Cook Inlet Physical Habitat and Beluga Prey Abundance and Distribution

T.M Willette, Department of Fish and Game, Soldotna, Alaska
Cook Inlet Bottom Sediment Distribution

Course sediments generally found in areas with highest current speeds

Fish and invertebrate species assemblages affected by bottom sediment distribution
Cook Inlet
Mean
Circulation

Freshwater surface layer flows out of the inlet along the west side

Surface convergence along rip zones causes downwelling

Gyres west of Kachemak Bay cause nutrient upwelling and increased biological production
Cook Inlet Sediment Transport

Turbid freshwater surface layer flows along the west side

Very high turbidity in shallow areas of the northern inlet

Influx of clear, high salinity water west of Kachemak Bay

Low Primary Production

High Primary Production
**Eulachon Life History**

Mean Age – 3-4 years  
Mean Length – 198 mm  
Mean Body Weight – 60-70 g  
Energy Density – 2.5 kcal/g

Run timing follows ice out at river temperatures between 6-9°C.

Most spawning in Susitna River occurs below the Yentna confluence.

**Susitna River Eulachon Harvests**

<table>
<thead>
<tr>
<th>Year</th>
<th>Pounds</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>300</td>
<td>0.2</td>
</tr>
<tr>
<td>1980</td>
<td>4,000</td>
<td>2.0</td>
</tr>
<tr>
<td>1998</td>
<td>18,610</td>
<td>9.3</td>
</tr>
<tr>
<td>1999</td>
<td>100,000</td>
<td>50.0</td>
</tr>
<tr>
<td>2006</td>
<td>90,783</td>
<td>45.4</td>
</tr>
<tr>
<td>2007</td>
<td>125,044</td>
<td>62.5</td>
</tr>
<tr>
<td>2008</td>
<td>127,365</td>
<td>63.7</td>
</tr>
<tr>
<td>2009</td>
<td>78,258</td>
<td>39.1</td>
</tr>
</tbody>
</table>
Salmon Run Timing in Cook Inlet

Kenai River

Susitna River

Kasilof River

Little Susitna River
Red dots indicate locations in Cook Inlet where salmon escapements are estimated using either sonar or weirs.

Salmon escapement estimates are available for numerous other smaller streams in Cook Inlet.

Offshore Test Fishery provides inseason abundance estimates for salmon runs entering upper Cook Inlet.
Salmon Relative Abundance and Distribution

West side rivers support small Chinook and moderate coho salmon runs

Susitna River supports relatively large runs of all five salmon species

Little Susitna River supports moderately sized runs of pink, chum, and coho salmon

Knik and Turnagin Arm rivers support relatively small runs of all five salmon species
Coho Salmon Distribution in 2002

Mark-recapture estimates of coho salmon abundance in each area are indicated in boxes.

Abundances are in thousands of fish.
Drift Gillnet CPUE and Test Fishery Abundance Estimates

CPUE indicates deviation from average catch per effort in drift gillnet fishery.
Total run of sockeye salmon was estimated from sum of catch and escapement.
Total run of pink, coho, and chum salmon was estimated from Offshore Test Fishery.
Black dots indicate range of mark-recapture abundance estimates for coho and chum salmon.
Yentna River Salmon Abundance

Total salmon abundance is estimated using sonar. Proportions of each species in fish wheel catches are indicated for comparison. Dots indicate mark-recapture abundance estimates for coho (gray) and sockeye (red) salmon.
Susitna Sockeye Salmon Abundances

(Estimated using weirs on three major lake systems in the watershed)
Other Northern Cook Inlet Salmon Abundances

(Estimated using weirs on Little Susitna, Deshka, and Fish Creek, and ground surveys on Jim Creek)
Pacific Herring Biomass in Kamishak Bay
Pandalid Shrimp, Tanner Crab, and Demersal Fish Abundances in Lower Cook Inlet

- **Pandalid Shrimp**
- **Demersal Fish and Inverts**
- **Tanner Crab**

![Graph showing abundances of Pandalid Shrimp, Tanner Crab, and Demersal Fish and Inverts in Lower Cook Inlet from 1975 to 2010. The graph indicates fluctuations in abundance with peaks and troughs at different points in time.](image-url)
Summary

- Strong tidal currents running up the deep channel in the center of the inlet cause formation of tide rips and subsequent downwelling.

- Course bottom sediments are found in areas with strongest currents likely affecting fish and invertebrate species assemblages.

- A turbid, freshwater surface layer flows out along the west side, while clearer, high salinity water flows in along the east side.

- Northern Cook inlet food webs are likely detritus based due to high turbidity.

- Gyres west of Kachemak Bay cause nutrient upwelling and increased biological production.
Summary

- Eulachon biomass in the central Gulf of Alaska has increased and the Susitna eulachon run generally peaks in late May.

- West side rivers support small Chinook and moderate coho salmon runs.

- Susitna River supports relatively large runs of all five salmon species.

- Little Susitna River supports moderately sized runs of pink, chum, and coho salmon.

- Knik and Turnagain Arm rivers support relatively small runs of all five salmon species.

- Coho salmon were most abundant in Susitna River and 3X more abundant in Knik Arm than Turnagain Arm in 2002.
Summary

- Sockeye and coho salmon abundances have generally increased in upper Cook Inlet while chum salmon abundances have decreased.

- Salmon catches in northern Cook Inlet have generally declined due largely to declining fishing effort.

- Kamishak herring biomass has declined from 35,000 tons in the late 1980’s to less than 5,000 tons.

- Pandalid shrimp abundances have declined and demersal fishes (mostly pollock) have increased since the 1980’s in lower Cook Inlet.

- Decadal changes in fish abundance are related to North Pacific climate shifts affecting ocean temperature, zooplankton biomass, and spring plankton bloom timing.