

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672
1831 SCOMM 74: SEN. SPEC. COMM. ON DOMESTIC & INTL. FISH., 1991-92. 18

- Consider a temporary moratorium on ALF&G permits and salmon enhancement loans for new or expansion of sockeye salmon production until more research can be conducted on increased wild stock production in Cook Inlet through increased escapement goals. Increased wild stock production, as suggested by Dr. Collie's research, would be dramatically more cost effective and impose fewer management conflicts than increased enhanced production. *could* 7
- Restrict the use of salmon enhancement tax funds to the production of species that generated the funds. This would encourage a more cost-effective production mix and would be most equitable to the gear group paying the tax.
- Consider no further funding of the salmon enhancement loan fund for new or expansion of all enhanced salmon production to ensure that any program expansions are cost effective.
- Consider developing a statewide planning process because study results clearly show that enhanced production in one region affects prices and, thus, net benefits to fishermen and hatcheries in other regions.
- Consider increasing state support of research and development for the new salmon product development. This should be carefully tailored to minimize market distortions.
- Consider reviewing Alaska salmon fishing regulations to determine potential changes in regulations to decrease fishing costs and increasing product quality of wild and enhanced stocks while still maintaining maximum sustainable yield of wild salmon stocks.

Kodiak Island Sockeye Salmon Releases

CURRENT RELEASES

Kodiak Island Sockeye Salmon Releases						COMBINED RELEASES				
FRY RELEASES (thousands)				Upper Thumb 23400	Russell Creek	Year	Total Fry Releases	Brood Stock Required year t-1	0-SMOLT Kitoi Bay	Brood Stock Required year t-1
Year	Pillar Creek	Spirodon Lake	Kitoi Hatchery				932	Year	Total Fry Releases	Brood Stock Required year t-1
1986						1986	23400.0	0.000	0.0	0.000
1987						1987	0.0	0.000	0.0	0.000
1988						1988	0.0	0.899	0.0	0.000
1989					932	1989	932.0	2.065	0.0	0.845
1990	0	0	2141			1990	2141.0	4.402	853.0	0.000
1991	3314		1250			1991	4563.8	13.506	0.0	4.953
1992	5700	8000	304			1992	14004.0	13.506	5000.0	4.953
1993	5700	8000	304			1993	14004.0	13.468	5000.0	4.953
1994	2660	11000	304			1994	13964.0	13.468	5000.0	4.953
1995	2660	11000	304			1995	13964.0	13.468	5000.0	4.953
1996	2660	11000	304			1996	13964.0	13.468	5000.0	4.953
1997	2660	11000	304			1997	13964.0	13.468	5000.0	4.953
1998	2660	11000	304			1998	13964.0	13.468	5000.0	4.953
1999	2660	11000	304			1999	13964.0	13.468	5000.0	4.953
2000	2660	11000	304			2000	13964.0	13.468	5000.0	4.953
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2004	2660	11000	304			2004	13964.0	13.468	5000.0	4.953
2005	2660	11000	304			2005	13964.0	13.468	5000.0	4.953
2006	2660	11000	304			2006	13964.0	13.468	5000.0	4.953
2007	2660	11000	304			2007	13964.0	13.468	5000.0	4.953
2008	2660	11000	304			2008	13964.0	13.468	5000.0	4.953
2009	2660	11000	304			2009	13964.0	13.468	5000.0	4.953
2010	2660	11000	304			2010	13964.0	13.468	5000.0	4.953
2011	2660	11000	304			2011	13964.0	13.468	5000.0	4.953
2012	2660	11000	304			2012	13964.0	13.468	5000.0	4.953
2013	2660	11000	304			2013	13964.0	13.468	5000.0	4.953
2014	2660	11000	304			2014	13964.0	13.468	5000.0	4.953
2015	2660	11000	304			2015	13964.0	13.468	5000.0	4.953
2016	2660	11000	304			2016	13964.0	13.468	5000.0	4.953
2017	2660	11000	304			2017	13964.0	13.468	5000.0	4.953
2018	2660	11000	304			2018	13964.0	13.468	5000.0	4.953
2019	2660	11000	304			2019	13964.0	13.468	5000.0	4.953
2020	2660	11000	304			2020	13964.0	13.468	5000.0	4.953
2021	2660	11000	304			2021	13964.0	13.468	5000.0	4.953

Egg-rel.	0.76	0.76	0.76
Rel.-adult	0.03	0.03	0.03
Weight (lb)	5.2	5.3	5.3

Spawners per egg:	0.000733
Fry per spawner:	1036.835
Smolts per spawner:	1009.550

Weighted mean % survival rates		
	Fry	Smolts
Hatchery Managers	3.00%	5.00%
Collie	2.19%	15.10%

0.74
0.05
5.2

The Emma Lake info is for average marine survival rate.

FRY RELEASES (thousands)

----- Prince William Sound -----

	Port San	Cannery	Esther	Solomon	Kitoi		Releases	required	Releases	required
Year	Juan-AFK	Creek	Lake	Gulch	Bay		PWS	PWS	Kodiak	Kodiak
1990	113840	143660	233260	122200	84908	1990	612960.0	1200.000	93207.6	168.650
1991					124148	1991	603520.0	1062.519	127648.0	296.296
1992	116916	134799	173817	230000	156000	1992	655532.0	1062.519	156000.0	296.296
1993	116916	134799	173817	230000	156000	1993	655532.0	1062.519	156000.0	296.296
1994	116916	134799	173817	230000	156000	1994	655532.0	1062.519	156000.0	296.296
1995	116916	134799	173817	230000	156000	1995	655532.0	1062.519	156000.0	296.296
1996	116916	134799	173817	230000	156000	1996	655532.0	1062.519	156000.0	296.296
1997	116916	134799	173817	230000	156000	1997	655532.0	1062.519	156000.0	296.296
1998	116916	134799	173817	230000	156000	1998	655532.0	1062.519	156000.0	296.296
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2000	116916	134799	173817	230000	156000	2000	655532.0	1062.519	156000.0	296.296
2001	116916	134799	173817	230000	156000	2001	655532.0	1062.519	156000.0	296.296
2002	116916	134799	173817	230000	156000	2002	655532.0	1062.519	156000.0	296.296
2003	116916	134799	173817	230000	156000	2003	655532.0	1062.519	156000.0	296.296
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2006	116916	134799	173817	230000	156000	2006	655532.0	1062.519	156000.0	296.296
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2010	116916	134799	173817	230000	156000	2010	655532.0	1062.519	156000.0	296.296
2011	116916	134799	173817	230000	156000	2011	655532.0	1062.519	156000.0	296.296
2012	116916	134799	173817	230000	156000	2012	655532.0	1062.519	156000.0	296.296
2013	116916	134799	173817	230000	156000	2013	655532.0	1062.519	156000.0	296.296
2014	116916	134799	173817	230000	156000	2014	655532.0	1062.519	156000.0	296.296
2015	116916	134799	173817	230000	156000	2015	655532.0	1062.519	156000.0	296.296
2016	116916	134799	173817	230000	156000	2016	655532.0	1062.519	156000.0	296.296
2017	116916	134799	173817	230000	156000	2017	655532.0	1062.519	156000.0	296.296
2018	116916	134799	173817	230000	156000	2018	655532.0	1062.519	156000.0	296.296
2019	116916	134799	173817	230000	156000	2019	655532.0	1062.519	156000.0	296.296
2020	116916	134799	173817	230000	156000	2020	655532.0	1062.519	156000.0	296.296
2021	116916	134799	173817	230000	156000	2021	655532.0	1062.519	156000.0	296.296

Egg-rel.	0.927	0.917	0.922	0.90	0.78
Rel.-adult	0.053	0.045	0.053	0.05	0.032
Weight lb	3.3	3.3	3.4	3.3	3.5
Weight kg	1.50	1.50	1.54	1.50	1.59
Fecundity (avg)		1500			
Sex ratio:		0.5			
Holding mortality:		10%			
Spawners per egg:		0.001481			

Weighted mean % survival rates		
<i>hatching</i>	PWS	Kodiak
Managers	5.03%	3.20%
Collie	5.00%	2.00%

Fry releases (thousands)											Smolt releases (thousands)								Stock releases (thousands)				
Year	Meadow Creek Lake	Kirchner Lake	Bruin Lake	Hazel Lake	Chenik Lake	Tustumena Lake	Packers Lake	Hidden Lake	Bear Lake	Chelatina Lake	Paint Lake	Leisure Lake	P. Dick Lake	Elusivak Lake	Thumb Cove	Bear Lake	Coal Creek	Eklutna Hatchery	Year	Fry Releases	Stock required	Smolt Releases	Stock required
1988	15096				838	13560					820	2250			0	0	0	0	1988	32527.0	28.560	0.0	0.000
1987	11866	887			1005	15200						2022	705		0	0	0	0	1987	35382.9	32.033	0.0	0.000
1986	14482	521		783	2601	6270	2989	6085			1655	2100	222	552	0	0	0	0	1986	38270.3	23.501	0.0	0.000
1989	13206	250		1000	3500	6010					1500	2000	430	500	0	0	0	0	1989	28395.8	21.515	0.0	0.050
1990	10815	250	500	1500	3250	6014					1500	2000		500	0	59	0	0	1990	26328.6	18.582	58.8	0.148
1991	10037	250	250	1300	2100	6000					750	2000			0	75	0	0	1991	22687.3	19.808	74.9	1.614
1992	5475	250	250	1250	2220	6000	3200	2000	2200	1600					0	800	100	0	1992	24445.0	14.848	900.0	1.359
1993	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1993	18970.0	14.848	1600.0	1.359
1994	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1994	18970.0	14.848	1600.0	1.359
1995	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1995	18970.0	14.848	1600.0	1.359
1996	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1996	18970.0	14.848	1600.0	1.359
1997	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1997	18970.0	14.848	1600.0	1.359
1998	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1998	18970.0	14.848	1600.0	1.359
1999	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1999	18970.0	15.783	1600.0	1.359
2000	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2000	20070.0	15.783	1600.0	1.359
2001	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2001	20070.0	15.783	1600.0	1.359
2002	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2002	20070.0	15.783	1600.0	1.359
2003	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2003	20070.0	15.783	1600.0	1.359
2004	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2004	20070.0	15.783	1600.0	1.359
2005	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2005	20070.0	15.783	1600.0	1.359
2006	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2006	20070.0	15.783	1600.0	1.359
2007	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2007	20070.0	15.783	1600.0	1.359
2008	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2008	20070.0	15.783	1600.0	1.359
2009	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2009	20070.0	15.783	1600.0	1.359
2010	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2010	20070.0	15.783	1600.0	1.359
2011	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2011	20070.0	15.783	1600.0	1.359
2012	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2012	20070.0	15.783	1600.0	1.359
2013	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2013	20070.0	15.783	1600.0	1.359
2014	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2014	20070.0	15.783	1600.0	1.359
2015	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2015	20070.0	15.783	1600.0	1.359
2016	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2016	20070.0	15.783	1600.0	1.359
2017	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2017	20070.0	15.783	1600.0	1.359
2018	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2018	20070.0	15.783	1600.0	1.359
2019	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2019	20070.0	15.783	1600.0	1.359
2020	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2020	20070.0	15.783	1600.0	1.359
2021	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2021	20070.0	15.783	1600.0	1.359
Egg-rel.	0.75	0.84	0.64	0.84	0.84	0.84	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	?	?	Weighted mean %survival rates				
Rel.-adult	0.01	0.06	0.08	0.08	0.08	0.025	0.048	0.05	0.037	0.04					0.2	0.2	0.2	0.33	Fry				
Weight (lb)	4.2	4.1	4.1	4.1	4.1	4.1	5.5	5.5	6.5	5.5					8.5	8.5	5.0	5.0	Smolts				
Fecundity (Tustumena)		3271																	Managers				
Sex ratio:		0.5																	Collie				
Holding mortality:		10%																					

November 25, 1992

John Boyce
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Fairbanks, Alaska 99775

Dear Mark and John:

As I mentioned in my recent phone conversation with Mark, Kurt Schelle, Ben Muse, Jeff Hartman, and I have been reviewing your demand, fishing cost and benefit-cost reports. We have identified some areas in which we need additional information before we can fully evaluate the research results. These comments and information requests are by no means complete, but many of the other concerns can be addressed when editing the final benefit-cost analysis report. The information requested is needed before I can send editorial comments on the benefit-cost report.

As I am sure you are as anxious as I am to have this work completed, please provide me with this information as soon as possible. I would like to have you send the information and then set up a conference call time no later than next Friday, December 4. If there is any problem with this schedule, please let me know.

Sincerely,

Ginny Fay

c.c. Mary McDowell
Molly McCammon
Kurt Schelle
Ben Muse
Jeff Hartman

Benefit - Cost Analysis Review

International Salmon Demand Model

Need a clear and detailed explanation of how elasticities estimates from high- and low-valued species aggregations are transferred to single-species estimates. Specifically, how were cross-price elasticities within the aggregate groups calculated. Report states that single-species estimates are "ad hoc" estimates that are adjusted by "one quarter." Does this mean 25% or 0.25? The final combined report suggests that these ad hoc estimates are more reliable than the those empirically derived. Thus, the results to cases 5-11 are more reliable than cases 2-4. Need a clear understanding to evaluate these results and their policy implications.

Need a table or listing of assumptions regarding exogenous variables--exchange rates, population and income growth rates, farmed salmon production and growth rates (especially Chile's 12% annual growth, is this a reasonable assumption?). Need this information to evaluate report results. Assumptions should be separated into values for mid-point, optimistic, and pessimistic cases. If specific assumptions were not altered to attain low-, mid-, and high-price scenarios, explain how this was done.

Page 24 and 25- Are these price flexibilities and elasticities correct?

Unfortunately (or fortunately???), none of us are Bayesian Bootstrap Technique experts so we need a more complete set of summary statistics for evaluating how well the model performed. We are assuming that the statistics on page 87 are for the whole system (bloc 1 and 2) operating together. We would also like to see the 1) rms error, 2) rms % error, 3) mean error, and 4) mean % error.

Fishing Cost Model

Comments on the earlier draft were not addressed. Specifically, what is the potential bias in the fishing cost estimates from using only one year of data and, specifically, using 1990 when ex-vessel prices were relatively low. Are producer surplus figures probably on the hide side because of 1) lower prices, 2) short-term analysis, and 3) earnings to non-residents are not segregated?

We have also had quite a bit of discussion within our review group regarding which costs your analysis captures. Is it very short-run capturing only variable

costs or to what extent are fixed costs captured? We would like time with a conference call for a detailed explanation.

Was there any discussions with fishermen regarding results? One discussion I had suggested the Cook Inlet Drift Net fishery producer surplus estimates are low; that drift net fleets should be more efficient than purse seine fleets.

Benefit - Cost Final Report

Need to delete recommendations and limit the report to results of economic and biological analyses firmly couched in appropriate caveats and clearly identified assumptions as well as the impact of altering key assumptions.

Many of the conclusions/results and policy recommendations are rather bold given the warnings and caveats provided earlier in the report. While removing recommendations will alleviate some of these problems, limitations and effects of key assumptions must be noted with reporting of results. Editing suggestions will be provided.

Similar to demand model, final report needs a complete summary of values and assumptions regarding exogenous variables including production of wild and enhanced stocks, and farmed salmon by appropriate species, region, and/or country; income and population growth rates, and exchange rates. Most of these were part of the demand study so probably one appendix be used for the final report and the demand analysis. If it is only located in one location, however, it is imperative that it be attached to the final report.

I need an explanation of footnote 9. Sounds a bit drastic. Did you remember to remove Valdez production number since we did not have their costs? Could this be the source of the problem? Also, did you remember that Gulkana costs and production were reported by the state and not PWSAC?

Need an explanation of footnote 6. Why was this done? Why were revenues higher in year 15?

Would be simplest if results were presented as discounted net present values as is standard methodology. Also, must have high- and low-price scenarios presented with mid-point results.

Important to point out that analysis is limited to direct benefits, no indirect benefits to communities of fishing and fish processing. Also, no analysis of direct

net benefits to fishermen based on residency of fishermen, especially non-resident fishermen.

FRY RELEASES (thousands)						Stock				
Year	Pillar	Spirodon	Kitoi	Upper	Russell	Year	Total	Stock	0-SMOLT	Stock
	Creek	Lake	Hatchery	Thumb	Creek		Fry	Required	Kitoi	Required
1986				23400		1986	23400.0	0.000	0.0	0.000
1987						1987	0.0	0.000	0.0	0.000
1988						1988	0.0	0.899	0.0	0.000
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2002	2660	11000	304			2002	13964.0	13.468	5000.0	4.953
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2020	2660	11000	304			2020	13964.0	13.468	5000.0	4.953
2021	2660	11000	304			2021	13964.0	13.468	5000.0	4.953
Egg-rel.	0.76	0.76	0.76						0.74	
Rel.-adult	0.03	0.03	0.03						0.05	
Weight (lb)	5.2	5.3	5.3						5.2	

Spawners per egg: 0.000733
 Fry per spawner: 1036.835
 Smolts per spawner: 1009.550

Weighted mean %survival rates		
	Fry	Smolts
Managers	3.00%	5.00%
Collie	2.19%	15.10%

"Managers" = hatchery managers who filled out surveys

FRY RELEASES (thousands)

----- Prince William Sound -----

Year	Port San	Cannery	Est. er	Solomon	Kodiak	Total	Brood-	Total	Brood-
	Juan-AFK	Creek	Lake	Gulch	Kitoi	Fry	stock	Fry	stock
					Bay	Releases	required	Releases	required
						PWS	PWS	Kodiak	Kodiak
1990	113840	143660	233260	122200	84908	1990	612960.0	1200.000	93207.6
1991					124148	1991	603520.0	1062.519	127648.0
1992	116916	134799	173817	230000	156000	1992	655532.0	1062.519	156000.0
1993	116916	134799	173817	230000	156000	1993	655532.0	1062.519	156000.0
1994	116916	134799	173817	230000	156000	1994	655532.0	1062.519	156000.0
1995	116916	134799	173817	230000	156000	1995	655532.0	1062.519	156000.0
1996	116916	134799	173817	230000	156000	1996	655532.0	1062.519	156000.0
1997	116916	134799	173817	230000	156000	1997	655532.0	1062.519	156000.0
1998	116916	134799	173817	230000	156000	1998	655532.0	1062.519	156000.0
1999	116916	134799	173817	230000	156000	1999	655532.0	1062.519	156000.0
2000	116916	134799	173817	230000	156000	2000	655532.0	1062.519	156000.0
2001	116916	134799	173817	230000	156000	2001	655532.0	1062.519	156000.0
2002	116916	134799	173817	230000	156000	2002	655532.0	1062.519	156000.0
2003	116916	134799	173817	230000	156000	2003	655532.0	1062.519	156000.0
2004	116916	134799	173817	230000	156000	2004	655532.0	1062.519	156000.0
2005	116916	134799	173817	230000	156000	2005	655532.0	1062.519	156000.0
2006	116916	134799	173817	230000	156000	2006	655532.0	1062.519	156000.0
2007	116916	134799	173817	230000	156000	2007	655532.0	1062.519	156000.0
2008	116916	134799	173817	230000	156000	2008	655532.0	1062.519	156000.0
2009	116916	134799	173817	230000	156000	2009	655532.0	1062.519	156000.0
2010	116916	134799	173817	230000	156000	2010	655532.0	1062.519	156000.0
2011	116916	134799	173817	230000	156000	2011	655532.0	1062.519	156000.0
2012	116916	134799	173817	230000	156000	2012	655532.0	1062.519	156000.0
2013	116916	134799	173817	230000	156000	2013	655532.0	1062.519	156000.0
2014	116916	134799	173817	230000	156000	2014	655532.0	1062.519	156000.0
2015	116916	134799	173817	230000	156000	2015	655532.0	1062.519	156000.0
2016	116916	134799	173817	230000	156000	2016	655532.0	1062.519	156000.0
2017	116916	134799	173817	230000	156000	2017	655532.0	1062.519	156000.0
2018	116916	134799	173817	230000	156000	2018	655532.0	1062.519	156000.0
2019	116916	134799	173817	230000	156000	2019	655532.0	1062.519	156000.0
2020	116916	134799	173817	230000	156000	2020	655532.0	1062.519	156000.0
2021	116916	134799	173817	230000	156000	2021	655532.0	1062.519	156000.0

Egg-rel.	0.927	0.917	0.922	0.90	0.78
Rel.-adult	0.053	0.045	0.053	0.05	0.032
Weight lb	3.3	3.3	3.4	3.3	3.5
Weight kg	1.50	1.50	1.54	1.50	1.59
Fecundity (avg)		1500			
Sex ratio:		0.5			
Holding mortality:		10%			
Spawners per egg:		0.001481			

Weighted mean % survival rates		
	PWS	Kodiak
Managers	5.03%	3.20%
Collie	5.00%	2.00%

	Meadow Creek	Kirchner Lake	Bruin Lake	Hazel Lake	Chenik Lake	Tustumena Lake	Packers Lake	Hidden Lake	Bear Lake	Chelatina Lake	Paint Lake	Leisure Lake	P. Dick Lake	Elusivak Lake	Thumb Cove	Bear Lake	Coal Creek	Eklutna Hatchery	Year	Releases	stock required	Smolt Releases	stock require
1986	15058				839	13560					820	2250			0	0	0	0	1986	32527.0	28 560	0.0	0.00
1987	11886	867			1005	15200		3718				15200	705		0	0	0	0	1987	35382.8	32 033	0.0	0.00
1988	14402	521		783	2601	6270	2989	6085			1655	2100	222	552	0	0	0	0	1988	38270.3	23 501	0.0	0.00
1989	13206	250		1000	3500	6010					1500	2000	430	500	0	0	0	0	1989	28385.8	21 515	0.0	0.05
1990	10815	250	500	1500	3250	6014					1500	2000		500	0	58	0	0	1990	26328.8	18 562	58.8	0.14
1991	10037	250	250	1300	2100	6000					750	2000			0	75	0	0	1991	22887.3	19 808	74.9	1.8
1992	5475	250	250	1250	2220	6000	3200	2000	2200	1600					0	600	100	0	1992	24445.0	14 848	900.0	1.35
1993	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1993	18970.0	14 848	1600.0	1.35
1994	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1994	18970.0	14 848	1600.0	1.35
1995	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1995	18970.0	14 848	1600.0	1.35
1996	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1996	18970.0	14 848	1600.0	1.35
1997	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1997	18970.0	14 848	1600.0	1.35
1998	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1998	18970.0	14 848	1600.0	1.35
1999	0	250	250	1250	2220	6000	3200	2000	2200	1600					250	250	100	1000	1999	18970.0	15 783	1600.0	1.35
2000	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2000	20070.0	15 783	1600.0	1.35
2001	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2001	20070.0	15 783	1600.0	1.35
2002	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2002	20070.0	15 783	1600.0	1.35
2003	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2003	20070.0	15 783	1600.0	1.35
2004	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2004	20070.0	15 783	1600.0	1.35
2005	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2005	20070.0	15 783	1600.0	1.35
2006	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2006	20070.0	15 783	1600.0	1.35
2007	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2007	20070.0	15 783	1600.0	1.35
2008	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2008	20070.0	15 783	1600.0	1.35
2009	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2009	20070.0	15 783	1600.0	1.35
2010	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2010	20070.0	15 783	1600.0	1.35
2011	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2011	20070.0	15 783	1600.0	1.35
2012	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2012	20070.0	15 783	1600.0	1.35
2013	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2013	20070.0	15 783	1600.0	1.35
2014	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2014	20070.0	15 783	1600.0	1.35
2015	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2015	20070.0	15 783	1600.0	1.35
2016	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2016	20070.0	15 783	1600.0	1.35
2017	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2017	20070.0	15 783	1600.0	1.35
2018	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2018	20070.0	15 783	1600.0	1.35
2019	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2019	20070.0	15 783	1600.0	1.35
2020	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2020	20070.0	15 783	1600.0	1.35
2021	0	250	250	1250	2220	6000	3200	2000	3300	1600					250	250	100	1000	2021	20070.0	15 783	1600.0	1.35
Egg-rel.	0.75	0.94	0.94	0.94	0.94	0.94	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	?	?	Weighted mean %survival rates				
Rel-adult	0.01	0.08	0.08	0.08	0.08	0.025	0.048	0.05	0.037	0.04					0.2	0.2	0.2	0.33		Fry	Smolts		
Weight (lb)	4.2	4.1	4.1	4.1	4.1	4.1	5.5	5.5	6.5	5.5					8.5	6.5	5.0	5.0	Managers	5.97%	28.13%		
Fecundity (Tustumena)		3271																	Collie	2.19%	15.10%		
Sex ratio:		0.5																					
Holding mortality:		10%																					

