

## **A2. Forage fishes in the Gulf of Alaska**

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### **Executive summary**

The forage fish category in the Gulf of Alaska (GOA) Fishery Management Plan (FMP) contains over sixty species with diverse characteristics (Table 1). Many of the species in this category are rare and poorly sampled with standard survey methods, therefore the exact number and types of species in the forage fish category is not known. Species in the forage fish category have been identified as having ecological importance as prey, and directed fishing is prohibited for the group. Beginning in 2011, forage fishes in the GOA are designated as “Ecosystem Components” in the GOA FMP; as such, they are outside of the specification process and stock assessments are not conducted for this category. Although a full forage fish report has not been prepared since 2008, a lack of new developments and of new data led the Alaska Fisheries Science Center (AFSC) to limit this year’s report to an executive summary. Catch data are updated and there is a brief discussion of two recent developments relevant to GOA forage fishes: 1) the listing of eulachon stocks in northern California, Oregon, Washington, and southern British Columbia as threatened under the Endangered Species Act and 2) progress in implementing the GOA Integrated Ecosystem Research Project (IERP) that is envisioned to enhance our understanding of GOA forage fish abundance, distribution, and ecology.

### **Summary of current forage fish management measures**

In federal waters, management of this group is governed by section 50 CFR 679b20.doc of the federal code. Briefly:

- 1) directed fishing for species in the forage fish category is prohibited
- 2) catches are limited by a maximum retention allowance (MRA) of 2% by weight of the retained target species (Table 10 to 50 CFR part 679)
- 3) processing of forage fishes is limited to fishmeal production.

The regulation applies only to vessels fishing in federal waters, so onshore processors are not affected by the rule. In 1999, the state of Alaska adopted a statute with the same taxonomic groups and limitations (5 AAC 39.212 of the Alaska administrative code), except that no regulations were passed regarding the processing of forage fishes.

### **Overview of status and catch**

The status of forage fish populations in the GOA is difficult to determine, largely because the standard survey gear does a poor job of sampling forage fish species. This is due to their small size and their distribution in pelagic waters and nearshore areas. Biomass estimates for species such as capelin vary widely. Eulachon are likely the best-sampled species due to their slightly larger size and frequent distribution near the seafloor. The 2009 survey biomass estimate for eulachon was higher than the previous survey estimate in 2007, and higher than the long-term average (Table 2). Eulachon are also the main species captured in commercial fisheries (Table 3). Most of this catch occurs in the pollock midwater trawl fishery and peaks dramatically in some years for unknown reasons. Particularly high catches were reported in 2005 and 2008, but have been comparatively low since 2008.

### **New developments**

- 1) Listing of southern Distinct Population Segment of eulachon as threatened

In May 2010 NOAA Fisheries listed the southern Distinct Population Segment (DPS) of eulachon as threatened under the Endangered Species Act. The southern DPS consists of eulachon stocks from the Mad River in northern California to the Skeena River in British Columbia (Figure 1). The inclusion of these stocks in a single DPS was based on several factors, including similarity in genetic markers,

ecological similarities, and common environmental conditions faced by the listed stocks (EBRT 2010). The southern DPS was declared to be at “moderate” risk of extinction due to four main factors (in decreasing order of importance: 1) climate change effects on ocean conditions, 2) climate change effects on freshwater habitats, 3) dams and water diversions in the Columbia and Klamath rivers, and 4) commercial harvesting.

Although Alaskan stocks of eulachon are not included in this listing, two aspects of this decision are of importance to Alaska fisheries management. The main threat to the southern DPS is altered ocean conditions due to climate change. Alaska eulachon stocks face different environmental conditions (and a different oceanographic regime) but may also experience altered ocean conditions. In addition the team that reviewed the southern DPS noted the paucity of data regarding eulachon abundance and harvest and the resulting difficulty in assessing population status and trends. Similar conditions exist in Alaska and have been noted in past forage fish reports.

