4K92-23

WESTWARD REGION SHELLFISH STAFF MEETING MINUTES

KODIAK FISHERIES INDUSTRIAL TECHNOLOGY CENTER

FEBRUARY 25-29, 1992

Compiled By:

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Regional Information Report[1] No. 4K92-23

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

May 1992

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On February 25, 1992 the Westward Region's Commercial Fisheries Shellfish staff met at the Kodiak Fisheries Industrial Technology Center for the annual staff meeting. Staff in attendance is listed in Table 1. The meeting was convened at 09:30 hours and in session through 1630 hours. The meeting was reconvened on February 26 and 27 at 0830 hours and adjourned at 1630 for each of those respective dates. All action items are numerated and listed in Table 2. All staff meeting reference materials are attached and listed in Appendices 1 through 12.

Introduction by Bill Nippes.

A. Budget (Nicholson)

Mr. Nicholson requested to move this agenda item to the end of the meeting. At this time Bill Nippes suggested staff attend the Kodiak Local Advisory Committee meeting on February 26 at 7:00 p.m. in the fishermen's hall.

B. Review of 1990/91 (Appendices 1, 2, and 3)

KODIAK. Mr. Spalinger presented a brief review of the area shellfish fisheries. In this review the issue of biological and management thresholds were discussed. Mr. Spalinger stressed the need to develop these thresholds for the Kodiak area fisheries. Pot limits were recently introduced for the area Tanner crab fishery (75 pots/vessel). Pot limits were tied to biomass, and all participating vessels are allotted an equal number of pots. Buoy identification stickers were issued and few problems were encountered using this system (Mr. Spalinger indicated that 11 replacement stickers have been issued to date). Mr. Spalinger also presented 1991 effort and harvest figures for the area Dungeness, scallop, urchin and octopus fisheries.

SOUTH PENINSULA AND CHIGNIK. Mr. Spalinger informed the staff that the Tanner crab fishery was closed in 1991 due to small numbers of legal sized males found in the annual trawl survey conducted in the summer of 1991. The survey results also indicated that there was no evidence of a significant change in this trend for the near

Table 1. 1992 Westward Region annual shellfish staff meeting attendance.

Staff Member	Title
Bruce Barrett	Kodiak/Alaska Peninsula Area Finfish Research Biologist
Dean Beers	Bering Sea/Aleutians Area Asst. Shellfish Research Biologist
Bill Donaldson	Kodiak Area/Alaska Peninsula Shellfish Research Biologist
Ken Griffin	Bering Sea/Aleutians Area Shellfish Management Biologist
David Jackson	Kodiak/Alaska Peninsula Area Asst. Shellfish Management Biologist
Larry Nicholson	Westward Region Supervisor
Bill Nippes	Regional Shellfish Coordinator
Rance Morrison	Mandatory Shellfish Observer Program Coordinator
Doug Pengilly	Regional Biometrician
James Spalinger	Kodiak/Alaska Peninsula Area Shellfish Management Biologist
Donn Tracy	Asst. Mandatory Shellfish Observer Program Coordinator
Mike Ward	Bering Sea/Aleutians Area Asst. Shellfish Management Biologist
Leslie Watson	Bering Sea/Aleutians Area Shellfish Research Biologist

Table 2. 1992 Westward Region annual shellfish staff meeting action items.

Item	Description and directed staff member(s):
1.	Directive from L. Nicholson and B. Nippes to L. Watson for information detailing the short and long term possibly achievable objectives from implementation of a P.I.T. tag study in the regional shellfisheries. Ms. Watson requested clarification from staff of management goals by usage of a fisheries tag study prior to April 1, 1992.
2.	Directive from L. Nicholson and B. Nippes to send D. Beers and D. Tracy to the Alaska State Trooper Academy for Peace Officer deputization.
3.	Directive from B. Nippes to D. Beers to contact NMFS and clarify federal versus state identification of hybrid Tanner crab to account for the population in survey data.
4.	Directive from L. Nicholson to K. Griffin and R. Morrison for draft of a memo detailing need for an alternative sideband frequency or means of communication for obtaining observer reports during fisheries.
5.	Directive from B. Nippes to D. Jackson for draft of a proposal to the Board of Fisheries restricting multiple Tanner registration in the Kodiak/peninsula fisheries.
6.	Directive from L. Nicholson and B. Nippes to R. Morrison and D. Tracy for production of an Observer Program video presentation for board meetings and public relations.
7.	Directive from B. Nippes and L. Nicholson to R. Morrison for draft of a proposal to the Board of Fisheries mandating observer coverage at shoreside processing plants.
8.	Directive from L. Nicholson to K. Griffin for draft of a memo detailing the housing shortage and affordability problems for state employees in Dutch Harbor.

future. Mr. Spalinger also presented 1991 effort and harvest figures for the area Dungeness fishery.