Release Year	CURRENT RELEASES					1-SMOLT RELEASES											Brood stock year t
	Snettisha Juneau Remote	Deer Mt. Ketchikan Creek	Crystal Lake Hatchery	Earl West	Burnett Inlet	NSRAA Hidden Falls	NSRAA Medvejie Creek	Sheldon Jackson	Port Armstrong	SSRAA Neets Bay	SSRAA Whitman Lake	SSRAA Carroll Inlet	Little Port Walter	Tamgas	Gastineau Hatchery		
20	15																
1986	387.2	46.4	552.0	98.0	0.0	92.1	108.0	54.2	0.0	1115.0	119.0	51.0	213.0	573.4	0.0	2.48	
1987	1047.0	42.1	427.0	251.0	0.0	98.0	227.5	47.0	0.0	734.2	98.0	816.6	205.0	1445.7	0.0	3.88	
1988	430.4	121.0	550.0	483.0	3.0	155.6	174.6	32.0	0.0	708.2	151.0	892.3	286.7	164.4	0.0	5.49	
1989	1224.0	191.0	708.0	394.0	170.0	343.8	743.8	96.7	89.9	699.2	55.0	702.5	161.8	888.9	0.0	3.35	
1990	1631.0	121.0	1141.0	486.5	193.0	351.5	911.3	100.5	144.0	1608.0	75.4	1004.8	166.0	1131.8	101.5	5.76	
1991	400.0	160.0	456.4	399.6	125.0	184.4	866.9	35.0	100.0	900.0	73.7	1102.1	209.5	674.0	42.0	6.07	
1992	300.0	100.0	800.0	500.0	65.0	1700.0	1100.0	99.5	2400.0	995.0	73.7	1000.0	270.0	600.0	150.0	4.95	
1993	300.0	100.0	800.0	500.0	0.0	2145.0	1215.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1994	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	0.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1995	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1996	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1997	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1998	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
1999	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2000	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2001	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2002	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2003	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2004	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
2005	300.0	100.0	800.0	500.0	0.0	2400.0	1370.0	99.5	2400.0	995.0	73.7	1000.0	300.0	600.0	190.0	6.28	
	-4.00717	-3.59417	-3.58317	-3.04717	-4.00717	-5.52717	-4.93717	-5.50717	-4.00717	-3.26317	-2.72917	-2.88717	-3.50317	-4.00717	-4.00717		
Egg-rel.	0.62	0.75	0.75	0.75	0.81	0.8	0.9	0.85	0.8	0.75	0.75	0.75	0.75	0.75	0.95		
S-A Model	1.82%	2.75%	2.78%	4.75%	1.82%	0.40%	0.72%	0.41%	1.82%	3.83%	6.53%	5.57%	3.01%	1.82%	1.82%		
S-A Survey	2.00%	3.50%		4.50%	4.00%	1.00%	2.00%	0.92%	5.00%	3.98%	5.66%	3.53%			3.00%		
Weight (lb)	25.5	21.5	17.5	17.5	16.0	14.7	15.5	19.6	20.0	?	?	?			25.5		
Fecundity	5000																
Sex ratio:	0.5																
Holding m	10%																

"S-A" = survey-to-adult



Alaska State Legislature

SENATE

Official Business

P.O. Box V
State Capitol
Juneau, Alaska 99811

July 16, 1992

To: Gordon Harrison, Director
Legislative Research Agency

From: Senator Dick Eliason, President
Alaska State Senate 

RE.: Alaska Salmon Enhancement Program Review Project

As you know, the Senate Special Committee on Domestic and International Commercial Fisheries is conducting a review of the Alaska salmon enhancement program. Part of this review includes an economic analysis of the program. Your agency has been involved in this economic review through your assistance with enhancement project survey production and mailings.

Now that the results of these surveys have been received, they are being reviewed by Alaska Department of Fish and Game (ADF&G) staff. The ADF&G staff are also developing a computerized database system for the survey results. I would like to request your agency's assistance with data entry. ADF&G anticipates that the database system will be ready in early August and will probably take approximately two person-weeks to enter the data. The ADF&G will loan your agency a copy of the necessary software to be installed by the Legislative Affairs Agency data processing section. We need to have the completed database sent to the University of Alaska researchers by September 1. Ginny Fay (465-3711) will be coordinating this aspect of the project and can answer any specific questions.

Please let me know if you anticipate any problems with this schedule. Thank you for your kind assistance.

C.C.
Jeff Koenings
Bob Clasby
Molly McCammon
Ginny Fay



Alaska State Legislature

SENATE

Official Business

P.O. Box V
State Capitol
Juneau, Alaska 99811

July 16, 1992

To: Bob Clasby, Director
Division of Commercial Fisheries
Alaska Department of Fish and Game

From: Senator Dick Eliason, President 
Alaska State Senate

RE.: Alaska Salmon Enhancement Review Project Management Costs

As you know, the Senate Special Committee on Domestic and International Commercial Fisheries is conducting a review of the Alaska salmon enhancement program. Part of this project includes an economic analysis of the program. Your division has been involved in this economic review through your assistance with the development of the study plan, provision of data for population modeling, and review of the enhancement project production survey results.

One of the Division of Commercial Fisheries comments regarding the economic review of the Alaska salmon enhancement program was that insufficient management costs resulting from enhanced fish stocks have been incorporated into prior benefit - cost analyses. Therefore, the legislative study enhancement cost survey explicitly requests information on ADF&G management costs. In the next couple weeks, the FRED Division will provide the completed enhancement facility cost surveys for your Division's review and management cost estimates. While we understand that this is the busy fishing season, we would appreciate your cooperation in expediting this review so the data can be entered onto computer and transferred to University of Alaska researchers.

In addition, it has been brought to my attention that Dr. Jeremy Collie, who is conducting the population modeling research for the project, is waiting for additional data from your division. To ensure that the project can be completed in a timely manner, please encourage your staff to provide these data as soon as possible.

Thank you for your assistance and continued cooperation with this project.

C.C.
Jeff Koenings
Jeremy Collie
Molly McCammon
Ginny Fay



Alaska State Legislature

SENATE

Official Business

P.O. Box V
State Capitol
Juneau, Alaska 99811

Status of the Legislative Review of the Salmon Enhancement Program Economic Projects

This provides a brief status report on the economic projects being completed primarily by the University of Alaska Fairbanks for the Senate Special Committee on Domestic and International Commercial Fisheries (see the attachment for a description of the studies). Four of the studies are being conducted via RSAs; one is being completed by Alaska Department of Fish and Game (ADF&G) and legislative staff, and the Legislative Research Agency. For the four RSAs, half of the funding was paid when the project was initiated with the remainder to be paid when the projects are reviewed and accepted by the Committee as complete. Each of the following descriptions identifies the project, principal researcher, total project funds, expected date of completion, and reasons for delay.

Population and Exploitation Model, Dr. Jeremy Collie, \$10,000, August 15, 1992. This project is late as a result of delays in the transfer of data by ADF&G because the data were not in a form readily transferable to Dr. Collie. ADF&G staff had to compile the information in addition to their usual assignments. Unfortunately, this resulted in Dr. Collie compiling a significant portion of the data himself, although the RSA specified that the data would be provided by ADF&G.

International Salmon Demand Model, Drs. Mark Herrmann and Joshua Greenberg, \$18,000, September 15, 1992. This project is awaiting 1991 Alaska salmon price, gross earnings, and harvest data that will be provided by the Commercial Fisheries Entry Commission (CFEC) when it becomes available in August. Preliminary review of the May 1992 report on work completed to date indicates that the study is going well and will provide the legislature and ADF&G with valuable information on Alaska's salmon fisheries. The researchers requested a time extension in order to use the 1991 data and make the results more meaningful.

Salmon Fishing Cost Model, Dr. John Boyce, \$20,000, September 1, 1992 ??? The final completion date on this project is uncertain as a result of countless frustrating and futile attempts to contact the researcher.

Initially, the project was delayed because of the transfer of large data sets from CFEC and the time required for their analysis. The researcher provided an inadequate progress report to the Committee in May. All attempts to solicit additional information on research progress have gone unanswered.

Enhancement Production and Cost Surveys and Model, legislative and ADF&G staff and the Legislative Research Agency (LRA), August 15, 1992. This portion of the research is composed of a number of activities coordinated between legislative and ADF&G staff and university researchers. The primary activity is the development of the enhancement project production and cost surveys. Four production and two cost surveys were developed (legislative and ADF&G staff) and mailed (LRA and ADF&G) to obtain information on all salmon enhancement projects in Alaska. Different surveys were required depending on whether a project was part of a state or PNP facility. The results of the production survey were used for the population modeling, by Dr. Collie, which is nearing completion. At this time, two-thirds of the PNP cost surveys and less than half of the state-facility cost surveys have been returned. When all surveys are returned, they must be reviewed (legislative and ADF&G staff), data entered on to computer (LRA), and transferred to university researchers to incorporate into the combined model. This aspect of the research has been delayed because of the legislative session workload, delays in survey result reviews by ADF&G, and delays in returning of surveys including the Southern Southeast Regional Aquaculture Association, which thus far has not completed any surveys.

Model Combining and Benefit - Cost Analyses, Drs. John Boyce, Diane Bischak, and Mark Herrmann, \$10,000, November 1, 1992. This final portion of the research is delayed because all four other research pieces must be completed before it can be initiated.

There are two primary tasks remaining for the economic review project manager. The first is to coordinate the enhancement project survey data collection, review, and data entry and transfer to university researchers. The population modeling project used only approximately half of the fisheries production survey data collected. The remaining half will be less intensively model by ADF&G staff (this approach was done based on the contribution of enhancement projects to fisheries).

In addition to this remaining population data, the production cost survey results need to be reviewed, ADF&G management cost must be estimated, and the final data must be organized on a computer database for analysis by

university researchers. While ADF&G staff will conduct most of the data review, estimation of management costs, and design the database, and the Legislative Research Agency will enter the data, coordination is needed to ensure that the tasks proceed in a timely manner. In addition, technical oversight is required so the resulting products are compatible with the combined modeling effort. This coordination and review effort should take approximately two weeks of time between July and September.

The second task is the 1) review of individual work projects to ensure they fulfill the RSA specifications and provide necessary output data for the combined model, 2) provide technical troubleshooting advice during combined model development and policy simulations, and 3) review and/or edit the final report executive summary to ensure that it is understandable to legislators and other non-economists (this was done for the preliminary results given to the Committee in May). This task should require approximately two to three weeks of time between August and October.

July 16, 1992

**UNIVERSITY OF ALASKA FAIRBANKS****School of Management**
Fairbanks, Alaska 99775-1070

DATE: July 22, 1992

TO: Ginny Fay

FROM: Mark L. Herrmann *MLH*
Department of Economics

Re: Salmon Progress Report

I received your report on the status of the Legislative Review of the Salmon Enhancement Program. The report looks fine to me. On the progress on the salmon demand model, it is moving slowly but not because of lack of effort. I have been putting in 80 hour weeks on it for the last three months. Despite the lack of speed the modelling effort will be done by the end of August and given to John to use in the simulation analysis. I will have the reports to you in draft form by the middle of September and will wait for your comments before I finalize it.

Again, much of the delay is because of the slowness in receiving the 1991 data. I finally realized that I will not be able to wait on all the 1991 data for the entire modelling effort. For the exvessel price equations, I have just asked DFO (Vancouver) and CFEC for the preliminary data since neither department will have the final exvessel price data finished by August. Nevertheless, the preliminary exvessel price data should be fairly good. I have also had problems obtaining enough memory in my computer to simulate the entire set of equations. But I have just recently cleared this up.

John says his cost model is making excellent progress. I do not know the details. Diane B. and John B. will do the final simulations. My part will be to program the demand part of the model simulations into SAS and to make sure the results make sense. I also may supply them with predicted future values of the exogenous variables. However, the bulk of the simulation will be done by Diane and John. I don't see a problem making the final deadline if the runs from Dr. Collie will be in by the end of August.

One thing that I do not remember how we resolved was getting an estimate on Canadian harvests in the future. When I was in France last week at the IIFET conference I was able to get a better handle on the farmed salmon situation.

If you have any questions feel free to call me at my office (907) 474-7116 or home (907) 455-9073. Hope your having a nice summer, it has been absolutely beautiful here.

DRAFT

Salmon Population and Exploitation Modeling

by

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For the
Alaska State Legislature
Senate Special Committee on Domestic and
International Commercial Fisheries

As part of the
Legislative Review of the Alaska Salmon Enhancement Program
Benefit-Cost Analysis

November 1992

DRAFT: Do not quote without permission of the author.

Introduction

The objectives of the salmon population and exploitation modeling was to project Alaska salmon production levels by region to the year 2022. For each region, projections were made of expected wild and enhanced production based on current facility capacity. Estimates of commercial salmon harvests are based on present fisheries management practices.

Background

In the early 1970s, the state of Alaska initiated a salmon enhancement and rehabilitation program through the Alaska Department of Fish and Game (ADF&G), Division of Fisheries Rehabilitation, Enhancement, and Development (FRED). Salmon production through enhancement efforts was to compensate for extremely low wild salmon returns in the 1970s.

The hatchery (or ocean ranching) component is the largest part of the enhancement program. There are two categories of hatcheries: 1) state hatcheries, which are state funded and operated by FRED, and 2) private non-profit (PNP) hatcheries. Private PNP hatcheries include regional aquaculture association facilities which can collect salmon enhancement tax receipts from fishermen in the region and "mom and pop" operations that are independent from the regional associations. The independent operations can not collect enhancement taxes. All PNPs can sell cost-recovery harvest fish to pay for operating costs and apply for state enhancement loans through the Alaska Department of Commerce and Economic Development, Division of Investments.

During the last 20 years, the state of Alaska has invested extensively in hatcheries by providing capital construction costs and operating costs to state facilities and loans to PNPs. In addition, FRED provides administrative, technical, research, and planning support to PNP facilities. As a result of declining state revenues, there is an increasing trend towards privatization of state owned and operated facilities. This has primarily been accomplished through contracts with regional aquaculture associations for the operation of state-owned facilities. Support to PNPs through FRED and salmon enhancement loans have also declined.

In general, the enhancement program has been very successful in producing more fish. Recent annual harvests from the hatchery program range from 15-23 million fish.

Enhancement Program Review

In May 1991 the Senate Special Committee on Domestic and International Commercial Fisheries initiated an extensive review of the Alaska salmon hatchery and enhancement program. The purpose of the study is to:

- 1) Review the history and legislative intent of the program.
- 2) Analyze the current status of the program.
- 3) Consider future options for the program ranging from fine tuning to possible redirection.

Part of the program review is an economic analysis. An economics study group was formed to address questions raised by the Committee including:

- if the present levels of Alaska salmon harvest are over- or under-supplied from a world market perspective, and
- if increased enhanced salmon production will raise or lower prices, fishing revenues, and the total net benefits of Alaska's salmon fisheries.

A benefit-cost analysis is required to answer these two questions. This salmon population and exploitation modeling project is one part of this benefit-cost analysis.

Fisheries Modeled

To bound the modeling project, a subset of regions and species was jointly selected by legislative and FRED representatives and the author. These fisheries were to be intensively modeled:

- Kodiak pink salmon
- Kodiak sockeye
- Cook Inlet sockeye
- Prince William Sound pink salmon
- Southeast Alaska chinook salmon

This set was selected because it includes most of enhanced salmon production harvested by commercial fleets (Figure 1). The models developed aggregate production over the region of interest. It was also agreed that the remainder of the commercial salmon population and exploitation estimates (the non-intensively modeled set) would be based on projections of state and PNP hatchery managers and ADF&G, Division of Commercial Fisheries estimates of wild stock historical harvests. Only the intensively modeled fisheries are discussed in this report.

Modeling Methodology

The modeling effort followed the standard approach to estimating the catch of enhanced fish:

$$\text{Hatchery Catch} = \text{Fry released} * \text{Survival} * \text{Exploitation Rate}$$

Improvements were made to the model by:

- estimating survival rates and variance from past releases and
- considering constraints on the exploitation rate imposed by mixed fisheries.

The first step in developing a Salmon Simulation Model (Figure 2) is to estimate the model parameters from historical data. If there are insufficient data or no data exist to quantify a relationship, the effect can not be included in the model. Initial considerations regarding the intensive modeling of the Prince William Sound chum salmon fishery and the Southeast Alaska coho salmon fishery were discontinued based on inadequate data.

Release data for enhanced stocks were obtained by surveying hatchery managers. The survey of hatchery managers was conducted as a joint legislative and FRED effort. Survey results were provided to the author. Most of the survey results indicate that current capacity estimates change very little after the initial survey years. This suggests that the hatchery managers' planning horizon is relatively short despite the fact that investment decisions must be made using a longer planning horizon. In most cases, planned releases are the same as current releases. The exception was Cook Inlet sockeye salmon; managers are planning significant production expansion.

Wild stock historical escapement data, future escapement targets, and mixed-fisheries management constraints were provided by ADF&G, Division of Commercial Fisheries.

Monte Carlo Simulations

The inputs for the Monte Carlo simulations included enhanced fry and smolt releases, wild stock escapements during the initialization years, and the escapement target for future years. Random variability was introduced into the survival rates to indicate the level of natural variability to expect around the median estimates. Mean survival rates and their variances were calculated from spawner recruitment data for wild stocks, and from historical release data for hatchery stocks. Wild-stock preference was built into the exploitation sub-model such that the harvest rate of hatchery fish in the mixed-stock fishery was conditional on the escapement target for the wild stock. Excess hatchery fish were assumed to be harvested in the

terminal areas.

The simulation outputs were adult returns, divided into the various harvest and escapement boxes (Figure 2). One hundred stochastic replicates of the 30-year simulations were run. The 100 replicates were then sorted by total return for each year to obtain median, 10%, and 90% quantiles. The quantiles of the return distribution provide an empirical confidence interval around the median; 80% of the replicates lie between the 10% and 90% quantiles.

As part of the benefit-cost analysis public policy simulation, enhanced production was hypothetically altered to estimate how net benefits would change under different production scenarios. To develop accurate population and exploitation estimates for these simulations, the population models were run using the production scenarios listed below. Changes in production refer to numbers of returning adult salmon available for harvest by commercial fisheries. The first five changes were specified by the legislature. The sixth was added to compare enhanced production with increased wild salmon production through increased escapement targets. The results of the latter scenario are referred to as the "management" option in the figures. Only the first five scenarios were included in the complete benefit-cost analysis.

Production Scenarios

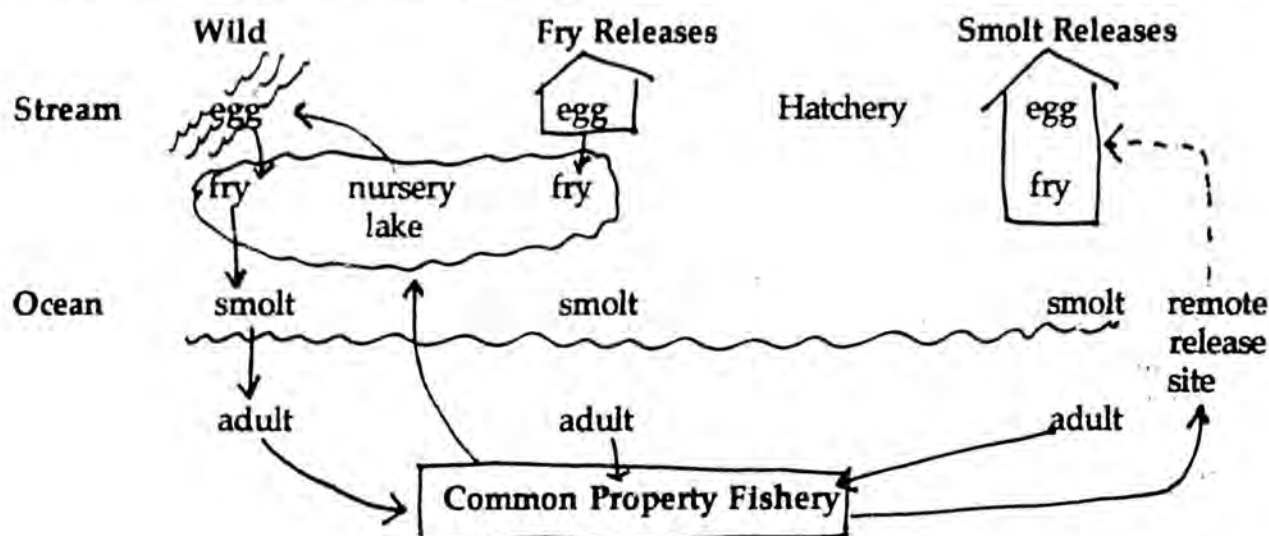
1. Hatchery production continues at current permitted levels (Base Case)
2. Hatchery production continues at planned (unconstrained) levels.
3. Hatchery production is eliminated (no egg take in 1993)
4. Hatchery production is increased 15% over the Base Case
5. Hatchery production is decreased 15% from the Base Case
6. Hatchery production is eliminated and escapement target are increased.

The next sections provide information on modeling methodology and results for the Cook Inlet sockeye, Prince William Sound pink, and Southeast Alaska chinook salmon fisheries. Results for Kodiak pink and sockeye salmon are not included in this draft report. Methods for Kodiak are the same as for Cook Inlet sockeye and Prince William Sound pink salmon. In fact, the Kodiak and Prince William Sound simulations were combined in a single program.

Cook Inlet Sockeye Salmon

Considerable research has been conducted in Alaska on sockeye salmon dynamics. During a visit to Kenai in May 1992, ADF&G limnologist, Dana Schmidt, provided the information needed for the Cook Inlet and Kodiak regions. Cook Inlet is the region of Alaska producing the most enhanced sockeye. The Cook Inlet Regional Salmon Enhancement Plan projects a harvest of 1 million enhanced sockeye by the year 2000. Cook Inlet also supports large natural runs of sockeye. From 1968 through 1985, the median return of wild sockeye was 4 million fish

Figure 3. Sockeye salmon life history



Sockeye enhancement, consisting primarily of fry lake releases, fish passes, and lake fertilization has until recently been relatively "benign." This is for the most part because the enhanced stocks are from wild egg takes that are transported to nursery lakes and harvested with wild stocks rather than creating a new separate stock. These enhancement methods, however, provide no mechanism for generating cost recovery revenue because the fry releases do not return to a hatchery facility. For this reason, most of the initial sockeye fry enhancement in Cook Inlet was conducted by FRED. In contrast, smolts released in remote release sites return as adults to the release sites. Cost recovery harvests can be conducted in those locations. It is likely that smolt remote release will provide for cost-recovery sales harvest but it will also complicate management.

Spawner-Recruitment Data

Escapement targets and returns have both increased since 1971 (Figure 4). The fitted spawner-recruit curve is a straight line. It is uncertain where the curve begins to bend such that increased escapement result in proportionally fewer adult returns. However, the 1992 return of approximately 10 million adult salmon primarily from the 1987 escapement of 2.3 million might provide an indication. (Incidentally, the 1989 escapement, which has caused concerns, was also 2.3 million.)

Sockeye life stage survivals are summarized in Figure 5 from Koenings and Kyle (1991). Many of the observations are from Lake Tustumena where there has been fry tagging and smolt enumeration.

