SB

13

FISCAL NOTE

STATE OF ALASKA
1999 LEGISLATIVE SESSION

BILL NO. SB 13

Revision Date/Time (Note if correction)		Dept. Affected	Fish and Game
Title	DISCRETE SALMON STOCK MGMT AND ASSESSMENT	BRU	Administration and Support
		Component	Administrative Services
Sponsor	Senator Halford		
Requester	Senate Resources	Component Serial No.	479

Expenditures/Revenues (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

OPERATING EXPENDITURES	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Personal Services						
Travel						
Contractual						
Supplies						
Equipment						
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0
CAPITAL EXPENDITURES						
CHANGE IN REVENUES ( )	97.2	268.9	268.9	268.9	268.9	268.9

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF						
1005 GF/Program Receipts						
1037 GF/Mental Health						
Other (Specify Type)						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY99) cost: 0.0

POSITIONS

Full-time						
Part-time						
Temporary						

ANALYSIS: *(Attach a separate page if necessary)*

The Department of Fish and Game administers the commercial crewmember licensing system. The estimates of the revenue that would be raised by the $10 surcharge proposed in SB 13 are based on the following information. During 1997, 28,421 crew member licenses were sold. In 1998 25,367 licenses were sold. Averaging these years, we estimate that $268.9 would be raised annually by the surcharge on crew member licenses, beginning in FY2001. For fiscal year 2000, we estimate that $97.2 would be generated based on the average number of licenses sold between January 1 and June 30 in 1997 and 1998.

Prepared by	Geron Bruce CBrooks Director of Admin	Phone	465-6143
Division	Commissioner's Office	Date/Time	2/9/99 12:07 PM
Approved by Commissioner	Frank Rue	Date	2/9/99
Agency	Fish and Game		

PREPARER TO PROVIDE ALL DISTRIBUTION COPIES TO GOVERNOR'S LEGISLATIVE OFFICE

For further distribution information, call the Governor's Legislative Office

(Rev 10/98) 99mform xls/OMB

FISCAL NOTE

STATE OF ALASKA
1999 LEGISLATIVE SESSION

BILL NO. SB 13

Revision Date/Time (Note if correction)		Dept. Affected	Fish and Game
Title	DISCRETE SALMON STOCK MGMT AND ASSESSMENT	BRU	Sport Fish
		Component	Sport Fish
Sponsor	Senator Halford		
Requester	Senate Resources	Component Serial No.	464

Expenditures/Revenues (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

OPERATING EXPENDITURES	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Personal Services		410.0	410.0	410.0	410.0	410.0
Travel		18.0	18.0	18.0	18.0	18.0
Contractual		29.0	29.0	29.0	29.0	29.0
Supplies		29.0	29.0	29.0	29.0	29.0
Equipment		14.0	14.0	14.0	14.0	14.0
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	0.0	500.0	500.0	500.0	500.0	500.0
CAPITAL EXPENDITURES						
CHANGE IN REVENUES ( )	0.0	0.0	0.0	0.0	0.0	0.0

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts		300.0	300.0	300.0	300.0	300.0
1003 GF Match						
1004 GF						
1005 GF/Program Receipts						
1037 GF/Mental Health						
Other Fish and Game Fund 1024		200.0	200.0	200.0	200.0	200.0
TOTAL	0.0	500.0	500.0	500.0	500.0	500.0

Estimate of any current year (FY99) cost: 0.0

POSITIONS

Full-time		5	5	5	5	5
Part-time		2	2	2	2	2
Temporary						

ANALYSIS: *(Attach a separate page if necessary)*

The revenue to pay for the discrete stock assessments will come from increases in certain sport fishing licenses fees contained in HCS CSSB 7(FIN), CHAPTER 74 SLA 97 and Federal Aid funds.

Prepared by	Geron Bruce	Phone	465-6185
Division	Commissioner's Office	Date/Time	2/9/99 3:26 PM
Approved by Commissioner	Frank Rue	Date	2/9/99
Agency	Department of Fish and Game		

PREPARER TO PROVIDE ALL DISTRIBUTION COPIES TO GOVERNOR'S LEGISLATIVE OFFICE

For further distribution information, call the Governor's Legislative Office

(Rev 10/98) 99fnform xls/OMB

FISCAL NOTE

STATE OF ALASKA
1999 LEGISLATIVE SESSION

BILL NO. SB 13

Revision Date/Time (Note if correction)		Dept. Affected	Fish and Game
Title	DISCRETE SALMON STOCK MGMT AND ASSESSMENT	BRU	Commercial Fisheries
		Component	All Regional Fisheries management components and Headquarters
Sponsor	Senator Halford		
Requester	Senate Resources	Component Serial No.	2167/2168/2169/2170/2171

Expenditures/Revenues (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

OPERATING EXPENDITURES	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Personal Services		630.5	630.5	630.5	630.5	630.5
Travel		31.0	31.0	31.0	31.0	31.0
Contractual		46.2	46.2	46.2	46.2	46.2
Supplies		46.2	46.2	46.2	46.2	46.2
Equipment		15.0	15.0	15.0	15.0	15.0
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	0.0	768.9	768.9	768.9	768.9	768.9
CAPITAL EXPENDITURES						
CHANGE IN REVENUES ( )		0.0	0.0	0.0	0.0	0.0

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF		268.9	268.9	268.9	268.9	268.9
1005 GF/Program Receipts		500.0	500.0	500.0	500.0	500.0
1037 GF/Mental Health						
Other (Specify Type)						
TOTAL	0.0	768.9	768.9	768.9	768.9	768.9

Estimate of any current year (FY99) cost: 0.0

POSITIONS

Full-time		8	8	8	8	8
Part-time		2	2	2	2	2
Temporary						

ANALYSIS: *(Attach a separate page if necessary)*

Revenues to fund expenditures for stock assessment and escapement enumeration required in SB 13 in this BRU will come from the $10 surcharge on crew member licenses and the surcharge on salmon limited entry permits permits. Expenditures by component will vary based on the research needs identified by the board and the projects selected by the department to address those research needs.

Prepared by: Geron Bruce [signature], for Director of C.F. — Phone: 465-6143
Division: Commissioner's Office — Date/Time: 2/9/99 3:26 PM
Approved by Commissioner Frank Rue [signature] for — Date: 2/9/99
Agency: Fish and Game

PREPARER TO PROVIDE ALL DISTRIBUTION COPIES TO GOVERNOR'S LEGISLATIVE OFFICE
For further distribution information, call the Governor's Legislative Office

FISCAL NOTE

STATE OF ALASKA **BILL NO.** SB 13
1999 LEGISLATIVE SESSION

Revision Date/Time (Note if correction)		Dept. Affected:	Fish and Game
Title	An Act relating to assessment of discrete salmon stocks discrete salmon stock assessment surcharges	BRU:	Commercial Fisheries (Limited) Entry Commission
		Component:	Limited Entry Program Administration
Sponsor	Senator Halford		
Requester	Senate Resources	COMPONENT SERIAL NO.	0471

Expenditures/Revenues (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

OPERATING EXPENDITURES	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Personal Services						
Travel						
Contractual						
Supplies						
Equipment						
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0
CAPITAL EXPENDITURES						
CHANGE IN REVENUES ( )	400.0	500.0	500.0	500.0	500.0	500.0

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF						
1005 GF/Program Receipts	0.0	0.0	0.0	0.0	0.0	0.0
1006 GF/MHTIA						
Other						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY99) cost: $ 0.0

POSITIONS

FULL-TIME						
PART-TIME						
TEMPORARY						

ANALYSIS: *(Attach a separate page if necessary)*

No fiscal impact

Prepared by Roger Kolden Phone 790-6950
Agency Commercial Fisheries (Limited) Entry Commission Date/Time 02/09/99

Approved by Commissioner Mary McDowell *Mary McDowell*
Agency Commercial Fisheries (Limited) Entry Commission Date: 2/9/99

PREPARER TO PROVIDE ALL DISTRIBUTION COPIES TO GOVERNOR'S LEGISLATIVE OFFICE

For further distribution information call the Governor's Legislative Office

(Rev 10/98) 99fnform xls/OMB

Alaska State Legislature

Senate

Official Business

RICK
HALFORD
State Capitol
Juneau, Alaska
99801-1182
Phone (907) 465-4958
Fax (907) 465-4928

P.O. Box 670190
Chugiak, Alaska 99567
Phone (907) 694-4958
Fax (907) 694-0549

800 E. Railroad Avenue
Wasilla, Alaska 99654
Phone (907) 376-4958

Senate Bill 13
Sponsor Statement

"An Act relating to assessment of discrete salmon stocks and to discrete salmon stock assessment surcharges."

A great deal of controversy and total lack of consensus has surrounded the allocation of Alaska's salmon stocks. These allocative battles have left all user groups unsatisfied and have been to the detriment of the sustained yield of some population segments, and to the genetic diversity of the overall population.

Current salmon management centers around heavy exploitation of mixed stock fisheries and disregards the negative effects this policy has on discrete stocks of all salmon species. Not until we recognize the importance of implementing an assessment plan for discrete salmon stocks, based on the necessary information, can we fulfill our constitutional obligation to preserve the sustained yield of all stocks of the resource.

The need for this change in management philosophy and implementation of a discrete salmon stock assessment policy is heavily supported by information from the scientific community. The National Research Council of the National Academy of Science assembled the leading experts in the field of salmon management and published Upstream: Salmon and Society in the Pacific Northwest, in December 1995.

An extensive review by leading experts to analyze data on salmon stocks, their decline and options for intervention supports the need for discrete stock assessment. The following is excerpted from their findings:

- Because of their anadromous life cycles and homing behaviors and the variety of environments they occupy, each species tends to differentiate into local breeding populations that are in general reproductivity isolated from other populations and adapted to each stream. To sustain productive natural populations of salmon, it is crucially important to maintain this genetic variation and local adaptation.

- When fishing occurs on a mixture of populations with different stock-recruitment functions and fishing cannot be regulated at a rate appropriate for each component population, the stage is set for overfishing of the less abundant components.

The conclusion of this report points out the potential deficiency in Alaska's current management philosophy and supports the need for the discrete salmon stock assessment policy. The experts conclude:

- The long-term survival of salmon depends crucially on a diverse and rich store of genetic variations. Because of their homing behavior and the distribution of their populations and their riverine habitats, salmon populations are unusually susceptible to local extinction and are dependent on diversity in their genetic make-up and population structure. Therefore, management must recognize and protect the genetic diversity within each salmon species, and it must recognize and work with local breeding populations and their habitats. It is not enough to focus only on the abundance of salmon.

In order to uphold our Constitutional mandate to provide for sustained yield, we cannot afford to ignore the biological realities and maintain the status quo. The passage of SB 13 is intended to redirect our attention from the past mistakes of allocation driven management system toward a system which will fully meet our constitutional responsibility to sustained yield.

LEGAL SERVICES

DIVISION OF LEGAL AND RESEARCH SERVICES
LEGISLATIVE AFFAIRS AGENCY
STATE OF ALASKA

(907) 465-3867 or 465-2450
FAX (907) 465-2029
Mail Stop 3101

130 Seward Street, Suite 409
Juneau, Alaska 99801-2105

MEMORANDUM February 9, 1999

SUBJECT: Sectional Summary of SB 13; An Act relating to assessment of discrete salmon stocks and to discrete salmon stock assessment surcharges.

TO: Senator Rick Halford
ATTN: Brett Huber

FROM: George Utermohle
Legislative Counsel

You have requested a sectional summary of SB 13; An Act relating to assessment of discrete salmon stocks and to discrete salmon stock assessment surcharges.

As a preliminary matter, note that a sectional summary of a bill is not an authoritative interpretation of the bill. The bill itself is the best statement of its contents.

Section 1 of the bill sets out the purpose and intent of the bill.

Section 2 of the bill amends AS 16.05 by adding a new section relating to discrete salmon stock assessment. The Board of Fisheries shall identify and rank those salmon stocks for which discrete salmon stock assessments are needed. The Department of Fish and Game, with the assistance of the Board of Fisheries and public comment, shall develop a list and priority ranking of proposed salmon stock assessment research projects. The governor shall include a request for funding for salmon stock assessment research projects as part of the annual appropriation bill.

Section 3 of the bill adds a new subsection to AS 16.05.480 to provide for imposition of a $10 salmon assessment surcharge on crewmember fishing licenses. The revenue collected from the surcharge may be appropriated to fund expenditures for the discrete salmon stock assessment program.

Section 4 of the bill amends AS 16.43.160(a) to provide that the amount of the fee paid for a crewmember license may be used to offset a portion of the cost of the renewal fee for an interim-use or entry permit. This subsection clarifies that the offset authorized under this subsection does not apply to salmon assessment surcharges. The setoff for the stock assessment surcharge is authorized under section 5 of the bill.

Section 5 of the bill amends AS 16.43.160(d) to provide that the Alaska Commercial Fisheries Entry Commission may charge interest on past due stock assessment surcharges.

Section 6 of the bill adds a new subsection to AS 16.43.160 to authorize the Alaska Commercial Fisheries Entry Commission to collect a stock assessment surcharge at the time of renewal of limited entry permits and interim-use permits for salmon fisheries. The total amount of revenue collected from the surcharge must approximate $500,000. The revenue collected from the surcharge may be appropriated to fund expenditures for the discrete salmon stock assessment program.

Section 7 of the bill provides that (1) the Department of Fish and Game shall develop the first annual list and priority ranking of proposed salmon stock assessment projects in time to be included in the department's proposed budget for fiscal year 2001; and (2) the salmon assessment surcharges imposed on crewmember licenses, entry permits, and interim-use permits under secs. 3 and 6 of the bill are applicable to licenses and permits issued for 2000 and subsequent years.

GU:glc
99-055.glc

AMENDMENT

OFFERED IN THE SENATE BY SENATOR HALFORD

TO: SB 13

Page 3, lines 7 - 12:

Delete all material.

Renumber the following bill sections accordingly.

Page 3, lines 27 - 30:

Delete "The commission shall credit the amount of a stock assessment surcharge paid by a permit holder under AS 16.05.480(e) toward payment of the surcharge imposed under this subsection. A permit holder may receive only one credit toward the payment of a surcharge during each year."