BERING SEA. Mr. Griffin presented a summary of the 1991 king and Tanner crab fisheries. Discussion was focused on the fact that increased effort in the St. Matthew and Bristol Bay king crab fisheries has shortened the duration of the seasons to the point that inseason management of these fisheries has become increasingly difficult (Closure of the 1991 St. Matthew fishery was based on a comparison of historical data to the pre-season assessment of anticipated effort). Questions were raised pertaining to what constitutes a reasonable fishery duration to allow for inseason management. Suggested proposals were mandating pot limits for such fisheries and pre-registration to allow for earlier effort assessment. Mr. Griffin also summarized the 1991 Bering Sea hair crab harvest and concluded that the small amount of effort indicates that there is currently no directed fishery on this species.

ALEUTIANS. Mr. Griffin presented a summary of effort and harvest in the king and Tanner crab fisheries. Discussion was focused on the theory that Dutch Harbor and Adak brown king crab populations are shared stocks. A visual or PIT (Passive Integrated Transponder) study was proposed as a means to resolve this issue and facilitate better management of these fisheries.

C. Review/Discussion of ongoing projects. (See Appendices 4, 5 and 6).

BITTER CRAB SYNDROME. Mr. Jackson presented a summary of research conducted in the Kodiak, Alaska Peninsula and Eastern Aleutians areas in 1990 to document and analyze the incidence of Bitter Crab Syndrome (BCS) in the Tanner stocks in those areas. Mr. Jackson gave a brief overview of sampling procedures and analysis mentioning that detecting early stages of BCS using blood smear samples can now be conducted in the Kodiak office as a staff member has gained the necessary training from the ADF&G Juneau pathology lab. Discussion was focused on the possible effects of an increased incidence of BCS on the commercial Tanner fisheries and the need to harvest marketable crab while still in the early stages of disease.

PIT PROJECT. (Watson, Beers, Pengilly). Ms. Watson and Mr. Pengilly presented a summary accompanied by a video of the Bering Sea test fishery funded PIT feasibility study conducted at Westward Seafoods in Dutch Harbor during late October and early November 1991. Working in conjunction with Infopet Systems Inc., Ms. Watson and staff concluded that the use of PIT tags accompanied by an automated tag detection system can be an effective means of implementing tag study applications and objectives (detection of tags was determined to be 99% effective overall). Discussion was focused on the feasibility of continued funding of the study and clear definition of long term objectives of the project. Also a comparison of the effectiveness of visible (Floy) tag usage versus the PIT tag was commented on. (Action item 1).

COLLECTORS. Mr. Donaldson gave an oral and visual presentation of the ongoing "sausage collector" study being conducted in Chiniak Bay, Kodiak. A summary of the study revealed information about the rearing and settling patterns of juvenile red king crab. Discussion focused on the continuing benefits of the study, continued funding and support for the project from the regional staff.

D-E. Review of planned activities & Does current management/research structure meet goals on the long term or short term? (See Appendix 7).

MANAGEMENT/RESEARCH. Staff members participated in a discussion of the priorities/issues facing the region and where management and research needed to focus effort to address these topics. Stock assessment was agreed upon as the paramount problem and possible ways to resolve this issue were commented on. The application of a tag study for future comparison to annual trawl survey results was discussed and once again the question arose with regard to the advantages/disadvantages of the usage of P.I.T. tags as opposed to a visible tag study. Another topic brought up was the problem of excessive effort levels in certain fisheries. Mr. Griffin suggested possible solutions being pot limitations and reducing entry in the affected fisheries to prolong seasons and allow for some degree of inseason management.

The harvest of illegal (undersize) bairdi Tanner crab during the Bering Sea opilio fishery was also an issue and the Dutch Harbor staff was encouraged to take a more active role in assisting Fish & Wildlife Protection (FWP) with regard to enforcement and it's relation to the shellfish observer program. Overall there was consensus among staff members that a need exists for more interaction and cooperation between management and research personnel to address regional priorities. (Action item 2).

F. Trawl Survey (See Appendix 8)

POTENTIAL PROBLEMS. Mr. Pengilly gave a presentation of his statistical analysis of the federal and state crab population surveys and discussed factors that potentially affect the accuracy of the survey conclusions. Mr. Pengilly stated that factors to consider can include disregarding tows with high densitys of crab, problems with randomly surveying the vast areas encompassed by the fisheries, an absence of clearly defined crab habitat, and variations in the marine substrate where surveying is necessary.