Residuals from log survival rates are used to estimate the variance of the random deviations in survival (Figure 6). Note the increasing trend for wild stocks. Deviations in survival at other life stages are not in phase. In fact, there may be compensatory survival, or measurement error.

Cook Inlet Sockeye Releases

Fry are released into about a dozen lakes. Figure 7 shows historic fry releases as well as current, planned, and the 15% increase and decrease production scenarios. Changes in releases are assumed to begin with 1994 releases. Planned releases would be almost double the currently permitted levels.

Smolt releases are the latest trend in sockeye salmon enhancement (Figure 8). Smolts are being released both at age-0 and age-1. There are plans to release 5 million sockeye smolts.

Results

Figure 9 shows commercial catch from current releases and wild stocks with 10%, median, 90% levels, and the actual 1992 catch. The distance between the 90 and 10 percent levels represents an approximately $\pm 1-2$ million fish from the median estimate. Projected catches are initially high because of high escapements in the late 1980s. Escapement was 2.3 million in 1987 and 1989. In the model, escapement is maintained at the ADF&G target of 1 million so there are approximately half as many fish returning. It appears that high catches in the 1990s are realistic--the model predicted exactly the 1992 catch.

Commercial Catch Estimates for Production Scenarios

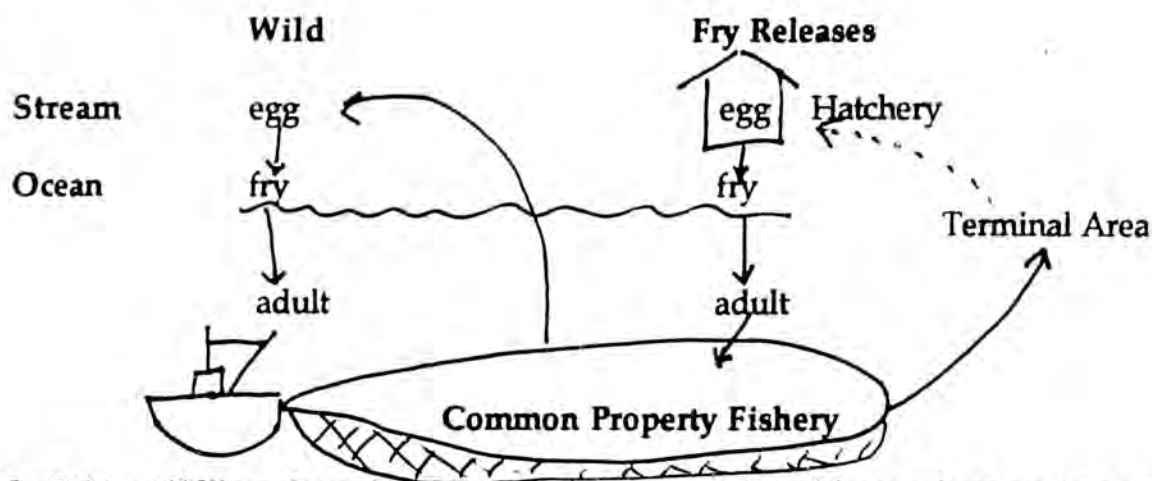
Planned increases in hatchery fry and smolt releases add about 1 million returning adult salmon to be harvested by the common property commercial fishery by the year 2000 (Figure 10). Eliminating hatchery production reduces catches by approximately 1/2 million annually. Doubling the escapement target to 2 million results in an initial decrease of 1 million salmon annually (a total reduction in harvests of 4 million sockeye over the four year period 1993-1996). This increased escapement would result in an eventual annual payoff of 3.5 million sockeye salmon. The management option exceeds harvest levels of planned sockeye enhancement by approximately 2.5 million annually.

Terminal sockeye harvests will increase with increases in smolt production (Figure 11). If hatcheries close, there would be a short burst of terminal catch followed by declines. The number of sockeye harvests in the terminal areas is about two orders of magnitude lower than the number harvested in the common property fishery. It is assumed that under "optimal" management there would be no remote releases of smolts. This is because management for a cost-recovery sales harvest of sockeye salmon would further complicate fisheries management in Cook Inlet, which is already adversarial.

Prince William Sound Pink Salmon

This pink salmon model is based on a 1991 paper by Eggers, Peltz, Bue and Willette titled, "Trends in abundance of hatchery and wild stocks of pink salmon in Cook Inlet, Prince William Sound, and Kodiak, Alaska." The relationships described in this paper were used to estimate salmon abundance in the future.

Figure 12. Pink salmon life history



In Prince William Sound there exist the perennial problems of trying to optimize the escapement of wild and hatchery fish in the common property fishery. In the model simulations the harvest rate is conditioned on the strength of the wild stock.

Spawner-Recruitment Data

Increased escapement results in greater returns of adult pink salmon with the exception of 1984 (Figure 14). The Ricker curve passes through the center of the data which fall into two clusters—good years and bad years. The Ricker curve gives fairly conservative predictions of adult returns. The present escapement target is 1.5 million; the apparent optimum is 5 million.

Hatchery Survival Rates have averaged 5% until the 1990 releases (Figure 14). There is not yet evidence of density-dependent survival.

Deviations in survival rates are correlated between 1) Prince William Sound hatchery and wild pink salmon and 2) Prince William Sound hatchery and Kodiak hatchery survival (Figure 16). This covariance structure was programmed into the model simulations.

Average body weight appears to decrease as a function of the combined run of pink salmon (Figure 16). However, there is plenty of scatter because the weights were derived from fish ticket data, not measurements of individual fish. This body weight relationship was modeled with a log-log function so that body weight

decreases asymptotically with changing run size.

Fry Releases were initiated in 1976, and jumped to over 1/2 billion in 1988 (Figure 17). Current Prince William Sound fry production capacity is 650 million. Planned capacity is approximately 700 million. It does not appear that releases will reach the 1 billion level.

Results

Total annual adult returns of hatchery and wild salmon are projected at approximately 40 million, which is consistent with the 1990-91 returns (Figure 18). Eighty percent of the model realizations fall between the upper and lower broken lines. Actual 1992 adult returns were only approximately 10 million fish.

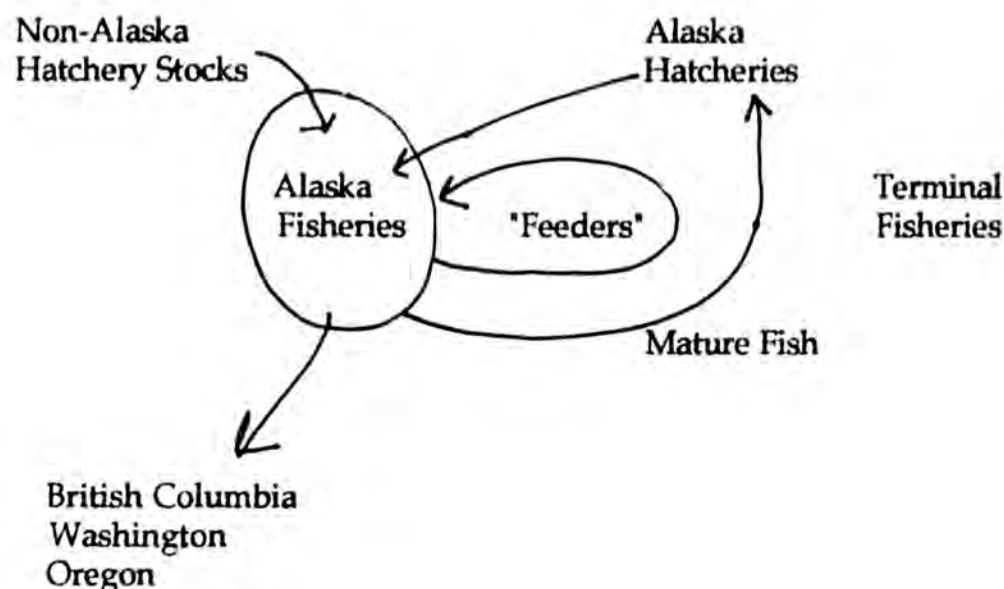
Common Property Catch is highly variable because if the wild stock return is weak the fishery is closed which results in lower harvest of hatchery stocks (Figure 19). This relationship is apparent for the current and increase cases. In these cases, the extra fish are harvested in the hatchery terminal areas where the enhanced stocks are no longer mixed with wild stocks. In the case of decreased production, median catches are more constant across years. If hatcheries are eliminated the wild stocks produce a median catch of about 4 million annually. If the escapement goal was raised to 5 million (the "manage" scenario), a annual catch of 7.5 million could be obtained. This is still a fraction of the harvest level with hatchery production.

Terminal cost recovery harvests are equal in magnitude to common property harvest. As fry releases increase, more of the salmon must be caught in terminal areas to protect wild stocks.

Southeast Alaska Chinook Salmon

The chinook salmon model was the most challenging to construct because of the more complex life history and the trans-boundary nature of the fisheries. This fishery was modeled using an existing coastwide chinook model that reconstructs all the chinook stocks except the Alaska hatchery stocks. Estimates of non-Alaska hatchery chinook abundance were provided by John Carlile (ADFG, Douglas, AK), for the years 1979 through 2005. For this reason, projections of chinook production end in 2005.

Figure 20. Chinook Salmon Life History



Fisheries Management

The chinook salmon fishery is governed by the US-Canada treaty. Provisions of the treaty include a quota of chinook salmon to be caught in waters adjacent to Southeast Alaska of 263,000 non-AK hatchery fish. This quota applies to all commercial gear types, and user groups. Alaska hatchery fish can be taken in excess of the quota provided that their contribution is estimated in-season from coded-wire tags (CWT). This Alaska hatchery "add on" is calculated as the lower 90% confidence interval of the estimated hatchery contribution. The original plan was to produce 100,000 harvestable chinook as the Alaska hatchery add on. Under treaty stipulation, even if the hatchery fish are produced, they may not be harvestable if the treaty quota is exceeded.

The treaty "pie" was allocated by the Alaska Board of Fish in March 1992. Each gear group (troll, net and sport) can increase its catch according to its hatchery contribution rate. The hatchery contribution rate depends on the production of AK-hatchery chinook P_H and the abundance of non-Alaska-hatchery chinook P_N .

$$\frac{CH_g}{CN_g} = a_g + b_g \frac{P_H}{P_N}$$

where:

g = gear type

CH = Alaska hatchery catch

CN = Non-Alaska hatchery catch

a, b = parameters

A_g = gear allocation

Q = Treaty Quota

$$CN_g = A_g Q$$

$$CH_g = [a_g + b_g \frac{P_H}{P_N}] A_g Q$$

Hatchery contribution rates have increased as hatchery production increased (Figure 21). The sport fishery has the highest hatchery catch ratio, because the effort is in inside waters where the hatchery chinook are concentrated. The troll fleet has the lowest contribution because much of the effort is in outside waters where they intercept more non-Alaska hatchery fish and it is more difficult for the fleet to target the hatchery fish. The relationship for commercial net gear does not appear to be linear.

Given the coastwise abundance index and hatchery production, hatchery contribution rate can be calculated for each fishery. Hatchery production is estimated from releases and marine survival rates. A mean marine survival rate and variance are required for the stochastic simulation.

Marine Survival of Chinook Salmon was estimated from coded-wire tag data. Data were compiled from 128 tag lots from 11 hatcheries and 10 release years to examine factors affecting marine survival rates. General linear models were then fitted with the response variable being log survival. The variables--size at release, hatchery, and release year--are apparently all significant with a total r^2 of 0.78.

The simulation model included only the hatchery and release year effects because the future sizes at release are not known. The year effects suggest a temporal pattern (Figure 22). Hatcheries are plotted in rank order according to the estimated hatchery effects (Figure 23). Adding the constant back into the hatchery effects, the mean marine survival rate of each hatchery was calculated with year effects removed (Figure 24).

The survival model is:

$$S_{hy} = S_h * T_y * R_{yt}$$

h is hatchery

y is year

t is random shared-year effect

R is random effect not shared by hatcheries

Chinook Salmon Releases

Smolt releases increase and become constant after 1995 (Figure 25). This production is a doubling from the 1988 levels. Most chinook spend 3 or 4 years at sea, so we are just beginning to see the returns from the large releases.

Note that the coastwise index is also increasing (although it is exaggerated in Figure 25). This means it is harder to catch the Alaska hatchery fish without overrunning the treaty quota.

Results

For all gear types, total catch is expected to increase as the large releases begin to return (Figure 26). The total 1991 catch was slightly overestimated by the model.

The troll harvest is expected to increase to about 300 thousand fish annually (Figure 27). Without hatchery production, the treaty harvest is approximately 200 thousand. The trollers are estimated to receive about 100 thousand additional chinook by 1996 under current production scenarios. In general, two hatchery chinook are required for the trollers to catch one. The 1991 troll catch was well predicted by the model.

Sport harvests are estimated to increase to 100 thousand by 1995 (Figure 28). Without hatchery production the sport fishing treaty allocation is 40 thousand. The model over-estimated the 1991 sport harvest. Terminal cost-recovery harvest is also estimated to increase to 100 thousand (Figure 29).

Conclusions

Alaska's hatchery program has been very successful in producing fish. If survival rates continue to be high, we can expect lots more hatchery fish in the future. While lower than hatchery managers' estimates, these simulation results are, if anything, over optimistic.

Status of wild stocks has changed dramatically since inception of Alaska's salmon enhancement program.

Given a wild stock preference and the US-Canada Treaty, increases in hatchery production will increasingly have to be harvested by sport fish user groups in terminal areas.

Privatization of hatcheries complicates management, which is likely to make it more costly and contentious.

In some regions, substantial yield increases may be obtainable by increasing the escapement targets of wild salmon stocks.

Maximizing yield is not the only important management objective. There is also a need to minimize the variance of yield to develop markets for Alaska salmon.

With the legislature's proposed merger of the Division of Commercial Fisheries and FRED, management and enhancement should be given common direction.

DRAFT

Salmon Population and Exploitation Modeling

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★ FRED hatcheries
▲ Private hatcheries

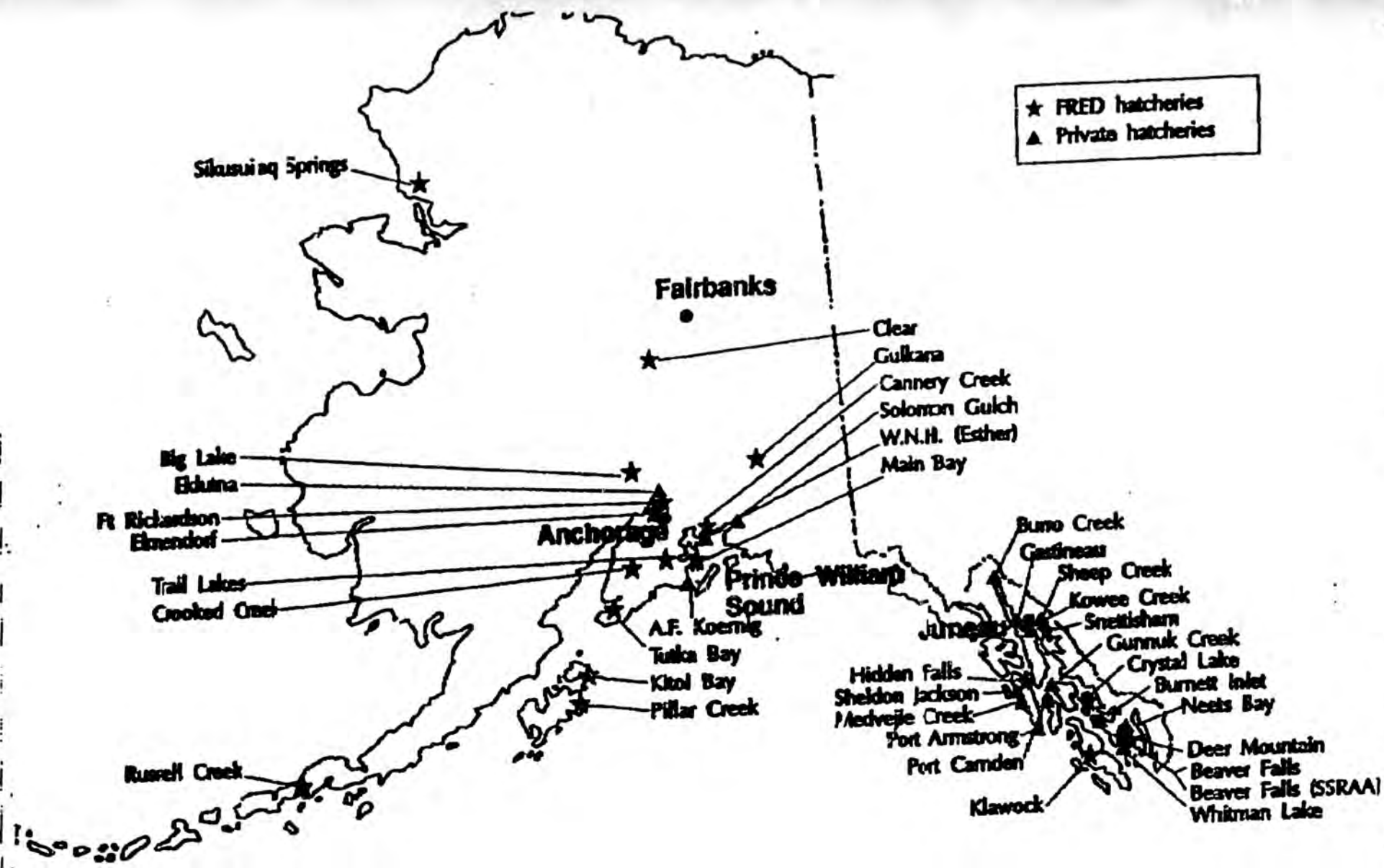
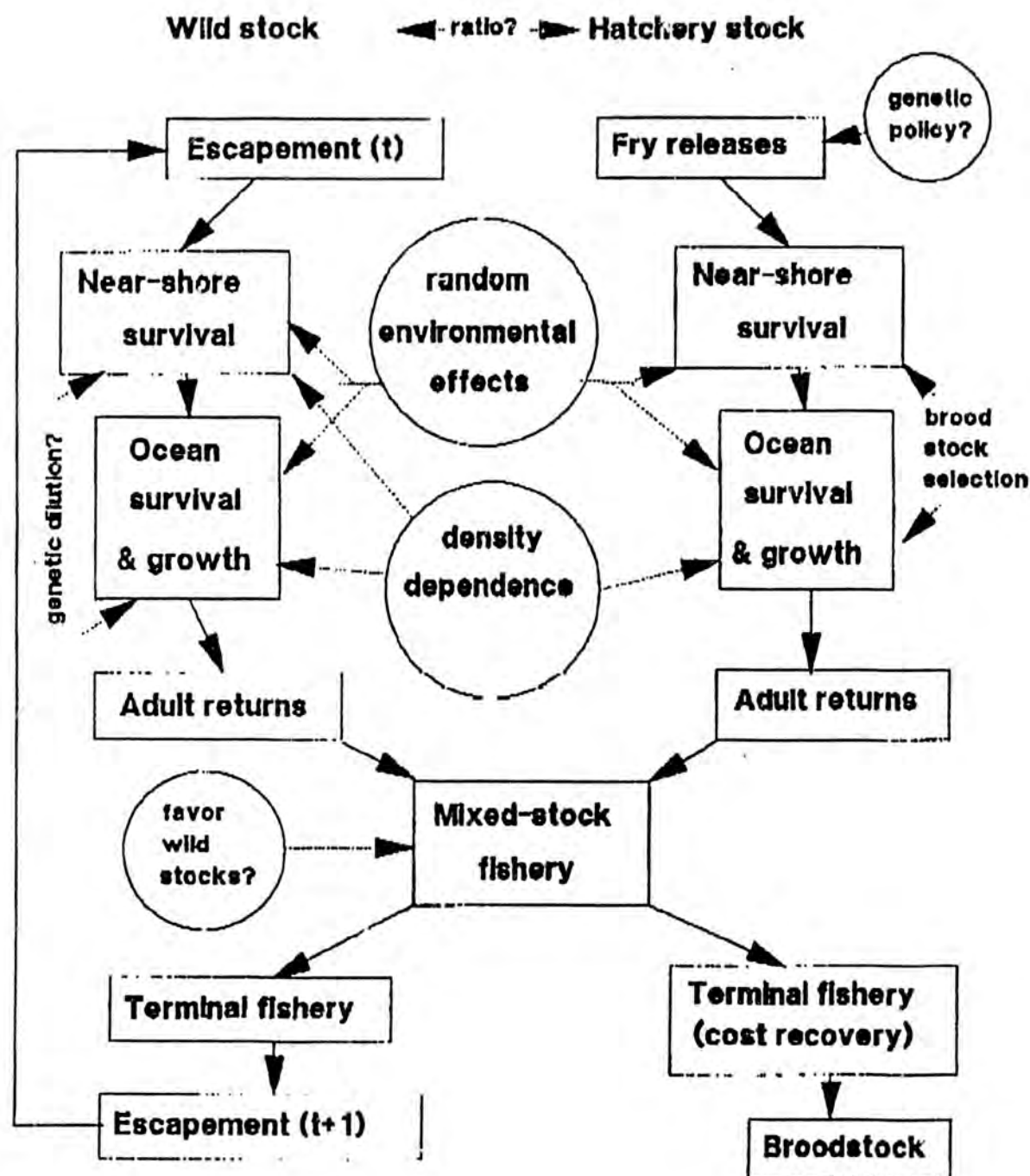