Page 4, line 10:

Delete "6 of"

Insert "5 of"

United Southeast Alaska Gillnetters Assoc.
PO Box 22427
Juneau, AK 99802
Phone: (907) 586-5860
Fax: (907) 780-6621

Senate Resources
Senator Rick Halford, Chairman
Alaska State Legislature
State Capitol
Juneau, AK 99801-1182

Re: Testimony for Senate Bill 13 – "Discrete Stock Assessment"

The United Southeast Alaska Gillnetters Association (USAG) is an organization which represents the Southeast Alaska drift gillnet salmon permit holders that are members of our organization. There are 480 drift gillnet permits in Southeast Alaska. Our membership of permit holders averages approximately 200 members over the last several years. USAG is a member of United Fishermen of Alaska and the Alaska Seafood Council.

USAG has concerns regarding Senate Bill 13 and currently opposes this bill. First, what is the definition of discrete stock? Depending on the definition of discrete stock is how narrowly focused or how broadly this bill can be interpreted. USAG is against this bill because while ADF&G is not directed to manage for discrete stocks, it is implied that is the direction the Dept. would be steered towards as the research for discrete stock assessments is gathered.

USAG feels that the State of Alaska is the best manager of salmon fisheries in the world. While other states and countries are having trouble with their salmon runs, the State of Alaska has had some record runs and rebuilt runs that were in trouble. In fact, in international arenas we argue against the idea of discrete stock management and have pushed for the acceptance of the idea of abundance based management.

While USAG fully supports ADF&G conducting all the research projects they feel are necessary and /or important, to provide for the sustained yield of the stocks and make management decisions based on the best science and information available. The current and past budget cuts have prevented the ADF&G from pursuing all the necessary research that they feel is prudent and necessary. ADF&G needs the necessary funding in order to perform research programs as needed.

USAG is opposed to research for allocation decisions being disguised as stock assessment research. Thank you for considering our comments regarding this bill.

Sincerely,

Kathy Hansen
USAG Executive Director

ALASKA BOATING ASSOCIATION

Rick Halford, Senator,
Alaska State Legislature
State Capital (MS 3100)
Juneau, Alaska 99801-1182

Subject, SB 13 Feb. 10th. 1999

Dear Senator Halford

As president of the Alaska Boating Association, a member of the Matanuska Valley Fish and Game Advisory Committee, a member of the Alaska Outdoor Council and as a person that has fished Upper Cook Inlet streams for 36 years, strongly support SB 13.

I have listened to and participated in many discussions concerning salmon management. With the exception of a few up years, the trend is continually downwards; with less fish and more fishermen. Between those of us trying to put fish in our freezers, the guides, tourists and floaters, there are just too many people and two few fish. When I talk with a fish biologist about this problem. (How many fish go up this stream?) Or (How many fish can this stream handle?) the answer is invariably " we do not know-we have no data on that species in this stream". We all know that harvests are going down. There is data for commercial fish harvests from Cook Inlet going back to 1893 (from Sam E. McDowell, presented to the board of Fish, Feb. 4th.1998) see attached. The picture presented by this data paints a dismal picture of Cook Inlet Fisheries Management. Discreet stock assessment is critical if we are to reverse this trend and assure sustained yield of wild salmon stocks. Gentlemen look at the data; the situation is critical. Chum salmon have been reduced to the point that some people are talking endangered species. Pink salmon, probably the most important contributor to the food chain of the entire system, have been reduced ten fold from pre1982 levels. Yes, while some harvest fluctuations are due to regulatory changes the overall picture is undeniable; Cook Inlet Salmon are being managed into oblivion. No matter how you look at the data. We need more salmon of all species in the upper Cook Inlet streams. Discreet Stock Assessment is the tool that is needed to provide the data to do the job.

Of course and especially in today's financial climate the players, both commercial and sport must pay the cost. I urge you to pass Senate Bill 13. I thank you for the opportunity to comment on the bill and I thank you all for the time you dedicate to the people and the resources of our great state.

Cliff Judkins, President,
Alaska Boating Association

Cliff Judkins - President • P.O. Box 874124 • Wasilla, Alaska 99687
(907) 373-3591 • Fax 373-3592 • E-Mail: cjudkins@customcpu.com

Table 1. Historical harvest of Cook Inlet salmon in numbers of fish and by species (1893-1982). 1/

Date	Chinook	Sockeye	Coho	Pink	Chum	Total
1893	30,000	170,000	34,000	0	0	234,000
1894	15,500	406,840	19,000	0	0	441,340
1895	25,199	324,277	0	0	0	349,476
1896	18,076	309,863	27,600	37,800	0	393,339
1897	14,083	354,800	28,000	0	0	396,883
1898	16,389	551,168	83,412	0	0	650,969
1899	17,102	558,529	54,890	0	0	630,521
1900	26,683	585,309	20,000	0	0	631,992
1901	34,319	482,406	8,967	5,591	0	531,283
1902	49,013	710,280	54,864	79,246	0	893,403
1903	66,023	564,189	58,968	0	0	689,180
1904	30,073	489,348	23,800	0	0	543,221
1905	17,668	95,547	0	0	0	113,215
1906	22,420	225,506	93,485	64,100	0	405,511
1907	62,944	460,620	177,276	6,420	0	707,260
1908	33,774	670,774	94,936	375,140	0	1,174,624
1909	59,624	582,562	88,350	3,740	0	734,276
1910	49,028	840,187	79,702	217,666	1,318	1,187,901
1911	55,845	1,249,154	87,909	70,665	749	1,464,322
1912	47,866	1,194,888	70,567	1,661,874	121,628	3,096,823
1913	63,652	1,369,196	81,484	10,926	10,813	1,536,071
1914	47,554	1,472,829	188,341	1,255,798	39,905	3,004,427
1915	83,793	1,860,684	122,028	19,308	27,833	2,113,646
1916	62,895	1,699,323	209,978	1,682,672	128,322	3,783,190
1917	65,499	1,659,907	60,776	54,286	78,468	1,918,936
1918	34,886	1,668,394	251,151	712,231	108,200	2,783,862
1919	23,801	943,694	172,855	43,447	54,333	1,238,130
1920	39,563	1,314,916	302,353	445,524	97,541	2,199,897
1921	13,946	983,625	20,519	4,717	42,409	1,065,216
1922	31,030	860,019	199,923	637,405	74,389	1,802,766
1923	29,911	1,099,465	142,926	39,146	23,481	1,344,929
1924	27,012	1,056,090	187,656	752,016	36,755	2,059,529
1925	51,033	1,510,861	198,146	11,828	15,064	1,786,932
1926	75,620	1,999,720	353,173	586,054	118,455	3,133,022
1927	87,404	1,459,068	387,746	251,866	59,380	2,245,464
1928	69,885	1,172,959	522,509	568,052	101,086	2,434,491
1929	67,694	1,049,851	184,858	376,863	134,601	1,813,867
1930	72,317	917,882	498,475	1,022,679	99,630	2,610,983
1931	51,402	805,526	328,294	472,221	62,628	1,720,071
1932	70,931	1,131,958	374,976	441,125	64,749	2,083,739
1933	59,281	1,336,135	187,972	118,187	57,245	1,758,820
1934	72,379	1,815,267	251,260	929,992	91,319	3,160,217
1935	75,075	1,355,787	170,438	430,540	161,424	2,193,264
1936	81,062	2,390,281	328,496	852,924	264,909	3,917,672
1937	85,982	1,581,183	215,700	487,692	148,869	2,519,426
1938	57,663	2,425,253	213,804	848,733	191,328	3,736,781
1939	52,726	2,334,904	163,010	319,312	231,645	3,101,597
1940	63,016	1,648,952	478,096	2,604,235	280,831	5,075,130

- continued -

#(1)

*Average Annual Historial Harvest

1947–1951: 134906.8

1966–1970: 8415.4

Table 1. Historical harvest of Cook Inlet salmon in numbers of fish and by species (1893- .). 1/ (continued) TO: 1996

Date	Chinook	Sockeye	Coho	Pink	Chum	Total
1941	104,822	1,293,234	359,224	715,211	272,345	2,744,836
1942	95,180	1,540,185	644,823	965,507	400,989	3,646,684
1943	111,381	1,468,279	279,852	1,457,161	301,899	3,618,572
1944	85,210	1,939,932	256,621	1,815,441	258,840	4,356,044
1945	69,202	1,556,713	329,828	1,367,950	305,901	3,629,594
1946	64,281	1,474,473	581,374	1,338,731	383,563	3,842,422
1947	106,804	1,473,973	443,879	681,731	279,227	2,985,614
1948	105,996	2,035,306	408,079	1,660,147	439,314	4,648,842
1949	111,281	2,153,213	279,701	443,003	238,646	3,215,844
1950	162,942	2,642,374	351,366	1,132,164	463,507	4,752,353
1951	187,511	2,481,170	271,384	408,454	290,478	3,638,997
1952	74,469	1,502,491	222,949	2,232,630	444,592	4,477,131
1953	89,429	1,489,972	224,280	546,116	533,661	2,883,458
1954	65,325	1,234,607	334,129	2,451,499	773,710	4,859,270
1955	46,495	1,059,079	174,292	1,230,014	313,906	2,823,786
1956	65,309	1,294,799	203,772	1,786,557	869,583	4,220,020
1957	42,647	667,753	127,080	305,566	1,207,889	2,350,935
1958	22,847	495,947	241,556	2,465,450	596,038	3,821,838
1959	32,723	634,728	107,162	94,590	408,332	1,277,535
1960	27,539	948,040	314,153	2,023,252	776,079	4,089,063
1961	19,778	1,185,079	119,397	337,394	405,221	2,066,869
1962	20,270	1,172,079	358,051	4,960,030	1,149,841	7,661,051
1963	17,632	958,101	203,876	234,052	525,537	1,939,198
1964	4,622	990,709	462,114	4,287,378	1,402,419	7,147,242
1965	9,751	1,426,352	154,481	139,561	344,521	2,074,666
1966	9,606	1,867,447	295,248	2,584,985	661,818	5,419,104
1967	8,035	1,409,106	180,455	407,717	382,282	2,387,595
1968	3,500	1,200,146	474,733	2,863,634	1,194,248	5,736,265
1969	12,471	915,040	101,585	236,474	331,045	1,496,615
1970	8,465	768,946	284,849	1,400,923	1,024,987	3,488,170
1971	19,838	659,032	105,197	428,495	475,631	1,688,193
1972	16,174	937,621	83,167	657,239	705,559	2,399,760
1973	5,339	699,234	106,747	633,586	783,074	2,227,980
1974	6,769	524,588	206,639	534,636	418,148	1,690,780
1975	4,918	706,878	227,950	1,399,061	972,627	3,311,432
1976	11,317	1,722,290	211,926	1,393,188	520,628	3,859,349
1977	15,009	2,152,567	195,471	1,846,008	1,379,011	5,588,066
1978	19,049	2,778,071	225,889	2,041,659	645,477	5,710,145
1979	14,976	988,832	277,416	3,059,516	873,385	5,214,125
1980	14,219	1,643,079	285,883	2,676,133	464,302	5,083,616
1981	13,326	1,549,490	495,926	3,403,390	1,172,642	6,634,774
1982	21,936	3,391,114	840,829	1,342,170	1,631,853	7,227,902
1983	20,634	5,049,733	516,322	70,327	1,114,858	6,771,874
1984	10,062	2,106,714	449,993	617,452	680,726	3,864,947
1985	24,088	4,060,429	667,213	87,828	772,849	5,612,407
1986	39,240	4,787,982	756,830	1,299,360	1,134,173	8,017,585
1987	39,661	9,500,186	451,404	109,801	349,139	10,450,191
1988	29,060	6,834,342	560,022	469,972	708,573	8,601,969
1989	26,742	5,010,698	339,201	67,430	122,027	5,566,098
1990	16,105	3,604,064	500,634	603,630	351,197	5,075,630
1991	13,535	2,177,576	425,724	14,663	280,223	2,911,721
1992	17,171	9,108,340	468,911	695,859	274,303	10,564,584
1993	18,719	4,754,698	306,822	100,918	122,767	5,303,924
1994'	19,640	3,526,353	567,411	521,697	292,370	4,927,471
1995	17,857	2,951,827	446,954	133,575	529,422	4,079,635
1996	14,168	3,882,992	325,459	242,967	158,160	4,623,846
1997	13,013	4,086,536	144,043	70,521	89,480	4403,593

Please note: The 1997, 89,480 Chum salmon harvest is the lowest harvest since 1934 (63 years).

