



Steller sea lion telemetry update

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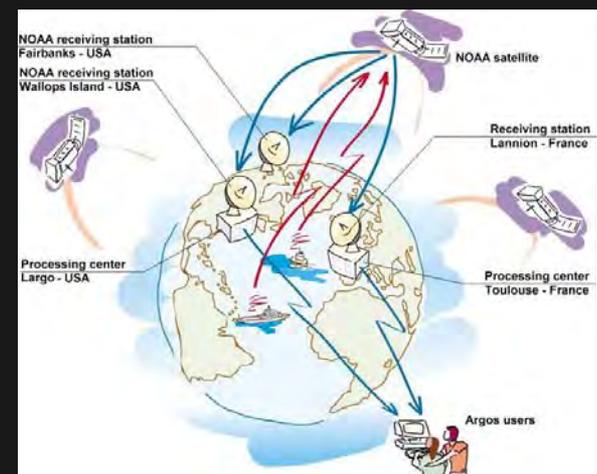
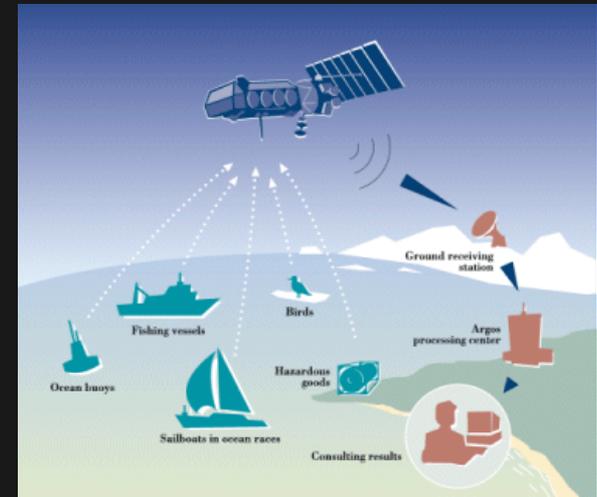


Alaska Fisheries Science Center

NATIONAL MARINE FISHERIES SERVICE

Telemetry studies- review

- Sea lions captured on land or in water
- SDRs attached
- Transmitter position calculated by Argos
- Positions assigned location-quality classes
- SDR transmits data for dive depth, proportion of time at depth, dive duration, transmitter status, wet/dry status
- Dive data summarized into 6-h bins (histograms)



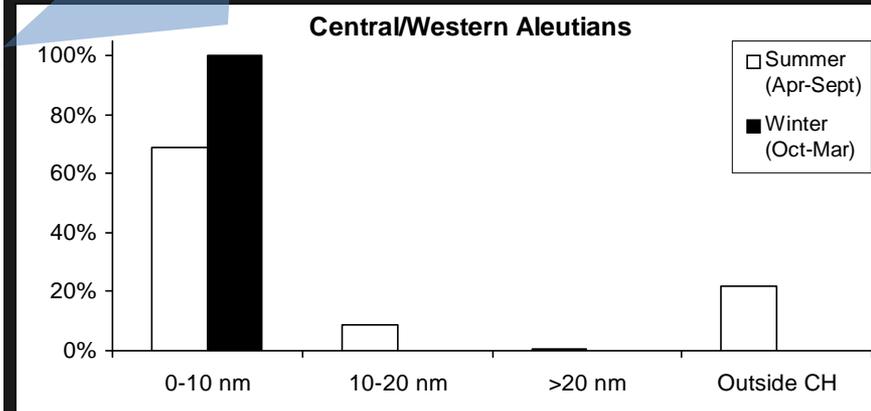
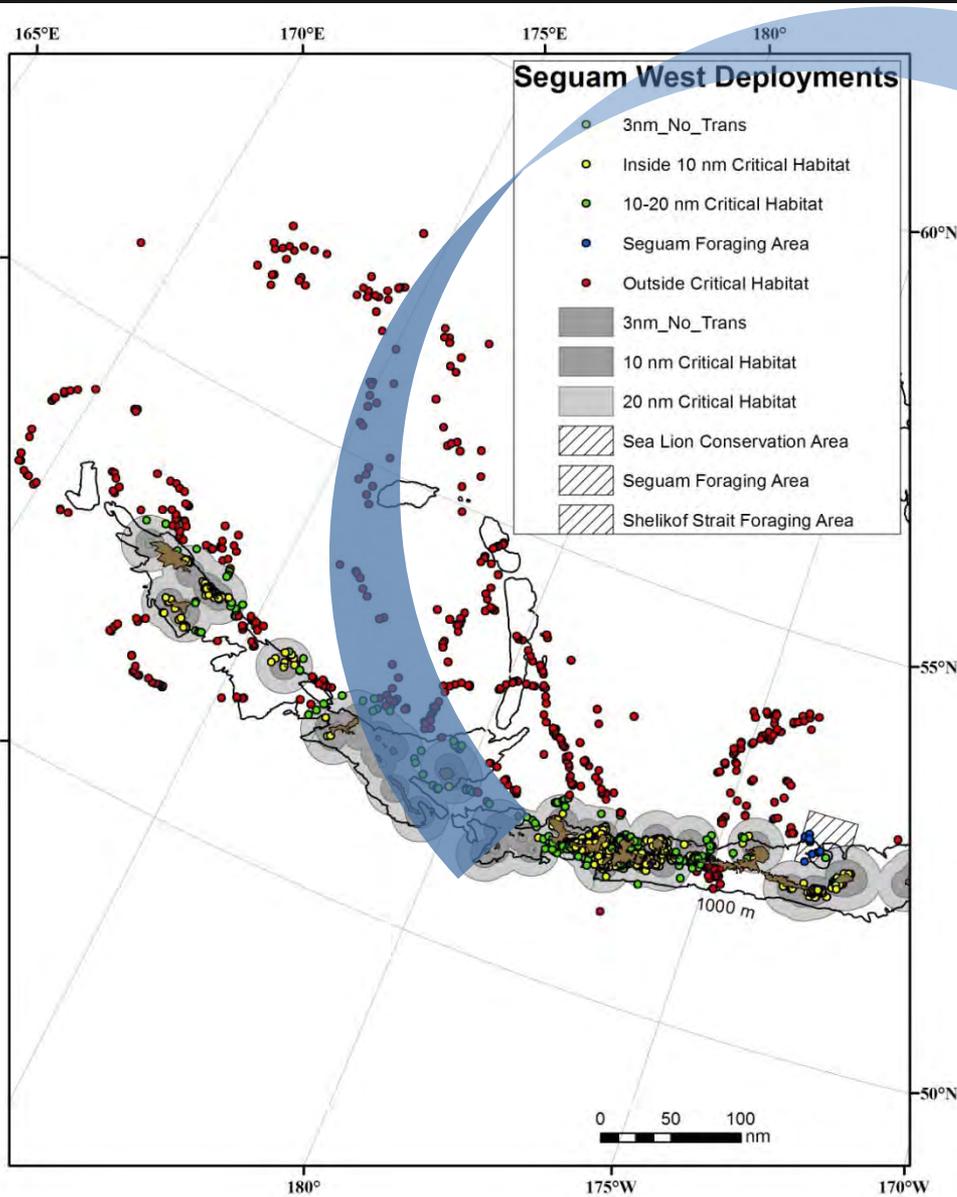
Telemetry studies- review

- What changed since 2003 BiOp amendment?
(presented in 2006)
 - Additional deployments
 - Increased age, region coverage
 - Combined NMML & ADFG telemetry data
 - 116 sea lions (63 previous, 53 new)
 - Ages 3-26 months at capture

Telemetry studies- review

- The 2006 analysis followed methods of analysis for 2003 amendment to 2001 BiOp:
 - Used NMML and ADFG western stock data (2000-2005)
 - Combine location and dive data sets
 - Processing/filtering
 - Selected only at-sea locations associated with diving to >4 m
 - Determine whether locations were 0-10 nm, 10-20 nm, or >20 nm from nearest listed haulout or rookery, or outside of critical habitat

Telemetry review: 2006 analysis example



Depending on age, season, region:

0-10 nm 78.4-95.4% of locations

10-20 nm 3.5-8.9% of locations

Outside CH 1.0-11.9% of locations

Telemetry – review

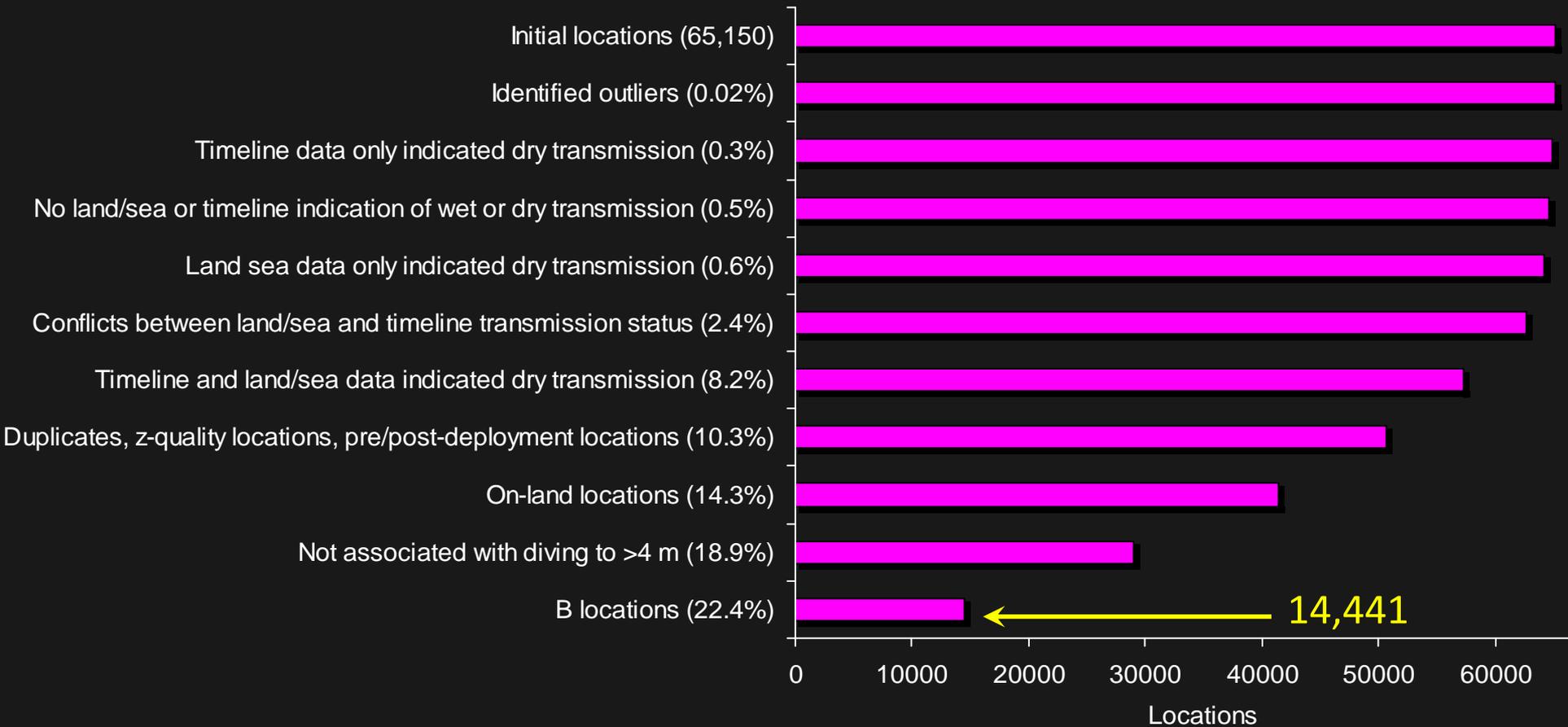
- In 2006 the SSL Mitigation Committee suggested exploring distance distributions by individual, rather than by ‘cookie-cutter’ bins.
- Pursued at request of Alaska Region for the new Biological Opinion.
 - To what extent did critical habitat encompass potential juvenile sea lion foraging locations?