POTENTIAL FIXES: Mr. Pengilly proposed that a potentially more effective means of assessing densities would be to more closely scrutinize those areas where large numbers of crab are found during tows and incorporate this information into the assessments that define the guideline harvest levels. Overall Mr. Pengilly concluded that the Kodiak area surveys have most likely been overestimating population abundances in the past.

G. Review of Region Management Plans.

THRESHOLDS. Mr. Donaldson presented a comparison of biological versus management thresholds applied in the fisheries and noted that the Dept. has no established biological thresholds with the exception of the Kodiak area king crab fishery (5.5 million mature females). Mr. Nippes added that management thresholds for the Bering Sea stocks are established in the Federal Management Plan and are monitored through trawl survey findings and inseason CPUE's. A proposal was made to establish biological thresholds for each fishery that would possibly allow closures to be based on numbers of fecund females as well as legal males in the population.

H. Tanner Crab

SPECIES IDENTIFICATION. Mr. Beers initiated a discussion on the question surrounding hybrid Tanner crab identification by the National Marine Fisheries Service during the annual trawl surveys. The current estimate by NMFS of a 1% percent occurrence of Tanner hybrids in the Bering Sea was questioned by Mr. Beers, Mr. Griffin and Mr. Tracy. Also discussed was the problem of NMFS using different criteria for the identification of Tanner hybrids than is used by Department personnel. (Action item 3).

"RED EYE" LEGAL DEFINITION. (Griffin, Morrison, Beers, Tracy). The Dutch Harbor staff all commented that the current legal definition appears to be a workable solution to species identification of Tanner crab both from a legal and industry standpoint. Mr. Morrison and Mr. Tracy indicated that some adjustment in the Shellfish Observer Program was necessary with respect to data forms to incorporate the regulation changes.

I. Inseason Management.

USE OF P.I.T. TAGS. (Watson, Beers). No staff meeting notes are available to reference this discussion.

SALMON/HERRING. No presentation on this topic was given during the staff meeting.

CRAB. Mr. Griffin indicated that during the Bering Sea opilio fishery there was a need for an alternative side band radio frequency to accommodate weekly observer catch reports. Mr. Griffin noted that current observer reporting schedules often conflict with industries daily contact with fishing vessels. (Action item 4).

J. Need for Board of Fisheries action. (See Appendix 9).

PROPOSALS: (All Staff).

Subsistence - Mr. Nippes submitted a proposal that the Commercial Fisheries Division be relieved of the responsibility of accounting for subsistence catches and administering permits. Mr. Jackson proposed that restrictions on fishing depths for Tanner crab be lifted. Mr. Spalinger also proposed that state regulations regarding size limits for Tanner and Dungeness crab model those of the federal government.

Bering Sea commercial pot storage - Mr. Nippes suggested eliminating wet pot storage in the Bering Sea completely to eliminate excess gear utilization during fisheries. Mr. Jackson indicated that a clarification of regulations would be helpful. All staff agreed on restricting wet storage.

Bering Sea commercial pot limits - Dr. Paul Hooker from the Commercial Fisheries Division and Dr. Mark Herrmann from the University of Alaska presented an economic impact analysis of pot storage limits using the 1990 Bristol Bay Red King Fishery as a model for their study. Reasons for proposing pot limits in the fisheries included reduction of excessive gear loss during the Tanner seasons and extension of the seasons of the red and blue king crab fisheries to allow for some degree of inseason management. The results of the study indicated that alternative pot limits would have some effects on the productivity of the fleet relative to vessel size and a small effect on increasing the duration of king crab fisheries to allow for inseason management.

District registration for Kodiak Tanner crab - Mr. Jackson proposed that registration for Kodiak Tanner crab be separated by district. Mr. Nippes suggested possibly creating new registration areas to address this issue. (Action item 5).

Groundfish longlining - Mr. Nippes and Mr. Jackson proposed that longlining gear for cod pot fishing be eliminated by regulation. Mr. Ward commented that pot fishing was less of a gear conflict with crab fishermen than trawling. All staff agreed to work in the direction of eliminating long lining of cod pot gear in the Kodiak and Chignik areas.

Other issues - Mr. Griffin brought up the issue of deadloss (i.e. undersize and female retained crab) being discarded on site at shoreside processors in the Bering Sea and the possible stock contamination from such practices. Mr. Morrison and Mr. Tracy mentioned that a number of floating processors in the Akutan area were using tender vessels to transport delivered catches during the Tanner fisheries. The question of extending observer coverage to these tender vessels was discussed as a possible inclusion in the proposal detailed under "OBSERVER PROGRAM" to mandate observer coverage at shoreside processing plants.

