. This model is Appendix B of the Essential Fish Habitat environmental impact statement (NMFS 2005).

Hook-and-line and pot gear may also damage benthic habitat by contact with sedentary bottom dwelling organisms (e. g., seawhips, corals, and sponges) (Sections 3.4.3.2.4 and 3.4.3.2.5 in NMFS 2005). Hook-and-line gear can snare coral and sponges and damage or remove these organisms during gear retrieval. Pots can crush or dislodge benthic organisms as the pots are set or as they are retrieved and dragged across the bottom.

7.3 Significant Criteria for Habitat

Criteria used in this EA/RIR to evaluate effects of the proposed action on habitat are provided in Table 7-1. The reference point against which the criteria are applied is the current size and quality of marine benthic habitat and other essential fish habitat in the Aleutian Islands subarea and are incorporated from the HAPC EA (NMFS 2006). The criteria are grouped into four categories:

1. Mortality and damage to living habitat species: Damage to or removal of living habitat species by direct contact with fishing gear;
2. Modification of non-living substrate by direct contact with fishing gear (non-living substrates such as rock and cobble);
3. Modification of the community structure in terms of benthic biodiversity; and
4. Modification of habitat suitability to support healthy fish populations.

Each of the criteria was assessed qualitatively, due to the lack of existing habitat data. Specifically, the second category, "modifications to nonliving substrate by gear" is somewhat hypothetical, as problems have been identified in assessing impacts for fishing gears. The third category identifies effects from fishing that may result in a change in the biodiversity within the habitat area. Intense or high frequency fishing activities within a relatively small area may result in a change in diversity by removing resident species and by attracting opportunistic fish species that feed on injured or uncovered marine organisms disturbed in the wake of the tow.

Specific impacts to habitat from different management regimes are very difficult to predict. The ability to predict the potential effects on benthic habitat from mitigation measures that change the geographical and seasonal patterns of fishing depends on having detailed information regarding habitat features, life histories of living substrates, the natural disturbance regime, and how fishing with various gear types at different levels of intensity affects different habitat types.

Several simplifying assumptions were made:

1. Disturbances, such as fishing, in sensitive habitats add additional stress on areas with slow recovery times and fragile sessile marine organisms.
2. Closing areas to disturbances benefits benthic habitat, presumably by allowing it to return to a condition similar to pre-fishing effects.
3. Removal or disruption of non-living structure, such as boulders, may remove attachment substrate for species, such as Primnoa coral species.
4. If more area is restricted or closed to fishing, fewer alterations and disturbances to marine habitat from fishing are expected. Conversely, increasing the fishing effort in an area will place additional stress on benthic habitat.
5. Management measures that propose to protect one area will likely result in benefits to that area, with potential for increased stress on habitats elsewhere.

Table 7-1 Criteria used to determine significance of effects on habitat.

Effect	Criteria			
	Significantly Negative (-)	Insignificant (I)	Significantly Positive (+)	Unknown (U)
Habitat complexity: Mortality and damage to living habitat species	Substantial increase in mortality and damage; long-term irreversible impacts to living habitat species.	Likely not to substantially change mortality or damage living habitat species.	Substantial decrease in mortality or damage to living habitat species.	Information, magnitude, and/or direction of effects are unknown.
Habitat complexity (non-living substrates such as gravel, sand, and shell hash)	Substantial increase in the rate of removal or damage of non-living substrates.	Likely not to substantially change, alter, or damage non-living substrates.	Substantial decrease in the rate of removal or damage of non-living substrates.	Information, magnitude, and/or direction of effects are unknown.
Benthic biodiversity	Substantial decrease in community structure from baseline.	Likely not to substantially change community structure.	Substantial increase in community structure from baseline.	Information, magnitude, and/or direction of effects are unknown.
Habitat suitability	Substantial decrease in habitat suitability over time.	Likely not to substantially change habitat suitability over time.	Substantial increase in habitat suitability over time.	Information, magnitude, and/or direction of effects are unknown.

7.4 Long Term Effects Indices

Table 7-2 provides the long-term effects indices (LEIs) for Bering Sea and Aleutian Islands groundfish fisheries that may be affected by this action. The LEIs are based on the fisheries in 2005. The Atka mackerel fishery impacts at that time resulted in greater habitat reductions than other groundfish fisheries in the Aleutian Islands. This analysis has not been updated since the implementation of habitat conservation measures for the Aleutian Islands and Bering Sea so it is likely that these effects are less today than shown in the table.

Table 7-2 2005 Groundfish Fisheries LEI (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types.

	Percent Reduction of Habitat [General Distribution (95%) and Concentration (75%)]											
	% of Area		Infauna Prey		Epifauna Prey		Living structure		Non-living Structure		Hard Coral	
Habitat	(95%)	(75%)	(95%)	(75%)	(95%)	(75%)	(95%)	(75%)	(95%)	(75%)	(95%)	(75%)
Pacific Cod												
AI Deep	4	2	1	1	1	1	5	8	3	5	11	19
AI Shallow	4	4	1	1	1	1	8	10	5	6	19	24
BS Mud	7	6	0	0	0	0	1	1	0	0	0	0
BS Sand	21	23	1	1	1	1	6	7	1	1	0	0
BS Sand/Mud	32	36	2	2	2	2	11	13	2	2	0	0
BS Slope	2	3	2	2	2	2	10	10	3	3	0	0
Atka Mackerel												
AI Deep	33	57	2	3	2	3	15	20	10	13	32	40
AI Shallow	44	50	1	2	2	3	14	20	8	13	30	40
Yellowfin Sole												
BS Sand	53	61	1	0	0	0	5	5	0	0	0	0
BS Sand/Mud	43	39	2	3	2	3	13	18	1	2	0	0
Rock Sole												
BS Sand	28	37	1	1	1	1	6	6	1	1	0	0
BS Sand/Mud	37	41	2	3	2	2	13	15	2	2	0	0
Arrowtooth Flounder												
BS Sand/Mud	33	34	3	4	2	3	16	20	2	3	0	0
BS Slope	3	5	2	3	2	2	10	12	3	3	0	0

Source: Table B.3-3 in NMFS 2005

In 2005, the EFH EIS concluded that despite persistent disturbance to certain habitats, the effects of the Alaska groundfish fisheries on EFH are minimal because the analysis found no indication that continued fishing activities at the rate and intensity in 2005 would alter the capacity of EFH to support healthy populations of managed species over the long term. Even though this conclusion did not require minimizing fishing impacts, extensive habitat protection and conservation measures have been adopted for the Aleutian Islands and Bering Sea subarea (see Chapter 2, section 2.1.1, 71 FR 36692, June 28, 2006, and 73 FR 43362, July 25, 2008). The effects of the Aleutian Islands and Bering Sea groundfish fisheries habitat conservation measures were analyzed in previous NEPA analysis (NMFS 2005 and 2008). These habitat conservation measures were determined to have insignificant effects on habitat and these conclusions are incorporated by reference. Therefore, Alternative 1 is likely to have insignificant effects on habitat complexity of living and nonliving structures, benthic diversity, and habitat suitability.

7.5 Effects of Alternative 2 and 3

In Alternatives 2 & 3, large portions of the Central and Western Aleutian Islands would be closed to fishing for Atka mackerel and Pacific cod, which would likely result in benefits to habitat in those areas. Detailed information regarding the areas closed to fishing for each alternative can be found in Chapter 2, and information regarding the likely outcome of changes in fishing effort can be found in Chapter 10.3. Alternatives 2 and 3 would have the same habitat effects in Area 543 as no Pacific cod or Atka mackerel retention would be allowed in this area under both alternatives. Nonpelagic trawling for Atka mackerel and Pacific cod would not occur in Area 543 and 542 under Alternative 2. Alternative 3 would allow for nonpelagic trawling outside of critical habitat in Area 542. Hook-and-line and pot fishing for Pacific cod in area 542 would be limited to outside of 10 nm of critical habitat under Alternative 3. Atka mackerel fishing would not occur in critical habitat in Area 541 under Alternatives 2 and 3. Alternative 2 would also prohibit Pacific cod fishing inside critical habitat in Area 541 but Alternative 3 would allow Pacific cod trawling in Area 541 outside of 10 nm of critical habitat. Alternative 3 allows for more trawling and more hook-and-line and pot fishing in the Aleutian Islands subarea than Alternative 2, which allows for more potential for habitat impacts by fishing gear than Alternative 2 but less than Alternative 1.

Due to the relatively large size of the areas closed to fishing and the substantial fishing effort in those areas, adjacent areas either in the Aleutian Islands or Bering Sea will likely support some level of the fishing being displaced under Alternatives 2 and 3 (Section 10.3.3). It is then possible to assume that some fishing grounds would be fished with more frequency, potentially increasing direct impacts. However, based on existing habitat conservation and protection measures for the Aleutian Islands and Bering Sea subareas, increased fishing effort in habitats currently fished would likely not be significantly higher than already exists, and the types of habitat impacted would not change substantially.

Fish stocks may rely on habitats that may be impacted by the shift of fishing under Alternatives 2 and 3 for some stage of their life history. It is not likely that changes would occur to fish populations compared to the status quo as the 2005 EFH EIS found that in no case were the effects of fishing from any gear type more than minimal or not temporary in nature (NMFS 2005) and the current fisheries have been modified to further minimize the effect of fishing on habitat.

Because much of the primary fishing ground for both Atka mackerel and Pacific cod are closed under both alternatives in the Western and Central Aleutian Islands, the positive changes in LEI (values are likely to tend towards 0) are likely to be relatively high. The fisheries participants may shift to Bering Sea yellowfin and rock sole to replace Aleutian Island cod and Atka mackerel fisheries. These flatfish fisheries are prosecuted on sand or sand/mud habitats, which is much less vulnerable than the hard bottom coral-dominated ecosystem in the Aleutian Islands.

Due to the relatively small size of area that is open to fish in area 542 under Alternative 3, adjacent areas will likely support the amount of fishing being displaced, as Pacific cod is managed BSAI-wide. It is possible that some fishing grounds would be fished with more frequency, with the potential for increased direct impact. However, it is likely that the increased fishing effort in habitats currently fished would not be much greater than effort that already exists and the impacts would be minimized by the existing habitat conservation and protection measures.

Habitat Complexity (living habitat): Several species of high relief coral have been documented in the Aleutian Islands. Fish and crab have been documented in situ on or near the high relief living structures. Fishery data and the LEI analysis conducted for the EFH EIS suggest that fisheries conducted in the Aleutian Islands have a small impact on these features. Portions of the Aleutian Islands subarea would be closed from future Atka mackerel and Pacific cod fishing disturbances, further reducing potential impacts from those identified in NMFS (2005). Therefore, a slight benefit to these habitats is expected; however, the extent of this benefit is not likely to cause a substantial increase in living habitat complexity, and therefore the effects are likely insignificant.

Habitat Complexity (non-living): Little information is available to assess non-living structures in the Aleutian Islands. Three-dimensional contour imagery is available for several small areas; however, comprehensive bottom sampling has not occurred. Substrate information reveals that the predominate types include hard bedrock, soft substrates, and a range of both hard and soft substrates. A fisheries gear assessment model (Fujioka 2006), discusses that harder substrates, such as bedrock, are able to withstand direct impacts from bottom contact gear. The model also suggests that fishing impacts on soft substrates can leave trenches and gear marks. Therefore, hard and soft non-living substrate could be altered minimally from bottom contact fishing, and it is unlikely that any substantial alteration of the physical structure occurs from removing fishing activity. Therefore, the effect to non-living habitat is insignificant.

Benthic Biodiversity: While species information does exist in the Aleutian Islands, the direct relationship between resident fish, prey, and other species is unknown. A prohibition of bottom contact gear may reduce the effect on the benthic community, and is likely to protect the benthic community and decrease the likelihood of changing the community structure. A substantial increase in structure is not anticipated with Alternatives 2 and 3, and therefore the effects of these alternatives on benthic biodiversity are likely insignificant.

Habitat Suitability: Information is not available to assess the suitability of habitat in the Aleutian Islands. Regardless, Alternatives 2 and 3 are likely to preserve the suitability of habitat but are not expected to enhance habitat to cause a substantial increase in suitability. Therefore, the effect the alternatives on habitat suitability is likely insignificant.

7.6 Cumulative Effect

7.7 Summary of Effects

As previously stated, the EFH EIS (NMFS 2005) found no substantial adverse effects to habitat in the Aleutian Islands due to fishing activities; Alternatives 2 and 3 would remove a substantial portion of any localized effects that were occurring under the status quo alternative. The potential effects on an area would be constrained by the amount of TAC available (particularly for Atka mackerel) and by the existing habitat conservation and protection measures. It is possible that impacts may increase slightly in other areas due to displaced fishing effort, but in context of the entire Aleutian Islands and Bering Sea, the effects of either Alternatives 2 or 3 on habitat are beneficial in the Aleutian Islands subarea, but not

substantially so. Alternative 3 would result in more potential for bottom habitat impacts in Areas 542 and 541 as more fishing would be allowed under this alternative compared to Alternative 2 but this fishing would be conducted within the annual harvest specifications and under the current habitat conservation and protection measures. For these reasons, effects to habitat complexity for both living and non-living substrates, benthic biodiversity, and habitat suitability are predicted to be insignificant for all habitat types evaluated under Alternatives 2 and 3.

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8.0 ALEUTIAN ISLANDS ECOSYSTEM

The Aleutian Islands is a complex ecosystem. The Council created the Aleutian Islands Fishery Ecosystem Plan (AI FEP, NPFMC 2007) as an educational tool and resource that provides the Council with an 'early warning system' and an ecosystem context to fishery management decisions affecting the Aleutian Islands area. The scope of the AI FEP encompasses all Federal fisheries within the area, and considers the interactions of Federal and State fisheries with each other, and with other components of the ecosystem, encompassing relationships among fisheries, prey and predators of target and non-target species, their habitat, the impacts of climate, and the cumulative impact on ecosystems from all fisheries and non-fishing impacts.

The AI FEP provides an understanding of important relationships among ecosystem components, thereby assisting the Council to better integrate ecosystem principles into fishery management. The AI FEP also identifies areas of uncertainty, describes how the Council may currently be addressing the associated risks, and provides suggestions for other tools the Council may wish to consider.

8.1 Description of the Ecosystem

This EA incorporates by reference the information on the Aleutian Islands ecosystem provided in the AI FEP (NPFMC 2007). AI EFP Chapter 3 describes the ecosystem, beginning with a historical overview, and addressing the ecosystem's current physical, biological, socioeconomic, and management relationships. AI EFP Chapter 4 develops a framework of the key interactions that characterize the AI ecosystem, assesses risks, discusses the implications of the risk assessment, and identifies indicators for monitoring each interaction and future research needs.

8.1.1 Recent Ecosystem Trends

The following ecosystem trends are summarized from the Ecosystem Considerations for 2010 (NPFMC 2009).

8.1.1.1 Climate and Physical Environment Trends

- The North Pacific atmosphere-ocean system from fall 2008 through summer 2009 featured relatively cool sea surface temperature (SST) along its northern flank extending from the BS through the GOA to off the coast of California.

- Consequences of a weak Aleutian low during the past winter and spring included relatively cold conditions and heavy sea ice for the EBS, and mostly upwelling-favorable wind anomalies from the GOA to the Pacific Northwest.

- The 2008/09 winter included a La Nina of modest amplitude; the higher latitude response to the tropical Pacific was stronger than that during the past winter, even though the La Nina was weaker.

- The summer of 2009 featured a shift in the wind pattern and an overall moderation of coastal SSTs.

- El Nino conditions developed in the summer of 2009; this will likely persist and probably strengthen into 2010. This is liable to bring about a positive state for the Pacific Decadal Oscillation and relatively warm SSTs along the west coast of North America.

- Eddy kinetic energy (EKE) in the AI was lower than average in 2008 and in the spring of 2009, suggesting possibly reduced volume, heat, salt, and nutrient fluxes to the BS compared to periods of high EKE.

- The western AI experienced southerly wind anomalies early in the period and northerly wind anomalies during the past summer, 2009. The SST here was warm during the latter part of 2008, cooling to near normal by summer 2009 relative to seasonal norms.

- The eastern portion of the Alaska Peninsula and AI experienced suppressed storminess during winter and spring 2009; the sense of the wind anomalies since late 2008 is from the east to southeast, which is associated with enhanced transports through Unimak and the other shallow passes in the eastern AI.

8.1.1.2 Ecosystem Trends

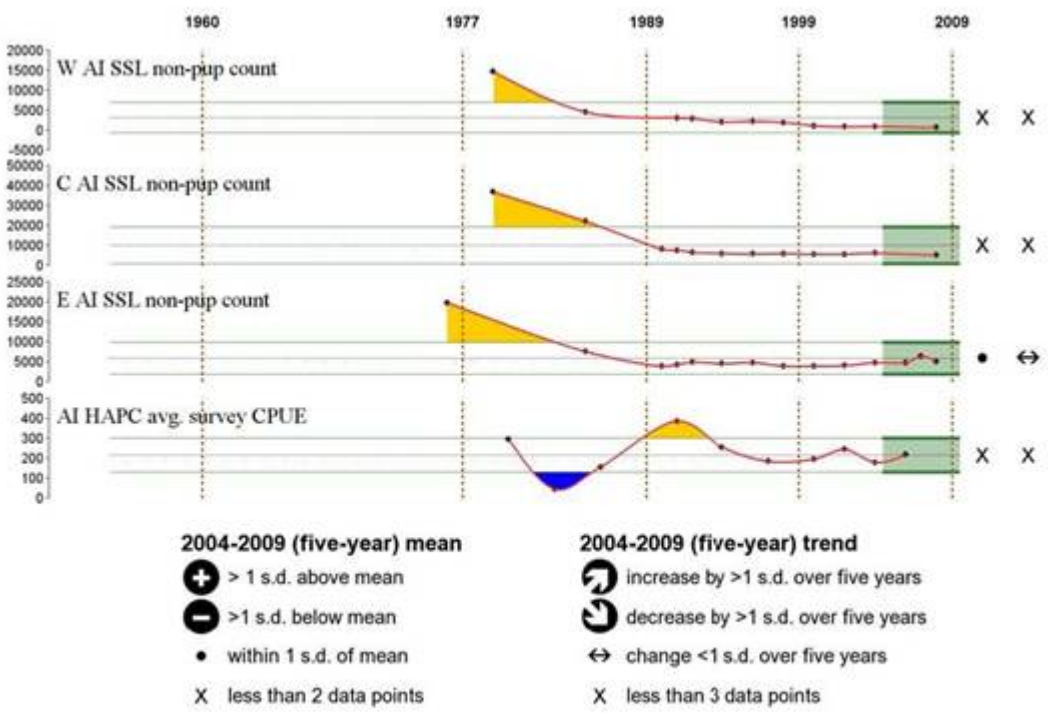

Figure 8-1 Ecosystem trends – Aleutian Islands.
Green shaded area shows +/- one standard deviation of time series over measured time period.

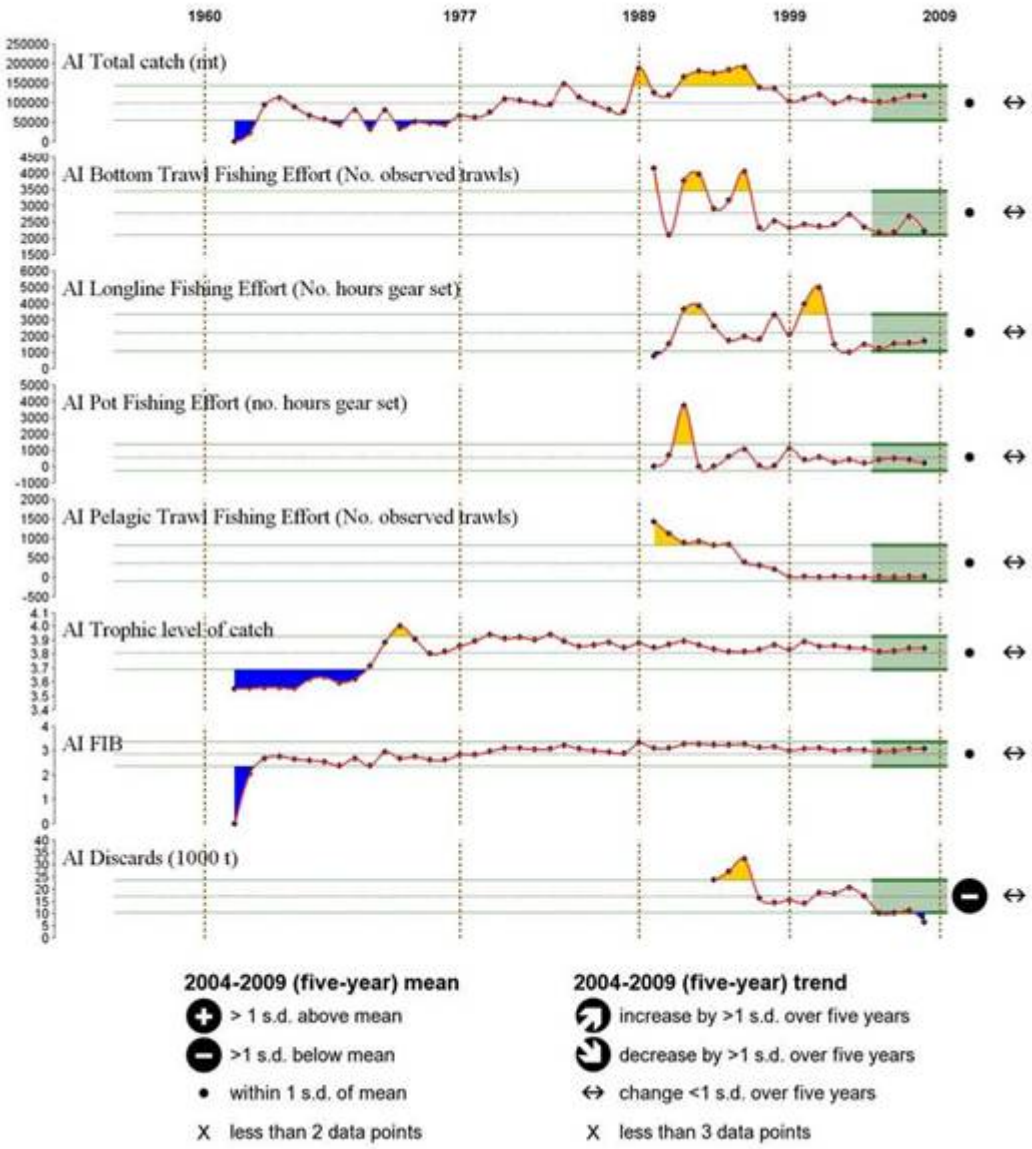

Figure 8-2 Fishing and fisheries – Aleutian Islands.
Green shaded area shows +/- one standard deviation of time series over measured time period.

8.2 Effects on Ecosystem Relationships

8.2.1 Significant Criteria for Ecosystem Relationships

The proposed action could affect the marine ecosystem through changes in spatial removals of fish biomass or alteration of the habitat. Three primary means of measurement of ecosystem change are evaluated here: predator-prey relationships, energy flow and balance, and ecosystem diversity. The criteria used to evaluate the significance of the effects on the ecosystem from the proposed action are

provided in Table 8-1. These criteria are based on the criteria used in the EA for the groundfish harvest specifications (NMFS 2006), which provided an overall analysis of the effects of groundfish fishing on the ecosystem and is applicable for this EA/RIR. The reference point for predator-prey relationships against which the criteria are compared are fishery induced changes outside the natural level of abundance or variability for a prey species relative to predator demands. The reference point for energy flow and balance will be based on bottom gear effort (qualitative measure of unobserved gear mortality, particularly on bottom organisms) and a quantitative assessment of trends in retained catch levels over time in the area. The reference point for ecosystem diversity will be a qualitative assessment whether removals of one or more species (target, non-target) effects overall species or functional diversity of the area.

Table 8-1 Significance Thresholds for Fishery-induced Effects on Ecosystem Relationships.

Effect	Criteria			
	Significantly Negative (-)	Insignificant (I)	Significantly Positive (+)	Unknown (U)
Predator-prey relationships	A decline outside of the natural level of abundance or variability for a prey species relative to predator demands.	No observed changes outside the natural level of abundance or variability for a prey species relative to predator demands	Increases of abundance or variability for a prey species relative to predator demands	Magnitude or direction of effects are unknown
Energy flow and balance:	Long-term changes in system biomass, respiration, production or energy cycling, due to removals.	No observed changes in system biomass, respiration, production or energy cycling, due to removals.	Increases in system biomass, respiration, production or energy cycling, due to lack of removals.	Magnitude or direction of effects are unknown
Ecosystem Diversity	Removals from area decreases either species diversity or the functional diversity outside the range of natural variability. Or loss in one or more genetic components of a stock that would cause the stock biomass to fall below minimum biologically acceptable limits	No observed changes outside the natural level for species diversity, functional diversity or genetic components of a stock.	Non-removal from the area increases the species diversity or functional diversity or improves the genetic components of a stock.	Magnitude or direction of effects are unknown

Fisheries can remove predators, prey, or competitors and thus alter predator-prey relationships relative to an unfished system. Fishing has the potential to impact food webs, but each ecosystem must be examined to determine how important the potential impacts to the food webs are for that ecosystem. A review of fishing impacts to marine ecosystems and food webs of the North Pacific under the status quo and other alternative management regimes was provided in the programmatic groundfish SEIS (NMFS 2004) and in Appendix C of NMFS 2007.

Fishing may alter the amount and flow of energy in an ecosystem by removing energy and altering energetic pathways through the return of discards and fish processing offal back into the sea. From an ecosystem point of view, total fishing removals are a small proportion of the total system energy budget and are small relative to internal sources of interannual variability in production.

Fishing can alter different measures of diversity. Species level diversity, or the number of species, can be altered if fishing removes a species from the system. Fishing can alter functional or trophic diversity if it

selectively removes a trophic guild member and changes the way biomass is distributed within a trophic guild. Fishing can alter genetic level diversity by selectively removing faster growing fish or removing spawning aggregations that might have different genetic characteristics than other spawning aggregations. Large, old fishes may be more heterozygous (i.e., have more genetic differences or diversity) and some stock structures may have a genetic component, thus one would expect a decline in genetic diversity due to heavy exploitation.

8.2.2 Effects on the Ecosystem

[placeholder for direct and indirect effects of the alternatives on the Aleutian Islands ecosystem, based on significance criteria and a synthesis of the impacts on the environmental components analyzed in this EA]

8.2.3 Cumulative Effect

[placeholder for cumulative effects]

8.2.3.1 Climate Effects on Ecosystem Relationships and Ecosystem Trends

The Aleutian Islands are subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species. Regime shifts are natural phenomena that have important implications for future human actions in the Aleutian Islands.

Predicting regime shifts will be difficult until the mechanisms that cause the shifts are better understood. It will require better understanding of the probability of certain climate states in the near-term and longer term, and the effects of this variability on individual species' production, distribution, and food webs. Future ecosystem assessments may integrate various climate scenarios into the multispecies and ecosystem forecasting models by using assumptions about the effects of climate on average recruitment of target species.

8.2.4 Summary of Effects

8.3 References

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8.4 Preparers and Persons Consulted

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9.0 ENVIRONMENTAL CONCLUSIONS

10.0 REGULATORY IMPACT REVIEW

10.1 Introduction[1]

In April 2006, National Marine Fisheries Service (NMFS) Alaska Region, Sustainable Fisheries Division (SFD, action agency), reinitiated Endangered Species Act (ESA) Section 7 consultation with NMFS Alaska Region, Protected Resources Division (PRD, consulting agency), on the potential effects of the Alaska groundfish fisheries on ESA-listed species and their designated critical habitat (NMFS 2006a). Consultation was reinitiated in consideration of new scientific information and changes to the fisheries since the last biological opinion on the groundfish fisheries was supplemented in 2003 (NMFS 2003). After reviewing all ESA-listed species within NMFS's jurisdiction that may be affected by the Alaska groundfish fisheries and after consulting with PRD, SFD determined that the Alaska groundfish fisheries were likely to adversely affect Steller sea lions and their designated critical habitat, humpback whales, and sperm whales; therefore, formal consultation was required. In formal Section 7 consultations, PRD reviews the status information for the species and designated habitat, environmental baseline information, and the potential effects of the action on the species and develops a biological opinion.

If the biological opinion concludes that the action is likely to jeopardize the continued existence or adversely destroy or modify designated critical habitat (JAM) for an ESA-listed species, the opinion would include a reasonable and prudent alternative (RPA) that must be implemented to avoid JAM. In July 2010, PRD completed a draft biological opinion on the Alaska groundfish fisheries (FMP biop) (NMFS 2010). The FMP biop found that additional changes to the Pacific cod and Atka mackerel fisheries in the Aleutian Islands are necessary to avoid the likelihood of JAM for the western distinct population segment (WDPS) of Steller sea lions and their designated critical habitat. This finding is based on the biological information of the WDPS of Steller sea lions and the potential effects of the groundfish fisheries on the WDPS of Steller sea lions and their critical habitat. The effects of the Alaska groundfish fisheries that are likely to result in JAM are located in the Western and Central sub-regions of the Aleutian Islands, as described in the 2008 Steller sea lion recovery plan (NMFS 2008).

The RPA to mitigate the effects of the groundfish fisheries on the WDPS of Steller sea lions is specific to the Atka mackerel and Pacific cod fisheries in Areas 543, 542, and 541 of the Aleutian Islands. This RPA provides the baseline for consideration of changes that could be implemented to ensure the WDPS of Steller sea lions are not likely to experience JAM because of the groundfish fisheries.

This regulatory impact review (RIR) provides a cost-benefit analysis of proposed changes to groundfish management. The analysis in this document addresses the statutory requirements of the Presidential Executive Order (E.O.) 12866.

10.1.1 What is a Regulatory Impact Review?

This RIR is required under E.O. 12866 (58 FR 51735, September 30, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following statement from the order:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and*

[1] This chapter provides an RIR for this action addressing the requirements of E.O. 12866. If an action alternative is chosen by the Council and Secretary, the action will be implemented with a direct final rulemaking. Thus an Initial Regulatory Flexibility Analysis is not required under the Regulatory Flexibility Act, and has not been prepared.

> *benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

E.O. 12866 further requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A significant regulatory action is one that is likely to –

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

10.1.2 Statutory Authority

NMFS manages the U.S. groundfish fisheries of the Bering Sea and Aleutian Islands Management Area (BSAI) in the exclusive economic zone off Alaska under the Fishery Management Plan (FMP) for Groundfish of the BSAI (NPFMC 2009). The North Pacific Fishery Management Council (Council) prepared, and the Secretary of Commerce (Secretary) approved, this FMP under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801, *et seq*.).

10.1.3 Purpose and Need

The purpose of this action is to implement revisions to the management of Aleutian Islands Atka mackerel and Pacific cod fisheries to ensure these fisheries are not likely to cause JAM for the WDPS of Steller sea lions and their critical habitat in consideration of existing fishery management programs. Consideration of the existing fishery management programs will ensure that any revisions implemented would provide the most efficient and effective solutions to meeting the requirements of the ESA. The proposed action would modify the Aleutian Islands Pacific cod and Atka mackerel fisheries such that the fisheries are not likely to jeopardize the continued existence of Steller sea lions or adversely modify or destroy their designated critical habitat. If more than one alternative accomplishes the primary purpose of this action, a secondary objective would be to modify the fisheries in a way that minimizes the economic and social costs that will be imposed on the commercial fishing industry and associated coastal communities.

The need for this federal action stems from several sources. First, NMFS has a responsibility to ensure that fishing activities authorized under the groundfish FMPs and implementing regulations are not likely to jeopardize the continued existence of any ESA-listed species or adversely modify or destroy its critical habitat. Second, in order for the Pacific cod and Atka mackerel fisheries to commence on January 1, 2010, NMFS must implement a suite of Steller sea lion protection measures—the RPA from the 2010 draft FMP biop or a different alternative that meets the same requirement to avoid the likelihood of JAM.

The commencement of a new fishing year and implementation of new harvest specifications must be done in compliance with the ESA. Without any action by NMFS, the Aleutian Islands Pacific cod and Atka mackerel fisheries prosecuted under the current Steller sea lion protection measures are likely to result in JAM, as determined by the FMP biop (NMFS 2010).

Finally, this action is needed to meet the Council's objective in its groundfish FMPs to maintain or adjust current protection measures as appropriate to avoid jeopardy of extinction or adverse modification to critical habitat for ESA-listed Steller sea lions (section 2.2.1 in NPFMC 2009). New information about potential interaction between Steller sea lions and the groundfish fisheries and new trend information have been taken into account in the draft FMP biop allowing for adaptive management of the groundfish fisheries.

This action is focused on the Aleutian Islands based on the population trends of the animals in sub-regions, as identified in the Steller sea lion recovery plan (NMFS 2008). The recovery plan divides Alaska waters into sub-regions for purposes of determining recovery. Area 543 is the Western Aleutian Islands sub-region and Areas 542 and 541 are the Central Aleutian Islands sub-regions. The recovery plan concluded that to achieve recovery, no two adjacent subareas may have significantly declining population trends for non-pups (NMFS 2008).

Steller sea lions occurring in the Aleutian Islands have experienced negative population trends (NMFS 2010). The negative population trends for non-pups in Areas 543, 542, and 541 would prevent the population from meeting the recovery criterion (NMFS 2008). The negative growth rates and counts in Areas 543, 542, and 541 indicate that the Steller sea lions in these areas are having difficulty maintaining or increasing their populations, and removal of potential fisheries effects is needed to ensure fisheries are not likely to result in JAM.

The remaining statistical areas for the groundfish fisheries in the Bering Sea and Gulf of Alaska (GOA) have positive or stable annual growth rates and positive counts for pups and non-pups. Therefore, additional Steller sea lion protection measures for the groundfish fisheries in the Bering Sea and GOA are not required in the RPA to ensure effects from the remaining groundfish fisheries are not likely to result in JAM for Steller sea lions and their designated critical habitat. Because of the overlap of Atka mackerel management between the Aleutian Islands and Bering Sea subareas, a minor change to the seasonal harvest of Atka mackerel in the Bering Sea subarea is included in the RPA. The total allowable catch (TAC) for Atka mackerel in Area 541 is combined with the Bering Sea subarea so that this allocation is managed as a unit. Any adjustments to the Atka mackerel fishery management in Area 541 potentially would need to be applied to the Bering Sea subarea. This concurrent change in the Bering Sea subarea is not necessary to prevent JAM, but is necessary to facilitate management. Because this seasonal change in the Bering Sea for Atka mackerel harvest could further distribute fishing effort in a manner beneficial to Steller sea lions and involves only a minor component of the Atka mackerel fishery, it is not considered a substantial change with discernable environmental effects. Thus, the action area analyzed in this Environmental Assessment/Regulatory Impact Review (EA/RIR) is focused on the Aleutian Islands subarea.

10.1.4 Alternatives

Chapter 2 of this EA/RIR provides a detailed description of, and explanation of the rationale for, the alternatives under consideration in this action. In summary, there are three alternatives:

Alternative 1 (Status Quo)

Under this alternative, no changes would be made to the current groundfish fisheries management in the Aleutian Islands. Chapter 2 provides a detailed description of the management measures that are proposed to be changed by this action (primarily the measures affecting the Atka mackerel and Pacific cod fisheries in the Aleutian Islands).

Alternative 2 (Enhanced Conservation Approach)

This alternative would use management measures for the Aleutian Islands Atka mackerel and Pacific cod fisheries to remove most of the potential adverse effects on Steller sea lions and their critical habitat. Alternative 2 would provide protection measures for Steller sea lions and their critical habitat no less stringent than currently implemented and provide additional measures at least as protective as the RPA in the FMP biop (NMFS 2010). The protection is greater in the areas where population growth has been the most negative (Areas 543 and 542 compared to Area 541). The enhanced conservation approach would facilitate NMFS's implementation by simplifying the area closures and seasonal management measures in Area 542 and 541 compared to critical habitat zone specific measures described in Alternative 3. Except for the changes described below, the current Steller sea lion protection measures (e.g., Pacific cod trawl season dates, no Atka mackerel directed fishing in critical habitat in Area 541) would remain unchanged.

Alternative 2 would—

<u>In Areas 542 and 543</u>:

- Prohibit retention of Atka mackerel and Pacific cod by federally permitted vessels, including those operating in State of Alaska (State) waters 0–3 nautical miles (nm).
- Establish TACs for Atka mackerel sufficient to support incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the Harvest Limit Area (HLA) (Area 543 and western portion of Area 542).
- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

<u>In Area 541 and the Bering Sea</u>:

- Close critical habitat in Area 541 to directed fishing for Pacific cod by federally permitted vessels.
- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Prohibit Pacific cod directed fishing in Area 541 November 1 through December 31. (This extends the current trawl season restriction to the nontrawl fishery.)

Under this alternative, the TAC for Atka mackerel in Areas 543 and 542 would be set at a level sufficient to support incidental catch in other directed groundfish fisheries (e.g., Pacific ocean perch). Pacific cod in Areas 543 and 542 would be placed on prohibited species status and closed to directed fishing. Currently, Pacific cod is managed under a single TAC for the BSAI so no area specific TAC to support incidental catch can be specified. Any retention of Atka mackerel or Pacific cod would be prohibited to remove any incentive to retain these species by operators of vessels targeting other groundfish species. Because no directed fishery for Atka mackerel would be allowed in Areas 543 and 542, the platoon management system and HLA would be removed from the regulations. Unless otherwise restricted by the State,

vessels not federally permitted may participate in the State-managed Pacific cod fisheries in waters 0–3 nm in those areas closed to directed fishing for Pacific cod by federally permitted vessels.

Alternative 3 (RPA Specific Approach)

Alternative 3 is a more specific application of fishery restrictions based on the management of the fisheries and the Steller sea lion foraging behavior, population trends, and the potential competition between the Atka mackerel and Pacific cod fisheries and Steller sea lions. This alternative is the same as the RPA described in the 2010 FMP biop (NMFS 2010), providing only the level of fishery restrictions necessary to ensure that JAM is not likely to occur for Steller sea lions and their designated critical habitat. Development of Alternative 3 considered current management of vessels under Amendment 80, historical harvest activities, and gear specific area closures and seasonal apportionments to disperse fishing over area and time. Unless otherwise specified in the alternative, all current Steller sea lion protection measures would continue to be implemented in the Aleutian Islands (e.g., Pacific cod seasonal apportionments; and pollock, Pacific cod, and Atka mackerel closures around rookeries and haulouts and in the Seguam foraging areas). Restrictions in State waters from 0–3 nm apply to federally permitted vessels. State-managed Pacific cod fisheries for vessels not federally permitted may occur in waters 0–3 nm unless otherwise restricted by the State.

Alternative 3 would—

<u>In Area 543</u>:

- Prohibit retention of Atka mackerel and Pacific cod.
- Establish a TAC for Atka mackerel sufficient to support the incidental discarded catch that may occur in other targeted groundfish fisheries (e.g., Pacific ocean perch).
- Eliminate the Atka mackerel platoon management system in the HLA.

<u>In Area 542</u>:

Groundfish

- Close waters from 0–3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels.

Pacific cod

- Close 0–10 nm zone of critical habitat to directed fishing by federally permitted vessels using nontrawl gear year round. Close critical habitat10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
- Close 0–20 nm zone of critical habitat year round to directed fishing by federally permitted vessels using trawl gear.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 542. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Set TAC for Area 542 to no more than 47 percent of acceptable biological catch.
- Close 0–20 nm critical habitat to directed fishing by federally permitted vessels year round.
- Change the Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.
- Eliminate the Atka mackerel platoon management system in the HLA.