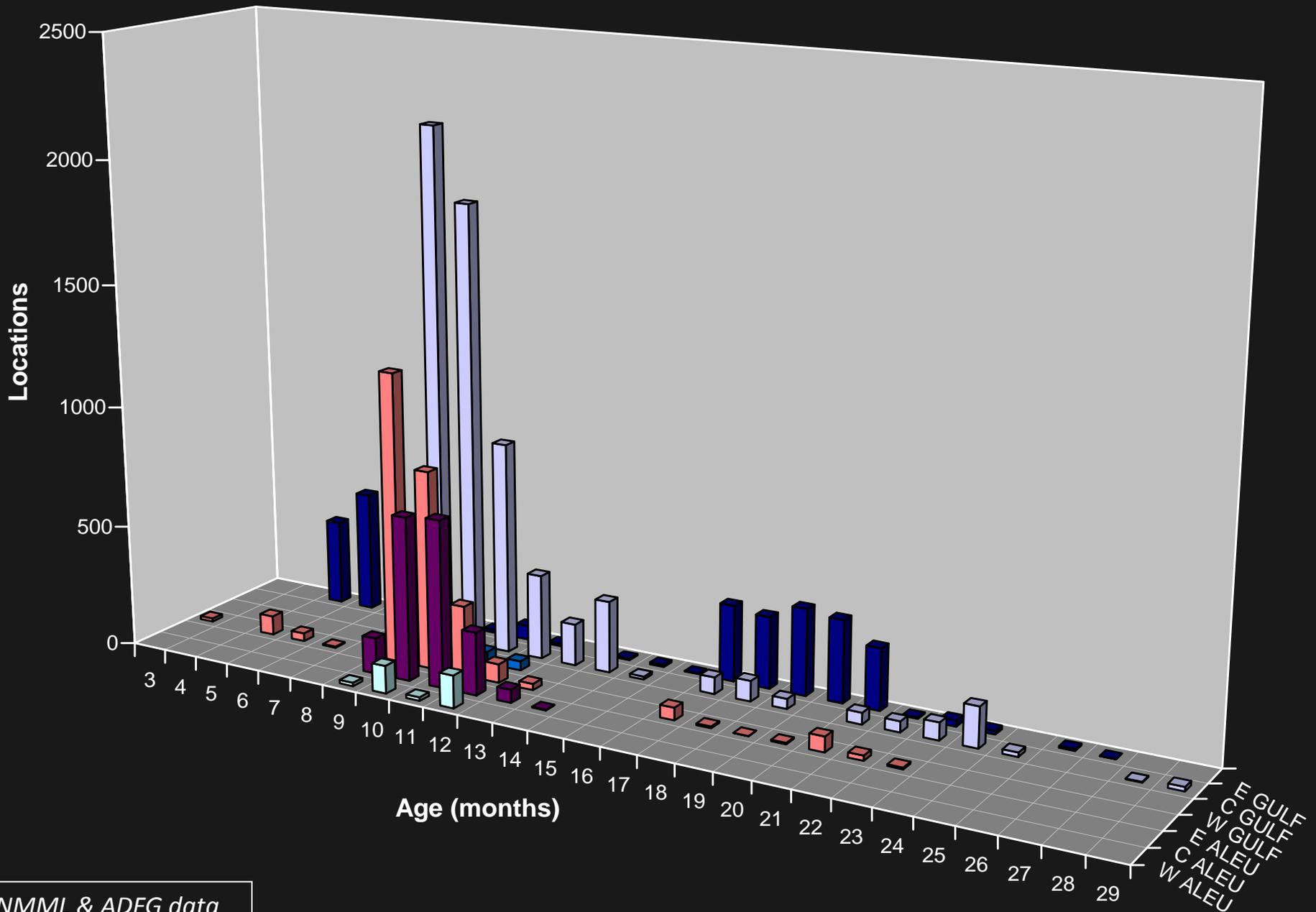
New methods

- Used 14,441 locations associated with diving to >4 m.
- Calculated cumulative frequencies of distance (progressive 1 nm bins) of diving location to nearest listed site.
- Locations stratified by analytical zone, age class and season
- Of 116 sea lions, 14 were excluded because of <10 locations within any age/season strata.