REPORTS. Mr. Nippes suggested to research and observer program staff members that compiling video presentations for board meetings and other functions may be an effective means of giving outside parties a broader perspective of ongoing research projects and the shellfish observer program. Other possibilities for video presentations included annual trawl surveys and major projects. All staff agreed that video can be utilized as an important public relations tool. (Action item 6).

ATTENDANCE. (Nicholson, Nippes). Mr. Nicholson brought up the issue of the increasing need for greater personnel attendance at staff and fisheries board meetings. Mr. Nippes added that upcoming personnel changes necessitated more contact and exposure between regional and statewide staff. Mr. Nicholson also encouraged more regional staff attendance at local advisory committee meetings to facilitate more informative responses from staff to local and regional issues.

K. Dutch Harbor Staffing/Equipment. (See Appendix 10).

STAFF. Mr. Griffin presented an assessment of current Dutch Harbor staffing needs and levels noting that in 1991 additional staff from Kodiak and Cold Bay were required to meet the requirement of offering tank inspections for the king crab fisheries (i.e. St. Matthew, Bristol Bay) in areas stipulated in regulation. Mr. Griffin added that recent staff reductions posed difficulties for maintaining a dockside sampling strategy and a Department presence at remote processing locations.

EQUIPMENT. Mr. Griffin emphasized the need for replacement of existing state vehicles for the Dutch Harbor office. Mr. Nippes indicated that a Department purchased vehicle would be arriving on the state ferry in early May of this year. Mr. Nicholson added that the Department of Transportation had budgeted for two additional replacement vehicles to be available for the Dutch Harbor office in June or July.

OBSERVER PROGRAM. (Nicholson, Nippes, Griffin, Morrison, Tracy). Mr. Morrison presented an overview of the Mandatory Shellfish Observer Program focusing on historic background and the continuing expansion of the program primarily due to the mandate requiring observer coverage beginning in 1990 for catcher and floating processors participating in the Bering Sea opilio fishery. Mr. Morrison also indicated that the increasing amount of vessel effort in all the regional shellfisheries was in part responsible for the elevated need of observers. A series of tables and graphs were exhibited that displayed trends in levels of observer deployment, briefings/debriefings and violations reported by observers in various fisheries. Mr. Morrison and Mr. Tracy also brought forth a number of proposed regulatory changes to alleviate ongoing problems with the efficient implementation of the departments role in the program. At this point, Mr. Nicholson introduced the current federal and state proposal to be taken up by the North Pacific Fisheries Management Council that in effect would incorporate the federal groundfish and state shellfish observer programs with funding for both programs to be derived from a tax levied on industry. Discussion focused on whether necessary changes could be assimilated into the possible restructuring of the shellfish program if the NPFMC approved the incorporation of federal and state observer programs. Mr. Nicholson and Mr. Nippes suggested that the observer coordinating staff submit the proposed changes in a general draft of ideal shellfish program structure. Mr. Griffin expressed support for the proposal mandating observer coverage for shoreside processing plants in view of Department staff reductions, and all staff concurred with this. (Action item 7).

L. Other.

DUTCH HARBOR HOUSING/BUNKHOUSE. (Griffin, Tracy). Mr. Griffin brought up the issue of the current shortage of available housing in Dutch Harbor and the problems of affordability for seasonals not included in the regional policy regarding bunkhouse residence. Mr. Griffin also commented on the fact that all federal and some other state employees (full time and seasonal) were provided with housing allowances/subsidies for residence in Dutch Harbor. Mr. Tracy presented a sample listing of rental housing prices and availability in the area. Mr. Nicholson suggested a memo detailing the problem be submitted to headquarters for possible action. (Action item 8).

M. Budget. (See Appendices 11 and 12).

Mr. Nicholson presented a brief overview of the proposed FY93 regional budget and distributed handouts detailing this issue. Mr. Nicholson noted that increments for 1993 were included for Dutch Harbor area management and the Mandatory Shellfish Observer Program and requested that questions and comments on budget matters be withheld until all staff members present had the opportunity to review the written materials.

APPENDIX 1

Table 1. 1991 landings and values of fisheries to the Port of Kodiak.