Historical Annual Harvest
1981-1988 = 945,601.62
1989-1996 = 266,308.62

#(1)

*Average Annual Historial Harvest

Table 1. Historical harvest of Cook Inlet salmon in numbers of fish and by species (1893-). 1/ (continued) TO: 1996

Average Annual Historial Harvest	Date	Chinook	Sockeye	Coho	Pink	Chum	Total
	1941	104,822	1,293,234	359,224	715,211	272,345	2,744,836
	1942	95,180	1,540,185	644,823	965,507	400,989	3,646,684
	1943	111,381	1,468,279	279,852	1,457,161	301,899	3,618,572
	1944	85,210	1,939,932	256,621	1,815,441	258,840	4,356,044
	1945	69,202	1,556,723	329,828	1,367,950	305,901	3,629,594
	1946	64,281	1,474,473	581,374	1,338,731	383,563	3,842,422
	1947	106,804	1,473,973	443,879	681,731	279,227	2,985,614
	1948	105,996	2,035,306	408,079	1,660,147	439,314	4,648,842
134906.8	1949	111,281	2,153,213	279,701	443,003	228,646	3,215,844
	1950	162,942	2,642,374	351,366	1,132,164	463,507	4,752,353
	1951	187,511	2,481,170	271,384	408,454	290,478	3,638,997
	1952	74,469	1,502,491	222,949	2,232,630	444,592	4,477,131
	1953	89,429	1,489,972	224,280	546,116	533,661	2,883,459
	1954	65,325	1,234,607	334,129	2,451,499	773,710	4,859,270
	1955	46,495	1,059,079	174,292	1,230,014	313,906	2,823,786
	1956	65,309	1,294,799	203,772	1,786,557	869,533	4,220,020
	1957	42,647	667,753	127,080	305,566	1,207,889	2,350,935
	1958	22,847	495,947	241,556	2,465,450	596,038	3,821,838
	1959	32,723	634,728	107,162	94,590	408,332	1,277,535
	1960	27,539	948,040	314,153	2,023,252	776,079	4,089,063
	1961	19,778	1,185,079	119,397	337,394	405,221	2,066,869
	1962	20,270	1,172,079	358,051	4,960,030	1,149,841	7,661,051
	1963	17,632	958,101	203,876	234,052	525,537	1,939,198
	1964	4,622	990,709	462,114	4,287,378	1,402,419	7,147,242
	1965	9,751	1,426,352	154,481	139,561	344,521	2,074,666
	1966	9,606	1,867,447	295,248	2,584,985	661,818	5,419,104
	1967	8,035	1,409,106	180,455	407,717	382,282	2,387,595
8415.4	1968	3,500	1,200,146	474,733	2,863,634	1,194,248	5,736,265
	1969	12,471	815,040	101,585	236,474	331,045	1,496,615
	1970	8,465	768,946	284,849	1,400,923	1,024,987	3,488,170
	1971	19,838	659,032	105,197	428,495	475,631	1,688,193
	1972	16,174	937,621	83,167	657,239	705,559	2,399,760
	1973	5,339	699,234	106,747	633,586	783,074	2,227,980
	1974	6,769	524,588	206,639	534,636	418,148	1,690,780
	1975	4,918	706,878	227,950	1,399,061	972,627	3,311,432
	1976	11,317	1,722,290	211,926	1,393,188	520,623	3,859,349
	1977	15,009	2,152,567	195,471	1,845,008	1,379,011	5,588,066
	1978	19,049	2,778,071	225,889	2,041,659	645,477	5,710,145
	1979	14,976	988,832	277,416	3,059,516	873,385	5,214,125
	1980	14,219	1,643,079	285,883	2,676,133	464,302	5,083,616
	1981	13,326	1,549,490	495,926	3,403,390	1,172,642	6,634,774
	1982	21,936	3,391,114	840,829	1,342,170	1,631,853	7,227,992
	1983	20,634	5,049,733	516,322	70,327	1,114,858	6,771,874
	1984	10,062	2,106,714	449,993	617,452	680,726	3,864,947
	1985	24,088	4,060,429	667,213	87,828	772,849	5,612,407
	1986	39,240	4,787,982	756,830	1,299,360	1,134,173	8,017,585
	1987	39,661	9,500,186	451,404	109,801	349,139	10,450,191
	1988	29,060	6,834,342	560,022	469,972	708,573	8,601,969
	1989	26,742	5,010,698	339,201	67,430	122,027	5,566,098
	1990	16,105	3,604,064	500,634	603,630	351,197	5,075,630
	1991	13,535	2,177,576	425,724	14,663	280,223	2,911,721
	1992	17,171	9,108,340	468,911	695,859	274,303	10,564,584
	1993	18,719	4,754,698	306,822	100,918	122,767	5,303,924
	1994'	19,640	3,526,353	567,411	521,697	292,370	4,927,471
	1995	17,857	2,951,827	446,954	133,575	529,422	4,079,635
	1996	14,168	3,882,992	325,459	242,967	158,160	4,823,646
	1997	13,013	4,086,536	144,043	70,521	89,480	4403,593

Please note: The 1997, 89,480 Chum salmon harvest is the lowest harvest since 1934 (63 years).

Historical Annual Harvest
1981-1988 = 945,601.62
1989-1996 = 266,308.62

ALASKA OUTDOOR COUNCIL
211 4th St. #302A
Juneau, Ak. 99801
(907) 463-3830
FAX 586-6020

Jan. 29, 1999

The Honorable Rick Halford, Chair
The Alaska State Senate Resources Committee
Alaska State Capitol
Juneau, AK 99801

Dear Senator Halford:

We would like to thank you for introducing Senate Bill 13. At the legislative workshop we held in November 1998, our members voted to continue their support for discrete stock management of Alaska salmon. We feel SB 13 does just that.

It is common knowledge that Alaska is currently experiencing problems with salmon returns. Bristol Bay has recorded two poor years in a row, and in the area where most of our members fish, Cook Inlet, several species of salmon have recorded less than desirable returns over the past decade or longer. The Alaska Outdoor Council feels the Department of Fish and Game and the Board of Fisheries need to implement plans that will correct these types of problems with our salmon returns. Discrete stock assessment work would be a major step forward in that regard.

We understand that as with any resource related issue Alaskans will often times be divided over whether it is good policy or not. However, we believe the majority of Alaskans would support sound conservation measures that help insure the health of the resource. We would find it hard to understand anyone opposing your legislation when there is an obvious need for sound research to provide our fisheries managers with viable information for maintaining healthy stocks.

The Alaska Outdoor Council appreciates the effort you are making to provide sound conservation measures for our fisheries and we hope your colleagues in the Senate and House will join you in this effort.

Sincerely,

Rod Arno

Rod Arno
President

Sport Fishing Alaska *Trip Planners*

1401 Shore Drive Anchorage Alaska 99515-3206 (907) 344-8674 Fax (907) 349-4330 E-mail: sfa@alaska.net

Page 1 of 1
February 10, 1999

TO: Senator Rick Halford
FAX: 907-465-4928

FROM: Russ Redick
RE: Senate Bill 13

Senator Halford -

This letter indicates my support for the concept and goals of SB13.

A better understanding of the characteristics of our various salmon stocks is mandatory if we are to improve the management of the salmon resource.

I am, however, concerned about how sport fish license funds might be spent under this legislation. A priority ranking of the most critical problem stocks could well be made up of large commercial fisheries that are in distant areas (False Pass, Lower Yukon, Kuskokwim, etc.) that have very little use by sport fish license buyers. We would expect that a significant portion of these funds be used to solve problems in areas that are critical to sport fishermen.

With these qualifications I do support SB13.

Russ Redick

January 21, 1999

Senator Rick Halford
Senate Resources Chairman
State Capital Rm 21
Juneau AK 99567-0190

Dear Senator Halford,

The disastrous 1998 salmon-fishing season may be the result of an outdated ***Salmon Management strategy*** based on a single stock management concept coupled with a significant lack of data. Much of Cook Inlet salmon management is based on sockeye management in the Kenai River. As a result of this many streams in upper Cook Inlet are experiencing problems with low returns of chum and coho salmon. The chum salmon returns are so low on the McNeil River that there are concerns for the food supply for the bears. The Yukon River has suffered salmon run failures for several years. Bristol Bay has had back to back failure of sockeye salmon runs. The reasons for these failures are not known. Compared to most of the West Coast salmon runs, Alaska's runs are still moderately healthy. I believe that if we are to save them from the same fate, SB 13 must be passed and implemented immediately.

Alaska is not alone, numerous articles on the worsening conditions of the world's ocean fisheries and declining value of commercially caught salmon have been published in both local and international publications. According to the United Nations Food and Agriculture Organizations, 11 of the 15 main oceans fishing grounds are seriously depleted. There are more than 100 counties involved in fisheries disputes in both the Atlantic and Pacific Oceans. These disputes have ranged from armed clashes between navies, to a blockade of an Alaskan cruise ship.

The Fish Stocks Assessment Report, commissioned by the National Marine Fisheries Service and written by National Academies of Sciences and of Engineering, determined that it is difficult to count fish through nondestructive means, and that computer models are sometimes slow to pick up accelerated rates of decline. In 1995, The National Marine Fisheries Service reported that one third of the 275 commercial fisheries stocks in U.S. coastal waters were over fished and nearly half existed at levels below what is necessary to produce long term sustain yields. The report also warns that commercial fishermen have an incentive to exaggerate numbers where they fear shortages will result in new restrictions on their catch. The disastrous state wide salmon returns of 1997 and 1998 are prime examples of what can happen even with the best of fisheries management.

The current management plans being used in Cook Inlet are older than most Alaskans and are from and era when the Alaskan salmon numbers were much higher. These plans must be replaced by plans that put the resource first and that manage salmon from the fresh water out instead of from saltwater in. The commercial priority in Cook Inlet is the only one of its kind in Alaska and has to be removed, as it prevents effective salmon management by limiting the Department's options. Current Department strategies that use Maximum Sustain Yield (MSY) as bases are in violation of Alaska law and the Alaska Constitution, as MSY has never been codified.

Single stock management is not being used anywhere else but Alaska since it is detrimental to all stocks.

During a recent briefing by the Alaska Department of Fish and Game on the new Kenai River managing strategy, I asked them if they planned to put together a similar system for the Yenta River. They commented that would not be possible because they did not have the data necessary to construct the program. This is an example of the limited ability the Department has to effectively manage our salmon using current and past methods.

Senator Halford, you and your committee are working on the future of Alaska's salmon. The task before you is extremely difficult but it is one that must be completed this year. I believe that you are dedicated to resolving the problems in and around Cook Inlet. I encourage you to continue on the path that you have chosen that will bring salmon management in Alaska into the 21 century.

Sincerely

Bruce Knowles

Bruce Knowles
P.O. Box 873206
Wasilla, AK 99687
President of the Mat-Su Valley Guides Association

Cook Inlet Public Fisheries Council
P.O. Box 549
Soldotna, AK 99669
(907) 283-3375
(907) 283-4575 (FAX)

Dedicated to the preservation and propagation of all wild stock fisheries in both salt and fresh water, ensuring habitat protection and the equitable public access to these fishery stocks.

February 9, 1999

Senate Resources Committee
State Capitol
Room 508
Juneau, AK 99801-1182

Re: Senate Bill No. 13 – "An Act relating to management of discrete salmon stocks, to salmon management assessments and to the fisher business tax."

Dear Committee Member:

We support the concept of sustainable fisheries as contained in Senate Bill No. 13. We would encourage Department of Fish & Game to do the following:

1) Require the Department of Fish and Game to prioritize their management of salmon harvest for escapement, thereby ensuring a sustained return of all salmon species to all waters of Cook Inlet.

2) Survey small streams in Upper Cook Inlet for biological escapement of all stocks and species of salmon to determine where a conservation emergency exists and take corrective measures to abate the emergency.

3) Require the Board of Fisheries to address management of salmon harvest throughout the entire migration route of each salmon species and stock.

Current management policies of the Board of Fisheries and Department of Fish and Game have resulted in the closure of some of the state's most popular sport fishing areas. Senate Bill 13 is a major stride in improving the management capabilities for the valuable resource. The Act requires the Board of Fisheries to adopt and implement management policies that are consistent with the constitutional requirement of managing the resource for a sustained yield. It also provides a means to offset the costs incurred by the state in implementing the management policies.

As we have said, we encourage the adoption and implementation of the management policies as proposed.

Regards,

Ron Rainey
Chairman

FINAL REPORT

COOK INLET FISHERIES MANAGEMENT STRATEGY

Submitted to the

ALASKA DEPARTMENT OF FISH AND GAME

by

THE MEDIATION INSTITUTE OF ALASKA
217 Second Street, Suite 204
Juneau, Alaska 99801

February 14, 1996

Contract #IHP 96-002

THE MEDIATION INSTITUTE
OF ALASKA

217 Second Street, Suite 204, Juneau, Alaska 99801
Tele (907) 586-2701 Fax: (907) 586-8059

Dr. Gerald W. Cormick
15629 Cascadian Way
Mill Creek, Washington 98012-5928
(206) 745-8792
(206) 743-6103 (fax)
cormick@cases.pubaf.washington.edu

Dr. Phillip R. Mundy
1015 Sher Lane
Lake Oswego, Oregon 97034-1744
(503) 636-6335 (ph. and fax)
mundy@teleport.com

Paul H. Grant, Esq.
217 Second Street, Suite 204
Juneau, Alaska 99801
(907) 586-2701
(907) 586-8059 (fax)
grant@alaska.net

Cook Inlet Fisheries Management Strategy

CIFMS Science Committee Final Report and
Minutes of October 16, 1995, as amended by review of the committee

Present:

Terry Bendock, 907-262-9368, 907-262-4709 fax // Stephen Braund, 276-8222, 276-6117 fax // Al Carson. 907-267-2335, 907-267-2464 fax // Loren Flagg, 907-262-2492, 907-262-2898 fax // Stephen Fried, 907-267-2130, 907-267-2442 fax // Theo Matthews, 283-3600, 283-3366 fax // Tom Mears, 907-283-5761, 283-9433 fax // Doug McBride, 907-267-2227, 907-267-2424 fax // Phil Mundy, 503-636-6335, 503-636-6335 fax // Larry Peltz. 907-745-5016, 907-745-7362 fax // Jim Richardson, 907-279-2883, 907-276-0830 fax // Gary Sonnevil 907-262-9863, 907-262-7145 fax // Lance Trasky, 907-267-2335, 907-267-2464 fax // Mark Wenger, 907-224-3374, 907-224-3268 fax //

Not present. but participating in process: Suzanne Fisler, 907-262-5581, 907-262-3717 fax //

Correspondents: Phil Cutler, 564-5828, 564-4637 fax // Jim Fall, 267-2359, 267-2450 fax // Jim Sumner 653-7308

I. Introduction

A.. Statement of Purpose

The Science Committee is a fact finding body for the mediation process known as the Cook Inlet Fisheries Management Strategy. The Science Committee is formed to identify data gaps which may inhibit conservation of Cook Inlet salmon, and to further support the mediation process by addressing the ability of available information to permit implementation of proposed allocation regulations, and to identify data gaps that make a proposed allocation regulation untenable. The Science Committee is expected to identify, define, integrate, and synthesize relevant information. The Science Committee is charged to remain free of advocacy, proposal of allocation actions, and debate of allocation options, other than in a scientific context.

APPENDIX V

Specifically, the function of the CIFMS Science Committee is to develop a list of data gaps which are either relevant to conservation of the salmon resources, or which may foreclose options for managing all types of the harvest of the resource. The list of data gaps is to be placed in order of priority to the extent possible. As the mediation process develops, the Committee is likely to be asked to address the kinds of information necessary to implement specific management options, as well as the feasibility of acquiring of such information. A further task is to identify relevant bibliographic sources and data bases for the final report of the Committee.