In Area 541 and the Bering Sea:

Pacific cod

- Close 0–10 nm of critical habitat to directed fishing for Pacific cod by all federally permitted vessels year round.
- Limit the amount of catch that can be taken in the 10–20 nm area of critical habitat based on gear type used:
  - Close critical habitat 10–20 nm to directed fishing for Pacific cod using nontrawl gear by federally permitted vessels January 1 through June 10.
  - Close critical habitat 10–20 nm to directed fishing by for Pacific cod using trawl gear by federally permitted vessels June 10 through November 1.
- Prohibit Pacific cod fishing November 1 through December 31 in Area 541. (This extends this trawl gear restriction to nontrawl gear.)

Atka mackerel

- Change the Bering Sea/Area 541 Atka mackerel seasons to January 20 through June 10 for the A season and June 10 through November 1 for the B season.

10.1.5 History of this Action

Section 1.4.1 of this EA/RIR provides a detailed description of the history of ESA consultations leading to the July 2010 draft FMP biop. The Council scheduled a special meeting in August 2010, to review the draft FMP biop and to provide recommendations to NMFS on the alternatives for this EA/RIR.

The initial draft of this EA/RIR was provided to the Council for review by its Scientific and Statistical Committee (SSC), by its Advisory Panel (AP) and by the Council at the special August 2010 meeting. The Council, SSC, and AP provided opportunity for public comment during their review of the documents, and these comments were considered as each body developed their recommendations for NMFS's consideration.

The final draft of the EA/RIR is scheduled for Council review and recommendation of a preferred alternative at its October 2010 meeting. This Council meeting also will provide for public testimony for Council consideration in developing its recommendations on this action.

10.2 Background

The analysis in this RIR groups the fleets harvesting Atka mackerel and Pacific cod in the Aleutian Islands into four categories of vessels. The Amendment 80 trawl catcher/processor fleet is a small fleet of large vessels that fish using trawl gear and process their product on board. These vessels fish both Atka mackerel and Pacific cod. The term "Amendment 80" refers to the BSAI Fishery Management Plan Amendment that created the institutional structure under which this fleet has operated since 2008. This fleet sector is discussed in Section 10.2.2.[2]

Another fleet of catcher/processor vessels uses hook-and-line or pot gear to target Pacific cod. The catcher/processors fishing with these gears have been grouped into a "fixed gear" category for analysis.

[2] In the present analysis, the "Amendment 80 fleet" is defined to include to include trawl catcher processors fishing for Atka mackerel and/or Pacific cod in the Aleutian Islands. Thus, the fleet analyzed here actually includes one non-Amendment 80 vessel trawl catcher/processor, which has been grouped with these for analytical purposes.

This is because, in some years, there were relatively few of the vessels of one or the other of these types operating, and that might create confidentiality problems. These vessels are discussed in Section 10.2.3.

Catcher vessels targeting Pacific cod form a third group. These vessels operate with a range of gear types, including hook-and-line, jig, pot, and trawl. The largest part of the fleet, in both numbers of vessels and in volume of catch, is the trawlers. These vessels deliver to shoreside processors or motherships. These four gear types have also been grouped for the purpose of this discussion, again out of a concern for confidentiality issues. This group has been defined to include vessels fishing in Federal waters, or in state waters during a simultaneous "parallel" fishery. This group of vessels is discussed in Section 10.2.4.

A final group of vessels are those fishing in a state managed fishery in state waters. This fishery takes place when the federal fishery is closed. This fishery is described in Section 10.2.5.

10.2.1 Atka mackerel and Pacific cod sector allocations

Prior to 1992, Atka mackerel ABCs were allocated to the entire Aleutian Islands management area. In 1992, the Council recognized the need to disperse fishing effort throughout the range of the stock to minimize the likelihood of localized depletion because of increases in the ABC. In mid-1993, Amendment 28 to the BSAI Fishery Management Plan became effective, dividing the Aleutian Islands subarea into three districts at 177°W and 177°E for the purposes of spatially apportioning TACs. Since 1994, the BSAI Atka mackerel TAC has been allocated to the three regions based on the average distribution of biomass estimated from the Aleutian Islands bottom trawl surveys.

The Aleutian Islands Atka mackerel fisheries are almost exclusively prosecuted by catcher/processors using no pelagic trawl gear. The majority of catch is harvested by vessels that are now in the Amendment 80 sector. A total of 28 vessels qualified for Amendment 80, of which 24 applied for initial quota share in 2008. Information on the Amendment 80 program including participants and allocations is at http://alaskafisheries.noaa.gov/sustainablefisheries/amds/80/default.htm. Currently, the vessels are required to be registered with NMFS to fish inside the harvest limit area (HLA) in areas 542 and 543. NMFS publishes information bulletins on the web to notify owners and operators of registered vessels of their assignments for the A and B season Atka mackerel HLA fisheries in areas 542 and/or 543 (http://alaskafisheries.noaa.gov/index/infobulletins/infobulletins.asp?Yr=2010).

Since 2008 the following vessels have participated in the Aleutian Islands Atka mackerel fisheries: Amendment 80 cooperative - federal fishery permit number (FFP) 2134 Ocean Peace, FFP 3835 Seafisher, and FFP 2733 Seafreeze Alaska; Amendment 80 limited access - FFP 3423 Alaska Warrior, FFP 4093 Alaska Victory, FFP 2443 Alaska Juris, and FFP 3819 Alaska Spirit; BSAI trawl limited access sector - FFP 11770 Alaska Knight.

A description of the Atka mackerel TAC may be found in section 679.20(a)(8)(ii) and the final 2010 and 2011 harvest specifications for groundfish of the BSAI (http://alaskafisheries.noaa.gov/sustainablefisheries/2010_11hrvstspecs.htm). The Atka mackerel TAC is allocated to the Amendment 80 and BSAI trawl limited access sectors, after subtraction of the CDQ reserves, jig gear allocation, and ICAs for the BSAI trawl limited access sector and non-trawl gear. The allocation of the ITAC for Atka mackerel to the Amendment 80 and BSAI trawl limited access sectors is established in Table 33 to part 679 and § 679.91. Pursuant to § 679.20(a)(8)(i), up to 2 percent of the EAI and the BS Atka mackerel ITAC may be allocated to jig gear. The amount of this allocation is determined annually by the Council based on several criteria, including the anticipated harvest capacity of the jig gear fleet. Since 2008 it has been set at .05 percent. Table 10-1, below, describes the allocation of the Aleutian Islands Atka mackerel TAC among areas and sectors in 2010.

Table 10-1 Gear Shares, CDQ Reserve, Incidental Catch Allowance, and Amendment 80 Allocations of the BSAI Atka Mackerel TAC

2010 allocation by area			
Allocation	Eastern Aleutian District/Bering Sea	Central Aleutian District	Western Aleutian District
TAC	100%	100%	100%
CDQ reserve	10.7%	10.7%	10.7%
ICA (mt)	75	75	50
Jig[6]	0.05%	0	0
BSAI trawl limited access	10%	10%	0
Amendment 80 sectors	79.25%	79.30%	89.30%

Currently, the BSAI Pacific cod ABC and TAC are not allocated by subarea. However, the Council is considering the possibility of specifying separate TACs in the BS and AI subareas. A description of the Pacific cod TAC may be found in section 679.20(a)(7)(i) and (ii) and the final 2010 and 2011 harvest specifications for groundfish of the BSAI (http://alaskafisheries.noaa.gov/sustainablefisheries/2010_11hrvstspecs.htm). The right to harvest BSAI Pacific cod may be exercised anywhere in the BSAI that is not closed by regulation. The TAC is subdivided among different sectors, defined by gear type, vessel size, catcher/processor or catcher vessel status, and AFA status. The rules for the allocation of this TAC among the different sectors are described in Table 10-2 below.

Table 10-2 Gear and Sector Allowances of the BSAI Pacific Cod TAC

Sector	Non-CDQ TAC	Overall TAC
Jig vessels	1.4	1.3
Hook-and-line/pot catcher vessels < 60 ft. LOA	2	1.8
Hook-and-line catcher vessels >= 60 ft. LOA	0.2	0.2
Hook-and-line catcher/processors	48.7	43.5
Pot catcher vessels > 60 ft. LOA	8.4	7.5
Pot catcher/processors	1.5	1.3
AFA trawl catcher/processors	2.3	2.1
Non-AFA trawl catcher/processors	13.4	12.0
Trawl catcher vessels	22.1	19.7
Total	100	89.3

An incidental catch allowance is deducted from the aggregate portion of Pacific cod TAC annually allocated to the hook-and-line and pot gear sectors before the allocations above are made to these sectors. Since 2001 this amount has been 500 mt and included in the harvest specifications.

Table 3-1 in Chapter 3 shows the ABCs, TACs, and estimated catches of Atka mackerel by management area from 1994 through 2010. In recent years catches have been highest in Area 542, and lowest in Area 543. The ABC and TAC dropped in each area in 2010. Atka mackerel catches are typically quite close to the available TACs. Pacific cod ABCs, TACs, and catches may be found in Table 3-4. Pacific cod catches in the Aleutian Islands are smaller than those of Atka mackerel, and are concentrated to a greater extent in Area 541.

10.2.2 Amendment 80 Trawl Catcher/Processors

Atka mackerel and Pacific cod are targeted by large trawl catcher processors fishing Amendment 80 quota share in the Aleutian Islands.

Persons who receive Amendment 80 QS may, on an annual basis, elect to form a cooperative with other Amendment 80 QS holders to receive an exclusive harvest privilege for the portion of the ITAC resulting from their aggregated QS holdings. This "cooperative quota" (CQ) is the amount of annual Amendment 80 species ITAC dedicated for exclusive use by that cooperative. Amendment 80 establishes the requirements for forming an Amendment 80 cooperative as well as procedures for the allocation of annual CQ to a cooperative and transfers of CQ between cooperatives. The cooperative structure presents a number of operational and economic benefits to its members.

Cooperative participants could consolidate fishing operations on a specific Amendment 80 vessel or subset of Amendment 80 vessels, thereby reducing monitoring and enforcement (M&E) and other operational costs, and harvest fish in a manner more likely to be economically efficient and less wasteful. Amendment 80 provides flexibility, encourages efficient harvesting, and discourages waste through the opportunity to trade harvest privileges with other cooperatives.

In addition to annual CQ of Amendment 80 species, each Amendment 80 cooperative receives an exclusive limit on the amount of crab and halibut PSC the cooperative can use while harvesting in the BSAI. This halibut and crab PSC CQ is assigned to a cooperative proportional to the amount of Amendment 80 QS held by its members, and is not based on the amount of crab or halibut PSC historically used by the cooperative members.

A cooperative structure may allow Amendment 80 vessel operators to better manage PSC rates than do operators who must race to harvest fish as quickly as possible before a PSC allocation causes fishery closures. By reducing PSC use through more efficient cooperative operations (such as through gear modifications) Amendment 80 vessel operators may also increase the harvest of valuable targeted groundfish species and improve revenues that would otherwise be foregone. Amendment 80 cooperative participants may have access to additional ITAC. Amendment 80 cooperatives may receive a rollover of an additional amount of CQ, if a portion of the Amendment 80 species or crab or halibut PSC allocated to the BSAI trawl limited access sector is projected to go unharvested. This rollover to the Amendment 80 cooperatives is at the discretion of NMFS, based on projected harvest rates in the BSAI trawl limited access sector and other criteria. Each Amendment 80 cooperative would receive an additional amount of CQ based on the proportion of the Amendment 80 QS held by that Amendment 80 cooperative as compared with all other Amendment 80 cooperatives.

Amendment 80 cooperatives allow vessel operators to reduce the amount of discards.

Amendment 80 assigns quota share (QS) for Amendment 80 species to the owners of Amendment 80 vessels. Amendment 80 QS could be used to yield an exclusive harvest privilege for a portion of the Amendment 80 sector ITAC. Amendment 80 establishes criteria for harvesters in the Amendment 80 sector to apply for and receive QS, and for NMFS to initially allocate and transfer QS. Amendment 80 assigns Amendment 80 QS based on historic participation of Amendment 80 vessels during 1998 through 2004. QS Allocations are based on the relative proportion of an Amendment 80 species harvested by an Amendment 80 vessel compared with the proportion harvested by all other Amendment 80 vessels.
QS will only be assigned only to eligible persons who submit a complete application for Amendment 80 QS that is subsequently approved by NMFS. In most cases, Amendment 80 QS is assigned to an Amendment 80 vessel owner. In specific cases where an Amendment 80 vessel has been lost or is otherwise permanently ineligible to fish in U.S. waters, the Amendment 80 QS will be assigned

to the holder of the License Limitation Program (LLP) license originally assigned to that Amendment 80 vessel. Once Amendment 80 QS is assigned to an Amendment 80 vessel, it cannot be divided or transferred separately from that Amendment 80 vessel. If Amendment 80 QS is assigned to the LLP license originally issued for an Amendment 80 vessel, it cannot be transferred separately from that LLP license.

The small number of Amendment 80 vessels that actually fish Atka mackerel was listed above. These use their own quota share, and quota share leased from other holders, or fished under cooperative arrangements. Table 10-3 shows the numbers of Amendment 80 vessels active in the fishery each year, and provides estimates of the metric tons of Atka mackerel harvested, measured in round weight. Pacific cod is another Amendment 80 species, and the table provides related information for Pacific cod as well.

Table 10-3 Number of Active Amendment 80 vessels

Numbers of vessels								
	Atka mackerel targets				Pacific cod targets			
Year	541	542	543	AGG	541	542	543	AGG
2003	9	10	8	10	9	7	4	9
2004	7	10	9	10	10	6	3	10
2005	9	10	10	10	7	4	4	8
2006	10	11	9	11	8	6	5	9
2007	10	10	8	11	10	9	3	10
2008	7	7	7	7	6	3	2	6
2009	9	7	7	9	4	3	2	5

Source: NMFS AKR CAS. "c" indicates confidential information. Two Amendment 80 vessels with small fishing for other targets in Area 541 in 2009 were assigned to Atka mackerel targets. These are not otherwise treated in this analysis.

Figure 5-3 in Chapter 5 identifies the locations in which Atka mackerel is fished. Figures 10-1, 10-2 and 10-3, below provide more detailed information, by management area, showing Atka mackerel harvest locations.

Tables 10-4 and 10-5, which follow the figures, shows the amounts of Atka mackerel and Pacific cod catch coming from the different management areas and ranges of critical habitat, by year, for the period from 2003 through 2009. The Atka mackerel harvest is almost entirely taken by the Amendment 80 fleet. The Pacific cod catch documented in Table 10-5 shows the sum of targeted Pacific cod catch by all fleets in the Aleutian Islands.

As shown in Table 10-4, the Atka mackerel harvests are made during a winter-spring "A" season and a fall "B" season. Catches in Area 541 come largely from outside critical habitat, while significant proportions of the catches in Area 542 come from inside and outside critical habitat. Catches in Area 543 came predominately from outside critical habitat in 2003, but as time passed, larger proportions appear to have come from inside critical habitat.

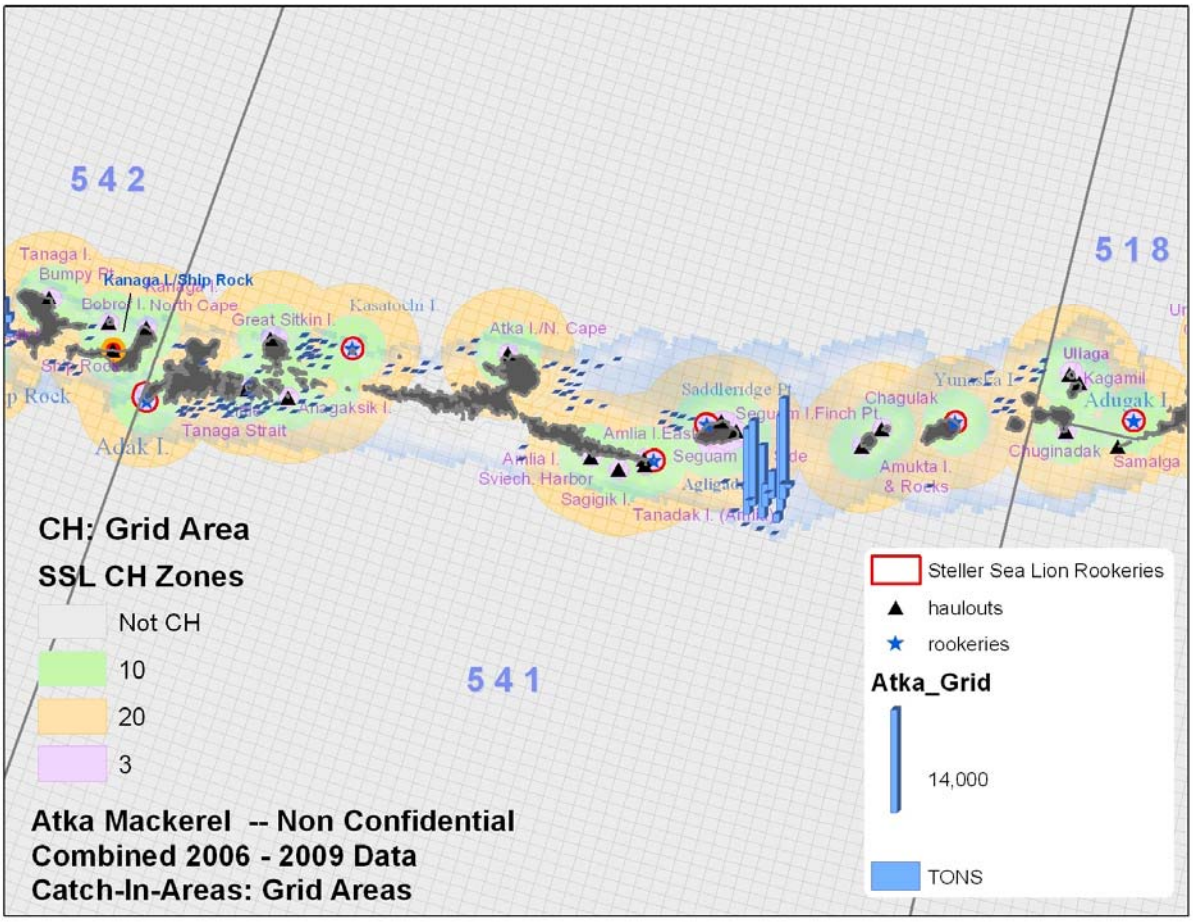

Figure 10-1 Location of Atka mackerel harvests in Area 541
Source: NMFS AKR AT.

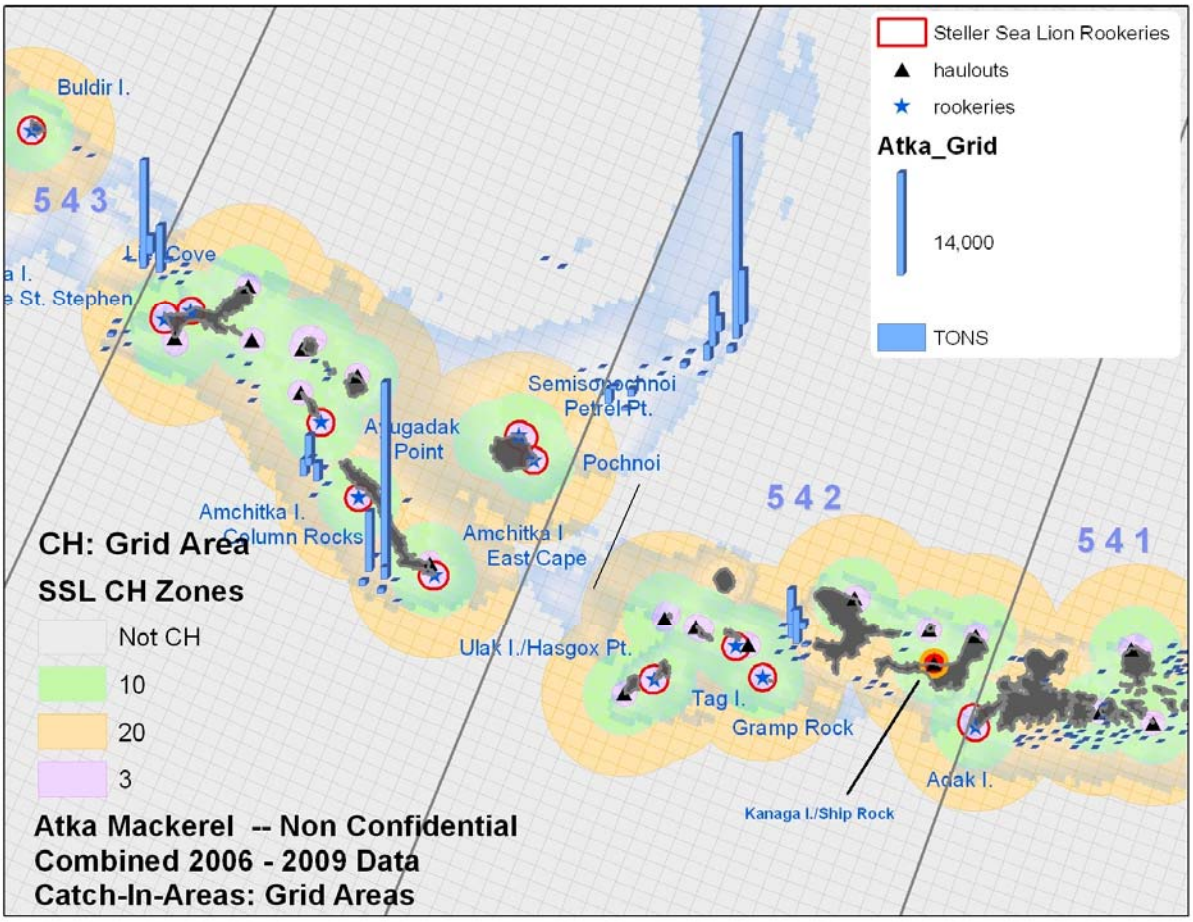

Figure 10-2 Location of Atka mackerel harvests in Area 542
Source: NMFS AKR AT.

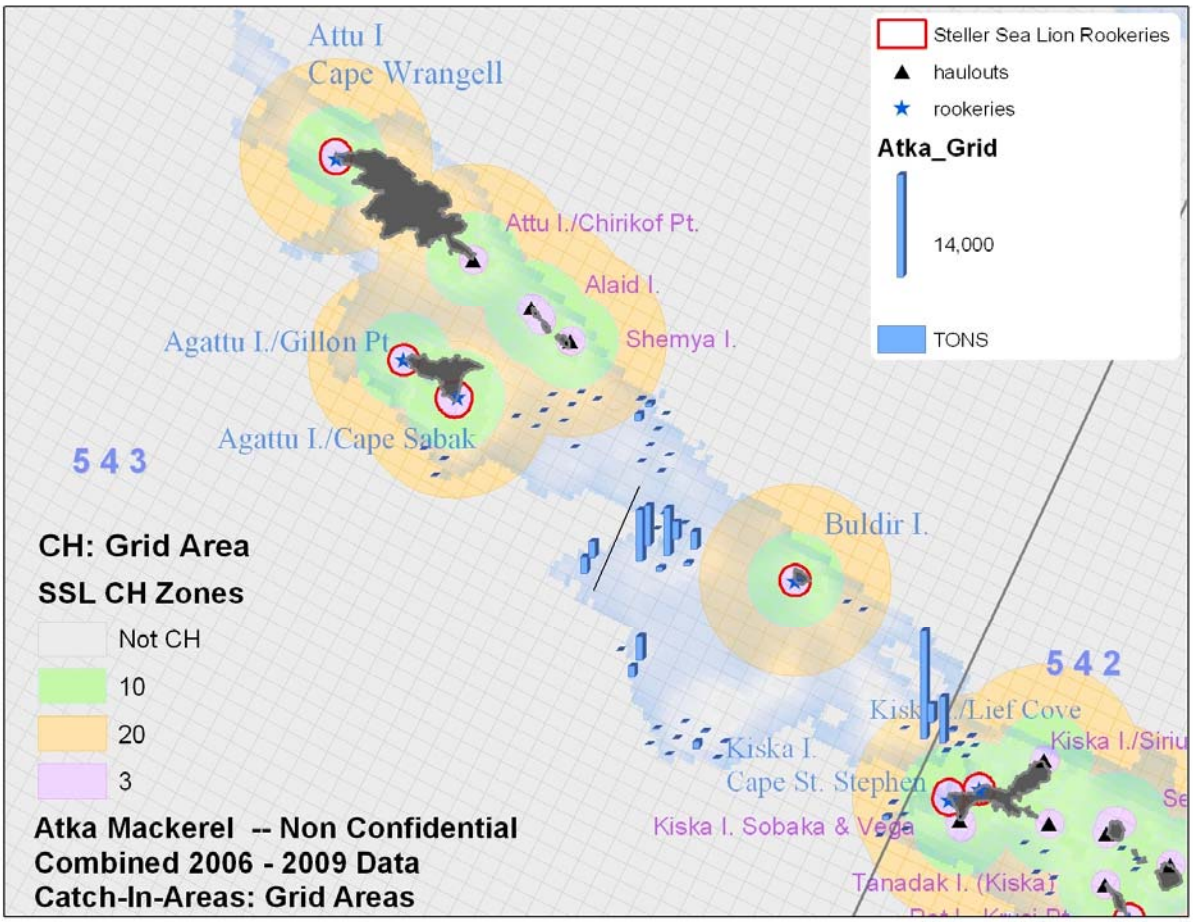

Figure 10-3 Location of Atka mackerel harvests in Area 543
Source: NMFS AKR AT.

Table 10-4 Atka mackerel catches by year, season, area, and relationship to critical habitat

	541 Atka Mackerel				542 Atka Mackerel				543 Atka Mackerel		
Row Labels	**0-10nm CH***	**10nm -20nm CH**	**Outside CH**	**Total 541**	**0-10nm CH ***	**10nm -20nm CH**	**Outside CH**	**Total 542**	**ide CH (0-20nm**	**Outside CH**	**Total 543**
A	49	283	2,906	3,238	75	6,050	4,462	10,588	1,461	5,569	7,030
Between A&B	196	225	108	530	26	291	1,326	1,643	52	308	360
B	0	0	1,877	1,877	207	6,300	6,694	13,201	1,120	9,375	10,495
2003 Total	**246**	**508**	**4,891**	**5,645**	**308**	**12,641**	**12,482**	**25,431**	**2,633**	**15,252**	**17,885**
A	12	127	2,735	2,874	112	6,242	7,571	13,926	798	2,725	3,523
Between A&B	52	60	479	591	121	620	712	1,454	37	1,055	1,092
B	163	18	34	215	37	8,123	6,631	14,791	422	14,516	14,938
2004 Total	**227**	**205**	**3,248**	**3,681**	**271**	**14,985**	**14,914**	**30,170**	**1,257**	**18,296**	**19,553**
A	4	47	7	58	144	9,243	7,249	16,636	1,485	1,039	2,524
Between A&B	158	274	117	549	39	1,126	201	1,365	7	1	8
B	15	3	3,036	3,054	70	9,262	7,874	17,205	1,949	15,124	17,073
2005 Total	**176**	**325**	**3,160**	**3,661**	**252**	**19,630**	**15,324**	**35,207**	**3,441**	**16,165**	**19,606**
A	7	20	1	28	52	9,351	9,564	18,967	16	43	59
Between A&B	94	265	297	657	98	919	584	1,600	138	218	356
B	8	13	3,542	3,563	108	9,923	9,237	19,268	3,346	10,875	14,221
2006 Total	**109**	**298**	**3,841**	**4,248**	**258**	**20,193**	**19,385**	**39,836**	**3,501**	**11,135**	**14,636**
A	6	27	7,749	7,781	5	3,975	3,228	7,208	0	240	240
Between A&B	97	61	1,226	1,384	26	366	425	816	102	153	256
B	5	25	10,726	10,756	52	8,810	9,846	18,708	3,412	5,180	8,592
2007 Total	**108**	**112**	**19,702**	**19,921**	**82**	**13,151**	**13,499**	**26,732**	**3,515**	**5,573**	**9,088**
A	2	1	8,208	8,211	53	6,106	385	6,544	1	4,973	4,975
Between A&B	49	60	656	765	10	830	730	1,570	445	1,617	2,062
B	1	87	9,656	9,744	26	6,523	8,257	14,807	5,051	3,961	9,013
2008 Total	**52**	**148**	**18,519**	**18,719**	**90**	**13,458**	**9,372**	**22,921**	**5,498**	**10,551**	**16,049**
A	18	21	9,712	9,750	126	8,523	1,860	10,509	330	2,427	2,756
Between A&B	1	3	3,910	3,914	9	1,835	988	2,833	1,226	318	1,544
B	5	5	12,498	12,509	182	8,294	8,365	16,841	4,872	7,033	11,905
2009 Total	**24**	**29**	**26,119**	**26,173**	**317**	**18,652**	**11,213**	**30,183**	**6,427**	**9,778**	**16,205**

Numbers generated by the Catch in Areas Database and ran on July 13, 2010

** 0-3 nm included and not represented due to confidentiality. The average of all years 0-3 nm CH catch of Atka mackerel was less than 1 mt in area 541 (primarily incidental catch) and less than*

*** 0-3 nm and 0-10 nm atka mackerel catch not represented due to confidentiality. The avearge 0-10 nm CH catch in area 543 was around 25mt with a maxiumum of approximately 75mt.*

Table 10-5 Pacific cod catches by year, season, area, and relationship to critical habitat

	541 Pacific Cod				542 Pacific Cod				543 Pacific Cod		
	0-10nm CH*	10nm -20nm CH	Outside CH	Total 541	0-10nm CH*	10nm -20nm CH	Outside CH	Total 542	0-10nm CH*	10nm -20nm CH	Outside CH
Jan 1 -Jun 10	8,058	9,332	5,015	22,406	1,727	1,500	2,630	5,858	1,419	777	218
Jun 11 - Dec 31	245	48	61	355	294	350	54	698	42	91	368
2003 Total	**8,304**	**9,381**	**5,077**	**22,761**	**2,021**	**1,850**	**2,684**	**6,556**	**1,461**	**868**	**586**
Jan 1 -Jun 10	5,435	8,829	3,424	17,688	2,010	1,164	1,481	4,655	1,222	1,762	82
Jun 11 - Dec 31	477	91	28	596	1,006	999	280	2,285	107	273	196
2004 Total	**5,912**	**8,920**	**3,452**	**18,284**	**3,016**	**2,163**	**1,761**	**6,940**	**1,328**	**2,034**	**278**
Jan 1 -Jun 10	3,428	6,001	2,148	11,577	1,435	709	755	2,899	458	2,790	11
Jun 11 - Dec 31	1,880	1,180	257	3,318	34	555	44	634	-	201	729
2005 Total	**5,309**	**7,181**	**2,405**	**14,895**	**1,470**	**1,265**	**799**	**3,534**	**458**	**2,991**	**741**
Jan 1 -Jun 10	1,983	8,077	2,245	12,305	761	748	305	1,814	1,590	2,525	10
Jun 11 - Dec 31	328	182	201	711	163	802	196	1,161	0	244	105
2006 Total	**2,311**	**8,259**	**2,446**	**13,017**	**924**	**1,550**	**501**	**2,975**	**1,590**	**2,769**	**114**
Jan 1 -Jun 10	5,102	10,343	4,686	20,131	958	1,261	442	2,661	935	2,554	20
Jun 11 - Dec 31	271	159	430	860	688	600	295	1,583	425	746	297
2007 Total	**5,373**	**10,503**	**5,116**	**20,991**	**1,646**	**1,861**	**737**	**4,244**	**1,361**	**3,300**	**317**
Jan 1 -Jun 10	2,551	9,195	2,738	14,484	751	371	75	1,198	1,450	3,572	46
Jun 11 - Dec 31	364	145	292	802	2,117	575	217	2,910	1,007	841	198
2008 Total	**2,915**	**9,341**	**3,030**	**15,286**	**2,868**	**947**	**293**	**4,107**	**2,456**	**4,414**	**244**
Jan 1 -Jun 10	2,150	7,152	2,801	12,102	465	531	2,057	3,052	2,793	2,317	28
Jun 11 - Dec 31	377	273	380	1,031	1,294	640	155	2,090	1,233	1,193	276
2009 Total	**2,527**	**7,425**	**3,181**	**13,134**	**1,759**	**1,171**	**2,212**	**5,142**	**4,026**	**3,511**	**304**

Numbers generated from the Catch in Area data base on July 13, 2010. * 0-3 nm included and not represented due to confidentiality.

Table 10-5, summarizes information on Pacific cod for catcher vessels and catcher/processors and all gear types. It shows that most of this harvest comes in the first half of the year. In all three Aleutian Islands management areas, areas outside of critical habitat generally account for relatively small proportions of the Pacific cod catch.

Figure 5-2, in Chapter 5 shows the locations of non-pelagic trawl gear Pacific cod harvest in the Aleutian Islands. The figure shows the locations for catcher vessel and catcher/processor Pacific cod trawl harvests in the Aleutian Islands. Confidentiality considerations preclude presenting the locations of Amendment 80 catcher/processor trawl fishing activity alone in a similar figure. Likewise, a table similar to Table 10-5, only showing catcher/processor harvests is precluded by confidentiality considerations.

Table 10-6 shows estimated gross revenues from Atka mackerel fishing in the three areas of the Aleutian Islands from 2003 through 2009. Prices rose in most years over the period 2000 to 2009, reaching a peak in 2008 and then falling off slightly in 2009. The trend in first wholesale prices is shown in Figure 10-4.

Table 10-6 Estimated First wholesale gross revenues from Atka mackerel, 2003-2009.

	Metric tons (round weight)			$/mt round weight	Gross revenue (in millions)			
	541	542	543		541	542	543	Total
2004	3,618	30,158	19,551	$ 603	$ 2.2	$ 18.2	$ 11.8	$ 2.2
2005	3,631	35,066	19,743	$ 630	$ 2.3	$ 22.1	$ 12.4	$ 36.8
2006	4,213	39,825	14,637	$ 657	$ 2.8	$ 26.2	$ 9.6	$ 38.5
2007	19,906	26,711	9,092	$ 805	$ 16.0	$ 21.5	$ 7.3	$ 44.8
2008	18,709	22,444	16,486	$ 848	$ 15.9	$ 19.0	$ 14.0	$ 48.9
2009	26,164	30,032	16,273	$ 948	$ 24.8	$ 28.5	$ 15.4	$ 68.7
mean	12,707	30,706	15,964	$ 749	$ 11	$ 23	$ 12	$ 45
median	11,461	30,095	16,380	$ 731	$ 9	$ 22	$ 12	$ 42

Notes: Catches are in metric tons round weight retained catch, including targeted and incidental and Amendment 80 and CDQ.
Source: NMFS AKR

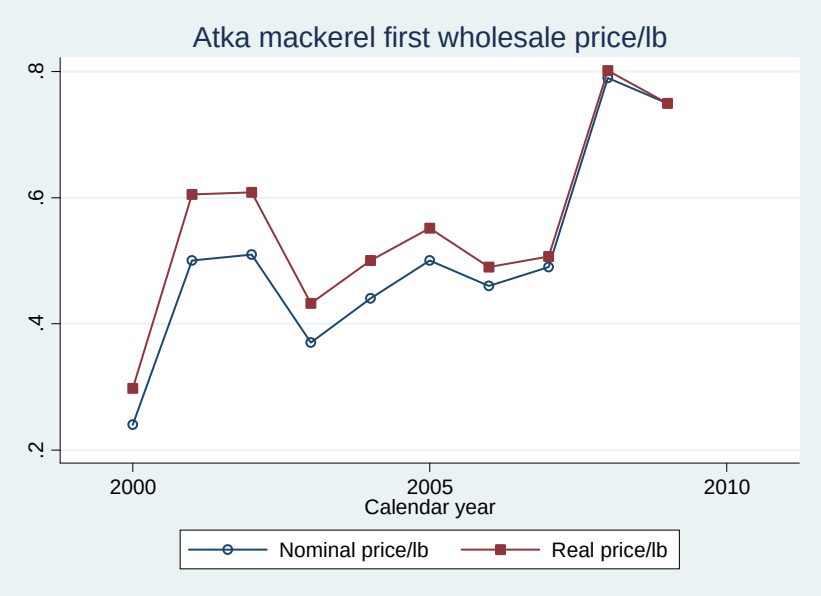

Figure 10-4 First wholesale price per pound of Atka mackerel, 2000 through 2009
Source: AKFIN nominal prices, NMFS AKR real price estimates in 2009 dollars

The Amendment 80 vessels also fish for Pacific cod in the Aleutian Islands. Estimated gross revenues for Pacific cod are shown in Table 10-7.

Table 10-7 Estimated gross revenues for Amendment 80 vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009.

	Metric tons (round weight)			$/mt round weight	Gross revenue (in millions)			
	541	542	543		541	542	543	Total
2004	5,669	3,331	3,250	$ 1,172	$ 6.6	$ 3.9	$ 3.8	$ 14.4
2005	5,187	2,228	4,192	$ 1,388	$ 7.2	$ 3.1	$ 5.8	$ 16.1
2006	5,069	1,880	3,021	$ 1,755	$ 8.9	$ 3.3	$ 5.3	$ 17.5
2007	7,855	2,217	2,233	$ 2,044	$ 16.1	$ 4.5	$ 4.6	$ 25.2
2008	2,834	2,442	*	$ 2,061	$ 5.8	5.0	*	$ 10.9
2009	1,975	3,212	*	$ 1,252	$ 2.5	4.0	*	$ 6.5
mean	4,765	1,996	2,671	$ 1,612	$ 7.9	$ 3.1	$ 4.2	$ 15.1
median	5,128	2,049	2,627	$ 1,572	$ 6.9	$ 3.2	$ 4.2	$ 15.2

Notes: Catches are in metric tons round weight retained catch, including targeted and incidental and Amendment 80 and CDQ. Small amounts of discarded catch are included in the calculations.
Source: NMFS AKR
*542 and 543 combined for confidentiality

Gulf of Alaska sideboards

In order to limit the ability of participants eligible for the Amendment 80 program to expand their harvest efforts in the GOA, the Amendment 80 program established groundfish and halibut PSC catch limits for Amendment 80 program participants. These are referred to as "sideboards." (75 *FR* 11772)

Groundfish harvesting sideboard limits were established for all Amendment 80 program vessels, other than the F/V GOLDEN FLEECE, to amounts no greater than the limits shown in Table 37 to part 679. Sideboard limits in the GOA are for pollock in the Western and Central Regulatory Areas and in the West Yakutat district, Pacific cod gulfwide, Pacific ocean perch, and pelagic shelf rockfish in the Western Regulatory Area and West Yakutat district, and northern rockfish in the Western Regulatory Area. (75 *FR* 11772)

The harvest of Pacific ocean perch, pelagic shelf rockfish, and northern rockfish in the Central Regulatory Area of the GOA is subject to regulation under the Central GOA Rockfish Program. Amendment 80 program vessels not qualified under the Rockfish Program are excluded from directed fishing for these rockfish species in the Central GOA. The F/V GOLDEN FLEECE is prohibited from directed fishing for pollock, Pacific cod, Pacific ocean perch, pelagic shelf rockfish, and northern rockfish in the GOA. (75 *FR* 11772)

Groundfish sideboard limits for Amendment 80 program vessels operating in the GOA are based on their average aggregate harvests from 1998 to 2004. Table 10-8 lists the final 2011 sideboard limits for Amendment 80 program vessels. All targeted or incidental catch of sideboard species made by Amendment 80 program vessels will be deducted from the sideboard limits. (75 *FR* 11772)

The PSC sideboard limits for Amendment 80 program vessels in the GOA are based on the historic use of halibut PSC by Amendment 80 program vessels in each PSC target category from 1998 through 2004. These values are slightly lower than the average historic use to accommodate two factors: Allocation of halibut PSC Cooperative Quotas (CQs) under the Central GOA Rockfish Program and the exemption of the F/V GOLDEN FLEECE from this restriction (§ 679.92(b)(2)). Table 10-9 lists the final 2011 halibut PSC limits for Amendment 80 program vessels. (75 *FR* 11772)

A minimum groundfish retention standard (GRS) applies to all Amendment 80 vessels fishing in the BSAI. The GRS was recommended by the North Pacific Fishery Management Council (Council) as Amendment 79 to the BSAI FMP in June 2003, published as a final rule in April 2007, and became effective in 2008. The percentage of catch that must be retained was 65 percent in 2008, increasing to 75 percent in 2009, 80 percent in 2010, and 85 percent in 2011 and all future years. Amendment 80

modified the GRS as recommended under Amendment 79 in two critical ways. First, the GRS was extended to apply to all non-AFA trawl catcher/processors operating in the BSAI, without an exemption for vessels under 125 feet LOA. Second, Amendment 80 modified the method of calculating the total retention of catch that applies to cooperatives. Under the GRS as modified by Amendment 80, each vessel participating in the Amendment 80 limited access fishery must ensure that it meets the GRS requirements, based on the amount of catch retained by that vessel. Vessels participating in a cooperative can aggregate the total catch and total retained catch by all vessels in the cooperative. Therefore, vessels with poorer retention rates may have an incentive to join a cooperative with other vessels that have a better retention rate and are able to offset the lower retention rate of those vessels. Vessels participating in the limited access fishery may face increasing difficulty meeting the GRS.