Species	Pounds[1]	Ex-Vessel Value[2]
Tanner		
C. bairdi	3,184,721	5,226,596
C. opilio	1,512,868	1,059,008
Dungeness	1,494,703	2,047,743
Red King Crab	628,077	1,947,039
Scallops	589,535	2,252,024
Sea Urchins	30,472	28,034
Octopus	129,355	138,410
Groundfish	190,970,581	33,876,000
Halibut	11,285,000	21,667,200
Salmon[3]	87,516,380	31,483,465
Herring[4]		
Sac Roe/Food/Bait	5,288,000	2,152,032
Total	302,629,692	101,877,551

[1] Represents pounds of product landed at the Port of Kodiak and may not have been harvested in the Kodiak Management Area.

[2] Dollar value to fishermen in season and does not reflect postseason settlements.

[3] Represents pounds of product harvested in the Kodiak Management Area.

Table 1. Commercial catch and effort for the Tanner crab (Chionoecetes bairdi), Kodiak Management District, since 1967[1].

Year	Vssls	Lndngs	Number of crab[1]	Number of lbs.[1]	Pots Lifted	CPUE	Avg. Wt.	Price Per #
1967	-	83	-	110,961	-	-	-	$ .07
1968	-	817	-	2,560,687	-	-	-	.10
1969	85	955	-	6,827,312	72,748	43	-	.11
1969/70[2]	67	833	3,237,244	8,416,782	78,266	42	2.6	.11
1970/71	82	453	2,686,067	6,744,163	60,967	44	2.5	.11
1971/72	46	505	3,878,618	9,475,902	65,907	59	2.4	.13
1972/73	105	1,466	13,609,688	30,699,777	188,158	67	2.3	.17
1973/74[3]	123	1,741	11,857,573	29,820,[illegible]99	217,523	59	2.5	.20
1974/75[3]	74	471	5,459,940	13,649,966	73,826	83	2.5	.17
1975/76[4]	104	1,168	10,748,958	27,336,909	199,304	64	2.5	.20
1976/77[5]	102	998	7,830,727	20,720,079	164,213	48	2.6	.33
1977/78[6]	148	1,483	12,401,243	33,281,472	251,621	49	2.6	.43
1978/79[7]	218	1,225	10,702,829	29,173,807	275,455	38	2.7	.55
1979/80[7]	211	1,385	6,813,128	18,623,875	282,946	24	2.7	.55
1980/81[8]	188	771	4,398,631	11,748,629	174,351	25	2.7	.65
1981/82[9]	221	950	5,413,467	13,756,159	230,403	24	2.5	1.65
1982/83[9]	348	1,439	7,744,812	18,927,061	377,562	21	2.4	1.25
1983/84[9]	303	1,229	5,891,968	14,478,066	303,764	10	2.5	1.20
1984/85[10]	214	710	4,567,037	12,024,553	176,830	26	2.6	1.50
1985/86[10]	233	601	3,457,930	8,996,151	160,808	21	2.6	1.90
1986/87[10]	189	503	1,830,365	4,833,473	110,963	16	2.6	2.62
1987/88[10]	176	557	1,614,874	3,888,006	101,488	16	2.4	2.40
1988/89[11]	171	567	2,106,320	5,208,999	86,556	24	2.5	3.05
1989/90[11]	233	548	1,435,477	3,456,314	97,333	15	2.4	2.40
1990/91[11]	137	448	764,107	1,917,713	54,110	14	2.5	1.59
TOTAL	-	-	128,450,963	336,768,615	3,805,100	-	-	-
AVERAGE	165	877	5,838,680	13,470,745	165,439	34	2.5	-

[1] Data Source: Alaska Department of Fish and Game annual Board of Fish and Game Reports and annual Kodiak Area Management Report.
[2] Fishing year July 1 - June 30
[3] Legal season November 1 - June 30, Season terminated May 15 due to onset of mating period.
[4] Legal season November - April 30
[5] Legal season January 1 - April 30
[6] Legal season January 1 - May 15
[7] Legal season January 5 - May 15
[8] Legal season January 22 - May 15
[9] Legal season February 10 - May 15
[10] Legal season January 15 - May 15
[11] Legal season January 15 - March 31

Table 1. Dungeness crab commercial catch and effort by fishing year for the Kodiak Management District.