The basic ground rules for the committee are; 1) Committee work is limited to scientific issues, including harvest management, habitat and land use: individuals contribute professional expertise without regard to institutional affiliation, 2) Comments made within the committee process are not for attribution; contributors remain anonymous in the work of the Committee, 3) Members take the floor when recognized by the convener; everyone gets to speak in the order recognized.

B. Networking information from the committee

1. Other current committees working on comprehensive plans or reports of relevance, committee contact in parentheses.

- Economic study of marginal impacts of salmon allocation, U. Alaska Anchorage, Institute for Social and Economic Research (Richardson)
- Exxon Valdez Oil Spill Trustee Council Research (Mundy, Fried)
- Kenai Peninsula Borough Kenai River Working Group (Mears)
- Kenai River Interagency Habitat Task Force, Board of Fisheries (Doug Vincent-Lang, ADFG/SFD)
- Kenai River Special Management Area Plan Update (Richardson, Pres. of the SMA board)
- Kenai Area Land Use Plan, Alaska Department of Natural Resources (Trasky)
- Interagency Planning Team on the Upper Kenai River (Sonnevil)
- Mat-Su Valley Forest Plan, Mat-Su Borough (Trasky)
- Public Use Planning, USFWS, Kenai National Wildlife Refuge (Sonnevil)
- Regional Planning Team, Salmon Enhancement (Mears)
- State/federal Interagency Summit on the Kenai River, Nov. 1, 1995, (Wenger; Chair Steve Zemke, USFS)
- Statewide Sport Fishing Guide Task Force, Alaska Board of Fisheries, (McBride; Doug Vincent-Lang)

2. Past committees working on comprehensive plans or reports:

- Kenai River Sockeye Salmon Task Force (McBride)
- Kenai River Comprehensive Management Plan (ADNR; Trasky)
- Comprehensive Summary of Actions. Glenn Siemans
- Carrying Capacity Study, (ADNR; Trasky)

3. Reports of past committees

- Recommendations for Protection of Fish Spawning and Rearing Habitat on the Kenai River, Kenai Peninsula Borough Working Group
- McBride and Hammarstrom (1995)
- Governor's (Cowper) Fisheries Task Force (Meacham)
- State Game Refuge Management Plans (Palmer Hay Flats, Training Bay, Redoubt Bay, Kustatan, MacArthur) (Trasky)
- Board of Fisheries Reports
- Kodiak Interceptions Task Force. Ivan Vining Report (Swanton, ADFG/CFMDD)

4. Comprehensive data bases available, electronic copies

- Commercial Fisheries Entry Commission
- fish tickets and limited entry permit registration data, commercial catch by species, date, locality

- Commercial Fisheries Management and Development Division
- Registration of permits by subdistrict, since 1993; Annual Management Reports have summaries of commercial catch and effort, prices paid by species
- Private Nonprofit Hatchery Annual Reports (Fried; Ellen Simpson and Steve McGee, ADFG/CFMDD),
- Commercial catches and escapements by year, system, and age

- Sport Fish Division ADFG

- Annual Harvest, Catch, and Participation

- Kenai Sockeye Salmon Task Force, Summaries and Analysis of Catch, Escapement
- Fish Transport Permit records, ADFG, Irv Brock (SFD)

- Board of Fisheries
- History of fishing regulations. the codifieds. (Laird Jones, ADFG)

- Cook Inlet Aquaculture Association
- Hatchery releases and rack returns. eggs taken. (Mears)
- Alaska Department of Environmental Conservation
- List of impaired water bodies

- Habitat and Restoration ADFG
- Anadromous Waters Catalogs Atlas
- Alaska Habitat Guides, 1986 (abundance, distribution. life history, harvest)
- Alaska Department of Natural Resources Geographic Information System on the 29 areas of the Kenai Peninsula scheduled for logging within next five years

- Coded Wire Tag Recoveries of Upper Cook Inlet hatchery reared salmon
- Fishing Guide Data Base for Kenai and Deep Creek, ADNR
- Kenai Area Land Use Plan (ADFG/HRD)
- Public Access Data Base. ADNR
- Susitna Area Plan (ADFG/HRD)
- Subsistence(Tyonek, Nanwalek, Port Graham), educational (Kenaitze. Ninilchik and Eklutna), and personal use fisheries data bases (Jeff Fox and Linda Brannian, ADFG/CFMDD; see also Sport Fish Division Annual Management Reports)
- · Recreation Rivers Management Plan (Susitna) (ADFG/HRD)
- List of current and proposed logging sites
- Library automated reference database

5. Bibliographies, Bibliographic sources, electronic copies

- ADFG/CFMDD Library, Anchorage (Fried)
- Technical Data Reports (1972-1988)
- Technical Fishery Reports (1987-1994) now
- Regional Information Report
- Informational Leaflets, (1961-1988)
- Fishery Research Bulletin (1987-1992)
- Alaska Fishery Research Bulletin (1994-present)

- Upper Cook Inlet Management Reports (1974-1987) merged with Regional Information Reports
- Upper Cook Inlet Data Reports, (1961-1987) merged with Regional

Information Reports

- Regional Information Reports. Upper Cook Inlet, 1988-present, including Annual Management Reports

- ADFG/HR Library, Anchorage (Trasky)
- ADFG/CFMDD Library, Juneau (Paul DeSloover)
- Special Publications
- Professional Publications (journal manuscripts)
- ADFG/CFMDD Publications Juneau (Bob Wilbur)
- US Fish and Wildlife Publications List (Sonnevil)
- US Forest Service - Forest Service Information (Wenger)
- ADNR/Various information bases

II. Data Gaps: Information Necessary to Salmon Conservation or Allocation Presently Unavailable

The Science Committee has not placed the data gaps in order of priority. The data gaps are broadly organized into allocation and conservation, although there is some overlap between the two.

II. A. Data Gaps Relating Primarily to Conservation of Fisheries Resources

II. A. 1. Relative importance of freshwater, nearshore marine and offshore marine survivals to salmon productivities

A better understanding of freshwater salmon productivity, as measured by survivals, and early marine survivals is needed. This information is needed to set escapement objectives for salmon species appropriate to sustained yield management, to identify and maintain critical freshwater and nearshore marine habitats, and to forecast future adult salmon returns and harvest levels. Better information is available for Kenai River sockeye than other drainage-species combinations. Relatively little information on survival by life history stage is available for species other than sockeye salmon. It is important to develop understandings of survival for coho and chinook salmon, because populations of these species can be heavily exploited due to strong public demand, particularly among sports harvesters.

The full extent of freshwater rearing areas has not been confirmed by direct observation for most species, so this information is needed to complete the anadromous stream catalog. Under existing laws, state biologists can only control activities in streams where the presence of salmon has been physically confirmed. Such information is therefore essential to managing the effects of urbanization and development on salmon. and it is essential to understanding and predicting the effects of development on salmon productivities.

Partitioning freshwater effects from marine effects is essential to understanding the effects of habitat degradation on salmon production. Smolt to adult survivals, when measured close to the estuary, provide a composite of nearshore and offshore marine effects which can be distinguished from egg to smolt freshwater effects. Return per spawner analyses integrate the effects of all life history stages, marine and freshwater. Consequently, marine and freshwater habitat effects are statistically confounded in return per spawner analyses. In a return per spawner analysis, excellent marine conditions for salmon rearing can mask the effects of freshwater habitat degradation on salmon productivity for extended periods of time, approximately ten to fifteen years. This is undesirable in a sustained-yield salmon management context because, when poor marine conditions for salmon rearing return, either the habitat degradation is too far advanced for remedies to be socially acceptable, or the losses in freshwater continue to be ascribed to marine conditions until salmon population levels reach critically low levels. Both circumstances are contrary to the interests of sustained yield management of the salmon resources. Hence being able to distinguish freshwater mortalities from marine mortalities is essential to sustained yield salmon management.

Measuring adult escapements is an essential part of sustained yield salmon management. Upper Cook Inlet Coho salmon in general, and early and late run Kenai River coho escapements in particular, need attention in enumeration and escapement goal formulation (see Fried 1994, Table 3).

II. A. 2. Impacts of resource extraction and land development on habitat

There are data gaps on the effects of logging, road building, residential and commercial construction on fish bearing habitat. Such habitat alterations result in erosion, siltation, introduction of contaminants such as petroleum products, blockage of migratory fish movements, and alteration of flow and thermal regimes. Although information is available for other regions such as southeastern Alaska and British Columbia, quantitative data are needed on the status of Cook Inlet's salmon bearing habitat, and approaches for estimating impacts of habitat alterations on salmon production. Some relevant information exists for riparian zones of the Kenai River (Liepitz 1994), but more work is needed, both on the Kenai and in other watersheds. There are not enough local studies to keep up with the number of habitat alterations now occurring.

Some studies are now in progress. For example, the Division of Forestry, ADNR, has a $500K study in progress, and the Tongass National Forest has a history of studies. Assessment (model) of impacts of logging and roading on the salmon productivities of affected streams. Refer to the U.S. Forest Service's Moose Pass Plan for an example of a study of proposed logging.

II. A. 3. Impacts of fishing activities on habitat

There are data gaps on the effects of fishery activities on salmon bearing habitat. Such activities as stream bank erosion from stream bank angling, disturbance of stream banks and spawning grounds from walking and motoring to fishing sites, results in increased siltation which probably lowers primary productivity and renders spawning habitat unsuitable. Studies are needed in the areas of the habitat impacts of fisheries management actions, and the role of boat wakes in stream bank erosion. A model which relates horsepower and number of angler trips to stream bank erosion would be useful. Follow-up studies on the effects of past remediation efforts could provide useful information on how to design future efforts.

II. A. 4. Impacts of exotic species of fish on production of salmon and resident native fish species. At present four species of piscivorous (fish eating) fishes have been introduced into the Kenai River from some other locality (Arctic grayling, Alaska blackfish, Northern pike and burbot (lush). Northern pike, an especially effective predator species, are now known to occur in parts of the Kenai River system which support rearing of coho juveniles, a suitable prey species. The extent to which these introductions have impacted salmon production in the Kenai needs to be understood. Further introductions by members of the public is a matter of serious concern in an area as heavily utilized by the public as the Kenai Peninsula.

II. B. Data Gaps Relating Primarily to Allocation of Fisheries Resources

II. B. 1. Stock identification of catches

Stock identification information is essential to sustained yield management, and to allocation among user groups, for any species or stock of salmon which is harvested extensively in mixed stock situations. Resource managers need to know when and where the various spawning stocks are to be found in the harvest areas, if they are to effectively control harvests. Specifically, it is important to understand where salmon originating in Cook Inlet are harvested in directed fisheries and as bycatch, in the waters of Cook Inlet and elsewhere, such as in fisheries in Shelikof Strait and near Kodiak Island. Whenever hatchery contributions become a factor in the management of the populations, it is important to be able to identify hatchery contributions to catches, and to be able to identify hatchery reared salmon on the spawning grounds.

At present the stock identification capabilities contributing to harvest management decisions are limited to Kenai River sockeye salmon (genetic stock identification), wild chinook salmon from Deep Creek and the Kenai River (coded wire tagged) and hatchery reared chinook and coho salmon, all of which are presently coded wire tagged. Since 1995 genetic stock identification of Kenai River sockeye has been available to managers during the harvest season. Coho salmon smolt (juveniles) have been marked with coded wire tags and adipose fin clips in the Kenai River since 1992, and in the Deep Creek since 1995. Chinook and coho salmon juveniles have been similarly marked in the Kenai River and in Deep Creek since 1993.

II. B. 2. Migratory paths and relative timings of stocks and species

Understanding where and when salmon species and stocks transit harvest areas is essential to understanding the impact of mixed-stock harvests on these species and stocks. Distinct differences in migratory paths and timings among stocks in mixed stock harvest areas can serve the purposes of stock identification information. At present the best understanding and implementation of stock identification capability in Upper Cook Inlet is for Kenai River sockeye. Historical information is available for the Central District of Upper Cook Inlet as a whole for the four major sockeye drainages (i.e. Mundy et al. 1993). Unfortunately the programs which produced the historical sockeye salmon stock identification information had to be discontinued. These programs (see Marshall et al. and Cross in Mundy et al. 1993) were replaced by genetic stock identification techniques which presently identify only the Kenai River sockeye in commercial catches.

The information on coded wire tags recovered from adult catches now accumulating for hatchery produced coho and chinook holds promise for understanding the migratory paths of these stocks. Recoveries of adult wild chinook and coho which were marked in Deep Creek and the Kenai River as juveniles may provide the ability to discern migratory paths and timings for these stocks. It may also be possible to make crude inferences on wild coho and chinook paths and timings of stocks which are not presently tagged by analogy to the coded wire tag recoveries from those stocks which are.

Stock identification capabilities and programs for chum and pink salmon originating in Cook Inlet are presently lacking, although genetic stock identification tools may be appropriate.

II. B. 3. Organization and accessibility of information

The public needs ready access to harvest and biological data, and analyses of these data by the concerned agencies in an understandable format. There are publication series by the agencies, and there are electronic data bases from which the public may draw, if they know how. Yet there is no one source which the public and concerned scientists can access in a common format and location for Cook Inlet salmon data. As item number I.B.4 above attests, there are many sources located across a large number of concerned agencies.

II. C. Data gaps submitted by individual members after the meeting of October 16, 1995.

II. C. 1. Analysis of existing data on Knik arm drainages with respect to run sizes, escapements, and factors limiting production for each salmon species.

II. C. 2. Integration and analysis of present status of critical harvest management information, including genetic stock identification, Central District marine sonar, freshwater sonar escapement estimation, Anchor Point offshore test fishing, and historical scale pattern analysis. An analysis is needed on the current status of the ability of the Anchor Point offshore test fishery to estimate sockeye catches and abundances in light of new knowledge on Central District run strength developed from sonar surveys and genetic stock identification. To what extent can the Anchor Point Test fishery now be calibrated without using catches from the drift gill net fleet? To what extent will it still be necessary to use drift catch data to calibrate the offshore test fishery in order to make estimates of total abundance of sockeye salmon in the Central District? The report should focus on the ability of the test fishery to make total abundance estimates by time period, and by locality, in order to provide more precision in harvest management.