Effects of processing/filtering on sample size

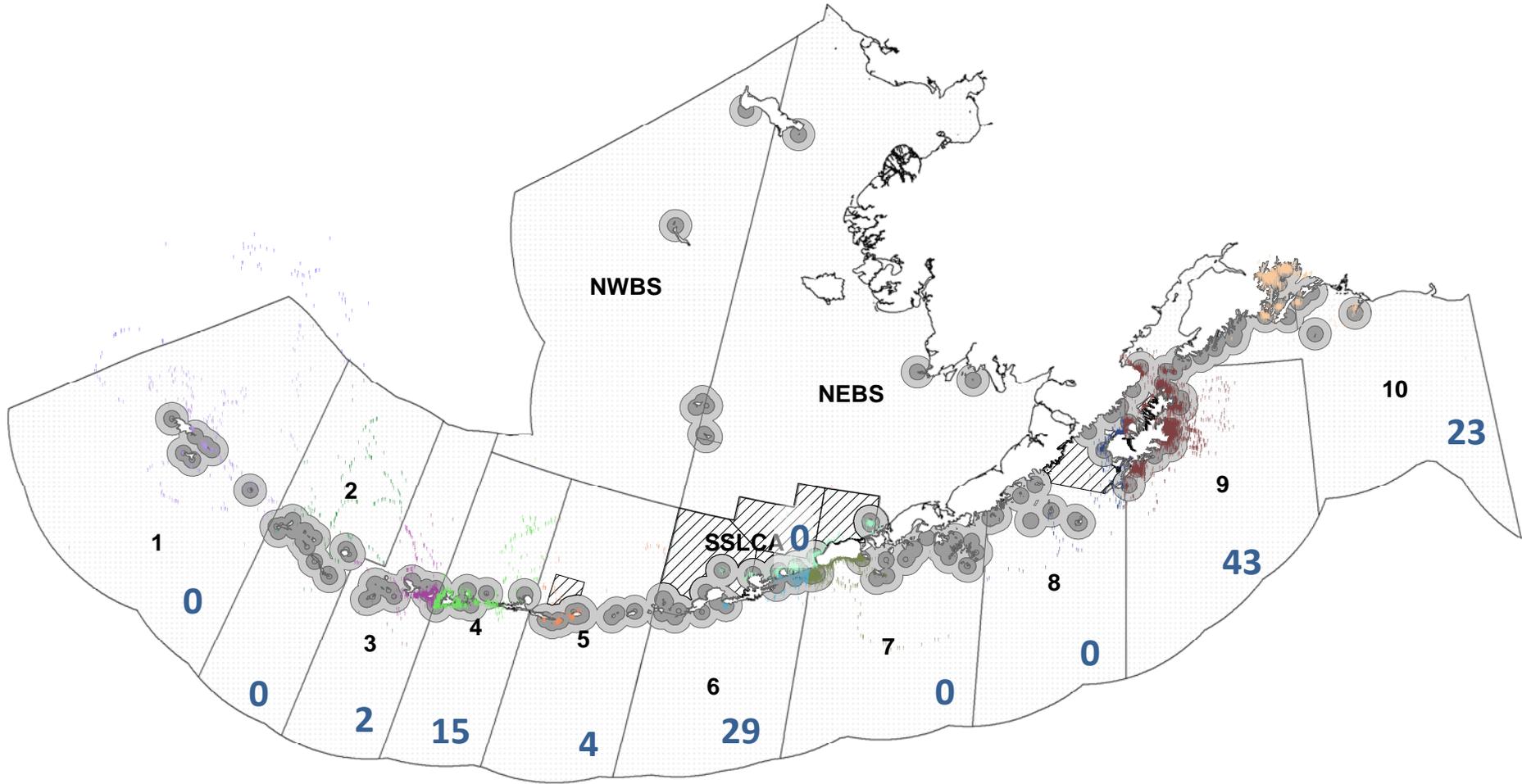


Steller sea lion diving locations by area, 2000-2005

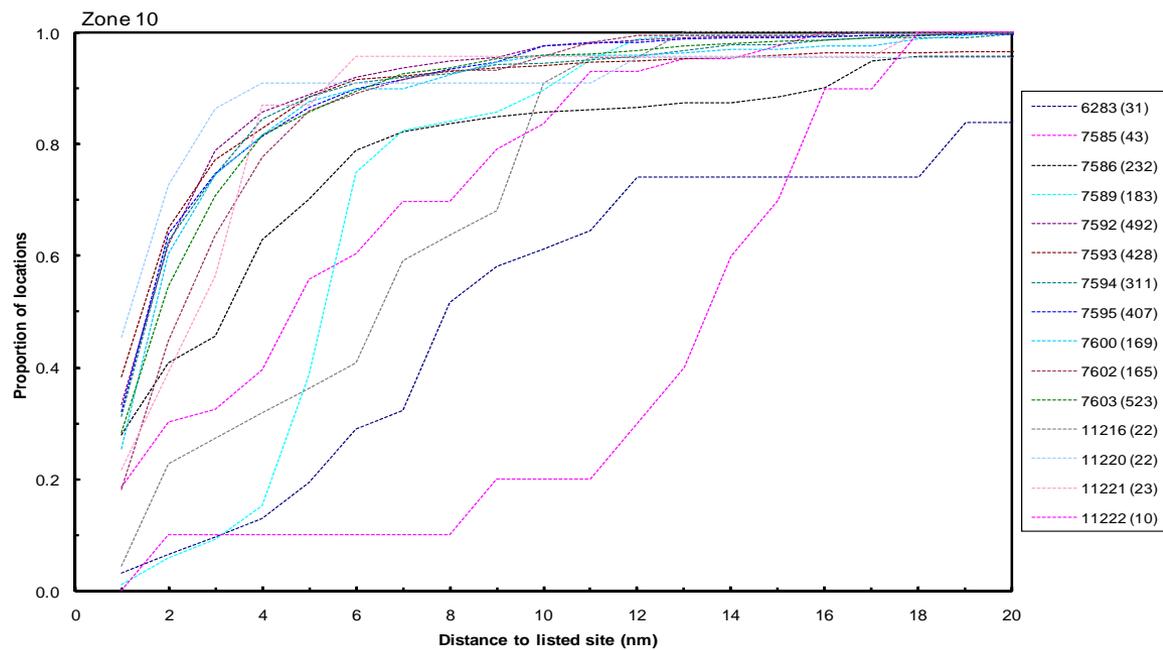
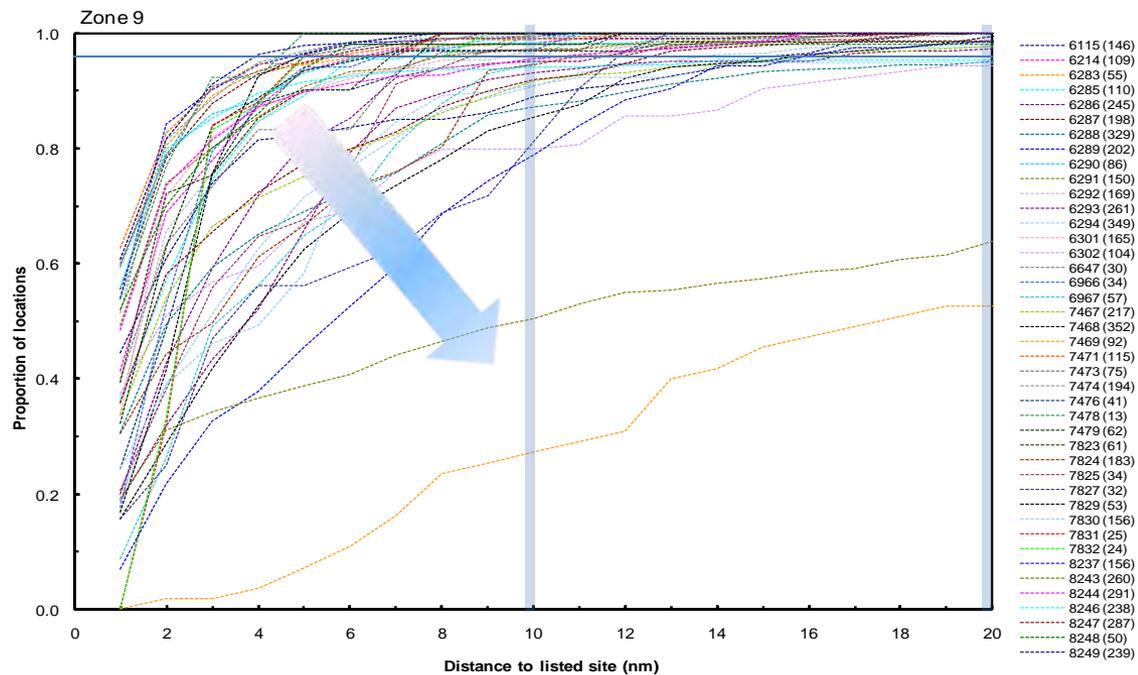
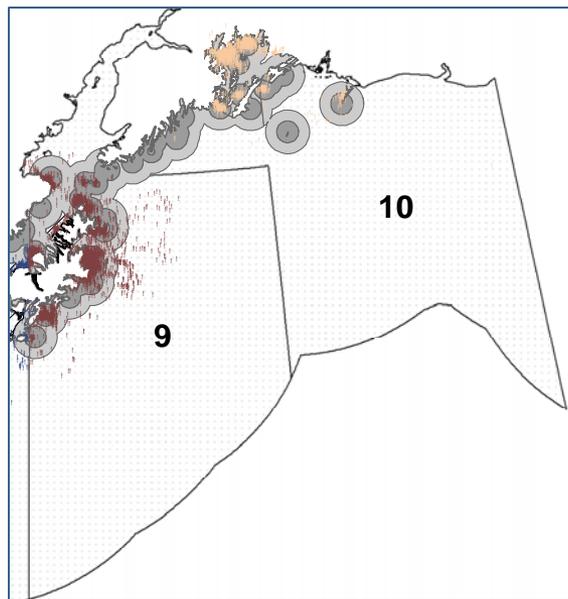


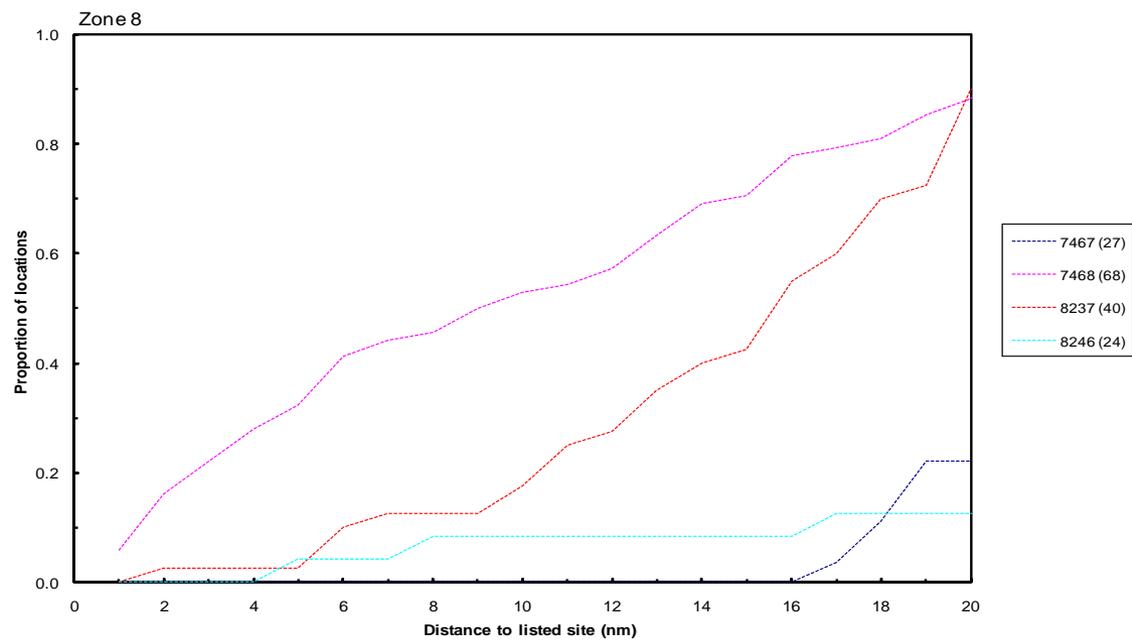
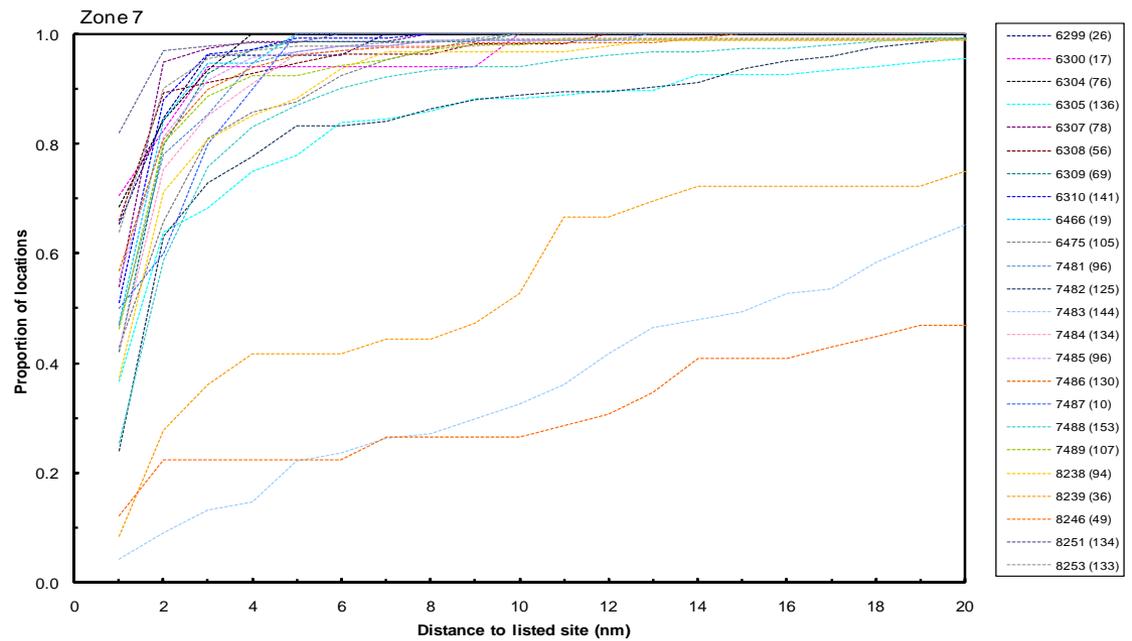
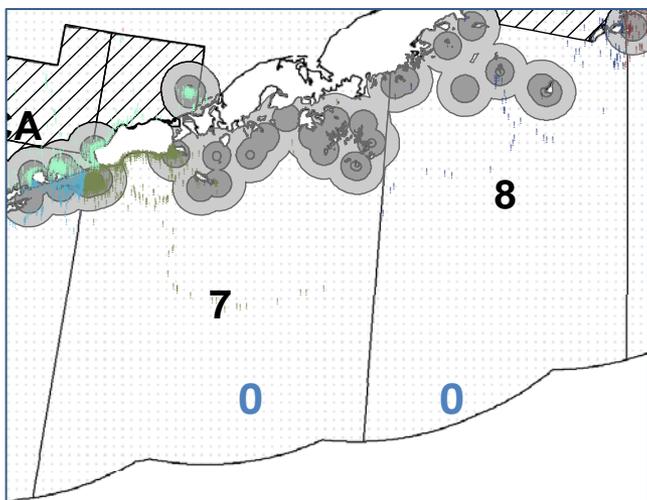
NMML & ADFG data