A proposed action is being considered that would modify the calculation of the GRS as it applies to cooperatives.

Table 10-8 Final 2011 GOA Groundfish Sideboard Limits for Amendment 80 Program Vessels
(Values are rounded to nearest metric ton.)

Species	Apportionments and allocations by season	Area	Ratio of Amendment 80 sector vessels 1998 - 2004 catch to TAC	2011 TAC (mt)	2011 Amendment 80 vessel sideboards (mt)
Pollock	A Season	Shumagin (610)	0.003	7,342	22
	January 20 - February 25	Chirikof (620)	0.002	11,129	22
		Kodiak (630)	0.002	5,823	12
	B Season	Shumagin (610)	0.003	7,342	22
	March 10 - May 31	Chirikof (620)	0.002	13,128	26
		Kodiak (630)	0.002	3,824	8
	C Season	Shumagin (610)	0.003	10,022	30
	August 25 - September 15	Chirikof (620)	0.002	6,451	13
		Kodiak (630)	0.002	7,820	16
	D Season	Shumagin (610)	0.003	10,022	30
	October 1 - November 1	Chirikof (620)	0.002	6,451	13
		Kodiak (630)	0.002	7,820	16
	Annual	WYK (640)	0.002	2,686	5
Pacific cod	A Season[1]	W	0.020	15,419	308
	January 1 - June 10	C	0.044	27,314	1,202
	B Season[2]	W	0.020	10,280	206
	September 1 - December 31	C	0.044	18,210	801
	Annual	WYK	0.034	2,496	85
Pacific ocean perch	Annual	W	0.994	2,797	2,780
		WYK	0.961	1,937	1,861
Northern rockfish	Annual	W	1.000	2,549	2,549
Pelagic shelf rockfish	Annual	W	0.764	607	464
		WYK	0.896	405	363

[1] The Pacific cod A season for trawl gear opens January 20.
[2] The Pacific cod B season for trawl gear closes November 1.

Table 10-9 Final 2010 and 2011 Halibut PSC Limits for Amendment 80 Program Vessels in the GOA
(Values are rounded to nearest metric ton.)

Season	Season dates	Target fishery	Historic Amendment 80 use of the annual halibut PSC limit catch (ratio)	2010 and 2011 annual PSC limit (mt)	2010 and 2011 Amendment 80 vessel PSC limit (mt)
1	January 20 - April 1	shallow-water	0.0048	2,000	10
		deep-water	0.0115	2,000	23
2	April 1 - July 1	shallow-water	0.0189	2,000	38
		deep-water	0.1072	2,000	214
3	July 1 - September 1	shallow-water	0.0146	2,000	29
		deep-water	0.0521	2,000	104
4	September 1 - October 1	shallow-water	0.0074	2,000	15
		deep-water	0.0014	2,000	3
5	October 1 - December 31	shallow-water	0.0227	2,000	45
		deep-water	0.0371	2,000	74

Table 10-10 below, provides estimates of the percent of the Pacific cod harvest made in targeted Pacific cod hauls, by fleet sector, Aleutian Islands management area, and year. The Amendment 80 sector, described in the table as “CP NPT” for catcher/processor non-pelagic trawl, varied in the extent to which Pacific cod harvests were the result of targeted hauls. In Area 541, most Pacific cod were taken as targets, although the proportions fell off somewhat in 2008 and 2009. In Area 542, much smaller proportions of Pacific cod were taken in targeted hauls, and these proportions fell off considerably in 2008 and 2009, following the introduction of Amendment 80. Finally, the proportions taken in targeted hauls were higher in Area 543, but not as high as in Area 541.

Table 10-10 Percent of the Pacific cod catch made as targeted harvests, by fleet segment and management area, 2003-2009

Area 541							
	CP HAL	CV HAL	CV Jig	CP NPT	CV NPT	CP POT	CV Pot
2003	97%	9%	100%	94%	100%	na	0%
2004	99%	28%	na	98%	100%	na	0%
2005	99%	0%	100%	98%	100%	na	0%
2006	99%	73%	100%	97%	100%	100%	100%
2007	95%	96%	100%	95%	100%	na	100%
2008	100%	86%	100%	94%	100%	100%	100%
2009	99%	94%	100%	86%	99%	100%	na
Area 542							
	CP HAL	CV HAL	CV Jig	CP NPT	CV NPT	CP POT	CV Pot
2003	100%	9%	na	72%	100%	na	100%
2004	100%	45%	na	50%	100%	na	na
2005	2%	25%	0%	57%	100%	na	na
2006	44%	0%	100%	52%	100%	0%	0%
2007	96%	96%	na	60%	98%	221%	0%
2008	100%	69%	100%	11%	96%	na	0%
2009	99%	0%	na	17%	96%	na	0%
Area 543							
	CP HAL	CV HAL	CV Jig	CP NPT	CV NPT	CP POT	CV Pot
2003	89%	2%	na	76%	na	na	na
2004	100%	0%	na	90%	na	na	na
2005	0%	0%	na	77%	na	na	na
2006	100%	0%	na	91%	100%	na	na
2007	100%	0%	na	85%	100%	na	na
2008	100%	0%	na	86%	100%	100%	na
2009	100%	0%	na	84%	100%	100%	na
Source: NMFS AKR estimates from CAS							

10.2.3 Fixed Gear Catcher/Processor sector

A small number of hook-and-line and pot catcher/processors targets Pacific cod in the Aleutian Islands. Table 10-11 below provides estimates of the numbers of these vessels by year and area, and size of their harvests. The number of hook-and-line vessels ranged from four in 2005 to 10 in 2006; the number of pot vessels ranged from none to four in 2008. In much of this chapter, these two sectors are treated as a single sector to address confidentiality concerns with the data from both.

Table 10-11 Number of Active Fixed Gear Catcher/Processors

Numbers of vessels								
	Hook-and-line				Pot			
Year	541	542	543	AGG	541	542	543	AGG
2003	5	4	2	7				
2004	6	2	3	6				
2005	4	1		4				
2006	8	1	1	10	1			1
2007	5	3	3	5		1		1
2008	7	6	3	9	2	4	1	4
2009	6	5	2	7	2	3	1	3
Source: NMFS AKR CAS. “c” indicates confidential information								

Table 10-10 shows the percentages of fixed gear catcher/processor harvests of Pacific cod taken in the Pacific cod target. The information is in the table under the headings “CP HAL” and “CP POT”. The hook-and-line vessels have typically taken almost all of their Pacific cod as targeted harvests in all three areas. The only exceptions appear in Area 542 in 2005 and 2006. The pot catcher/processors made all of their catches in targeted Pacific cod fishing.

Table 10-12 shows that the fixed gear catcher/processor fleet has accounted for between $3.5 million and $14 million in estimated gross revenues (at first wholesale prices) each year. Gross revenues rose each year from 2004 through 2008, and then fell precipitously in 2009.

Table 10-12 Estimated gross revenues for fixed gear (hook-and-line and pot) catcher/processor vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009.

	Metric tons				Gross revenue (in millions)			
	541	542	543	$/mt	541	542	543	Total
2004	1,615	1,389	*	$ 1,172	$ 1.9	$ 1.6	*	$ 3.5
2005	2,851	*	*	$ 1,388	$ 4.0	*	*	$ 4.0
2006	3,160	*	*	$ 1,755	$ 5.5	*	*	$ 5.5
2007	1,826	2,448	*	$ 2,044	$ 3.7	$ 5.0	*	$ 8.7
2008	1,942	4,897	*	$ 2,061	$ 4.0	$ 10.1	*	$ 14.1
2009	1,435	4,770	*	$ 1,252	$ 1.8	$ 6.0	*	$ 7.8

Notes: Catches are in metric tons round weight retained catch, including targeted and incidental and Amendment 80 and CDQ.
Source: NMFS AKR
*combined with cell to the left for confidentiality

10.2.4 Catcher vessel sector

Vessels fishing for Pacific cod with jig, hook-and-line, pot, and trawl gear all operate in the Aleutian Islands. Table 10-13 provides counts of the number of vessels using each of these gears, and estimates of their Pacific cod catches, from 2003 through 2009. The number of hook-and-line vessels ranged between 1 and 9, the number of jig vessels, between none and 8, the number of pot vessels between none and 4, and the number of trawl vessels between 15 and 37. The trawl vessels were the largest segment of this fleet, measured by numbers of active vessels, and by the volume of fish harvested.

Table 10-13 Number of Active Catcher Vessels

Numbers of vessels								
	Hook-and-line				Pot			
Year	541	542	543	AGG	541	542	543	AGG
2003	2	3	2	4				
2004	2	1		2				
2005		1		1				
2006	2			2	1	3		4
2007	6	1		6	3			3
2008	5	2		9	1			1
2009	1			1				
	Jig				Trawl			
Year	541	542	543	AGG	541	542	543	AGG
2003	1			1	31	17		31
2004					19	16		20
2005	1			1	15	6		15
2006	1	1		1	20	18	1	24
2007	1			1	37	23	1	37
2008	8	6		8	36	17	2	36
2009					25	15	2	27

Source: NMFS AKR estimates from CAS. “c” indicates confidential information

Table 10-10 shows the percentages of catcher vessel harvests of Pacific cod in the Pacific cod target. The information is in the table under the headings “CV HAL”, “CV jig,” “CV NPT,” and “CV pot.” The pot, trawl, and jig fisheries have taken almost all of their harvests in targeted Pacific cod fisheries. The hook-and-line fleet has taken large amounts in targeted fisheries at times, but in many years, these harvests have come in large part as incidental catches in other targeted fisheries, such as sablefish.

Table 10-14 shows that the catcher vessel fleet has accounted for a harvest with an ex-vessel (to the fisherman) value of between $4 million and $18 million. Gross revenues rose each year from 2005 through 2008, and then fell off precipitously in 2009.

Table 10-14 Estimated ex-vessel gross revenues for catcher vessels targeting Pacific cod in the Aleutian Islands, 2003 through 2009.

	Metric tons				Gross revenue (in millions)			
	541	542	543	$/mt	541	542	543	Total
2004	11,125	2,496	*		$ 5.8	$ 2.4	*	$ 7.2
2005	6,839	1,397	*		$ 3.6	$ 1.9	*	$ 4.4
2006	5,209	2,157	*		$ 4.0	$ 3.0	*	$ 5.7
2007	11,400	2,235	*		$ 11.2	$ 3.7	*	$ 13.4
2008	10,633	3,847	*		$ 13.2	$ 6.8	*	$ 18.0
2009	9,795	5,317	*		$ 5.3	$ 6.3	*	$ 8.2

Notes: Catches are in metric tons round weight retained catch, including targeted and incidental and Amendment 80 and CDQ.
Source: NMFS AKR
*combined with row to left for confidentiality

Table 10-15, below, shows the first wholesale value to shoreside processors, shoreside floating processors, or vessels acting as motherships that accept delivery of Pacific cod from catcher vessels. Wholesale values ranged between $10 million and $26 million.

Table 10-15 Estimated first wholesale gross revenues associated with catcher vessel deliveries of Aleutian Islands Pacific cod, 2003 through 2009.

	Metric tons				Gross revenue (in millions)			
	541	542	543	$/mt	541	542	543	Total
2004	11,125	2,496	*	$ 959	$ 10.7	$ 1.3	*	$ 13.1
2005	6,839	1,397	*	$ 1,332	$ 9.1	$ 0.8	*	$ 11.0
2006	5,209	2,157	*	$ 1,412	$ 7.4	$ 1.7	*	$ 10.4
2007	11,400	2,235	*	$ 1,663	$ 19.0	$ 2.2	*	$ 22.7
2008	10,633	3,847	*	$ 1,765	$ 18.8	$ 4.8	*	$ 25.6
2009	9,795	5,317	*	$ 1,188	$ 11.6	$ 2.9	*	$ 18.0

Notes: Catches are in metric tons round weight retained catch, including targeted and incidental and Amendment 80 and CDQ.
Source: NMFS AKR

Within Area 541, Adak and Atka have shoreside processing plants. Atka Pride Seafoods in Atka has not processed Pacific cod in the past. Adak Fisheries at Adak has recently filed for Chapter 11 bankruptcy, and the future of Pacific cod processing at that community is uncertain. Catcher vessels may also deliver Pacific cod to shoreside processors at Dutch Harbor/Unalaska, a shoreside floating processor, or motherships.

10.2.5 State of Alaska fishery

In February, 2006, the Alaska Board of Fisheries approved regulations creating a non-exclusive state-waters Pacific cod fishery in the Aleutian Islands. The fishery was established to encourage the economic development of Adak. The following text extract from Milani (2009) and amplified by Milani for this analysis, provides a regulatory history through 2008[3]:

Regulations for AI state Pacific cod fishery as of June 2010:

1. Area is AI west of 170.
2. GHL (guideline harvest level) is 3% of federal BSAI Pacific cod ABC.
3. Max of 70% of GHL is available before June 10.
4. Fishery "A" season opens 4 days after the closure of the federal BSAI CV Pacific cod trawl fishery.
5. Fishery "A" season closes when GHL is reached or on April 1.

[3] Krista Milani. Alask Department of Fish and Game, Division of Commercial Fisheries. Dutch Harbor. pers. comm.. August 3, 2010.

6. If there is remaining “A” season GHL, fishery “A” season will reopen after federal BSAI CV Pacific cod trawl fishery closes.
7. “A” season legal gear is non-pelagic trawl for vessels =<100 feet LOA, jig and longline for vessels =<58 LOA, and pot for vessels =<125 LOA
8. Fishery “B” season opens on June 10.
9. Fishery “B” season closes when GHL is reached or on Sept 1.
10. If there is remaining “B” season GHL, fishery “B” season will reopen after federal BSAI CV Pacific cod =>60 feet for pot gear closes.
11. From June 10 – July 31 “B” season is open to trawl, jig, longline, and pot gear for vessels =<60 LOA.
12. August 1 – December 31 “B” season is open to trawl, jig, and longline vessels =<60 LOA, and pot vessels =<125 LOA.
13. A vessel may concurrently utilize both jig and longline gear.
14. 150,000 lb trip and daily limit is in place.
15. All NMFS Steller sea lion closures, Aleutian Islands Habitat Conservation Area closures, and coral garden closures that are in effect during the parallel season remain closed during the state-waters Pacific cod fishery.

Historical regulations for AI state Pacific cod fishery:

The fishery GHL was set by regulation at three percent of the federal BSAI ABC with a maximum of 70% of the GHL available before June 10. By regulation the fishery opened on or after March 15, at the conclusion of the initial parallel catcher vessel trawl fishery for Pacific cod in the federal BSAI Area. Non-pelagic trawl, longline, jig, and pot gear were all permissible in the 2006 fishery and there were no vessel size limits. Trawl and longline gear could not be used from May 1 through September 15, unless operating in the Adak vessel length and gear restriction zones. The Fishery Management Plan stipulated a daily harvest limit of 150,000 pounds and a 300,000 pound trip limit. All Pacific cod was required to be retained and any overage was required to be immediately reported to ADF&G, with proceeds from the overage forfeited to the state. In addition, all fishers were required to report daily to ADF&G the pounds of Pacific cod taken by the vessel.

All NMFS Steller sea lion closures, Aleutian Islands Habitat Conservation Area closures, and coral garden closures that are in effect during the parallel season remain closed during the state-waters Pacific cod fishery.
In October of 2006, the BOF made several changes to the Aleutian Islands pacific cod management plan. The management plan defined the portion of the GHL available before June 10 as the A season, and the portion available after June 10 as the B season. The A season opening date was changed to four days after the closure of the initial parallel catcher vessel trawl fishery for Pacific cod in the federal BSAI Area. Vessel size limits of 125’ or less overall length (OAL) for pot vessels, 100’ or less OAL for trawl vessels, and 58’ or less OAL for longline and jig vessels were adopted. In addition, the trip limit was lowered to 150,000 pounds. The vessel size limits and smaller trip and daily harvest limits were adopted in part to slow the pace of the fishery during the A season. The BOF repealed the regulations applying to the Adak vessel length and gear restriction zones for the duration of the state-waters fishery. The regulation which allowed unharvested state-waters Pacific cod to be utilized by NMFS was repealed as well. The new regulations took effect beginning in the 2007 fishery.

In December 2008, the BOF passed a new regulation prohibiting vessels >60 from participating in the B season which went in to place for the 2009 June 10 B season opening.

In February 2010 the BOF again amended the management plan allowing pot vessels =<125 feet OAL to participate in the B season beginning on August 1. From June 10 to July 31 the B season would still be restricted to vessels =<60 feet. These new regulations took effect in the 2010 June 10 B season.

Tables 10-16 and 10-17 summarize key information about this state waters fishery for 2006-2008.

Table 10-16 Summary information on the state waters Pacific cod fishery in the Aleutian Islands.

Year	Season	Initial GHL (millions of whole pounds)	Harvest (millions of whole pounds)	Vessels (number)	Fishery value (millions)	Average dollars/lb
2006	A	8.9	8.5	26	$1.3	$0.23
	B	3.8	C	5	C	C
	Total	12.8	C	30		
2007	A	8.1	8.2	27	$3.6	$0.45
	B	3.5	3.4	15	$1.3	$0.52
	Total	11.6	11.6	41		
2008	A	8.1	7.5	30	$4.5	$0.63
	B	3.5	4.2	18	$1.8	$0.57
	Total	11.6	11.7	45		
Source: Milani (2009). "C" is confidential						

Table 10-17 Harvests by gear type in state-waters Pacific cod fishery in the Aleutian Islands (millions of whole pounds)

Year	Season	Longline	Trawl	Pot	Jig	Total
2006	A	C	7.1	C	0	8.5
	B	C	0	C	0	C
2007	A	O	7.0	1.2	0	8.2
	B	C	0	2.4	C	3.4
2008	A	C	6.1	C	0	7.5
	B	0.4	0	3.8	0.1	4.2
Source: Milani (2009). "C" is confidential						

10.2.6 CDQ Program

A portion of the Federal pollock TAC in the Bering Sea is allocated for harvest by participants in the CDQ Program. The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The largescale commercial fisheries of the BSAI developed in the eastern Bering Sea without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species including pollock, crab, halibut, and various groundfish, to such communities. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to participate in and benefit from the BSAI fisheries.

A total of 65 communities are authorized under Section 305(i)(1) of the Magnuson-Stevens Act to participate in the program through six CDQ entities.[4] These CDQ entities are non-profit corporations that

[4] The CDQ entities include the Aleutian Pribilof Island Community Development Association (APICDA), theBristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA).

manage and administer the CDQ allocations, economic development projects, and investments, including ownership interest in the at-sea processing sector and catcher vessels. Annual CDQ allocations provide a revenue stream for CDQ entities through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. Geographically dispersed, the members communities extend westward to Atka, on the Aleutian Island chain, and northward along the Bering Sea coast to the village of Wales, near the Arctic Circle. The 2000 population of these communities totaled over 27,000 persons of whom approximately 87 percent were Alaska Native. In general economic terms, CDQ communities are remote, isolated settlements with few commercially valuable natural assets with which to develop and sustain a viable, diversified economic base. As a result, economic opportunities are few, unemployment rates are chronically high, and communities and the region are economically depressed. The CDQ Program ameliorates some of these circumstances by providing an opportunity for residents of CDQ communities to directly benefit from the BSAI fishery resources.

The CDQ Program was implemented by the Council and NMFS in 1992 with allocations of 7.5 percent of the pollock TAC. Allocations of halibut and sablefish were added to the program in 1995. Authorization for the CDQ Program was added to the Magnuson-Stevens Act by the U.S. Congress in 1996. In 1998, the Council expanded the CDQ Program by adding allocations of the remaining groundfish species, prohibited species, and crab. Currently, the CDQ Program is allocated portions of the groundfish fishery that range from 10.7 percent for Amendment 80 species, 10 percent for pollock, and 7.5 percent for most other species.

The Atka mackerel CDQ allocation is divided among the three management areas in proportion to the allocation of TAC across those three areas. In the five year period from 2005 through 2009, CDQ groups were able to use their Atka mackerel allotments effectively, normally fishing over 95 percent of each. The only instance in which the harvest fell below 90 percent was in 2005, when the only about 85 percent of the Area 541-Bering Sea allotment was harvested.

Allotments are not distributed equally among the six CDQ groups. These have not changed since 2006. Table 10-18 shows the distribution in 2010. Two groups APICDA and YDFDA have relatively large allotments of Amendment 80 species. APICDA especially, gets a relatively large share of the Atka mackerel and Pacific ocean perch (30 percent of each). On CDQ group, CBSFA, has relatively small allotments of Amendment 80 species (8 to 9 percent of each).

Table 10-18 Proportional allotments of Amendment 80 species CDQ allocations among CDQ Groups in 2010

	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Pacific cod	15	21	9	18	18	19
Atka mackerel	30	15	8	15	14	18
Yellowfin sole	28	24	8	6	7	27
Rock sole	24	23	8	11	11	23
Flathead sole	20	21	9	15	15	20
Pacific ocean perch	30	15	8	15	14	18
Source: NMFS AKR worksheet accessed at http://alaskafisheries.noaa.gov/cdq/current_historical.htm on July 2, 2010.						

In 2007, the six CDQ entities held approximately $543 million in assets. Since inception of the CDQ Program in 1992, the CDQ entities have generated more than $204 million in wages, education, and

training benefits. CDQ entities fund fisheries infrastructure investments such as docks, harbors, seafood processing plants, fisheries support centers, and vessels such as motherships and catcher/processors that operate in crab, halibut, and groundfish fisheries. In 2007 fisheries and fishery related investments by the six CDQ entities totaled more than $140 million, primarily in the BSAI. Local programs purchase limited access privileges in the fishery and acquire equity position in existing fishery businesses. The six CDQ entities had total revenues in 2007 of approximately $170 million, of which 41 percent ($70 million) was derived from CDQ royalties. Income from sources other than royalties has exceeded royalty income since 2004, with direct income accounting for 54-59 percent of revenue annually (WACDA 2007).

Pollock royalties are a very important source of CDQ Program revenues that directly fund investments in the region. Pollock royalties have historically represented about 80 percent of total annual royalties from the CDQ allocations and, in 2005, were approximately $50 million. Specific information about total annual pollock royalties for all CDQ entities combined has not been publically available since 2005.

10.2.7 Subsistence use of Steller sea lions

Alaska Natives hunt Steller sea lions for subsistence. They have done so for at least 6,000 years, as indicated by remains found at prehistoric archeological sites (Turek et al. 2008:14). Harvest data collected intermittently between 1981 and 1991, from 25 communities on the lower Alaska Peninsula, lower Cook Inlet, Prince William Sound, and Kodiak Island, indicate an annual harvest in that area of between 300 and 400 animals in those areas (Turek et al. 2008:34). Systematic harvest estimates are available from 1992 through 2008; the point estimates of total takes (harvested animals and animals struck and lost) range from 146 animals in 2008 to 549 animals in 1992. The 95 percent confidence interval around the 2008 point estimate was 106 to 224 animals. The harvest declined from 1992 to 1996, and then leveled off at a lower level through 2008 (Wolfe et al. 2009:25–26).

Relatively small numbers of subsistence users harvest Steller sea lions. In 2008, an estimated 57 Alaska Native households reported hunting Steller sea lions, and an estimated 50 households reported harvesting sea lions. These participation levels had dropped considerably since 1992, when 135 households reported hunting sea lions, and 91 reported harvesting sea lions. In 2008, 96.8 percent of the households surveyed did not hunt Steller sea lions (Wolfe et al. 2008:35, 38).

Larger numbers of households are affected by subsistence harvests, since Steller sea lion products are distributed through subsistence trade and sharing networks (Wolfe et al. 2009:38). For, example, Atka, a small community in Area 541, for which subsistence survey information was collected in 2008, there were 25 Native households and an estimated Native population of 84 persons. Atka residents harvested an estimated 35 sea lions in 2008. An estimated 40 percent of the households harvested sea lions, 70 percent received sea lion products, and 60 percent gave away sea lion products (Wolfe et al. 2009:C-91). The reported survey information does not distinguish between sea lion products entering and leaving the community. The percentages suggest that people receiving sea lion products will also give them away, and that households harvesting sea lions may still receive sea lion products through exchange networks.

Atka is one of two Alaska communities within the action area of Areas 541 to 543. Atkans are relatively active in Steller sea lion harvests and distribution compared to residents of other Alaska subsistence communities. The 2008 Atka harvest of 35 sea lions was a large percentage of the statewide 2008 harvest of 146 sea lions. The other community in this action area is Adak. Residents of Adak are estimated to have taken four sea lions in 2008 (Wolfe et al. 2009:C-87).

Turek et al. (2008), citing Haynes and Mishler (1991:14), describe the traditional subsistence uses for sea lions:

> Traditionally, Steller sea lions were taken for food, clothing, and for materials for skin boats. Sea lion blubber and meat, including the livers and hearts, was dried, baked, boiled, or eaten raw. Boots soles were made from the skin of the flippers and boot uppers from the skin of the throats. The stomach was used as a water-tight container, and the bladder was made into a fishing float. Sea lion whiskers decorated wooden hunting hats and cleaned tobacco pipes.

As noted, harvests of sea lions declined in the early 1990s and then leveled off for the remainder of the period. Subsistence harvests of sea lions have not been regulated or controlled by the state or federal government; therefore this is not the reason for the decline. The size of the sea lion population could affect this in three ways. [5]

First, a smaller population may lead to lower catch per unit of effort. Even if effort stayed at historical levels, catches could drop. Steller sea lions aggregate reasonably persistently at known haulout and rookery locations year after year. Declining populations would still do so, except if a haulout or rookery population crossed a threshold leading to abandonment of a site. Under these circumstances catch per unit of effort could remain relatively high as population declined.

Second, it is unlikely that effort would stay at historical levels. If catch per unit of effort gets smaller, time required to find, and kill, each sea lion increases, and the opportunity costs of harvesting sea lions, as opposed to pursuing other subsistence activities, or using time for other purposes, becomes larger. A day spent hunting sea lions would have a higher cost in terms of foregone harvests of other fish and game species. Some subsistence hunters would spend less time hunting sea lions, and others would stop hunting altogether.

Third, publicity about declining stocks and the listing of the animals may cause subsistence hunters to stop hunting because of a conservation motive, or out of confusion about hunting regulations. Haynes and Mishler (1991:33) observed "a widespread misapprehension among Native hunters that it is illegal for them to take sea lions for subsistence because of their widely publicized listing as a threatened species. All over the state Native hunters are increasingly afraid of being prosecuted if they do take sea lions…. This misunderstanding in itself will almost certainly lead to a reduced overall harvest in coming years."

The available information is not sufficient to discriminate between these reasons for the decline in harvests.

10.3 Impact on Fleet Activity and Fish Harvests

10.3.1 Introduction

The purpose of this section is to explain how the restrictions proposed in the two action alternatives may change the behavior of fishing vessels, and the amounts of fish of different species that are harvested. The restrictions may prompt the directly regulated fishing firms to shift their vessels to alternative fisheries and these shifts may, in turn, affect vessels already active in those fisheries.

In recent years, researchers have begun to publish analyses based on models of the ways firms choose to deploy their fishing vessels in various locations and fisheries when operating in the North Pacific.[6] These

[5] It is possible that increasing productivity in other subsistence activities, or increasing wage income opportunities, may increase the opportunity costs of hunting sea lions. Desire to harvest SSL may also change as village culture evolves.

[6] These models are variants of random utility discrete choice modeling (also called random utility models or RUMs).

are similar to models that have been used in fisheries since the 1980s, and for analysis of choices among other types of discrete alternatives since the 1970s. In the North Pacific, models have been applied to Bering Sea pollock fishing decisions in 2000 (Haynie and Layton), GOA groundfish fishing decisions in 2001 (Berman et al 2008.), Bering Sea and Aleutian Island flatfish fishing (Haynie, Hicks, and Schnier 2009; Abbott and Wilen 2010), and Aleutian Islands Atka mackerel fishing (Hicks and Schnier 2010; Schnier and Felthoven [forthcoming]). In several instances these models have been applied to evaluate the impacts of spatial fishery closures (Haynie and Layton; Berman et al. 2008; Hicks and Schnier 2009; Schnier and Felthoven [forthcoming]). The time frame for this analysis, however, has been too short to allow this modeling approach.[7]

Because it has been impractical to implement empirically based economic models of location choice in the time available, a more qualitative, three-part, approach has been adopted:

- First, the impacts of the alternative actions on the directly regulated vessels are evaluated. These alternatives restrict harvesting activity and lead to reductions in Atka mackerel and Pacific cod catches in the Aleutian Islands. The impacts are identified and described, and estimates of catch reductions are made, to the extent possible.
- Second, potential responses of the directly regulated vessels are evaluated. When vessel operators lose fishing opportunities for species in a given area, they will react in an effort to minimize their losses. The most likely alternative opportunities are identified and described. Possible alternative species catch weights are estimated.
- Third, the impacts of the redeployment of the directly regulated vessels on the vessels already operating in the fisheries to which they redeploy are evaluated.

Estimates in this draft are based on the informed judgment of NMFS Alaska Region staff. The constraints imposed in modern fisheries by quota share programs, TAC limits, sector allocations, sideboards, and other regulatory restrictions help bound estimates of potential impacts.

When TACs are used in the analysis, the 2011 TACs are used. These are TACs adopted for 2011 by the Council in December 2009 and published in the *Federal Register* (75 FR 11778, March 12, 2010). These TACs were chosen for analysis because they are currently the effective TACs for the first year in which this action will be effective. The Council and Secretary will revisit these TACs in fall 2010, and many of them may change in response to new and updated information about the fisheries.

This section only discusses changes in vessel deployment and in the weights of fish caught. Estimates of revenue and welfare impacts are provided in section 10.6.

The three alternatives under consideration in this action were described in detail in chapter 2, and in section 10.1 of this EA/RIR.

As noted earlier, for the purpose of this analysis, the fleets that may be directly regulated by this action have been grouped into four categories: (1) Amendment 80 trawl catcher/processors, (2) trawl catcher vessels delivering codends over the side to catcher/processors acting as motherships and delivering shoreside in Adak and Dutch Harbor/Unalaska, (3) fixed gear (longline and pot) catcher/processors targeting Pacific cod, and (4) vessels operating within the State managed Pacific cod fishery. Trawl catcher vessels operating in State waters during the parallel fishery have been treated in category 2 along with trawl catcher vessels operating in federal waters. Some segments of this fleet include small numbers of vessels, or deliver to a limited number of firms, so confidentiality of data precludes providing certain

[7]Models of the type used in these analyses can permit inferences about the welfare impacts of fisheries closures. This is addressed further in section 10.6.

information. Hook-and-line and pot catcher/processor vessels are aggregated into a fixed gear group for this reason.

The analysis assumes that the State will continue to manage its parallel fishery by adopting the management regulations governing the fishery in federal waters. The State's actual management would depend on actions taken by the Alaska Board of Fisheries. The analysis assumes that the State will manage its State-managed State waters fishery so as to maintain the character of the fleet in that fishery.

As described in section 10.2, the BSAI Pacific cod TAC is allocated among sectors defined by vessel length, fishing gear, processor status, and CDQ or Amendment 80 status. While the sector allocations are complex, the area allocations are simple: each sector allocation may be fished anywhere a Pacific cod fishery is authorized in the BSAI—that is, the sector allocations are not divided among fishing areas. A fishing vessel may fish against its sector allocation in the Aleutian Islands or in the Bering Sea. Prohibiting retention in the Aleutian Islands does not change the size of the overall sector TAC allocation.

10.3.2 The Amendment 80 Trawl Catcher/Processors

Amendment 80 trawl catcher/processors harvest both Atka mackerel and Pacific cod in the Aleutian Islands. The proposed action would reduce the sector's catches of both of these species. The smaller harvests of these target species would also be associated with reduced harvests of other groundfish and prohibited species taken as incidental catch or bycatch in the Aleutian fisheries. The sector will not be able to find sources of Atka mackerel to offset the loss of fishing opportunities for that species. The fleet may have difficulty offsetting the loss of Pacific cod by fishing for it more intensely in the Bering Sea. In the absence of provisions to allow the rollover of TAC allocation from this sector, if it becomes apparent that it is unlikely to be harvested, this action could reduce the overall harvest of Pacific cod. The fleet is likely to increase its harvests of rock sole and yellowfin sole in the Bering Sea.

Table 10-19 outlines the key provisions of Alternatives 2 and 3 that would affect fixed gear catcher/processors. Both alternatives close the waters from 0 to 3 nm around Kanaga Island to groundfish fishing. As noted in a subsequent section, this would have little impact on directed fishing. Likewise, the platoon system would be eliminated under both alternatives.

Table 10-19 Selected provisions affecting Amendment 80 trawl catcher/processors in the Aleutian Islands (expressed as changes from status quo).

Area	Alternative 2	Alternative 3
Atka mackerel		
541	Change in Atka mackerel seasons	Change in Atka mackerel seasons
542	Prohibit retention of Atka mackerel	Close 0 to 20 nm of critical habitat. Reduce TAC to no more than 47% of the ABC. Modify the Atka mackerel season.
543	Prohibit retention of Atka mackerel	Prohibit retention of Atka mackerel
Pacific cod		
541	Close critical habitat to directed fishing.	Close 0 to 10 nm to directed fishing. Close 10 to 20 nm of critical habitat from June 10 to November 1.
542	Prohibit retention of Pacific cod	Close 0 to 20 nm of critical habitat to directed fishing
543	Prohibit retention of Pacific cod	Prohibit retention of Pacific cod
Source: Discussion of alternatives in chapter 2 of the EA.		

Aleutian Islands Atka mackerel fishery

Alternative 2 closes critical habitat in Area 541 to directed fishing for Atka mackerel and Pacific cod. Directed trawling for Atka mackerel is already prohibited within critical habitat in Area 541 (50 CFR 679), so this measure would have no impact on fishing for Atka mackerel in Area 541.

Alternative 2, which prohibits retention of Atka mackerel in Areas 542 and 543, regulates Amendment 80 vessels targeting Atka mackerel in those areas. Four firms own significant amounts of Amendment 80 quota share in those areas, permitting them to conduct directed fishing operations. These firms have operated seven catcher/processors and one catcher vessel in 2008 and 2009 (since Amendment 80 went into effect). The catcher vessel delivers to one of the catcher/processors. These firms would no longer be able to use this quota for directed fishing. One additional trawl catcher/processor also included in this sector for this analysis would also be precluded from fishing. The weights of fish caught in directed fishing operations would go to zero and the trawling associated with these operations would stop.

Alternative 2 also prohibits the retention of Atka mackerel as an incidental catch for operations targeting other species, for example, Pacific ocean perch in Areas 542 and 543. Atka mackerel TACs would be set at a level large enough to allow other target fisheries to continue, but these operations would be required to discard any Atka mackerel taken.

The closure of Areas 542 and 543 is unlikely to lead much effort to shift into Area 541. The existing vessels are already harvesting close to the entire Area 541/Bering Sea Atka mackerel TAC. Since the advent of Amendment 80 in 2008, at least 98 percent of the CDQ and Amendment 80 Atka mackerel allocations for Area 541 have been harvested (NMFS Alaska Region [AKR] Catch Reports accessed at http://alaskafisheries.noaa.gov/sustainablefisheries/catchstats.htm). Moreover, the existence of a quota share program for Atka mackerel in Area 541/Bering Sea will prevent new effort from entering the area in a competitive race to catch the available TAC.

Assuming the entities would no longer be able to target Atka mackerel in Areas 542 and 543 or to retain incidental catch in other target fisheries, but would face no new restrictions on fishing for Atka mackerel in Area 541, they are estimated to lose a total of about 41,800 metric tons (mt) of Atka mackerel production in 2011. The calculation, based on the 2011 TACs and TAC allocation, and the percentages of TAC allocations harvested in 2008–2009 (under Amendment 80), is detailed in Table 10-20.

Table 10-20 Estimated 2011 Atka mackerel catch under Alternative 1 (status quo and no action alternative) in Areas 542 and 543.

Area	2011 TAC component	2011 TAC allocation (mt)	Percent of TAC Allocation harvested in 2008–2009	Estimated 2011 harvest (mt)
542	TAC	26,000		
	ICA	75	3.033	228
	Trawl LA	1,851		
	Trawl A80	21,292	0.914	21,147
	CDQ	2,782	0.985	2,741
	Total 542 harvest			24,115
543	TAC	18,100		
	ICA	50	2.100	105
	Trawl A80	16,113	0.975	15,706
	CDQ	1,937	0.970	1,879
	Total 543 harvest			17,689

Sources: 75 FR 11778, March 12, 2010; NMFS AKR BSAI Catch Reports (including CDQ) for 2007, 2008, and 2009. Accessed at http://alaskafisheries.noaa.gov/sustainablefisheries/catchstats.htm on June 25, 2010. Trawl limited access allocation and Amendment 80 allocations in Area 542 have been consolidated and adjusted with the same percent of allocation percentage.

Alternative 2 would reduce aggregate trawl catcher/processor effort in Areas 542 and 543 by about 70 weeks since the these seven catcher/processor vessels averaged ten weeks with an Akta mackerel target haul in 2008 and 2009.

Alternative 3 is tailored very precisely to address the requirements of the RPA in the draft FMP biop (NMFS 2010). Alternative 3 prohibits retention in Area 543, and adopts a combination of measures to reduce the size of Atka mackerel and Pacific cod harvests in Areas 541 and 542, and to limit the locations where harvests may take place in those areas. Chapter 2 contains a detailed description of the elements of, and the rationale for, Alternative 3.

Firms would no longer be able to target Atka mackerel in Area 543, and would lose an estimated 17,700 mt of Atka production from that area in 2011. The estimate takes account of the 2011 TACs and TAC allocation, and of the percentages of TAC allocations harvested in 2008–2009 (under Amendment 80). This estimate is based on the estimate of the 2011 harvest in Area 543, in Table 10-20.