II. C. 3. Analysis of sport harvest rates in the rivers on Northern Cook Inlet chinook and coho salmon stocks and habitats.

II. C. 4. Timely reporting of harvest by sport fishing guides.

II. C. 5. Analysis of the socioeconomic effects of the Upper Cook Inlet Management Plan on the native village of Tyonek. Has the historical pattern of reliance on commercial fishing by the village been sustained? What is the time series of the number of commercial fisheries entry permits at Tyonek from 1974 to present? What are the reasons for the changes in commercial fishing activities. and how do these impact the social and economic factors in the community?

III. Questions posed by the Strategy Group

The following are questions raised by the participants at the meetings of Oct 13-14, except that questions with the same general answer are grouped under a single question in square brackets [ ].

1. Are there harvest management methods [for the set nets] which promote delivery of kings into the Kenai River? [Please identify size and species specific harvest methods as they may be applicable to Cook Inlet salmon.] [Please look into the feasibility of limits on commercial bycatch of individual commercial harvesters daily, annual.]

Yes. Time and area closures can promote delivery of chinook salmon into the Kenai River, however little information exists which would permit the effects from these types of actions to be evaluated. A study now in progress under the ADFG Sports Fish Division is designed to produce this type of information. Gear modifications, web material, reductions in length, and depth of net, may also provide reduction of king salmon bycatch in sockeye set net fisheries. ADFG Sport Fish Division initiated a study (under Mike Bethe) on July 1, 1995 to address information needed to design such regulations. The Eastside Set Net Monitoring Program (ADFG/CFD March 1984) provides some information relevant to management measures. The 1984 study noted a problem with catch reporting in that fish retained for personal use by commercial harvesters were not required to be reported. Personal use fish are now required by law to be reported. Data on the amount of set net gear by harvest period fished in each period are also lacking. Legal counsel is needed to determine if it would be possible to draw closure lines that would exclude harvest of individual permit holders.

2. Can we partition freshwater and marine mortality in order to determine the ability of freshwater habitat to support spawning and rearing?

Yes, we can, but so far we have not done so for most salmon stocks. This constitutes a major data gap for sustained yield management of Cook Inlet salmon. Studies on the sockeye salmon of the Kenai and Kasilof Rivers have provided data which infer density dependent freshwater mortality, and which could permit differentiation of marine and freshwater effects for some brood years. Survival studies of Bristol Bay sockeye salmon production are available for comparison. Smolt-to-adult survivals (mostly marine) may become available for chinook and coho stocks to which coded wire tags have been applied. While the technologies are available, each application entails substantial expense to adapt the technology to the stocks, species and localities of interest in Upper Cook Inlet.

3. Questions related to the "overescapement" issue. What are the differences between single stock or single species Maximum Sustained Yield (MSY) strategies and multiple stock and multiple species sustained yield management? How do these differ in terms of management objectives and information requirements?[Please describe means to maximize productivity of all Cook Inlet salmon. How do we maximize productivity?] [Please contrast information needs for single stock, single species versus integrated management of multiple stocks and species.][Please develop a discussion paper on the overescapement issue, and the implications and impacts of overescapement, as an introduction to a joint policy and science committee briefing on the issue.]

Salmon allocation issues in Cook Inlet often involve the concept of overescapement. While there is only one basic biological theory relevant to "overescapement," the variability in the quality and quantity of data available for a salmon stock can cause reasonable scientists to have different opinions on what constitutes overescapement. The purpose of the text which follows is to explain how the concept of overescapement is defined, and how the fact of overescapement for one salmon stock can mean underescapement for another stock or species of salmon.

The question of how best to divide any salmon resource between catch and escapement is complex, regardless of how the catch is allocated. In principle there is an annual number of spawners, an escapement goal, which allows each spawner in a salmon stock to produce the most offspring which survive to adults (recruits). The appropriate catch limit then becomes what is left over after the escapement goal is subtracted from the total number of adult salmon in the stock that year. That much is easy, at least in principle. With respect to this single stock of salmon, any number of spawners in excess of the escapement goal may be termed, overescapement, and any number of spawners less than the escapement goal may be termed, underescapement.

The complexity is introduced because, in practice, escapement goals are often set for species of salmon in river systems, and not for individual salmon stocks. The escapement goal for sockeye salmon in a river system such as the

Kenai is the average of the escapement goals of all the stocks in that drainage, so that even when the river's escapement goal is achieved exactly, there will necessarily be overescapements and underescapements with respect to the individual salmon stocks. This combination of overescapements and underescapements also can occur when mixtures of salmon species, such as sockeye and coho, are managed to attain the escapement goal for one of the species in one, or more, river systems.

The foundation of escapement goals is the concept that managers can influence the productivity of stocks (groups of spawners, usually from the same watershed or river) by harvest which is widely accepted in all areas of natural resource management, including wildlife, fisheries and forest management. The basic idea is that populations such as Douglas fir trees, coyotes, sockeye, and other types of plants and animals grow fastest when they number about half the maximum amount the environment can support, the carrying capacity. At this level there are not so many individuals as to create competition for limiting resources such as food and sun light, but there are enough individuals around to make full use of the limiting resources to produce wood or fish. The exact population level, i.e. escapement level, at which the total amount of wood or fish grows the fastest is the level of maximum sustained yield, MSY, or so the theory goes. Through controlled harvests fish populations can be kept at levels of sustained yield other than those at which the harvestable surplus is the greatest, if other constraints compel.

Each identifiable group of spawners, a stock, may have a different level of maximum sustained yield, due to differences in the number of eggs per female, the average size of the eggs produced, and the critical qualities of the spawning and rearing environments. There are obvious differences in MSY among species; salmon produce more offspring per female than do coyotes. But within species there are differences in MSY as well, even if all the biological factors are the same. For example, sockeye salmon stocks coming from two lakes identical in every way, except that one is smaller than the other, will have different MSY harvest levels. This is true because the population level at which total production is the fastest is about one-half the carrying capacity of the environment. In general, big environment means big MSY, and conversely, all other factors being equal. So the actual population level, or escapement goal, which provides the greatest rate of return on a mixture of stocks is not the escapement goal which gives the theoretical maximum sustained yield on a single stock. The mixed stock MSY is a somewhat higher escapement level than the single-stock MSY which permits the mixture of stocks actually harvested to survive and produce at the highest rate possible for the combination of stocks. All salmon escapement goals in Alaska are most likely to be based on data collected from mixtures of stocks, although the mixture may be arbitrarily designated a single stock. For example, the many spawning aggregates of the Kvichak River sockeye of Bristol Bay have been managed effectively as a single stock, even though one of its two major rearing lakes, Iliamna, has more surface area than Puget Sound.

In a mixed stock management context, as well as in an ecosystem management context, overescapement and underescapement for individual stocks and species is a given, no matter what the escapement goal may be. Even when escapement goals can be identified for individual salmon stocks, when these stocks are harvested in mixed stock fisheries, some stocks experience "overescapement" relative to their theoretical MSY escapement level, and some experience "underescapement," even when the average escapement goal for the stock mixture is perfectly achieved. In this context, overescapement is not waste. Overescapement is the price to be paid for keeping the entire mixture of stocks producing on a sustained yield basis. Further, when the importance of escapements to the production of other species resident in the watershed such as rainbow trout, grayling, char, bald eagle, bear, and others is considered, overescapement of a salmon stock may be fully consistent with maximum sustained yield objectives for these other species.

So far, the approach of most fishery management agencies to sustained yield is to harvest the most economically prominent group of fish stocks at an annual rate which produces the maximum average rate of return for that mixture of stocks. The more stocks and species which are managed simultaneously in a mixed stock scenario, the greater the information requirements, and the greater the costs. The "economically important stocks" approach is so often taken because governments typically provide only enough funds to collect the information necessary to manage the economically most important stocks, if for those. So, as previously noted, the management escapement goal is not defined in terms of the yields or productivities of other stocks of the same species, or of other species.

When it comes to the question of maximizing the productivity of a natural resource, there are several questions which policy makers must answer before scientists can even begin to frame an answer. Which species? Which stocks? Within what time frame, years, decades, or centuries? What do you want to maximize; present dollar value to a gear type, future dollar value to a gear type, biomass, population viabilities, recreational opportunities, or whatever? Which stocks or species are you willing to sacrifice to this maximization? How much are you willing to pay to have what you want? Each of these questions has already been answered explicitly in Board of Fisheries actions, or during the implementation of the Board's intentions during the management season. In framing proposals to the Board it is important to 1) understand the present answers to each question. and 2) the answers your own interests would pose to each of these questions.

4. Please look at the feasibility of weak stock management.

Weak stock management may or may not be feasible depending on the nature of information available for the smallest, or most chronically under seeded, group of spawners. A "weak stock" is the smallest identifiable spawning group of salmon for which 1) there is sufficient information on which to base fishing regulations, and 2) for which the responsible parties have agreed to provide a stated escapement or harvest rate objective. In general, the wider the data gaps, the more terminal the harvest management regime must be in order to effect weak stock management. Terminal fishing refers to fishing as near to the spawning grounds as product quality concerns permit. For example, the east side Bristol Bay sockeye salmon fisheries in the nearshore marine waters adjacent to the river mouths of the Naknek, Kvichak, Egegik and Ugashik are considered terminal fisheries, whereas the west side Bristol Bay sockeye fisheries in Nushagak Bay are mixed stock, working on the salmon from at least three river systems. Mixed stock fisheries generally require more information and are much more expensive to manage on a sustained yield basis than are terminal fisheries. See also the answer to number three, immediately above.

5. Please look at the impacts of hatchery fish on the fishery management and reproduction of wild stocks in Cook Inlet.

In general, production of salmon from hatcheries, and the harvest of that production, may impact wild salmon stocks in a number of different ways. Salmon from hatcheries may interbreed with wild salmon producing effects which appear to depend on the degree to which the hatchery and wild stocks differ. Transmission of disease among hatchery and wild stocks is another concern. Mixed stock harvest of wild and hatchery stocks at rates appropriate to the hatchery stock would result in loss of productivity and increased risk of extirpation for the wild stock. Data gaps exist on all three of these areas of impact.

Data are not available to address the degree to which hatchery salmon may have spawned with wild salmon, nor is it possible to tell what effects this may have had on the fitness or viability of the wild population, if they did. Since hatchery coho and chinook are now all coded wire tagged, in instances where spawning ground surveys allow collection of carcasses, if any, the proportion of hatchery fish in the escapement might be roughly estimated. Collection of carcasses would not give any indication of whether the hatchery fish spawned successfully, nor whether it may have spawned with a wild salmon as opposed to another hatchery fish.

Contributions of hatchery production of coho and chinook salmon to Cook Inlet, and other, harvests can now be determined by the recovery of coded wire tags. All such production is being coded wire tagged prior to release from the hatcheries, and there is a program in place to sample fisheries for the tagged fish which are recognizable by the absence of an adipose fin, clipped at time of tagging, or by the use of a metal detector. The extent to which fishery management decisions for these species are influenced by the presence of hatchery fish can be determined in post season analysis of tag recoveries. It should be noted that harvest decisions for wild chinook salmon in Crooked Creek, the Ninilchik River and salt water south of Bluff Point are being driven by the real and perceived levels of returning hatchery fish.

Harvest decisions for wild stocks of sockeye salmon in Upper Cook Inlet have not been determined by the level of returning hatchery sockeye, but by the total numbers of wild and hatchery fish escaping to the Kenai River, as measured at the sonar site. Between 1976 and 1995 sockeye salmon escapements to Hidden Creek hatchery program averaged 3.5% of the total escapement to the Kenai River. In only two of those years, 1990 and 1991, did hatchery escapements exceed 10% of the Kenai River total, reaching the maximum of 17.5% in 1991, and 11.8% in 1990. Since the brood years which produced the bulk of the 1990 and 1991 escapements, levels of hatchery production of sockeye salmon have been deliberately held at levels which produce returns far smaller than the natural return. Hatchery escapements as a percent of total Kenai river sockeye salmon escapement were 3.3%, 1.4%, 0.6%, and 1.2% in 1992 through 1995, respectively. In the peak year of hatchery escapements, 1991, the difference between the hatchery escapement of 112,792 and the sonar count of 645,000 sockeye was above the lower boundary of the Kenai River sockeye escapement goal, as was the case in the next largest hatchery escapement year, 1990. Since the hatchery escapement had an effect on the apparent rate of increase in Kenai River sockeye salmon escapement in 1990 and 1991, and since fishery management decisions in the commercial fishery take into account the rate at which the Kenai River sockeye salmon escapement is building, it is fair to say that the hatchery escapements could have influenced fishery management decisions. As a consequence of the ability to identify hatchery production in the samples at the Kenai river fishwheels, hatchery escapements on the fishery management decisions of 1990 and 1991, did not inhibit managers from providing the Kenai River with wild sockeye salmon escapements within the optimum range.

During the 1991 sockeye harvest management season, escapements were sampled from fish wheel catches in the lower Kenai River at the sonar counting sites. Hatchery sockeye from Hidden Lake were identified by examining growth rings on the fish scales. Sockeye scales of the hatchery origin sockeye reflect the large amount of freshwater growth which typically occurs in Hidden Lake relative to other sockeye rearing Lakes in the Kenai River system. Sockeye smolt (emigrants) from Hidden Lake commonly attain the length of 120 mm, whereas smolt from the larger glacial lakes, such as Skilak, would be quite a bit shorter, usually less than 100 mm. As it happened in 1991, sockeye salmon from Hidden Lake were obvious in the escapements from inspection of scale samples. Consequently harvest management intentionally tried to attain escapements toward the upper end of the Kenai River sockeye escapement goal of 700,000 in order to achieve full seeding of spawning areas other than those attendant to Hidden Lake. In the opinion of management it would have exceeded their statutory authorities to intentionally permit escapements of sockeye above the upper limit set by the Board of Fisheries.

Concerns over the ability to manage the large hatchery related sockeye returns to Hidden Lake have lead to the current conservative stocking limit of two million spring fry. The stocking limit also serves to address water quality concerns of the U.S. Fish and Wildlife Service. The Service also supported the limit in order to control financial and habitat costs of managing the harvest of very large sockeye returns to Hidden Lake. In order to harvest Hidden Lake surplus it is estimated to have cost the Service approximately $1.00/fish and the large number of harvesters had negative impacts on the habitat.