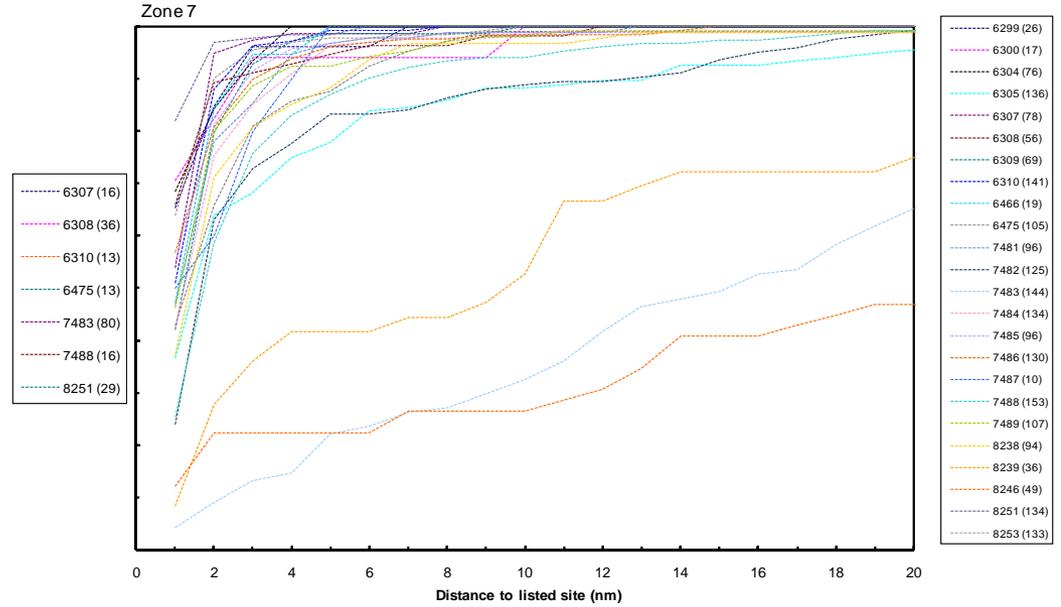
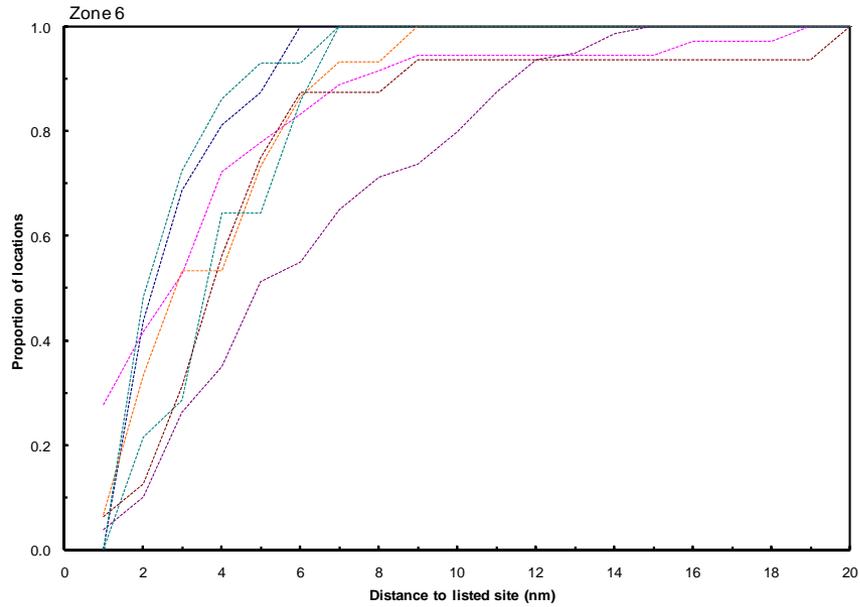
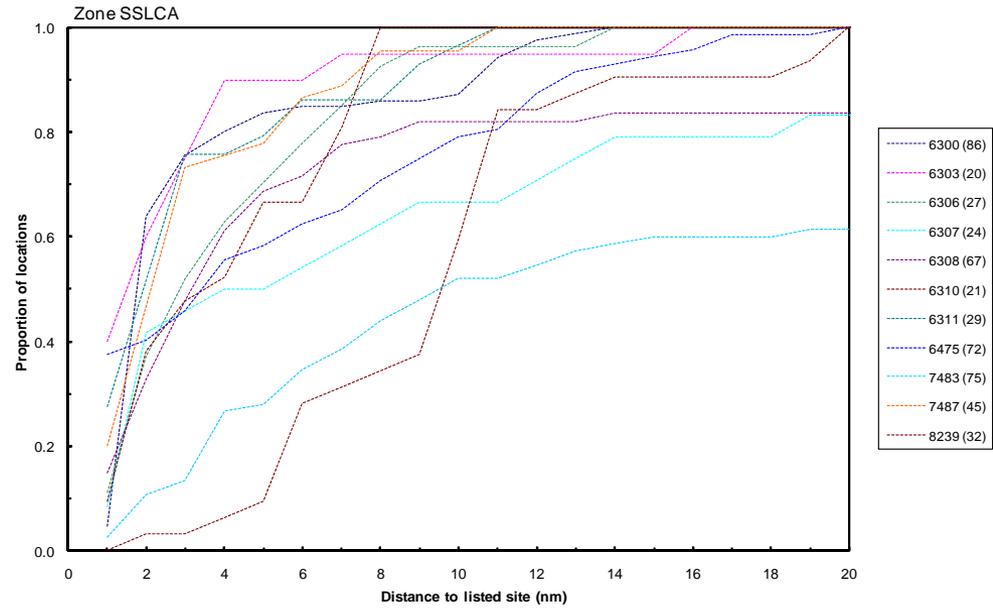
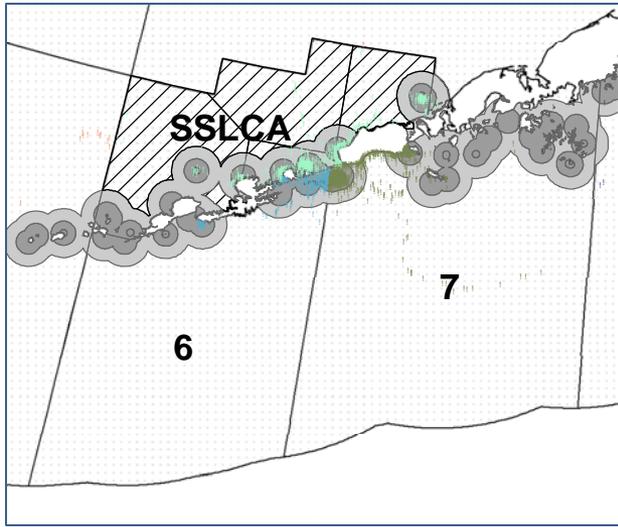
Juvenile Steller sea lion locations associated with diving to > 4m (NMML/ADFG 2000-2005)

