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STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT DETAILED STUDY PLAN

Project Title:

INJURY TO PINK SALMON EGG AND PREEMERGENT FRY IN THE KODIAK AND CHIGNIK MANAGEMENT AREAS

Study ID Number: Lead Agency: Fish/Shellfish Study Number 8b State of Alaska, ADF&G OSIAR Division

Cooperating Agency(ies):Federal: USFWS State : None

Principal Investigator: Charles Swanton, Fishery Biologist II Assisting Personnel: Kevin Brennan, Fishery Biologist II Date Submitted: March 5,1990

ONFIDENTIAL



INTRODUCTION

During 1989, numerous commercial salmon harvest opportunities within the Kodiak and Chignik Management Areas were foregone due to the EXXON VALDEZ oil spill. Potential repercussions from this event are overescapement (unrealized harvest) and less than desired returns from the 1989 brood year escapements. Annually, pink salmon comprise 78% and 31% (1978-1988) of the Kodiak and Chignik salmon harvest, respectively. The ex-vessel value of this harvest has annually averaged (in millions of dollars) 14.2 for Kodiak and 1.5 for Chignik.

A total of 386 Kodiak and 90 Chignik streams support populations of pink salmon. Preemergent sac fry sampling has been conducted in 44 Kodiak and 18 Chignik streams periodically over the last 20 years. These streams, referred to as index streams, provide data which are utilized by management biologists for forecasting returns and projecting potential harvest.

Potential damage caused by the 1989 brood year escapements upon future brood year returns can be quantified by: 1) examination of observed versus expected numbers of live fry/dig produced from potential egg deposition; 2) Comparison of 1989 potential egg deposition to preemergent fry survival for the odd years 1969 to present; 3) Evaluation of numbers of live fry/dig for streams with optimum spawning density versus streams with spawner densities above optimum.

OBJECTIVES

- A. Estimate potential egg deposition for all Kodiak and Chingnik preemergent index streams.
 - Estimate average number of fry/m² for Kodiak and Chignik Index streams.
- B. Determine survival of pink salmon eggs from potential egg deposition to preemergent fry.
- C. Assess changes in production, if any, of pink salmon preemergent fry due to the oil spill.

METHODS

Potential Egg Deposition

Potential egg deposition (PED) for each of the 62 Kodiak and Chignik Management Area index streams will be determined using index stream total escapements and fecundity data collected during the 1989 field season. The PED estimates will be based upon an assumed 1:1 male to female ratio, average fecundity derived from the relationship of fish length to number of eggs carried and the total escapement estimates derived using the Johnson and Barrett (1988) model.

Preemergent fry sampling

Preemergent sac fry sampling will be conducted on 44 Kodiak and 18 Chignik index streams (Tables 1 and 2). A majority of these streams have been frequently and consistently sampled each year. Sampling station (spawning riffles) selection is founded upon pink salmon spawner distribution and specific habitat utilization as The number of sampling sites per recorded from aerial surveys. stream is based upon escapement magnitude, stream size and observed productivity of individual index streams. Generally, smaller streams where escapements average less than 20,000 will have 4-6 sampling stations, 6-9 stations for the larger intermediate sized streams and the most productive streams will have 10-15 stations. Historically, 10 digs have been completed for each station using a pump and associated equipment which hydraulically remove pink salmon eggs and fry both live and dead from the stream bed. A collection frame 0.3m² is used to capture eggs and fry as they are displaced from the gravel. Depth of stream bed sampling is 15.2 to 45.7 cm with a duration of 1-3 minutes depending on substrate. After eggs and fry (both live and dead) are enumerated the collection frame is moved to the next dig location and the steps repeated. Sampling is done in an X configuration with equal numbers of digs done above and below the center of the X. Dias which are at the extremes of the configuration are those which are closest to the stream banks. Ancillary information recorded along with egg and fry counts are stream temperature, predator presence, stage of fry development, quantities of egg fragments and evidence of stream bed scouring or shifts (Brennan 1990). Only minor modifications have occasionally beset the above sampling program and were associated with water conditions, ice coverage or flood events which had altered the stream channel. Presently the only modification which will be imposed on the sampling program for 1990 will be that a minimum of 30 digs with at least one live fry be obtained for each stream sampled, regardless of the historic number of digs done for that system (Johnson 1990). Alternative stations additional digs to meet this constraint will be from for established sampling sites. Preemergent sac fry sampling will be conducted in a time frame which will minimize the chances of fry emigration prior to sampling.

