Appendix 2: 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) includes over fifty species ranging from smelts to euphasiids. These are species that have been identified as important ecosystem components, mainly as prey for other fishes, seabirds, and marine mammals. Directed fishing for forage fishes is prohibited under the FMP, and retention of incidental catches of forage fishes is managed under a maximum retention allowance. Therefore, Annual Catch Limits (ACLs) are not estimated for the forage fish complex. The intent of this document is to review current information on forage fishes and identify future assessment needs. Data on the abundance, distribution, and life histories of forage fish species are still extremely limited. For 2007, the GOA Plan Team requested only a short summary and we only include information on two of the most important forage fish species, capelin (*Mallotus villosus*) and eulachon (*Thaleichthys pacificus*). We also depart from the usual SAFE report format.

Capelin
Capelin is a small (max. length 20 cm) pelagic forage fish distributed throughout the coastal GOA. They are particularly abundant in nearshore areas and in the vicinity of large canyons off the coast of Kodiak Island. Capelin has an entirely marine life cycle, spawning in intertidal areas. There are currently no directed fisheries for capelin in the GOA, and most of the incidental catch of capelin in Alaska occurs in the pollock fisheries (Table 1). Biomass estimates for GOA capelin are highly uncertain. Neither the gear or the sampling location of the AFSC bottom trawl survey are optimized for capelin, and survey biomass estimates (Table 2) are almost certainly low and unreliable. Echo-integration trawl (EIT) surveys conducted by the Alaska Fisheries Science Center (AFSC) resulted in a capelin biomass estimate of 116,000 t in 2003 (Table 3). Capelin biomass estimates from AFSC mass-balance ecosystem models are even higher, at approximately 2 million tons (Table 3). Given the ubiquity of capelin in predator diets it is likely that this latter estimate is a better reflection of capelin biomass in the GOA, but it is clear that reconciling these estimates is critical for monitoring the interaction between capelin and the ecosystem.

Eulachon
Eulachon is slightly larger than capelin (max. length 34 cm) and spawns in freshwater, usually in large glacial river systems with high discharge. The oceanic distribution of eulachon is not well known but it is well-represented in AFSC bottom trawl surveys (Table 2) and is caught incidentally in large numbers (Table 3), primarily in the pollock fisheries. As is the case for Pacific salmon species, the anadromous nature of eulachon potentially exposes it to additional human impacts including habitat disruption. Eulachon are also highly desired as a subsistence food item and because of their high lipid content were historically used as a source of oil for food and light. Subsistence and personal use fisheries in Alaska still remove large amounts of eulachon in southcentral and southeast Alaska. The scale of these removals is unclear. For example, in 2003 the reported personal use harvest (based on sportfish license-holder surveys) of eulachon in the 20-Mile River was 4.6 t, while a simultaneous creel survey estimated a 20-Mile River harvest of 14.9 t (Table 4). In addition, there are no reporting requirements for federally-managed subsistence fisheries. There are directed fisheries in Alaska state waters for eulachon in Upper Cook Inlet, the Copper River area, and in southeast Alaska. There has been little commercial activity in recent years, due to either lack of interest or closures resulting from concerns over diminished spawning runs, but there is potential for substantial amounts of harvest. For example, the annual harvest quota for the Copper River is 272 t, although this fishery is closely monitored as a test fishery and the quota is adjusted based on run strength.

Eulachon biomass estimates are uncertain. Biomass estimates of the Copper River run in 2001, based on larval abundance, were between 2,637 t and 8,108 t depending on assumptions regarding levels of river discharge. This resulted in an estimated range of directed commercial fishery exploitation rates of 0.87-2.99%. In Berners Bay in southeast Alaska, peak abundance during the 2002 spawning run was 139 t although it is unclear how this corresponded to total biomass for that run. Eulachon run strength also appears to fluctuate dramatically among years. The return of spawning eulachon in the Unuk River in southeast Alaska has been extremely low since 2004 and runs in British Columbia rivers have also been weak in recent years. These declines have yet to be explained, but in British Columbia three possible causes have been identified: offshore fishery bycatch, excessive directed fishing, and freshwater habitat destruction.