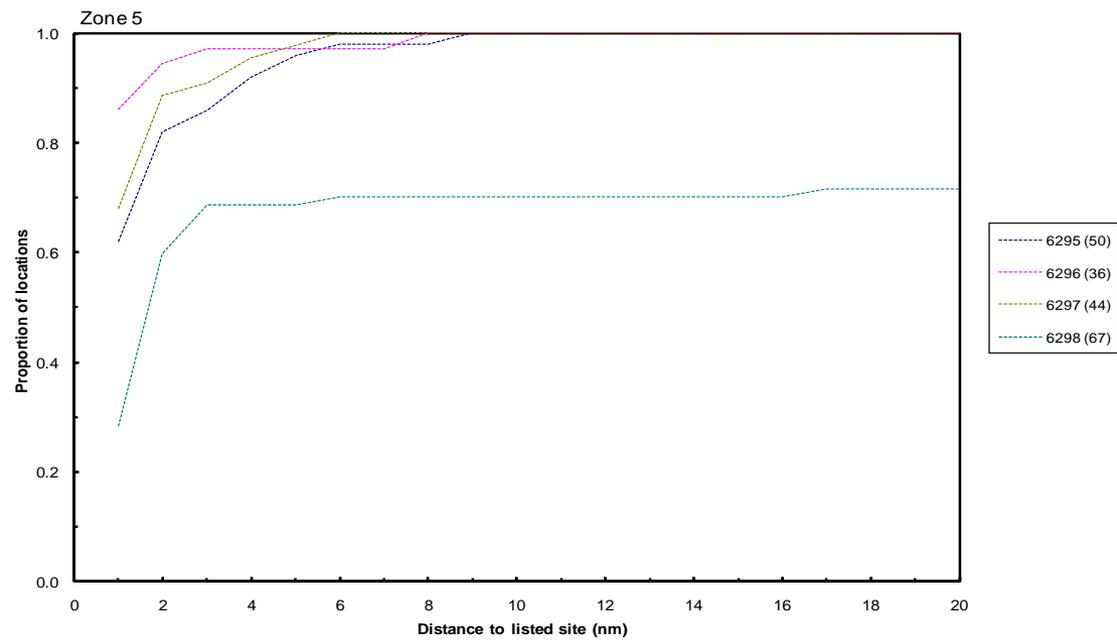
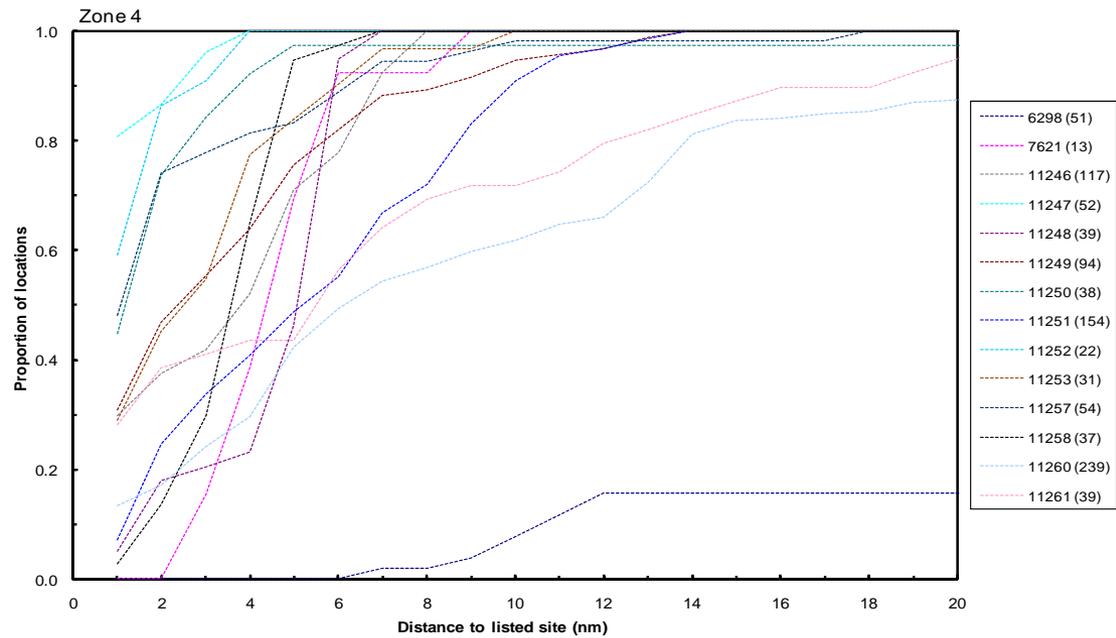
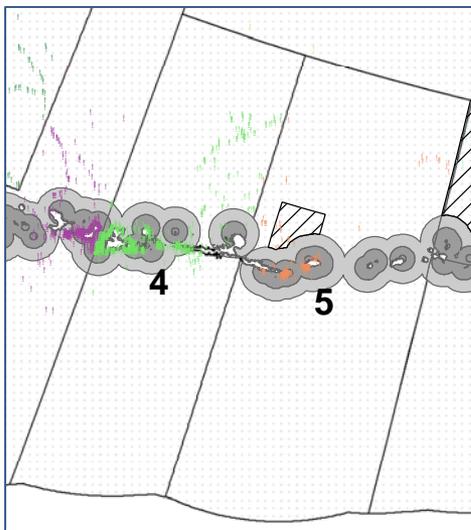


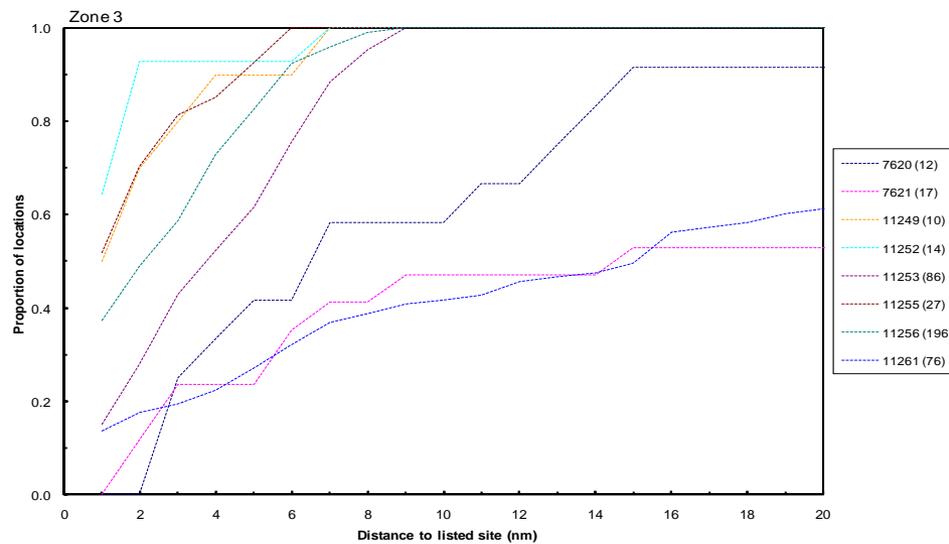
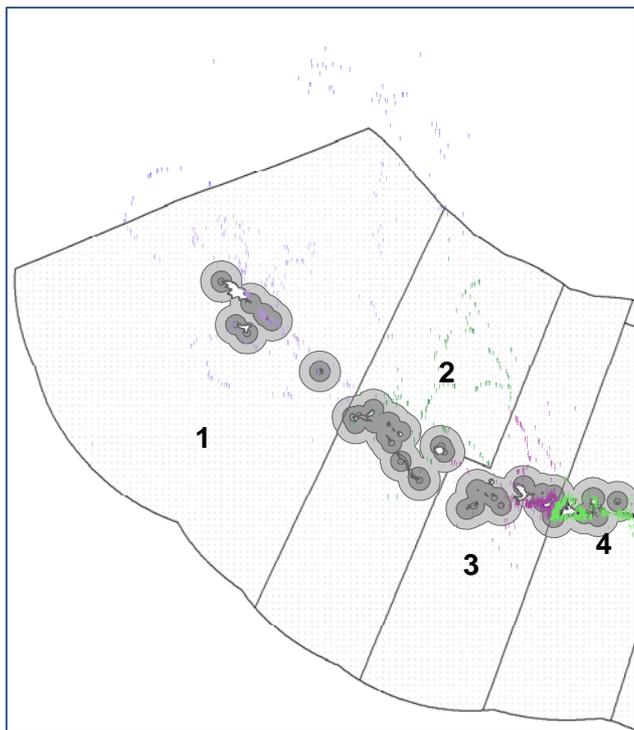
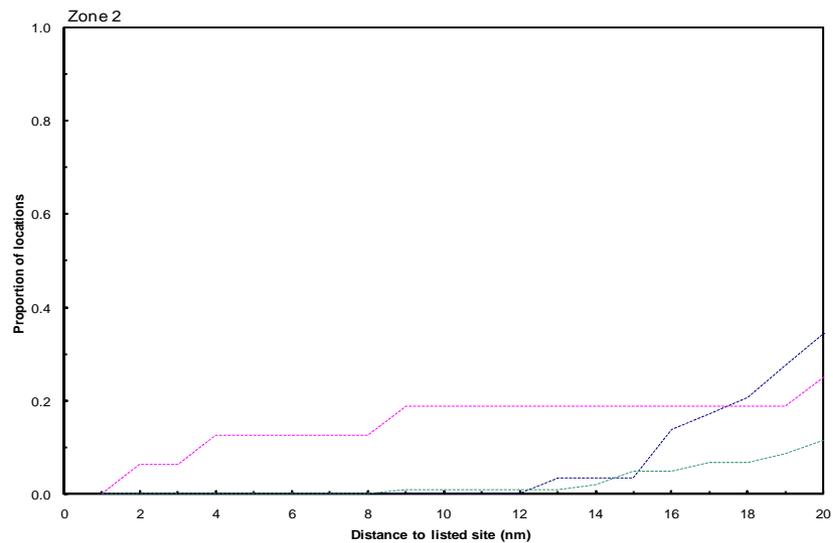
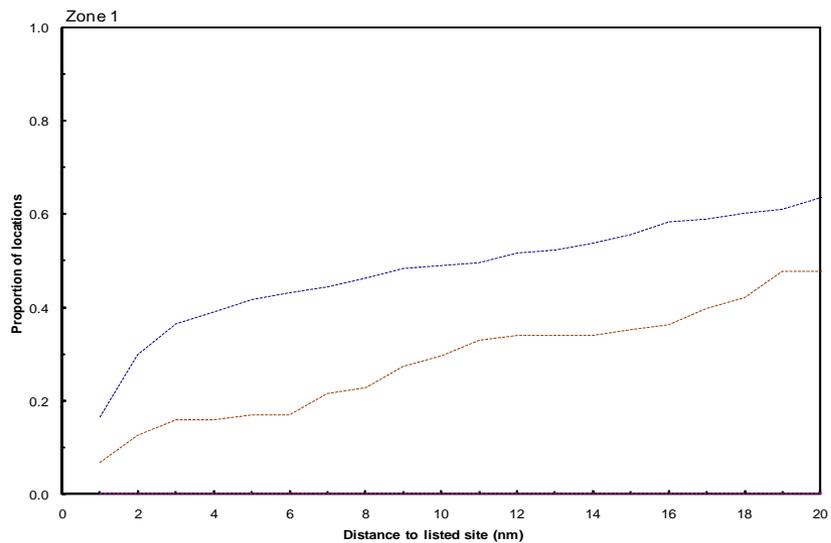
Sea lions tagged by zone