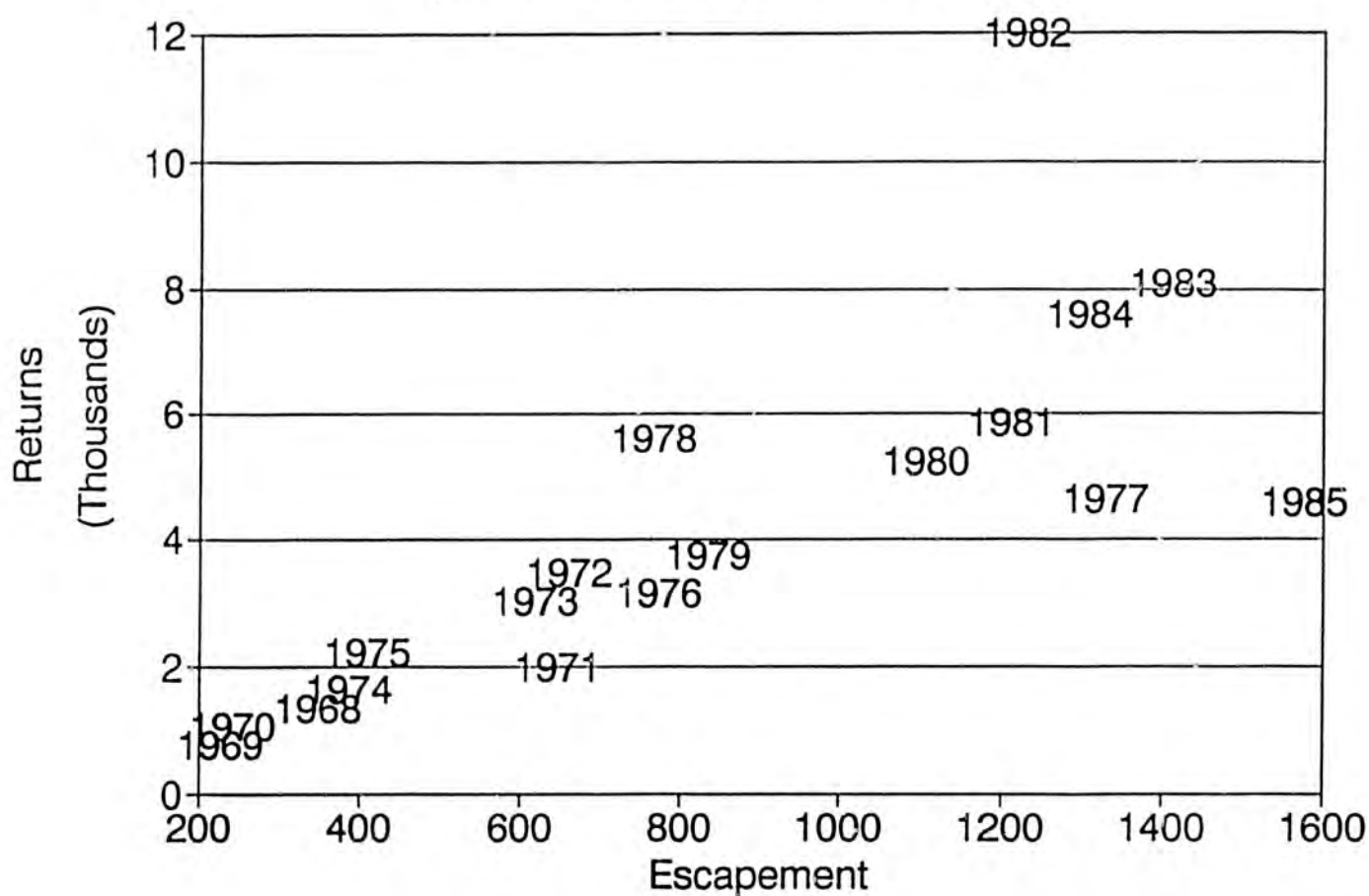
Figure 1

Salmon Simulation Model

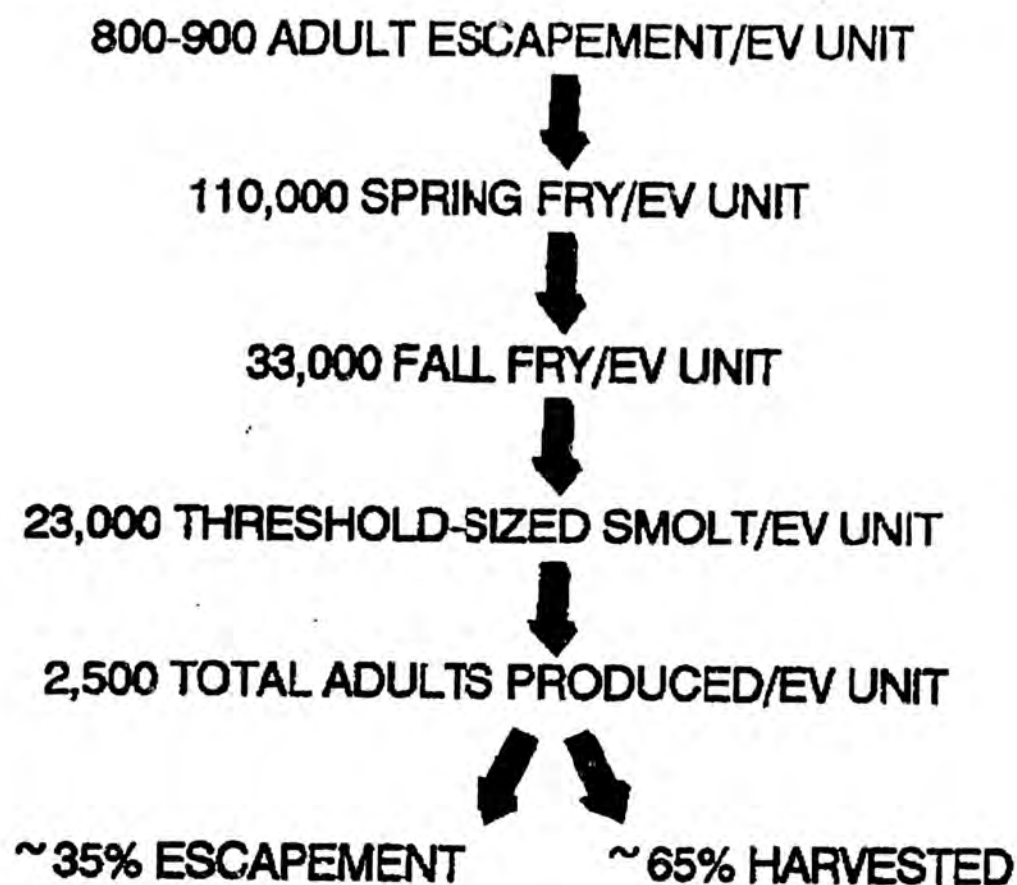


Stock-recruit relationship

Upper Cook Inlet Sockeye Salmon (numbers in thousands)

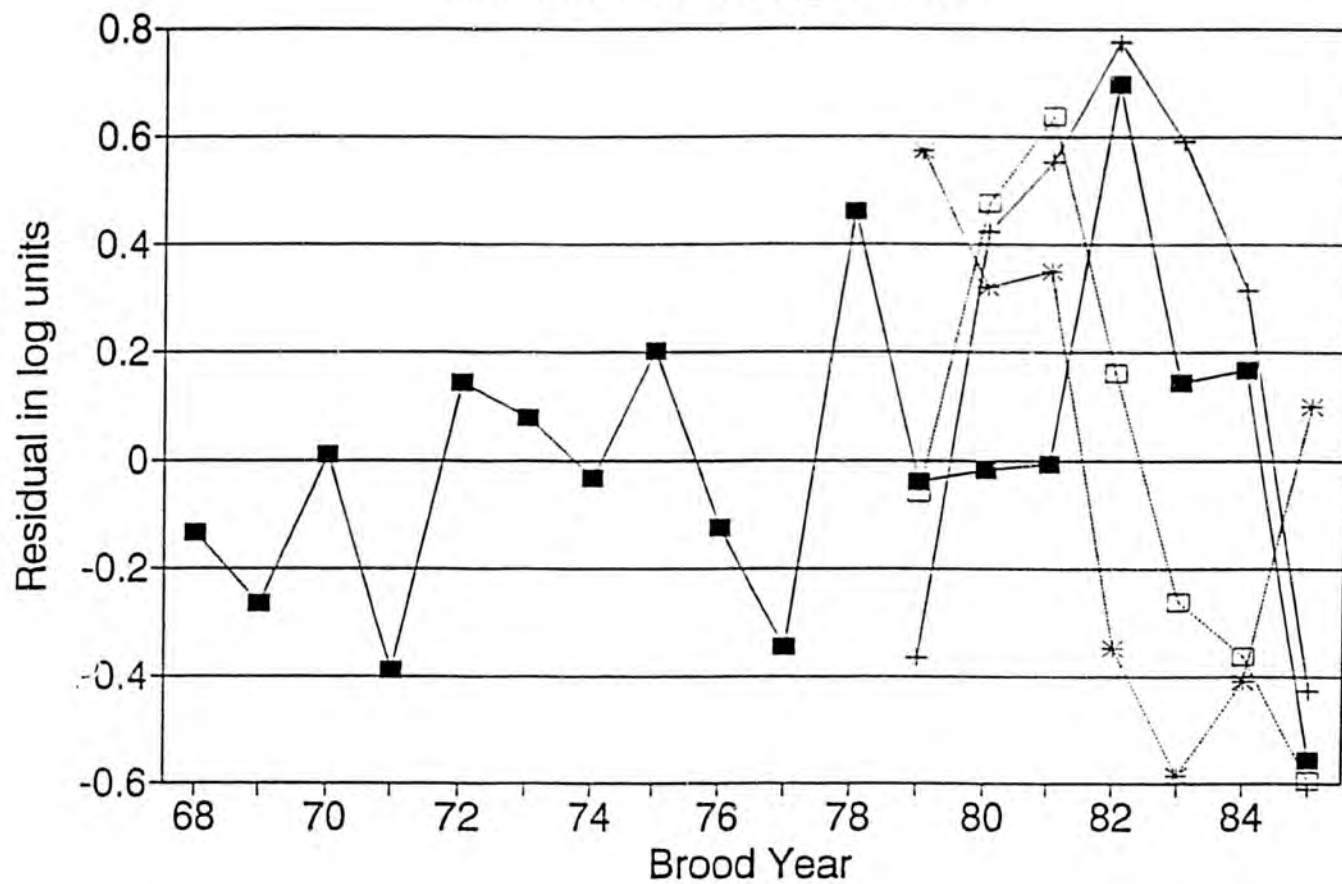


***Sockeye Salmon Life-Stage Survivals at Rearing
Limitation Based on Euphotic Volume (EV)***



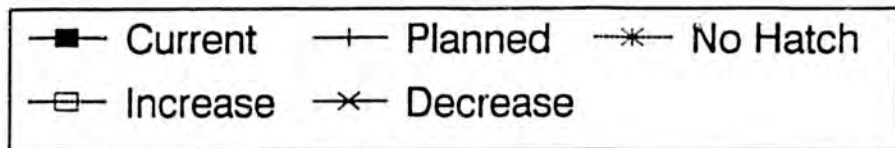
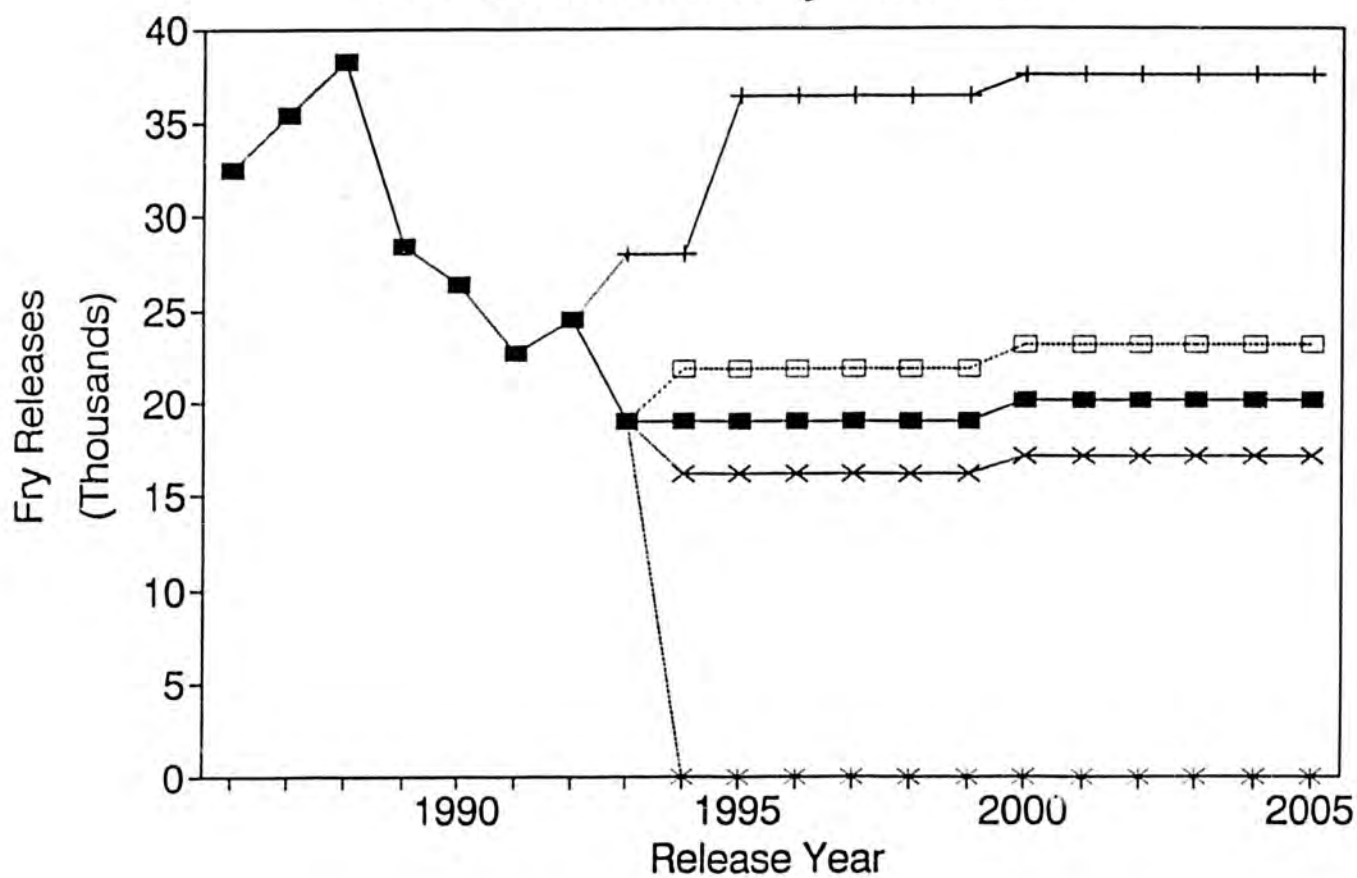
Residual variability included in stochastic model

Tustumena Sockeye Salmon Residuals from log survival

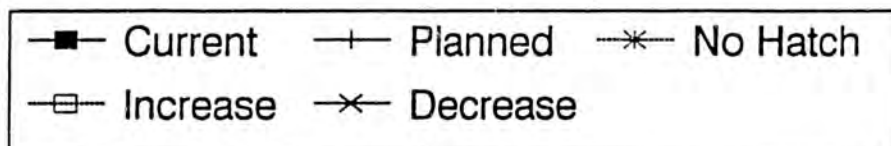
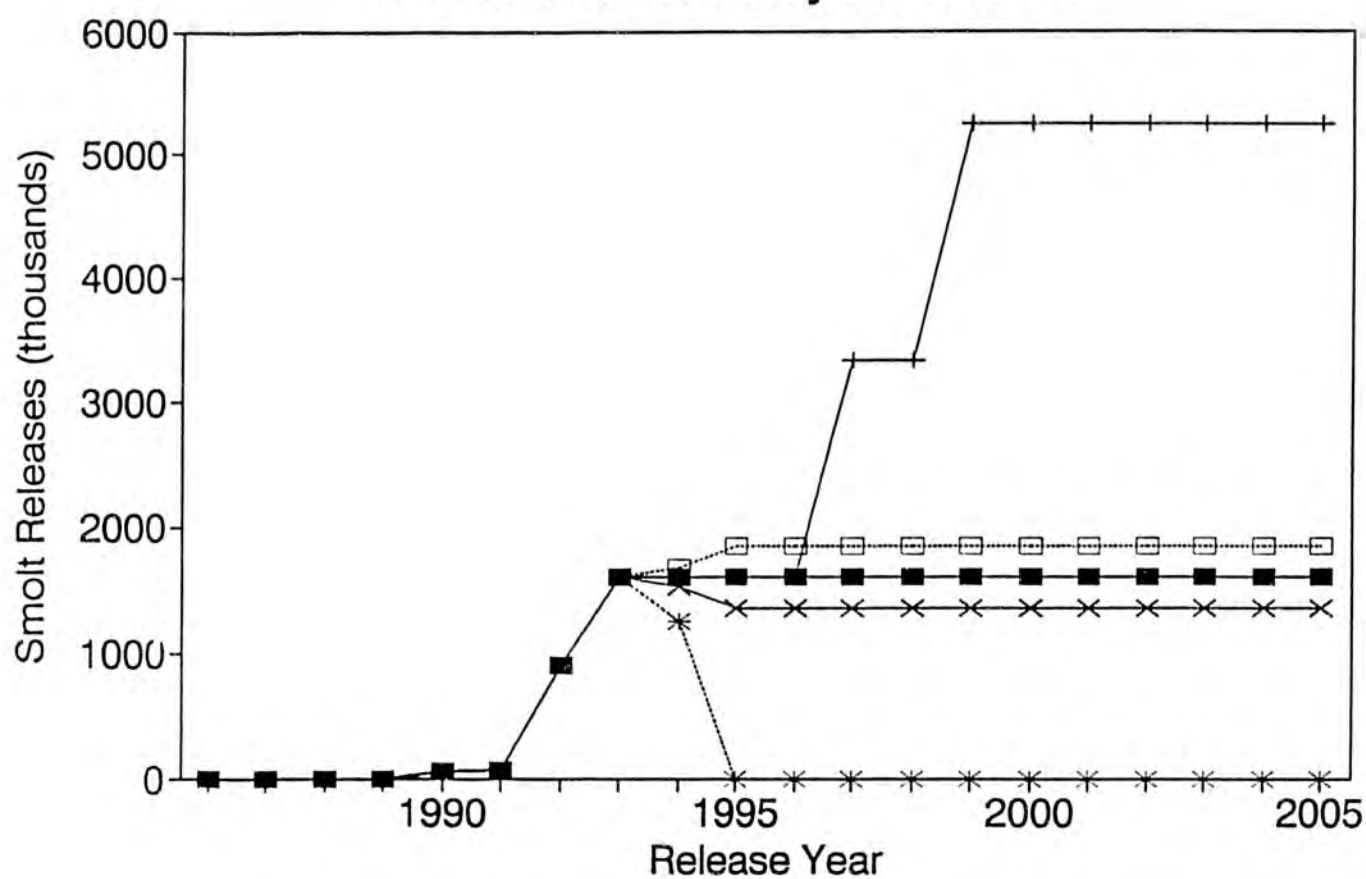