6. Do we need better detection of in season impacts in terms of who is catching what?

Yes we do, especially at the level of stocks. At present it is only possible to determine the origin of Kenai River sockeye salmon caught by commercial harvesters in mixed stock areas. When harvests occur inside major river systems, such as the Susitna or the Kenai, it is not usually possible to identify the spawning grounds to which the fish were returning. The river of origin of coho and chinook salmon caught in the commercial fisheries of the Central District is a matter of speculation, although those caught near the river mouths are presumed to be from that river. Studies of straying behavior in chinook salmon using radio tags do not necessarily support this presumption. Implementation of multiple species sustained yield management, any Susitna Management Plan, or any Coho

Management Plan will require some assumptions about the origins of the harvests in the Central District based on timing and geographic location.

8. Please identify methods to increase passage to Northern Cook Inlet with minimum impact on the [catches of non-Susitna sockeye in the] Central District.

Corridor openings which hold the drift gill net fleet relatively close to the east side beaches have been effective at reducing the efficiency of the commercial drift fleet (Mundy et al. 1993) with respect to Susitna bound sockeye in the Central District, while permitting harvest of Kenai bound fish. Kasilof special harvest areas have allowed targeting of commercial fishing effort on Kasilof bound sockeye, while apparently sparing Kenai and Susitna bound sockeye. Impacts of corridor openings on rate of catch of other species, such as Kenai River king salmon, need to be examined. Possibilities other than corridor openings have been identified in proposals to the Board of Fisheries which involve time and area closures need to be evaluated.

9. Describe harvest methods and regulations that promote the avoidance of waste.

Time and area regulations which avoid peak periods of abundance, and which evenly space relatively short openings, and which control the amount of gear which an individual harvester may employ, are all conducive to controlling waste in general. Specific objectives in terms of times, areas, and harvests, and/or escapement objectives by species and/or stock need to be supplied in order for the science committee to respond further.

10. Comment on the feasibility of developing a management plan for the Susitna.

Specific objectives in terms of times, areas, and harvests, and/or escapement objectives by species and/or stock need to be supplied in order for the science committee to respond. Data gaps and basic salmon migratory behavior may define the degree of specificity which management could achieve with respect to stocks and species.

11. Comment on the feasibility of developing a coho management plan for Cook Inlet.

See answer to preceding question on Susitna Plan.

12. Identify the effects on commercial harvesters of reducing the commercial season from July 1 - August 15 to July 7 - August 9.

The impacts on commercial harvesters can be estimated from available historical for the data of each fishery (gear-locality combination) by looking at the percent of the annual harvest which occurs during these time periods, July 1 - July 6, and August 10 - 15, as an average over all available years of record. Each fishery may experience a different impact from this option. Such information may be available from previous analyses, or it may require requesting a fish ticket run from Juneau. The Science Committee needs clarification of whether the request includes deletion of special openings for commercial fishing prior to July 1 under circumstances indicating an early and or heavy sockeye run? If so, the best approach may be to consider all commercial harvest prior to July 7 as an average percent of total annual harvest.

Miscellaneous issues, briefly addressed due to lack of time

1. Spread sport fish impact on Kenai River habitat by opening other areas to fisheries (fairness). Data gap exists, impacts are not quantifiable.

2. Allocation of current sport priority to other sectors (early run/late run). Specific objectives in terms of times, areas, and harvests need to be supplied in order for the science committee to respond.

3. Non residents commercial harvesting with sport gear. Legal tools may not be available to enforcement. Need a legal opinion. Specific objectives in terms of times, areas, and harvests need to be supplied in order for the science committee to respond.

4. Enforcement (limits). Specific objectives in terms of times, areas, and harvests need to be supplied in order for the science committee to respond.

BIBLIOGRAPHY

Alaska Department of Fish and Game. 1993a. An atlas to the catalog of waters important for spawning, rearing or migration of anadromous fishes. South central Region, Habitat Division, Anchorage, Alaska.

ADFG. 1993b. Cook Inlet/ Kodiak / Chignik Commercial Fishing Regulations, Alaska Department of Fish and Game, Juneau.

Alaska Department of Natural Resources. 1986. Kenai River comprehensive management plan. ADNR, Anchorage, and Kenai Peninsula Borough, Soldotna.

ADFG. 1995 Sport Fishing Regulations Summary for Cook Inlet. Regulations effective April 15, 1995 through April 14, 1996. Alaska Department of Fish and Game, Juneau.

ADFG. 1995. Northern Cook Inlet Chinook. 1995 Management actions prior to the fishing season, research and assessment actions, and a history. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.

ADFG. 1995. Susitna River Chinook Issues. Copies of figures for a report to the Board of Fisheries in February, 1995. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.

ADFG. 1995. Alaska Board of Fisheries 1995/1996 Proposals. Cook Inlet & Kodiak/Chignik Areas Finfish. Statewide King/Tanner Crab Shellfish Proposals and Supplemental Issues. Alaska Department of Fish and Game, Boards Support Section, Juneau.

Alexandersdottir, M. And L. Marsh. 1990. Abundance estimates of the escapement of chinook salmon into the Kenai River, Alaska, by analysis of tagging data, 1989. Fishery Data Series Number 90-55. Division of Sport Fish, Alaska Department of Fish and Game, Anchorage.

Bendock, T. and M. Alexandersdottir. 1990. Hook and release mortality of chinook salmon in the Kenai River recreational fishery. Fishery Data Series No. 90-16. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage.

Bendock, T. and M. Alexandersdottir. 1991. Hook-and-release mortality in the

MEMORANDUM

STATE OF ALASKA
COMMERCIAL FISHERIES ENTRY COMMISSION

TO: The Honorable Rick Halford
Chairman, Senate Resources
Alaska Senate
M/S:3100

DATE: February 8, 1999

PHONE: (907) 789-6160 VOICE
(907) 789-6170 FAX

FROM: Commercial Fisheries Entry Commission
Marlene Johnson, Commissioner
Mary McDowell, Commissioner Mary McDowell
Bruce Twomley, Chairman

SUBJECT: Stock Assessment Surcharges Under SB13 (1-LS0159\A)

Brett Huber, your legislative aide, requested that we provide the Senate Resources Committee with an estimate of the magnitude of the stock assessment surcharges that would need to be imposed on salmon permit and interim-use permit holders under SB 13. Our rough estimates, based upon 1998 salmon permit renewals, are shown in the table below.

ALL SALMON INTERIM-USE AND ENTRY PERMIT HOLDERS Estimated Stock Assessment Surcharge By Fee Class Required to Raise $500,000			
Fee Class	*Number of 1998 Permits Renewed*	*Estimated Stock Assessment Surcharge*	*Revenues Raised*
$15	889	$5.26	$4,676.14
$50/$150	3,706	$17.54	$65,003.24
$100/$300	1,751	$35.08	$61,425.08
$150/$450	857	$52.62	$45,095.34
$200/$600	1,069	$70.16	$75,001.04
$250/$750	2,838	$87.70	$248,892.60
Totals:	11,110		$500,093.44

CFEC sets annual permit renewal fees to reasonably reflect the different rates of economic return for different fisheries in accordance with AS 16.43.160. CFEC annually places permits for different fisheries into one of five fee classes in accordance with the methodology described in 20 AAC 05.240. These fee classes are simple multiples of each other ranging from $50 to $250 for residents and from $150 to $750 for nonresidents as shown above. Permit holders who qualify under AS 16.43.160(c) can pay a "poverty" renewal fee irrespective of the fee class of the permit being renewed.

If SB13 is enacted into law, CFEC would attach the stock assessment surcharge to permits by fee class. The surcharge would vary across fee classes in the same proportion as the fee classes vary with each other. For example, the annual renewal fee in our highest fee class is five times as great as the annual renewal fee in our lowest fee class. Therefore the stock assessment surcharge in our highest fee class would be five times as great as the stock assessment surcharge for the lowest fee class.

The estimates in the table in this memorandum were based upon active permits where 1998 renewal fees have been paid. Please note that CFEC would have to establish the stock assessment surcharge before the year in which the surcharge would apply. This means that the surcharge for a given year would be estimated from permit renewals in a previous year. Thus the actual amount collected in a given year could be greater than or less than the target amount of $500,000. Also note that these estimates do not take into account credits, as required under Section 6 of SB13, for any surcharge paid under Section 3 of SB13.

Additionally, SB13 asks CFEC to impose an additional surcharge on the renewal of a salmon entry permit or interim-use permit held by a nonresident to the extent permitted by law. We continue to litigate the *Carlson* challenge to all nonresident fee differentials. Therefore, we do not yet have clear direction from the Alaska Supreme Court as to what, if any, differential can be defended.

Because of this very serious litigation, it is currently unclear what fee differential is permitted by law. CFEC would be hesitant to impose an additional surcharge on nonresident permit holders while the State is attempting to defend the legality of the current differentials. Among other things, an additional surcharge would generate even greater damage claims by the plaintiffs in *Carlson*. For these reasons, we have used the same annual stock assessment surcharge for both residents and nonresidents for the estimates provided in the table on page one of this memorandum.

We hope that this information is useful to the Senate Resources Committee. If you have any questions about the estimates or this memorandum, please let us know.

PREPUBLICATION COPY

Upstream

Salmon and Society in the Pacific Northwest

Committee on Protection and Management of Pacific Northwest Anadromous Salmonids

Board on Environmental Studies and Toxicology

Commission on Life Sciences

1995

National Research Council

Executive Summary

Pacific salmon have disappeared from about 40% of their historical breeding ranges in Washington. Oregon, Idaho, and California over the last century, and many remaining populations are severely reduced. Most runs that appear plentiful today are largely composed of fish produced in hatcheries. Recreational and commercial fishing for several salmon species has been restricted or even prohibited from the coastal waters of the region to the headwaters of many streams, and tribal fishing has been much reduced. Petitions have been filed to list several populations as endangered or threatened under the Endangered Species Act; a few have been listed, and more could be soon.

Salmon have great cultural, economic, recreational, and symbolic importance in the Pacific Northwest. As a result. their declines—which have numerous interacting causes—have resulted in much concern. The often expensive efforts to reverse the declines have been controversial and unsuccessful in many cases. Faced with the possibility of dozens or perhaps even hundreds of listings of Pacific salmon under the Endangered Species Act, and faced with controversies over the effectiveness of proposed actions to slow, halt, or reverse the salmon declines, Congress requested advice from the National Research Council (NRC). In response. the NRC's Board on Environmental Studies and Toxicology assembled the expert Committee on Protection and Management of Pacific Northwest Anadromous Salmonids to review information concerning the seven species of anadromous salmonids[1] in the Pacific Northwest.

The committee was asked to "evaluate options for improving the prospects for long-term sustainability of the stocks, and [to] consider economic and social implications of such changes" (statement of task; see Preface). It was asked to perform the following tasks:

- Assess the status of the salmon stocks.
- Analyze the causes of declines.
- Analyze options for intervention.

The committee was asked to consider all stages of salmon life histories, including the ocean phase, and to consider the appropriate roles of hatcheries. Congress did not request advice on whether society *should* make the investments needed to halt and reverse salmon declines. However, the committee's analysis of options for intervention and their likely effectiveness should help to inform that policy decision.

[1] This report deals with anadromous forms of the seven species of the genus *Oncorhynchus*. They are chinook. chum. coho, pink, and sockeye salmon and the anadromous forms of rainbow and cutthroat trout: steelhead and searun cutthroat. In this report, the general term *salmon* refers to all seven species.

STATUS OF SALMON POPULATIONS

The status of many specific salmon populations in the Pacific Northwest is uncertain, and there are exceptions to most generalizations with regard to overall status. Nevertheless, a general examination of the evidence of population declines over broad areas is helpful for understanding the current status of species with different life cycle characteristics and geographical distributions, and with some caution, the following generalizations are justified:

- *Pacific salmon have disappeared from about 40% of their historical breeding ranges in Washington, Oregon, Idaho, and California over the last century, and many remaining populations are severely depressed in areas where they were formerly abundant.* If the areas in which salmon are threatened or endangered are added to the areas where they are now extinct, the total area with losses is two-thirds of their previous range in the four states. Although the overall situation is not as serious in southwestern British Columbia, some populations there also are in a state of decline, and all populations have been completely cut off from access to the upper Columbia River in eastern British Columbia. Even if the estimate of population losses of about 40% is only a rough approximation, the status of naturally spawning salmon populations gives cause for pessimism.
- *Coastal populations tend to be somewhat better off than populations inhabiting interior drainages.* Species with populations that occurred in inland subbasins of large river systems (such as the Sacramento, Klamath, and Columbia rivers)—spring/summer chinook, summer steelhead, and sockeye—are extinct over a greater percentage of their range than species limited primarily to coastal rivers. Salmon whose populations are stable over the greatest percentages of their range (fall chinook, chum, pink, and winter steelhead) chiefly inhabit rivers and streams in coastal zones.
- *Populations near the southern boundary of species' ranges tend to be at greater risk than northern populations.* In general, proportionately fewer healthy populations exist in California and Oregon than in Washington and British Columbia. The reasons for this trend are complex and appear to be related to both ocean conditions and human activities.
- *Species with extended freshwater rearing (up to a year)—such as spring/summer chinook, coho, sockeye, sea-run cutthroat, and steelhead—are generally extinct, endangered, or threatened over a greater percentage of their ranges than species with abbreviated freshwater residence, such as fall chinook, chum, and pink salmon.*
- *In many cases, populations that are not smaller than they used to be are now composed largely or entirely of hatchery fish.* An overall estimate of the proportion of hatchery fish is not available, but several regional estimates make clear that many runs depend mainly or entirely on hatcheries.

Chapter 4 discusses some of the difficulties in evaluating the status of wild populations and how these difficulties have been addressed in recently published status reports. Regional trends are summarized, and the overall conditions of the species are presented.

