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POTENTIAL IMPACTS OF FISHERY ENHANCEMENT IN KACHEMAK BAY

Background

Tutka Bay Hatchery releases approximately 60.6 million pink salmon fry into Kachemak Bay every year.[1] Kachemak Bay is both a Critical Habitat Area and a State Park. Once known as the "richest bay in the world," it has experienced the loss of significant stocks of Dungess, tanner and king crab, five species of shrimp, wild salmon and herring; halibut quotas for sport fishermen in 2020 are slated to be reduced by 40%.

When the Tutka Bay hatchery first started operations, like hatcheries all over the State of Alaska, it was meant to rehabilitate depressed stocks.[2] Because hatcheries were new, release sizes, stock sources, and operation sites were experimental. At the outset, Tutka Bay hatchery's releases were relatively similar to the sizes of the natural run (stream surveys that took place three years before hatchery releases began estimate returns of 14,500 fish to Tutka Lagoon Creek; returns remained in that range until the early 90s;[3] however, the release of an average of 60.6 million fish every year between 1995 and 2017[4] represents a shift in purpose and scope of impact from the initial intent of rehabilitation. Operations now possibly exceed the carrying capacity of the waters of Kachemak Bay.

In this respect, Tutka Bay is not unique; hatchery fish in Alaska are seldom released in numbers that are related to the carrying capacity of the receiving stream.[5] Additionally, Tutka Lagoon Creek may experience over-escarpment of hatchery stocks that may be detrimental to wild stocks: escapement numbers at Tutka Lagoon Creek are variable, but in some years can be 10

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[1] http://ciaanet.org/data/

[2] 1974 The Hatchery Act was created for "…the purpose of contributing, by artificial means, to the rehabilitation of the states depleted and depressed salmon fishery. The program SHALL be operated without adversely affecting natural stocks of fish in the State and under a policy of management which allows reasonable segregation of hatchery reared salmon from naturally occurring stocks."

[3] Fishery Management Report No. 17-26 2016 "Lower Cook Inlet Area Finfish Management Report" by Glenn Hollowell Edward O. Otis and Ethan Ford, ADF&G, p. 81. See appended for data table.

[4] *Ibid,* p. 150.

[5] "Evaluating Alaska's Ocean-Ranching Salmon Hatcheries: Biologic and Management Issues" Prepared by Environment and Natural Resources Institute, University of Alaska Anchorage, 2001, p. 18.

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times more than the suggested goals of 6,500-17,000 fish; for example, escapement in 1997 was 45,000 fish; in 2005 escapement was 133,600, and in 2015 escapement was 81,600 fish.

Do Alaskans Benefit?

The hatchery has not been a benefit to many people, though it has been a significant benefit to a few. By far the largest beneficiary of the Tutka Bay Hatchery is Cook Inlet Aquaculture itself. According to Cook Inlet Aquaculture's Annual Reports and ADF&G, between 1996 and 2017, the hatchery harvested 82% of the total pink salmon harvest, and commercial common property harvesters captured 18% of the total.[6]

Competition, Predation, and Straying

The Tutka Bay hatchery pink salmon releases that are orders of magnitude larger than historic wild salmon in the bay very likely reduce areas available for public enjoyment by reducing fitness and productivity of species that are important sources of subsistence and recreation including King, Tanner and Dungeness crab, halibut, shrimp, herring, Pacific cod, clams, and muscles, which juvenile pink salmon are known to either compete with or predate upon these

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[6] http://ciaanet.org/data/ and ADF&G's "2016 Lower Cook Inlet Area Finfish Management Report," (p. 149) Online at: http://www.adfg.alaska.gov/FedAidPDFs/FMR17-26.pdf. See appendix for relevant tables.

species.[7] [8] [9] [10] Furthermore, Pink salmon are known to stay in Kachemak Bay throughout the summer,[11] so the scope of potential impacts are highly significant.