From 2003 through 2009, 47 percent of Atka mackerel harvests were taken from outside critical habitat in Area 542 (the calculation excludes the years with the highest and lowest percentages). Very little Atka mackerel came from the Kanaga Island/Ship Rock closure zone. Thus, to preserve historical access to Atka mackerel resources outside of critical habitat, while preventing more intense harvests outside due to redeployment of the fleet, the RPA requires that the TAC in Area 542 be set at no more than 47 percent of ABC (NMFS 2010). The 2011 ABC and TAC were both equal to 26,000 mt, and consideration of 2008–2009 harvest rates suggests that 24,100 mt of this would have been harvested. A 53 percent reduction in this harvest implies that the fleet would lose an estimated 11,300 mt from this area.

The reduction in targeted Atka mackerel fishing in the Aleutian Islands would be associated with reductions in the catches of incidentally taken groundfish species, and with catches of prohibited species catch (PSC) species. Table 10-21 provides estimates of the reductions in harvests of all species for both alternatives, using average bycatch rates from 2008 and 2009. The estimates in Table 10-21 are based on the rates summarized in Table 10-22.

Table 10-21 Estimated changes in catches of species in 2011 by Amendment 80 trawl catcher/processors targeting Atka mackerel in the Aleutian Islands under Alternatives 2 and 3.

Species	Alternative 2	Alternative 3	Units
Atka mackerel	(41,805)	(30,471)	mt
Northern rockfish	(2,663)	(1,941)	mt
Pacific ocean perch	(2,416)	(1,761)	mt
Pacific cod	(1,283)	(935)	mt
All other groundfish species	(1,133)	(826)	mt
Total groundfish	(49,300)	(35,934)	mt
C. bairdi	-	-	crab
C. opilio	-	-	crab
Red king crab	(937)	(683)	crab
Golden king crab	(9,367)	(6,827)	crab
Halibut	(39)	(29)	mt
Chinook salmon	(148)	(108)	salmon
Other salmon	(197)	(144)	salmon

Notes: Parentheses indicate negative amounts.
Source: NMFS AKR calculations

Table 10-22 Estimated species catch rates per ton of Amendment 80 Aleutian Island groundfish harvest in the Atka mackerel fishery, and rates of prohibited species catch (averages for 2003 to 2009).

Species	Groundfish	PSC	Units
Northern rockfish	0.0637		
Pacific ocean perch	0.0578		
Pacific cod	0.0307		
All other groundfish species	0.0271		
C. bairdi		0	Crab/mt groundfish
C. opilio		0	Crab/mt groundfish
Red king crab		0.019	Crab/mt groundfish
Golden king crab		0.19	Crab/mt groundfish
Halibut		0.0008	mt/mt groundfish
Chinook salmon		0.003	Salmon/mt groundfish
Other salmon		0.004	Salmon/mt groundfish
Source: NMFS AKR estimates			

Alternative 3 is estimated to reduce the Amendment 80 fishing time in Areas 542 and 543 to four weeks. Area 543 is closed to fishing. In 2008 and 2009, vessels spent an average of eight weeks fishing in Area 542. Given the reduction in the Area 542 TAC to no more than 47 percent of the ABC under Alternative 3, the vessels active in Area 542 are assumed to require half as much fishing time. Thus, while Alternative 2 is estimated to shorten the fishing period in Areas 542 and 543 from 10 to zero weeks, Alternative 3 is estimated to shorten it from 10 to four weeks.

Aleutian Islands Amendment 80 Trawl Catcher/Processor Pacific Cod Fishery

The top half of Table 10-23 provides estimates of the potential reductions in Pacific cod harvests by Amendment 80 trawl catcher/processors by year, for 2003 through 2009, if the management measures proposed under Alternative 2 had been in place in each year. These reductions were estimated by estimating the catches from within areas closed by the two alternatives. The decline in catch would have ranged from about 4,410 mt in 2008 to about 12,444 mt in 2003. The median decline in catch under Alternative 2 would have been about 10,500 mt.

For the purpose of evaluating the impact of the alternative on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years from 2003 through 2009. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands, from the restrictions in Alternative 2, is a reduction of about 4,410 to 12,444 mt.

The lower half of Table 10-23 also provides estimates of the potential reductions in Pacific cod harvests by Amendment 80 trawl catcher/processors by year for 2003 through 2009, if the management measures proposed under Alternative 3 had been in place in each year. The decline in catch would have ranged from about 6,500 mt in 2003 to about 8,700 mt in 2008. The median decline in catch under Alternative 3 would have been about 7,100 mt.

For the purpose of evaluating the impact of the alternative on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years from 2003 through 2009. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands, from the restrictions in Alternative 3, is a reduction of about 2,464 to 6,876 mt. The median decline is about 5,300 mt.

Table 10-23 Estimated aggregate reductions in Amendment 80 trawl catcher/processor Pacific cod harvests in the Aleutian Islands, had Alternatives 2 or 3 been in effect, by year, from 2003 through 2009.

	Change in Pacific cod harvest (mt round weight)				Reduction in catch as a percentage of total catch			
	541	542	543	Total	541	542	543	Total
Alternative 2								
2003	7,190	2,412	2,843	12,444	83%	100%	100%	
2004	4,334	3,333	3,250	10,916	76%	100%	100%	
2005	4,056	2,234	4,192	10,482	78%	100%	100%	
2006	4,234	1,939	3,021	9,194	81%	100%	100%	
2007	6,197	2,281	2,233	10,712	79%	100%	100%	
2008	1,976	785	1,668	4,428	70%	100%	100%	
2009	1,195	1,552	1,663	4,410	61%	100%	100%	
Average	4,169	2,076	2,696	8,941	75%	100%	100%	
Median	4,234	2,234	2,843	10,482	78%	100%	100%	
2003	2,443	1,148	2,843	6,434	28%	48%	100%	
2004	1,100	2,369	3,250	6,718	19%	71%	100%	
2005	708	1,976	4,192	6,876	14%	88%	100%	
2006	601	1,484	3,021	5,106	11%	77%	100%	
2007	1,358	1,673	2,233	5,264	17%	73%	100%	
2008	273	522	1,668	2,464	10%	67%	100%	
2009	46	782	1,663	2,491	2%	50%	100%	
Average	933	1,422	2,696	5,050	15%	68%	100%	
Median	708	1,484	2,843	5,264	14%	71%	100%	
Source: NMFS AKR Catch Accounting System. 2003 mt does not include CDQ.								

Other groundfish, and prohibited species, are taken incidentally in the Aleutian Islands Pacific cod fishery. Table 10-24 provides estimates of changes in the catches of these species as the Aleutian Islands Pacific cod harvest declines under Alternatives 2 and 3. Table 10-25 provides the estimated incidental catch and bycatch rates for these species on which Table 10-24 was based.

Table 10-24 Estimated changes in catches of species by Amendment 80 trawl catcher/processors targeting Pacific cod in the Aleutian Islands under Alternatives 2 and 3.

	Alternative 2		Alternative 3		
	Low	High	Low	High	
AI Pacific cod	(4,410)	(12,444)	(2,464)	(6,876)	mt
AI Atka mackerel	(106)	(300)	(59)	(166)	mt
AI rock sole	(102)	(287)	(57)	(158)	mt
AI pollock	(77)	(218)	(43)	(121)	mt
Arrowtooth flounder	-	-	-	-	mt
AI all other groundfish species	(140)	(396)	(78)	(219)	mt
All groundfish	(4,836)	(13,645)	(2,702)	(7,539)	mt
AI *C. bairdi*	(745)	(2,101)	(416)	(1,161)	crab
AI *C. opilio*	(63)	(177)	(35)	(98)	crab
AI red king crab	(300)	(846)	(168)	(467)	crab
AI golden king crab	(48)	(136)	(27)	(75)	crab
AI halibut	(9)	(25)	(5)	(14)	mt
AI Chinook salmon	(218)	(614)	(122)	(339)	salmon
AI other salmon	(48)	(136)	(27)	(75)	salmon
Notes: Reductions in parentheses. Source: NMFS AKR estimates					

Table 10-25 Estimated species catch rates per ton of Amendment 80 trawl catcher/processor groundfish harvest in the Aleutian Island Pacific cod fishery, and rates of prohibited species catch (averages for 2003–2009).

Species	Groundfish	PSC	Units
Atka mackerel	2.4%		
Rock sole	2.3%		
Pollock	1.8%		
All other groundfish species	3.2%		
C. bairdi		0.154	Crab/mt groundfish
C. opilio		0.013	Crab/mt groundfish
Red king crab		0.062	Crab/mt groundfish
Golden king crab		0.01	Crab/mt groundfish
Halibut		0.0018	mt/mt groundfish
Chinook salmon		0.045	Salmon/mt groundfish
Other salmon		0.01	Salmon/mt groundfish
Source:			

Redeployment of Amendment 80 Vessels

The eight Amendment 80 vessels whose Atka mackerel and Pacific cod harvests are restricted in the Aleutian Islands may be used to harvest fish in other fisheries. The Bering Sea Pacific cod, rock sole, and yellowfin sole fisheries are the most likely alternatives. These are discussed below. Halibut bycatch in these three fisheries may limit fishing activity in all three. At this time, it is not clear which combination of these other fisheries might be utilized. Other options for alternative vessel activity appear less likely. This sub-section first discusses potential activity in the Pacific cod, rock sole, and yellowfin sole fisheries, and then looks at the less likely options.

In the analysis that follows, fishing for Atka mackerel is assumed to be the behavioral driver for the fleet. The fleet makes many Aleutian Island hauls that target Pacific cod, but, by and large, these take place during periods when the fleet is in the Aleutian Islands to target Atka mackerel. Some of the catcher/processors did not target Pacific cod. As discussed earlier, Alternative 2 is expected to shorten the Atka mackerel fishery in Areas 542 and 543 by about ten weeks, while Alternative 3 is expected to shorten the fishing by about six weeks.

Not all the Aleutian Islands areas would be closed to fishing operations. Areas outside of critical habitat in Area 541 would remain open under both alternatives, as would areas outside of critical habitat in Area 542 under Alternative 3. However, the Area 542 Pacific cod TAC would be set at 47 percent of the Area 542 ABC, in order to prevent fishing from expanding in areas left open. In Area 541, the fleet has taken relatively small portions of its harvest in areas outside critical habitat.

Yellowfin sole and rock sole may be relatively attractive alternative targets for the Amendment 80 trawl fleet. These fisheries take place during periods when Atka mackerel fishing would no longer be possible. The Amendment 80 trawl catcher/processors hold quota share for these fisheries, or may be able to lease it from other quota share holders. Recent TACs have not been fully harvested, leaving room for expansion in production. Halibut bycatch rates are lower for these fisheries than for the Bering Sea Pacific cod fishery.

As noted earlier, the seven Amendment 80 trawl catcher/processor vessels that fish for Atka mackerel in the Aleutian Islands spend an average of about ten weeks each, fishing in Areas 542 and 543. The time is divided between the “A” and “B” seasons in the winter-spring and the fall.

The Amendment 80 fleet typically fishes Atka mackerel first thing in the year, switching to rock sole at the end of February and in March. The fleet then fishes rock sole for about four weeks. During this early part of the year, yellowfin sole fishing grounds are still covered by sea ice and are inaccessible to the

fleet. If Pacific cod fishing in the Bering Sea were precluded for the reasons discussed above, NMFS estimates that, of the ten weeks that may be freed up by the closure of the Atka mackerel and Pacific cod fisheries in the Aleutian Islands, three weeks could be spent in the rock sole fishery in the Bering Sea. The remaining seven weeks could be allocated to the yellowfin sole fishery. Halibut bycatch rates are usually higher in rock sole target fisheries, so that has limited participation in the past.

The fleet typically fishes yellowfin sole in April and May, and again in August and October. The fall Atka mackerel season typically occurs in September. Thus, it seems likely that the remaining seven weeks freed up by the Atka mackerel closure would be spent fishing for yellowfin sole. The yellowfin season may begin earlier in the spring, and continue straight through September.

In 2008–2009, Amendment 80 vessels caught 445 mt of yellowfin a week, during weeks in which they were targeting that species. At this rate, seven vessels fishing yellowfin for an additional seven weeks could take 21,800 mt. Yellowfin harvests could increase by this amount and stay within typical TAC levels. With only one week, total yellowfin catches would be 3,115 mt. In 2008–2009, Amendment 80 vessels targeting rock sole caught 204 mt of rock sole a week, during weeks in which they were targeting that species. At this rate, seven vessels fishing for rock sole for an additional three weeks could take 4,284 mt. These are the estimates used as the basis for estimates of yellowfin catches, incidental groundfish catches, and prohibited species bycatches summarized below in Table 10-26. Table 10-27 summarizes the incidental catch and bycatch rates used to prepare Table 10-26.

Table 10-26 Harvests by 80 trawl catcher/processor fishing Bering Sea yellowfin sole at a rate of 445 mt a week, and Bering Sea rock sole at a rate of 204 mt a week.

	Yellowfin sole		Rock sole		Overall change	
	Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Rock sole	1,744	748	4,284	4,284	6,028	4,533
Flathead sole	872	374	257	257	1,129	382
Yellowfin sole	21,805	9,345	1,114	1,114	22,919	4,229
Pacific cod	1,744	748	514	514	2,258	763
Arrowtooth flounder	436	187	86	86	522	148
Total groundfish	26,602	11,401	6,255	6,255	32,857	10,055
C. bairdi	63,845	27,362	10,633	10,633	74,478	19,754
C. opilio	82,467	35,343	1,876	1,876	84,343	13,657
Red king crab	5,320	2,280	6,255	6,255	11,575	7,015
Golden king crab	-	-	-	-	-	-
Halibut	186	80	81	81	268	108
Chinook salmon	27	11	63	63	89	66
Other salmon	53	23	25	25	78	33
Source: NMFS AKR estimates						

Table 10-27 Estimated species catch rates per ton in the Amendment 80 Bering Sea rock sole and yellowfin sole trawl catcher/processor harvests, and rates of prohibited species catch.

	Rock sole	Yellowfin sole	Rock Sole	Yellowfin sole	Units
Rock sole	68.5%	6.6%			
Flathead sole	4.1%	3.3%			
Yellowfin sole	17.8%	82.0%			
Pacific cod	8.2%	6.6%			
Arrowtooth flounder	1.4%	1.6%			
C. bairdi			2.4	1.7	Crab/mt
C. opilio			3.1	0.3	Crab/mt
Red king crab			0.2	1	Crab/mt
Golden king crab			0	0	Crab/mt
Halibut			0.007	0.013	Percent of weight
Chinook salmon			0.001	0.01	Salmon/mt
Other salmon			0.002	0.004	Salmon/mt
Source: NMFS AKR Catch Accounting System					

The Amendment 80 fleet could choose to fish its Pacific cod quota share in the Bering Sea rather than in the Aleutian Islands. Table 10-28 provides estimates of the amounts of groundfish bycatch and prohibited species that would be taken if the fleet were able to offset the entire estimated reduction in Aleutian Islands Pacific cod harvests in the Bering Sea. Table 10-29 provides the bycatch rates used to make these estimates.

Table 10-28 Hypothetical Incidental catch and PSC bycatch if Amendment 80 trawl catcher/processors catching as much Pacific cod in the Bering Sea as they caught in the Aleutian Islands under Alternatives 2 and 3.

	Alternative 2		Alternative 3		Units
Species	Low	High	Low	High	
Pacific cod	4,410	12,444	2,464	6,876	mt
Atka mackerel	-	-	-	-	mt
Rock sole	203	573	114	317	mt
Pollock	878	2,479	491	1,370	mt
Arrowtooth flounder	125	354	70	196	mt
All other species	365	1,029	204	568	mt
All groundfish	5,982	16,879	3,342	9,326	mt
C. bairdi	12,992	36,660	7,259	20,257	crab
C. opilio	9,780	27,597	5,464	15,249	crab
Red king	257	726	144	401	crab
Golden king	-	-	-	-	crab
Halibut	109	307	61	170	mt
Chinook	257	726	144	401	salmon
Other salmon	197	557	110	308	salmon

Notes: Reductions in parentheses.
Source: NMFS AKR estimates

Table 10-29 Estimated species catch rates per ton of Amendment 80 trawl catcher/processor groundfish harvest in the Bering Sea Pacific cod fishery, and rates of prohibited species catch (averages for 2003–2009).

	Groundfish	PSC	Units
Pacific cod	73.8%		
Atka mackerel	0%		
Rock sole	3.4%		
Pollock	14.7%		
Arrowtooth	2.1%		
All other species	6.1%		
C. bairdi		2.172	Crab/mt
C. opilio		1.635	Crab/mt
Red king		0.043	Crab/mt
Golden king		0	Crab/mt
Halibut		0.0182	Mt/mt
Chinook		0.043	Salmon/mt
Other salmon		0.033	Salmon/mt

Note: Section As discussed in the text, data for extrapolating targeted groundfish bycatch in the Bering Sea is limited for this fleet. Trawl catcher vessel target rates have been used as a proxy.
Source: NMFS AKR Catch Accounting System

There are several reasons why the Amendment 80 fleet may not fully offset the lost Pacific cod harvest in the Bering Sea. First, anecdotal evidence suggests that Pacific cod in the Bering Sea tend to be somewhat smaller than in the Aleutian Islands, and thus a less attractive target. Second, the Amendment 80 trawl fleet has shown little evidence of targeting Pacific cod in the Bering Sea in the past. Thus, this is not a traditional fishery for this fleet.

Third, the halibut bycatch in the Bering Sea trawl fishery is relatively high. The estimated halibut bycatch rate in the Aleutian Islands is 0.0018 mt of halibut per metric ton of groundfish, however, it is 0.0182 mt (ten times as much) of halibut per metric ton of groundfish in the Bering Sea. Moreover, the rates are per metric ton of groundfish associated with harvesting a Pacific cod target; estimated incidental

catch rates of groundfish in a Pacific cod target fishery are somewhat higher in the Bering Sea than in the Aleutian Islands. The estimated halibut bycatch when taking 10,000 mt of Pacific cod in the Aleutian Islands is 20 mt (see Table 10-24), but, the estimated halibut bycatch required to take the same 10,000 mt of Pacific cod in the Bering Sea is 247 mt (see Table 10-28).

In 2008 and 2009, the years since fishing began under the Amendment 80 provisions, the difference between the Amendment 80 halibut PSC allowance, and its catch of halibut has been about 300 mt. In-season managers would like to see at least a 50-mt buffer between expected catch and the PSC allowance. This suggests that Amendment 80 fishing may be limited by a 250 mt potential increase in halibut bycatch.

Table 10-30 summarizes information on halibut bycatch changes from earlier tables in this section. Each of the lines summarizing earlier table information it based on the linear extrapolation under consideration in each of those tables. Each table was prepared without considering the way halibut prohibited species use in another fishery would affect production in the fishery (Pacific cod, rock sole, or yellowfin sole) for which the table was prepared. Under both action alternatives, halibut bycatch limits would make it impossible to harvest all the potential groundfish harvest discussed above. The calculations in this section are rough approximations, and halibut needs could be more (or less) than implied under the Alternative 3 summary.

Table 10-30 Potential halibut bycatch changes estimated in this section.

	Alternative 2		Alternative 3	
Species	Low	High	Low	High
Aleutian Islands Atka mackerel	(39)	(39)	(29)	(29)
Aleutian Islands Pacific cod	(9)	(25)	(5)	(14)
Bering Sea Pacific cod	109	307	61	170
Bering Sea rock sole	81	81	81	81
Bering Sea yellowfin sole	186	186	80	80
Net halibut requirement	328	510	188	288
Available	250	250	250	250
Excess	78	260	0	38

Source: Earlier tables in this section
Note: Hypothetical changes in halibut associated with assumptions used in each section. Calculations do not take account of potential limitation of groundfish catch by halibut PSC constraints.

NMFS is unable to judge how the Amendment 80 trawl catcher/processors would use their available halibut mortality allocation among Bering Sea rock sole, yellowfin sole, and Pacific cod fisheries. NMFS expects some additional effort in the Aleutian Islands where Pacific cod habitat remains available, providing access to Pacific cod at a lower cost in terms of halibut mortality. However, because of the limitation of remaining available Pacific cod habitat under Alternative 2, the Amendment 80 fleet would be unable to harvest the amounts they have historically taken within the Aleutian Islands. Therefore the Amendment 80 vessels would need to move to the Bering Sea to harvest additional Pacific cod.

Since targeted Pacific cod in the Bering Sea has the highest incidence rate of halibut mortality, it is possible that a large amount of Pacific cod allocated to Amendment 80 vessels would be left unharvested. Table 10-24 shows the estimated reduction in Pacific cod harvests in the Aleutian Islands. Based on this table, a significant portion (4,400 to 12,400 mt) of Pacific cod could go unharvested under Alternative 2, and a significant portion (2,500 to 6,900 mt) could go unharvested under Alternative 3. Unlike other sectors, this Pacific cod could not be reallocated to other sectors and would be left unharvested.

Although halibut may be a limiting factor, the Amendment 80 vessels may have an ability to reduce halibut bycatch through cooperative arrangements. If cooperative management leads to better control

over halibut bycatch, the Amendment 80 vessels may be able to fully offset the lost production in the Aleutians with additional production in the Bering Sea.

There are options besides fishing for Pacific cod, rock sole, and yellowfin sole available to the Amendment 80 trawl catcher/processors. These include (1) remaining in port; (2) pursuing fishing opportunities outside of Alaskan waters; (3) increasing the effort put into BSAI species that are not covered by Amendment 80, for example, arrowtooth flounder and Greenland turbot; (4) increasing effort in the GOA; and (5) increasing fishing effort for other Amendment 80 species. Each of these five possibilities is discussed below.

Vessels may remain in port during the period they would otherwise have been harvesting Atka mackerel and Pacific cod. If the vessels displaced from the Aleutian Islands remained in their home ports during the period when they had formerly been fishing, there would be no offsetting fish catches. Vessels may remain in port only part of the time, fishing in Alaska for the remainder. For example, it is possible that vessels may remain in port for a week or so longer than they otherwise would have done, before traveling to Alaska. In the absence of other information, the following analysis assumes that vessels would not remain in port during the time when they would otherwise have been fishing for Atka mackerel. This implies that the variable revenue, from vessel use during these weeks, exceeds the variable cost of fishing. However, this assumption may be wrong for some or all of the vessels and weeks. If this is the case, the analysis overstates the potential revenue offset to the revenue reductions in the Aleutian Islands.

Opportunities for these vessels to fish outside Alaskan waters are probably limited. Large catcher/processors are unusual in U.S. fisheries, although trawl catcher/processors are used in the fishery for whiting under the jurisdiction of the Pacific Fishery Management Council. Because many of the vessels active in Alaska fisheries are based in the Pacific Northwest, this analysis has been limited to potential use in that region. While some catcher/processors in the pollock fishery participate in the whiting fishery, the whiting fishery is now under limited entry. Catcher/processors displaced from the Aleutian Islands could only enter the whiting fishery, either as a catcher/processor or mothership, by buying a limited entry permit. Freezer-longliner participation is prohibited in the Pacific Northwest sablefish fishery, so Pacific cod longline catcher/processors could not be used there. In general, this does not appear to be a source of offsetting revenues for the firms adversely impacted by this alternative, nor does it appear to be a source of offsetting aggregate production for U.S. fisheries (J. Seger, Economist, Pacific Fisheries Management Council, personal communication, June 25, 2010).

Another possibility is that these vessels may increase the effort in fishing for Bering Sea and Aleutian Islands species that are not covered by Amendment 80. The most likely fisheries among these are the arrowtooth flounder and Greenland turbot fisheries. These are relatively new target fisheries and some Amendment 80 Atka mackerel vessels have been prosecuting this fishery since the Amendment 80 program began in 2008. These remain derby-style fisheries. However, the 2009 arrowtooth flounder catch was only 28,686 mt or 43 percent of the initial TAC. The Greenland turbot fishery is also prosecuted by hook-and-line catcher/processors. In 2009, the catch reached 49 percent of the Bering Sea initial TAC and 99 percent of the Aleutian Islands TAC. The season opening date for both fisheries is May 1, thus, these fisheries are not available as a new target for the Atka mackerel vessels when the “A” season Atka mackerel fishery is currently open. While arrowtooth flounder and Greenland turbot production may increase through time, this production would not be related to the closure of Atka mackerel fishing in Areas 542 and 543 during the first part of the year.

Alaska plaice and “other flatfish” are the only other BSAI species or species groups not managed by catch shares that are open for directed fishing. Alaska plaice generally have been lightly harvested as no major commercial target fishery exists for them. The 2009 catch was 13,944 mt or 33 percent of the initial TAC, primarily caught in pursuit of other flatfish species. The miscellaneous species of the “other flatfish”

species category are generally not pursued as fishery targets but are captured in fisheries for other species. The 2009 catch was 2,163 mt or 15 percent of the initial TAC. Amendment 80 catcher/processors also could target the trawl allocation of sablefish, but high halibut PSC rates discourage this target.

Regulations limit Amendment 80 vessels to historic catch levels by establishing sideboard amounts for some groundfish species and GOA halibut PSC. Amendment 80 sideboards are applied to all Amendment 80 vessels in aggregate. Since sideboards were implemented to limit the Amendment 80 vessels to historical levels of harvest once they had become rationalized in their Bering Sea fisheries, these vessels are not believed to have much opportunity to expand operations in the GOA to compensate for the loss of fishing opportunities in the Aleutian Islands.

These firms might increase the effort they put into fishing for other Amendment 80 species. There are five Amendment 80 species in addition to Atka mackerel. These are Pacific ocean perch in the Aleutian Islands, Pacific cod, flathead sole, yellowfin sole, and rock sole. The Amendment 80 program created quota shares for these species, and facilitated the formation of cooperative arrangements for harvest.

It is possible that these vessels would turn their attention to fishing Pacific ocean perch more intensely, and coming closer to taking the full TAC. With the cessation of targeted Atka mackerel harvests, the opportunity cost of time spent fishing and processing in the Pacific ocean perch fishery would get smaller, and firms may feel justified in investing the time needed to fish for and process both species.

In general, increases in Pacific ocean perch catches are likely to be modest. As shown below, in most of the Aleutian Islands areas, vessels normally take in excess of 90 percent of the available TACs. The only area where the catch fell significantly below the TAC was the Bering Sea since directed fishing for Pacific ocean perch has been closed in the Bering Sea. Table 10-31 provides an estimate of the total potential Pacific ocean perch TAC that may be available to more intense harvest. The estimate is the difference between the average catch from 2007 through 2009, subtracted from the 2011 TACS (and set to zero when the average historical catch exceeds the 2011 TACs). The estimated Pacific ocean perch available is about 3,300 mt.

Table 10-31 Impact of Alternative 2 on Pacific perch catches in the BSAI.

Pacific ocean perch catches compared to 2011 TACs (all values in mt)						
Area	2007	2008	2009	Avg. 07-09	2011 TAC	TAC – Avg.
BS (incl CDQ)	870	510	623	668	3,790	3,122
541	4,762	4,250	3,621	4,211	3,733	0
541 CDQ	335	445	416	399	447	48
542	4,303	4,358	3,848	4,170	3,777	0
542 CDQ	357	450	429	412	453	41
543	7,280	6,653	5,768	6,567	5,787	0
543 CDQ	544	764	643	650	693	43
Total						3,254
Sources: 75 FR 11778; NMFS AKR BSAI Catch Reports (including CDQ) for 2007, 2008, and 2009. Accessed at http://alaskafisheries.noaa.gov/sustainablefisheries/catchstats.htm on June 25, 2010.						

In addition to these considerations, Pacific ocean perch is traditionally fished in the GOA and in the Aleutian Islands in July. This is a holdover from the years before the implementation of Amendment 80, when the fishery was restricted to this period by regulation. For at least the first years of the Amendment 80 management program, the Amendment 80 vessels have continued to operate in this fishery in July. Thus, the additional fishing time for Amendment 80 trawl catcher/processors will not be created at the traditional period for the Pacific ocean perch fishery. However, as time passes, vessels may experiment with this fishery at other times of the year. The release of Amendment 80 vessels in the spring and fall may prompt Pacific ocean perch fishing in those periods. However, given the high levels of TAC already

taken, this would involve a shift in the time Pacific ocean perch were harvested, but only limited potential increases in the aggregate harvest.

Flathead sole has not been targeted by Amendment 80 Atka mackerel vessels in the past. The flathead sole these vessels do catch is usually caught incidentally in yellowfin sole and rock sole target fisheries. The Amendment 80 Atka mackerel vessels receive only 19 percent of the overall flathead sole quota share. If halibut mortality is low enough compared to the available allocation of PSC, it would be possible for these vessels to increase their flathead sole catch; however, past history suggests that it is more likely they would reserve their available halibut PSC allocation for use in the rock sole, yellowfin sole, and arrowtooth flounder fisheries. As discussed elsewhere in this section, halibut PSC could restrict Amendment 80 vessel redeployment.

Changes in Behavior of Fleets Impacted by Amendment 80 Vessel Redeployment

From the preceding discussion, it appears that the winter fishery for rock sole, and the spring and fall fisheries for yellowfin sole, would be the fisheries most directly affected by the closure of the Atka mackerel fishery in Areas 542 and 543. The rock sole fishery is an Amendment 80 fishery and the available rock sole TAC is allocated among the participating firms in proportion to their quota share holdings. The yellowfin sole TAC is divided between the BSAI trawl limited access fishery and the Amendment 80 fishery. The Amendment 80 portion of the yellowfin sole harvest is governed by the allocation of quota share. The additional harvest by Amendment 80 vessels will not reduce the size of the trawl limited access fishery's allocation or increase congestion by vessels harvesting the Amendment 80 portion.

Figure 10-5 shows the areas within which the rock sole and yellowfin sole fisheries take place. Given the large areas that are fished, and the mobile nature of trawl gear, it is unlikely that the increase in time spent in the fishery by seven catcher/processors would create significant congestion, or have other direct impacts on other vessels operating in these fleets.

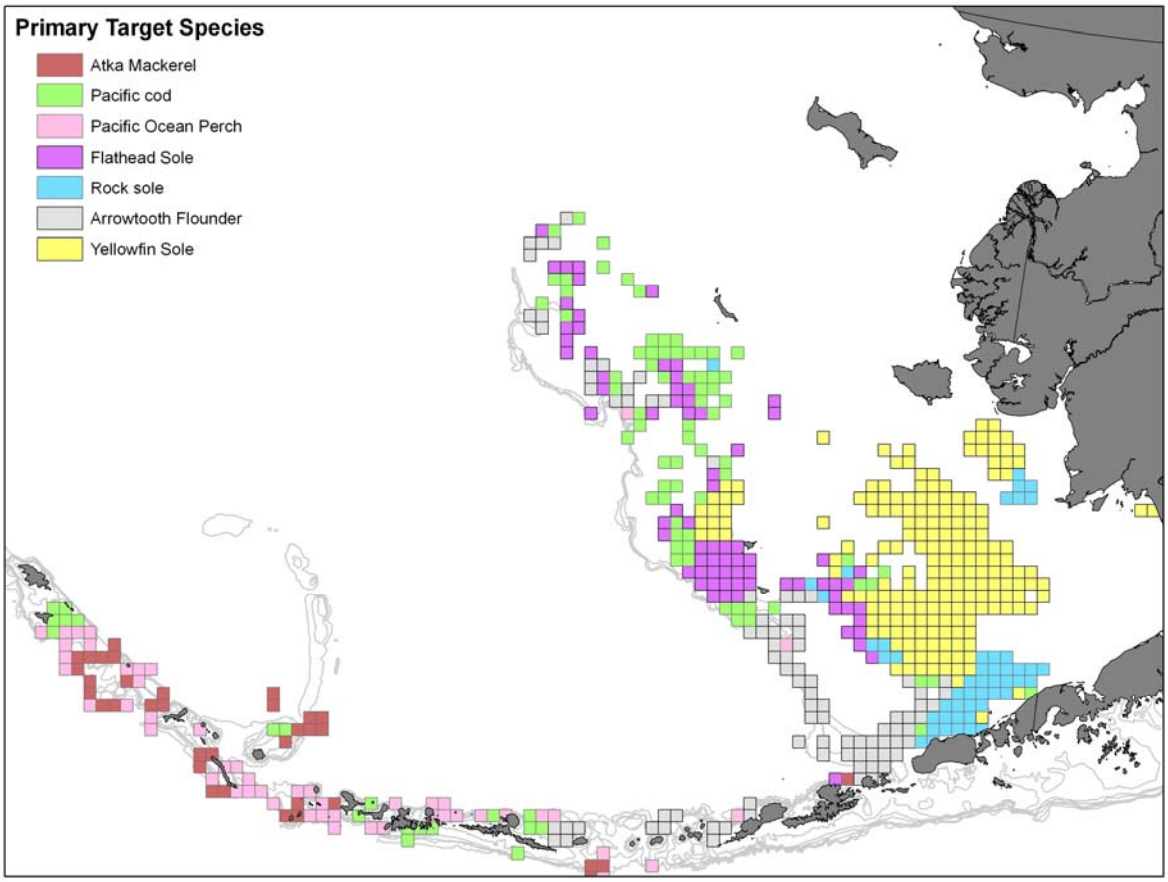

Figure 10-5 Primary target areas for Amendment 80 species (Atka mackerel, Pacific cod, Pacific ocean perch, flathead sole, rock sole, and yellowfin sole) and Arrowtooth flounder. Source: NMFS AKR Catch Accounting System.

The elimination of about two-thirds of the directed Atka mackerel harvest may increase Atka mackerel prices, creating an incentive for vessels in other fisheries to increase their incidental catch of Atka mackerel. A price effect might work in reverse in the rock sole and yellowfin sole fleets. Price impacts are discussed further in section 10.6.

10.3.3 Catcher Vessels

Alternatives 2 and 3 treat trawl and non-trawl catcher vessels somewhat differently. The differences by management area are described in Table 10-32. Both alternatives close the waters from 0 to 3 nm around Kanaga Island to groundfish fishing. As noted in a subsequent section, the closure around Kanaga Island would have little impact on directed fishing.

Table 10-32 Key provisions affecting Pacific cod catcher vessel operations (expressed as changes from status quo).

	Trawl		Non-trawl	
Area	Alt 2	Alt 3	Alt 2	Alt 3
541	Close critical habitat to directed fishing.	Close 0 to 10 nm of critical habitat to fishing. Close 10 to 20 nm to directed fishing from June 10 to November 1.	Close critical habitat to directed fishing. Prohibit directed fishing by non-trawl gears in November and December.	Close 0 to 10 nm of critical habitat to fishing. Close 10 to 20 nm to directed fishing from January 1 through June 10.
542	Prohibit retention of Pacific cod.	Close 0 to 20 nm of critical habitat to directed fishing year round.	Prohibit retention of Pacific cod.	Close 0 to 10 nm to directed fishing year round. Close 10 to 20 nm to directed fishing January 1 through June 10
543	Prohibit retention of Pacific cod	Prohibit retention of Pacific cod	Prohibit retention of Pacific cod	Prohibit retention of Pacific cod
Source: Discussion of alternatives in chapter 2 of the EA.				

As discussed in section 10.2, trawl, hook-and-line, pot, and jig catcher vessels all harvest Pacific cod in federal waters and in associated parallel fisheries in State waters of the Aleutian Islands. To preserve data confidentiality, the vessels in these fleets have been grouped together in a catcher vessel category for analysis.

In this section, the catcher vessels operating in federal waters, and those operating in the parallel fishery in State waters, are treated together. The vessels that operate in the State managed Pacific cod fishery in State waters will be treated separately in a later section. This action would reduce the catch of Pacific cod by catcher vessels in the Aleutian Islands.

Catcher vessels may be able to offset some of this loss by increased activity in the Bering Sea; however, it is also possible that this fleet would not be able to fully offset the lost harvest. If it is not able to so do, Pacific cod quota may be rolled over in the fall "C" season to other sectors. Pacific cod rollovers are complex, and are governed by regulations.

The top half of Table 10-33 provides estimates of the potential reductions in Pacific cod harvests by catcher vessels delivering to motherships and shoreside processors, by year, for 2003 through 2009, if the management measures proposed under Alternative 2 had been in place in each year. The annual estimates in this table are based on estimates of the volume of Pacific cod taken in waters that would be closed by the two alternatives. The decline in catch would have ranged from about 7,700 mt in 2005 to about 14,000 mt in 2003. The median decline in catch would have been about 12,100 mt.

For the purpose of evaluating the impact of Alternative 2 on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years from 2003 through 2009. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands, from the restrictions in Alternative 2, is a reduction of about 7,700 to 14,000 mt.

The bottom half of Table 10-33 also provides estimates of the potential reductions in Pacific cod harvests by trawl catcher vessels delivering to motherships and shoreside processors, by year, for 2003 through 2009, if the management measures proposed under Alternative 3 had been in place in each year. The decline in catch would have ranged from about 2,300 mt in 2006 to about 7,100 mt in 2003.

For the purpose of evaluating the impact of Alternative 3 on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years from 2003 through 2009. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands, from the restrictions in Alternative 2, is a reduction of about 2,300 to 7,100 mt.

Table 10-33 Estimated aggregate Pacific cod reductions for catcher vessels delivering to motherships or shoreside processors in the Aleutian Islands had Alternatives 2 and 3 been in effect, by year, from 2003 through 2009.

	Change in Pacific cod harvest (mt round weight)				Reduction in catch as a percentage of total catch			
	541	542	543	Total	541	542	543	Total
Alternative 2								
2003	10,172	3,741	39	13,952	74%	100%	100%	80%
2004	9,475	2,605	13	12,092	86%	100%	100%	89%
2005	6,306	1,299	72	7,678	92%	100%	100%	93%
2006	4,720	2,455	1,036	8,211	68%	100%	100%	79%
2007	8,637	1,651	1,068	11,356	59%	100%	100%	66%
2008	8,844	1,255	3,144	13,243	67%	100%	100%	75%
2009	7,690	2,137	3,460	13,287	75%	100%	100%	84%
Average	7,978	2,163	1,262	11,403	75%	100%	100%	81%
Median	8,637	2,137	1,036	12,092	74%	100%	100%	80%
Alternative 3								
2003	5,620	1,461	39	7,121	41%	39%	100%	41%
2004	4,262	1,341	13	5,616	39%	51%	100%	41%
2005	2,841	672	72	3,585	41%	52%	100%	44%
2006	724	513	1,036	2,273	10%	21%	100%	22%
2007	3,693	627	1,068	5,388	25%	38%	100%	31%
2008	2,006	668	3,144	5,818	15%	53%	100%	33%
2009	2,003	434	3,460	5,897	20%	20%	100%	37%
Average	3,021	817	1,262	5,100	27%	39%	100%	36%
Median	2,841	668	1,036	5,616	25%	39%	100%	37%

Note: This table provides estimates of the reduction in harvest associated with the proposed actions. A comparison of this table with Table 10-14, will show that some of these reductions, especially in Area 542 under Alternative 2, exceed actual estimated harvest. The two tables were prepared with different data sets. Table 10-33 was prepared with the Alaska Regions Catch in Area (CIA) data set. There may be misallocation of some harvest between Area 542 and other areas. NMFS AKR is investigating this issue with the intent of making appropriate adjustments for the final draft of the RIR.
Source: NMFS AKR Catch in Area (CIA) data set.

The key elements of Alternatives 2 and 3 are outlined in Table 10-32. Alternative 2 would force directed fishing for Pacific cod to shift to areas outside Area 541 critical habitat, and into the Bering Sea. Alternative 3 would force all directed fishing to areas outside critical habitat in Areas 541 and 542, and into the Bering Sea.