THE SALMON PROBLEM

The salmon problem is the decline of wild salmon runs and the reductions in abundance of salmon even after massive investments in hatcheries. The declines—largely a result of human impacts on the environment caused by activities such as forestry, agriculture, grazing, industrial activities, urbanization, dams, hatcheries, and fishing—are widespread, although not universal. They have a variety of causes, and they are exacerbated by the unusual life cycle of Pacific anadromous salmon, which spawn in freshwater, migrate to sea to grow and mature, and return to their natal streams to reproduce. Salmon thus require high-quality environments from mountain streams, through major rivers, to the ocean. Economic development and population growth have created widespread declines in anadromous salmon abundance in the Pacific Northwest. Variations in ocean conditions—especially in water temperature and currents and the associated biological communities—also contribute to the rise and fall of salmon abundance, often thwarting the interpretation of events in freshwater and the surrounding terrestrial systems.

GENERAL CONCLUSION

To achieve long-term protection for a diversity and abundance of salmon in the Pacific Northwest, two general goals must be achieved:

- The long-term survival of salmon depends crucially on a diverse and rich store of genetic variation. Because of their homing behavior and the distribution of their populations and their riverine habitats, salmon populations are unusually susceptible to local extinctions and are dependent on diversity in their genetic make-up and population structure (Chapter 6). Therefore, management must recognize and protect the *genetic diversity* within each salmon species, and it must recognize and work with local breeding populations and their habitats. It is not enough to focus only on the abundance of salmon.
- The social structures and institutions that have been operating in the Pacific Northwest have proved incapable of ensuring a long-term future for salmon, in large part because they do not operate at the right time and space scales. As described in Chapter 13, differences among watersheds mean that different approaches are likely to be appropriate and effective in different watersheds, even where the goals are the same. This means that institutions must be able to operate at the scale of watersheds; in addition, a coordinating function is needed to make sure that larger perspectives are considered.

As a framework in which to approach its deliberations, the committee chose to focus on *rehabilitation*—a pragmatic approach that relies on natural regenerative processes in the long term and the selected use of technology and human effort in the short term—rather than on attempts to restore the landscape to some pristine former state and rather than on a primary reliance on substitution, i.e., the use of technologies and energy inputs, such as hatcheries, artificial transportation, and modification of stream channels. Rehabilitation would protect what remains in an ecosystem and encourage natural regenerative processes.

The solutions will not be easy or inexpensive to implement; even a holding action to prevent further declines will require large commitments of time and money from many people in many segments of society in the Pacific Northwest. Therefore, broad-based societal decisions are needed to successfully provide a long-term future for natural salmon populations.

ENVIRONMENTAL FACTORS

Natural and human-caused environmental changes affect all aspects of salmon life histories. Although humans can do little in the short term to control or even predict large-scale changes in environmental conditions, salmon-management programs must expect such changes and take them into account. Managers must also recognize that the natural variability in environmental conditions and people's desires for large and stable catches of salmon are often not compatible. Natural changes in environmental conditions in the ocean, in fresh water, and on land occur continually; sometimes they can lead to increased salmon productivity in an area; at other times they can lead to decreased productivity.

The emerging understanding of interdecadal changes in the ocean climate and the related mechanisms that affect salmon at sea have implications that are both exciting and disconcerting to scientists thinking about resource management. Humans are beginning to understand what happens to salmon during the majority of their lives—the portion spent at sea. Although we know little of the details, the new insights already demonstrate that variations in salmon abundance are linked to phenomena on spatial and temporal scales that humans and human institutions do not ordinarily take into account. Consider that the apparent effectiveness of hatcheries might have resulted from favorable ocean and climatic conditions in the era when the hatcheries were built; what looked like human manipulation of the total number of salmon might have been only a reapportionment among different populations. Or consider that the decline of some populations might be a direct result of introducing new hatchery populations into an ocean pasture of limited capacity.

The scale of human endeavor often has been incommensurate with the scale of salmon ecology. Some of our current policies are based on deep ignorance: it is not reasonable to assume that ocean conditions vary in ways that are generally uniform and random in their impacts on populations of salmon. Interdecadal variations and the importance of the ocean phase should be incorporated into human thought, planning, and actions in response to the effects of and attempts to repair damage that occurred during the freshwater phases of the salmon lives. The possible overriding effects of interdecadal changes in ocean conditions on salmon, the results of freshwater salmon management, and the overwhelming focus of human attention on the more-visible freshwater phases of the salmon history combine to provide the key ingredients for surprises in future.

Recently, natural environmental conditions in the Pacific Northwest appear to have been unfavorable to salmon production. As changes continue to occur, environmental conditions will probably favor salmon and lead to larger runs in some areas for a time, even without human intervention. If such changes do occur, they should be regarded as providing time to develop better strategies for rehabilitation of salmon populations. They should *not* be used as reasons for abandoning efforts to rehabilitate salmon, for they will surely be followed by other natural changes. Inappropriate short-term responses to large-scale environmental changes at sea or on land should be avoided, because there can be long lags between causes and effects.

LIMITS ON SALMON PRODUCTION

The salmon production cycle has three principal components that determine abundance:

reproductive potential of adults returning from the sea to spawn, which is affected by their growth at sea; production of offspring from natural reproduction in streams and artificial propagation in hatcheries; and sources of mortality (including natural mortality, fishing mortality, dam-caused mortality, mortality from habitat alterations and changes in environmental conditions, and so on). All three components are affected by changes in environmental conditions as well as by human activities. Variation in the three components and their interactions ultimately determine the ability to sustain salmon populations and their production. These limitations cannot be easily overcome through technology. Although it has been widely assumed that a loss of natural salmon production can be compensated by enhancement (e.g., by increasing hatchery production), chapters 6, 11, and 12 show that such an assumption is untenable by explaining the need to conserve sufficient genetic variation in natural populations to support the evolutionary and ecological processes needed for sustained salmon production. Compensating for salmon loss from any source over the long term therefore requires reducing other losses. Furthermore, an increasing appreciation of the marine environment and its effects on the above components is emerging as an essential consideration in salmon management.

VALUES

The salmon problem, like many other environmental issues, has been addressed through choices made within economic, political, and individual ethical frameworks. Values and ethical positions held by people involved in and affected by the salmon problem encompass a pluralistic, pragmatic and evolutionary approach to natural resource management. Recognizing and articulating that pluralism is important because problems in managing and protecting fish populations are due in part to the failure to articulate divergent interests, goals, and values and to address them explicitly. Chapter 5 describes how the widely varied ways that humans intervene in salmon populations are linked to socially validated values.

From a policy perspective, the salmon problem is one of long-standing and serious conflict in fact, interest, and values. People often invoke widely held values to protect particular interests, but values are genuine sources of conflict in themselves. Value conflict stems from different assessments of the desirable goals of public action. From a scientific perspective, wild salmon populations are an example of an ecosystem's natural capital. Our greatest success has been in designing ways to use human-food benefits from wild salmon. Our corresponding failure has been in protecting indirect and nonhuman benefits.

One way to present the salmon problem is to say that the value of the Pacific Northwest's salmon-capital asset has depreciated over time as its productivity has declined. A major problem is that the market does not account for the full range of costs and benefits of salmon. That is called a market distortion. When such market distortions exist, some resources are underpriced and overused, and others overpriced and underused. Many nonmarket values of salmon are underrepresented and are not easy to measure or compare. Thus management decisions often do not adequately reflect the importance of salmon to society and decisions about resource use may not achieve societal goals. To correct the discrepancy between social values and resource use, attempts can be made to design policies that reflect the full range of resource values.

Full value is a public, not a private, question. Consequently, public choices are central to the salmon problem. Public choices have to take into account many owners with multiple preferences, attributes that are not fully observable and sometimes unknown, and prices that reflect only part of the resources' full value to society. The concept of full value points to the problem of "externalities"—the problem that some costs and benefits are beyond the accounting of the decision-making unit.

Environmental variability creates economic uncertainty, which causes people to discount the future more heavily, and this leads to pressures to increase rates of immediate, direct use. Environmental variability also creates scientific uncertainty about biological processes, which can be perceived to call for a cautious approach and lead to pressures to lower rates of immediate, direct use. The resulting tension between economic and scientific responses to uncertainty adds complexity to decisions about appropriate rates of resource use. That tension is widespread in decisions concerning the salmon problem.

Problems like these emphasize the need to develop more appropriate interdisciplinary approaches. The idea of rebuilding the salmon runs of an industrialized ecosystem is heroically optimistic—a hope that might not have occurred to anyone except those who had rehabilitated the Willamette River basin in Oregon or Lake Washington near Seattle. Those environmental successes came through the disciplined execution of the planning paradigm that has been fitfully applied to the much larger Columbia basin. The extension of those experiences to the multijurisdictional, multifunctional situations of the Pacific Northwest would require coordinated action and learning on a new, larger scale—a scale on which planning and action have been tried but have not been successful. A more explicit appreciation of the values, interests, and institutions involved in this undertaking is required. Chapter 13 explores this further and urges constructive change in institutions that include cooperative management, bioregional governance, and adaptive management.

GENETICS AND CONSERVATION

Pacific salmon reproduce in freshwater streams. Their progeny migrate to the sea to grow and mature, and then return to freshwater streams to reproduce and (nearly always) die. This pattern of freshwater reproduction and growth at sea is called *anadromy*. Most of the adults actually return to the streams where they hatched. This behavior—called *homing*—is an essential part of salmon biology and makes their genetics and conservation unusual. There is a great deal of environmental variation among the various streams and lakes where salmon spawn and in the rivers through which they migrate. Because of their anadromous life cycles and homing behaviors and the variety of environments they occupy, each salmon species tends to differentiate into local breeding populations—called *demes*—that are in general reproductively isolated from other populations and adapted to each stream. To sustain productive natural populations of salmon, it is crucially important to maintain this genetic variation and local adaptation. Chapter 6 describes examples of such local adaptation.

However, more is involved than only local adaptation to various streams. Natural environmental fluctuations, including major disruptions caused by geological activity, can cause the extinction of local populations. Because homing is not perfect, fish that stray from nearby streams can replenish those populations. Strays are more likely to re-establish a population if the environment in the new stream is similar to that in the stream where they hatched. Thus, strays into tributaries in the same major river system or into nearby streams are more likely to succeed than those that stray into very different environments. This network of local populations (known as a *metapopulation*) provides a balance between local adaptation and the evolutionary flexibility that results from exchange of genetic material among local populations (Chapter 6). It likely also explains why artificial attempts to re-establish populations from a captive broodstock have often failed—too often, the gene pool of the broodstock has had reduced variation or has been derived from a population adapted to a different environment (Chapter 12). The metapopulation structure provides a balance between local adaptation and evolutionary flexibility; therefore, maintaining a metapopulation structure with good geographic distribution should be a top management priority to sustain salmon populations over the long term. Many of the committee's recommendations are based on this crucial conclusion.

There is no "correct" answer to the question of precisely how much biological diversity and population structure should be maintained or can be lost to provide a long-term future for salmon. Scientific estimates—including uncertainties associated with them—are only part of the argument. Society must decide what degree of biological security would be desirable and affordable if it could be achieved, i.e., the desired probability of survival or extinction of natural populations, over what time and what area, and at what cost. Nonetheless, biological diversity and the structure of salmon populations are being lost at a substantial rate, and this loss threatens the sustainability of naturally reproducing salmon populations in the Pacific Northwest.

HABITAT LOSS AND REHABILITATION

The main habitat requirements of salmon in freshwater include a stream or lake, the adjacent border of vegetation (riparian zone) that serves as the interface between aquatic and terrestrial ecosystems, and the quality and quantity of water (Chapter 7). The water must be clean enough and cool enough to support returning adults, for eggs to hatch, and for young to survive and grow until they migrate to sea. There must be enough water in the rivers at crucial times to make migration possible, to allow fish to escape predators, and to allow fish to find adequate food. Well-aerated streambed gravels are important for spawning. Streamside vegetation provides shade, which keeps the water cool; it provides a buffer against soil erosion, which maintains water quality; it provides living space for various animals that provide food and nutrients for streams; and it provides a source of large woody debris, which plays a key role in the formation of physical habitat and storage of sediment and organic matter and provides habitat complexity in stream channels, thus improving the stream environment for salmon. These requirements for environmental conditions in streams and adjacent riparian zones depend on the condition of the entire watershed in which they occur.

Many human activities—such as forestry; agriculture; grazing; industrial uses; commercial, residential, and recreational development; and flood control—have a variety of adverse effects on salmon habitats. For example, they can increase soil erosion, reduce the amount of woody debris in streams, raise the water temperature, add contaminants to the water, affect water flow, and reduce the amount of water available, with resultant loss or degradation of riverine and adjacent riparian and near-river habitat. Therefore, protection and rehabilitation of riverine and riparian habitats and associated watershed processes will be an integral part of rehabilitating salmon populations, although it is a major and difficult undertaking (Chapter 8). In the past few years, genuine improvements in protecting forested streams have been initiated. Nonetheless, for real progress to occur, habitat protection must be coordinated at landscape scales appropriate to salmon life histories, and they must be more consistent across different types of land use (chapters 8 and 13).

DAMS

Hundreds of dams have been built on rivers of the Pacific Northwest. They range from small irrigation dams with a hydraulic head of only a few feet to massive dams at Grand Coulee, Dworshak, and Hells Canyon on the Columbia and Snake rivers that are several hundred feet high and completely block upstream and downstream passage of anadromous fish. Dams on various rivers—some of them impassable—have greatly reduced wild runs. Even smaller dams (e.g., those associated with many hatchery operations and irrigation-diversion dams) can block salmon runs. In addition to their effects on migration, large storage dams affect the quantity and timing of water flow in the river as well as flow velocities, water chemistry, and water temperatures. Reservoirs behind dams can also inundate extensive areas of spawning and rearing habitat, although in some cases the reservoirs provide new (but different) rearing habitat. Many water diversions for irrigation lack protective fish screens of modern design; installing such screens would reduce mortality of smolts as they migrate downstream.

Even when fish ladders provide passage for adult salmon, many young salmon (smolts) migrating downriver die at dams. Although as many as 90% of young salmon might survive passage over, around, and through any single major project on the Columbia-Snake mainstem, the cumulative reduction in survival caused by passing many projects has adversely affected salmon populations. To counteract these effects, it is essential to improve the survival of smolts migrating through hydropower projects, especially in the Columbia and Snake rivers. Serious consideration needs to be given to all available alternatives for doing so; even a small improvement in survival would be helpful if it were repeated at several dams.