## 2) GOA IERP begins in 2011

The North Pacific Research Board has funded all components of the GOA IERP. The Middle Trophic Level (or forage) component (led by the author, Ormseth) will use comparative approaches to study the abundance, distribution, habitat preferences, and trophic linkages of GOA forage fishes and juvenile groundfishes. The core of the study is a comparison of southeast Alaska to the central GOA (Kodiak Island and Kenai Peninsula). Field years occur in 2011 and 2013, and the study includes an analysis of retrospective data. More information can be found at: <http://goaierp.nprb.org/>.

## Literature Cited

Eulachon Biological Review Team (2010) Status Review Update for Eulachon in Washington, Oregon, and California. Obtained at <http://www.nwr.noaa.gov/Other-Marine-Species/Eulachon.cfm>.

Table 1. List of scientific and common names of species contained within the forage fish category.

<b>Scientific Name</b>	<b>Common Name</b>
<b><u>Family Osmeridae</u></b>	<b><u>smelts</u></b>
<i>Mallotus villosus</i>	capelin
<i>Hypomesus pretiosus</i>	surf smelt
<i>Osmerus mordax</i>	rainbow smelt
<i>Thaleichthys pacificus</i>	eulachon
<i>Spirinchus thaleichthys</i>	longfin smelt
<i>Spirinchus starksi</i>	night smelt
<b><u>Family Myctophidae</u></b>	<b><u>lanternfish</u></b>
<i>Protomyctophum thompsoni</i>	bigeye lanternfish
<i>Benthoosema glaciale</i>	glacier lanternfish
<i>Tarletonbeania taylora</i>	taillight lanternfish
<i>Tarletonbeania crenularis</i>	blue lanternfish
<i>Diaphus theta</i>	California headlightfish
<i>Stenobranchius leucopsarus</i>	northern lampfish
<i>Stenobranchius nannochir</i>	garnet lampfish
<i>Lampanyctus jordani</i>	brokenline lanternfish
<i>Nannobranchium regale</i>	pinpoint lampfish
<i>Nannobranchium ritteri</i>	broadfin lanternfish
<b><u>Family Bathylagidae</u></b>	<b><u>blacksmelts</u></b>
<i>Leuroglossus schmidti</i>	northern smoothtongue
<i>Lipolagus ochotensis</i>	popeye blacksmelt
<i>Pseudobathylagus milleri</i>	stout blacksmelt
<i>Bathylagus pacificus</i>	slender blacksmelt
<b><u>Family Ammodytidae</u></b>	<b><u>sand lances</u></b>
<i>Ammodytes hexapterus</i>	Pacific sand lance
<b><u>Family Trichodontidae</u></b>	<b><u>sandfish</u></b>
<i>Trichodon trichodon</i>	Pacific sandfish
<i>Arctoscopus japonicus</i>	sailfin sandfish
<b><u>Family Pholidae</u></b>	<b><u>gunnels</u></b>
<i>Apodichthys flavidus</i>	penpoint gunnel
<i>Rhodymenichthys dolichogaster</i>	stippled gunnel
<i>Pholis fasciata</i>	banded gunnel
<i>Pholis clemensi</i>	longfin gunnel
<i>Pholis laeta</i>	crescent gunnel
<i>Pholis schultzi</i>	red gunnel

Table 1 continued. List of scientific and common names of species contained within the forage fish category. Data sources: GOA FMP, “Fishes of Alaska” (Mecklenburg et al. 2002).