—■— Spawner-adul —+— Fry-smolt —*— Smolt-adult —□— Fry-adult

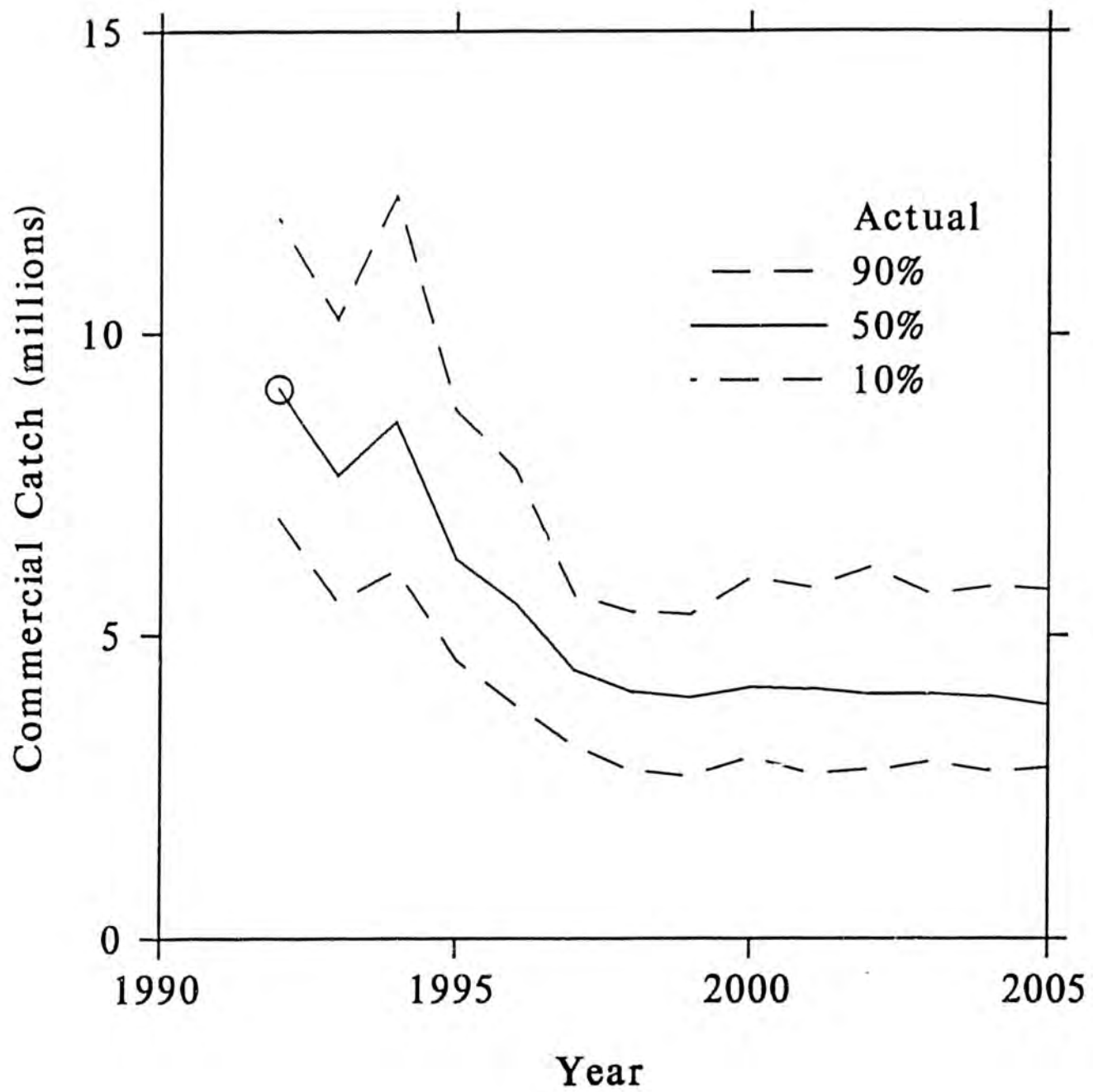
Cook Inlet Sockeye Salmon



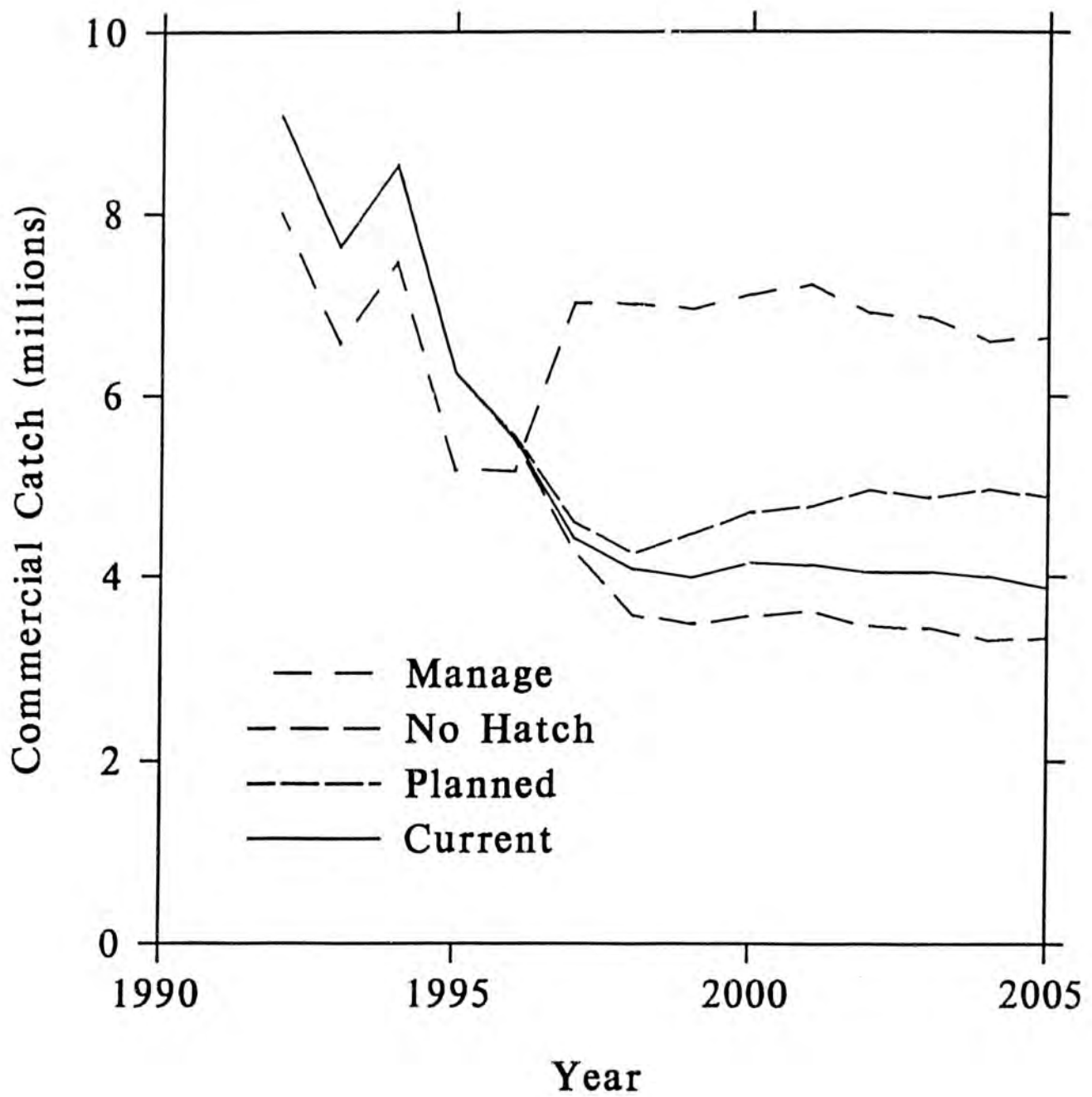
Cook Inlet Sockeye Salmon



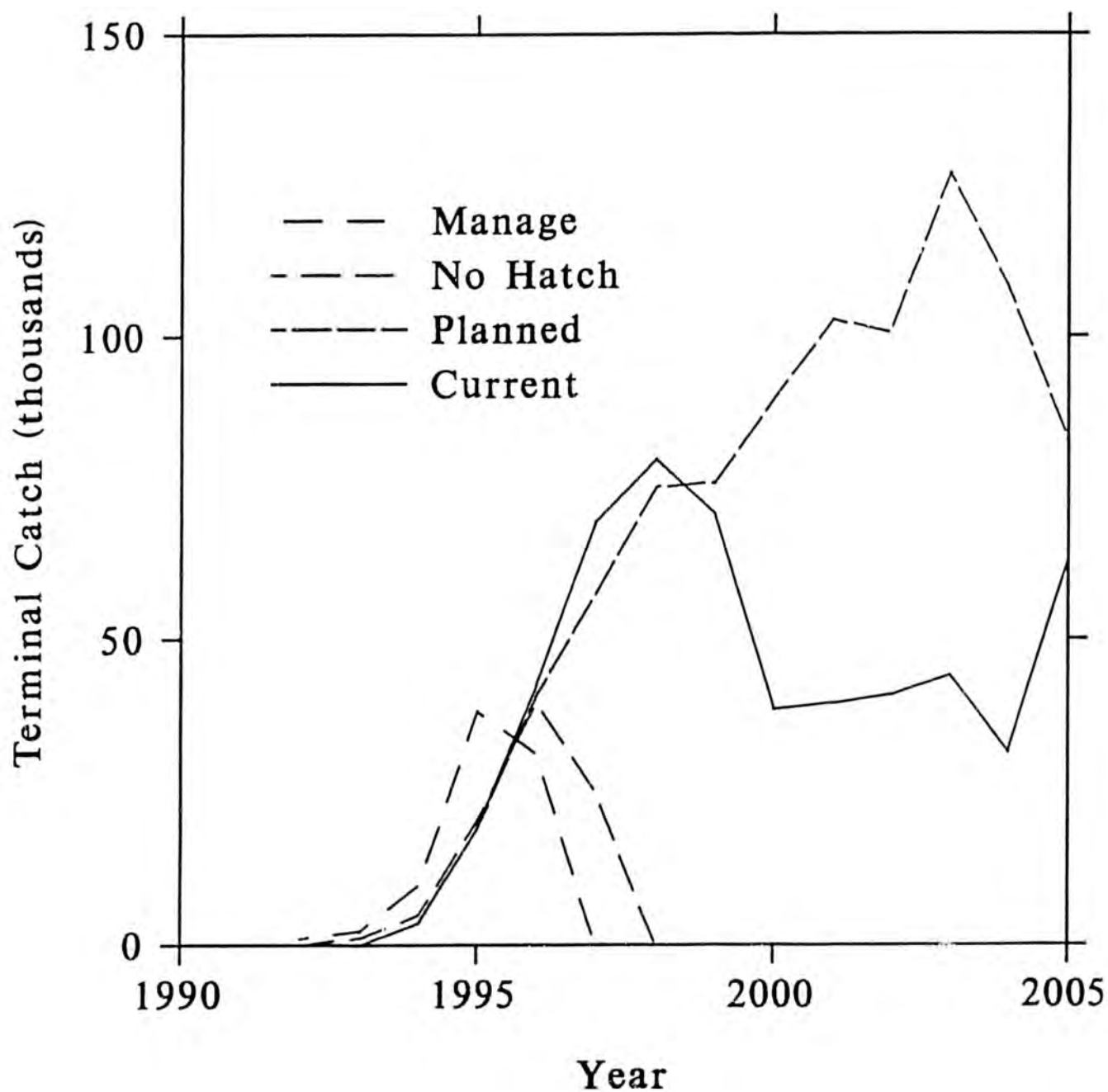
Cook Inlet sockeye catch with "Current" releases.



Cook Inlet Sablefish Catch

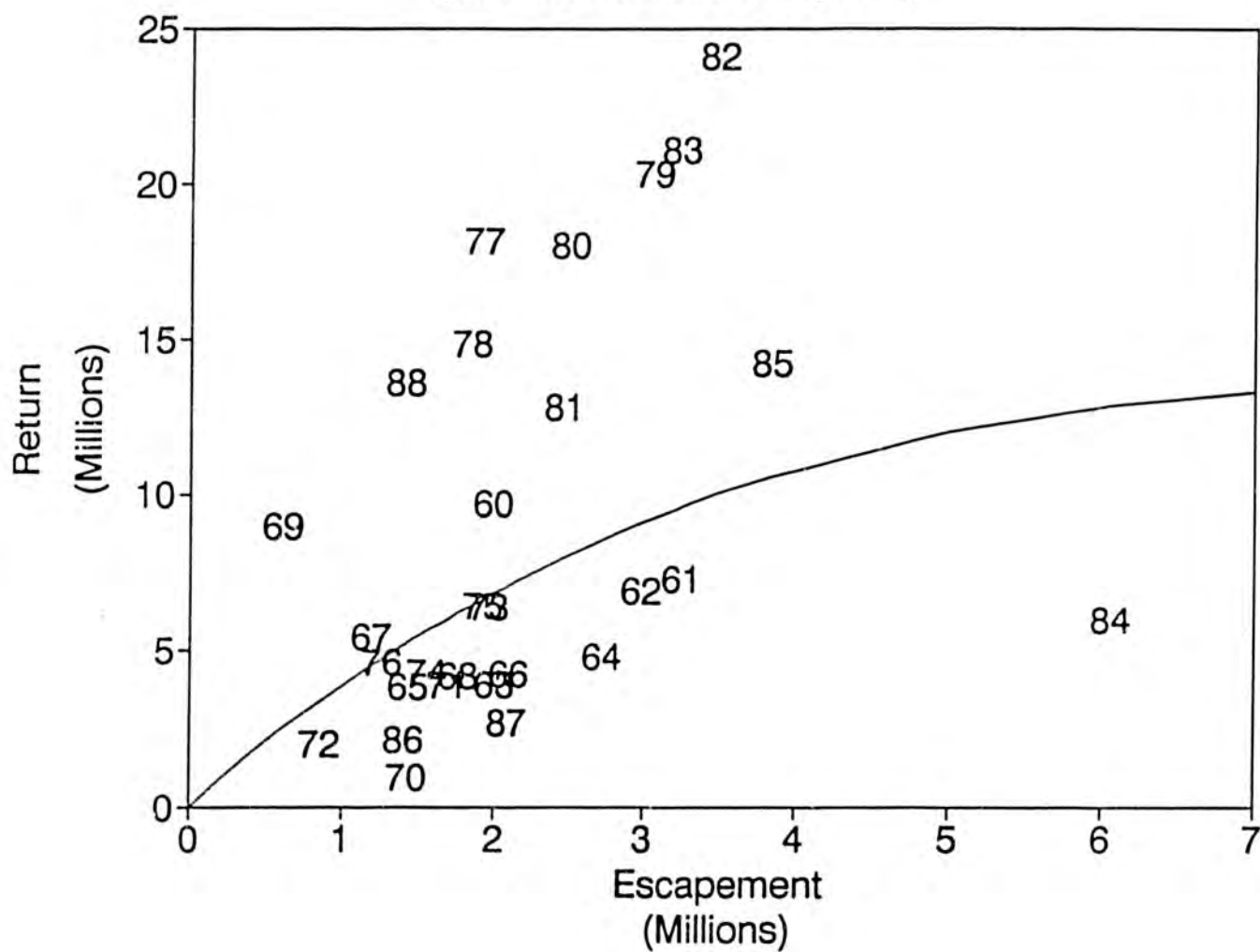


Cook Inlet sockeye catch of smolt release returns



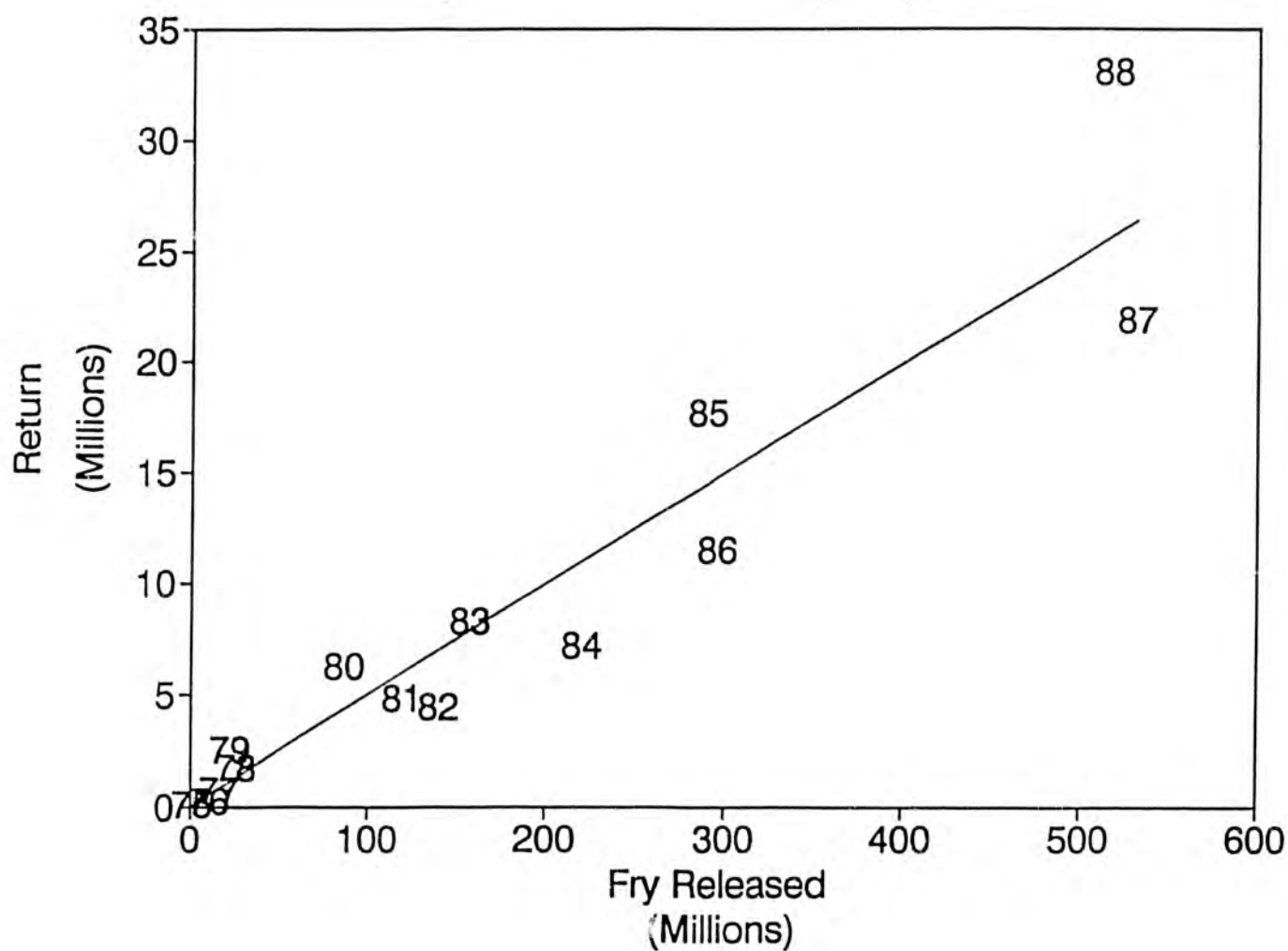
Prince William Sound Wild Pink Salmon

(data labels are brood years)

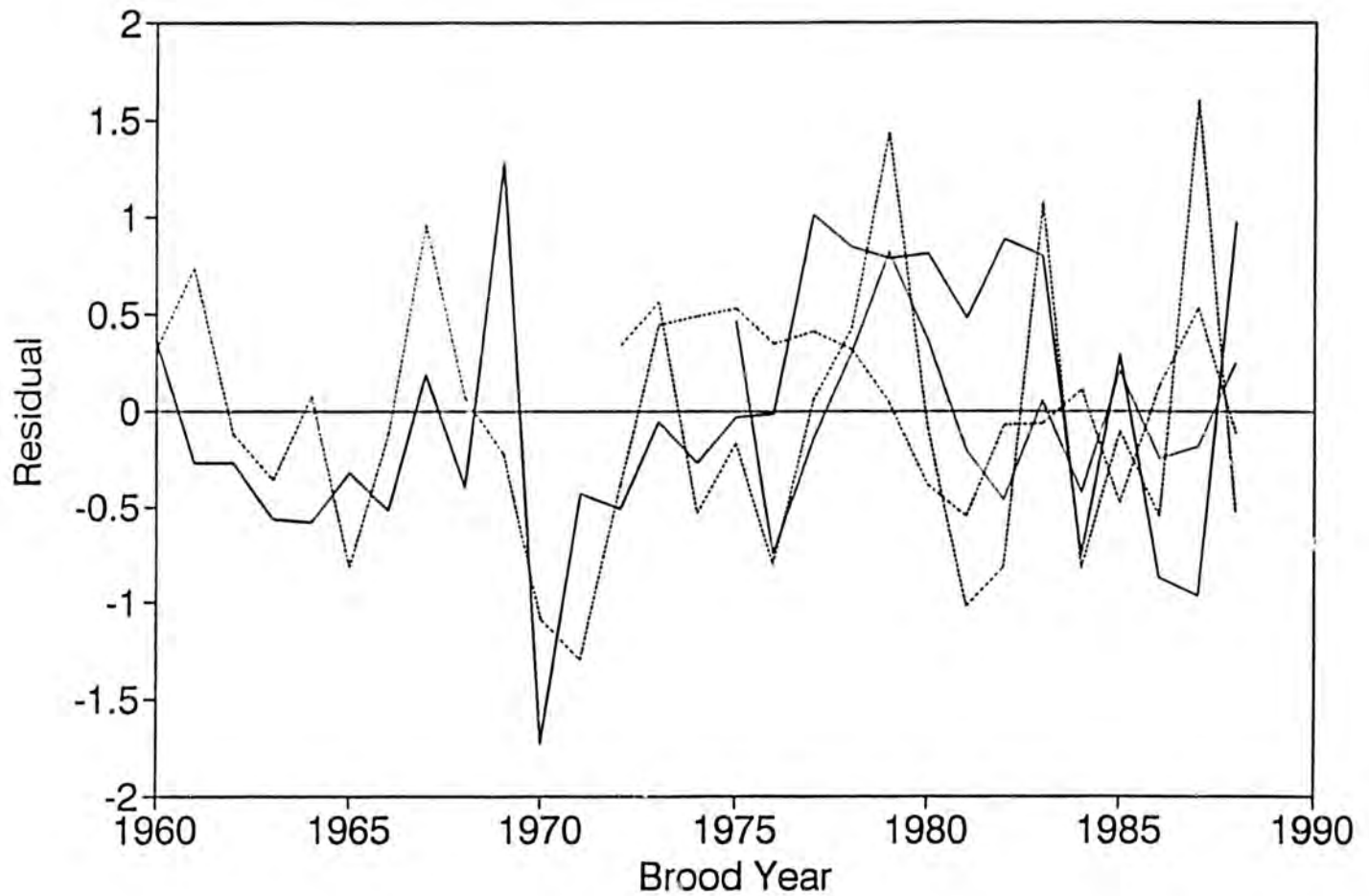


PWS Hatchery Pink Salmon

(data labels are brood years)

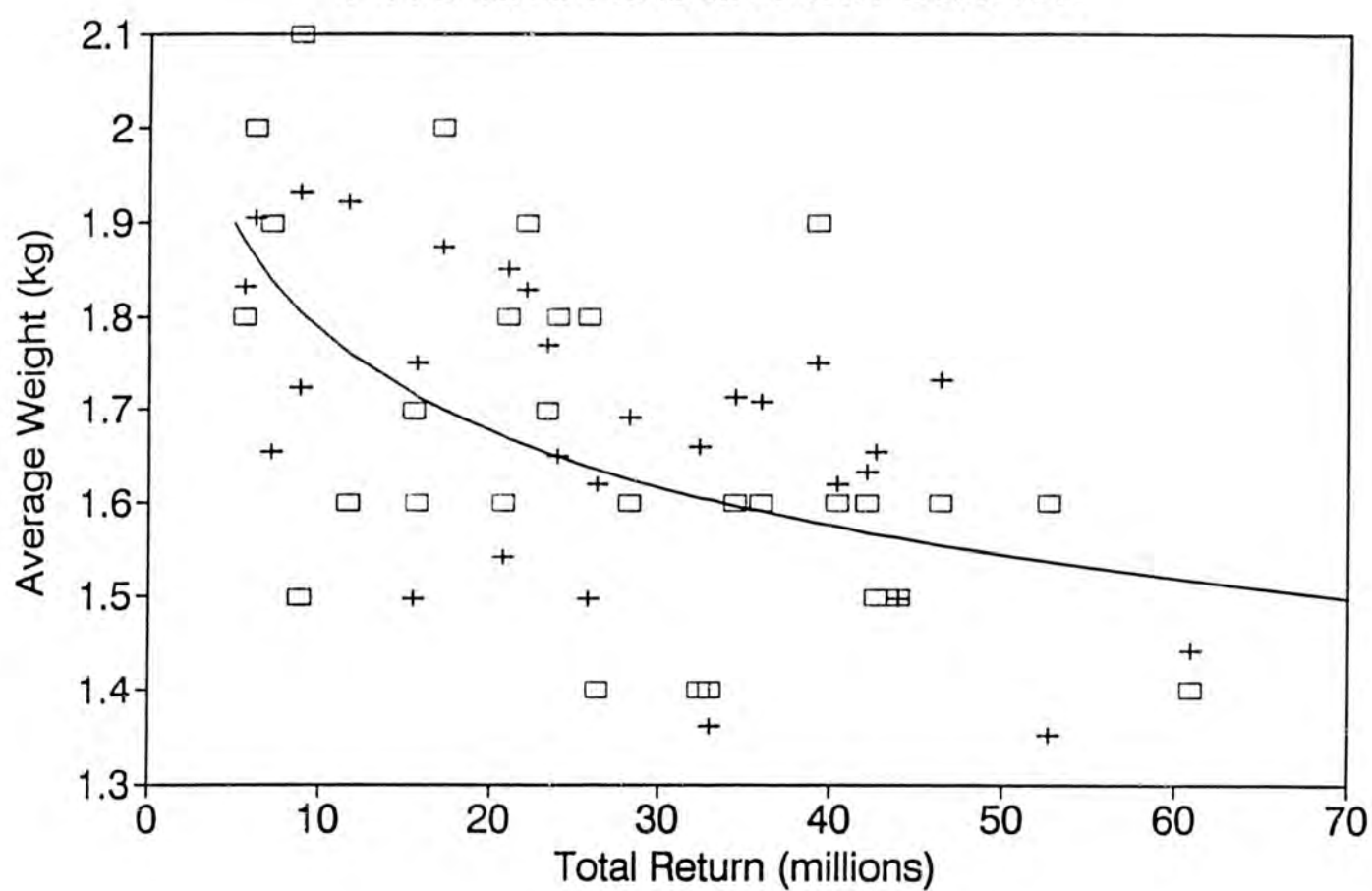


Residual variability to incorporate into stochastic model



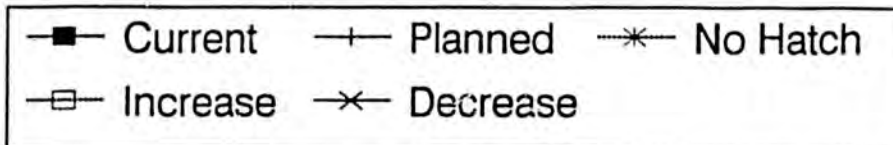
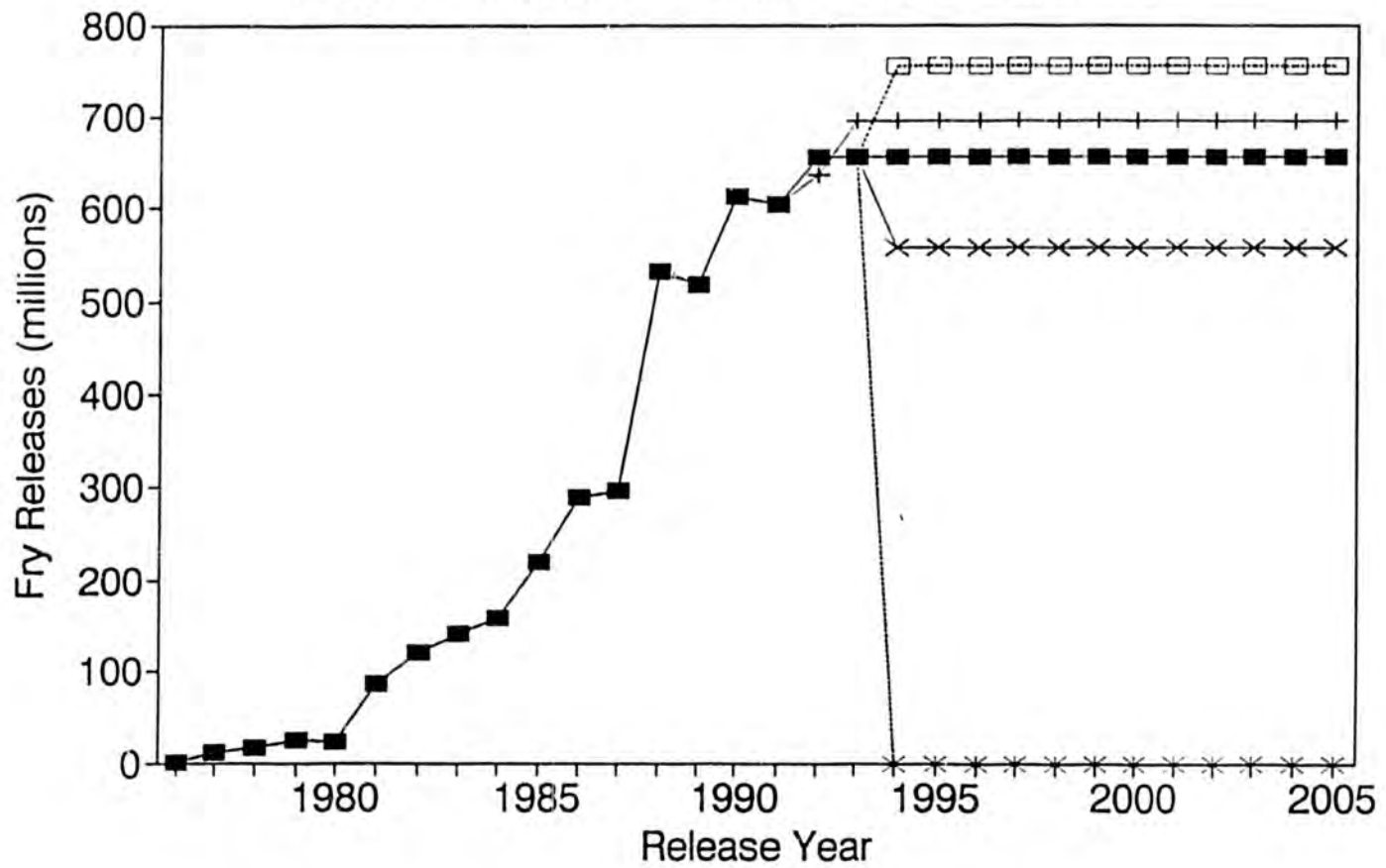
— PWS wild — PWS hatch — Kodiak wild — Kodiak hatch