Year	Lndgs	Vssls	---Commercial Catch--- No. Crab	No. Pounds	Pots Lifted	Avg Lbs Per Lndg	CPUE	Avg Price Per Lb	Ex-Vessel Dollars
1962[1]	149	-	-	1,904,567	-	12,782	-	$ .09	171,000
1963	354	-	-	2,487,512	-	7,026	-	.09	224,000
1964	395	29	-	4,254,565	-	10,537	-	.09	375,000
1965	351	25	-	3,311,571	-	9,434	-	.12	397,000
1966	144	12	-	1,416,174	-	7,976	-	.13	149,000
1967	439	18	-	6,663,668	-	15,179	-	.13	866,000
1968	536	43	-	6,829,061	-	12,741	-	.14	956,000
1969	455	29	-	5,834,628	190,967	12,823	12	.16	934,000
1970	318	33	-	5,741,438	249,800	18,005	9	.14	804,000
1971	173	24	515,653	1,445,864	90,913	8,358	6	.18	260,000
1972	316	34	766,960	2,059,536	140,921	6,517	6	.40	824,000
1973	487	42	879,484	2,000,526	251,467	4,108	3	.50	1,000,000
1974	172	23	337,839	750,057	104,062	4,361	3	.47	353,000
1975	154	15	307,272	639,813	76,411	4,154	4	.61	390,000
1976	6	4	38,072	87,110	4,410	14,518	9	.15	13,000
1977[2]					Confidential				
1978	173	20	618,357	1,362,306	93,633	7,875	6	.75	1,022,000
1979	237	28	595,850	1,311,275	137,951	5,543	4	.75	943,000
1980	197	21	968,829	2,011,736	107,261	10,212	9	.45	905,000
1981/82[3]	466	50	2,614,545	5,566,463	295,138	11,945	9	.70	3,897,000
1982/83[4]	991	111	2,004,075	4,546,311	481,542	4,588	4	.75	3,410,000
1983/84[4]	1,079	103	2,044,505	4,752,148	503,464	4,408	4	1.05	4,989,000
1984/85[4]	1,163	106	2,393,974	5,303,052	627,441	4,564	4	1.45	7,689,000
1985[5]	1,243	125	1,791,446	4,160,435	599,291	3,347	3	1.20	4,992,522
1986	577	81	439,738	967,423	199,881	1,667	2	1.15	1,112,500
1987	379	45	747,117	1,450,983	150,067	3,828	5	1.26	1,828,000
1988	363	50	1,064,387	2,125,114	203,217	5,854	5	1.06	2,253,000
1989	359	47	1,428,973	3,077,937	185,242	8,574	8	1.10	3,385,730
1990	519	62	1,294,241	2,937,306	296,168	5,660	4	1.54	4,435,000
1991	732	62	695,470	1,414,499	279,872	1,932	2	1.37	1,938,000
Average	431	45	1,026,763	2,880,481	229,375	7,841	7	.61	1,688,689

[1] Season open year round 1962 - 1976
[2] Open May 1 through December 31, 1977 - 1980
[3] Open February 27, 1981 through February 1, 1982
[4] Open May 1, 1982 through February 1, 1983
[5] Open May 1, 1985 through December 31, 1985

Table 1. Historic commercial red king crab catch and effort for the Kodiak Registration Area 'K', 1960/61 through the current fishing season.

Fishing Year[1]	Vessels	Landings	No. of Crab	No. of Pounds	Pots Lifted	CPUE	----Average---- Wt. Per Crab	Price Per #
1960/61	143	-	2,116,375	21,064,[illegible]	-	-	-	$ .085
1961/62	148	-	3,181,554	28,962,900	-	-	-	.95
1962/63	195	-	4,146,143	37,626,703	-	-	-	.10
1963/64	181	-	4,158,988	37,716,223	-	-	-	.10
1964/65	189	-	4,923,309	41,596,518	95,951	51	-	.10
1965/66	175	-	11,061,709	94,431,026	173,083	64	-	.128
1966/67[2]	213	-	8,476,299	73,817,779	223,174	38	-	.11
1967/68	227	3,847	5,147,321	43,448,492	207,392	25	-	.26
1968/69	178	1,839	2,348,950	18,211,485	119,146	20	-	.26
1969/70[3]	136	978	1,606,181	12,200,571	96,841	17	-	.28
1970/71	100	830	1,561,318	11,719,970	119,192	13	-	.30
1971/72	89	507	1,539,157	10,884,152	66,166	23	-	.39
1972/73	88	683	2,029,670	15,479,916	70,806	29	-	.55
1973/74	129	837	1,847,679	14,397,287	77,826	24	-	.45
1974/75	158	1,195	2,910,201	23,582,[illegible]	110,297	26	-	.45
1975/76	169	1,569	2,976,909	24,061,651	113,795	26	8.1	.66
1976/77	195	1,165	2,177,956	17,966,846	130,777	17	8.2	1.37
1977/78	179	1,186	1,590,477	13,503,666	145,867	11	8.5	1.34
1978/79	194	1,077	1,464,021	12,021,850	177,261	8	8.2	1.60
1979/80	247	1,346	1,979,394	14,608,900	207,991	9	7.3	.95
1980/81	164	1,175	2,787,199	20,448,654	201,531	14	7.3	1.05
1981/82	246	2,214	3,035,674	24,237,601	388,751	8	8.0	2.00
1982/83	309	1,373	1,011,109	8,729,761	283,795	4	8.6	3.75
1983/84			NO FISHERY	- SEASON CLOSED				
1984/85			NO FISHERY	- SEASON CLOSED				
1985/86			NO FISHERY	- SEASON CLOSED				
1986/87			NO FISHERY	- SEASON CLOSED				
1987/88			NO FISHERY	- SEASON CLOSED				
1988/89			NO FISHERY	- SEASON CLOSED				
1989/90			NO FISHERY	- SEASON CLOSED				
1990/91			NO FISHERY	- SEASON CLOSED				
1991/92			NO FISHERY	- SEASON CLOSED				
AVERAGE[4]	174	1,359	2,963,898	24,834,120	143,813	21	-	-