<b>Scientific Name</b>	<b>Common Name</b>
<u>Family Stichaeidae</u>	<u>pricklebacks</u>
<i>Eumesogrammus praecisus</i>	fourline snakeblenny
<i>Stichaeus punctatus</i>	arctic shanny
<i>Gymnoclinus cristulatus</i>	trident prickleback
<i>Chirolophis tarsodes</i>	matcheck warbonnet
<i>Chirolophis nugatory</i>	mosshead warbonnet
<i>Chirolophis decoratus</i>	decorated warbonnet
<i>Chirolophis snyderi</i>	bearded warbonnet
<i>Bryzoichthys lysimus</i>	nutcracker prickleback
<i>Bryzoichthys majorius</i>	pearly prickleback
<i>Lumpenella longirostris</i>	longsnout prickleback
<i>Leptoclinus maculatus</i>	daubed shanny
<i>Poroclinus rothrocki</i>	whitebarred prickleback
<i>Anisarchus medius</i>	stout eelblenny
<i>Lumpenus fabricii</i>	slender eelblenny
<i>Lumpenus sagitta</i>	snake prickleback
<i>Acantholumpenus mackayi</i>	blackline prickleback
<i>Opisthocentrus ocellatus</i>	ocellated blenny
<i>Alectridium aurantiacum</i>	lesser prickleback
<i>Alectrias alectrolophus</i>	stone cockscomb
<i>Anoplarchus purpureus</i>	high cockscomb
<i>Anoplarchus insignis</i>	slender cockscomb
<i>Phytichthys chirus</i>	ribbon prickleback
<i>Xiphister mucosus</i>	rock prickleback
<i>Xiphister atropurpureus</i>	black prickleback
<u>Family Gonostomatidae</u>	<u>bristlemouths</u>
<i>Sigmops gracilis</i>	slender fangjaw
<i>Cyclothone alba</i>	white bristlemouth
<i>Cyclothone signata</i>	showy bristlemouth
<i>Cyclothone atraria</i>	black bristlemouth
<i>Cyclothone pseudopallida</i>	phantom bristlemouth
<i>Cyclothone pallida</i>	tan bristlemouth
<u>Order Euphausiacea</u>	<u>krill</u>

Table 2. Gulf of Alaska trawl survey biomass estimates (t) for GOA forage fishes.

	1984	1987	1990	1993	1996	1999	2001	2003	2005	2007	2009
<b>Pacific sand lance</b>											
WGOA	0	2	0	0	1	1	5	2	1	1	0
CGOA	3	13	63	2	5	8	7	8	32	4	2
EGOA	0	0	1	0	0	2		1	0	0	1
<b>total GOA</b>	<b>3</b>	<b>15</b>	<b>64</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>11</b>	<b>33</b>	<b>4</b>	<b>3</b>
<b>Pacific sandfish</b>											
WGOA	12	28	16	69	2	9	6	29	0	0	9
CGOA	1,858	558	329	155	135	22	89	80	383	931	93
EGOA	354	529	377	296	16	542		3,832	75	315	50
<b>total GOA</b>	<b>2,223</b>	<b>1,115</b>	<b>722</b>	<b>520</b>	<b>153</b>	<b>572</b>	<b>94</b>	<b>3,941</b>	<b>458</b>	<b>1,246</b>	<b>152</b>
<b>unidentified</b>											
<b>smelts</b>											
WGOA	1	0	0	92	0	0	0	0	0	0	0
CGOA	0	0	35	30	1	1	0	0	6	2	21
EGOA	0	160	114	81	63	42		231	6	47	43
<b>total GOA</b>	<b>1</b>	<b>160</b>	<b>149</b>	<b>203</b>	<b>64</b>	<b>43</b>	<b>0</b>	<b>231</b>	<b>12</b>	<b>48</b>	<b>65</b>
<b>eulachon</b>											
WGOA	38	1,787	453	2,553	1,444	438	2,867	1,610	195	1,126	654
CGOA	4,767	8,663	19,043	24,172	26,470	11,665	49,061	94,991	40,796	41,184	73,902
EGOA	2,300	5,864	8,493	8,278	4,334	2,587		16,882	14,080	9,486	12,671
<b>total GOA</b>	<b>7,105</b>	<b>16,314</b>	<b>27,988</b>	<b>35,003</b>	<b>32,248</b>	<b>14,690</b>	<b>51,928</b>	<b>113,482</b>	<b>55,071</b>	<b>51,796</b>	<b>87,227</b>
<b>capelin</b>											
WGOA	37	5	0	2	5	34	4	18	2	29	82
CGOA	387	38	136	46	718	102	275	7,272	428	631	295
EGOA	7	8	14	76	755	106		298	586	125	112
<b>total GOA</b>	<b>430</b>	<b>51</b>	<b>151</b>	<b>124</b>	<b>1,479</b>	<b>241</b>	<b>279</b>	<b>7,588</b>	<b>1,015</b>	<b>785</b>	<b>488</b>
<b>pricklebacks</b>											
WGOA	7	0	5	23	19	2	7	10	8	12	58
CGOA	163	9	141	180	100	187	2,001	230	221	1,427	351
EGOA	0	5	3	1	24	28		39	1	1	10
<b>total GOA</b>	<b>170</b>	<b>15</b>	<b>149</b>	<b>205</b>	<b>143</b>	<b>217</b>	<b>2,008</b>	<b>278</b>	<b>231</b>	<b>1,441</b>	<b>419</b>