PWS and Kodiak Pink Salmon



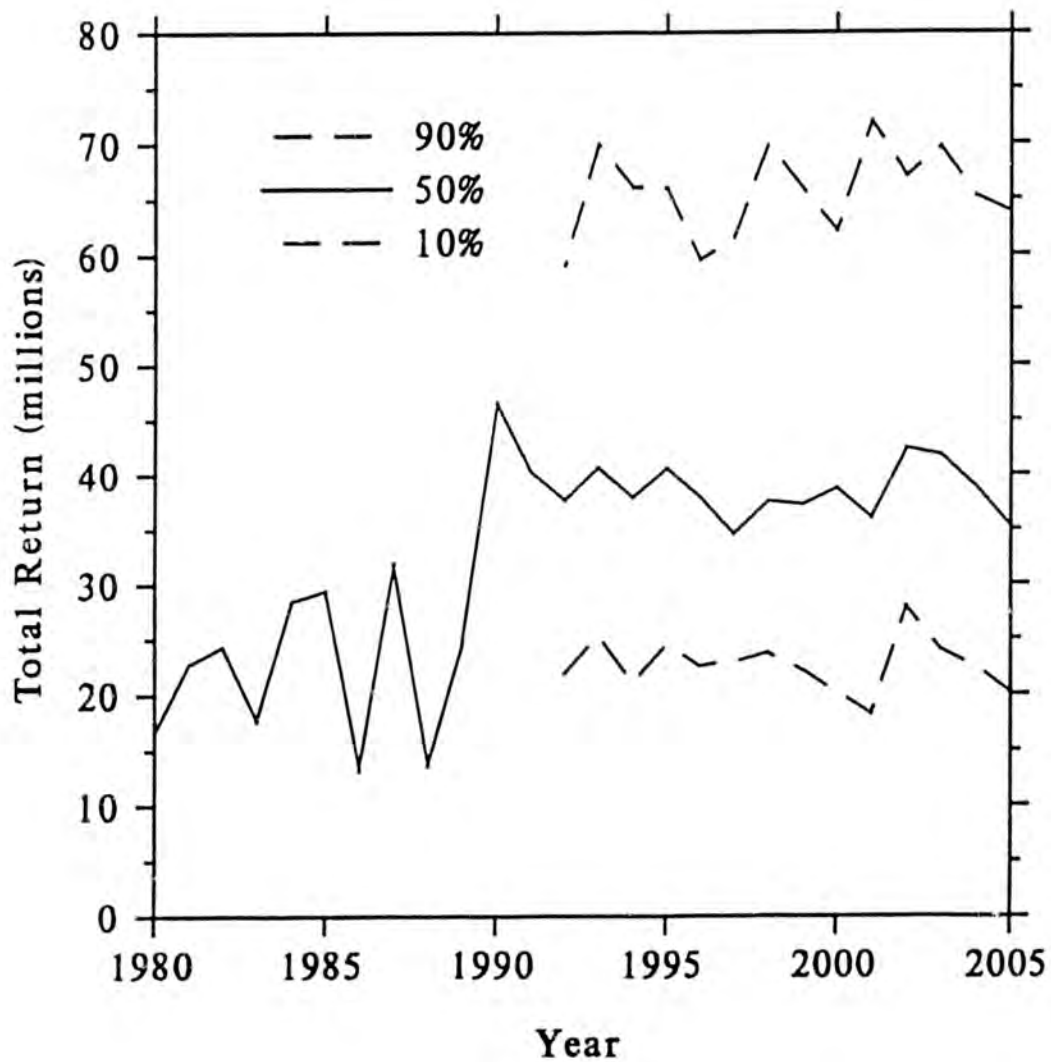
+ Kodiak □ PWS — Predicted

Prince William Sound Pink Salmon

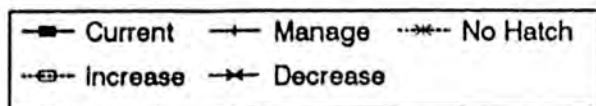
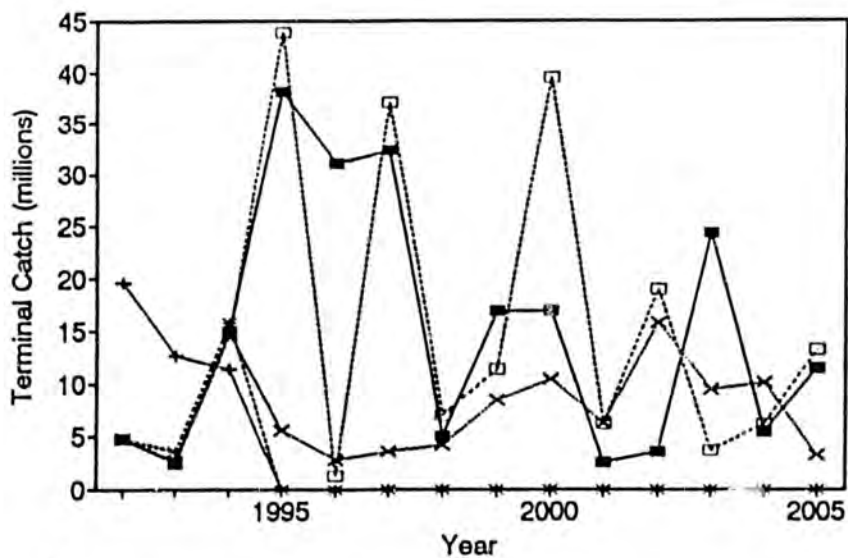
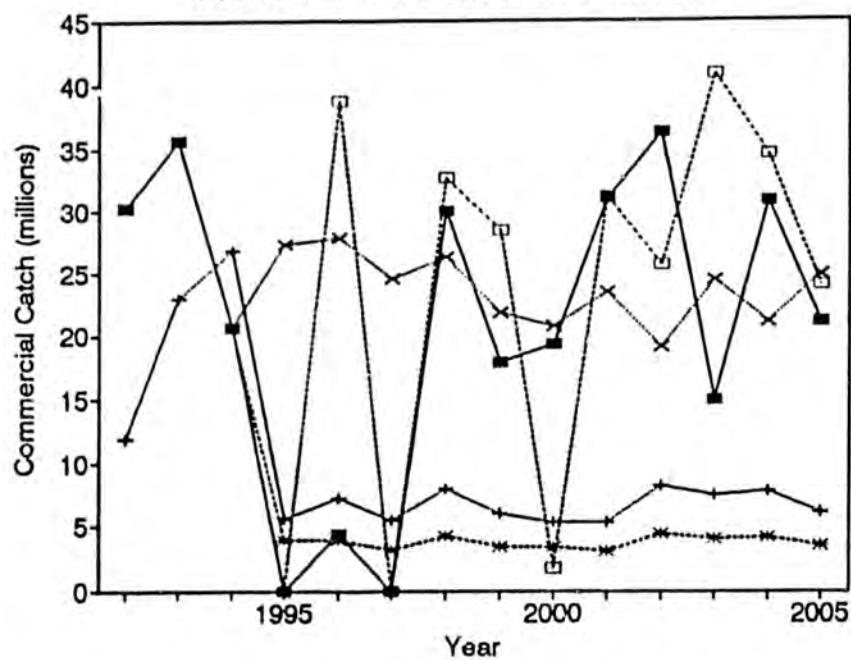


Total returns with CURRENT releases.

Prince William Sound Pink Salmon

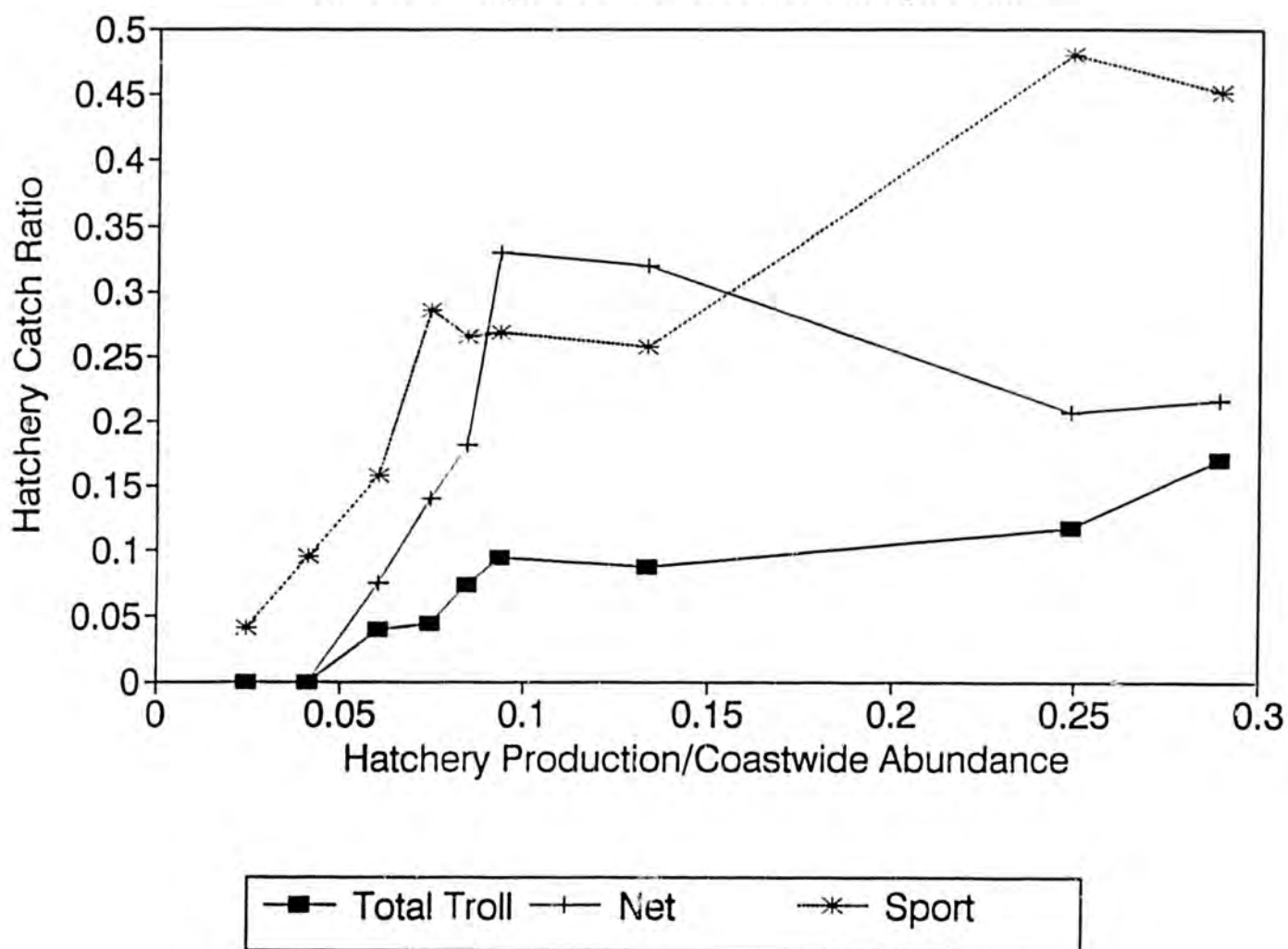


Prince William Sound Pink Salmon

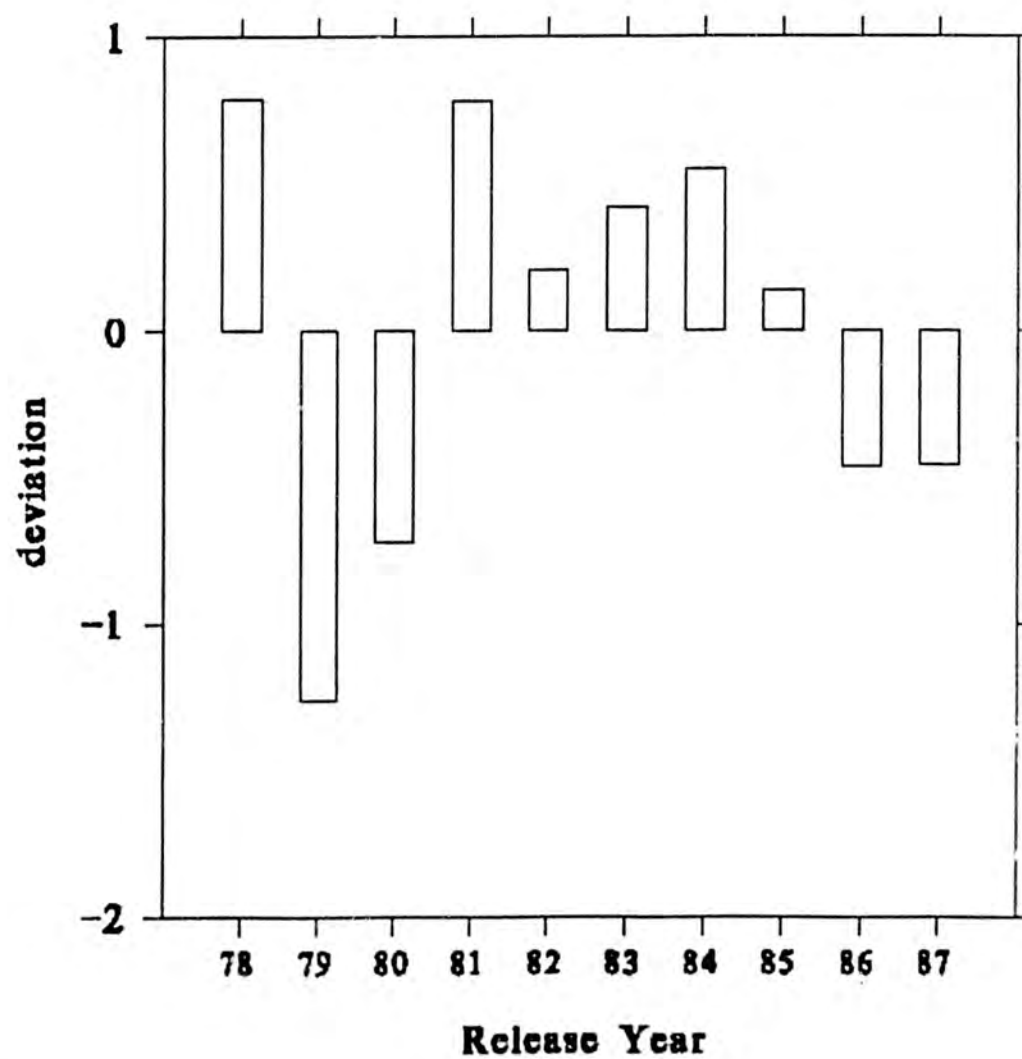


Southeast Alaska Chinook Salmon

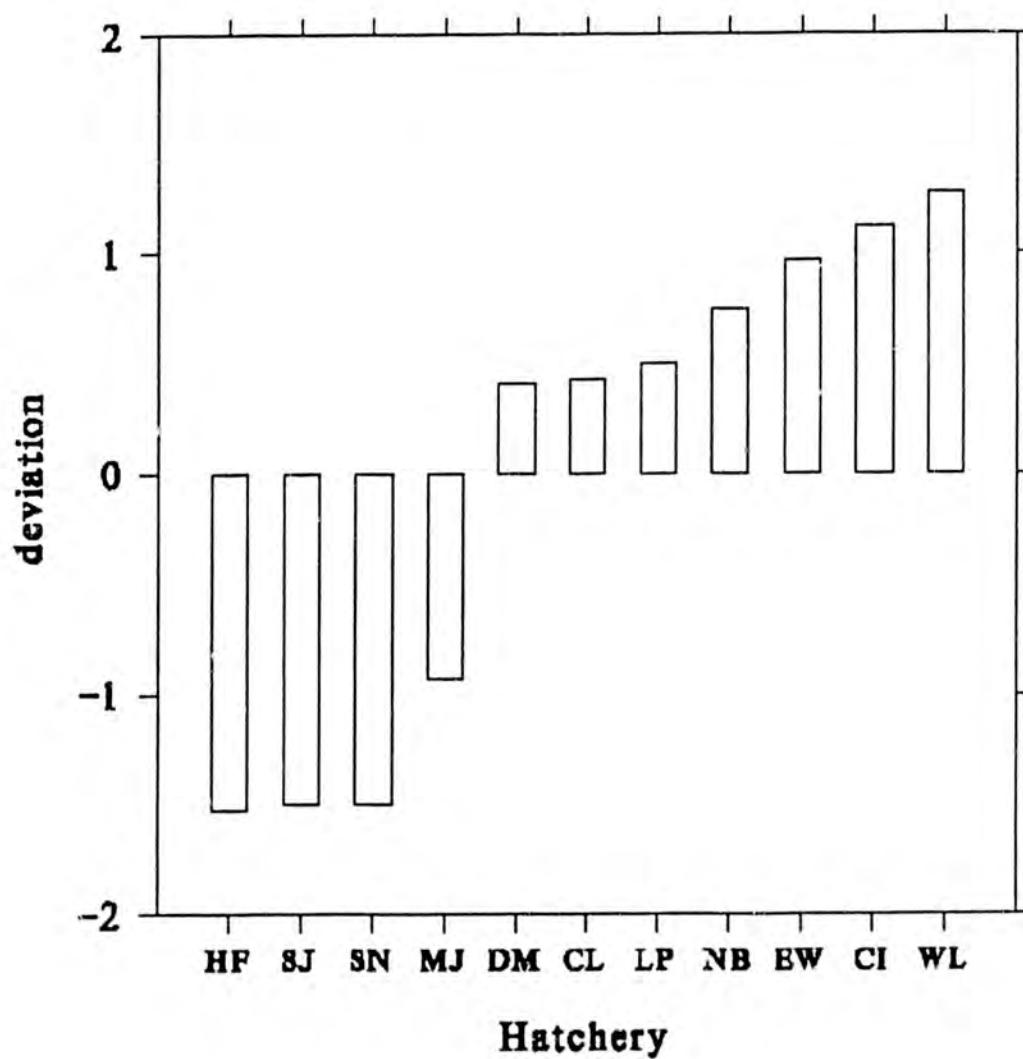
AK-hatchery-catch/Non-AK-hatchery-catch



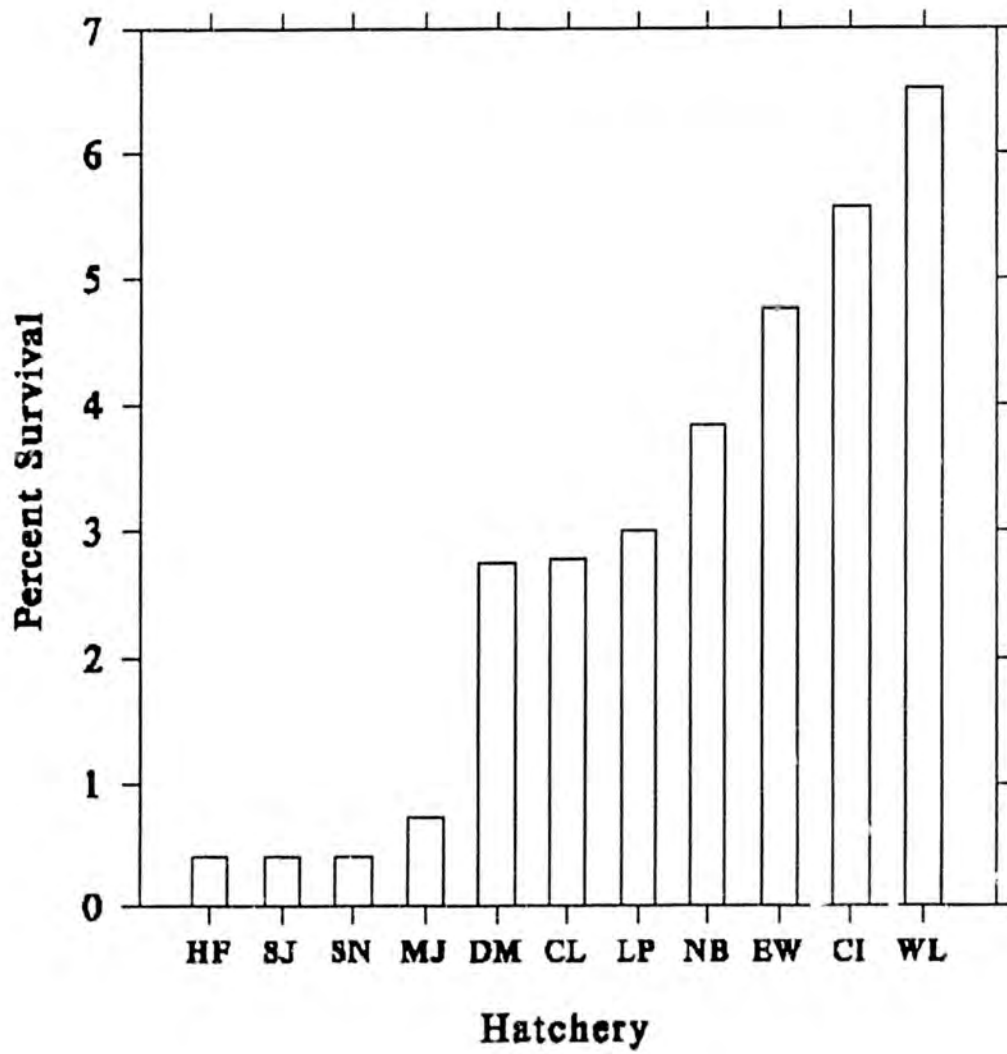
Year Effects on Smolt Survival



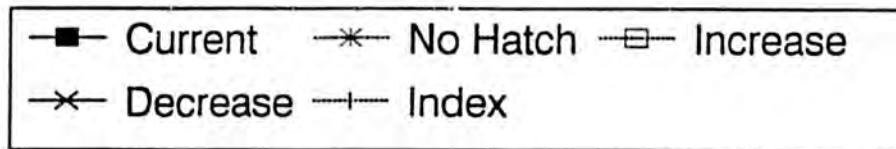
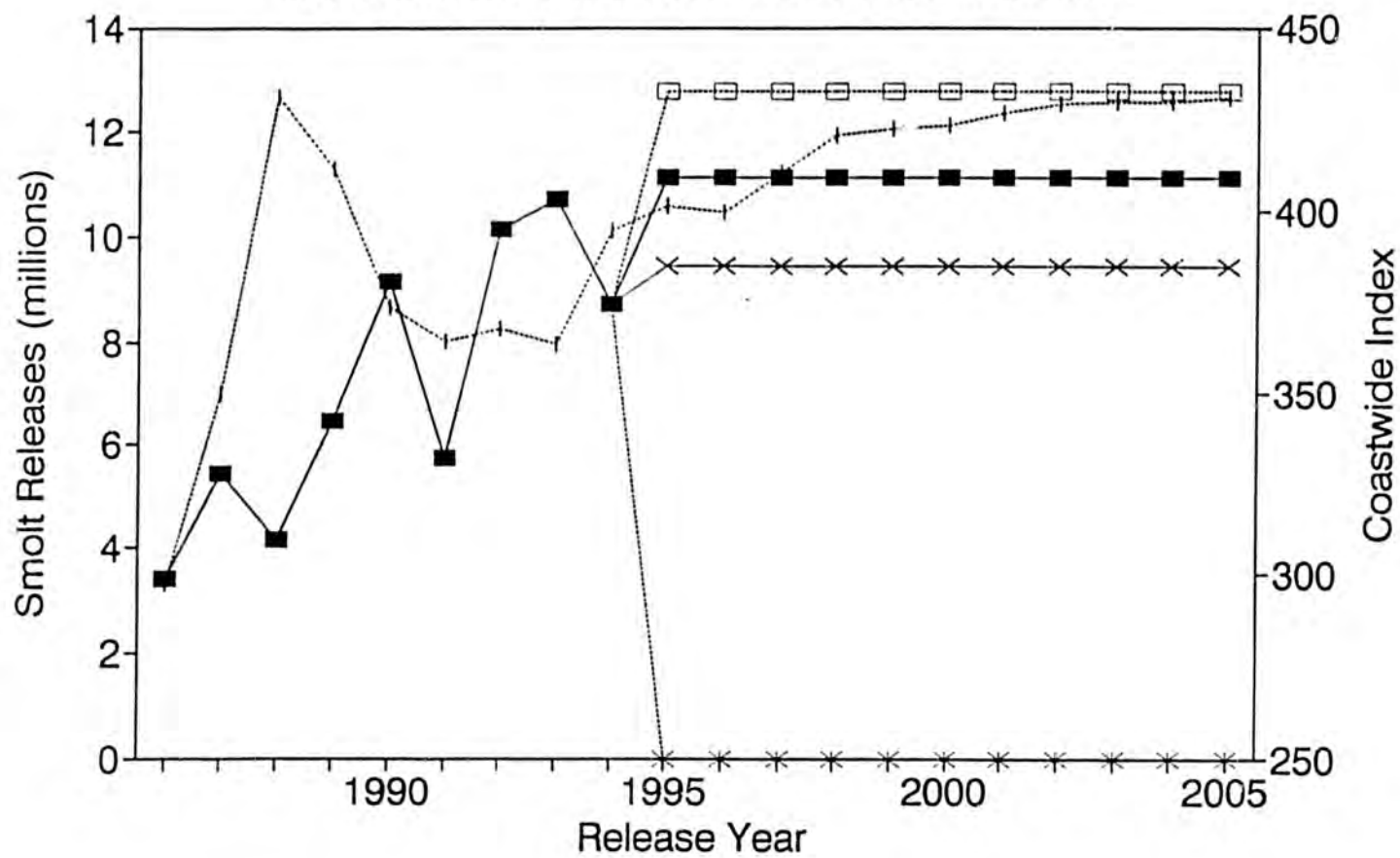
Location Effects on Smolt Survival