As shown in Table 10-5 in section 10.2, less than half of the overall Pacific cod harvests have come from outside critical habitat in Areas 541 and 542 from 2003 through 2009. The proportion was often much less than half. Because of this, it is unlikely that available Pacific cod habitat outside critical habitat would be able to support the historical effort in the Aleutian Islands, and the majority of the vessels would be forced to move into the Bering Sea to harvest the similar amounts of Pacific cod.

The Pacific cod fishery by catcher vessels in the Aleutian Islands is largely conducted by trawl vessels and is seasonal with the majority of harvests occurring from February to April. Catcher vessels targeting Pacific cod largely focus effort in Area 541 around Adak and Atka Islands. Some effort occurs in Areas 542 and 543, primarily by catcher vessels delivering to motherships. Effort in Area 543 by catcher vessels was minimal prior to 2006. In 2006 and 2007 approximately 1,000 mt were taken in this area. In 2008 and 2009 the catch in Area 543 increased to 3,000 mt.

Trawl halibut bycatch rates have been higher in the Bering Sea than in the Aleutian Islands. Bycatch constraints may prevent trawl catcher vessels that historically participated in the Aleutian Islands from maintaining similar levels of catch in the Bering Sea. If Pacific cod harvests from the trawl catcher vessel allocation become smaller, unused amounts of “B” season trawl Pacific cod catch would be rolled into the trawl “C” season. Since the “C” season quota is rarely fully utilized by the trawl catcher vessel fleet, a large amount of this would be reallocated to other sectors, the majority being obtained by hook-and-line catcher/processors, thereby possibly extending their season.

For these reasons, the catcher vessel fleet is not expected to be able, itself, to fully offset the loss of about 7,700 to about 14,000 mt of Pacific cod in the Aleutian Islands under this alternative.

Fishing effort in Area 542 has occurred mostly within critical habitat. This effort is likely to shift to the Petrel Bank area, and to areas open in Area 541. In Area 541, the area closed under Alternative 3 produced 30 percent to 50 percent of the historical catch within critical habitat. This closure would force those vessels to concentrate in Pacific cod habitat outside critical habitat. Based on NMFS catch accounting records, NMFS believes that the majority of this catch could be harvested within Area 541 outside of 10 nm, although some effort could shift to the Bering Sea. NMFS believes that the "A" and "B" seasonal allocation would still be harvested under Alternative 3, though it may take longer to harvest the same amount depending on how much effort shifts to the Bering Sea and the effect of increased fishing in a smaller area.

Motherships that operated in the Aleutian Islands would be forced to compete for business in areas typically fished by shore-based catcher vessels. This removes some of the benefit for a catcher vessel to operate with a mothership and could cause some catcher vessels to switch from mothership to shore-based operations. There is a chance that certain vessels that historically fished for shore-based operations in the Bering Sea and Area 541 would be able to compete more effectively for Pacific cod resources. This would shift catch away from catcher vessels that historically delivered to motherships in Areas 542 and 543, to those shore-based vessels. Furthermore, mothership activity for Pacific cod typically does not occur in the Bering Sea, and it is not expected that under this alternative, motherships would shift into the Bering Sea.

The impact of the Aleutian Islands Pacific cod restrictions are examined below for the catcher vessels under two alternative scenarios: (1) that the catcher vessel fleet finds itself able to fully harvest the Pacific cod in the Bering Sea, and (2) that it is unable to do so, and the Pacific cod quota is entirely rolled over to the "C" season and harvested by the fixed gear catcher/processor sector. These two assumptions bound the range of potential outcomes; the actual result is likely to fall between them.

Table 10-34 shows the reduction in Pacific cod harvest and associated species catches in the Aleutian Islands, and the results in the Bering Sea, on the assumption that the catcher vessel fleet is able to harvest the Pacific cod there. Since a preponderance of this Pacific cod is harvested by trawl catcher vessels, the impact on these vessels if the Pacific cod is all rolled over to the "C" season and harvested by other fleet sectors is approximated in the first part of the table showing the decline in the Aleutian Islands quantities. Table 10-35 summarizes the bycatch rates used for the catcher vessel fleet in this analysis.

Table 10-34 Changes in Aleutian Island catcher vessel Pacific cod harvests, and possible changes for the same fleet in the Bering Sea if it completely offsets its Pacific cod harvests there.

Area	Species	Alternative 2		Alternative 3	
		Low	High	Low	High
Aleutian Islands	Pacific cod	(7,700)	(14,000)	(2,300)	(7,100)
	Atka mackerel	(186)	(338)	(55)	(171)
	Rock sole	(177)	(322)	(53)	(163)
	Pollock	(135)	(246)	(40)	(125)
	All other groundfish species	(245)	(445)	(73)	(226)
	All groundfish	(8,443)	(15,351)	(2,522)	(7,785)
	C. bairdi	(1,300)	(2,364)	(388)	(1,199)
	C. opilio	(110)	(200)	(33)	(101)
	Red king crab	(523)	(952)	(156)	(483)
	Golden king crab	(84)	(154)	(25)	(78)
	Halibut	(15)	(28)	(5)	(14)
	Chinook salmon	(380)	(691)	(113)	(350)
	Other salmon	(84)	(154)	(25)	(78)
Bering Sea	Pacific cod	7,700	14,000	2,300	7,100
	Atka mackerel	-	-	-	-
	Rock sole	355	645	106	327
	Pollock	1,534	2,789	458	1,414
	All other groundfish species	856	1,556	256	789
	All groundfish	10,444	18,989	3,120	9,630
	C. bairdi	22,684	41,244	6,776	20,917
	C. opilio	17,076	31,047	5,101	15,745
	Red king crab	449	817	134	414
	Golden king	-	-	-	-
	Halibut	190	346	57	175
	Chinook salmon	449	817	134	414
	Other salmon	345	627	103	318
Net impact	Pacific cod	-	-	-	-
	Atka mackerel	(186)	(338)	(55)	(171)
	Rock sole	177	323	53	164
	Pollock	1,399	2,543	418	1,290
	All other groundfish species	611	1,110	182	563
	All groundfish	2,001	3,638	598	1,845
	C. bairdi	21,384	38,880	6,387	19,718
	C. opilio	16,966	30,848	5,068	15,644
	Red king	(74)	(135)	(22)	(69)
	Golden king	(84)	(154)	(25)	(78)
	Halibut	175	318	52	161
	Chinook salmon	69	126	21	64
	Other salmon	260	473	78	240

Source: NMFS AKR estimates.

Table 10-35 Estimated species catch rates per ton of catcher vessel groundfish harvest, and rates of prohibited species catch (averages for 2003–2009).

	Groundfish AI	Groundfish BS	PSC AI	PSC BS	Units
Pacific cod	91.2%	73.8%			
Atka mackerel	2.2%	0.0%			
Rock sole	2.1%	3.4%			
Pollock	1.6%	14.7%			
All other groundfish species	2.9%	8.2%			
C. bairdi			0.154	2.172	Crab/mt groundfish
C.opilio			0.013	1.635	Crab/mt groundfish
Red King			0.062	0.043	Crab/mt groundfish
Golden King			0.01	0	Crab/mt groundfish
Halibut			0.0018	0.0182	Mt/mt groundfish
Chinook salmon			0.045	0.043	Salmon/mt groundfish
Other salmon			0.01	0.033	Salmon/mt groundfish
Source: NMFS AKR Catch Accounting System					

10.3.4 Fixed Gear Catcher/Processors

Catcher/processors operating in the Aleutian Islands with hook-and-line and pot gear target Pacific cod (but not Atka mackerel). The restrictions proposed under Alternatives 2 and 3 would limit the ability of this fleet to continue to target Pacific cod in the Aleutian Islands. This fleet is expected to be able to make up this Pacific cod catch in the Bering Sea. This section discusses the shift in Pacific cod harvests, and associated changes in incidental catches of other groundfish species and prohibited species catches.

Table 10-36 outlines the key provisions of Alternatives 2 and 3 that would affect fixed gear catcher/processors. Both alternatives close the waters from 0 to 3 nm around Kanaga Island to groundfish fishing. As noted in a subsequent section, this would have little impact on directed fishing.

Table 10-36 Key provisions affecting fixed gear catcher/processors catching Pacific cod (expressed as changes from status quo).

Area	Alternative 2	Alternative 3
541	Close critical habitat to directed fishing for Pacific cod.	Close 0-10 nm of critical habitat to directed fishing. Close critical habitat from 10 to 20 nm from January 1 through June 10. Prohibit Pacific cod fishing in November and December.
542	Prohibit retention of Pacific cod	Close 0 to 10 nm of critical habitat to directed fishing. Close 10 to 20 nm to directed fishing from January 1 through June 10. Prohibit Pacific cod fishing in November and December.
543	Prohibit retention of Pacific cod	Prohibit retention of Pacific cod
Source: Discussion of alternatives in chapter 2 of the EA.		

Table 10-37 provides estimates of the potential reductions in Pacific cod harvests by fixed gear catcher/processors, by year, for 2003 through 2009, if the management measures proposed under Alternative 2 had been in place in each year.[8] The annual estimates in this table are based on estimates of the volume of Pacific cod taken in waters that would be closed by the two alternatives. In some years the number of operations active in some areas precludes reports of the round weight of Pacific cod harvest that would have been foregone. For those years for which the totals can be reported, the decline in catch

[8]These are estimates of the reduction in harvests, not of the residual harvests given the impact of the action.

ranged from about 7,400 mt in 2008 to about 2,100 mt in 2005. The median decline in catch would have been about 2,400 mt.

The 2011 Atka mackerel TACs were used to bound the potential reduction in Atka mackerel harvests under Alternative 2. However, because the Pacific cod TAC and associated sector allocations are not area-specific, the Pacific cod TAC is not helpful in the same way. For the purpose of evaluating the impact of the alternative on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years 2008 and 2009. Closure of these areas eliminated this production. These years were chosen to reflect the impact of the recent increase in production in Areas 542 and 543. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands is a reduction of about 6,600 to 7,400 mt.

Table 10-37 also provides estimates of the potential reductions in Pacific cod harvests by fixed gear (hook-and-line and pot) catcher/processors, by year, for 2003 through 2009, if the management measures proposed under Alternative 3 had been in place in each year. As noted above, in some years the number of operations active in some areas precludes reports of the round weight of Pacific cod harvest that would have been foregone. For those years for which the totals can be reported, the decline in catch ranged from about 1,400 mt in 2006 to about 5,200 mt in 2008. The median decline in catch would have been about 1,900 mt. The potential reduction in catch in the fishery grew significantly in 2008 and 2009 in Areas 542 and 543.

For the purpose of evaluating the impact of Alternative 3 on Pacific cod production in the Aleutian Islands, a range was defined by the aggregate production in each of the years 2008 and 2009. These years were chosen to reflect the impact of the recent increase in production in Areas 542 and 543. Thus, the estimated impact on the round weight of Pacific cod harvests in the Aleutian Islands is a reduction of about 4,600 to 5,200 mt.

Table 10-37 Estimated aggregate reductions for fixed gear catcher/processors in Pacific cod harvests in the Aleutian Islands, had Alternatives 2 and 3 been in effect, by year, from 2003 through 2009.

	Change in Pacific cod harvest (mt round weight)				Reduction in catch as a percentage of total catch			
	541	542	543	Total	541	542	543	Total
Alternative 2								
2003	322	403	c	c	75%	100%	100%	88%
2004	1,023	1,002	395	2,420	63%	100%	100%	80%
2005	2,127	c	c	2,131	75%	100%	100%	75%
2006	1,616	c	c	2,158	55%	100%	100%	62%
2007	1,041	848	1,697	3,585	57%	100%	100%	82%
2008	1,436	3,612	2,362	7,410	74%	100%	100%	94%
2009	1,068	2,743	2,812	6,623	69%	100%	100%	93%
Average	1,233	1,248	1,105	3,586	67%	100%	100%	82%
Median	1,068	848	418	2,420	69%	100%	100%	82%
Alternative 3								
2003	240	262	c	c	56%	65%	100%	63%
2004	549	986	395	1,930	34%	98%	100%	64%
2005	1,760	c	c	1,764	62%	10%	100%	62%
2006	985	c	c	1,412	34%	8%	100%	41%
2007	322	666	1,697	2,685	18%	79%	100%	61%
2008	636	2,184	2,362	5,181	33%	60%	100%	65%
2009	478	1,296	2,812	4,586	31%	47%	100%	65%
Average	710	772	1,105	2,587	38%	52%	100%	60%
Median	549	666	418	1,930	34%	60%	100%	63%

Note: This table provides estimates of the reduction in harvest associated with the proposed actions. A comparison of this table with Table 10-12, will show that some of these reductions, especially in Area 542 under Alternative 2, exceed actual estimated harvest. The two tables were prepared with different data sets. Table 10-33 was prepared with the Alaska Regions Catch in Area (CIA) data set. There may be misallocation of some harvest between Area 542 and other areas. NMFS AKR is investigating this issue with the intent of making appropriate adjustments for the final draft of the RIR.
Source: NMFS AKR Catch in Area (CIA) data set. "c" indicates that confidentiality precludes reporting data.

In the Aleutian Islands most fixed gear catcher/processor effort occurs in the "B" season and is spread out along the entire Aleutian chain. The Pacific cod TAC can be harvested in either the Bering Sea or the Aleutian Islands; therefore, any displaced effort due to closures in the Aleutian Islands would likely shift into the Bering Sea, or to areas that remain open in Areas 541 and 542. There is a possibility of increased effort in those areas that remain open and contain Pacific cod habitat, however due to the footprint that fixed gear catcher/processors create to effectively fish an area, and due to the amount of Pacific cod habitat available, increased effort would be limited. Vessels unable to fish those areas would shift into the Bering Sea where they have historically fished.

There would be no significant impact on amount of harvest as the fish is easily obtained in the Bering Sea or areas that remain open in the Bering Sea. Although competition for available habitat in the Aleutian Islands may occur, the fixed gear catcher/processor fleet is organized and, therefore, could avoid this by only a couple of boats going to the Aleutian Islands instead of six or more. Weekly catch rates comparisons of vessels that fish in the Aleutian Islands indicate there is no significant difference in weekly catch rates in the Aleutian Islands versus the Bering Sea by those same vessels and same time period. Halibut and other bycatch are relatively low for this fleet, and PSC is not likely to be a constraint on them. Approximately six vessels would be required to shift "B" season effort into the Bering Sea or outside critical habitat in Area 541. Historical fishing effort by these vessels indicates that they will respond to the fishing restrictions in the Aleutian Islands by shifting to the Bering Sea Pacific cod fishery.

For these reasons, the Pacific cod these vessels would no longer harvest in Areas 542 and 543, or in critical habitat in Area 541, under Alternatives 2 and 3, would be offset by equivalent catches by this fleet, either in Area 541, outside of critical habitat, and in the Bering Sea. This shift in the location of Pacific cod harvest by this sector would be associated with changes in the incidental catch of other groundfish species, and of PSC species. The relevant incidental and bycatch rates for the Aleutian Islands

and the Bering Sea are summarized in Table 10-38. The estimated impacts on actual harvests are summarized in Table 10-39.

Table 10-38 Summary of harvest impacts associated with regulation of the fixed gear catcher/processor vessels.

Area	Species	Alternative 2		Alternative 3	
		Low	High	Low	High
Aleutian Islands	Pacific cod	(6,600)	(7,400)	(4,600)	(5,200)
	Sharks, sculpin, octopus	(1,023)	(1,147)	(713)	(806)
	Other species	(360)	(403)	(251)	(283)
	All other groundfish species	(7,982)	(8,950)	(5,563)	(6,289)
	C. bairdi	(35,170)	(39,433)	(24,513)	(27,710)
	C. opilio	(45,395)	(50,898)	(31,639)	(35,766)
	Red king crab	(1,157)	(1,298)	(807)	(912)
	Golden king crab	(319)	(358)	(223)	(252)
	Halibut	(75)	(84)	(52)	(59)
	Chinook salmon	-	-	-	-
	Other salmon	-	-	-	-
Bering Sea	Pacific cod	6,600	7,400	4,600	5,200
	Sharks, sculpin, octopus	827	927	577	652
	Other species	425	476	296	335
	All other groundfish species	7,852	8,803	5,472	6,186
	C. bairdi	29,892	33,515	20,833	23,551
	C. opilio	23,751	26,630	16,554	18,713
	Red king crab	1,398	1,567	974	1,101
	Golden king crab	-	-	-	-
	Halibut	31	35	22	25
	Chinook salmon	-	-	-	-
	Other salmon	8	9	5	6
Net impact	Pacific cod	-	-	-	-
	Sharks, sculpin, octopus	(196)	(219)	(136)	(154)
	Other species	65	73	45	51
	All other groundfish species	(131)	(146)	(91)	(103)
	C. bairdi	(5,279)	(5,918)	(3,679)	(4,159)
	C. opilio	(21,644)	(24,268)	(15,085)	(17,053)
	Red king crab	240	269	167	189
	Golden king crab	(319)	(358)	(223)	(252)
	Halibut	(44)	(49)	(30)	(34)
	Chinook salmon	-	-	-	-
	Other salmon	8	9	5	6
Source: NMFS AKR estimates					

Table 10-39 Estimated species catch rates per ton of fixed gear catcher/processor groundfish harvest, and rates of prohibited species catch (averages for 2003–2009).

	Groundfish AI	Groundfish BS	PSC AI	PSC BS	Units
Pacific cod	82.6%	84.1%			
Shark, sculpin, octopus	12.8%	10.5%			
Pollock		3.3%			
Arrowtooth flounder		1.0%			
Other groundfish	4.5%	1.06%			
C. bairdi			4.406	3.807	Crab/mt groundfish
C. opilio			5.687	3.025	Crab/mt groundfish
Red king crab			0.145	0.178	Crab/mt groundfish
Golden king crab			0.04	0	Crab/mt groundfish
Halibut			0.0094	0.004	Mt/mt groundfish
Chinook salmon			0	0	Salmon/mt groundfish
Other salmon			0	0.001	Salmon/mt groundfish
Source: NMFS AKR Catch Accounting System					

As discussed in section 10.3.4, the trawl catcher vessel fleet may be unable to effectively harvest additional Pacific cod in the Bering Sea to make up for the loss of Pacific cod fishing opportunities in the Aleutian Islands. If that is the case, the unused trawl allocation may be rolled over to the fixed gear catcher/processor fleet towards the end of the year. Table 10-40 shows the potential harvest increment, and associated groundfish and prohibited species bycatches if such a rollover occurs. The amounts of Pacific cod are those estimated to be given up in the Aleutian Islands by the trawl catcher vessel fleet, while the amounts of other groundfish and of the prohibited species are estimated using the fixed gear bycatch rates.

Table 10-40 Possible additional incidental groundfish catch and PSC bycatch by fixed gear vessels if the trawl catcher vessel allotments in the Bering Sea are rolled over to the vessels in the sector.

Species	Alternative 2		Alternative 3		Units
	Low	High	Low	High	
Pacific cod	7,700	14,000	2,300	7,100	mt
Atka mackerel	965	1,755	288	890	mt
Rock sole	303	551	91	279	mt
Pollock	92	166	27	84	mt
All other groundfish species	101	183	30	93	mt
All groundfish	9,160	16,655	2,736	8,447	mt
C. bairdi	34,873	63,406	10,417	32,156	crab/mt
C. opilio	27,710	50,382	8,277	25,551	crab/mt
Red king crab	1,631	2,965	487	1,503	crab/mt
Golden king crab	-	-	-	-	crab/mt
Halibut	37	67	11	34	mt/mt
Chinook salmon	-	-	-	-	salmon/mt
Other salmon	9	17	3	8	salmon/mt
Source: NMFS AKR estimates					

Fixed gear catcher/processor vessels traditionally operating in the Bering Sea could face increased congestion and competition for resources. However, due to the amount of available Pacific cod habitat in the Bering Sea and the small number of vessels affected, that impact is expected to be minimal.

10.3.5 State Managed Pacific Cod Fishery in State Waters

Catcher vessels fishing in the State managed Pacific cod fisheries in State waters would not currently be affected by this action unless they hold Federal Fisheries Permits (FFPs). The limits described under the alternatives would apply to vessels carrying FFPs and would apply to those vessels as long as they carry the permit, and whether or not they are operating in federal or state waters. Currently, catcher vessels and

catcher/processors are able to surrender their FFPs and subsequently acquire new ones. Operations will sometimes surrender FFPs in order to fish in State waters without complying with requirements that would apply if the vessel carried a federal permit. An operation may thus sometimes avoid a closure, a vessel monitoring system, or observer requirement that would otherwise apply in state waters. FFPs are currently issued without charge; the cost of surrender and reacquisition is thus not a serious deterrent to the practice.[9]

NMFS is preparing a regulatory amendment that would prevent hook-and-line and pot catcher/processors from reacquiring an FFP that has been surrendered within the three year term of the original permit. If the permit is surrendered within a day of being acquired, the vessel owners would not be able to obtain a replacement for three years (if it was surrendered on the next to the last day, they would acquire a new one almost immediately. Gulf of Alaska FMP Amendment 83 proposes to make a similar change for vessels holding an FFP originally designated to the Gulf of Alaska. The Council has recommended both of these actions, but NMFS has not yet published a proposed rule for either.

Should these amendments be adopted in their current form, the costs to catcher/processors and to vessels desiring to fish for groundfish in the Gulf of Alaska will be increased. This may discourage vessels from participating in Aleutian Pacific cod fisheries in the first two years of the three year FFP term. Costs would decline each year, but could still be significant in the final year, since the Aleutian Pacific cod fishery takes place in the spring, and vessels would be without an FFP for fishing in the Gulf of Alaska for the remainder of the year. As noted in Sub-section 10.2.5, 45 vessels fished in the Aleutian Islands state Pacific cod fishery in 2008.

The impacts of this action will also depend in part on whether or not the State changes the management measures it currently uses in its Aleutian Islands waters. For the purposes of this analysis, the State is assumed to manage this fishery so as to maintain the character of the existing fleet.

10.3.6 Kanaga Island and HLA Repeal

Alternatives 2 and 3 both close waters from 0 to 3 nm around Kanaga Island/Ship Rock to directed fishing for groundfish by federally permitted vessels. This measure, therefore, goes beyond the regulation of Atka mackerel and Pacific cod to prohibit all groundfish harvest in this area.

However, this action would have minimal impacts on fishing activity. A review of catches in this area from 2003 through 2009 shows an average annual harvest of about five mt of fish. Much of this was Atka mackerel and Pacific cod, and retention of these would already be prohibited under Alternative 2.

In Area 543 and the western portion of Area 542, Atka mackerel trawling may occur in critical habitat under the Harvest Limit Area (HLA) platoon system, which is intended to distribute and disperse fishing effort and was implemented by final rule in 2003 (68 FR 204, January 2, 2003).

The HLA is 20-nm areas around Steller sea lion rookeries and haulouts in Area 543 and the western portion of Area 542 are shown in Figure 2-3 in Chapter 2. The HLA includes critical habitat and additional 20-nm areas around haulouts that were identified in the 2001 biological opinion (NMFS 2001). The amount of Atka mackerel harvest in the HLA is limited to no more than 60 percent of the seasonal apportionment. The harvest of Atka mackerel in the HLA is further dispersed by dividing the Atka mackerel fleet into platoons that are limited to fishing in one area (either 543 or 542) at a time. Vessels in

[9]The Council has recently adopted amendments to its fishery management plans which would require fishing operations to reimburse NMFS for the costs of issuing permits. These costs, however, are likely to be modest.

a platoon fish in their assigned area for the estimated number of days for the vessels to take the available TAC and then switch to the other HLA area. Because Pacific cod trawling is prohibited in the HLA when the HLA is open to Atka mackerel trawling, the HLA fishery is limited to 14 days.

Since the implementation of Amendment 80, the fleet has demonstrated an ability to modify their fishing patterns to reduce catch rates. The ability to tailor fishing operations to the specific allocation of quota allows vessel operators to avoid the concentration of harvests that may occur under a race for fish. The HLA fishery, however, requires Atka mackerel to be harvested during a discrete time period. HLA management may result in a greater concentration of Atka mackerel harvest than would be likely under cooperative management without the HLA.

Because no directed fishery for Atka mackerel would be allowed in Areas 543 and 542, the platoon management system and HLA would be removed from the regulations.

10.3.7 Summary Points

In summary:

- Both alternatives reduce Atka mackerel harvests in the Aleutian Islands. Alternative 2 reduces harvests more than Alternative 3.
- Under neither alternative will the Amendment 80 trawl catcher/processor sector be able to significantly offset the decline in Aleutian Islands Atka mackerel harvests with increased harvests elsewhere.
- The Amendment 80 trawl catcher/processor fleet will most likely increase its harvests of rock sole and yellowfin sole.
- The Amendment 80 trawl catcher/processor fleet will reduce its harvests of Pacific cod in the Aleutian Islands. There is a high probability that it would not be able to fully offset the reduction in Pacific cod harvests in the Aleutian Islands by increased Pacific cod harvests in the Bering Sea.
- The size of its halibut prohibited species allocation is likely to constrain the ability of the Amendment 80 trawl catcher/processor fleet to fully offset the reduction in Aleutian Islands Atka mackerel with increased harvests of rock sole, yellowfin sole, and Pacific cod.
- It is likely that some of the Pacific cod TAC will be left unharvested as a result of this action. Current regulations do not allow this TAC to be rolled over to another fleet segment if it appears that the Amendment 80 trawl catcher/processor fleet would be unable to harvest it.
- Both alternatives will reduce the trawl catcher vessel fleet harvest of Pacific cod in the Aleutian Islands. The reduction would be greater under Alternative 2 than Alternative 3.
- The trawl catcher vessel fleet may not be able to fully offset the decline in Pacific cod harvests in the Aleutian Islands by an increase in harvest in the Bering Sea. If it is not, then there may be an increased annual rollover of Pacific cod to the hook-and-line catcher/processor fleet in the fall.
- Under both alternatives, the fixed gear fleet (hook-and-line and pot vessels) will harvest less Pacific cod in the Aleutian Islands. This fleet should be able to successfully offset the decline in Aleutian Island harvests by an increase in Pacific cod harvests in the Bering Sea.

10.4 Social Benefits Associated with the Protection of the Western Stock of Steller Sea Lions

10.4.1 Introduction

In this chapter, we discuss the measurement of the public's economic benefits associated with protecting the western stock of Steller sea lions under the alternatives being considered in this RIR/EA.

This section is organized on the basis of whether or not a value derives from activities taking animals out of the population, or otherwise disturbing or harming the animals. Values derived from activities that do so are defined as "consumptive" activities, and are dealt with in Sub-section 10.4.3. The only consumptive activity is subsistence hunting. Non-consumptive values are defined as values from activities that do not kill, harm, or disturb specific animals, or the population. Non-consumptive values are addressed in Sub-section 10.4.2. A wide variety of activities and motivations may give rise to non-consumptive values. The study on which the non-consumptive benefits analysis is based used survey questions that identified individual values, without detailed inquiry into the individual's motivations for those values. Thus it is believed to comprehensively cover all values from activities and motivations that do not derive from those that are consumptive. This sub-section does not inquire deeply into the origins of non-consumptive values. Eco-tourism may fall into a grey area between consumptive and non-consumptive, since eco-tourism activities may disturb animals. However, the survey question is broad enough to include values due to eco-tourism and any eco-tourism values and are assumed to be included under the non-consumptive heading. Subsistence activities may also have been included within the ambit of the survey question. However, the survey sample frame is unlikely to have picked up significant numbers of subsistence hunters or users, so subsistence is treated here, as a practical matter, as not covered by the survey.

The economic benefits of protecting Steller sea lions are primarily the result of the non-consumptive values that individuals attribute to such protection, such as active use values associated with viewing them, passive use values from reading or seeing films about them, or from knowing they exist. Consumptive values, such as those derived from hunting, may also be important but are more limited in scope, as Steller sea lion hunting is restricted to a small number of subsistence users in Alaska.

According to economic theory, individuals choose between bundles of goods and services that maximize their well-being, referred to as *utility*. This bundle includes private and government-provided goods and services, as well as quantities and qualities of goods and services from natural and environmental resources, like threatened and endangered species protection, which are not bought or sold in explicit markets. These latter goods and services are generally referred to as *non-market goods*, since they cannot be observed to be bought and sold in explicit markets. The trade-offs between different bundles of goods and services each individual makes provides an indication of the value people place on them.

Since the economic value of non-market goods cannot be readily measured using conventional market valuation techniques, due to the absence of price information for the good to be valued (i.e., protection of the species in this case), researchers must employ other valuation methods to estimate them, specifically, revealed preference (RP) or stated preference (SP) valuation approaches. RP valuation methods use information on observed behavior to infer the value of the non-market good or service (Bockstael and McConnell 2007). As such, these methods require data on observable behavior to be linked to the non-market good in question.[10] SP methods, on the other hand, involve asking individuals carefully-worded

[10] Included in the category of RP methods are travel cost methods (Parsons 2003), hedonic methods (Taylor 2003), and the avoidance expenditure approach (Dickie 2003). The appropriateness of each method depends upon how the non-market good enters individuals' preferences (utility), as discussed in Freeman (2003). In many of

hypothetical market questions to either directly or indirectly infer the value they place on a non-market good or service (Mitchell and Carson 1989; Carson, Flores, and Meade 2001). Thus, the principal difference between RP and SP methods is the data used. Revealed preference methods use data on observed behavior to infer economic values, while stated preference methods use data on stated or intended behavior, typically gathered through surveys, to infer economic values. Due to its reliance on observable behavior, revealed preference methods are generally not able to estimate major components of non-consumptive values, specifically those not tied directly to observable behavior like non-use values. Thus, researchers generally utilize stated preference methods to estimate non-consumptive values.

In Section 10.4, we are concerned with estimating the economic benefits, or value, of the results of protecting Steller sea lions under the protection alternatives considered. The action alternatives are designed to "insure that the groundfish fisheries would not likely jeopardize the continued existence of the western population of Stellers sea lions or adversely modify their critical habitat such that the likelihood of their survival and recovery in the wild is reduced appreciably." (NMFS 2010). By reducing potential competition for prey species in the western and central Aleutian Islands, the alternatives may lead to increased population sizes for the western stock of Steller sea lions, relative to the status quo alternative. The remainder of the section chapter focuses on this task or evaluating the benefits that may accrue if the Steller sea lion population trajectory is improved.

Stated Preference Methods and Benefits Transfer

The most commonly-used and best known stated preference method is the contingent valuation method (CVM). In CVM, economic values for a non-market good or service are revealed through survey questions that set up hypothetical markets for a non-market good or service, and involve asking the respondent to indicate their willingness to pay (or willingness to accept) for the good or service. In a typical contingent valuation survey, a public good is described, such as a program to protect one or more threatened or endangered species, and respondents are asked questions to elicit their willingness to pay (WTP) for the public good through a payment vehicle, like taxes or contributions to a trust fund (Mitchell and Carson 1989; Arrow et al. 1993).[11] Contingent valuation methods are differentiated by the way they elicit WTP. Respondents are commonly asked to state their maximum WTP (an "open-ended" CVM question), choose the amount they are willing to pay from a list of values (a "payment card" CVM question), or accept or reject a specific amount (a "referendum," or "dichotomous choice," CVM question). Variations of these question formats exist, but these are the most frequently used. When asked properly, answers to CVM questions yield an estimate of WTP or willingness to accept (WTA) associated with the good being valued, depending upon the format of the question posed (Freeman 2003).

Although the CVM method has been subjected to criticisms related to several validity issues (e.g., Diamond and Hausman [1994] and Hausman [1993]), the NOAA Panel on Contingent Valuation, a distinguished panel of economists led by Nobel Laureates, Kenneth Arrow and Robert Solow, found that despite their problems, "CVM studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive-use values" (Arrow et al. 1993:43).[12]

these methods, the economic value of the non-market good is measured through changes in the observable demand for a related good, such as a good that is consumed in conjunction with the non-market good (complement) or instead of the non-market good (substitute).

[11] While willingness-to-accept is sometimes the more relevant economic value measure, empirical and experimental application has primarily chosen to use of WTP welfare measures in stated preference surveys owning to the greater familiarity of study subjects with "paying" for a desired good or service, rather than estimating what they would "accept" in payment to forego the good (e.g., Arrow et al. [1993]; Adamowicz, Bhardwaj, and McNab [1993]; Mansfield [1999]).

[12] The NOAA Panel provided a number of recommendations for designing and conducting CVM surveys that would lead to "reliable" estimates of value. A number of subsequent studies have been conducted to test the

CVM methods are not the only SP methods available for estimating non-consumptive values.[13] The stated preference choice experiment (CE), or stated choice approach, for eliciting economic values has been increasingly used by researchers due to its flexibility (Adamowicz, Louviere, and Williams 1994; Adamowicz et al. 1998; Alpizar, Carlsson, and Martinsson 2001; Hanley, Wright, and Adamowicz 1998). In the choice experiment approach, respondents are asked to choose between two or more alternatives that differ in one or more attributes, including cost.[14] Choice experiments offer a useful alternative to CVM for estimating a wider range of economic values. By decomposing environmental goods, in the form of choice alternatives (e.g., species protection programs), into measurable attributes (e.g., specific outcomes of protection such as population size under each protection program), value can be estimated from an analysis of choices between different alternatives. Since choice alternatives are described by their attributes, and the effects of these attributes on choice are estimated in the model, it is possible to estimate WTP for alternatives not originally included in the CE questions seen by respondents. Hanley, Mourato, and Wright (2001) and Hanley, Wright, and Adamowicz (1998) argue that CE methods have several advantages over CVM, among them, the ability to estimate values of each attribute (often the policy variable of interest) and avoiding some biases in responses typically associated with CVM questions.

A growing field in non-market valuation is concerned with how to transfer economic value information from one or more previously completed studies to a new application (which we will refer to as the "policy application"). This process is called *benefits transfer*, or value transfer.[15] There are four general approaches to transferring economic benefit information from an existing study to a new policy application:

1. *Unit value transfer:* This is the simplest and easiest benefits transfer method and typically involves using the mean or median economic value estimate from an existing study directly in the new policy application (Boyle and Bergstrom 1992; Desvousges et al. 1992). No adjustments are made to the value estimate to account for differences in the population of interest that may arise due to income or demographic, resource use, or behavioral differences.
2. *Value function transfer*: Instead of transferring values from an existing study, this approach involves directly using the estimated function from the existing study that was used to calculate economic values, instead of the values themselves (Loomis 1992). Adjustments to the value estimate arise by inserting information about the new policy application into the transferred value function. For example, if in the original study a WTP function was estimated as a function of demographics of the sample, a new WTP estimate could be calculated from the function by inserting the demographics of the population of interest in the new policy application.[16]

reliability of CVM estimates (see Boyle [2003] for a useful summary). In the report, passive use value is used synonymously with non-use value, which is generally a major component of the non-consumptive value of a threatened or endangered species and other environmental goods and services with limited, if any, use value associated with them. In recent literature, the term passive use value is used interchangeably with non-consumptive value.

[13] In addition to stated preference choice experiments and related conjoint analysis methods (contingent rating and contingent ranking), is a recent method that employs gathering small groups of people in a participatory process that involves some group processing as a means of determining nonuse values (valuation workshops) (Alvarez-Farizo et al. 2007).

[14] Variants of the choice experiment include contingent rating and contingent ranking, where the respondent rates or ranks each choice alternative, respectively, instead of choosing between them. See, for example, Bateman et al. (2006).

[15] Benefits transfer has received considerable interest by researchers and policy analysts in the last two decades. Special issues of *Water Resources Research* (Volume 28, number 3) and *Ecological Economics* (Volume 60, number 2) have been dedicated to this subject. See also Brouwer (2000), Navrud and Ready (2007), and Rosenberger and Loomis (2003) for overviews and details about the methodology.

[16] For a recent example of a value function transfer, see Scarpa et al. (2007).

3. *Meta-Analysis*: Meta-analyses have been used to synthesize and summarize existing valuation studies in the areas of threatened and endangered species (Loomis and White 1996; Richardson and Loomis 2009), outdoor recreation (Walsh, Johnson, and McKean 1992; Smith and Kaoru 1990), visibility at national parks (Smith and Osborne 1996), wetlands (Woodward and Wui 2001), and air pollution (Smith and Huang 1995), among others. Meta-analyses of this type involve conducting regression analysis to understand how economic values from existing studies vary by the characteristics of the goods being valued in each study and on features of the studies themselves. For instance, the meta-analysis conducted by Loomis and White (1996) to understand variations in WTP estimates for threatened and endangered species involved regressing WTP values from 20 CVM studies on variables such as the population size change being valued in the CVM study, the type of payment vehicle, the type of CVM question used, the type of species being valued, and the survey response rate achieved. The resulting summary value function can then be used in the same manner as in the value function transfer to provide a customized estimate of economic value for the new policy application (Bergstrom and Taylor 2006; Johnston, Besedin, and Ranson 2006).
4. *Preference calibration*: A fourth benefits transfer method requires making assumptions about the specific form for a representative member of the population's underlying preferences, or utility function, then "calibrating" this preference function, using information about the economic values from one or more studies (Smith, van Houtven, and Pattanayak 2002; Pattanayak, Smith, and van Houtven, and Smith 2007).[17] The calibrated preference function is then used to generate value estimates for the new policy application, much like value function transfers.

The first three benefits transfer methods are most commonly employed in the literature, with meta-analyses being increasingly used in recent years (Rosenberger and Phipps 2007; Shrestha, Rosenberger, and Loomis 2007; Johnston, Besedin, and Ranson 2006). Preference calibration is arguably much more complex than the other methods, which may explain the scarcity of empirical applications.

Regardless of the method used, benefits transfer is only useful if it provides valid estimates of value for the new policy application. The validity of transferred values has been studied extensively for unit value transfers and value function transfer. Rosenberger and Phipps (2007) and Rosenberger and Loomis (2003) provide useful summaries of these studies, which seek to evaluate the difference between the transferred values and values from *de novo* studies conducted for the policy application (an approximation of the "true" values), which is measured by a "transfer error." Their analysis of the tests of the validity of unit value and value function transfers indicate that the greater the similarity of the original study to the policy application, the smaller the expected transfer error will be. Moreover, there is evidence in the literature that value function transfers yield more accurate values for the policy application than unit value transfers. This makes sense, given the ability to further reduce the dissimilarity between the original study and the policy application by adjusting the value for characteristics of the policy application. Moreover, there is some evidence that the use of meta-analysis to transfer benefits outperforms value function transfers (Rosenberger and Phipps 2007; Shrestha, Rosenberger, and Loomis 2007) assuming the information about the estimates from the original studies, and about the studies themselves, are of sufficient quality. In summary, the literature seems to support the idea that the more closely the researcher can customize the value estimate to the new policy application, the more accurate the transferred value will be to the value that would be generated if a primary study had been done.

Each of the methods requires selection of one or more studies to base the transfer upon. Boyle and Bergstrom (1992) caution that in choosing a study to use for benefits transfer so as to maximize the likelihood of a valid transfer, the non-market good needs to be the same as the one in the new application

[17] This calibration process essentially involves solving for the unknown parameters of the assumed preference function using the existing value estimates.

and the population characteristics of the original study need to be similar in the new application, conditions that are rarely met in practice. McConnell (1992) adds that consideration must also be given to the quality of the original study, suggesting that the transferred value or function can only be as good as the original it is based upon. This point is particularly persuasive, given that meta-analyses have shown how researcher judgments about how to define the good, the type of valuation methods used, and the manner of implementing the survey, along with other characteristics of the study, can have significant effects on economic values.