Second, hatchery fish are not as fit as wild fish, and recent ADFG studies show that hatchery pink salmon progeny have about 50% less likely to survive than wild progeny.[12] When hatchery fish mate with wild fish there are significant losses to genetic variation in the total population and also significant losses to the fitness of the wild population. See the following for a discussion of hatchery straying and impacts to wild salmon genetic diversity and fitness:

- https://www.adfg.alaska.gov/static/fishing/PDFs/hatcheries/research/2016_nprb_final_report.pdf
- https://www.adfg.alaska.gov/static/fishing/PDFs/research/genetics_finfish_policy.pdf
- https://link.springer.com/article/10.1007/s10641-012-9975-7
- http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081916
- https://www.researchgate.net/publication/5909528_An_Evaluation_of_the_Effects_of_Conservation_and_Fishery_Enhancement_Hatcheries_on_Wild_Populations_of_Salmon1

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7 "Recent studies in Prince William Sound found Dungeness crab megalopolis composed 35% to 65% of the stomach contents of pink salmon." ("Evaluating Alaska's Ocean-Ranching Salmon Hatcheries: Biologic and Management Issues" Prepared by Environment and Natural Resources Institute, University of Alaska Anchorage, 2001, p. 21).

8 Juvenile Pink salmon have been shown have flexibility in feeding on a diverse spectrum of prey types. ("Diet Composition and Feeding Behavior of Juvenile Salmonids Collected in the Northern Bering Sea from August to October, 2009–2011" by Mary E. A. Cook and Molly V. Sturdevant *North Pacific Anadromous Fish Commission Technical Report* No. 9: 118-126, 2013).

9 "A History of the Research on the Early Marine Life of Pacific Salmon Off Canada's Pacific Coast" by Richard J. Beamish, Isobell A. Pearsall, and Mike C. Healey in *N. Pac. Anadr. Fish Comm. Bull. 3*: 1–40.

10 "Historical Diets of Forage Fish and Juvenile Pacific Salmon in the Strait of Georgia, 1966–1968" by Geoffrey J. Osgood, Laura A. Kennedy, Jessica J. Holden, and Eric Hertz. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 8:580–594, 2016. Published with license by the American Fisheries Society

11 The 1993 *Kachemak Bay and Fox River Flats Critical Habitat Areas Management Plan* states, "Nearshore waters in Seldovia Bay serve as a rearing area for pink, coho and king juvenile salmon. Pink and chum fry rear in Tutka Bay for most of the summer. Pink fry and sockeye smelt rear in China Poot Bay in late spring and summer. Pink fry rear in Halibut Cove Lagoon in early summer" (A-11).

12 See Final Grant Reports at https://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.findings_updates. See also ADFG Genetic Policy.

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Assessment of the scope of impacts of straying, competition, and predation of hatchery operation to the flora and fauna of to wild populations in Kachemak Bay would have to begin with the following questions:

- Where do hatchery juvenile and adult salmon go in Kachemak Bay?[13]
- How long are hatchery juvenile salmon and returning adults in Kachemak Bay?
- What are they eating in the nearshore environment?[14] [15]
- How much are they eating in the nearshore environment?
- How does the volume and quality of the hatchery salmon diet affect the flora, fauna of the Kachemak Bay State Park and Critical Habitat Area?
- What is the carrying capacity of the waters of the state park where the hatchery fry and adults are found?

Discharges into Alaskan Waters

According to telephone communications with DEC Seafood Processing Lead Clynda Case and Jackie Ebert, Environmental Specialist IV, **there is no historical record of any reporting from Tutka Bay Hatchery to DEC on effluent discharges, receiving water body quality, or the benthos below the net pens or in in the carcass dumping grounds, or on water flow at the net pens or at the carcass dumping site.**[16] Sadly, Tutka Bay is not alone; there is little to know

[13] The 1993 *Kachemak Bay and Fox River Flats Critical Habitat Areas Management Plan* states "Nearshore waters in Seldovia Bay serve as a rearing area for pink, coho and king juvenile salmon. Pink and chum fry rear in Tutka Bay for most of the summer. Pink fry and sockeye smelt rear in China Poot Bay in late spring and summer. Pink fry rear in Halibut Cove Lagoon in early summer" (A-11). This is old research and needs to be updated, but the fact that pink fry rear in Tutka Bay for most of the summer suggests that impacts of hatchery releases would be significant. Further research on where hatchery pinks go when they return is needed.

[14] "Recent studies in Prince William Sound found Dungeness crab megalopolis composed 35% to 65% of the stomach contents of pink salmon." ("Evaluating Alaska's Ocean-Ranching Salmon Hatcheries: Biologic and Management Issues" Prepared by Environment and Natural Resources Institute, University of Alaska Anchorage, 2001, p. 21). This and other diet work indicates that pink salmon predate upon or compete with King and Tanner and Dungeness crab, halibut, shrimp, herring, Pacific cod, clams, and muscles.