Fry Survival

Determination of egg to preemergent fry survival (1989-1990) will be founded upon PED, live fry/dig, and habitat data collected from Fish/Shellfish study 7b. An estimate of spawning density for all spawning riffles sampled for preemergent fry will be obtained from the detailed spawner distribution maps.

DATA ANALYSIS

Relationship between PED and Live fry/dig

Utilizing PED and number of live fry/dig data spanning the odd years 1969 to 1989 analyses will consist of fitting and assessing an empirical relationship. Data will be analyzed on both geographical and Management Area wide scales. If required for quantifying possible outlying data points, climatological variables (precipitation and mean monthly temperature) will be assessed as possible causative factors. Damage from this analytical standpoint would be live fry/dig values which fall outside (descending limb of curve) the range of expected values, given that PED level. Hypothesis testing using non-parametric tests will be used to assess whether observed differences in number of live fry/dig are statistically significant. A significance level of 0.9 will be used for all statistical analyses.

PED to preemergent fry survival

Employing PED, live fry per dig and spawning habitat data collected from Fish/Shellfish study 7b, fry survival will be determined using weighted number of live fry/dig and later converted to m^2. The observed difference between potential eggs deposited and resultant preemergent fry will be designated as fry survival for a given year. The equation which will provide the estimate will be from Snedecor and Cochran (1967, p.520) with N defined as spawning area.

Potential egg deposition in this framework will be determined from the proportion of the total escapement which during odd years utilize this fraction of the overall spawning habitat. Again, data for the odd years 1969-1989 will be used and comparisons of eggs/m² and fry/m² for contrasting levels of escapements and years will be made. If needed, climatological conditions will be assessed in relation to calculated survival values. Damage due to escapement levels experienced in 1989 potentially will be quantified from this method.

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Control Versus Treatment Streams

This analysis component will take into account available spawning habitat, total estimated escapement and preemergent fry dig data. Control streams will be designated based upon a cumulative ranking of escapement and total available habitat in which the overall density of all streams will be 1.3 individuals per M^2 or less. All index streams that fall outside of this classification will be designated as treatment streams (those with spawner densities above the calculated optimum of 1.3 fish/M^2). There are 17 control and 14 treatment streams within the Kodiak Management Unit and 11 control and 3 treatment streams in the Chignik Management Unit (Tables 3 and 4). Analysis will consist of comparing the live fry/dig data in composite for the control versus treatment streams. An alternative method proposed by the consulting Biometrician will use an independent, mutually exclusive classification method for each index stream. He notes that the above (control versus treatment) method incorporates streams with density values that are above the defined optimum into the control group. Index streams (13 Kodiak and 4 Chignik) without available spawning habitat estimates will be included in this analysis when estimates become available. Impact will be assumed if the treatment streams fry values fall below the value of the control streams, and similarly for the alternative method proposed.

SCHEDULES AND REPORTS

DATES

ACTIVITY

February-April

May-December

January-February

Field data collection

Historic and present fry and egg data analysis

Data analysis

Line Item	category	Budget	
100	Personnel	86.4	
200	Travel	1.1	
300	Contractual	53.0	
400	Supplies	8.8	
500	Equipment	0.0	
700	Grants	0.0	
Total		\$149.3	

PROJECT BUDGET

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Class		; PCN Name		MM	OT	SEA	HAZ	COST
FB	IV	1203	P.Probasco	0.0	0	0	0	-0-
FB	III	7016	B.Barrett	0.0	0	0	0	-0-
FB	II	7017	C.Swanton	0.0	0	0	0	-0-
FB	II	7018	K.Brennan	12.0	200	0	0	66.0
FB	I	N329	Vacant	2.0	200	0	0	10.2
FB	I	N330	Vacant	2.0	200	0	0	10.2

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- Johnson, B.A. 1990. Detecting changes in pink salmon (Onchorhynchus gorbuscha) fry density for Humpy Creek, Alaska, and determination of sample size requirements. Alaska Department of Fish and Game, Kodiak. Regional Information Report No. 4K90-3. 6pp.
- Malloy, L.M. 1989. 1988 Kodiak area salmon management report to the Alaska board of fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak. Regional Information Report No. 4k89-6. 72pp.
- Snedecor, G. W., and Cochran, W. G. 1967. Statistical Methods. Iowa State University Press, Ames, Iowa.
- Thompson, F.M. and Fox, J.R. 1989. Chignik Management Area Annual Finfish Management Report, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak. Regional Information Report No. 4k89-5. 171pp.