[1] Fishing year defined as May 1 - April 30.

[2] July 1 - April 30 season established.

[3] August 15 - January 15 established.

[4] Average includes only years with open fishing season.

Table 1. Historic commercial shrimp catch and effort for the Kodiak District of Westward Statistical Area 'J', 1958 through 1991/92 seasons.

Calendar Year	Fishing Year	Vessels	Landings	Commercial Pounds	Harvest Price
1958		-	-	31,886	$.035
1959		-	-	2,861,900	.035
1960		11	94	3,197,985	.039
1961		12	203	11,083,500	.04
1962		11	204	12,654,027	.04
1963		-	-	10,118,472	.043
1964		6	-	4,339,114	.04
1965		11	320	13,823,061	.04
1966		17	551	24,097,141	.045
1967		23	-	38,267,856	.045
1968		16	-	34,468,713	.04
1969		26	935	41,353,461	.055
1970		18	1,024	62,181,204	.04
1971		49	1,746	82,153,724	.04
1972		63	1,398	58,352,319	.04
1973		50	1,283	70,511,477	.055
	1973/74	63	1,029	56,203,992	.08
	1974/75	75	1,100	58,235,982	.08
	1975/76	58	884	49,086,591	.08
	1976/77	62	762	46,712,083	.10
	1977/78	58	653	26,409,366	.13
	1978/79	50	328	20,506,021	.165
	1979/80	37	242	12,863,536	.225
	1980/81	67	462	27,101,218	.29
	1981/82	55	298	19,112,367	.27
	1982/83	40	224	10,391,207	.27
	1983/84	14	63	2,779,030	.35
	1984/85	13	59	2,942,922	.33
	1985/86	5	26	1,145,980	.20
	1986/87		Confidential		
	1987/88		Confidential		
	1988/89	0	0	0	.00
	1989/90	0	0	0	.00
	1990/91	0	0	0	.00
	1991/92	0	0	0	.00
Fishing Year Averages		33	556	25,917,820	$.12

Table 4. Pot shrimp catch statistics, Kodiak District of Statistical Area 'J', 1969 - 1991.

Year	Vessels	Landings	Pounds
1969		Confidential	
1970	-	20	12,302
1971*	-	-	-
1972		Confidential	
1973		Confidential	
1974	6	73	10,336
1975	7	77	12,782
1976		Confidential	
1977	3	26	2,565
1978		Confidential	
1979		Confidential	
1980	4	25	4,700
1981	4	6	2,511
1982	6	18	9,754
1983	12	31	18,686
1984	6	21	4,361
1985		Confidential	
1986		Confidential	
1987*	-	-	-
1988		Confidential	
1989		Confidential	
1990		Confidential	
1991*	-	-	-

**No commercial landings recorded for 1971, 1987 or 1991.*

Table 1. Historic catch, effort and value of Weathervane scallops, Alaska Westward Region.