Table 3. Incidental catch of forage fish catches in GOA groundfish fisheries, 2003-2010. Data are from the Alaska Regional Office Catch Accounting System. GOA subregions indicated in table comprise the following NMFS statistical areas: WGOA, 610; CGOA, 620 and 630; EGOA, 640, 649, 650, 659.

		incidental catch (t) in groundfish fisheries							
	area	2003	2004	2005	2006	2007	2008	2009	2010*
<b>capelin</b>	WGOA	0.70	1.14	0.12	0.00	0.00	0.00	0.01	0.00
	CGOA	5.28	66.2	2.63	0.10	0.00	0.01	0.02	0.02
	EGOA	0.24	0.68	0.09	0.00	0.00	0.00	0.00	0.00
	<b>GOA total</b>	<b>6.22</b>	<b>68.0</b>	<b>2.84</b>	<b>0.11</b>	<b>0.00</b>	<b>0.01</b>	<b>0.03</b>	<b>0.02</b>
<b>eulachon</b>	WGOA	1.26	6.84	37.8	17.6	52.3	160	14.7	31.7
	CGOA	16.7	161	800	378	168	586	208	189
	EGOA	0.15	1.70	14.4	3.52	0.44	11.4	2.78	3.85
	<b>GOA total</b>	<b>18.1</b>	<b>170</b>	<b>852</b>	<b>399</b>	<b>220</b>	<b>757</b>	<b>226</b>	<b>225</b>
<b>other smelts</b>	WGOA	44.3	4.01	11.4	16.6	10.9	113	13.1	1.39
	CGOA	300	62.1	168	155	38.9	262	158	5.30
	EGOA	8.45	0.58	6.51	10.6	0.10	4.52	1.54	0.16
	<b>GOA total</b>	<b>353</b>	<b>66.7</b>	<b>186</b>	<b>182</b>	<b>49.9</b>	<b>380</b>	<b>173</b>	<b>6.84</b>
<b>sand lance</b>	WGOA	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	CGOA	0.00	0.01	0.00	0.01	0.00	0.00	0.19	0.00
	EGOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	<b>GOA total</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.20</b>	<b>0.00</b>
<b>gunnels</b>	WGOA	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
	CGOA	0.01	0.00	0.00	0.02	0.00	0.03	0.00	0.00
	EGOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	<b>GOA total</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.03</b>	<b>0.00</b>	<b>0.04</b>	<b>0.00</b>	<b>0.00</b>
<b>myctophids</b>	WGOA	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	CGOA	0.00	0.00	0.14	0.01	0.00	0.00	0.00	0.00
	EGOA	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	<b>GOA total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.15</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>pricklebacks</b>	WGOA	0.02	0.00	0.96	0.12	0.05	0.00	0.02	0.17
	CGOA	0.47	0.11	1.24	0.78	0.28	0.15	2.74	0.83
	EGOA	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
	<b>GOA total</b>	<b>0.49</b>	<b>0.11</b>	<b>2.20</b>	<b>0.91</b>	<b>0.33</b>	<b>0.15</b>	<b>2.76</b>	<b>1.00</b>

\* 2010 catch data incomplete; retrieved October 10, 2010.