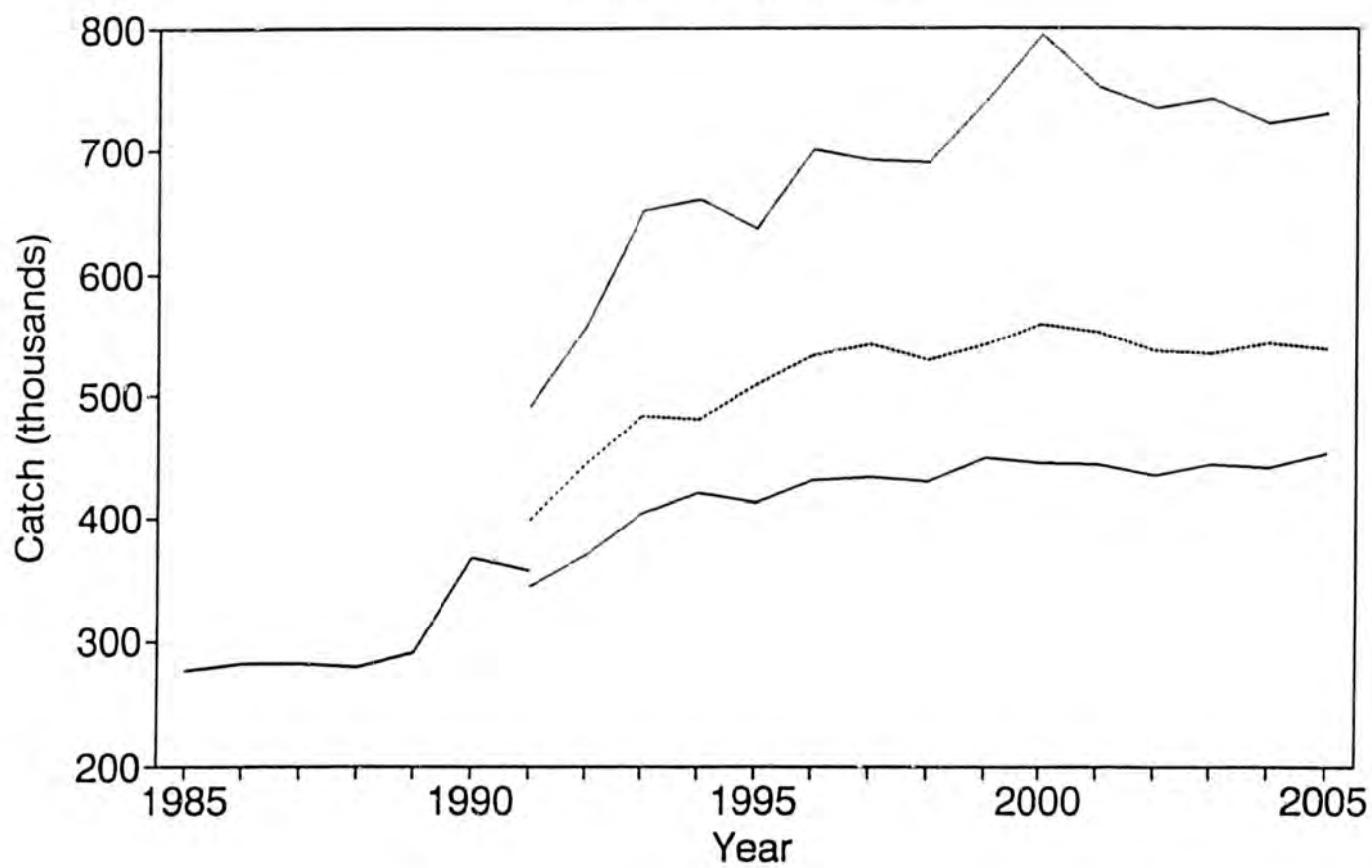
Smolt Marine Survival



Southeast Alaska Chinook Salmon

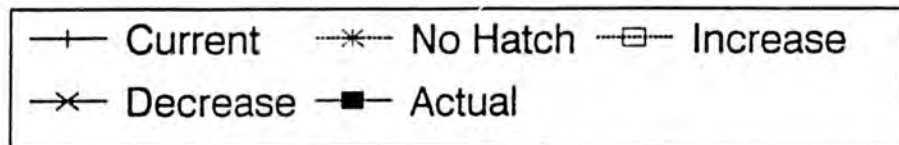
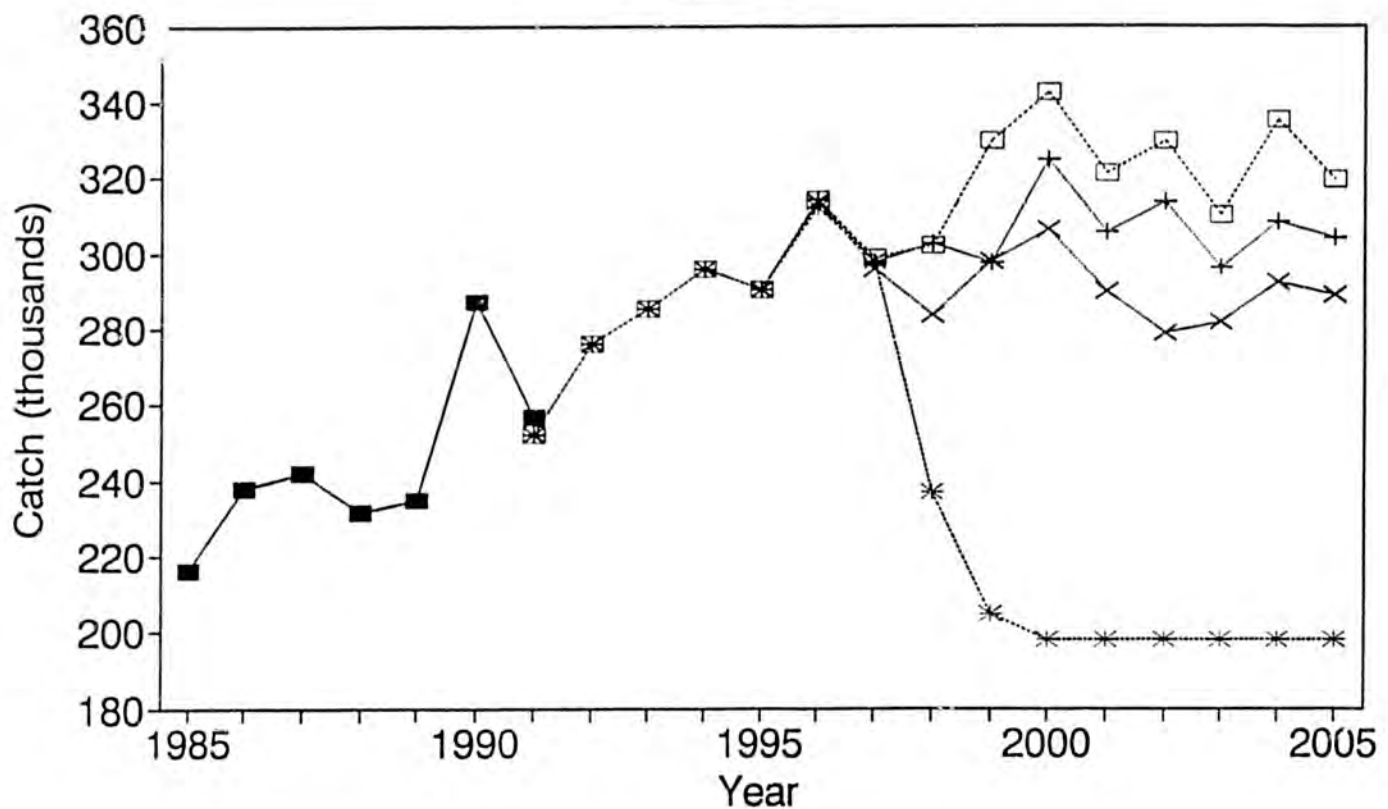


Southeast Alaska Chinook Salmon Total Catch of All Gear

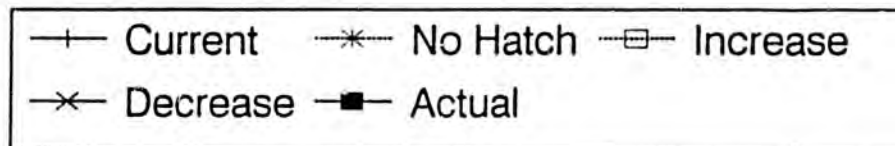
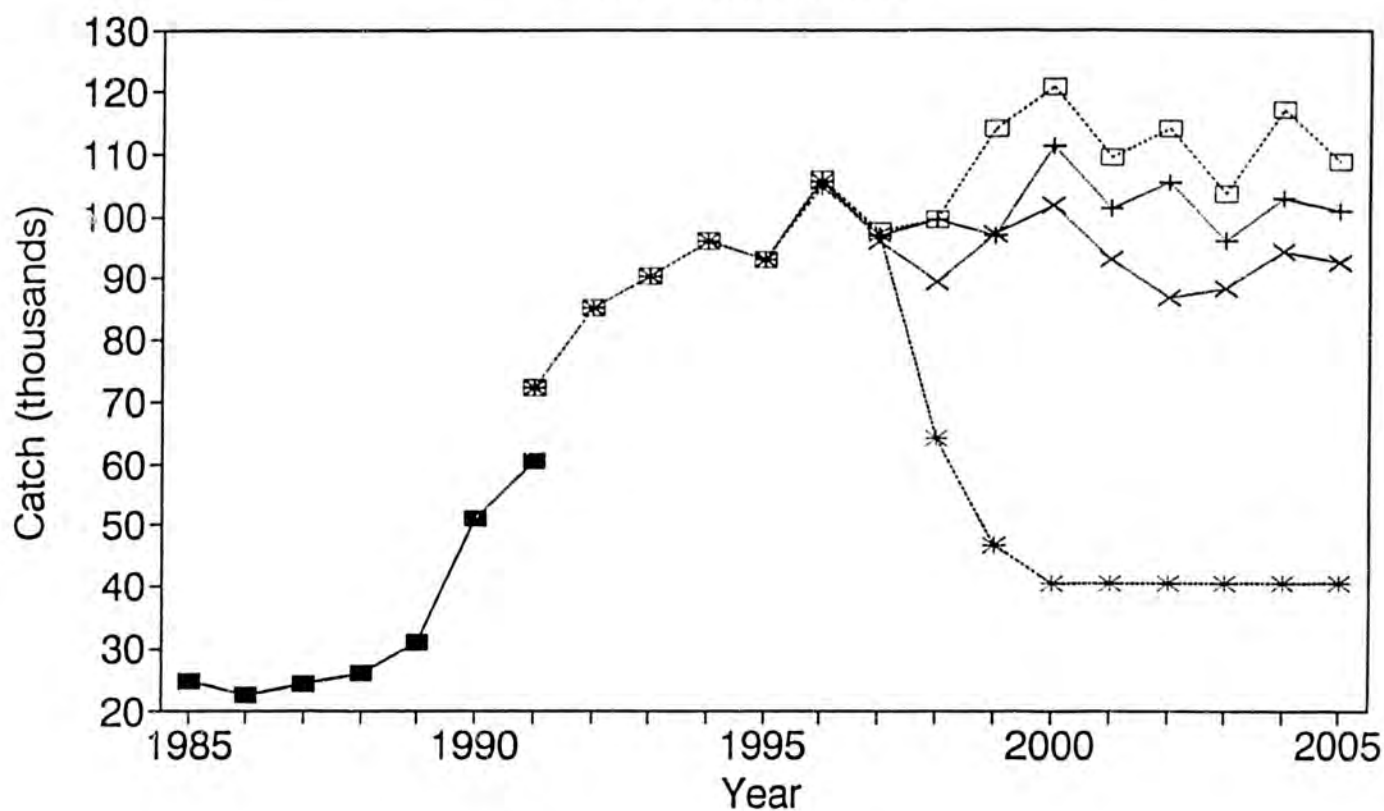


— 10% 50% — 90% — Actual

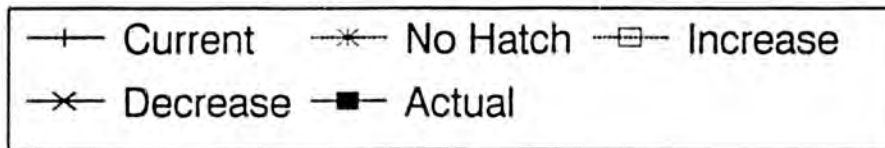
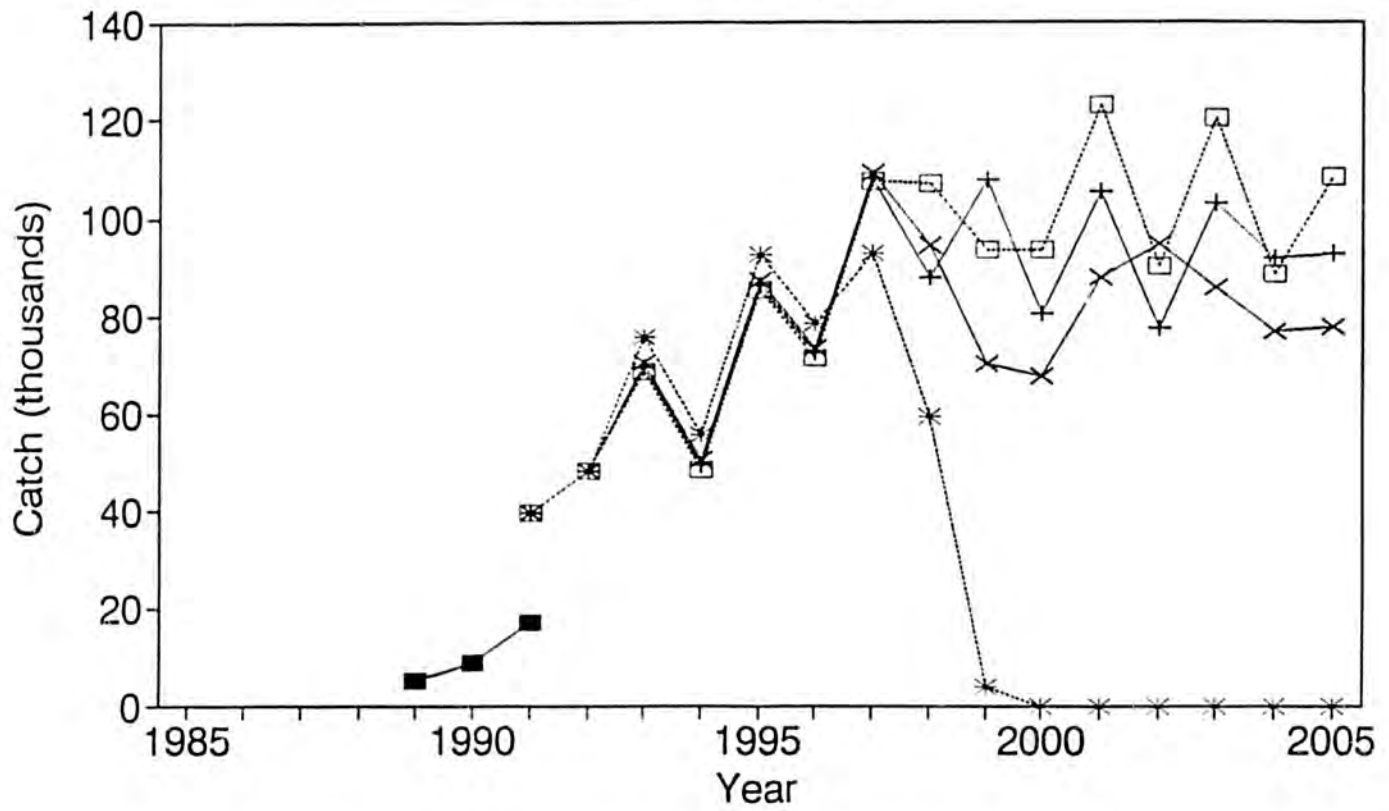
Southeast Alaska Chinook Salmon Total Troll



Southeast Alaska Chinook Salmon Total Sport Catch



Southeast Alaska Chinook Salmon Total Terminal Catch



SCOMM

74:38

April 24, 1992

We would like to thank you for the time and effort you have invested in responding to the survey of intensively modeled enhancement projects sent to you as part of the Legislative Enhancement Program Review Project. The contractor for the salmon population modeling research is using the survey data to complete that aspect of the study.

Enclosed is the last survey portion of the project; we would again like your assistance by completing two additional forms (enclosed). The first form is the **Salmon Enhancement Project production survey** for the less intensively modeled projects. This pink survey form is shorter and simpler than the survey form for more intensively modeled enhanced fisheries which you have already completed.

There are three primary reasons for modeling some of the enhancement projects less intensively--1) enhanced production is a relatively small portion of a particular fishery's commercial harvest, 2) Alaska Department of Fish and Game (ADF&G) data are insufficient for more extensive modeling efforts, and 3) the scope of the review project does not allow intensive population modeling of all enhanced fisheries.

As with the more intensively modeled production survey, a separate survey form is included for each "project," which has the same definition as in the first survey. The first page of each production survey has been partially completed based on ADF&G, FRED Division staff identification of salmon enhancement projects. If you have any corrections to the project name or other identifying data, or if there are additional projects not included in the surveys provided, please make the appropriate corrections or additions. Blank forms are attached.

The second (blue) form is a cost-of-production survey for each facility identified under FACILITY NAME in the SALMON ENHANCEMENT PRODUCTION SURVEY. The blue cost-of-production form, called the **FACILITY OPERATING, CONSTRUCTION, AND MANAGEMENT COST SURVEY**, is designed to be similar to budget forecasting that your facility probably does for any upcoming fiscal year. Only one of these production cost survey forms is to be completed for all of a facility's intensively and non-intensively modeled projects collectively.

It is important to note that in completing the one production cost survey form for your facility that "years" in this form refers to fiscal years while the production surveys refer to calendar years. However, this should be consistent with your facility's operations and budgeting.

There are some special hypothetical production cost cases that will require you to project costs for production levels that may not be likely or feasible for your facility's operations, e.g. question four asks you to estimate how your production costs would change if a portion of your production was excluded. These hypothetical cases are necessary to create a mathematical model of operating and construction costs for the statewide enhancement program, which allows the computation of costs of production levels not included in the survey. These cases will only be analyzed in aggregate and will not be used to determine benefits and costs of individual hatchery outputs.

Operating and construction costs for some increased production scenarios are also requested in the survey form. These production increases are aggregated by species while production survey forms have been completed on a project basis. Since some facilities will have more than one project and release location for a given species, this may cause some confusion in determining how to apportion these costs between projects. In these cases, the total incremental production costs (for the 15 percent increase scenario) should be estimated for the most likely and efficient combination of production from each project that would result in the increased production. **For all of the hypothetical cases in questions 4 and 5, the total annual costs should be entered on the survey form rather than the estimated change in annual costs.** For example:

Two sockeye projects are carried out at Facility Z. Together they produce 20,000 sockeye harvests in 1996 and are projected to produce 30,000 harvests in 1999 to 2021.

Increased production of Project 1 for sockeye salmon (producing harvests of 10,000 fish in 1996 from smolt releases in previous years) would be difficult to increase by 15 percent without some radical changes in operation or new construction.

On the other hand, Project 2 also produces 10,000 harvested fish in 1996 but fry releases could easily be increased to 15 percent of the total sockeye production of 20,000 harvested fish ($20,000 \times 1.15 = 23,000$ fish from Project 2). Thus, costs

for the increase production should be estimated for Project 2,
the most likely source of increased production.

For the 15 percent incremental increased production scenario, it may not be practical to increase production for a particular species in your facility. If there is simply no way to do this without adding a new project, leave the associated 15 percent production case blank for that species but note why you could not carry it out on the form.

Finally, the cost projections for the 15 percent production level increase should be based upon obtaining the increased harvests in one single salmon life cycle or as nearly as possible to that time interval.

The completed survey forms need to be sent to Steve McGee at the ADF&G, FRED Division Headquarters Office by June 15, 1992. There will undoubtedly be questions about how to fill out the survey. Please address these to Jeff Hartman or Steve McGee, ADF&G, 465-4160.

Again, thank you for your time and cooperation.

Sincerely,

Senator Dick Eliason
Senate President

Jeff Koenings, Director
Division of FRED

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF FISHERIES REHABILITATION
ENHANCEMENT & DEVELOPMENT (FRED)

WALTER J. HICKEL GOVERNOR

P.O. BOX 3-2000
JUNEAU ALASKA 99802-2000
PHONE (907) 465-4160
FAX (907) 465-4160

RAPIFAX TRANSMITTAL SHEET

To: Ginny Fay
Lee Latour Sen. Sam Cottler
From: Jeff Hartman
FRED Division

Date: 4-27-92
No. Pages 3
(following this page)

Message: Comments you requested are attached from
Jeff H. + Steve M. Hope all is going well
with you.

April 24, 1992

We would like to thank you for the time and effort you have invested in responding to the survey of intensively modeled enhancement projects sent to you as part of the Legislative Enhancement Program Review Project. The contractor for the salmon population modeling research is using the survey data to complete that aspect of the study.

Enclosed is the last survey portion of the project; we would again like your assistance by completing two additional forms (enclosed). The first form is the Salmon Enhancement Project production survey for the (less) intensively modeled projects. This pink survey form is shorter and simpler than the survey form for more intensively modeled enhanced fisheries which you have already completed.

There are three primary reasons for modeling some of the enhancement projects less intensively—1) enhanced production is a relatively small portion of a particular fishery's commercial harvest, 2) Alaska Department of Fish and Game (ADF&G) data are insufficient for more extensive modeling efforts, and 3) the scope of the review project does not allow intensive population modeling of all enhanced fisheries.