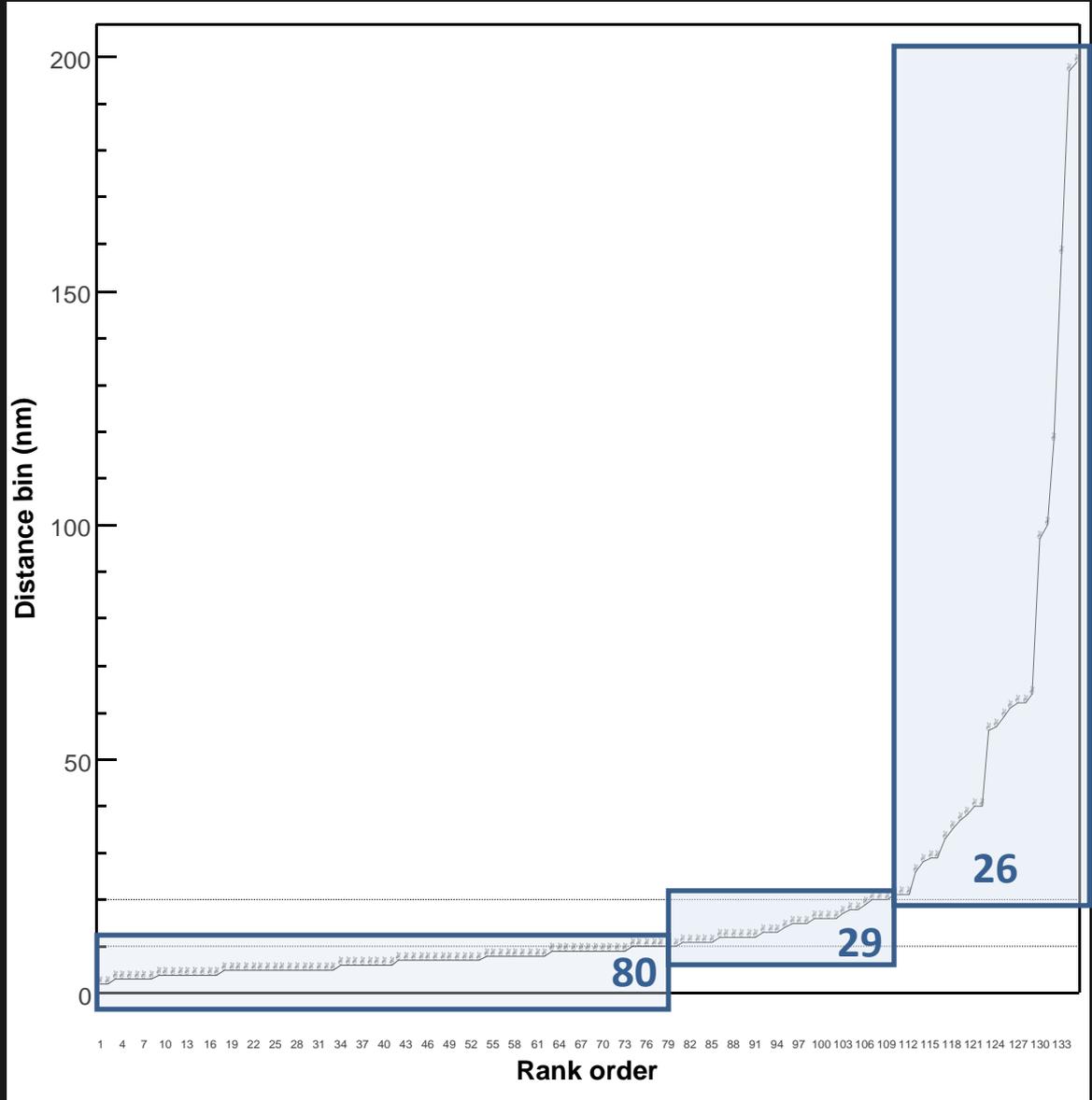






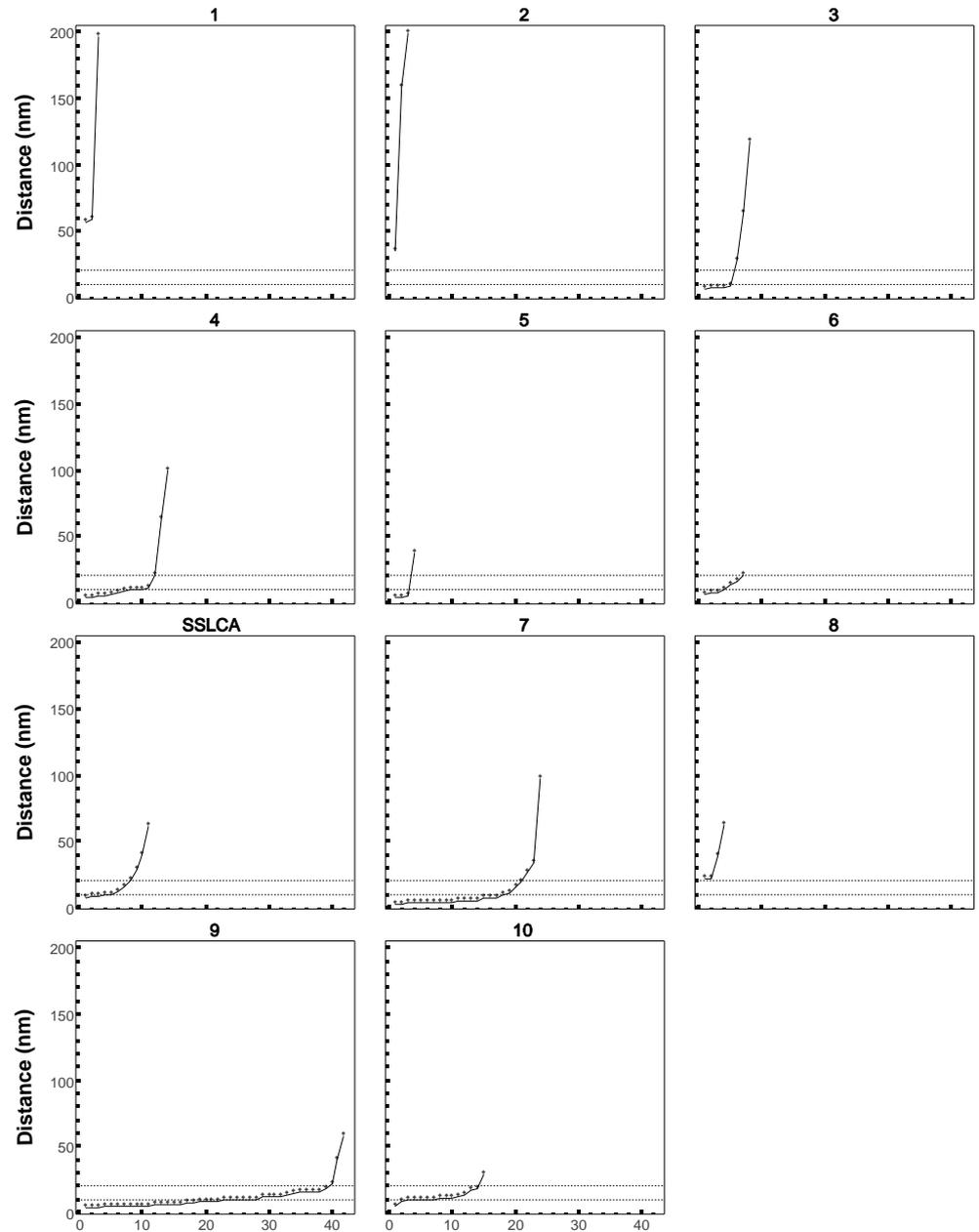




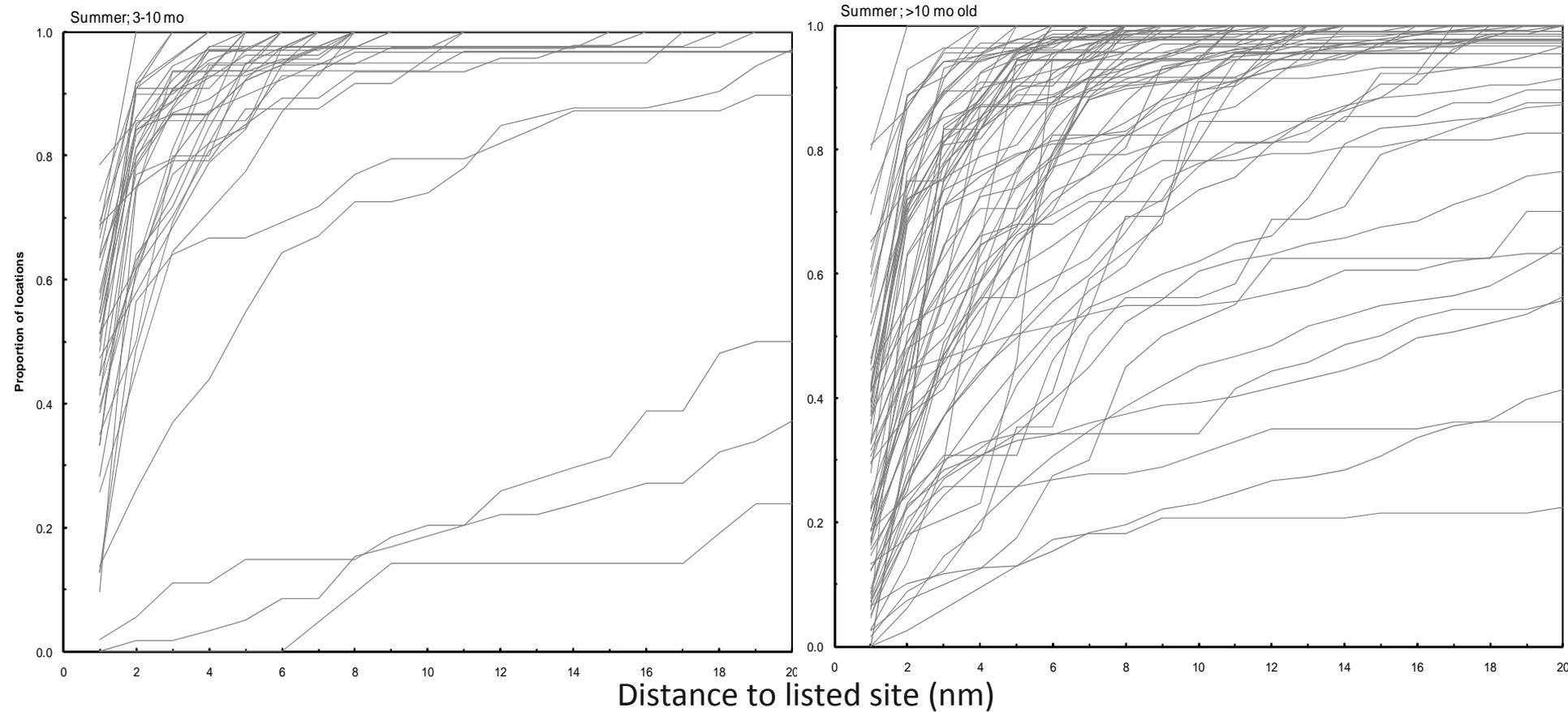


Rank order of distance bin encompassing at least 95% of the cumulative distribution of distances to the nearest listed site for locations associated with diving to >4 m within all analytical zones