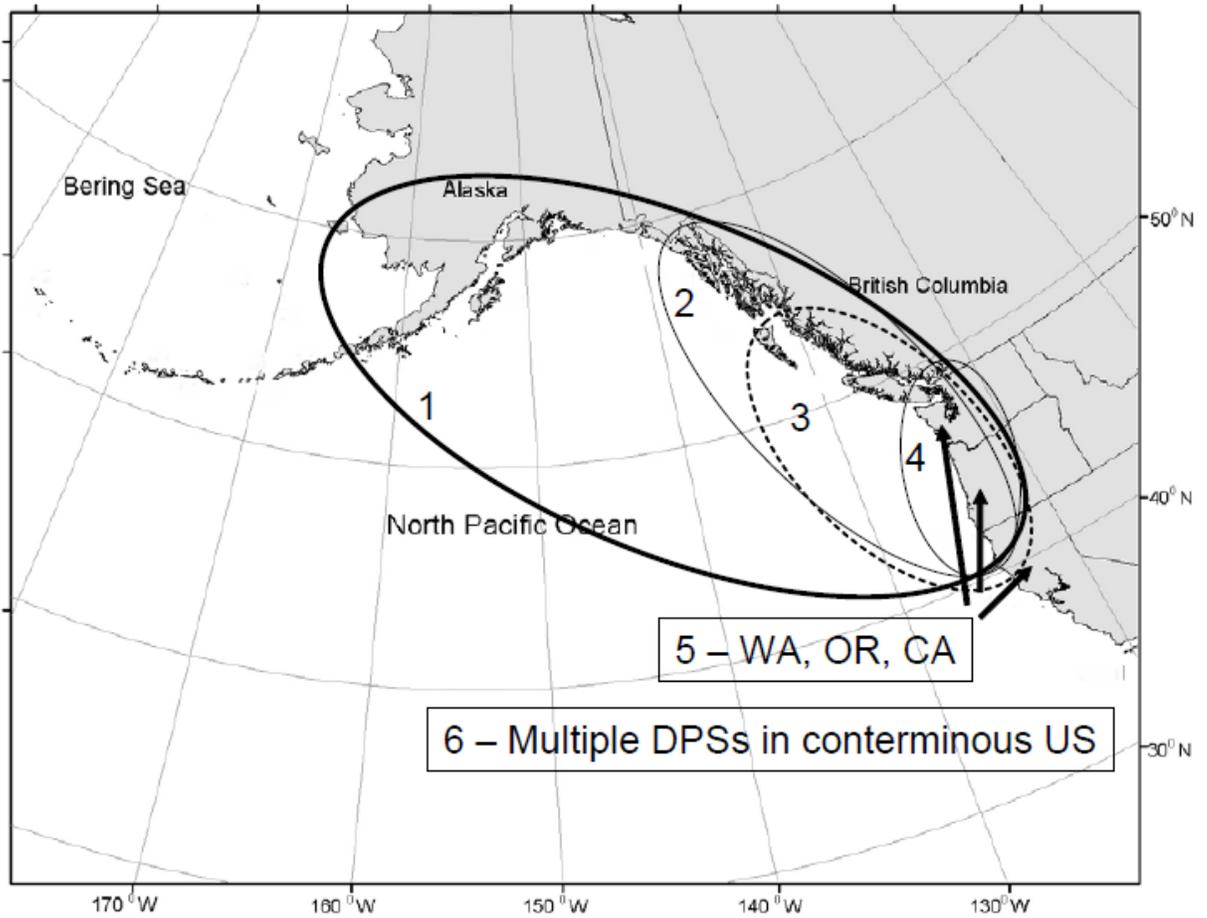


Figure 1. Map showing options for Distinct Population Segments (DPS) of eulachon considered by NOAA Fisheries. Option 3 (dashed line) was deemed to be the most likely boundary of the southern DPS based on genetic analyses and other factors. Map is from EBRT 2010.

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