Controversy surrounds the effects of dams and how best to mitigate them. Alternatives include removal of dams, modification of turbines and other structural aspects of dams to improve fish survival during passage, drawdown of the water during the seaward migration of smolts to restore the river's profile to its pre-dam (river-grade) configuration to increase the flow rate and diminish the smolts' travel time, drawdown of the river to some level above river grade, augmentation of water flows during smolt migration to speed their passage downriver, transportation of smolts around dams by truck or by barge, control of predators in reservoirs and below dams, and spilling of water over dams instead of through the turbines. However, there is a dearth of good scientific information on which to base evaluations of the alternatives, some of which would be very expensive and would cause large losses of hydropower revenues.

Dam removal and drawdown of those rivers to river grade would be enormously expensive, would take many years, and probably would have long-term adverse impacts on the rivers. However, because the many dams on the Columbia River and its tributaries cumulatively have large effects on salmon survival, the addition of any new major dams in undammed reaches in the system (e.g., the Hanford Reach of the Columbia River) would make the situation worse;

existing dams should have adequate fish-passage facilities where feasible and appropriate before being relicensed. The committee is unaware of any scientific data that unequivocally support drawdown to a level above river grade as the best available dam-mitigation option for the Columbia River or the Snake River. Based on limited information, transportation appears to be the most biologically effective and cost-effective approach for moving smolts downstream. It should be continued on an adaptive basis (i.e., in such a way that additional information can be obtained about its effectiveness). Additional information is needed on effects of transportation on survival to the adult return stage, on homing, on success of natural spawning, and on genetic diversity of returning adults. Because any action that could jeopardize all of the fish in a stream must be avoided, not all the fish in any stream should be transported.

Research is needed on the effects of various options on the survival of both smolt and adult migration through dam and reservoir systems. Any management option should be applied on an adaptive (experimental) basis. The committee is not recommending that the salmon be "studied to death," a criticism often leveled at those who urge further studies. Indeed, enough is known now to take some actions. In recommending "adaptive" actions, the committee is recommending that any mitigative actions be taken in a way that allows their effects and effectiveness to be measured and assessed objectively. For example, if some fish in a stream are transported downstream, the action should be designed so its effectiveness can be assessed and compared with other alternatives. Despite the paucity of information, it is clear that no single approach would eliminate the adverse effects of dams on salmon.

HATCHERIES

Hatcheries have been used for more than 100 years in attempts to mitigate the effects of human activities on salmon and to replace declining and lost natural populations. As a result, a major proportion of salmon populations in the Pacific Northwest now consist largely of hatchery fish. These hatchery fish appear to have had substantial adverse effects on native fish populations.

For many years, people did not recognize the potential for hatchery fish to affect wild fish and did not believe that there was any limit to the ocean's capacity to provide food for growing salmon. It therefore seemed that producing more juveniles would result in more returning adults. The difficulties and shortcomings of hatchery production did not become apparent until fishing pressure and habitat-related mortality increased and marking technologies became available. As a result, hatcheries were not part of an adaptive-management program; that is, they were not considered as scientific experiments—they were not even adequately monitored—so many of their effects were not well known.

It is now clear from synthesis of experience and from consideration of well-established biological knowledge that hatcheries have had demographic, ecological, and genetic impacts on wild salmon populations and have caused problems related to the behavior, health, and physiology of hatchery fish. They have resulted (among other effects) in reduced genetic diversity within and between salmon populations, increased the effects of mixed-population fisheries on depleted natural populations, altered behavior of fish, caused ecological problems by eliminating the nutritive contributions of carcasses of spawning salmon from streams, and probably displaced the remnants of wild runs (Chapter 12). Hatchery fish have at times exceeded the capacity of streams and are increasingly being associated with reduced marine growth and survival in wild salmon populations (Chapter 12).

Many of the problems stem from purposes to which hatcheries have been put—mainly to provide substitutes for natural populations lost or displaced because of human development activities. Because of their deleterious impacts, however, hatcheries should no longer be viewed solely as factories for producing fish. Hatcheries should also be thought of as laboratories that can provide controlled environments for studying juvenile fish and for testing treatments to improve our understanding of what happens to juveniles after they leave spawning areas. Seen in that light, hatcheries can be a powerful tool for learning about salmon.

Hatchery planning, management, and operations should be changed so that their goals are to assist recovery of wild populations and to increase knowledge about salmon. As described above and in many parts of this report, especially chapters 6, 11, and 12, precautions must be taken to protect the genetic diversity and ecological productivity of naturally spawning populations of salmon. Those precautions will include an overall decrease in hatchery-fish production and—over the short term—in fishing opportunities. The basic guideline is to ensure that any hatchery production for fishing is not detrimental to natural populations. Because adaptive-management experiments should be tailored to the circumstances in different watersheds of the Pacific Northwest, decisions about use of hatcheries will differ across these watersheds. Therefore, decisions about uses of hatcheries should include a focus on the whole watershed and its linkage to the region and the ocean pasture, rather than only on the fish.

FISHING

Fishing for salmon is important in the Pacific Northwest. It includes commercial, recreational, and treaty fishing at sea and in rivers and is an important source of mortality, especially for adults returning to spawn. Salmon mortality caused by other human activities and structures such as dams, habitat loss or degradation, pollution, and water diversion and by natural factors such as predators, disease, and environmental variability together usually exceed fishing mortality. Those causes of mortality have a major effect on the production of adult fish and thus influence the rate of fishing that can be sustained. However, fishing is the easiest mortality factor to control. Control of fishing has rehabilitated marine and anadromous fish populations in various parts of the United States.

Managing salmon fisheries is more difficult than managing many other fisheries because of the geographic distribution of salmon, their metapopulation structure, and the fact that most adult fish spawn only once and then die. In the jargon of Pacific salmon fisheries, managers refer to groups of salmon populations that are identifiable for management as *stocks*. Frequently, *stock* refers to a geographic aggregate of populations that includes many local breeding populations of varied size and productivity; this is too large a unit for conservation of genetic diversity and rehabilitation of salmon production. Managing at the stock level obscures critical biological complexity. But even managing such large units is difficult because of the complex relationships, responsibilities, and obligations among a large number of institutional entities in the region (including nations, states, provinces, federal agencies, tribes, interest groups, and other organizations), the mandates of the Endangered Species Act and other laws, and the diverse array of interests and values in the region.

For rehabilitation of salmon populations, the aim for fishery management—as for other management efforts—should be to achieve long-term sustainability based on maintaining diversity of gene pools and population structures. Therefore, a successful fishery-management component for protecting natural salmon runs in the Pacific Northwest should explicitly recognize the need to maintain and rehabilitate the genetic diversity of salmon and recognize the interdependence of genetic diversity, habitat, and salmon production. It must also account for the uncertainty in scientific predictions and the inherent variability of biotic and abiotic environmental factors.

In general, the aim should be to assure adequate escapements for depleted populations. To achieve long-term sustainability, which requires sufficient genetic diversity, fishing should occur only where the identity (i.e., the originating population) of the salmon is known, when total fishing mortality is consistent with productivity of the fish, and when the catching technology ensures minimal mortality in depleted demes. This will require fishing methods that allow different degrees of fishing effort on various salmon populations and that allow identification of fish taken from depleted demes so that they can be avoided or released alive. Two methods of achieving these goals (but not the only ones) are terminal fisheries and live-catch fisheries.

In general, the serious declines of wild salmon populations show that not enough fish are being allowed to return to spawn. The number of fish returning to spawn (escapements) must be substantially increased to conserve genetic diversity within and between demes, use available habitats, rehabilitate ecological processes (including the return of nutrients to aquatic ecosystems), and increase the sustainable production of salmon. Increasing escapements will disrupt fisheries, industry, and communities, but it is necessary for restoring production. As salmon abundance increases and fisheries begin operating at lower, but sustainable, catch *rates*, actual catches will gradually increase, although probably not to the sizes of some historical catches, because those were based on excessive catch rates. Implementing this recommendation will initially require low fishing effort in many areas, especially in the ocean, and it will require cooperation from British Columbia and Alaska, because many salmon that originate in the Pacific Northwest are caught at sea in British Columbia and southeastern Alaska (chapters 10 and 11).

INSTITUTIONAL CHANGE

The long and serious decline of salmon in the Pacific Northwest has been promoted—often unwittingly—by human institutions; effective remedies, if they are to be found, will have to involve changes in those institutions. Growth in human populations and economic activity threatens the continued existence of salmon in the Pacific Northwest. Institutions developed in different times for diverse purposes have been asked to do things foreign to their original objectives and capabilities. Political changes have hindered attempts to take a long-term perspective. There has been fragmentation of effort and responsibility.

Changing institutional structures is notoriously difficult, but it is possible. Because the problems facing salmon have many aspects, a multidisciplinary approach to their solution is essential. Indeed, if the money that has been spent to date on salmon research had been spent with a more unified, regional vision, greater progress would have been made in maintaining viable salmon populations (Chapter 14). Unless agencies cooperate more effectively, salmon populations are unlikely to recover.

One problem is that current institutions and the boundaries of their jurisdictions usually do not match the spatial, temporal, or functional scales of the salmon problem. In addition, current institutional structures lack both a fine-grained aspect to respond to local concerns and variations and a coarse-grained aspect to integrate across small regions and to make sure that the interests of a few small areas do not jeopardize larger regional interests.

Because we often do not know what the effects of a management option will be, management must be undertaken with an experimental, adaptive point of view. Flexibility must be built into institutional structures to allow for changes in management practices based on experience. Institutions must allow and encourage refocusing the energies of salmon management to recognize the importance of demes in maintaining genetic processes and to maintain and expand their diversity. The goal of management should be to achieve a biologically sound escapement (instead of focusing on a "sustainable" or permissible catch) for each metapopulation and an explicit adoption of time scales for management and planning that are commensurate with the multiyear scale of salmon life cycles.

Beyond those facilitating changes, the formal institutions that manage salmon need to be restructured or refocused to reflect three important institutional principles. First, decision-making authority should be shared among all legitimate interests (cooperative management); legitimate interests that are excluded from decision-making are likely to block desirable changes. Second, the organizational structures and decision-making processes should allow for local conditions and variations and the management strategies should vary accordingly. Third, systematic learning using appropriate experimental designs (adaptive management) should be an essential goal.

As a first step, the relevant agencies in the Pacific Northwest, including the National Marine Fisheries Service, should agree on a process to permit the formulation of salmon recovery plans *in advance* of listings under the Endangered Species Act, and the Pacific Northwest states, acting individually and through the Northwest Power Planning Council, should provide technical and financial assistance to watershed-level organizations to prepare and implement these preemptive recovery plans.

A SCIENTIFIC ADVISORY BOARD TO ADDRESS SALMON PROBLEMS

A great deal is known about salmon and their difficulties, but a great deal remains unknown or controversial despite the expenditure of large amounts of money and time on research. Part of the reason for the lack of knowledge is that people have not agreed on what information is needed, have duplicated each other's work, and have been unwilling to fund needed research. An independent, multidisciplinary, standing scientific advisory board should be established to ensure that the limited money available for research is spent most productively to answer the most critical questions in a timely manner. A standing scientific advisory board would also help to ensure that when urgently needed actions are taken, they are designed so that their effects and effectiveness can be properly assessed. The board's reports should be public.

AN APPROACH TO SOLVING THE SALMON PROBLEM

The salmon problem took many years to develop, and its solution will require the commitment of considerable time. money, and effort. The committee's analyses of the problems and potential solutions lead to the conclusion that there is no "magic bullet." Therefore, like the problem itself, solutions will be complex and often hard to agree on; to be successful, they will need to be based on scientific information, including information provided by social and economic sciences. In addition, to be successful, consensus will be needed about the size of the investments to be made in solving the problem and how the costs should be allocated. This means that solutions will have to be regionally based, just as the salmon problem has regional variations (see Chapter 13).

The committee recommends the following general approach. *For each major watershed or river basin*, the following should be assessed.

- All causes of salmon mortality, including their estimated magnitude and the uncertainties associated with the estimates. Factors known to decrease natural production should also be listed.
- Ways of reducing those sources of mortality or compensating for them, their probable effectiveness, and their drawbacks.
- The probable costs of each method of reducing mortality. To be most useful, the estimates should include both market and nonmarket costs. To the degree possible, it is important to identify what societal groups would bear the major portion of the costs of each method and significant uncertainties in the estimates. (For example, reductions in catch rates would primarily affect fishers and tourists; changes in water use could affect agricultural interests or ratepayers; changes in riparian management could affect forest-products industries or private landowners.)

All the estimates would include substantial uncertainties, due both to lack of knowledge and to fundamental environmental, socioeconomic, and biological uncertainties. Nonetheless, such a process of assessment and evaluation is essential for rational decision making. They will provide a basis for evaluating options—for weighing benefits and costs—and for identifying areas where research is critical. *All the recommendations in this report should be viewed in this context: they need to be considered on a regional basis (i.e., major watersheds) and in a comprehensive framework that includes an analysis of their costs, probable effectiveness, and the ability and willingness of various sectors to bear the costs.*

This will be challenging for several reasons. First, in many cases, the desired information has not been collated or does not exist. Second, considerable time and resources will be needed to perform such analyses even for one watershed. But the most important reason is that estimates of costs and how they might be distributed will require intimate knowledge of each watershed and of people's preferences and habits. These essential estimates should be made with input from the people involved. The committee believes this approach will lead to improved effectiveness and—if not reduced costs—at least increased cost-effectiveness and reduced controversy.

THE FUTURE

The best approach to establishing a sustainable future for salmon in the Pacific Northwest is to use currently available information to develop workable, comprehensive programs rather than reacting to crises. This report has analyzed many parts of the salmon problem and assessed many options for intervention. However, if current trends continue, the Pacific Northwest will continue to see the effects of more people, more resource consumption, changing economic demands and technologies, and changing societal values. Because the success of programs to improve the long-term prospects for salmon in the Pacific Northwest will depend on the societal and environmental contexts, it is important to develop ways for improving our ability to identify changing contexts and to respond to them. As long as human populations and economic activities continue to increase, so will the challenge of successfully solving the salmon problem.