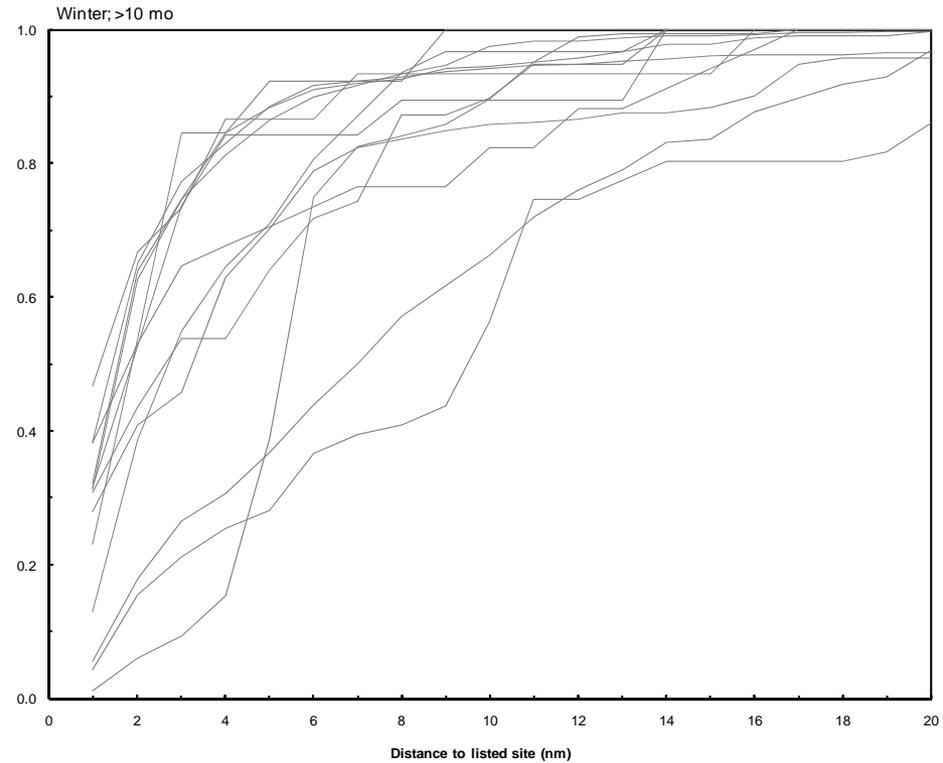
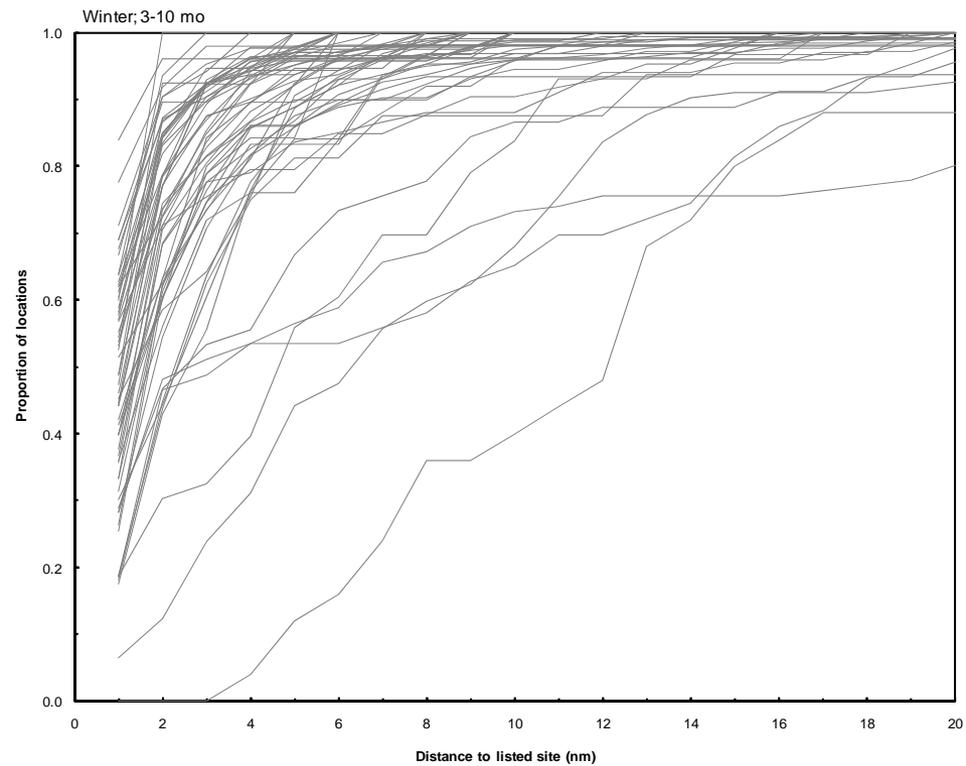
Rank order of distance bin encompassing at least 95% of the cumulative distribution of distances to the nearest listed site for locations associated with diving to >4 m by individual juvenile Steller sea lions



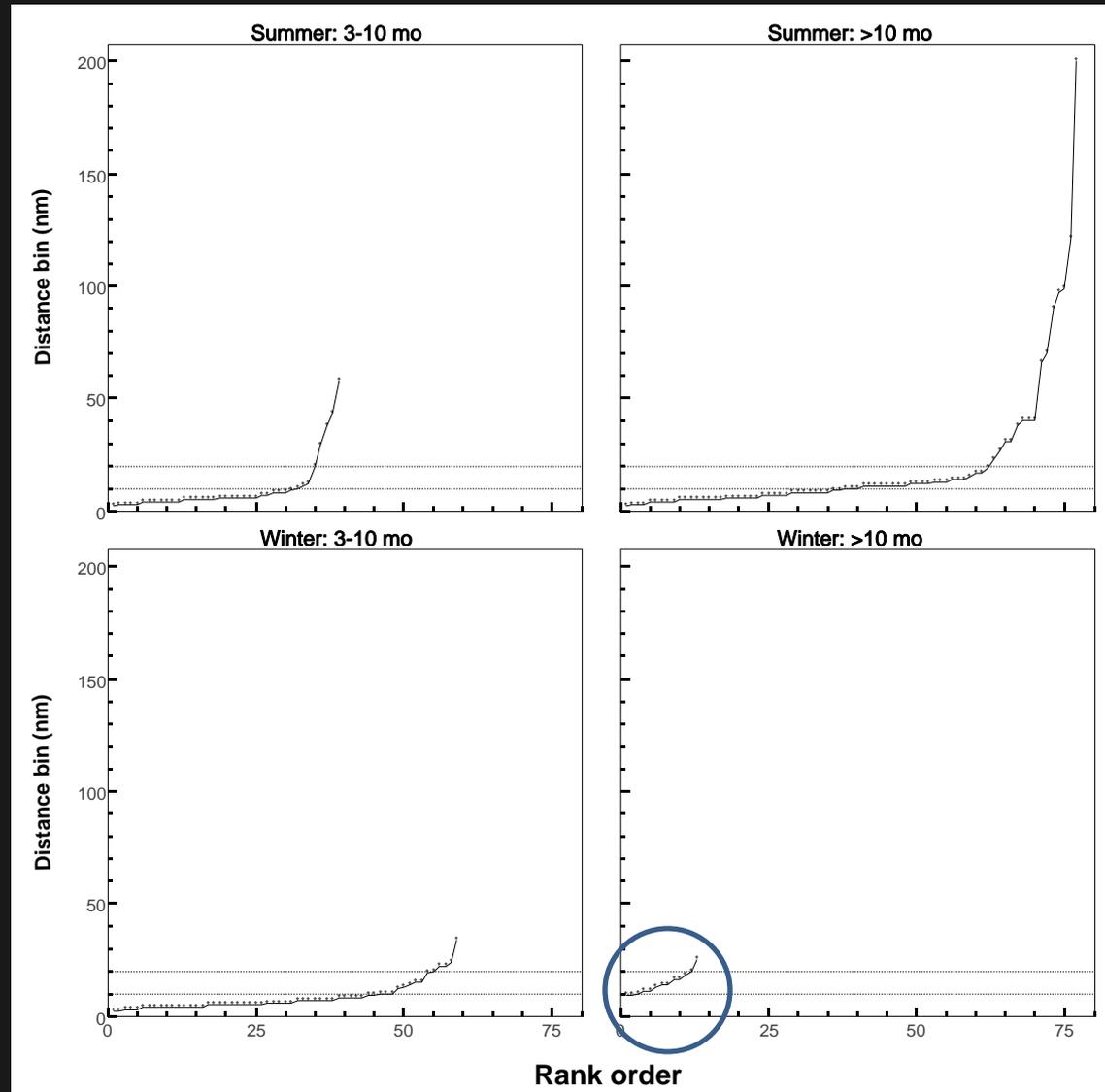
Steller sea lion individual cumulative frequencies of diving locations (April-September): age effect



Steller sea lion individual cumulative frequencies of diving locations (October-March): age effect



Steller sea lion individual cumulative frequencies of diving locations by age/season category



Telemetry update - summary

- Patterns consistent with 2006 approach
 - most animals had 75% of their dive locations within 10 and 20 nm of a listed site.
- Age, seasonal, and regional effects
 - <10 month olds
 - 75% of individuals in summer had all locations within 10 nm
 - 50% of individuals in winter had all locations within 10 nm
 - >10 month olds
 - 33% of individuals in summer had all locations within 10 nm
 - 8% of individuals in winter had all locations within 10 nm

Telemetry update - summary

- Age, seasonal, and regional effects continued
 - Patterns varied greatly with analytical area, but sampling coverage is an issue
 - Zones 1, 2, and 8 were entered by males only (no captures)
 - Individuals in Zones 1, 2, and 8 had much larger proportions of locations outside of 20 nm to a listed site
 - Only in Zone 6 were all locations within 20 nm of a listed site