	Stream	Num	ber		
		•••••	•••••	Last Yr.	Sample
Number	Name	Digs	· Years	Sampled	Year
251-105	Malina River	60	10	1989	000
251-404	Paramanof Creek	40	23	1989	ALL
251-822	Little Waterfall	10	8	1989	ALL
251-825	Portage Creek	50	14	1989	ALL
251-901	* Seal Bay Creek	25	13	1989	ALL
252-332	Big Danger Creek	40	21	1989	ALL
252-342	Afognak River	50	24	1989	ALL
252-343	Marka Bay	60	10	1989	000
253-115	Little River	40	9	1989	000
253-122	Uganik River	60	24	1989	ALL
253-331	Terror River	50	24	1989	ALL
253-332	Baumann's Creek	30	24	1989	ALL
254-202	Uyak River	60	24	1989	ALL
254-203	East Uyak Creek	20	6	1988	EVEN
254-204	Browns Lagoon	60	11	1989	000
254-301	Zachar River	50	24	1989	ALL
255-101	Karluk River	80	12	1989	ODD
256-201	Red River	120	12	1989	000
256-401	Sturgeon River	40	12	1989	000
257-401	Narrows Creek	30	24	1989	ALL
257-403	Dog Salmon River	60	24	1989	ALL
257-502	Deedman River	60	24	1989	ALL
257-701	Humpy River	90	24	1989	ALL
258-207	Kiliuda Creek	40	22	1989	ALL
258-522	Barling Creek	40	22	1989	ALL
258-542	Kalugnak Creek	50	24	1989	ALL
258-701	Seven Rivers	90	24	1989	ALL
259-101	Monashka Creek	20	9	1987	ALL
259-102	Pillar Creek	25	9	1987	ALL
259-211	Buskin River	60	24	1989	ALL
259-231	American River	60	24	1989	ALL
259-242	Sid Olds River	50	24	1989	ALL
259-371	Sheratin River	50	22	1989	ALL
259-412	Miam River	60	12	1989	000
259-414	Hurst Creek	40	21	1989	ALL
259-415	Saltery River	50	24	1989	ALL
262-271	Kukak River	20	7	1989	ALL
262-402	Missak Creek	20	12	1989	ALL
262-451	Kinak Creek	40	11	1989	ALL
262-501	Geographic Creek	20	11	1989	ALL
262-551	Dakavak River	30	12	1989	ALL
262-604	-Kashvik Creek	40	12	1989	ALL
262-651	Rig Alinchak	30	11	1989	ALL
262-702	Portage Creek	30	10	1989	ALL
262.761	All Creek	20	10	1081	ALL.
262-801	lute Creek	20	5	1083	AL 1
242-803	Vanatab Creak	20	•	1090	AL L
202-006	Neneldk Littk	20	7	1000	ALL
202-201	alg Lreek	40	1	1700	ALL

Table 1. Kodiak Management Area pink salmon preemergent index streams sample sizes, and preview of historic data available.

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* Non-index stream periodically sampled.

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Table 2.- Chignik Management Area pink salmon preemergent index streams sample sizes and preview of historic data available.

Str	eam	Num	ber	Year	S 1 -	
Number	Name	Digs	Years	Sampled	Years	
272-302	Hook Bay	40	9	1983	ALL	
272-501	Cape Kumliun	40	5	1982	ALL	
272-514	N.Fork Kujulik	45	3	1985	ALL	
272-702	Amber Creek	30	7	1985	ALL	
272-721	Yantarni Creek	30	1	1973	ONE	
272-801	Ocean Beach	40	1	1983	ONE	
272-802	Foot Bay Creek	30	11	1984	ALL	
272-903	Chiginagak	60	2	1974	TWO	
272-904	Chiginagak	30	1	1985	ONE	
272-905	Chiginagak	50	7	1985	ALL	
272-962	Agripina River	30	1	1974	ONE	
272-103	Kilokak Creek	50	1	1985	ONE	
272-702	Redbluff Creek	60	1	1976	ONE	
273-722	Ivan River	50	12	1985	ALL	
273-823	Spoon Creek	30	10	1984	ALL	
273-842	Portage Creek	30	12	1984	ALL	
275-406	Ivanof River	50	12	1985	ALL	
275-502	Humpback River	50	12	1985	ALL	