Thus, in summary, when a *de novo* study cannot be conducted for a given policy evaluation, such as in this case, benefits transfer offers an option for deriving economic value information from existing studies, provided several conditions hold. Specifically, benefits transfer can be considered a valid approach when there is one or more studies available that has measured a similar non-market good, the similarity of the non-market good from the original study and in the policy application is high, the methods used in data collection, economic modeling, and estimation are sound, and there is sufficient information to be able to customize the values to fit the policy scenario.

10.4.2 Stated Preference Economic Values and Steller Sea Lions

In the last 30 years, there have been dozens of studies done to estimate the value of threatened and endangered species. Loomis and White (1996) and Richardson and Loomis (2009) provide useful summaries of over 30 stated preference studies that have estimated the value of protecting, preserving, or enhancing threatened, endangered, or otherwise rare species. Of these studies, all but one employ CVM to estimate values (the other study uses CE methods). Average annual per person or per household WTP estimates from these studies ranged from $8 for the striped shiner to $241 for anadromous fish populations (in 2006 dollars) (Richardson and Loomis 2009). Only a handful of these studies involve marine mammals and most do not use national samples. Recent studies by Rudd (2009) and Olar et al. (2007) estimate public values for at-risk marine mammals in Canada using CE methods.

In the empirical literature, there are two non-market valuation studies focusing on Steller sea lions. The first is a study by Giraud et al. (2002), which used CVM to estimate the U.S. public's WTP for protecting Steller sea lions. The other is a recent study by Lew, Layton, and Rowe (2010) that used CE methods to estimate the WTP of U.S. households for improving Steller sea lion population sizes and statuses under the ESA.

In the study by Giraud et al. (2002:454), the CVM question in the survey asked respondents for their WTP for the "Enhanced Steller Sea Lion Recovery Program," which "doubled research funding and increased the restrictions of commercial fishing around the western stock of the Steller sea lion's [critical habitat] in the Gulf of Alaska, Bering Sea and North Pacific Ocean." Thus, the WTP values in this case, estimated to be $100.22 (in 2000 dollars) for non-Alaska U.S. households and $40.41 (in 2000 dollars) for Alaska households, are not measures of the public's value for recovering the species or specific improvements to the species *per se*, but rather the values for the program described (since it does not say the program will lead to any population increases or status changes). As a result, the Giraud et al. (2002) study results are not likely to be useful in the context of assessing the economic benefit of specific alternatives that increase the population size of the western stock or improve its ESA status.

In the second study, Lew, Layton, and Rowe (2010), hereafter referred to as LLR, estimate the public's willingness to pay for enhanced protection of Steller sea lions under several different assumed future population trajectories for the western and eastern stocks. It is important to recognize that the LLR analysis does not estimate direct use values, such as those that would accrue to subsistence users in Alaska. Instead, the values represent only non-consumptive values from indirect use (e.g. viewing

benefits) and non-use (e.g., the value from knowing the population continues to exist).[18] They used CE methods to estimate a value function that depends, in general, upon the population sizes and ESA status levels of the western stock and eastern stock. Three valuation functions were estimated, each corresponding to a different survey version that presented a different baseline future for the western stock population and its future ESA status. This set-up allows for the estimation of WTP for future improvements to the western stock under three different possible current trajectories. The Decreasing Version assumes that without additional protection actions, the western stock will decline to 26,000 in 60 years and remain endangered. The Stable Version assumes the western stock will remain listed as endangered and maintain its current population size in 60 years, which at the time the survey was developed was 45,000. The Increasing Version assumes the western stock will increase over time resulting in a population of 60,000 and a threatened status. Note that at the time the surveys associated with this study were developed, the Steller sea lion recovery plan (National Marine Fisheries Service 2008) had not been fully developed, so numeric estimates of the likely population threshold for re-listing the western stock had not been determined yet.

Depending upon the version and the amount of improvement to the population size and status of western stock Steller sea lions being measured, the mean economic benefits were estimated to range from $34 to $204 per household per year (in 2007 dollars). Importantly, note that the CE questions in the survey ask respondents for their WTP each year for 20 years, but the results on Steller sea lions will occur in 60 years. Thus, for example, if the total amount households are willing to pay over 20 years is converted to a present value amount and annualized to a constant payment over 60 years, the WTP estimates will be in the range of $24 to $141 per household per year (when using a discount rate of 5 percent). Or, equivalently, the present value of WTP assuming a 5 percent discount rate is $445 to $2,669 per household. Moreover, survey respondents were asked to value outcomes that would occur with certainty (i.e., 100 percent probability of the outcome occurring); the values respondents would place on certain outcomes would exceed the values they would place on uncertain outcomes. This is relevant in the present instance, when the potential outcomes under each of the three alternatives are highly uncertain.

The LLR study has been used to estimate the public's economic values associated with protection alternatives considered in this report for several reasons.

1. The surveys were carefully conducted. The three survey versions used in LLR were developed using input from numerous focus groups and cognitive interviews and underwent several peer reviews by experts in survey design, non-market valuation, and Steller sea lion biology.[19] The resulting surveys were implemented using a modified Dillman Tailored Design Method (Dillman 2007) that included multiple mailings and a telephone contact. This state-of-the-practice approach led to response rates for each survey version that ranged from a low of 59 percent for the Decreasing Version to a high of 64 percent for the Stable Version. The overall response rate across all versions was 60 percent. These response rates are good relative to other similar stated preference surveys and serves to minimize potential non-response bias that may be related to low response rates.

2. The econometric analysis used state-of-the-practice methods. LLR used panel rank-ordered mixed logit models to account for the fact that the data had a full rank ordering of respondents preferences among three choice alternatives in three separate questions and that not everyone in

[18] Sub-section 10.4.3 discusses subsistence values, the only consumptive or direct use, for the sea lions in the western population.

[19] Throughout development and implementation, significant effort was invested to minimize any potential biases to the CE data due to poor survey design, choice question wording and format, and survey implementation that researcher have identified in the literature as potential problems in SP studies.

the sample has the same preferences for protecting or improving the state of the western Steller sea lion. These models had much better fits statistically compared to models without preference heterogeneity, and are generally preferred to fixed parameter logit models typically used for analysis of CE data (Train 2003). In addition, the rank-ordered models improved statistical fit and precision of the model estimates.

3. The measured values are policy-relevant. The WTP estimates in LLR represent the value U.S. households place on a certain improvement in the population size and ESA listing status of Steller sea lion stocks. The Steller sea lion recovery plan (National Marine Fisheries Service 2008) recognizes that a goal of the recovery programs is to increase the overall population size of the western stock and, in fact, requires a sustained increase of 1.5 percent to 3 percent per year for a number of years to be eligible to be re-listed to threatened or de-listed entirely. Since the values are interpreted to be the WTP households place on an improvement from the status quo level of protection, which is what this chapter hopes to measure, the transfer error associated with using LLR's model results is likely to be small.

4. LLR presents sufficient information to enable the use of a benefits function transfer. Since a stated preference CE approach was utilized, the analysis of the CE data leads to a utility function that can be used to generate economic value estimates.[20] Even though the estimated models are functions of residual population sizes for the western stock (defined as the difference between a stated population size and the minimum population size needed to be listed in an ESA-listing category—endangered, threatened, or de-listed, or recovered as used in LLR), under some assumptions, estimates of value can be estimated for policy scenarios involving improvements to the population size of western Steller sea lions and their ESA listing status.

5. The study is recent. It was implemented in 2007, so estimates of public economic values generated from the model are likely to be less sensitive to potential systemic changes in preferences the public may have for Steller sea lions that may arise over long time periods as cultural values and attitudes toward the environment and threatened or endangered species change. Still, it is possible that recent environmental disasters, such as the *Deepwater Horizon* oil spill, may have changed environmental awareness and attitudes toward threatened and endangered marine species, like the Steller sea lion, that would not be accounted for in using the LLR results in a benefits transfer.

In the next section, we estimate the economic benefits associated with several growth scenarios using the LLR results and a benefit function transfer approach.

Economic Benefits of Growth Scenarios Using LLR

To generate economic benefit estimates associated with non-consumptive values for western stock Steller sea lion protection using a benefit function transfer approach with the LLR models, several key inputs are needed. First, the expected population sizes and statuses under each alternative must be estimated. Since the LLR models are functions of overall stock sizes, population sizes within specific areas of the western stock range are not needed, only the population size of the entire western stock. Second, since the model is based on residual population sizes for the western stock, the population sizes necessary to trigger changes from an endangered to threatened status and from a threatened to de-listed, or recovered, status, must be known.

[20] Technically, CE approaches model the probability of choices as trade-offs between conditional indirect utilities associated with each choice alternative. In the discussion of the valuation exercise later in the chapter, references to utility are intended to refer to these conditional indirect utilities.

The final Steller sea lion recovery plan (National Marine Fisheries Service 2008) defines the criteria to be used when re-listing the western stock to threatened and when de-listing it. The criteria include meeting population and growth rate goals and eliminating or otherwise controlling threats to the western stock. To reclassify the western stock to a threatened status, the stock's overall population size must increase at an average rate of 1.5 percent for a period of 15 years, in addition to five of the seven sub-regions defined in the recovery plan also displaying this consistent increasing trend. The recovery plan also lists threats that should be controlled, if not eliminated, so they do not re-emerge. Thus, these demographic (population size) criteria alone are not sufficient. To de-list the western stock, more stringent requirements are laid out in the recovery plan. In terms of demographics, the total population must increase for 30 years at an average rate of 3 percent per year with five of seven sub-regions displaying this consistent and increasing population trend without any significant declines in adjacent regions. Further, the threats to the western stock must be fully eliminated or controlled prior to de-listing.

In this chapter, we focus on estimating the economic benefits associated with three scenarios that lead to different western stock population growth rates: Scenario I, Scenario II, and Scenario III. Three alternative growth rates, each associated with a scenario, and the resulting population sizes and ESA listing status levels, are utilized to capture the likely range of possible outcomes from the alternatives considered in this RIR/EA. The alternative growth rates are annual average growth rates of -2 percent in Scenario I, +1 percent in Scenario II, and +2 percent in Scenario III. To generate scenarios that will be the basis of the economic value estimation, we assume these average growth rates will persist over the 60-year time horizon embodied by the choice experiment questions asked by LLR. Thus, under Scenario I, in which there is a -2 percent growth rate each year, the existing population size of 50,040[21] will decline to 14,890 by 2070. Under Scenario II there is a positive growth rate of 1 percent per year, which will result in a western stock population of 90,908 in 2070. Finally, under Scenario III, an average annual growth rate of +2 percent leads to a western stock population of 164,183 in 2070.

To be used in the LLR model, these western stock population sizes must be translated into two pieces of information, the residual population and an associated ESA status level (i.e., endangered, threatened, or recovered). For Scenario I, the lower population size suggests the western stock will keep its current endangered status. For Scenarios II and III, however, the threshold population sizes associated with a change in status from "endangered" to "threatened" (POP^{relist}) and with a change in status from "threatened" to "recovered" or de-listed (POP^{delist}) must be known to associate an ESA listing status with the population sizes in 60 years associated with the scenarios. Since these threshold population sizes depend upon when the western stock population has managed to average specific growth rates over specified periods of time (and is assumed to have successfully met the non-growth rate criteria), the thresholds will depend upon when the start and end years of these time periods are, as well as the initial population size in the start year.

To determine POP^{relist} and POP^{delist} for this analysis, one could infer from the recovery plan criteria that re-listing or de-listing would take place when population sizes had reached the level they would reach if, starting from today, the population grew at the rates designated for 15 or 30 years, respectively. If one assumes that the re-listing population threshold should be based on the present western stock population and furthermore that for 15 years the average growth rate will be 1.5 percent, then the threshold population size for the western stock to be re-classified to threatened from endangered will be 62,562 individuals. Similarly, assuming that the average annual growth rate over the next 30 years will average 3 percent means the threshold population size for the western stock to be de-listed will be 121,460. These two thresholds assume that the time period over which the growth rate is averaged begins immediately and the growth rate expectation is met exactly. Under these assumptions, in 60 years, the date posed for

[21] This is the latest population estimate for the total western stock based on discussions with Tom Gelatt and Lowell Fritz of the National Marine Mammal Laboratory, Alaska Fisheries Science Center.

consideration by the survey respondents in the question, Scenario II would lead to a re-listing of the western stock to a threatened status, while Scenario III would lead to de-listing of the western stock.

The scenarios to be used in the economic valuation are summarized in Table 10-41 in terms of the expected annual growth rate over 60 years, and expected population size and ESA status in 60 years.

Table 10-41 Expected Average Annual Growth Rate, Population Size, and ESA Status of Growth Scenarios

Growth Scenario	Expected Average Annual Growth Rate	Expected Population in 60 years	Expected ESA Status in 60 years
I	-2%	14,890	Endangered
II	+1%	90,908	Threatened
III	+2%	164,183	Recovered

Applying the LLR Model using a Value Function Transfer Approach

To calculate economic benefit estimates for Scenarios I, II, and III from the LLR results, we note from LLR that the formula for expected WTP associated with additional protection that would lead to a change from the status quo (no change from the current protection) is the following:

(1) $E[WTP] = -(1/\gamma)\cdot[V_1 - V_0]$,

where E is the expectation operator
V_1 = utility associated with the improved state of the world
V_0 = utility associated with the status quo (state of the world without the improved protection)
γ = marginal utility of money (COST parameter in Table 2).

LLR specify utility of the *j*th choice alternative *as*

(2) $V_j = \beta_{WSTAT2}\cdot WSTAT2 + \beta_{WSTAT3}\cdot WSTAT3 + \beta_{ENDPOP}\cdot ENDPOP + \beta_{THRPOP}\cdot THRPOP + \beta_{RECPOP}\cdot RECPOP + \beta_{EPOP}\cdot EPOP + \beta_{COST}\cdot COST + \varepsilon_j$.

That is, utility is a linear function of the western stock ESA status level (dummy variables, WSTAT2 and WSTAT3, taking values of one for a threatened or recovered status, respectively, and zero otherwise), western stock residual populations (ENDPOP, THRPOP, and RECPOP), the eastern stock population size (a dummy variable, EPop, corresponding to a population size of 80,000; otherwise assumed 60,000) and cost (COST).[22] Note that the estimation model assumes the non-cost parameters (β's) follow a normal distribution; both a mean and standard deviation are estimated to describe those distributions. Table 10-42 reproduces Table 4 from LLR and reports on these estimated mean and standard deviation parameters.

[22] In the CE questions used by LLR, cost is defined as the additional cost to the household each year resulting from an increase in prices of goods affected by Steller sea lion protection and by an increase in taxes.

Table 10-42 Model Estimation Results for LLR Models

	Decreasing Version		Stable Version		Increasing Version	
Random Parameter Mean Random Parameter Std Dev	Parameter Estimate	Asy. T-value	Parameter Estimate	Asy. T-value	Parameter Estimate	Asy. T-value
Western stock is threatened dummy variable (WSTAT2)	2.47817	10.76573	1.94421	11.65638	-	-
	4.56234	13.1196	2.9824	14.50215		
Western stock is recovered dummy variable (WSTAT3)	2.30689	4.83404	2.52087	8.45649	1.96102	7.09831
	1.17599	1.39657	-1.97212	-4.3139	2.72787	6.74361
W. stock population residual for endangered status (ENDPOP)	0.08119	12.16974	0.10383	6.90103	-	-
	0.02505	2.55294	-0.05528	-2.36026		
W. stock population residual for threatened status (THRPOP)	0.01714	3.07845	-0.01667	-3.48593	0.08709	9.36422
	-0.0019	-0.12868	0.0007	0.05268	0.09676	8.38644
W. stock population residual for recovered status (RECPOP)	0.00147	0.13689	-0.01789	-2.45925	0.00884	1.26077
	-0.01254	-0.93137	-0.00827	-0.56322	0.0118	0.94282
Eastern stock has population of 80,000 dummy variable (EPOP)	0.35287	3.30729	0.68995	5.90479	0.67988	5.56024
	-0.04929	-0.14362	-0.02351	-0.05867	-0.22552	-0.61935
Annual household cost (COST)	-0.01756	-14.8616	-0.01448	-18.3324	-0.02500	-13.2796
Sample size	717		648		587	
Maximized log-likelihood value	-2,719.93		-2,552.91		-2,249.47	
AICc	6,623.58		5,964.68		5,087.85	
BIC	5,623.95		5,287.09		4,594.57	

Notes: Estimates of the off-diagonal elements of the Choleski decomposition of the estimated random parameters covariance matrix are excluded from the table and were not needed for the welfare calculations. This table is adapted from Lew, Layton, and Rowe (2010).

For each version of the survey and associated model, V_0 is calculated for the status quo alternatives represented by the baseline scenario (see LLR for details) and V_1 is calculated for each of the three alternative growth scenarios (I, II, and III). There is no improvement under Scenario I, which means under the LLR model that WTP will always be zero regardless of the threshold scenario. The three scenarios are summarized in Table 10-43. The table also contains the values of ENDPOP, THRPOP, and RECPOP used in the benefit function transfer that are calculated by subtracting the expected population size in 60 years under each growth scenario from the threshold population level necessary to be re-listed to threatened (in the case of an improvement to threatened) or de-listed (in the case of an improvement to recovered). Since we assume there will be no change from the status quo level of protection with respect to the eastern stock population, EPOP = 0 in all scenarios (not displayed in the table).

Table 10-43 Growth Scenario Descriptions

Scenario	WSTAT2 (threatened)	WSTAT3 (recovered)	ENDPOP	THRPOP	RECPOP
I	0	0	0	0	0
II	1	0	0	29,255	0
III	0	1	0	0	46,006

For each of the three LLR models corresponding to different baseline future assumptions, the expected mean annual household WTP is calculated for each of the three scenarios, and 95 percent confidence intervals are calculated for each estimated WTP value using the simulation approach of Krinsky and Robb (1986).[23] Table 4 provides estimates of the mean annual household WTP for improvements to the western stock under each of the scenarios for the Decreasing Version, Stable Version, and Increasing Version models.

[23] Note that the expected WTP can be calculated with only the mean parameter estimates from LLR (and cost parameter) since we are interested in the mean WTP, and the variability of the parameter estimates suggested by the standard deviations do not play a role in the expected value.

Table 10-44 Estimated Mean Annual Household Willingness to Pay for Improvements to the Western Stock by Version. 95% Confidence Intervals in Parentheses.

Western Population Growth Scenario	Western stock growth and listing status	Survey instrument version		
		Decreasing baseline population version	Stable baseline population version	Increasing baseline population version
I	2% decline per year and endangered	$0.00	$0.00	$0.00
II	1% increase per year and is re-listed to threatened	$169 ($142, $199)	$100 ($72, $128)	$102 ($83, $121)
III	2% increase per year and is de-listed (recovered)	$134 ($90, $178)	$116 ($77, $157)	$94 ($69, $118)

Notes: Mean annual payments each year for 20 years, the period over which the survey question hypothesized payments. While these values have been rounded to the nearest whole dollar, later calculations are based on unrounded values.

Table 10-44 shows mean annual household values ranging from $0 to $169 per year, depending upon the scenario being valued and the version of the model used. Since the LLR models are used for valuing improvements to Steller sea lions, the public's WTP associated with a decline in the western stock is reported as zero in the table. As one would expect, given the differing baseline futures assumed in the different versions, the Decreasing Version model predicts mean WTP values that are larger than the Stable Version and Increasing Version mean values.[24] For Scenario III, the Stable Version model estimates mean WTP values greater than those from the Increasing Version model. For Scenario II, the models based on the Stable and Increasing Versions of the survey lead to very similar estimates with the Increasing Version estimate being slightly larger than the Stable Version estimate, although the difference between the WTP values does not appear to be statistically different (95 percent confidence intervals overlap).[25]

The Present Value of Household WTP

Recall that respondents to the LLR surveys were asked to indicate whether they would pay for programs with a specific cost per year for 20 years. At the same time, results being paid for through these hypothetical programs are expected in 60 years from the present. To understand the present value of the total WTP over the 20 years (and hence the sum total of what they are willing to pay in present day terms), one needs to discount the future annual payments since there is a time preference for money and an opportunity cost of foregoing the benefit of having a dollar today compared to in the future.[26] For a

[24] Because the Decreasing Version is the most pessimistic in its assumption about the future western stock population size and ESA status, one would expect the value of a given improvement to be higher than for less pessimistic versions since what is being valued is a larger improvement.

[25] To formally test to see whether the differences in WTP between alternatives are statistically significant or not requires a more in-depth analysis along the lines of Poe, Giraud, Loomis (2005), though our experience suggests these statements are likely to hold.

[26] Respondents say they are willing to pay a fixed amount each year for 20 years, but the future constant dollar payments will not buy as much in 20 years as they do today because of inflation. Thus, a correction can be made to account for inflation. According to the latest estimates, the current annual inflation rate based on the

constant payment, WTP_0, over 20 years, the present value of the sum of annual payments at a real discount rate r is denoted PV_{all}:

$$(3) \qquad PV_{all} = WTP_0 \times \sum_{t=1}^{20} \frac{1}{[1+r]^{t-1}}.$$

While it is generally agreed that in an intertemporal setting the stream of benefits and costs need to be discounted to a present value to enable useful comparisons in terms of net economic benefits, what discount rate to use is a matter of considerable debate in the economics and policy analysis literature.[27] Recent guidance from the Office of Management and Budget (OMB) (Circular A-4, September 17, 2003) recommends 3 percent and 7 percent as benchmarks for the discount rate. However, those rates are based on OMB's analysis of returns to capital investments with and without accounting for distortions caused by regulation that affects private consumption, with the lower rate being approximated by the real rate of return on long-term government debt.[28]

Several challenges have been levied against the use of these benchmarks, most notably with regard to the use of discounting of environmental policies with very long time horizons. When environmental policies have effects that span multiple generations, decisions made today will affect future, unborn generations, which raise issues of intergenerational equity (e.g., Sumaila and Walters, 2005). The U.S. Environmental Protection Agency (2000:52) provides a useful summary of the literature concerning discounting in this case and recommends using lower discount rates, in the range of 0.5 percent to 3 percent. Furthermore, recent economic analyses of climate change appear to favor discount rates ranging from 1.4 percent to 5.5 percent (Stern and Taylor 2007; Nordhaus 2008).

Since the effects of the growth scenarios considered in this chapter are expected to occur over the next 60 years, a lower discount rate range than the OMB recommended 3 percent to 7 percent range seems appropriate. For this analysis, we adopt the range recently used in analyses of climate change. To this end, Tables 10-45 and 10-46 contain the present value of the total WTP over the 60-year time horizon (based on the mean WTP per year) under each scenario and the corresponding 95 percent confidence interval using 1.4 percent and 5.5 percent, respectively, for the social rates of time preference (i.e., real discount rate).[29] For r = 1.4%, present values of household WTP range from $0 (Scenario I) to $1,587 (Scenario II-A under the Decreasing Version). For r = 5.5%, the range in present values is $0 to $1,342 per household. These present values represent the sum total of what, on average, a U.S. household with only non-consumptive values would pay for the scenarios and the expected improvements associated with them in 60 years. Clearly, these results are indicative of a positive and significant willingness to pay for improvements to the western stock in terms of population size increases and improvements in ESA listing status.

consumer price index is 2.0%, though for 2009, the inflation rate was -0.4%. Due to the uncertainty of future inflation rates, OMB Circular A-94 (http://www.whitehouse.gov/omb/rewrite/circulars/a094/a094.html) recommends not making an explicit assumption about inflation rates in discounting benefits or costs. Given the variability of recent inflation rates, we follow this recommendation.

[27] For example, see the special issue of the *Journal of Environmental Economics and Management* (volume 18(2), part 2) that is devoted to this issue.

[28] See OMB Circular A-94 for details.

[29] This range is consistent with the results of a survey of 2,160 Ph.D. economists that recommended an approximate discount rate of 2% for projects with time horizons within 26 to 75 years (Weitzman 2001)

Table 10-45 Present Value of Mean Household Willingness to Pay for Improvements to Western Stock with 1.4% Discount Rate

	Decreasing Version			Stable Version			Increasing Version		
Scenario	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**
I	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
II	$2,504.81	$2,968.13	$3,493.79	$1,269.94	$1,750.11	$2,253.35	$1,466.31	$1,788.88	$2,133.82
III	$1,576.70	$2,360.27	$3,127.69	$1,345.31	$2,041.45	$2,766.99	$1,208.41	$1,654.01	$2,066.19

Note: These are present values, calculated over a 20 year period. Thus they are not comparable to annual income estimates.

Table 10-46 Present Value of Mean Household Willingness to Pay for Improvements to Western Stock with 5.5% Discount Rate

	Decreasing Version			Stable Version			Increasing Version		
Scenario	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**	**Lower Bound of 95% CI**	**Estimated Mean**	**Upper Bound on 95% CI**
I	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
II	$1,796.16	$2,128.40	$2,505.34	$910.65	$1,254.98	$1,615.84	$1,051.47	$1,282.78	$1,530.13
III	$1,130.63	$1,692.51	$2,242.82	$964.70	$1,463.89	$1,984.17	$866.53	$1,186.06	$1,481.63

Note: These are present values, calculated over a 20 year period. Thus they are not comparable to annual income estimates.

Aggregation Issues

Before discussing aggregating the household WTP values presented in Tables 45 and 46, it is important to assess which of the three LLR models is likely most applicable. This depends upon the current status and population trend of the western stock. The most recent stock assessment for the western stock (Allen and Angliss 2010:3) suggests that the "overall trend in the western population of adult and juvenile Steller sea lions in Alaska is stable or possibly declining slightly". This description is closest to the baseline future described in the Stable Version. As a result, the Stable Version model results are likely the most appropriate to apply for this analysis and will be the values used in the aggregation exercise that follows. From Table 10-46, these mean values range from $1,750 to $2,968 per household using a discount rate of 1.4 percent. The range is slightly less, from $1,186 to $2,128, for a discount rate of 5.5 percent.

For the purposes of understanding the total non-consumptive values accrued to the U.S. public associated with adopting each of the alternatives, the household mean WTP values must be aggregated over the applicable population. To do this, we must define what population the WTP values should be applied to and determine the size of the population. According to the most recent American Community Survey conducted by the Census Bureau, there are 112,386,298 households in the U.S.[30] An upper bound on a population-level total WTP estimate (WTP^{agg}) can be obtained by simply multiplying the total U.S. households (N^{us}) by the mean present value of WTP estimate (WTP^{mean}): $WTP^{agg} = N^{us} \times WTP^{mean}$. However, that assumes the mean WTP estimate is (a) representative of the population and (b) applicable to the population of all U.S. households. These are two different assumptions worth discussing.

LLR note that there are (statistically significant) demographic differences between the sample of heads of households and the U.S. general population, particularly with respect to age, gender, ethnic composition, and income. Still, since the comparison is between heads of households and the general population, these dissimilarities may not be truly indicative of differences between the sample of heads of households and population of heads of households. Some models incorporating demographics in the utility specification have been estimated by LLR, but none have provided strong evidence that demographics play a major role in influencing WTP. As a result, the LLR mean WTP estimates are assumed to be appropriate for applying to the general population of U.S. households.[31]

A related issue is how many U.S. households to assume in the aggregation calculation. Loomis (1987) points to two common ways of calculating aggregate WTP that result in an upper bound and a lower bound. First, one can apply the mean WTP to all U.S. households as mentioned above to achieve an upper bound. Second, one can apply the mean WTP to a portion of the population, while assuming everyone else has a zero WTP. Typically, this approach involves using the survey response rate as the portion of the population to use. In this case, a 60 percent overall response rate implies assuming 60 percent of U.S. households should be used in the calculation of the aggregate WTP amount (i.e., about 67 million households).[32] In this latter approach, however, one may ask whether the survey response rate is the most appropriate measure of the proportion of the population to use since there are often further adjustments to the sample done prior to achieving the estimation data. In LLR, for instance, a portion of the data was excluded from the analysis because the respondents indicated a lack of confidence in their stated preference choice experiment question responses, did not provide any responses to the choice

[30] From 2008 American Community Survey Data File available at: http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuId=&_lang=en&_ts=.

[31] The LLR utility specifications assume linear income effects, though piecewise linear income effects models have been estimated that approximate non-linear income effects. However, those results are preliminary and have not been published yet.

[32] Loomis (1987) advocates using aggregation methods that adjust welfare estimates from the sample to better match the population.

questions, or provided responses that indicated a lack of understanding about how to answer the questions. Assuming these individuals should likewise be excluded from the calculation, the proportion drops to 52 percent or less (see Table 10-47). Using this approach with the proportions in the last column of Table 10-47 results in 58.26 million U.S. households as the number of households in the population applicable for the Stable Version. The remainder of the 112 million households in the U.S. are assumed to have zero willingness to pay for the growth scenarios.

Table 10-47 Sample Sizes and Respondents Used for Estimation

Survey version	Deliverable sample	Total survey respondents	Estimation sample	Estimation sample as proportion of deliverables
Decreasing	1,553	914	717	46.17%
Stable	1,250	801	648	51.84%
Increase	1,242	739	587	47.26%

As noted before, the public WTP associated with Scenario I is $0 since the public will not be willing to pay anything to achieve a result that is worse than what is currently expected (at least according to the LLR approach).

Under the 1.4 percent discount rate assumption, if each of the 58.26 million households have on average a willingness to pay for Scenario II (in present value terms) of $1,750 (from the Stable Version), the total estimated public WTP would be about $102.0 billion (95% with a confidence interval (CI) = [$74.0 billion, $131.3 billion]). The total public WTP for Scenario III is approximately $118.9 billion (95% CI = [$78.4 billion, $161.2 billion]).

Under the 5.5 percent discount rate assumption, the total estimated public WTP for Scenario II would be about $73.1 billion (95% CI = [$53.1 billion, $94.1 billion]). The total public WTP for Scenario III for a 5.5 percent discount rate is approximately $85.3 billion (95% CI = [$56.2 billion, $115.6 billion]).

In summary, the total non-consumptive benefit for all U.S. households associated with Growth Scenarios I, II, and III (under the model based on the Stable Version of the survey) are the following:

<u>Discount rate of 1.4%</u>
Scenario I (- 2 percent average growth): $0
Scenario II (1 percent average growth): $102.0 billion
Scenario III (2 percent average growth): $118.9 billion

<u>Discount rate of 5.5%</u>
Scenario I (-2 percent average growth): $0
Scenario II (1 percent average growth): $73.1 billion
Scenario III (2 percent average growth): $85.3 billion

Some Notes on the Benefits Transfer

The estimated public non-consumptive benefits associated with Growth Scenarios II and III are large, even under the Stable Version model results. Given the sheer number of applicable U.S. households, we would expect that even if each of these households would be willing to pay $1 (in present value) for a given alternative protection program that would lead to an improvement in the western stock population or listing status, the annual public WTP would be over $58 million, and would have a present value of a about a billion dollars with a 1.4 percent discount rate, and a present value of about three-quarters of a billion at a 5.5 percent rate. Thus, considering the range of WTP values, it should not be surprising that the estimated public benefits associated with the scenarios are in the billions of dollars. Recall that

Richardson and Loomis (2009) summarized a large portion of the non-market valuation literature and indicated that the annual WTP amounts for individual threatened and endangered species ranged from $8 to $241 (in 2006 dollars). If these annual amounts were to be put in present value terms as was done in this analysis, many would exceed the estimates derived here for the Steller sea lion.

Before turning to other issues, it is important to note several things about the use of LLR to estimate economic values for alternatives in this report.

First, even though the values estimated in LLR can generally be interpreted as applicable for all U.S. households, the random sample used was drawn from all U.S. households excluding those in Alaska. A separate random sample was drawn from all households in Alaska to enable separate economic value estimates for Alaskans to be generated. The results of the analysis of the Alaska household data have not been published yet, but are not statistically different from the estimates reported in LLR. However, importantly, the confidence intervals are much larger for the Alaska WTP estimates, suggesting greater variability and uncertainty about the precise WTP values associated with Alaska households. For the purposes of this analysis, however, the "rest of the U.S." household results from LLR are applied to all U.S. households, including Alaska households. Because the Alaska state population is so small compared to the overall U.S. population (less than 0.2 percent of the U.S. population according to the 2000 Census numbers), using different WTP estimates would not appreciably change the aggregate WTP estimates presented in the section above.

Second, it is important to recognize that the economic values estimated by the LLR models do not contain consumptive values, such as those that would accrue to subsistence users in Alaska. Instead, the values represent only non-consumptive values from activities such as viewing the animals, or knowing they exist. Consumptive uses are discussed in the next sub-section. To the extent these consumptive benefits exist and can be estimated for each scenario, adding them to the economic benefits estimated from the LLR model will yield a measure of the total economic benefits associated with the scenario.

Third, to the extent that preferences for protecting Steller sea lions have remained unchanged since 2007, the estimated WTP will reflect current preferences. However, if there has been a fundamental shift in the public's preferences for protecting the species, the value estimates reported here may be inaccurate. Two important events since the survey was implemented in 2007 could contribute to a shift in societal preferences: the global recession and the *Deepwater Horizon* oil spill. The recession that began in December 2007 led to many American losing their jobs. Economic theory suggests lower willingness to pay will follow diminished incomes, and therefore the WTP estimated today for the U.S. public may be less than what it would have been prior to the recession.[33]

The other major event that may shift public preferences for protecting Steller sea lions is the *Deepwater Horizon* oil spill that began in April 2010. This event has focused the public's attention on the environment, particularly the marine environment and marine species in the Gulf of Mexico. Assuming a change in preferences for protection measures is a lasting rather than an ephemeral change, the heightened public awareness of the oil spill and the effects it is having on marine mammals in the Gulf of Mexico may raise the concern for, and hence willingness to pay to protect, Steller sea lions. Thus, this oil spill is likely to have the opposite effect on preferences than the recession has had. In the preceding benefits transfer, no correction was made for these factors, as it is unclear what net effect these events have had on preferences.

[33] For reasons discussed in an earlier footnote, WTP is typically employed in CVM, even when the theoretically appropriate measure is WTA. While it is true that a reduction in disposable income 'should' reduce WTP bids, there is no equivalent influence on WTA.

Fourth, the aggregation of household WTP over U.S. households to generate a national-level estimate of non-consumptive benefits associated with the scenarios required several strong assumptions to be made. In particular, the mean WTP estimated from the Stable Version model was assumed to be applicable to all households determined to be in the population of households with a positive willingness to pay for Steller sea lion protection.

Fifth, Growth Scenario III used in this analysis leads to a population size in 60 years that is larger than any population size seen by any respondent in the original LLR survey. The largest population size for the western stock seen in the LLR surveys was 120,000. Growth Scenario III is assumed to grow at a rate of 2 percent per year for 60 years, resulting in a population size above 120,000. As a result, it is possible that the marginal WTP associated with population increases above 120,000 may not be accurately measured by the LLR estimated models (this may occur if there is a greater diminishing marginal utility associated with RECPOP, which was not tested in the LLR model).

Sixth, the survey respondents were posed with questions that asked them to value alternative, and certain, Steller sea lion population trajectories. A certain trajectory of a given size will be given a higher value than an uncertain trajectory of the same size. In the present instance, the population trajectories associated with each of the three alternatives, are highly uncertain. Thus, analysis based on the survey responses may overstate the values of the trajectories.

And finally, the accuracy of the WTP estimates is likely to be viewed with a critical eye, which is fair given the hypothetical nature of the questions used. However, as the NOAA panel on CVM (Arrow et al. 1993) and numerous others have argued, when carefully done, SP surveys can generate reliable estimates of WTP. In our view, the LLR study meets this criterion, as they used state-of-the-practice methods to develop the SP survey instruments, gather the data, and analyze it. Considerable time was spent developing instruments that reminded respondents at various places in the survey about other issues that may compete for their attention and money, such as other social issues (e.g., education, jobs), other seals and sea lions, and other threatened and endangered species. In addition, standard budget reminders were inserted to remind respondents that money they spend on protecting Steller sea lions in the CE questions could not be used to purchase other things. These things were tested extensively in a series of small group discussions (focus groups) and in-depth one-on-one interviews (cognitive interviews) with members of the public. Peer review also was sought at numerous stages of the study, from early review of survey materials by experts in survey methodologies and SP survey design to expert review of the analytic methods by non-market valuation economists with particular expertise in econometric modeling of CE data, as well as peer review by anonymous reviewers at *Marine Resource Economics* done as part of the publication process. Therefore, steps were taken to minimize the potential for biases and inaccuracies to enter, but of course, given the hypothetical nature of the CE questions and the inability to corroborate the values from observations of actual spending or behavior, it is possible the estimates may reflect some level of introduced bias.

10.4.3 Subsistence Values

Successful efforts to improve the Steller sea lion population trajectory, and a possible associated change in listing from endangered to threatened, or a possible delisting, may lead to increased catch per unit of effort, reduced opportunity costs of harvesting, and increased harvests, or to a reduction in conservation or regulatory concerns about hunting, and a greater willingness to hunt sea lions. If sea lion hunting or butchering skills have been lost, or cultural interest in harvesting sea lions has declined, due to relatively low participation in hunts in recent years, hunting may be delayed in returning to historical levels, or may not return.

An increase in the catch per unit of effort for hunting sea lions could improve welfare as households are able to consume more sea lions and/or to spend more time on collection and preparation of other subsistence resources while maintaining existing sea lion harvests. An increased variety of species for hunting may allow subsistence hunters and communities to diversify their "portfolios" of resources, and reduce income risks associated with changes in the availability of individual resources.

This result would strengthen subsistence based communities. Individual hunting households would be better off, as would individual households receiving sea lion products through exchange or as a gift. Native community cultures originated in subsistence communities and continue to depend heavily on subsistence production (even if most communities are now subsistence-market hybrids). Improved subsistence hunting opportunities could strengthen Native communities. This cultural contribution would be an important external effect of subsistence harvesting.

Improved stocks in the western Aleutians may have little impact on catch per unit of effort for most subsistence hunters, since there are no local subsistence communities within Areas 542 and 543. There may be some benefits to small communities, particularly to Atka, where subsistence harvests remain high and may be directly influenced by improvements in local populations. Benefits might be greater if subsistence hunters elsewhere in the BSAI or GOA regions are refraining from targeting sea lions to some extent from a precautionary motive, and if improvement in stocks leads to a change in listing status for the western population segment as a whole. If this is the mechanism by which the action benefits subsistence activities, the impact may be delayed for some years until listings are modified.

Uncertainty about the recovery of sea lion hunting in response to a population recovery, and limitations in available research, make it impossible to quantitatively measure possible benefits for an economic welfare analysis.[34] While individual subsistence households and subsistence community members may value an improvement in sea lion populations more than members of the average U.S. household, the number of U.S. households is so much larger (approximately 112 million U.S. households) that a quantitative estimate of the value of subsistence consumption, if it could be had, would be much smaller than a national valuation of non-consumptive benefits.