Publications using these data

- Call et al. (2007). At-sea and on-shore cycles of juvenile Steller sea lions (*Eumetopias jubatus*) derived from satellite dive recorders: A comparison between declining and increasing populations. *Deep Sea Research (Part II, Topical Studies in Oceanography)* 54(3-4): 298-310.
- Fadely et al. (2005). Immature Steller sea lion (*Eumetopias jubatus*) dive activity in relation to habitat features of the eastern Aleutian Islands. *Fisheries Oceanography* 14: 243-258.
- Lander et al. (2009). Regional differences in the spatial and temporal heterogeneity of oceanographic habitat used by Steller sea lions. *Ecological Applications* **19(6): 1645-1659.**
- Loughlin et al. (2003). Diving behavior of immature Steller sea lions (*Eumetopias jubatus*). *Fishery Bulletin* **101: 566-582.**
- Pitcher et al. (2005). Ontogeny of dive performance in pup and juvenile Steller sea lions in Alaska. *Canadian Journal of Zoology-Revue Canadienne De Zoologie* **83(9): 1214-1231.**
- Raum-Suryan et al. (2004). Development of dispersal, movement patterns, and haul-out use by pup and juvenile Steller sea lions (*Eumetopias jubatus*) in Alaska. *Marine Mammal Science* **20(4): 823-850.**

Adult female telemetry

NMML summary

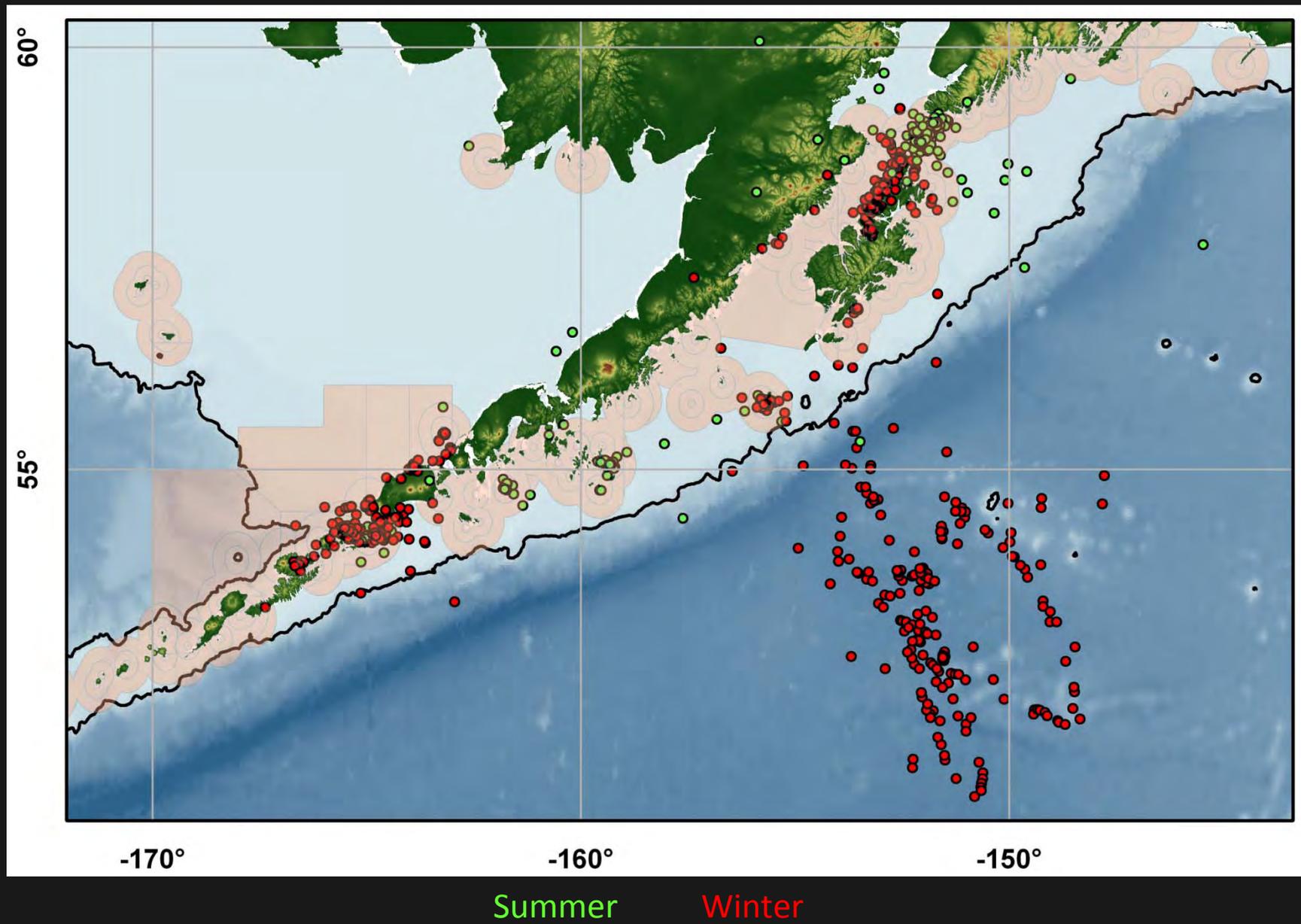
Merrick and Loughlin (1997) Foraging behavior of adult female and young-of-the-year Steller sea lions in Alaskan waters. Can J Zool. 75: 776-786

Loughlin et al. (1998) Diving behavior of adult female Steller sea lions in the Kuril Islands, Russia. Biosphere Cons. 1: 21-31

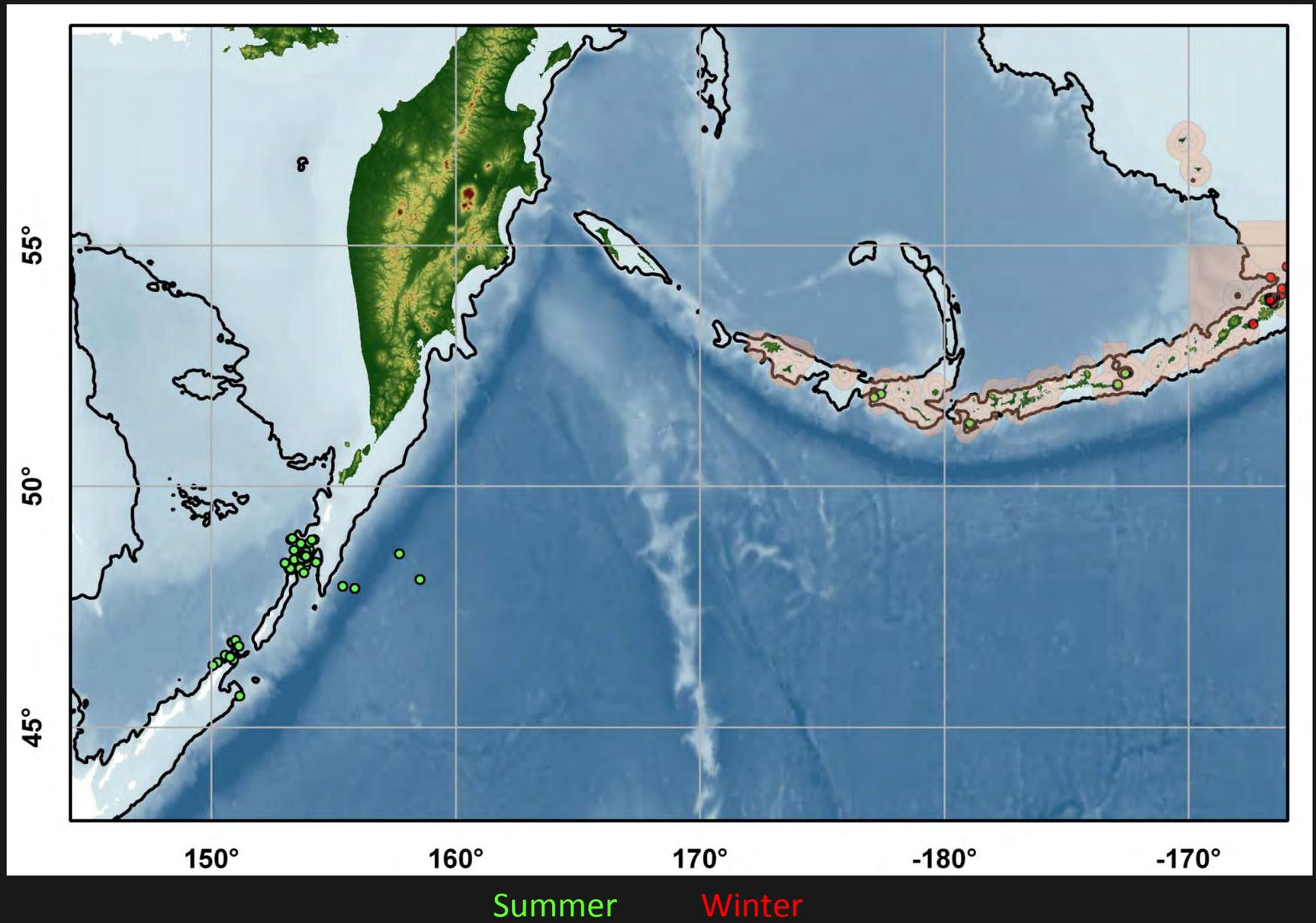
• 8 Russia summer deployments in 1991
 Rehberg et al. (2009) Foraging behavior of adult female Steller sea lions during the breeding season in Southeast Alaska. Mar Mammal Sci 25: 588-604

Year	Rookery	ID	Locations	
			Summer	Winter
1990	Chirikof	1955	13	
		1956	84	
		2130		1
		2131		28
		2132		17
		2133		6
	Hasgox Point	2117	3	
		2118	6	
	Kiska	2119	44	
		Saddleridge	2099	72
	Ugamak	2100	52	
1967		8		
1968		7		
1969		55		
2020		5		
1991	Chirikof	2535	2	
		9978		201
	Pinnacle Rock	2589	4	
		2590	22	
	Puale Bay	9977		7
		The Whaleback	2650	3
	Ugamak	2653		6
		2654		49
1992	Billingshead	2707		245
	Latax Rocks	2706		379
	Sugarloaf	2952	120	
		9987	86	
1993	Atkins	9989	51	

Adult female wDPS Steller sea lion locations: 140-170°W



Adult female Steller sea lion locations: Aleutians/Russia



Steller sea lion telemetry and POP locations