As with the more intensively modeled production survey, a separate survey form is included for each "project" which has the same definition as in the first survey. The first page of each production survey has been partially completed based on ADF&G, FRED Division staff identification of salmon enhancement projects. If you have any corrections to the project name or other identifying data, or if there are additional projects not included in the surveys provided, please make the appropriate corrections or additions. Blank forms are attached.

The second (blue) form is a cost-of-production survey for each facility identified under FACILITY NAME in the SALMON ENHANCEMENT PRODUCTION SURVEY. The blue cost-of-production form, called the FACILITY OPERATING, CONSTRUCTION, AND MANAGEMENT COST SURVEY, is designed to be similar to budget forecasting that your facility probably does for any upcoming fiscal year. Only one of these production cost survey forms is to be completed for each facility, intensively and non-intensively modeled projects collectively.

This paragraph may not be essential in for motion to operators.

all capitals

all capitals

originally these were referred to as:
non-intensive

probably redundant

not necessary

If a fiscal year does not begin on July 1, please indicate the starting date on the survey form. *or federal fiscal year or state fiscal year? (July 1)*

It is important to note that in completing the ~~the~~ production cost survey form for your facility that "years" in this form refers to fiscal years while the production surveys refer to calendar years. However, ~~this should be consistent with your facility's operations and budgeting.~~ *asked you in the survey*

You also, should not just say future costs or inflation.

There are some special, hypothetical production cost cases that will require you to project costs for production levels that may not be likely or feasible for your facility's operations. *for example,* question four asked you to estimate how your production costs would change if a portion of your production was excluded. These hypothetical cases are necessary to create a mathematical model of operating and construction costs for the statewide enhancement program, which allows the computation of costs of production levels not included in the survey. These cases will only be analyzed in aggregate and will not be used to determine benefits and costs of individual hatchery outputs.

combined together

Operating and construction costs for some increased production scenarios are also requested in the survey form. These production increases are aggregated by species, while production survey forms have been completed on a project basis. Since some facilities will have more than one project and release location for a given species, this may cause some confusion in determining how to apportion ~~these~~ costs between projects. In these cases, the total incremental production costs (for the 15 percent increase scenario) should be estimated for the most likely and efficient combination of production from each project that would result in the increased production. For all of the hypothetical cases in questions 4 and 5, the total annual costs should be entered on the survey form rather than the estimated change in annual costs.

for a facility (Project 1 and Project 2)

For example, two sockeye projects are carried out at Facility Z. Together they produce 20,000 sockeye harvests in 1996 and are projected to produce 20,000 harvests in 1997 to 2001.

(A) From
Increased production of Project 1 for sockeye salmon (producing harvests of 10,000 fish in 1996 from smolt releases in previous years) would be difficult to increase by 15 percent without some radical changes in operation or new construction.

On the other hand, Project 2 also produces 10,000 harvested fish in 1996 but fry releases could easily be increased to 15 percent of the total sockeye production of 20,000 harvested fish ($20,000 \times 1.15 = 23,000$ fish from Project 2). Thus, costs for the increase production should be estimated for Project 2, the most likely source of increased production, *in this*

example.

possible For the 15 percent incremental increased production scenario, it may not be practical to increase production for a particular species in your facility. If there is simply no way to do this without adding a new project, leave the associated 15 percent production case blank for that species but note why you could not carry it out on the form.

practical scenario
Finally, the cost projections for the 15 percent production level increase should be based upon obtaining the increased harvests in one single salmon life cycle or as nearly as possible to that time interval.

The completed survey forms need to be sent to Steve McGee at the ADF&G, FRED Division Headquarters Office by June 15, 1992. There will undoubtedly be questions about how to fill out the survey. Please address these to Jeff Hartman or Steve McGee, ADF&G, 463-4160.

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

*DIVISION OF FISHERIES REHABILITATION,
ENHANCEMENT & DEVELOPMENT (FRED)*

WALTER J. HICKEL, GOVERNOR

P.O. BOX 25526
JUNEAU, ALASKA 99802-5526
PHONE: (907) 465-4160
FAX: (907) 465-4168

May 21, 1992

The Honorable Sam Cotten
Alaska State Legislature
P.O. Box V
Juneau, AK 99801

Attn: Ms. Ginny Fay

Re: Surveys on the Economic Study for the Senate Special Committee on Domestic and International Fisheries.

Dear Ms. Fay:

I am responding to your request for (1) a review of the cost survey, including comments to make it applicable to state enhancement facilities; and (2) verification of a final list of private nonprofit hatchery operators to mail surveys to. I also have included a progress report on the missing survey forms that Jeremy Collie refers to in his May 4 letter to you.

1. I have reviewed the PNP cost survey and have enclosed a marked-up copy that our facility operators should be able to follow. When the surveys are distributed, they should probably be accompanied by a list (or copy of) the actual survey forms from the original project survey. I am assuming that you want Director Jeffery Koenings to distribute the final version of the survey to Fisheries Rehabilitation, Enhancement and Development Division staff.
2. Steve McGee and I have discussed the option of distributing the production and cost survey forms to the Kodiak Regional Aquaculture Association. He believes this would be redundant and confusing for the regional association staff. Currently, the planning and budgeting for Kitoi Bay Hatchery are the responsibility of FRED Division staff; they have a better handle on the future plans for the hatchery.
3. The state production surveys for the intensively modeled sites are currently being reviewed by the Division of Commercial Fisheries. I am expecting to see them any day and will forward them to Jeremy as soon as they arrive.

Ms. Ginny Fay

2

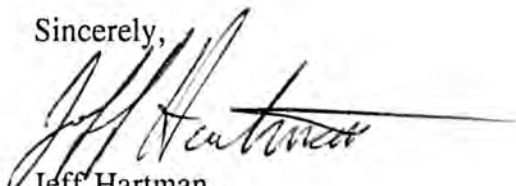
May 21, 1992

Of the 68 surveys for the nonintensively modeled state projects, I have received 62. The 6 missing projects are for some rehabilitation/fish pass projects that don't quite fit into our traditional production survey format. Of the 62 completed forms, only half have a completed final addendum page on harvest numbers. Over half of the 62 have some type of other response error, or I have a question about the response that will have to be cleared up before the data can be entered on any kind of database. This is to be expected in a survey with a few hundred fields (variables).

I believe the most efficient way to clear up the numerous response errors is to send out the previously completed production survey forms with the cost survey and a list of my questions to each of the original surveyed parties. We might get confused responses on the cost survey if the production numbers are not cleared up concurrently with initiating the cost survey. I have been tediously going through a 2-inch-thick pile of surveys, one facility at a time, and believe that I can have a list constructed for each facility by May 27.

Please, contact me if you have additional questions, or if you get an urge to error-check some of these green survey forms.

Sincerely,



Jeff Hartman
Economist

Enclosures

cc: Johnny Holland
Jeff Koenings

to: Ginny from: Jeff Hartman , Some additional things on the project

I don't know if you have replied to Jeremy Collie's letter of May 4th yet. I think that he is misinformed on the data collected in the cost survey, and on the economics of the demand models that Herrmann is constructing.

1. Collie is incorrect in his first assertion that there is no input for management costs in the survey form. There is a specific space in the cost survey form for management costs, to be filled out by the Division of Commercial Fisheries. Since there is no review of this field by the PNP and State operators, and no way to verify what has historically been spent to manage enhancement activities, I am more concerned that program costs might be overstated than understated, but see no more better way to get the data.

2. Collie is partially correct in his second point that Mark Herrmann's demand models will not produce different prices and for each species in terminal vs outside fisheries. Herrmann reported in his project summary to the legislature that he will produce different projections of prices by region. These regional prices will capture some of the differences in prices (some regions will have a higher portion of terminally harvested fish than others). It is important to remember that the mean price for all Alaska salmon, as computed in the CFEC fish ticket files, and used for Herrmann's models is a weighted mean price of all salmon, harvested in terminal and outer statistical areas. It isn't as though he is biasing the projections by using only prices from the stat areas with the highest historical prices.

For the previously mentioned reasons, and others, I do not share Collie's assertion that this will grossly overstate benefits of the statewide enhancement program. I have observed, from a Fish Ticket summary report on Special Harvest Area prices, that Elaine Denniford of CFEC sent to me (it is one of those confidential summaries containing fewer than 3 records for some aggregated fields) that many terminal fisheries do not vary significantly from prices in outer fisheries and in some years fish tickets from special harvest areas (SHA) receive higher prices. I think that an objective review of the priced fish tickets in special harvest areas and other stat areas would allow the Legislature to determine when and where prices are significantly different, and when/where they are only imagined to be different. This analysis should be carried out by economists. It would be fairly easy for you or me to write a little SAS program that compared the priced fish ticket files between special harvest areas and non special harvest areas, and determined where they were statistically different over the last 5 years.

If they are found to be statistically different in some regions, then perhaps economists should be asked to build an appropriate economic model to detect those differences.

3. I also got a copy of Marks preliminary draft of the demand model. It is a bit depressing to see estimated point elasticities for the high and low priced salmon in the unitary range for a record year like 1990 year. This is especially surprising results to see with a double log model (a functional form with constant elasticities over the entire demand curve). If double log functional forms end up working better than linear or log linear, it may make wild and hatchery production numbers that are chosen for the sensitivity testing less critical.

4. Did you know that NOAA is rewriting the NRDA regs? I have attached my comments for you to see. They probably won't end up in final ADF&G comments. Economics is still a black box to everyone here, they don't really understand how the portion of the regs that deal with quantitative economics favor the polluter.

RECEIVED

MAY 11 1992

LT

4 May, 1992

Ms. Ginny Fay
Legislative Analyst
c/o Senator Sam Cotten
Alaska State Legislature
P.O. Box V
Juneau, AK 99811

Dear Ginny,

Thank you for sending me a copy of the Legislative Review of Alaska's Fisheries Enhancement Program. It is comprehensive and well written. I am writing to you to provide a status report on my production and exploitation modeling. First of all, I decided not to attempt to intensively model SE coho salmon or PWS chum. I'll reiterate the reasons in case someone asks. The main reason is the dearth of data for the wild stocks of these species.

I talked to Leon Shaul (ADFG) about SE coho salmon. They have population data from a few indicator coho stocks, but there is no comprehensive escapement monitoring. The troll fishery is managed with an exploitation rate strategy, not knowing what the total run size is. Therefore it isn't possible to project the catch of wild coho in the future; using a recent average catch will do as well as trying to construct a model.

I talked with Samuel Sharr about the Prince William Sound chum database. He has reservations about trying to model PWS pink salmon, and the chum data are much worse. Again the main problem is escapement data. Not much effort has been put into chum escapement counts. Chum salmon are greatly outnumbered by pinks and the two can be mistaken in aerial surveys. Coded wire tagging was not started until 1989 and these tagged fish have not yet returned. The lack of tagging data makes it very hard to calculate representative survival rates for hatchery fry. I think it would be possible to build a chum model but it would take more time than we now have. I decided to devote my effort to pink salmon in PWS.

Ginny Fay
4 May, 1992
page 2

I now have preliminary simulation models for the other five species/region combinations. Up to now I have been concentrating on model development which can be done independently of data availability. I am now at a point where I need the historical data to calibrate the model parameters. Bits and pieces of data continue to trickle in, but we are still a long way from filling the comprehensive data request submitted in the fall. I'll continue working with the individual area biologists; if this approach is too slow, some pressure may need to be applied to speed up the process. I am enclosing a copy of the data request, annotated with what I have and have not received.

There are two important factors that I see are missing from the economic analyses as proposed by my UAF colleagues. One is the inclusion of management costs in the benefit-cost analysis. Are you surveying the area managers for what the management costs would be under different production scenarios? Including management costs is very important, not only because the costs are real, but because recognition of these costs will gain the cooperation of the Commercial Fisheries Division in the review of Alaska's Enhancement Program.

The second problem is the inability to estimate salmon prices on a local scale. Mark Herrmann's demand model operates at a global scale. My production models distinguish between mixed-fishery and terminal catch of hatchery fish. If all the terminal catch could be marketed there would be no economic problem, but we know this isn't true: when there is an oversupply of salmon, processors may not buy terminally caught salmon. The bioeconomic model must be able to assign a different value to terminally caught fish. Otherwise we will be overlooking a key element of the bioeconomics and may grossly overestimate the benefits.

I shall be in Fairbanks teaching fisheries management from 20-27 Feb. I can be contacted through SFOS at 474-7824. While in Fairbanks I shall try to meet with the economists to coordinate our research projects.

Sincerely yours,

Jeremy Collie
Assistant Professor

Enclosure

MEMORANDUM

STATE OF ALASKA
Department of Fish and Game

TO: Hal Geiger
Statewide Salmon Biometrician
Division of Commercial Fish

DATE: May 12, 1992

FILE NO:

THRU:

TELEPHONE NO: 465-4160

SUBJECT: Review of Survey from
Legislature

FROM: Jeff Hartman 
Economist
Division of FRED
Department of Fish and Game

Bob Clasby suggested that I directly contact you in the field to get a projected completion date for your review of the survey data sent to the Division of Commercial Fisheries on March 9, 1992 (see attached cover letter from Jeffrey P. Koenings). The survey, created by the Senate Special Committee on Domestic Fisheries, projects future enhancement production for the state enhancement program.

The responses in the "SALMON ENHANCEMENT PROJECT SURVEY" are being used by Jeremy Collie, (Juneau Center for Fisheries and Ocean Sciences) to develop a predictive model of salmon population growth and harvesting for certain fisheries in Alaska. Collie's letter of May 4, 1992 (attached), notes that he needs the data as soon as possible to complete his modeling contract with the Alaska State Legislature.

cc:
Holland
Koenings

MEMORANDUM

STATE OF ALASKA
Department of Fish and Game

TO: Chris Swenson
Habitat Biologist
Habitat Division
Department of Fish and Game

DATE: May 21, 1992

FILE NO:

THRU:

TELEPHONE NO: 465-4160

FROM: Jeff Hartman
Economist
Division of FRED
Department of Fish and Game

SUBJECT: Comments on NOAA's
Proposed Damage
Assessment Regs.

Thank you for the opportunity to critique the NOAA discussion document, covering language for The Oil Pollution Act of 1990 (OPA), Natural Resource Damage Assessment, and draft ADF&G comments.

Only one ADF&G comment on economic valuation methods appears in the draft memo to Alex Swiderski from Carl Rosier. While I believe that this is an appropriate one, it only addresses one of many obstacles, now existing in NRDA law, to computing the social costs of oil spills to Alaskans and other citizens of the U.S.

While NOAA has not yet determined its initial position on the various economic issues related to proposed NRDA regulations, I think ADF&G should at least identify the major obstacles in the NRDA law that handicapped the state's economic studies in preparation for EVOS litigation. These legal obstacles to competent analysis of the social costs of oil spills, are so well summarized in the economic literature on damage assessment, that they can be simply listed with little or no exposure to (and certainly no mention of) details of the states economic studies.

Within the spirit of the NRDA is an attempt to apply economic reasoning to computing costs of oil spills to society. The law, however, in NRDA itself places serious restraints on applying accepted or "good" economics. My comments are aimed at obtaining a more objective and technically correct measurement of social costs from oil spills. These corrections to the law would be particularly important for regions with highly valued natural resources at stake or where oil spills might be large or numerous.

These criticisms of NRDA are not new, and I did not invent any of them. In fact, most of these issues date back to problems in CERCLA, identified by one of the very economists hired by the A.G.'s office to critique damage assessment methods.

These following comments briefly summarize a few of the most serious economic issues embodied in the discussions on the rules which was recently reviewed by NOAA.

1. Unworkable definition of pathway to injury

The rule provides a pathway to injury that is fundamentally inconsistent with how economists value resources. It defines injury as a demonstratable change to physical natural resources. In economics, values are determined by changes in the preferences of people. The resources, of course, have no value system. The drafters of the rules wrongly left the definition of injury to the natural and physical scientists, thus, excluding demonstratable economic losses, arising from people who perceived that they have been injured. As an example, if recreationists avoid clamming in areas that they believe to contain contaminated clams, and later physical scientists cannot prove that the area was contaminated, the value of the lost opportunities to the recreationists is not counted.

2. Confusing definition of Public/Private in the rule

The line demarcating private and public use in the rule is unworkable. Damage assessment is limited to "public" resources because there are other well defined legal procedures for remedying losses arising from injury to private resources. This is an unnatural distinction for economists and economic models. In economics, the "unit" used to measure all benefits and costs is usually a household or "private" individual. Major areas of consumer surplus for market goods are excluded under this restrictive dictum.

3. Inappropriate interest rate

If damage to resources from an oil spill event is expected to occur in the future, the rule imposes an unrealistic 10% real discount rate, which is perhaps twice the real rate of interest. Even economists who prefer high interest rates oppose the 10 percent rate which understates future damages.

4. Contingent Valuation

Much of the debate that has centered on the technical problems of CV, detracts from a major problem in the rules that existence, option and bequest values are an accepted part of peoples value systems. While economists do disagree over how to design a CV study to capture these values, they do not disagree that social costs may arise from peoples perceptions about the existence, option and bequest value associated with an altered resource, or ecosystem.

In the rule, damages for option and existence values, obtained through the application of contingent valuation methods, can only be used if no use values can be determined. CV represents the only workable valuation method to treat these important values. The law should not create an ad-hoc restriction in the use of any economic methods that are imperfect or in the process of being developed. If this restrictive ideal was applied to other areas of the physical sciences, many biological population models would need to be exempted from NRDA on the basis of a history of serious measurement problems, and errors as identified in the literature.

5. Restrictive with and without Case for future damages

Traditional cost benefit analysis of any action, requires the construction of a "with the action" and "without the action" case. This requirement is reflected in the current NRDA laws.

The rule implies that future damages are estimated as the difference between the value of baseline economic activities without the spill or discharge and the estimated value of economic activities with the injury to natural resources. The regulations provide an unusual guide for future activities limiting them to committed uses. This is irrationally implies that all economic opportunities that the resources might provide in the future must be assumed to have zero value. This is again in contrast to economic theory and models which demonstrate that preferences and values change in the future with such variables as income, population, and substitutes.

cc:

Jeff Koenings
Johnny Holland
Peg Kerher

**SALMON ENHANCEMENT FACILITY
OPERATING, CONSTRUCTION, AND MANAGEMENT COSTS**

Please describe the annual operating and construction costs for your facility. Your cost estimates should correspond to a specific fiscal year and should be for all salmon produced by your facility rather than on a project basis. (This is different from the production survey.) For each fiscal year or series of years, provide your estimated total annual costs, as well as how costs can be allocated between commercial and sport/personal use fisheries. The percentage of total annual costs allocated to these fisheries should account for the "TOTAL ANNUAL COSTS." The "management costs" column is to be completed by Alaska Department of Fish and Game fisheries managers.

1. This question refers to the annual operating and construction costs of your facility's *current production*. This production level should correspond to the current production levels reported in the project surveys. For each fiscal year or series of fiscal years, please include the costs of all salmon production by your facility, and how these costs are allocated between commercial and sport/personal use fisheries production.

Fiscal Year		Costs		Percentage of Total Annual Costs			Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Comm.	Sport/ Personal	Cost- Recovery	
1992							
	2021						

2. This question refers to the annual costs of your facility's *planned production*. These costs must correspond to the planned production levels reported in the production survey for all projects. For each fiscal year or series of years, please include the expected operating and construction costs of all salmon production by your facility, and how you expect these costs to be allocated between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs			Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Comm.	Sport/ Personal	Cost- Recovery	
1992							
	2021						

The next series of questions are intended to provide information to determine the potential change in costs of the salmon enhancement program as a result of increases or decreases in production. These scenarios are required for creating a mathematical model of enhancement costs. Each scenario is completely hypothetical and are not being proposed by either the Legislature or the Alaska Department of Fish and Game.

Question 3 contains five parts, each of which hypothetically eliminates the enhancement of one species while holding the production of all other species at their currently permitted level in a facility. The results of question 4, together with the results of questions 1 and 3, will be used to calculate the "zero" point on the "production cost curves" for each species. If your facility does not produce the specific species, mark "NA" as appropriate.

- 3a. The *pink* salmon portion of the salmon enhancement in a facility is eliminated while all other components of the program remain at their current capacity. Please estimate how this would change the total annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Commercial	Sport/ Personal	
1992						
	2021					

- 3b. The *chum* salmon portion of the salmon enhancement in a facility is eliminated while all other components of the program remain at their current capacity. Please estimate how this would change the total annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Commercial	Sport/ Personal	
1992						
	2021					

- 3c. The *sockeye* salmon portion of the salmon enhancement in a facility is eliminated while all other components of the program remain at their current capacity. Please estimate how this would change the total annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs
From	To	Operating	Construction	Commercial	Sport/ Personal	(ADF&G Use Only)
1992						
	2021					

- 3d. The *coho* salmon portion of the salmon enhancement in a facility is eliminated while all other components of the program remain at their current capacity. Please estimate how this would change the total annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs
From	To	Operating	Construction	Commercial	Sport/ Personal	(ADF&G Use Only)
1992						
	2021					

- 3e. The *chinook* salmon portion of the salmon enhancement in a facility is eliminated while all other components of the program remain at their current capacity. Please estimate how this would change the total annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs
From	To	Operating	Construction	Commercial	Sport/Personal	(ADF&G Use Only)
1992						
	2021					

Question 4 also contains five parts. In this question, however, each part hypothetically *increases* by 15 percent the production level of one species while holding the production of all other species at their currently permitted levels. The results of question 5, together with the results of questions 1, 3, and 4, will be used to finish calculating the "production cost curves" for each species. If your facility does not produce the specific species, mark "NA" as appropriate.

- 4a. The *pink* salmon portion of the salmon enhancement program is increased by 15 percent while all other components of the program remain at their current capacities. Please estimate how this would change the annual costs (fiscal year) at your facility and the allocation of those costs between commercial sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs
From	To	Operating	Construction	Commercial	Sport/Personal	(ADF&G Use Only)
1992						
	2021					

- 4c. The *sockeye* salmon portion of the salmon enhancement program is increased by 15 percent while all other components of the program remain at their current capacities. Please estimate how this would change the annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

<u>Fiscal Year</u>		<u>Costs</u>		<u>Percentage of Total Annual Costs</u>		<u>Management Costs</u>
<u>From</u>	<u>To</u>	<u>Operating</u>	<u>Construction</u>	<u>Commercial</u>	<u>Sport/ Personal</u>	(ADF&G Use Only)
1992						
2021						

- 4d. The *coho* salmon portion of the salmon enhancement program is increased by 15 percent while all other components of the program remain at their current capacities. Please estimate how this would change the annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Commercial	Sport/ Personal	
1992						
2021						

- 4e. The *chinook* salmon portion of the salmon enhancement program is increased by 15 percent while all other components of the program remain at their current capacities. Please estimate how this would change the annual costs (fiscal year) at your facility and the allocation of those costs between commercial and sport/personal use fisheries.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs (ADF&G Use Only)
From	To	Operating	Construction	Commercial	Sport/ Personal	
1992						
2021						

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Please describe the annual operating and construction costs for your facility. Your cost estimates should correspond to a specific fiscal year and should be for all salmon produced by your facility rather than on a project basis. (This is different from the production survey.) For each fiscal year or series of years, provide your *and* estimated total annual costs, as well as how costs can be allocated between commercial, sport/personal use, and ~~cost-recovery~~ fisheries. The percentage of total annual costs allocated to these fisheries should account for the "TOTAL ANNUAL COSTS." The "management costs" column is to be completed by Alaska Department of Fish and Game fisheries managers.

1. This question refers to the annual operating and construction costs of your facility's *current production*. This production level should correspond to the current production levels reported in the project surveys. For each fiscal year or series of fiscal years, please include the costs of all salmon production by your facility, and how these costs are allocated between commercial and sport/personal use fisheries production.

Fiscal Year		Costs		Percentage of Total Annual Costs		Management Costs
From	To	Operating	Construction	Comm.	Sport/Personal	(ADF&G Use Only)
1992						
2021						