10.5 Impacts on other ecosystem resources

Section 10.4 discussed the consumptive and non-consumptive benefits the action alternatives may create by reducing possible conflicts between the fishing fleets and Steller sea lions. The action alternatives may also impact a range of other environmental resources. The following resources were discussed in separate chapters in the EA:

- Fish stocks
- Marine mammals
- Seabirds
- Habitat
- Ecosystem resources

The impacts of this action on fish stocks are discussed in Chapters 3 and 4. Alternatives 2 and 3 will reduce harvests of Atka mackerel and Pacific cod stocks in the Aleutian Islands, and increase harvests from rock sole, yellowfin sole, and Pacific cod stocks in the Bering Sea. Some catches of some

[34] The survey discussed elsewhere in this section did not include Alaskans in the survey frame and did not include any questions designed to elicit information about the valuation of subsistence uses. To the extent that residents of the U.S. value subsistence uses and the existence of subsistence communities, the survey results may be interpreted as including this source of value.

groundfish species taken incidentally to these targets may also change, as may mortality of prohibited species. Halibut bycatch, especially, may change. Reduction in Atka mackerel and Pacific cod harvests should tend to contribute to increases in those stocks in the Aleutians. Atka mackerel may be especially affected, since it is a localized species, and current harvests would be reduced considerably by this action. Harvest increases of rock sole, yellowfin sole, and Pacific cod in the Bering Sea would tend to reduce future population sizes for those stocks, but, as noted in the EA, not significantly. Prohibited species impacts would remain limited by restrictions on prohibited species harvests. These actions could affect human welfare through human interest in stock health in and of itself, through changes in the costs of harvest associated with changes in stock size, and through the role some fish species play in supporting bird and marine mammal populations that provide value. However, the EA does not find that this action will have significant impacts on fish stock resources. In general, it is likely that costs or benefits from this source will be small.

The impacts of this action on marine mammals are discussed in Chapter 5. The impacts on Steller sea lions, humpback whales, and sperm whales are discussed in detail in the draft FMP Biological Opinion (NMFS 2010) and in Chapter 5. Non-consumptive and consumptive values exist for marine mammals including subsistence harvests of some marine mammals. The non-consumptive benefits for other Alaskan marine mammals have not been studied to the extent that Steller sea lion non-consumptive benefits have been studied (Lew, pers. comm.)[35]. With respect to other marine mammals, the EA found little reason to believe that any of the actions under consideration would have a significant impact on incidental take or entanglement in marine debris, prey availability, or disturbance to marine mammals. In the Aleutians it is possible that shifting fishing away for near-shore areas may reduce disturbance of near shore mammals (e.g., harbor seals and northern sea otters). No significant environmental impacts on marine mammal populations were identified for the action alternatives. The actions under consideration here are therefore unlikely to have a large impact on values associated with these resources.

The impacts of this action on seabird populations were discussed in Chapter 6. Non-consumptive values exist for seabirds. One of them, value from birdwatching trips, could even have an economic impact within the Aleutian Islands. Seabirds are also harvested for sport and subsistence purposes. The information available to evaluate the benefits or costs of the action alternatives to seabird populations is not currently available. Chapter 6, however, suggests that the action alternatives may have relatively small impacts on seabird populations. Under the status quo, seabird takes, and disruptions to benthic habitat, and to prey availability, are low, and are mitigated to some degree by current spatial restrictions in the Aleutian Islands fisheries. The analysis found that there would be little, if any, impact to seabirds from additional closures or shifting fleets under the two action alternatives. Thus it is likely that the action alternatives will have little impacts on economic measures of benefits from seabird populations.

The physical impacts of this action on habitat are discussed in Chapter 7. This action should reduce the amount of bottom trawling, longlining, pot deployment, and other activities that may impact bottom habitat in the Aleutian Islands. Conversely there should be some increase in these activities in the Bering Sea. Habitat may provide non-consumptive benefits to persons who enjoy learning about, thinking about, and in some cases, possibly viewing, unique subsea habitats, such as coral gardens (although trawl impacts on coral gardens are believed to have been small, considering the trawl closures currently implemented). Habitat may also provide consumptive benefits by contributing to the productivity of fish stocks. Humans could accrue benefits if healthier fish stocks contributed to the health of bird, or marine mammal populations, or of fish stocks harvested for human use. However, as noted elsewhere in this section, this action is not expected to have significant impacts on these. The shift in activity could further remove potential adverse impacts of fisheries in the Aleutian Islands and increase potential impacts of the fisheries in the Bering Sea, thereby contributing to the benefits provided by Aleutian Islands habitat, and

[35] Daniel Lew, Ph.D. Economist. NMFS Alaska Fisheries Science Center. Seattle, Washington.

reducing benefits provided by Bering Sea habitat. Actual physical impacts, and economic benefits and costs, are likely to be small, since much of the habitat is already protected by various measures and for reasons discussed above. The analysis in the EA found that that there would be no environmentally significant impacts on habitat.

The impacts of this action on ecosystem function will be discussed in Chapter 8. This section of the EA has not been completed in the current draft. Ecosystem function refers to predator-prey relationships, energy flow and balance through the ecosystem, and ecosystem diversity. The fishing industry impacts these through its impacts on the various ecosystem elements (fish stocks, habitat, seabirds, and marine mammals) described above. To the extent that it does, these issues have already been addressed. One issue of concern is the potential for the introduction of invasive species into new habitats. Vessels may carry marine organisms on their bottoms or ballast tanks, or may carry rats which may find their way to island habitats. Rat infestations have been an important concern in the Aleutian and Pribilof Islands. Bird populations, for example, can be vulnerable to rat predation. Considerable sums have been spent to eradicate rats on some islands, and to prevent infestations on others. To the extent that the transportation of invasive species to new locations is a concern, the action alternatives of this action may reduce potential impacts in the Aleutians.

10.6 Costs Incurred by the fishing and processing industries

10.6.1 Introduction

Past Alaska Region analyses of spatial management measures have estimated the volumes of fish that had been harvested from areas to be closed or restricted, monetized them using prices from a recent period (first wholesale and/or ex-vessel, depending on the fleet), and described these as "revenues at risk." These revenues could be "at risk" because of uncertainty about the impact of the restrictions on catch in the area directly affected by the regulations, or because of uncertainty about the fleet's ability to redeploy, substitute new fishing activities, and earn offsetting revenues, in other areas.

Berman et al. (2008) describe the "revenue at risk" concept as a "completely inadequate measure of the losses that the industry—and society—would endure from such closures." The measure is described as inadequate because it does not take account of the ability of fleets to move to and exploit other fishing opportunities (Berman and his co-authors believe that in most cases in the North Pacific, catches and revenues would remain unchanged after these adjustments), and because the measures ignore the real costs that spatial management can pose for fishing operations, including "higher travel costs to reach open areas, higher operating costs from lower catch rates and interrupted trawls, search costs and costs of learning how to fish profitably in new areas" (Berman et al. 2008:3).

Producer's surplus is the appropriate measure of the welfare effects of the action for a producer. The producer's surplus is the difference between the gross revenues for the firms in the industry, and the total variable costs for those firms (Boardman et al. 1996; Just et al. 2004)[36]. Producer's surplus can differ from the profits received by the firm: producer's surplus is the difference between total revenues and total variable costs, while profits are the difference between total revenues and total costs (including both total variable costs and total fixed costs).

As discussed in section 10.3, in recent years a number of economists have developed statistical models of the choices fishermen make about where to fish, and have used these to analyze a range of issues. Several

[36] Technically, this economic concept is called quasi-rent, and producer's surplus is a way of measuring it geometrically (Just et al. 2004). Here the term producer's surplus is used because of its parallelism with the later use of the term consumer's surplus in section 10.8.

of these papers have applied these models to analyze spatial restrictions or closures. Because these models often condition fishing location choices on expected gross revenues from fishing in an area, it is possible to use these models to make inferences about the value placed on an opportunity to fish in an area by the owners of the fishing firm. These values can then be used to estimate the cost to these operations, that is, the loss of producer's surplus, from losing access to the fishing area. The estimate of loss of producer's surplus would be based on a measure of costs that captured the costs of a spatial closure described by Berman et al. (2008), as they are seen by the vessel's decision makers.[37] As discussed in section 10.3, however, it has been impractical to use this type of analysis for this RIR in the time available.

Amendment 80 included provisions to collect economic data, including operating cost information, from Amendment 80 firms involved in the fishery. Some data from this Economic Data Reporting (EDR) process is available. This data could, potentially, be used for estimating the average costs of fishing in an area, for example, the average costs per haul. These could be combined with average revenue information to estimate the net returns per haul.[38] In themselves, the data have limitations for this analysis. They are not available for several of the key fleet segments that will be impacted in this action: the fixed gear catcher/processors, and the catcher vessels. Moreover, the cost that can be estimated is purely the immediate financial cost of actually making a haul and, if appropriate, processing the fish. It does not reflect all of the types of costs described by Berman et al. (2008), for example, the costs of shifting to, and learning about, another fishing area. While this information may be useful for evaluating an action of the type under consideration, it has not been practical to use it in the time available.[39]

In the absence of these more sophisticated approaches to estimating the welfare impacts of this action, the analysis proceeds as follows. Section 10.6.2 provides estimates of the revenues that would be placed "at risk" in the Aleutian Islands. The shortcomings of this type of analysis have been discussed above. However, it is an analysis commonly used in the Alaska Region, and may provide an measure of impacts that many will find useful. Sub-section 10.6.3 discusses the potential for revenue offsets from other fisheries in the Bering Sea. This discussion is subject to the indeterminacy identified in the discussion of alternative fisheries in section 10.3. Sub-section 10.6.4 discusses the potential welfare impacts of the action, as distinct from the revenue changes. This section draws on recent academic literature on spatial choice, discussed above, for qualitative insights. Together, sub-sections 10.6.3 and 10.6.4 partially address the two major shortcomings identified by Berman et al. (2008) of the revenue at risk approach. Subsequent sub-sections provide estimates of the present value of gross revenue losses, and examine implications for CDQ groups.

A subsequent section (section 10.7) investigates the income and employment effects of the action alternatives. These must be sharply distinguished from the welfare discussion in the current section. The current section explores the benefits and costs of this action as defined for the purposes of a cost-benefit analysis.

Employment and income effects are important considerations, shedding valuable light on the distributional impacts of an action. These effects are of great concern to persons whose responsibilities

[37] The cost estimates would still fall short of the total social costs, because the value placed on fishing in an area would not reflect the value forgone by the fishing operation through taxes paid to the public. While the fishing firm would see these as a cost, they are a transfer from a public cost-benefit accounting stance.

[38] The EDR data might also be used to improve the models of decisions about where to fish, described in the preceding paragraph (A. Haynie, personal communication).

[39] While an analysis was not possible for this draft RIR, ongoing work in the Alaska Region and the Alaska Fisheries Science Center should make it possible to supplement this discussion with an EDR-based analysis in the final draft.

require them to pay more attention to local or regional impacts than national impacts, or who must take account of these impacts for local and regional planning purposes.

However, estimates of these effects do not provide estimates of benefits and costs usable in a standard cost-benefit format, especially one taking a national accounting perspective. The oil spill cleanup following the Exxon Valdez grounding in 1989 generated incomes and jobs for many persons in Alaska. Nevertheless, the accident was a bad thing from an efficiency or welfare point of view: it imposed net damage on the Alaska coast, and the workers and resources invested in the clean-up were taken from other useful activities. The foregone benefits from these other useful activities were a cost to the nation. Income to the workers involved in the cleanup should not have been included on the benefit side of a cost-benefit calculation. Similar considerations apply to the response to the Deepwater Horizon disaster in the Gulf of Mexico this year.

10.6.2 Adverse Impacts on Revenues in the Aleutian Islands

Alternatives 2 and 3 will reduce fishing revenues in the Aleutian Islands by restricting harvests of Atka mackerel and Pacific cod. Revenues will be directly reduced for the Amendment 80 trawl catcher/processor fleet, the fixed gear catcher/processor fleet, and the catcher vessel fleet. The impacts on retained catches for these fleets were discussed in detail in section 10.3.

In this section, these impacts on harvests are monetized. The approach has been to calculate a first wholesale gross value per metric ton of round weight, and multiply this value by the number of metric tons harvested. Separate first wholesale values have been used for fish processed by catcher/processors and fish processed by shoreside processors. In some instances prices have been further broken down into "A" and "B" season prices (for rock sole), and for fixed and trawl gear (for Pacific cod). Ex-vessel prices per metric ton of round weight have also been prepared for catcher vessel deliveries.

The value per metric ton round weight estimates were prepared using 2009 first wholesale values for products, derived from Commercial Operator Annual Reports (COAR reports), divided by COAR and Catch Accounting System (CAS) based estimates of the round weight of retained catches. The procedure is the same used to prepare Table 27 in the 2009 Economic SAFE report. A similar procedure was used for ex-vessel round weight values received by catcher vessels. In this case an ex-vessel value per metric ton of round weight was calculated based on prices obtained from the Alaska Commercial Fisheries Entry Commission and weights from Alaska fish tickets (data compiled and supplied by the Alaska Fisheries Information Network [AKFIN]). This procedure has been used to estimate changes in gross revenues in similar regional analyses in the past.

The estimated values[40] used for this analysis are summarized in Table 10-48. Pacific cod values have been adjusted to take account of 2008 prices as well, since 2008 prices were unusually high, and 2009 prices appear to have been unusually low.

[40] These wholesale values are not actual prices. They do reflect prices for groundfish products at the first wholesale level, but they are not actually prices for any specific product, or prices paid for a metric ton of a groundfish species. While tonnage is transferred within cooperatives or when a CDQ group receives a royalty in return for leasing a certain amount of metric tonnage, NMFS does not collect information on these prices. They represent the value of processed products at the first wholesale level per metric ton of round weight of catch used to produce them. Thus wholesale values reported here may differ from wholesale prices reported in other sources. The ex-vessel values may come closer to ex-vessel prices.

Table 10-48 First wholesale and ex-vessel values per metric ton round weight (2009 unless otherwise noted).

Sector	Species	Annual	A season	B season
Catcher/processor	Atka mackerel	$948		
	Arrowtooth	$547		
	Flathead sole	$1,216		
	Rock sole		$750	$550
	Yellowfin sole	$646		
	Pacific cod (trawl)*	$1,463		
	Pacific cod (fixed)*	$1,705		
Shoreside	Atka mackerel	$62		
	Pacific cod	$1,188		
Ex-vessel	Pacific cod	$858		
	Rock sole	$393		
	Atka mackerel	$37		
	Pollock	$426		
	Other species	$98		

Source: NMFS AFSC. *Pacific cod prices were very high in 2008 and very low in 2009. Trawl values were $1,775 in 2008 and $1,151 in 2009, while fixed gear values were $2,126 in 2008 and $1,284 in 2009. For the purposes of this section, a midpoint between the two years' prices was chosen. The ex-vessel "other species" value was set equal to one-half of the first wholesale shoreside other species value.

In some instances, changes in quantity are large relative to the baseline quantities. In these instances, if retained catches of the species are not totally eliminated, the price received for the production that continues after the rest of the fishery closes may increase. This potential effect is discussed in sub-section 10.6.3, which deals with offsetting revenue impacts.

This section provides estimates of the range of potential changes in fishery revenues associated with this action. As pointed out by Berman et al. (2008), revenue changes are not a good measure of the social welfare impact of an action, because they do not take account of costs, and thus are not equivalent to the change in net benefits from the action, and they do not take account of changes industry will make to minimize the net costs of the action to themselves (that is, shift their vessels to a different location or into an alternative fishery). Revenues may be the same before and after an action, but if the industry fishes in a new area, with lower catch per unit of effort, overall costs may go up.

Atka mackerel and Pacific cod fishing operations harvest and retain other species, incidental to their targeted species. The revenue estimates below take account of the value of these incidental species harvests. These have been valued using methods similar to those for the target species.

Prices used to construct the value estimates are regional BSAI prices, not Aleutian Islands specific prices. In part this reflects the way institutional systems are set up to prepare and report prices. In part it reflects concerns about inadvertently violating rules governing the confidentiality of data. In some instances there are small numbers of buyers or sellers of fish caught in the Aleutian Islands. This use of regional prices may produce misleading results in some instances. Pacific cod is a particular concern. Anecdotal information indicates that Pacific cod harvested in the Aleutians may be larger than those caught elsewhere, and bring a better price. This potential effect cannot be accounted for in these estimates.

These estimates are not predictions or forecasts of actual revenue changes in fishery revenues. Too many unpredictable factors affect these, including (but not limited to) the future evolution of the on-going world financial crisis and recession, changes in exchange rates, and changes in fish stock sizes. These estimates should be interpreted as changes in revenues, if all other factors remained unchanged from the baseline. The large difference between Pacific cod prices in 2008 and 2009 is a good indicator of the current instability in fish product markets.

The estimates in the following tables should be interpreted as indicative of the magnitude of change. There are a number of assumptions incorporated into these estimates, and a great deal of uncertainty

associated with them. Changes in markets, prices, survey information about fish stock size and composition, uncertainty about ability to harvest fish outside of critical habitat, and any number of other factors, could lead to changes in these estimates. They are best treated as a general indicator of the level of potential revenue decreases from reduced harvests of Atka mackerel and Pacific cod in the Aleutian Islands. Where ranges are reported, these are a result of the estimation procedure and are not meant to be maximum or minimum upper and lower bounds for the revenue change.

As discussed in section 10.3, the Amendment 80 fleet harvesting Atka mackerel in the Aleutian Islands will have its harvest severely restricted by both Alternative 2 and Alternative 3. Table 10-49 provides estimates of the potential loss in revenue directly associated with the harvest cutbacks. The metric tonnages in lost production for the Atka mackerel target and for incidental catches of other groundfish are from Table 10-21 in section 10.3. The revenue loss is considerable: $47 million under Alternative 2 and $34 million under Alternative 3. Gross revenue losses are $13 million, or 27 percent less under Alternative 3.

Table 10-49 Estimated reduction in the Amendment 80 Atka mackerel harvest value due to the reduction in harvest in Areas 542 and 543.

Species	Value per metric ton retained round weight	Alt 2 (millions $)	Alt 3 (millions $)
Atka mackerel	$ 948	$ (39.6)	$ (28.9)
Northern rockfish	$ 1,042	$ (2.8)	$ (2.0)
Pacific ocean perch	$ 965	$ (2.3)	$ (1.7)
Pacific cod	$ 1,463	$ (1.9)	$ (1.4)
All other species	$ 277	$ (03)	$ (0.2)
All groundfish	$ -	$ (46.9)	$ (34.2)

Source: NMFS AKR calculations.
Parentheses indicate negative numbers.

The Amendment 80 fleet would also find itself forced to reduce its harvest of Pacific cod in the Aleutian Islands. Table 10-50, based on Table 10-24 in section 10.3, summarizes the estimates of foregone gross revenues in the region, under Alternatives 2 and 3. Low and high results for each alternative are presented, corresponding to the range of potential harvest reductions identified in section 10.3. Gross revenue reductions range from $15 to $21 million for Alternative 2, and from $10 to $13 million for Alternative 3. As noted in section 10.3, the Amendment 80 Pacific cod allocation is not an Aleutian Islands specific allocation. The fleet does have an opportunity to fish this Pacific cod in the Bering Sea. However, as noted, the fleet may have difficulty fully harvesting its Pacific cod in the Bering Sea. The revenue implications of this are discussed in the next sub-section.

Table 10-50 Estimated annual reduction in the Amendment 80 Pacific cod harvest value due to the reduction in harvest in Areas 542 and 543

Species	Value per metric ton retained round weight	Alternative 2 (millions $)		Alternative 3 (millions $)	
		Low	High	Low	High
Pacific cod	$ 1,463	$ (6.5)	$ (18.2)	$ (3.6)	$ (10.1)
Atka mackerel	$ 948	$ (0.1)	$ (0.3)	$ (0.06)	$ (0.2)
Rock sole	$ 750	$ (0.1)	$ (0.2)	$ (0.04)	$ (0.1)
Pollock	$ 1,329	$ (0.1)	$ (0.3)	$ (0.06)	$ (0.2)
All other species	$ 277	$ (0.04)	$ (0.1)	$ (0.02)	$ (0.06)
All groundfish	$ -	$ (6.8)	$ (19.1)	$ (3.8)	$ (10.6)

Source: NMFS AKR calculations.
Parentheses indicate negative numbers.

The trawl catcher vessel fleet would also find itself forced to reduce its harvest of Pacific cod in the Aleutian Islands. Table 10-51, based on Table 10-34 in section 10.3, summarizes the estimates of foregone first wholesale gross revenues in the region, under Alternatives 2 and 3. Low and high results for each alternative are presented, corresponding to the range of potential harvest reductions identified in

section 10.3. Gross revenue reductions range from $13 to $23 million for Alternative 2, and from $4 to $12 million for Alternative 3. As noted in section 10.3, the trawl catcher vessel Pacific cod allocation is not an Aleutian Islands specific allocation. The fleet does have an opportunity to fish this Pacific cod in the Bering Sea. However, as noted, the fleet may have difficulty fully harvesting its Pacific cod in the Bering Sea. The revenue implications of this are discussed below.

Table 10-51 Impacts of Alternatives 2 and 3 on catcher vessel first wholesale gross revenues from targeted Pacific cod fishing in the Aleutian Islands.

Species	Value per metric ton retained round weight	Alternative 2		Alternative 3	
		Low (millions $)	High (millions $)	Low (millions $)	High (millions $)
Pacific cod	$ 1,625	$ (12.5)	$ (22.8)	$ (3.7)	$ (11.5)
Atka mackerel	$ 62	$ (0.01)	$ (0.02)	$ (0.00)	$ (0.01)
Rock sole	$ 191	$ (0.03)	$ (0.06)	$ (0.10)	$ (0.03)
Pollock	$ 1,272	$ (0.2)	$ (0.3)	$ (0.05)	$ (0.02)
All other species	$ 195	$ (0.05)	$ (0.09)	$ (0.01)	$ (0.04)
All groundfish	$ -	$ (12.8)	$ (23.2)	$ (3.8)	$ (11.8)

Source: NMFS AKR calculations.
Parentheses indicate negative numbers.

Table 10-51 provides estimates of the changes in the first wholesale value of species delivered by catcher vessels. Because they are first wholesale values, they are consistent with the valuations in other tables reporting gross revenues, which also use first wholesale value. However, in this instance, an evaluation of the impact of this action on catcher vessels also requires a report of estimated ex-vessel revenues. These are summarized below, in Table 1-52. [41] Gross ex-vessel revenue reductions range from $7 to $12 million for Alternative 2, and from $2 to $6 million for Alternative 3. These estimates are not additive with the first wholesale gross revenue estimates.

Table 10-52 Impacts of Alternatives 2 and 3 on catcher vessel ex-vessel gross revenues from targeted Pacific cod fishing in the Aleutian Islands.

Species	Value per metric ton retained round weight	Alternative 2 (millions $)		Alternative 3 (millions $)	
		Low	High	Low	High
Pacific cod	$ 858	$ (6.6)	$ (12.0)	$ (2.0)	$ (6.1)
Atka mackerel	$ 37	$ (0.01)	$ (0.01)	$ (0.00)	$ (0.01)
Rock sole	$ 393	$ (0.07)	$ (0.1)	$ (0.02)	$ (0.06)
Pollock	$ 426	$ (0.06)	$ (0.1)	$ (0.02)	$ (0.05)
All other species	$ 98	$ (0.02)	$ (0.04)	$ (0.01)	$ (0.02)
All groundfish	$ -	$ (6.8)	$ (12.3)	$ (2.0)	$ (6.2)

Ex-vessel prices are based on 2008 ex-vessel prices reported in the 2009 SAFE. Atka mackerel prices are not reported as Atka mackerel are not well represented in on-shore landings.
Source: NMFS AKR calculations.
Parentheses indicate negative numbers.

The fixed gear (hook-and-line and pot) catcher/processor fleet would also find itself forced to reduce its harvest of Pacific cod in the Aleutian Islands. Table 10-53, based on Table 10-38 in section 10.3, summarizes the estimates of foregone first wholesale gross revenues in the region, under Alternatives 2 and 3. Low and high results for each alternative are presented, corresponding to the range of potential harvest reductions identified in section 10.3. Gross revenue reductions range from $12 to $13 million for Alternative 2, and from $8 to $9 million for Alternative 3.

[41] Ex-vessel prices have little meaning for catcher/processors where the production process is a seamless whole, and there is no market where independent parties exchange largely unprocessed Pacific cod for money. Thus ex-vessel equivalent estimates have not been made for catcher/processors in this report.

Table 10-53 Impacts of Alternatives 2 and 3 on fixed gear catcher/processor gross revenues from targeted Pacific cod fishing in the Aleutian Islands.

Species	Value per metric ton retained round weight	Alternative 2 (millions $)		Alternative 3 (millions $)	
		Low	High	Low	High
Pacific cod	$ 1,705	$ (11.3)	$ (12.6)	$ (7.8)	$ (8.9)
Shark, sculpin, octopus	$ 277	$ (0.3)	$ (0.3)	$ (0.2)	$ (0.2)
Other species	$ 277	$ (0.1)	$ (0.1)	$ (0.07)	$ (0.08)
All groundfish		$ (11.6)	$ (13.0)	$ (8.1)	$ (9.2)

Source: NMFS AKR calculations.
Parentheses indicate negative numbers.

Table 10-54 summarizes the potential reduction in groundfish fishing revenues from curtailing Atka mackerel and Pacific cod fishing in the Aleutian Islands. These revenue reductions are large, ranging from about $86 million to $104 million for Alternative 2, and from about $56 million to about $69 million for Alternative 3. The ranges for each alternative reflect the range of Pacific cod harvested in the Aleutians from 2003 to 2009. The Atka mackerel production estimates were based on the impact of the action on 2011 TAC levels. To the extent that Pacific cod prices are higher for Aleutian Island product, Pacific cod based revenue change estimates may be biased downward.

Table 10-54 Summary of estimated potential first wholesale gross revenues from restricted fisheries in the Aleutian Islands (in millions).

Species	Alternative 2		Alternative 3	
	Low	High	Low	High
Amendment 80 trawl catcher/processor Atka mackerel	$ (47)	$ (47)	$ (34)	$ (34)
Amendment 80 trawl catcher/processor Pacific cod	$ (7)	$ (19)	$ (4)	$ (11)
Fixed gear catcher/processor Pacific cod	$ (13)	$ (23)	$ (4)	$ (12)
Catcher vessel Pacific cod	$ (12)	$ (13)	$ (8)	$ (9)
Total first wholesale gross revenues	($79)	($102)	($50)	($66)

Notes: numbers based on calculations in the RIR; numbers in parentheses are negative.
Source: NMF AKR SF estimates.

These revenue changes are large, but they also overstate the likely loss of net benefits to the fishery for several reasons:

- First, large production declines may lead to offsetting increases in prices for the remaining harvest of species. This would have the effect of increasing the revenues received for remaining production.
- Second, the changes do not reflect the costs of operating and processing fish in the Aleutians. Production costs would have to be deducted from the total gross revenue estimates to calculate net returns.
- Third, the changes do not account for the potential to shift many of the vessels involved into other fisheries. Amendment 80 vessel owners own or may lease quota share that would allow them to fish for rock sole, yellowfin sole, and Pacific cod in the Bering Sea. Pacific cod quotas for different vessel sectors are BSAI wide quotas, and operations participate in harvests in other regions. Thus, vessels displaced from the Aleutians could earn revenues and associated net returns in other areas of the Bering Sea, and vessel operators will take actions to minimize the costs of this action.

Another way to look at the reductions in gross revenues is on the basis of the average reduction per participating vessel. To approximate these average values, the total reductions in gross revenues are

divided by estimates of the average numbers of vessels active in 2009, taken from tables in section 10.2. The results are summarized in Table 10-55. The division by the number of vessels must be qualified somewhat for the Amendment 80 vessels, since these are fishing quota share on behalf of other Amendment 80 firms, and are fishing CDQ allocations on behalf of CDQ groups.

Table 10-55 Estimated reductions in average gross revenue per vessel in the Aleutians due to the restrictions (in millions of dollars).

		Alternative 2		Alternative 3	
	Estimated number of vessels (typical numbers, actual numbers vary by year	Low	High	Low	High
Amendment 80 trawl catcher/processor Atka mackerel	8	(5.9)	(5.9)	(4.3)	(4.3)
Amendment 80 trawl catcher/processor Pacific cod	5	(1.4)	(3.8)	(0.7)	(2.1)
Fixed gear catcher/processor Pacific cod	10	(1.3)	(2.3)	(0.4)	(1.2)
Catcher vessel Pacific cod	34	(0.3)	(0.4)	(0.2	(0.3)
Source: preceding tables					

Curtailment of fish production has implications for marketing chains and business relationships. Firms have invested in developing an understanding of how markets work, in developing an understanding of how to structure production to address market needs, in personal relationships with others downstream in the market network, in methods for on-going monitoring of market dynamics, and in product branding and distribution networks. A reduction or cessation of production may lead to a depreciation of this human and product capital. Moreover, a reduction in production may provide an opportunity for other firms to enter the market place, develop their own human capital, and take over market share. These factors may mean that if and when production opportunities increase, firms may only be able to sell their product at a lower cost than otherwise. These sources of potential revenue loss are another element, not estimable in itself, that needs to be considered.

In addition to the fisheries described above, there is a state waters fishery managed by Alaska that takes place after the fishery in Federal waters has ended. This fishery was described in Sub-section 10.2.5. The proposed action is not expected to affect this fishery in the short run. However, in the longer run, issues connected with proposed measures to change FFP surrender rules, interacting with SSL protection measures tied to FFP possession, may increase the costs of participation for some operations.

In the present instance, as discussed in section 10.3, a significant part of the Pacific cod production losses in the Aleutian Islands may be made up in the Bering Sea. Atka mackerel production losses in the Aleutian Islands may not readily be made up from other American sources. Atka mackerel from Russia may be a potential substitute in Asian markets, as may other species of fish. Amendment 80 mackerel production would not be eliminated under either of the action alternatives, but a reduction by half or two-thirds could still have adverse impacts, of unknown size, to this general category of marketing capital.

Sub-section 10.6.3, which follows, looks at some potentially offsetting sources of revenues.

10.6.3 Potential Offsetting Revenue Impacts

As discussed in section 10.3, fishing operations whose production is restricted in the Aleutian Islands by the proposed Steller sea lion protection measures may redeploy their vessels to fisheries in the Bering Sea. Amendment 80 vessels may be shifted into rock sole, yellowfin sole, and Pacific cod fisheries in the Bering Sea, while fixed gear catcher/processors and catcher vessels may also shift their focus to Pacific cod fishing in the Bering Sea. To some extent, the revenue and profits generated in Bering Sea fisheries would offset the losses incurred in the Aleutian Islands.

The estimates of revenue losses in the Aleutian Island fisheries in sub-section 10.6.2 were necessarily rough approximations of potential losses. The dollar estimates of potential offsets discussed in this section are even more speculative. The potential for offsets is not speculative, opportunities do exist. But as discussed in section 10.3, it is very hard to project exactly how the fishing fleets will respond. The halibut bycatch issue is an especially large uncertainty in the Amendment 80 trawl catcher/processor fleet. Halibut bycatch may preclude the fleet from fully pursuing all the available alternative fisheries; if cooperative arrangements allow the fleet to make more efficient use of its halibut bycatch, the constraint created by the halibut bycatch limits may be relaxed.

As shown in Table 10-21, Atka mackerel harvests are projected to drop by about 41,800 mt under Alternative 2 and by about 30,500 under Alternative 3. In the absence of this action, given the current 2011 TACs and the percentage of the TAC allocations that have been harvested in 2008 and 2009, the total Atka mackerel harvest would have been about 62,300 mt. Thus, Alternative 2 would reduce the harvest by about 67 percent, and Alternative 3 would reduce the harvest by about 49 percent. Changes in harvest of this magnitude may affect the price received for the Atka mackerel harvests that will continue. These price impacts, if they occur, could offset part of the potential loss in revenue from the reduction in overall harvest, described in Table 10-49.

In order to estimate the potential price change, it would be desirable to have a statistical model of the Atka mackerel market, with estimates of the responsiveness of price to quantity changes. A market model of this sort is not available, however.[42] It is therefore not possible to estimate the size of this source of increased revenues. One person knowledgeable about Asian markets speculated that there might be little or no price impact, as Russian Atka mackerel production might offset a loss in United States production. This observer thought prices might increase over the longer term if the Russian Atka mackerel stocks were depleted.[43] This is, however, only one person's casual observation in a conversation. It is certainly possible that there could be a significant price impact in the short run.

As discussed in section 10.3, Amendment 80 firms may be able to use their trawl catcher/processors in rock sole and/or yellowfin sole fisheries in the Bering Sea. Tables 10-56 and 10-57 in section 10.3 provided estimates of potential volumes of fish that might be caught.

[42] No econometric analysis of Atka mackerel markets was identified in the literature. Efforts to estimate simple ad hoc models for this analysis failed to identify a plausible demand curve.

[43] Thoughts of a Korean fish buyer, as reported by Quentin Fong of the University of Alaska Fairbanks, School of Fisheries in a personal communication.

Table 10-56 Possible Impacts of Alternatives 2 and 3 on Amendment 80 rock sole harvest values in the Bering Sea.

Species	Value per metric ton retained round weight	Alt 2 (millions $)	Alt 3 (millions $)
Rock	$ 750	$ 3.2	$ 3.2
Flathead	$ 1,216	$ 0.3	$ 0.3
Yellowfin	$ 646	$ 0.7	$ 0.7
Pacific cod	$ 1,463	$ 0.8	$ 0.8
Arrowtooth	$ 547	$ 0.05	$ 0.05
Total groundfish	$ -	$ 5.0	$ 5.0

Table 10-57 Possible Impacts of Alternatives 2 and 3 on Amendment 80 yellowfin sole harvest values in the Bering Sea.

Species	Value per metric ton retained round weight	Alt 2 (millions $)	Alt 3 (millions $)
Rock	$ 750	$ 1.3	$ 0.6
Flathead	$ 1,216	$ 1.1	$ 0.5
Yellowfin	$ 646	$ 14.1	$ 6.0
Pacific cod	$ 1,463	$ 2.6	$ 1.1
Arrowtooth	$ 547	$ 0.2	$ 0.1
Total groundfish	$ -	$ 19.2	$ 8.2

The Amendment 80 trawl catcher/processor fleet could fish for its Pacific cod allocations in the Bering Sea and thereby potentially offset some of the declines in revenues from the reduction in Aleutian Island fishing opportunities. There are, however, factors which may prevent it from fully accomplishing this. If it cannot, some of the Amendment 80 Pacific cod allocation may not be harvestable. Provisions do not currently exist allowing the rollover of potentially unharvested cod from this sector to other sectors.

There is no good way to project Bering Sea Pacific cod catches and incidental catches for the Amendment 80 trawl catcher/processors active in the Aleutian Islands. These vessels do not have a history of targeted Pacific cod fishing in the Bering Sea. A table based on their bycatch rates in the Bering Sea would be distorted by cases in which they actually targeted another species and, because of fishing circumstances, ended up with a predominance of Pacific cod in the haul. An alternative would be to project Amendment 80 catcher/processor trawl incidental catch rates on the basis of incidental catch rates for catcher vessel trawlers fishing for Pacific cod, but, given the difference in operational types, this is not an attractive alternative. Moreover, the situation is complicated by the introduction of rules facilitating the creation of cooperatives under Amendment 80, and by the potential for cooperatives to reduce halibut bycatch. Therefore, this analysis does not make explicit Pacific cod projections for this fleet sector in the Bering Sea. This fleet can fish for Pacific cod there, and may do so.

As discussed in section 10.3, the fixed gear catcher/processors displaced from the Pacific cod fishery in the Aleutians should be able to offset the losses in Pacific cod harvests in the Bering Sea. Table 10-58 shows estimated revenues from the target and incidental catches in the Bering Sea if the fixed gear fleet does harvest as much Pacific cod in the Bering Sea as it no longer harvests in the Aleutian Islands. The revenue changes are based on 2009 first wholesale prices, and species tonnage changes summarized in Table 10-38 in section 10.3.

Table 10-58 Possible gross revenues from fixed gear catcher/processor from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3.

Species	Value per metric ton retained round weight	Alternative 2 (millions $)		Alternative 3 (millions $)	
		Low	High	Low	High
BS Pacific cod	$ 1,705	$ 11.3	$ 12.6	$ 7.8	$ 8.9
BS Shark, sculpin, octopus	$ 277	$ 0.2	$ 0.3	$ 0.2	$ 0.2
BS Other species	$ 277	$ 0.07	$ 0.08	$ 0.05	$ 0.06
BS Other species	$ 277	$ 0.02	$ 0.02	$ 0.02	$ 0.02
BS Other species	$ 277	$ 0.02	$ 0.02	$ 0.02	$ 0.02
BS All groundfish		$ 11.6	$ 13.0	$ 8.1	$ 9.1
Source: NMFS AKR estimates					

A comparison of Tables 10-53 and 10-58 shows that the estimated net changes in gross revenues for the fixed gear catcher/processor fleet are small. Additional revenues from the Bering Sea approximately offset the revenue losses in the Aleutian Islands. The net changes range from -$25,000 for the low Pacific cod baseline harvest version of Alternative 3 down to -$41,000 for the high Pacific cod baseline harvest version of Alternative 2.

As discussed in section 10.3, the catcher vessels displaced from the Pacific cod fishery in the Aleutians may be able to offset the losses in Pacific cod harvests in the Bering Sea. Table 10-59 shows estimated revenues from the target and incidental catches in the Bering Sea if the fixed gear fleet does harvest as much Pacific cod in the Bering Sea as it no longer harvests in the Aleutian Islands. The revenue changes are based on 2008–2009 first wholesale prices, and species tonnage changes summarized in Table 10-34 in section 10.3.

Table 10-59 Possible catcher vessel <u>first wholesale</u> gross revenues from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3.

Species	Value per metric ton retained round weight	Alternative 2		Alternative 3	
		Low	High	Low	High
Pacific cod	$ 1,625	$ 12.5	$ 22.8	$ 3.7	$ 11.5
Atka mackerel	$ 62	$ -	$ -	$ -	$ -
Rock sole	$ 191	$ 0.07	$ 0.1	$ 0.02	$ 0.06
Pollock	$ 1,272	$ 2.0	$ 3.5	$ 0.6	$ 1.8
All other species	$ 195	$ 0.02	$ 0.3	$ 0.05	$ 0.2
All groundfish		$ 14.7	$ 26.7	$ 4.4	$ 13.6
Source: NMFS AKR estimates					

Table 10-60 Possible catcher vessel <u>ex-vessel</u> gross revenues from potential targeted Pacific cod fishing in the Bering Sea under Alternatives 2 and 3.

Species	Value per metric ton retained round weight	Alternative 2		Alternative 3	
		Low	High	Low	High
Pacific cod	$ 858	$ 6.6	$ 12.0	$ 2.0	$ 6.1
Atka mackerel	$ 37	$ -	$ -	$ -	$ -
Rock sole	$ 393	$ 0.1	$ 0.3	$ 0.04	$ 0.1
Pollock	$ 426	$ 0.7	$ 1.2	$ 0.2	$ 0.6
All other species	$ 19	$ 0.01	$ 0.03	$ 0.00	$ 0.01
All groundfish	$ -	$ 7.4	$ 13.5	$ 2.2	$ 6.8
Source: NMFS AKR estimates					

As should be evident throughout the discussion in this sub-section, these estimates of revenue offsets are relatively speculative. In recognition of that, this sub-section does not close with a summary table of the value of revenue offsets (as sub-section 10.6.2 closed with a table showing the value of potential revenue losses). The conclusions of this section are more qualitative and not as precise:

- Impacted fleets are likely to be able to redeploy into fisheries in the Bering Sea to offset some of their revenue and profit losses in the Aleutians. The degree to which this occurs is pivotal in determining the economic impact on fleets
- In addition, price increases for Atka mackerel may offset some of the losses for the Amendment 80 trawler catcher vessel fleet. Offsetting price impacts are much less likely for Pacific cod. In fact, Bering Sea Pacific cod tend to be smaller on average, and to bring a lower price. Thus, operations shifting to the Bering Sea may see price declines for that reason. The impact on Bering Sea prices themselves may depend on possible substitution effects between different sizes of Pacific cod.
- Fixed gear catcher/processors are likely to be able to offset much of their revenue loss in the Bering Sea and may receive additional opportunities to fish Pacific cod there if trawl catcher/processor and catcher vessel fleets are unable to fully harvest their Aleutian Islands Pacific cod allocations fishing in the Bering Sea.
- Revenue offsets may be on the order to tens of millions of dollars.