[15] Juvenile Pink salmon have been shown have flexibility in feeding on a diverse spectrum of prey types. ("Diet Composition and Feeding Behavior of Juvenile Salmonids Collected in the Northern Bering Sea from August to October, 2009–2011" by Mary E. A. Cook and Molly V. Sturdevant *North Pacific Anadromous Fish Commission Technical Report* No. 9: 118-126, 2013).

[16] According to the factsheet accompanying the draft discharge permit, AKG130000: "DEC does not have historical monitoring data from hatcheries needed to conduct a RPA [reasonable potential analysis]. The general permit requires hatcheries to monitor for several water quality parameters (TSS, SS, pH, ammonia, DO, and chlorine) to generate data for use in conducting a RPA during the next permit cycle."

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reporting to DEC from any hatchery in the State of Alaska for the entire history of operation—over 40 years.

In 2017, citizens recorded dissolved oxygen readings below 2 mg/L at depths of 6 and 10 meters in Tutka Bay Lagoon. Several readings between 4-6 mg/L were also recorded. These are clearly unacceptable levels.[17] We are concerned that there is insufficient flushing in the lagoon, driving down dissolved oxygen; the same lack of flushing in the lagoon can lead to contamination as a result of organic wastes, such as excess feed, fish feces and urine, including significant concentrations of chemicals characteristically found in commercial fish food: PCBs, organchlorine pesticides, brominated diphenyl ethers, PAHs and mercury. These concerns were all cited in the Alaska Department of Natural Resources Director's Determination to deny carcass dumping in the State Park, Special Park Use Permit (LAS 29920) .

Hypernutrification due to salmon farming is problematic in fjords and basins, like Tutka Bay, because they tend to be characterized by low flushing rates and therefore may be sensitive to organic waste loadings.[18] Hypernutrification leads to anoxic conditions that basically smother all life at the bottom of the basin, which include crab, shrimp and other shellfish.

A primary contamination concern related to aquaculture involves the organic wastes produced by salmon hatcheries. Types of waste include excess feed, fish feces and urine, fish carcasses and biofouling.[19] A recent pilot study conducted in British Columbia found that commercial feed used in salmon hatcheries had significant concentrations of PCBs, organchlorine pesticides, brominated diphenyl ethers, PAHs and mercury.[20] Persistent contaminants in fish food are of concern since these chemicals are known to bioaccumulate.[21] Health officials say PCBs pose a danger even in tiny amounts: in addition to causing cancer, PCBs can affect brain development and mimic the hormone estrogen.[22] The State of Washington has enacted a law requiring state agencies to purchase PCB-free products or the best alternative.

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[17] https://buoybay.noaa.gov/news/summertime-dissolved-oxygen-levels-what-do-they-mean-for-fish-and-fishermen

[18] "Ecological Criteria Used to Help Site Fish Farms in Fjords" by C. D. Levings, A. Ervik, P. Johannessen and J. Aure. *Estuaries*, Vol. 18, No. 1 (Mar., 1995), pp. 81-90.

[19] "Marine Environmental Quality in the Central Coast of British Columbia, Canada: A Review of Contaminant Sources, Types and Risks" Canadian Technical Report of Fisheries and Aquatic Sciences 2507, 2003, p. 41. Online at: http://www.dfo-mpo.gc.ca/Library/278588.pdf

[20] *Ibid*, p. 44.

[21] *Ibid.*

[22] http://www.spokesman.com/stories/2016/jan/20/fish-hatchery-suspected-as-a-source-of-pcbs-in-the/

In 2017, Cook Inlet Aquaculture "disposed" of 267,913 dead fish (868,038 lbs.) in Tutka Bay, after removing their row to hatch the next year's brood stock.[23] DEC currently permits discharges from the Tutka Bay Lagoon Hatchery under an Alaska Pollutant Discharge Elimination System General Permit to Aquaculture Facilities in Alaska, Permit No. AKG130000. This permit only requires that receiving waters be sampled by operators once a year, at a time and location chosen by the operator.[24] Receiving waters at the site of the carcass dump are not required to be monitored.[25] No data is being collected on what the Clean Water Act, section 117 calls the living resources of the site: "grasses, benthos, phytoplankton, zooplankton, fish, and shellfish" except immediately below the pens. There are no random visitations on the part of DEC to verify accurate reporting.