Tables

Table 1. Fishery incidental catch of capelin and eulachon. Data from the Catch Accounting System at the Alaska Regional Office.

year	2003	2004	2005	2006	2007*
total catch					
capelin (t)	6.2	68.0	2.8	0.1	0.0
eulachon (t)	18.1	169.0	848.1	398.9	162.7

* 2007 estimates as of October 5, 2007.

Table 2. AFSC GOA bottom trawl survey biomass estimates for capelin and eulachon

capelin biomass (t)					eulachon biomass (t)				
	western	central	Eastern	**gulfwide**		western	central	eastern	**gulfwide**
1990	0	136	14	**151**	1990	453	19,043	8,493	**27,988**
1993	2	46	76	**124**	1993	2,553	24,172	8,278	**35,003**
1996	5	718	755	**1,479**	1996	1,444	26,470	4,334	**32,248**
1999	34	102	106	**241**	1999	438	11,665	2,587	**14,690**
2001	4	275		**279**	2001	2,867	49,061		**51,928**
2003	18	7,272	298	**7,588**	2003	1,610	94,991	16,882	**113,482**
2005	2	428	586	**1,015**	2005	195	40,796	14,080	**55,071**
2007	29	631	125	**785**	2007	1,126	41,184	9,486	**51,796**

Table 3. Comparison of 2003 capelin biomass estimates in the GOA.

Method	estimated biomass (t)
bottom trawl survey	7,588
EIT survey[1]	115,978
mass-balance model[2]	2,014,309

[1]Guttormsen, M. A., and P. T. Yasenak. 2007. AFSC Processed Rep. 2007-04, NOAA/NMFS.
[2]S. Gaichas, AFSC, pers. comm..

Table 4. Eulachon harvest (t) in state waters of Alaska. Original data in numbers or pounds converted to metric tons (t) using an average body weight of 60 g or conversion factor 1 lb. = 0.454 kg, respectively. Total harvest figures do not include Unuk River subsistence harvest.

	20-Mile River reported personal use	20-Mile River creel survey personal use	statewide reported personal use	Upper Cook Inlet directed fishery	Copper River directed fishery	Unuk River subsistence and personal use catch	**total minimum state-waters harvest**
1978				0.1			**0.1**
1980				1.8			**1.8**
1986	7.4						**7.4**
1987	7.9						**7.9**
1988	8.4						**8.4**
1989	6.2						**6.2**
1990	8.0						**8.0**
1991	4.2						**4.2**
1992	2.6						**2.6**
1993	1.8						**1.8**
1994	3.0		6.4				**6.4**
1995	2.0		3.2				**3.2**
1996	1.3		3.7				**3.7**
1997	2.3		4.6				**4.6**
1998	2.0		4.8	8.6	78.3		**91.7**
1999	2.7		6.5	45.5	no fishery		**51.9**
2000	0.8		4.7		59.2		**63.9**
2001	2.2		5.1		71	8.5	**76.1**
2002	4.6	14.9	5.8		no fishery	2.1	**5.8**
2003	2.2		4.7		no fishery	8.4	**4.7**
2004	0.6		4.5		16.7	0.7	**21.2**
2005	0.5				no fishery	no fishery	**0.0**
2006				41.3	no fishery	no fishery	**41.3**

Sources:

Jennings, G. B., K. Sundet, and A. E. Bingham. 2007. Participation, catch, and harvest in Alaska sport fisheries during 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-40, Anchorage.

Miller, M.G. and D. Bosch. 2007. Area management report for the recreational fisheries of Anchorage, 2005 and 2006. Alaska Department of Fish and Game, Fishery Management Report No. 07-53, Anchorage

Moffitt, S., Marston, B., and Miller, M. 2002. Summary of eulachon research in the Copper River delta, 1998-2002. Regional Information Report No. 2A02-34. Anchorage: Alaska Department of Fish and Game

Sigler, M.F., Womble, J.N., Vollenweider, J.J. 2004. Can. J. Fish. Aquat. Sci. 61: 1475–1484 (2004)

Spangler, E. K., Spangler, R. E. and B. L. Norcross. 2003. Eulachon subsistence use and ecology investigations. USFWS Office of Subsistence Management, Fisheries Resource Monitoring Program, Final Report No. 00-041, Anchorage, Alaska

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