10.6.4 Net Impacts

Spatial choice models in which choices depend in part on gross revenue expectations from fishing in different areas can be used to infer the net value (benefits minus costs accruing to the decision-maker) placed on fishing in specific areas. These can provide insights into the welfare changes associated with area management measures. The available economic data and research on North Pacific fisheries is not sufficient yet to make it possible to infer the specific welfare changes from the actions being considered here. However, the research does shed some light on the impact of spatial closures on fishing operation welfare.

Haynie and Layton (2010) evaluated the short run costs to inshore trawl catcher vessels of the judicially mandated closure of the sea lion conservation area to pollock trawling in the summer of 2000, and found that the closure was likely to have an estimated cost of $6,995 per fishing trip (in 2000 dollars) for the vessels in their sample. The welfare change was estimated as "the amount of money that must be given or taken away to equate profits before and after the policy change." In this case, vessel operators would need to receive about $7,000 per trip to be as well off with the closure as they would have been without it.

The sample included trips by trawlers greater than or equal to 60 feet length overall. Haynie and Layton (2010) found that the welfare loss increased with measures of vessel size and power, but that the impact was proportionally worse for smaller vessels. They report that the vessels in their sample averaged about $48,000 per trip. Thus, an estimate of the welfare impact of losing a trip based on gross revenues would have been a multiple of the actual welfare cost, in this instance.[44]

Berman et al. (2008) applied a spatial model to evaluate the impact of 2001 Steller sea lion critical habitat closures in the GOA and BSAI on groundfish fishing operations. Their results found that in the GOA "the closures cost the Pacific cod trawl fishery about 38% of the profit per haul, and the Pollock fishery about 28%. The cost to the other trawl fisheries was slight: 0.2% of the operating profits." (Berman et al. 2008:30). Thus the costs of these actions to the two named fisheries were substantial. Another inference from the results is that the costs, expressed here as a fraction of the difference between variable revenues and variable costs per haul, were significantly less than variable revenues per haul.

[44] This is an approximation. The vessel and trip characteristics on which the welfare impact and gross revenue per trip estimates are based appear to be slightly different, and Haynie and Layton (2010) do not make this comparison.

Hicks and Schnier (2010) studied the Atka mackerel fisheries in the Aleutian Islands. Their study was designed to evaluate a new approach to the choice models and not to conduct a policy analysis addressing the questions of concern here. Hicks and Schnier (2010) studied 100 unique cruises[45] in the Atka mackerel fishery between 2002 and 2006. The average number of hauls per cruise was about 43, and average revenues per haul were about $12,800; average cruise revenues were about $546,000 (2006 dollars). [46]

They report welfare impacts from a hypothetical spatial closure for three small scale fishing zones or sites within the harvest limitation area (HLA) in Area 542. These sites were unusually productive, were the most visited sites within the Area, and were not typical of all areas within Area 542 or Area 543. The welfare costs of the closure of these areas, on the assumption that the vessel had the authority to fish within them, were about $3,000, $6,000, and $2,800 per haul. The analysis was not designed to evaluate the policy question discussed here, and a linear extrapolation of these results to other hauls in Area 542 is problematic. Therefore, this analysis has not been used to make estimates of the welfare impacts of the current actions.

Schnier and Felthoven (forthcoming) also studied the Atka mackerel fisheries in the Aleutian Islands using approximately the same data as Hicks and Schnier (2010). While they were also primarily interested in methodological questions, they carried out an explicit policy analysis corresponding to a part of the analysis under consideration here. They examined the welfare impact of a complete closure of the HLA in Area 543 for fishing operations, assuming the operations had the right to participate in the HLA fishery. The welfare costs resulting from removing the HLA areas within 543 ranged between a low of approximately $1,800 to a high of $3,300, depending on the modeling assumptions utilized, for each haul for which they are eligible. These values represent the compensation that fishermen within the Atka mackerel fishery would be required to be paid to not fish in the HLA regions of 543 and be just as well off as if they were able to fish in these regions. In this exercise, no other areas of the Aleutians were closed to Atka mackerel fishing, so entities impacted by this action had more readily available substitutes than they would have in the current instance.

None of these studies was prepared to evaluate the policy issues in this analysis. These papers were prepared to push the methodological envelope. Thus specific policy implications for this analysis are fragmentary. However, several inferences can be drawn from these papers:

- Two studies provide documentation of the common-sense idea that net returns impacted by an action are less than the gross returns. In the case of the Haynie and Layton (2010) and Berman et al. (2008) studies, the difference appears to be a large one.
- One would want to be careful in extrapolating proportions between net and gross revenues implied in the preceding point to the current situation. Those studies were done to evaluate different actions that were taken almost 10 years ago, and to evaluate different fleets than those that may be affected by the current action.
- These models estimate the benefits to operation owners (assuming the decisions about fishing location are made in their interests), and thus would understate the social benefits to the extent that these operations pay taxes. A tax payment is normally treated as a transfer payment in cost-benefit analysis, and in this instance, a part of the benefit of fishing that is transferred to other parties. Rental payments to scarce factor inputs, including Amendment 80 quota share lease payments and CDQ royalties, may also raise a similar issue.

[45] Cruises were defined by information about location fished, and estimates of the time between fishing hauls. A gap of three days between hauls separated one cruise from another.

[46] Figures from Tables 1 and 4 (Hicks and Schnier 2010), multiplied by two to address a unit conversion problem identified by Schnier in a personal communication.

- The evidence in Haynie and Layton (2010) suggests that the impacts of a closure may vary by vessel size; in their study, smaller vessels experienced proportionately greater adverse impacts.

Vessels that move into a new fishery will potentially increase the costs or decrease the revenues of vessels already in the fishery. They can increase the costs if they cause congestion, or if they reduce the average catch per unit of effort for vessels already present. They can reduce revenues if the reduced catch-per-unit-of-effort or congestion prevent existing vessels from harvesting as much as they had previously. This is especially likely to be the case in fisheries that are not rationalized. In a rationalized fishery, the harvest rights could be bought and sold, and operations would have the tools to integrate new capacity in an efficient manner. Congestion may be less of an issue for mobile gear and for fisheries conducted over a large area. Thus, this may be more of an issue for the fixed gear catcher/processors, for longline catcher vessels, and for pot catcher vessels, and relatively less of an issue for the Amendment 80 trawl catcher/processors (with quota shares, and low cost opportunities to form cooperatives in the fisheries they are most likely to enter), and for trawl and jig catcher vessels.

10.6.5 Present Value of Gross Revenue Changes

The impact of this action on the industry will be incurred over a number of years. Because of this, an analysis that focuses on costs in one year will understate the actual impact. On the other hand, simply summing the impacts over all years will overstate the aggregate impact; lost income in earlier periods is more costly than lost income in later periods, because of the potential forgone opportunities for investment of that income, and because consumption opportunities in the future are generally less attractive than consumption opportunities in the present. The standard approach to dealing with these issues is to estimate the present value of the costs, where the present value is the sum of the costs across all years, where the costs in future years are suitably discounted. A similar approach was used in section 10.4 to evaluate the non-consumptive benefits from sea lion protection. This is a standard procedure in cost-benefit analysis.

Discount rates were discussed in section 10.4, and the approach used there, adopting rates that are indicative of the range of rates used by economists in economic analyses of global climate change (1.4 percent and 5.5 percent) is used here.

In the absence of an alternative scenario, the projection of fishery restrictions was extended over a period of 50 years. This is a very long time, and assumes the substantial loss of Aleutian Islands fishing resources for two human generations.

The present value calculation has been carried out using the estimates of gross revenues losses in the Aleutians. For reasons discussed in the preceding two sections (because there will be offsetting price effects and because net revenues are less than total revenues), the use of gross revenues will significantly overstate the costs to industry of this action. These are the only reasonably firmly grounded estimates available for this calculation, however. Thus, the present value estimates will also be significantly overstated.

The results are summarized in Table 10-61. The range of present values for Alternative 2 is between $1.6 and $3.8 billion. The range of outcomes for Alternative 3 is between $1 and $2.5 billion. These estimates almost certainly substantially overstate the actual social cost of this action. The 50-year time period is almost certainly conservative in the sense of being excessively long and overstating the time in which these restrictions will be in place. But even more certain, the first wholesale gross revenues, on which these calculations are based, overstate the social costs of these restrictions, for reasons discussed earlier in this section.

Table 10-61 Present values for alternatives and different harvest scenarios within alternatives.

	Revenue scenario (largely based on different assumptions about Pacific cod catches)	Present value in billions of dollars for Low discount rate (1.4%)	Present value in billions of dollars for High discount rate (5.5%)
Alternative 2	Low	$2.9	$1.4
	High	$3.8	$1.8
Alternative 3	Low	$1.8	$0.9
	High	$2.4	$1.2
Source: NMFS AKR calculations . Present values calculated over 50 years.			

Further discussion of these estimates is deferred to section 10.9, where they will be used with other information, such as the estimates of the present values of the benefits of sea lion protection, to summarize the conclusions of this RIR.

10.6.6 CDQ Revenues

Significant amounts of Atka mackerel, Pacific cod, rock sole, and yellowfin sole TAC is allocated to CDQ groups. In 2011, the following amounts of these species are allocated to CDQ groups under the Council's current 2011 specifications (75 FR 11778; March 12, 2010):

- Area 541/Bering Sea Atka mackerel: 2,236 mt
- Area 542 Atka mackerel: 2,782 mt
- Area 543 Atka mackerel: 1,937 mt
- Bering Sea and Aleutian Islands Pacific cod: 22,211 mt
- Bering Sea and Aleutian Islands rock sole: 9,630 mt
- Bering Sea and Aleutian Islands yellowfin sole: 22,791 mt

These CDQ allocations are distributed among the CDQ groups, but not in equal amounts. Different CDQ groups have different levels of exposure to this action. Table 10-62 reproduces the CDQ group quota allocation matrix for 2010.

Table 10-62 CDQ group exposure to Steller sea lion protection measure Impacts.

Rates								
Species	Area	2011 CDQ allotment	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Atka mackerel	541	2,236	0.3	0.15	0.08	0.15	0.14	0.18
Atka mackerel	542	2,782	0.3	0.15	0.08	0.15	0.14	0.18
Atka mackerel	543	1,937	0.3	0.15	0.08	0.15	0.14	0.18
Pacific cod	BSAI	22,211	0.15	0.21	0.09	0.18	0.18	0.19
rock sole	BSAI	9,630	0.24	0.23	0.08	0.11	0.11	0.23
Yellowfin sole	BSAI	22,791	0.28	0.24	0.08	0.06	0.07	0.27
Volumes								
Species	Area	2011 CDQ allotment	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Atka mackerel	541	2,236	671	335	179	335	313	402
Atka mackerel	542	2,782	835	417	223	417	389	501
Atka mackerel	543	1,937	581	291	155	291	271	349
Pacific cod	BSAI	22,211	3,332	4,664	1,999	3,998	3,998	4,220
rock sole	BSAI	9,630	2,311	2,215	770	1,059	1,059	2,215
Yellowfin sole	BSAI	22,791	6,381	5,470	1,823	1,367	1,595	6,154
First wholesale value equivalent of CDQ holdings (not royalty payments)								
Species	Area	First Wholesale Value per metric ton round weight	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Atka mackerel	541	948	635,918	317,959	169,578	317,959	296,762	381,551
Atka mackerel	542	948	791,201	395,600	210,987	395,600	369,227	474,720
Atka mackerel	543	948	550,883	275,441	146,902	275,441	257,079	330,530
Atka mackerel subtotal			1,978,002	989,001	527,467	989,001	923,068	1,186,801
Pacific cod	BSAI	1,463	4,874,204	6,823,886	2,924,522	5,849,045	5,849,045	6,173,992
rock sole	BSAI	750	1,733,400	1,661,175	577,800	794,475	794,475	1,661,175
Yellowfin sole	BSAI	646	4,122,436	3,533,517	1,177,839	883,379	1,030,609	3,975,206
			12,708,042	13,007,578	5,207,628	8,515,900	8,597,196	12,997,174
Source: 2011 TAC specifications; CDQ group allocation matrix for 2010; prices from AFSC.								

Table 10-62 shows the CDQ entitlements in 2011 for each of the CDQ groups for each of the four species (Atka mackerel, Pacific cod, rock sole, and yellowfin sole) most likely to be affected by this action. Of these four species, only Atka mackerel is primarily harvested in the areas that would be affected by this action. Most Pacific cod, yellowfin sole, and rock sole are harvested in the Bering Sea.

The values in Table 10-62 report the first wholesale value equivalent value for the CDQ holdings. These were obtained by multiplying the quota holding in metric tons by the first wholesale value per round ton used in earlier sections. These values will exceed the royalty payments to the CDQ groups, as those are the amounts firms are willing to bid to incur the costs of harvesting the quota, and that will be less than

sales revenue by the costs of harvesting. Estimates of royalty payments for these species of CDQ are not generally reported or available.

Atka mackerel are the one species whose production will definitely decline by a significant amount because of this action. APICA is clearly the CDQ group most likely to be adversely impacted by this, as it is allotted 30 percent of the Atka mackerel CDQ. CBSFA is the CDQ group with the least impact. The other CDQ groups differ in their Atka mackerel holdings (these range from 14 percent to 18 percent), but the impacts on these fall into an intermediate range.

Rules governing CDQ bycatch differ from those governing non-CDQ bycatch. CDQ bycatch rules are more permissive. Operations will sometimes assign target catch to CDQ depending on what their haul is.

10.7 Employment and income impacts

10.7.1 Introduction

For analytical purposes, it is convenient to divide the employment and impact effects associated with policy changes into direct, indirect, and induced effects.[47] The direct effects are the jobs and income associated with direct participation in the fisheries. In this instance, direct employment would be the crew of the fishing vessels, and direct income would be income to various participants in the fishing firm: wages, salaries, or shares for crew, profits for vessel owners, or lease or royalty payments to quota share holders or to holders of CDQ fishing rights used by the firm.

The indirect effects are the effects generated in other businesses by the purchases of the fishing firms. In this instance, indirect effects would accrue to businesses supplying fuel and supplies, fishing gear and fishing gear repairs, ship construction and repairs, insurance, banking, legal, and accounting services, and lobbying and consulting. In the discussion that follows, activity in the home office (overall management and strategic direction, marketing, accounting, human resources, and legal services) will be treated as an indirect employment impact. There is no bright line between the internal provision of many of these services, and their provision through the market place. These identify ‘backward” linkages. Jobs and income may also be associated with “forward” linkages, in firms providing processing, warehousing, cold storage, brokering, and distribution services.

Alaska’s Fisheries Business Tax, whose receipts are shared with the communities in which fish are landed, is another source of indirect fishery impacts. Tax receipts may lead to reductions in community sales tax or property tax assessments, to additional municipal expenditures on goods and services within the community, to purchases of goods and services outside the community, or to some combination of these. Employment and community member income impacts would differ depending on which of these ways, or which combination of these ways, the tax revenue was spent.

Induced effects are those generated in an economy when directly or indirectly employed persons spend their money. These employment and income effects are associated with the provision of the goods and services people demand in their daily lives: groceries, gas, cars and car repairs, home repairs, home construction, insurance, and so on.

Different models are used to study employment and income impacts in a regional economy. Economic base models are relatively simple, dividing regional industries into base industries producing for export, and other industries dependent on economic activity in the base industry. Input-output models are more

[47] As explained in Section 10.6, the analysis in this section is not a cost-benefit analysis, and is not provided as an input into a cost-benefit analysis.

sophisticated, working out a complex network of purchases and sales between all industries in an economy, and relating these to final demands for the regional economy's output. Social accounting matrix models build on the input-output structure, adding elements that permit a more detailed examination of "the distributional impacts of fisheries, such as impacts on value added, households, or state and local governments." (Chang and Waters) Economic base models, input-output models, and social accounting matrix models incorporate a 'fixed price" assumption: prices do not vary in response to changes in the quantities demanded and transacted in the models. An alternative modeling approach, computable general equilibrium modeling, builds on a social accounting matrix framework, but allows prices to vary. A computable general equilibrium model offers the opportunity to move beyond estimates of income and employment impacts, to make statements about the welfare impacts of policy actions.

Models of all of these types exist for the Alaska and Washington State economies (for Alaska, see Chang and Waters (2006), (2009), and (2010)). It has not been possible to use these in the time available for the preparation of this draft.[48] The analysis below is more qualitative, using the categories of income and employment, and direct, indirect, and induced effects to organize the discussion.

It is customary to think of the outputs of these models in terms of multipliers showing the total employment and income impacts of additional direct sector jobs, or of additional direct sector income, as the direct income circulates. Multiplier estimates for Alaska are typically lower than those for other regions, because of the relative lack of depth in the Alaskan economy. Alaska imports a large proportion of the goods and services that are used there, and a large part of the fishing labor force in the Aleutians is from other states.[49]

The communities potentially primarily impacted by changes in direct employment and income associated with this action are the Alaskan communities of Adak and Dutch Harbor/Unalaska where catcher vessel, and some catcher/processor, deliveries are made, communities elsewhere in Alaska which serve as home ports to affected vessels, and communities in the Puget Sound area which serve as home ports to affected vessels.

The CDQ program, and possible changes in CDQ program revenues, are another factor that may potentially affect indirect and induced employment and income in western Alaska. Each CDQ group represents the interests of rural western Alaskan communities. Fluctuations in CDQ revenue may affect CDQ group expenditures on rural development initiatives, and thus affect employment and income in rural Alaska.

10.7.2 Income and employment effects

Direct employment effects

Six of the vessels in the Amendment 80 catcher/processor fleet averaged 50 crew members in 2009 and one averaged 80 crew members. The catcher vessel delivering Atka mackerel to the catcher/processors had an estimated crew of four. Thus, the total number of persons directly impacted by this action in this sector is 384.

Northern Economics (2001a) provides estimates of average crew sizes for longline and pot catcher processors operating in the BSAI. Average crew sizes for the pot catcher/processors averaged 11 persons

[48] Analysts at the NMFS AKR and the AFSC are engaged in ongoing work to apply a regional model of the Alaskan economy to this issue. This work may be completed in time for presentation to the SSC at the special August meeting of the North Pacific Fishery Management Council.

[49] This is conjecture, because good statistics crew place-of-residence are not available.

over the period 1992 through 2000 (the annual estimated averages, based on weekly production reports, varied between 10 and 14 from 1992 through 2000). Average crew sizes for the longliners averaged 19 persons over the same period (the estimates varied from 17 to 20). Estimates of the numbers of hook-and-line and pot catcher processors fishing for Pacific cod in the Aleutian Islands were supplied in Section 10.3. In 2008 there were 9 hook-and-line vessels and 4 pot vessels. Using the crew sizes reported above, this implies that there were 171 longline crew and 44 pot crew. In 2009 there were 7 hook-and-line vessels and three pot vessels, implying 133 hook-and-line crew and 33 pot crew. These changes in these estimates from one year to the next reflect the variability in the number of vessels participating in the Federal waters and State parallel Pacific cod fisheries. Recall that Pacific cod prices were very high in 2008 and very low in 2009.

Northern Economics (2001b) provides estimates of numbers of vessels falling into a seven categories of catcher vessels. Categories were defined by gear type, vessel length, and AFA eligibility. The report provides estimates of the number of vessels and the number of crew members in each category. This permits an estimate of the average number of crew. Among the fixed gear and trawl categories over 60 feet, crew size estimates ranged from an average of four and a half for trawlers to an average of five and a half for fixed gear vessels. Estimates of catcher vessel numbers were supplied in Section 10.2.4. Applying these average crew sizes to the number of catcher vessels operating in 2008, provides estimated crew sizes of 138 fixed gear catcher vessel crew, and 162 trawl catcher vessel crew. Applying the crew sizes to the number of catcher vessels in 2009, provides estimated crew sizes of 122 trawl catcher vessel crew, and 28 fixed gear catcher vessel crew. The comment about variability made in the preceding paragraph applies here.

Based on these estimates, direct employment in the Aleutian Islands Atka mackerel and Pacific cod fisheries was an estimated 899 crew in 2008, and an estimated 700 in 2009. This drop in numbers of crew reflects a drop in the number of active vessels, and this in turn may have been associated with the large decline in Pacific cod prices from 2008 to 2009. These jobs are not necessarily lost because of this action. As discussed in Section 10.3, a significant part of this fleet is likely to redeploy and continue fishing elsewhere. The distribution of place of residence for these crew members is unknown. A significant portion of them almost certainly are from outside Alaska, and will have limited opportunities to spend their income within Alaska.

Indirect and induced employment effects

Purchases and sales by catcher/processors and catcher vessels will generate additional indirect employment in Alaska and in the Puget Sound region. Within Alaska these will likely be concentrated in Adak and Dutch Harbor/Unalaska, the two fishing ports closest to the Aleutian Islands fishing grounds. The Pacific cod market in Adak has been an uncertain one since the Adak Fisheries filed for bankruptcy in 2009. Additional expenditures by CDQ groups will generate additional indirect employment in western Alaska. Expenditures of fisheries business taxes by the State of Alaska, and by communities receiving a share of the taxes, would also contribute to indirect employment.

Induced employment impacts would occur in the regions with direct impacts, but may also be more broadly spread to the extent that crew members have a more diverse distribution of residences, and to the extent that people purchase goods and services from outside the region in which they live.

The change in the number of indirect and induced jobs that would be caused in Alaska and in the Puget Sound area by the action alternatives is unknown.

As discussed in Section 10.6, Atka mackerel TAC is allocated to the Western Alaska Community Development Quota (CDQ) Program, and further allocated among six CDQ groups. The CDQ groups

receive allocations on behalf of 65 small western Alaskan communities. Atka mackerel CDQ allocations are unevenly distributed among these CDQ groups. Thus potential indirect and induced job impacts from this action in western Alaska may be distributed unevenly in the region (the distribution may also be affected by different CDQ group policies with respect to expenditures). The Aleutian Pribilof Island Community Development Association (APCIDA) receives 30 percent of the CDQ program allocation of Atka mackerel. The Central Bering Sea Fisherman's Association (CBSFA), with 8 percent of the allocation, would be the least affected. The other associations receive between 14 percent and 18 percent of the allocations.

Direct and induced income effects

The principles underlying the discussion of employment impacts in the preceding section are also applicable to income impacts.

The Amendment 80 Atka mackerel and Pacific cod fisheries are limited access fisheries ("Amendment 80") and allocations of Atka mackerel and Pacific cod are fished under the authority of quota share issued to 23 firms. Not all of these firms actively fish their quotas. Only four firms fish Atka mackerel quota share. However, the remaining firms and their owners receive income from the fisheries by leasing their quota share fishing rights to the firms actively fishing. Reduced revenue to fishing operations would affect the incomes of owners of quota allocations in this fishery.

10.8 Impacts on consumers

As described in section 10.3, this action will change the supplies of several fish species:

- The production of Atka mackerel from the Aleutians will decrease by about two-thirds under Alternative 2, and by about one-half under Alternative 3. This is the primary source for Atka mackerel in the United States. A small amount is also produced in the Gulf of Alaska.

- The production of Pacific cod may decrease if the Amendment 80 trawl catcher/processor fleet is unable to offset its loss of Aleutian Islands fishing opportunities with new fishing opportunities in the Bering Sea. In the absence of authority to rollover unfished portions of the Amendment 80 allocation if it appears as if it will go unfished, some of their Pacific cod may go unharvested.

- The production of rock sole is likely to increase.

- The production of yellowfin sole is likely to increase.

These changes in the quantities of these species of fish supplied to the market place may affect consumer welfare. The appropriate measure of this welfare change is consumers' willingness to pay to get an outcome that they consider a benefit, or to pay to avoid an outcome that they would consider a harm. As a practical matter, in many cost and benefit analyses, consumers' surplus is used as a proxy for the theoretically correct measure (Boardman et al. 1996, chapter 3). The consumers' surplus of a regulatory-induced change in the supply of a fish species would be measured by the area under the consumers' demand curve, between the original and new quantities, and above the lowest price associated with one of the outcomes. In order to make this calculation, it is necessary to have an estimate of the consumers' demand curve, usually obtained as part of a larger multi-equation econometric model. In the present instance, a model of this sort is not available for the four key species whose quantities may change. Thus, this discussion is necessarily qualitative.

Available anecdotal reports indicate that most Atka mackerel is exported to consumer markets in East Asia, principally Japan. Relatively little is said to be consumed in the United States (Q. Fong, University of Alaska Fairbanks, personal communication).[50] If this is the case, the consumers' surplus impact of the reduction in Atka mackerel supplies would be felt in Asia and not in the United States. Since a cost-benefit analysis typically focuses on impacts experienced by domestic consumers, the consumers' surplus impact of the reduction in Atka mackerel supplies is probably close to zero.

As discussed in section 10.3, the alternatives under consideration may reduce the amount of Pacific cod produced. Aleutian Islands production has accounted for no more than a fifth of the total BSAI Pacific cod harvest over the period 2000 through 2009. As discussed earlier, significant amounts of the reduction of harvest in the Aleutians can be offset by increased production in the Bering Sea. The fixed gear catcher/processors should be able to make up a large part, or all, of the reduction by fishing more intensely in the Bering Sea. The trawl catcher vessels and catcher/processors may be hobbled to a greater extent by the lack of a history of Bering Sea activity, or by higher halibut bycatch rates in the Bering Sea. However, these should be able to make up substantial parts of their Aleutian Islands harvests, or the harvests would be rolled over to other fishing sectors in the fall. Parts of the Pacific cod harvests are destined to foreign consumers, and these should absorb some of the potential losses in consumers' surplus. As discussed in section 10.2, consumers have numerous substitutes for Pacific cod. For these reasons, there is likely to be little change in consumer surplus for U.S. Pacific cod consumers.

Alaska's fisheries appear to account for most or all of the world production of rock sole and yellowfin sole. The rock sole fishery is a roe fishery. A report by Northern Economics, in Haitt et al. (2009), reports that rock sole females are exported to Japan (historically, most males have been discarded). Northern Economics also reports that rock sole males have increasingly been exported to China for filleting and re-export to the United States. The Japanese market for rock sole roe has been declining. Northern Economics explains that this may be due to preference changes associated with generational change.

Whole yellowfin sole has a consumption market in Korea. Headed and gutted yellowfin is exported to China for processing and re-export, mostly to the United States, Canada, and also, increasingly, to European markets. China evidently has an advantage in the relatively labor intensive process of filleting the relatively small fillets of the yellowfin (Northern Economics 2008).

As a first approximation, an increase in rock sole production is not likely to produce significant amounts of consumers' surplus for U.S. consumers. An increase in yellowfin production may produce some U.S. consumers' surplus. In both cases, potential benefits are impossible to estimate with our current knowledge.

Any changes that occur would be greater under Alternative 2 than under Alternative 3, because of the greater opportunity to fish for Pacific cod in the Aleutians under Alternative 3. As shown in Tables 10-21, 10-24, 10-34, and 10-38 in section 10.3, the expected reductions in Aleutian Islands Pacific cod harvests for the Amendment 80 trawl catcher/processors, the catcher vessel fleet, and the fixed gear catcher/processors are all smaller under Alternative 3.

[50] Fong, Quentin, Ph.D. Assistant Professor; Seafood Market Specialist. University of Alaska Fairbanks, School of Fisheries and Ocean Sciences. Kodiak, Alaska. Personal communication, July 2010.

10.9 Implementation issues

In-season management

The action alternatives involve normal in-season management measures, and do not impose new requirements on that branch. Elements of the alternatives would actually reduce the in-season management work load in small ways. Under Alternatives 2 and 3 there would be no need to take steps to close Atka mackerel fishing in Area 543, and under Alternative 2 there would be no need to take these steps in Area 542. The elimination of the HLA platoon registration and lottery will eliminate one task for inseason managers and for the Alaska Region's Restricted Access Management Program, but this is a minor task. Inseason managers take, perhaps, four hours to run the lottery. None of the alternatives would chance staffing requirements.

Enforcement

The proposed action may have implications for enforcement efforts by the NOAA Office of Law Enforcement, the NOAA Office of General Counsel, and the Coast Guard. These implications will be discussed in the final draft.

Safety

In general, both of the alternatives will shift vessels active in the western and central Aleutian Islands towards the east and into the Bering Sea. Such a shift will bring the vessels closer to Coast Guard search and rescue bases. The Coast Guard maintains seasonal search and rescue support facilities in Cold Bay in the late fall, and in St. Paul's Island at the start of the year. Otherwise, aircraft responding to a distress call in the western or central Aleutians would have to start from the Coast Guard base in Kodiak. Operational restrictions on the distance unescorted aircraft are allowed to fly over open water mean that planes originating from any of these locations would probably travel by way of Dutch Harbor and Adak. Travel time from Kodiak to Kiska could be eight hours for a C130, and 12 hours for a helicopter. Thus both alternatives would tend to shorten travel times to vessels that shift their operations to waters closer to these bases. Moreover, a shift in operations to the east increases the density of fishing vessels, increasing the likelihood of "good Samaritan" assistance if trouble occurs. (Lawrenson, pers. comm..) [51] Alternative 2, which is more restrictive in the central Aleutians than Alternative 3, would probably shift more fishing activity to the east.

A shift of fishing activity to the Bering Sea, by increasing fishing vessel density, may also increase competition among vessels in the Bering Sea for good fishing locations and opportunities. In an unrationalized fishery, increased competition for relatively desirable fishing locations, or for opportunities to set gear on fish aggregations, and the costs of failing to win such a competition, may increase the opportunity costs to fishermen of taking appropriate safety measures. This may lead to less safe operations. This is much more likely to be an issue in an unrationalized fishery, and thus more likely to be a concern with among the fixed gear catcher/processors and catcher vessels targeting Pacific cod. (Lawrenson, pers. comm..)

The two action alternatives do appear to have the potential for significant adverse impacts on operational gross revenues. Large losses are expected from foregone Atka mackerel and Pacific cod harvests in the

[51] Ken Lawrenson, United States Coast Guard. Commercial Fishing Vessel Safety Coordinator, US Coast Guard, 17th District Juneau, Alaska. Personal communication, July 26, 2010.

Aleutian Islands; large offsetting additional revenues are expected in the Bering Sea, but there is less certainty about the size of these. In recent years the Amendment 80 fleet has been cooperating with the Coast Guard to upgrade the safety status of its vessels through the Coast Guard's Alternative Compliance Safety Agreement. These upgrades were ultimately a response to changes in vessel function induced by fisheries regulations. Anecdotal evidence from industry sources suggests that in some cases, these upgrades can range in cost to a half a million dollars. To the extent that the motivation to undertake these upgrades was the stability and revenue opportunities presented by the quota allocations under the Amendment 80 program, and to the extent that this action reduces those opportunities for the Amendment 80 fleet, this action may reduce the incentive to undertake the upgrades, or to replace vessels with newer vessels. (Lawrenson, pers. comm.)

10.10 Summary

Atka mackerel and Pacific cod harvests from Federal fisheries in the Aleutian Islands have had an average wholesale value of about $84 million in recent years. In 2009, they were targeted by 8 trawl catcher/processors, 7 hook-and-line catcher/processors, 3 pot catcher/processors, and 28 catcher vessels. In recent years catcher vessels have used trawl, jig, hook-and-line, and pot gears.

Alternative 2 prohibits retention of Atka mackerel and Pacific cod in Areas 542 and 543 and prohibits directed fishing from 0 to 10 nm for Pacific cod in Area 541. Alternative 3 prohibits retention of Atka mackerel and Pacific cod in Area 543, prohibits directed fishing for these species inside most of critical habitat in Areas 542 and 541, and limits the Atka mackerel TAC in Area 542 to no more than 47 percent of the ABC. There are a number of other elements to the alternatives, however these are the main components.

Four fleets were defined for the analysis: the Amendment 80 fleet of trawler catcher/processors, fixed gear (hook-and-line and pot) catcher processors, catcher vessels (including vessels using jig, pot, hook-and-line, and trawl gear), and vessels fishing in the state waters fishery.

The potential costs to industry are the producers' surplus and factor rents that may be lost because of the restrictive measures in the Aleutian Islands. The information that would make it possible to estimate the value of the lost producers' surplus and factor rents is not available. It is possible to approximate the annual gross revenues that would be lost in the directly regulated fisheries.

In general the alternatives will reduce Atka mackerel and Pacific cod harvests. The industry is likely to respond to the restrictions in the Aleutian Islands by redeploying its fleets in an effort to minimize the losses the restrictions will impose. The Amendment 80 fleet may spend more time fishing for rock sole and yellowfin sole in the Bering Sea, and may fish more Pacific cod in the Bering Sea. It is not clear how effectively it may fish for Pacific cod in the Bering Sea. Halibut bycatch is higher there, the fleet doesn't have a history of Bering Sea Pacific cod fishing, and only a few of the vessels focused on Pacific cod in the Aleutian Islands. The fixed gear catcher/processors and catcher vessels catch Pacific cod, not Atka mackerel in the Aleutian Islands, and may switch to fishing Pacific cod in the Bering Sea.

Despite likely redeployment, the industry will incur losses. These size of these losses cannot currently be estimated. However, it is possible to estimate the approximate reduction in gross revenues in the Aleutian Islands:

- The reduction in Amendment 80 Atka mackerel gross revenues is estimated to be in the neighborhood of $47 million under Alternative 2, and of $34 million a year under Alternative 3.

- The reduction in Amendment 80 Pacific cod gross revenues is estimated to be in the neighborhood of $7 million to $19 million under Alternative 2, and $4 million to $11 million under Alternative 3
- The reduction in fixed gear catcher/processor gross revenues is estimated to be in the neighborhood of $13 million to $23 million a year under Alternative 2 and $4 million to $12 million a year under Alternative 3.
- The reduction in catcher vessel gross revenues is estimated to be in the neighborhood of $12 million to $13 million a year under Alternative2 and $8 million to $9 million a year under Alternative 3.
- The aggregate reduction in gross revenues across fleets is estimated to be in the neighborhood of $79 million to $102 million a year under Alternative 2, and $50 million to $66 million a year under Alternative 3.
- The state waters Aleutian Island Pacific cod fishery should not be affected in the short run, but may be in the long run, if proposed FFP regulatory changes interact with the Steller sea lion protection measures to discourage fishing operations from entering the state fishery.

These estimates of revenue reductions overstate the industry's net losses. First, gross revenues ignore fishing costs; the actual net loss in the Aleutians, caused by the restrictions, will be less than the gross loss. A review, in Section 10.6, of a recent literature on decision-making about fishing locations noted evidence that the difference between gross revenues and net revenues may be large.[52] Second, a reduction in Atka mackerel production may lead to increased prices for the remaining Atka mackerel harvest. Third, industry will respond to these changes by taking steps to reduce its losses. These will likely involve redeployment of vessels to the Bering Sea. Other steps, such as efforts to reduce trawl halibut bycatch in the Bering Sea, are also likely.

The three different federal fisheries fleets are estimated to employ about 700 to 900 persons. Estimates of indirect and induced employment associated with these fleets are not available. Estimates of direct, indirect, and induced incomes are not available. Changes in these, associated with the action alternatives, have not been estimated.[53]

The Biological Opinion states that "NMFS assumes that the logic applied to develop the RPAs by conserving important prey species in the areas and seasons of utmost importance to foraging Steller sea lions commensurate with the rate of decline observed in each fishery management area will be adequate to ameliorate the affect of the fisheries such that they would not be likely to suppress the survival and recovery of the species to an appreciable extent. (NMFS 2010)

Neither the RPA nor the EA project that the action will necessarily lead to an increase in the rate of population growth of Steller sea lion populations. The Biological Opinion implies that such an outcome would be one reasonable outcome:

> While effects of the RPA on the response of the Steller sea lion population cannot be projected with any amount of certainty with the available information, NMFS assumes that the logic applied to develop the RPAs by conserving important prey species in the areas and seasons of utmost importance to foraging Steller sea lions commensurate with the rate of decline observed in each fishery management area will be adequate to ameliorate the affect of the fisheries such that they would not be likely to suppress the

[52] NMFS AKR and the AFSC are cooperating to examine EDR data reports for further evidence on this issue. This work may be discussed in the final draft.

[53] NMFS AKR and the AFSC are cooperating working to apply a regional impact model to estimate indirect and induced impacts. This work may be discussed in the final draft.

> survival and recovery of the species to an appreciable extent. This assumption is supported by two important findings. First, after the implementation of the conservation measures associated with the 2001 Biological Opinion…, there was a change in the annual trajectory of the western DPS on the order of 5-6 percentage points (i.e., the trend was approximately -4% per year in the 1990s and increased to 1.4% per year between 2000 and 2008). As noted above, this change in the trajectory was statistically significant, although the experimental design to definitively conclude this change was entirely due to the imposed conservation measures was never implemented. Further, if evaluated by the subset of 13 "zones" that were in decline and which would have been closed to commercial fishing for Pollock, cod, and Atka mackerel (described in the 2000 Biological Opinion), the average change in the annual trajectory for these "zones" was approximately +6 percentage points. Because the actual conservation measures implemented in these seven zones were less than or equal to what was proposed in [the 2001 biological opinion], it seems reasonable to conclude that this estimate is conservative (although it should again be noted that no definitive experiment was done to quantify the extent to which the conservation measures implemented were directly responsible for the observed improvement in the trajectory). (NMFS, 2010).

The estimates of the benefits of Steller sea lion protection were discussed in Section 10.4, which presented the results of recent survey research into the willingness of U.S. households to pay for a certain improvement in the population growth rate of the western population of Steller sea lions. The large element of uncertainty about the impact of the proposed action on Steller sea lion population trajectories, makes it impossible to apply the survey results to this action.

Benefits or costs may accrue from this action because of impacts on other elements of the ecosystem (aside from Steller sea lions) such as other marine mammals, seabirds, fish stock impacts, habitat impacts, and ecosystem impacts. Impacts from these sources are likely to be small in relation to impacts to the industry or the values accruing from sea lion stock health. Benefits and costs may accrue to fish consumers. These also appear likely to be small relative to other impacts. Much of the harvest is exported, and Pacific cod, rock sole, and yellowfin sole production changes may be small in comparison with current consumption and normal variations in production. Management costs appear to be effectively zero. Enforcement issues were not evaluated in this draft.[54] A shift in the fleet's center of gravity to the east, brings it closer to USCG search and rescue resources and to potential "good Samaritan" assistance. Reduced profits may reduce investments in safety, and a reduction in the distance between fishing vessels may encourage a derby fishery mentality.

A part of this action that closes waters within three miles of Kanaga Island to groundfish fishing should have small costs to industry. Elimination of the HLA will have little impact, given other measures to restrict fishing in the HLA areas. The emergence of cooperatives under Amendment 80 provides an alternative way of slowing harvest.

Because the impact of this action on the Steller sea lion population trajectory cannot be estimated, it is impossible to determine whether or not this action will have a net benefit in terms of cost-benefit accounting measures. This action is necessary, however, to ensure the effects of the groundfish fisheries are not likely to result in jeopardy of extinction or adverse modification or destruction of critical habitat, as required by the Endangered Species Act (NMFS 2010).

[54] NMFS AKR is consulting with NOAA OLE and USCG on enforcement issues.

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