[23] "2017 Tutka Annual Report - Final Corrected" by CIIAA. Online at http://ciaanet.org/data/.

[24]Alaska Pollutant Discharge Elimination System General Permit to Aquaculture Facilities in Alaska. Permit No. AKG130000, pp. 8-10.

[25] *Ibid*.

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Appendix:

1) Pink salmon release numbers have grown significantly in Tutka Bay: Tutka Bay Lagoon Hatchery had an initial capacity of 10 million pink salmon eggs, but major renovation work in 1993-1994 increased the physical capacity to 150 million eggs.[26]

Appendix A8.–Estimated pink and chum salmon escapements in thousands of fish for the major spawning systems in the Southern District of the Lower Cook Inlet Area, 1975–2016.

	Pink salmon							Chum salmon
	Humpy Creek	China Poot Creek	Tutka Lagoon Creek	Barabara Creek	Seldovia River	Port Graham River	Total pink salmon escapement	Port Graham River
1975	64.0	21.6	17.6	22.7	36.2	27.3	189.4	3.0
1976	27.2	2.0	11.5	0.2	25.6	6.5	73.0	0.4
1977	86.0	3.9	14.0	5.7	35.7	20.6	165.9	5.2
1978	46.1	11.2	15.0	1.4	24.6	6.7	105.0	4.8
1979	200.0	20.6	10.6	10.0	43.7	32.7	317.6	2.2
1980	64.4	12.3	17.3	5.8	65.5	40.2	205.5	1.1
1981	115.0	5.0	21.1	16.8	62.7	18.4	239.0	4.8
1982	31.9	3.1	18.5	2.1	38.4	28.9	122.9	2.5
1983	104.0	14.1	12.9	14.8	27.9	4.6	178.3	1.9
1984	84.2	8.4	10.5	1.0	14.2	10.9	129.2	2.1
1985	117.0	1.9	14.0	1.6	22.8	26.3	183.6	0.5
1986	49.7	11.5	13.4	1.8	28.2	17.5	122.1	0.6
1987	26.6	3.1	4.8	0.3	7.6	3.8	46.2	1.5
1988	21.4	3.9	11.2	0.7	16.9	7.9	62.0	3.0
1989	93.0	8.5	11.9	4.5	26.2	19.1	163.2	1.3
1990	27.0	4.2	38.5	3.9	27.8	20.1	121.5	2.6
1991	17.4	2.6	16.8	10.9	30.0	29.0	106.7	1.1
1992	14.9	4.1	26.7	2.2	14.7	5.4	68.0	1.4
1993	36.0	1.6	27.4	11.9	43.4	12.8	133.1	2.5
1994	14.1	5.7	14.5	4.5	24.4	7.6	70.8	5.2
1995	89.3	2.0	15.9	10.8	48.5	10.0	176.5	3.8
1996	9.0	2.8	3.5	2.4	17.8	7.0	42.5	3.7
1997	78.3	2.8	45.0	12.5	39.1	12.5	190.2	4.1
1998	17.5	5.7	17.5	2.8	31.5	12.6	87.6	5.1
1999	12.8	0.7	27.9	3.9	12.2	9.7	67.2	6.6
2000	22.4	7.5	19.0	5.6	53.5	15.6	123.6	11.4
2001	30.5	6.6	4.5	2.3	12.3	10.3	66.5	6.0
2002	37.1	6.5	15.9	3.2	26.9	58.5	148.1	5.3
2003	90.9	6.7	30.9	5.1	35.1	14.9	183.6	2.9
2004	28.9	3.3	17.8	5.4	56.8	44.0	156.2	1.2
2005	93.8	9.2	133.6	14.4	98.6	69.1	418.7	0.7
2006	48.4	7.2	25.8	3.6	70.0	31.2	186.2	2.2
2007	54.0	6.2	5.7	25.2	69.4	25.6	186.1	1.9
2008	90.9	5.1	14.1	16.6	53.5	24.7	204.9	1.8
2009	5.2	1.1	3.8	2.6	14.6	14.0	41.3	1.0
2010	70.7	2.2	2.1	13.9	25.9	16.6	131.5	1.4
2011	1.7	3.5	22.0	8.2	46.2	20.9	102.4	1.8
2012	67.9	8.4	10.4	1.4	44.7	34.5	167.3	0.7
2013	6.7	7.1	9.5	17.4	36.8	11.9	89.5	1.9
2014	44.4	1.4	10.2	3.6	35.9	32.3	127.7	3.7
2015	38.0	7.4	81.6	25.2	108.8	82.4	343.3	4.0
Previous 10-yr average	42.8	5.0	18.5	11.8	50.6	29.4	158.0	2.1
2016	89.7	0.7	33.2	2.8	15.7	14.6	156.7	2.4