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			Total			Cumulative		40
Stream Name	n Number	Escapemen 1989	t Habitat	Density	Esc.	Habitat	Density	
Name Malina Narrows Browns Karluk Marka Paramanof Waterfall Barling Dog Salm. Dakavak Kiliuda Buskin Miam Seal Saltery	Number 251-105 257-401 254-204 255-101 252-343 251-404 251-822 258-522 258-522 258-522 258-522 258-207 259-211 259-211 259-411 259-415	1989 588 2097 4833 109880 20794 20056 6545 147423 315559 91579 69762 159123 196867 2805 249955	Habitat 6078 21532 40176 829515 58724 41345 10414 75209 137754 31214 22737 47945 53636 619 54040	Density 0.0967 0.09738 0.120295 0.132462 0.354097 0.485088 0.628480 1.960177 2.290742 2.933907 3.068214 3.318865 3.670426 4.531502 4.625370	Esc. 588 2685 7518 117398 138192 158248 164793 312216 627775 719354 789116 948239 1145106 1147911 1397866	Habitat 6078 0 27610 0 67786 0 897301 0 956025 0 997370 0 1007784 0 1082993 0 1220747 0 1251961 0 1274698 0 1322643 0 1376279 0 1376898 0	Density .096742 .097247 .110907 .130834 .144548 .158665 .163520 .288289 .514254 .574581 .619061 .716927 .832030 .833693 .976887	Control Streams
Hurst Kanatak	259-414 262-802	167617 121865	32471 23004	5.162052 5.297556	1565483 1687348	1463409 1 1486413 1	.069750	
Terror Baumans Jute Portage Humpy Deadman Oil Kaiugnak Pillar Portage Danger Seven R. Alinchak Uganik	253-331 253-332 262-801 262-702 257-701 257-502 262-751 258-542 259-102 262-702 252-332 258-701 262-651 253-122	408847 353333 48996 268637 1664629 1093543 120728 99610 41653 115929 46547 1201158 553457 968232	68798 44646 5473 29223 171739 111430 10966 7824 2541 4656 839 19588 3317 1884	5.942716 7.914102 8.952311 9.192656 9.692783 9.813721 11.00930 12.73133 16.39236 24.89884 55.47914 61.32111 166.8546 513.9235	2096195 2449528 2498524 2767161 4431790 5525333 5646061 5745671 5787324 5903253 5949800 7150958 7704415 8672647	1555211 1 1599857 1 1605330 1 1634553 1 1806292 2 1917722 2 1928688 2 1936512 2 1939053 2 1943709 3 1944548 3 1964136 3 1967453 3 1969337 4	.347852 .531091 .556392 .692916 .453529 .881196 .927410 .967020 .984613 .037107 .059734 .640765 .915933 .403840	Treatmen: Streams

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Table 3. Kod-iak Management Area control and treatment streams for the 1990 preemergent sac fry sampling program.

Table 4.	Chignik Management	Area	control	and t	reatment	streams	for	the
	1990 preemergent sa	c fry	sampling	prog	ram.			

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C 1	-		Total			Cumulati	/e	
Name	Number	1989	Habitat	Density	Esc.	Habitat	Density	
Amber Portage	272-702 273-842	4638 1200	200041	0.023185	4638	200041 219083	0.023185	-
Spoon Ivan	273-823 273-722	1700 32000	23652 189000	0.071875	7538 39538	242735 431735	0.031054 0.091579	(
North Fk. Hook	272-514 272-302	25497 41544	128837 153243	0.197901 0.271098	79115	640585 793828	0.123504 0.151996	Streams
Humpback Foot Ivanof Agripina	275-502 272-802 275-406 272-962	51000 10800 168403 82592	110293 18062 256723 115699	0.462404 0.597940 0.655971 0.713852	171659 182459 350862 433454	904121 922183 1178906 1294605	0.189862 0.197855 0.297616 0.334815	
Chiginagak Chiginagak	272-904 272-905	89000 32000	54203 19245	1.641975 1.662769	522454 554454	1348808 1368053	0.387344 0.405286	- Treatm