Note: Area-under-the-curve escapement indices are derived from periodic ground surveys with a 17.5 day stream-life factor applied.

From Fishery Management Report No. 17-26 2016 "Loer Cook Inlet Area Finfish Management Report" by Glenn Hollowell Edward O. Otis and Ethan Ford, ADF&G, (p. 150).

[26] Fishery Management Report No. 17-26 2016 "Lower Cook Inlet Area Finfish Management Report" by Glenn Hollowell Edward O. Otis and Ethan Ford, ADF&G, (p. 20).

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2) As can be seen below, escapement numbers at Tutka Lagoon Creek are variable, but in some years can be 10 times more than the suggested escapement goals of 6,500-17,000 fish, eg. 133,600 fish in 2005, 81,600 fish in 2015, 45,000 fish in 1997.

Appendix F7.–Tutka Bay Lagoon Hatchery salmon releases, 1977–2016.

Year released	Sockeye	Pink	Chum
1977	91,347 [a]	318,280 [a]	
1978	400,000 [a]	4,820,937 [a]	
1979		9,243,717 [a]	732,000 [a]
1980		6,795,244 [a]	5,872 [a]
1981		10,268,753 [a]	7,992 [a]
1982		15,475,435 [a]	15,440 [a]
1983		15,232,750 [a]	1,117,745 [a]
1984		18,142,463 [a]	140,500 [a]
1985		23,537,000 [a]	9,777 [a]
1986		26,234,600 [a]	18,000 [a]
1987		8,240,700 [a]	445,700 [a]
1988		15,589,360 [a]	3,211,200 [a]
1989		36,977,190 [a]	2,164,393 [a]
1990	355,347 [a]	36,684,662 [a]	1,508,557 [a]
1991		30,000,000 [a]	
1992		31,950,000 [a]	
1993		48,700,000 [a]	
1994		61,100,000 [a]	
1995		63,000,000 [a]	
1996	75,000 [a]	105,000,000 [a]	
1997	245,000 [a]	89,000,000 [a]	
1998		90,000,000 [a]	
1999	100,000 [a]	60,132,000 [a]	
2000		65,120,870 [a]	
2001		99,336,410 [a]	
2002		99,371,000 [a]	
2003		67,967,000 [a]	
2004		47,964,360 [a]	
2005	[b]		
2006	[b]		
2007	[b]		
2008	[b]		
2009	[b]		
2010	[b]		
2011	[b]		
2012	[b]	11,246,399 [a]	
2013		18,603,000 [c]	
2014		51,298,000 [c]	
2015		12,274,240 [c]	
2016		11,433,515 [c]	

[a] No thermal marking.
[b] Sockeye salmon fry reared and thermally marked at Trail Lakes Hatchery, remote released as smolt at Tutka Bay Hatchery. Release numbers are included in releases for Trail Lakes Hatchery.
[c] Thermally marked.

From Fishery Management Report No. 17-26 2016 "Lower Cook Inlet Area Finfish Management Report" by Glenn Hollowell Edward O. Otis and Ethan Ford, ADF&G, (p. 81).

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3) This augmentation of the CHA ecosystem does not benefit the public, especially in comparison to benefits garnered by the hatchery administration. If you run the numbers on the statistics below, you will find that between 1993 and 2017, *the hatchery harvested 82% of the total pink salmon harvest, while commercial common property harvesters captured 18% of the total.*

Appendix F6.–Estimated historical harvest contributions and total runs of pink salmon to greater Cook Inlet hatchery release sites, 1978–2016.

Return Year	Brood year	Fry release	Hatchery contribution to the ccpf	Hatchery contribution cost recovery	Hatchery contribution broodstock esc.	Hatchery donated	Total hatchery run	Estimated marine survival
1978	1976	318,280			3,700		3,700	1.16%
1979	1977	4,820,937			369,000		369,000	7.65%
1980	1978	9,243,717			315,000		315,000	3.41%
1981	1979	6,795,244	963,350		47,279		1,010,629	14.87%
1982	1980	10,268,753	181,400		4,400		185,800	1.81%
1983	1981	15,475,435	577,200				577,200	3.73%
1984	1982	15,232,750	230,000				230,000	1.51%
1985	1983	18,142,463	463,600				463,600	2.56%
1986	1984	23,818,500	380,135	55	50		380,240	1.60%
1987	1985	26,265,176	84,500				84,500	0.32%
1988	1986	8,278,967	836,000				836,000	10.10%
1989	1987	15,589,360	877,600				877,600	5.63%
1990	1988	36,977,190	167,400				167,400	0.45%
1991	1989	36,974,370	204,800				204,800	0.55%
1992	1990	30,602,576	97,577	276,000	69,000		442,577	1.45%
1993	1991	33,760,487	228,376	409,431	102,000		739,807	2.19%
1994	1992	48,700,000	604,037	959,064	153,966		1,717,067	3.53%
1995	1993	62,395,000	1,210,572	1,213,322	182,348		2,606,242	4.18%
1996	1994	63,358,000	19,510	423,306	140,152		582,968	0.92%
1997	1995	111,469,975	172,262	2,465,108	188,197		2,825,567	2.53%
1998	1996	89,918,000	507,850	787,538	175,468		1,470,856	1.64%
1999	1997	90,000,000	222,228	857,902	151,903		1,232,033	1.37%
2000	1998	64,797,691	8,580	1,043,705	269,808		1,322,093	2.04%
2001	1999	66,287,812	108,735	421,530	198,148		728,413	1.10%
2002	2000	126,635,207	9,791	1,041,529	252,777		1,304,097	1.03%
2003	2001	105,971,985	2,924	616,155	261,457	590	881,126	0.83%
2004	2002	125,167,000	1,523	2,459,189	117,222		2,577,934	2.06%
2005	2003	84,247,031	4,779	2,138,538	84,088		2,227,405	2.64%
2006	2004	26,567,983	5,000	246,781	27,741		279,522	1.05%
2007	2005	13,883,682		112,801			112,801	0.81%
2008	2006	13,282,049						
2009	2007							
2010	2008							
2011	2009							
2012	2010							
2013	2011	11,246,399		48,017	143,884		191,901	1.71%
2014	2012	18,603,000		32	28,739		28,771	0.15%
2015	2013	51,298,000		2,087,024	165,008		2,252,032	4.39%
2016	2014	14,474,300	14,750	23,776	127,771	404	166,701	1.15%
2017	2015	12,744,276						

Note: Harvest estimates of hatchery fish are from CIAA. CCPF = Commercial Common Property Fleet.

From ADF&G's "2016 Lower Cook Inlet Area Finfish Management Report," (p. 149).

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5 AAC 39.222. Policy for the management of sustainable salmon fisheries states: "…(5) in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats shall be managed conservatively as follows: (A) a precautionary approach, involving the application of prudent foresight that takes into account the uncertainties in salmon fisheries and habitat management, the biological, social, cultural, and economic risks, and the need to take action with incomplete knowledge, should be applied to the regulation and control of harvest and other human-induced sources of salmon mortality; a precautionary approach requires (i) consideration of the needs of future generations and avoidance of potentially irreversible changes; (ii) prior identification of undesirable outcomes and of measures that will avoid undesirable outcomes or correct them promptly; (iii) initiation of any necessary corrective measure without delay and prompt achievement of the measure's purpose, on a time scale not exceeding five years, which is approximately the generation time of most salmon species; (iv) that where the impact of resource use is uncertain, but likely presents a measurable risk to sustained yield, priority should be given to conserving the productive capacity of the resource; (v) appropriate placement of the burden of proof, of adherence to the requirements of this subparagraph, on those plans."

AS 16.20.500 Purpose of Kachemak Bay and Fox River Flats Critical Habitat Areas is to protect and preserve habitat areas especially crucial to the perpetuation of fish and wildlife, and to restrict all other uses not compatible with that primary purpose.