Year	Vessels	Landings	Commercial Catch (#s)	Average Price Per Pound
1967		Confidential		
1968	8	89	872,803[1]	.85
1969	11	86	1,012,860	.85
1970	7	102	1,417,612	1.00
1971	5	48	841,211	1.05
1972	5	68	1,038,793	1.15
1973	4	42	935,705	1.20
1974	3	14	147,945	1.30
1975	4	30	296,650	1.40
1976		Confidential		
1977	-	-	0	-
1978	-	-	0	-
1979		Confidential		
1980	7	33	371,018[2]	3.60
1981	15	61	441,401	4.00
1982	8	82	641,336	3.25
1983	4	29	191,510	5.00
1984	7	37	309,502	4.00
1985	3	26	608,955	4.00
1986	6	58	587,242	4.25
1987	4	43	583,686	3.70
1988	4	37	302,738	4.00
1989	6	48	464,421	4.06
1990	8	86	898,277	3.53
1991	7	75	683,261	3.91

[1] 718,671 pounds shucked - 154,132 pounds unshucked

[2] 353,433 pounds shucked - 17,575 pounds unshucked

Table 1. Historic harvest of sea urchins in the Kodiak area.

Year	Permittee	Landings	Pounds Harvested (Live Weight)	Per/lb.
1980		Confidential		
1985		Confidential		
1986		Confidential		
1987	12	78	104,139	.69
1988	28	260	190,509	.80
1989	29	81	44,862	.82
1990	25	83	84,004	.84
1991	6	24	30,472*	.92

**Preliminary total.*

OCTOPUS

The giant Pacific octopus (*Octopus dofleini*) exists throughout Alaskan waters and is quite numerous in the Kodiak District. Most recorded catches have been incidental to other commercial fishing activities such as crabbing and bottomfishing. The harvest increased through the years to a peak of over 19,000 pounds in 1980 (Table 1). Reduced catches after 1980 were the result of shortened Tanner crab seasons.

Interest in the fishery has been increasing due to the demand by longline fishermen for bait octopus. The octopus fishery experienced a dramatic increase in 1990. Caught incidentally to cod fish in the rapidly expanding pot cod fishery, the harvest increased to record levels. The 1990 catch was 69,607 pounds worth approximately $80,000. The harvest for 1991 continued to increase and was 129,355 pounds worth $138,410.

Stock Status

Although the octopus is numerous, no estimate of abundance is available. The Department currently has no directed study concerning octopus.

Table 1. Commercial catch, effort, and value for octopus in the Kodiak Management Area, 1977 - 1991.

Year	Number of Vessels	Number of Landings	Commercial Catch (Pounds)	Avg. Price Per Pound	Est. Value Ex-Vessel (dollar)
1977	5	9	1,000	.71	1,136
1978	11	21	3,336	.75	2,502
1979	20	43	6,978	.74	5,164
1980	27	61	19,342	.75	14,506
1981	21	46	5,872	.70	4,110
1982	12	29	3,854	.70	2,697
1983	12	20	3,764	.70	2,634
1984	17	43	6,487	.70	4,341
1985	10	12	4,812	.78	3,753
1986	5	8	643	.70	450
1987	8	15	14,151	1.08	15,300
1988	4	4	1,949	1.08	2,105
1989			Confidential		
1990	31	131	69,607	1.08	80,000
1991	70	342	129,355	1.07	138,410

Table 1. Historic commercial razor clam catch effort and value for Kodiak Management Area, 1960 - 1991.

Year	Registered Diggers[1]	Lndgs.	Commercial Catch (Pounds)	Avg. Catch Per Lndg. (Pounds)	Average Price Per #	Est. Pric Ex-Vesse (Dollars
1960	76		420,636		$ .105	44,000
1961	95		381,971		.105	40,000
1962	66		297,516		.105	31,000
1963	39		323,757		.11	35,600
1964	2		0		.00	-
1965	4		20,000		.25	5,000
1966	29		15,429		.38	6,000
1967	9		2,155		.40	900
1968	19		6,384		.40	2,600
1969	5	6	12,029	2,005	.40	4,812
1970	6	32	132,261	4,133	.40	53,000
1971	73	82	190,394	2,322	.30	57,000
1972	95	128	152,116	1,188	.35	53,000
1973	64	140	165,282	1,181	.40	66,000
1974	58	74	198,381	2,681	.50	99,000
1975	18	5	6,188	1,238	.50	3,000
1976	9	0	0	0	.00	-
1977			Confidential			
1978			Confidential			
1979	-	0	0	0	.00	-
1980	-	8	8,006	1,001	.79	6,325
1981	-	5	8,186[2]	1,637	1.00	8,186
1982	-	11	11,608[3]	1,055	1.00	11,608
1983	-	7	7,920	1,131	1.00	7,920
1984	-	21	33,972	1,613	1.00	33,972
1985	-	11	16,945[4]	1,540	1.00	16,945
1986	-	4	3,993	998	1.00	3,993
1987	-	-	-	-	-	-
1988	-	-	-	-	-	-
1989	-	-	-	-	-	-
1990	-	-	-	-	-	-
1991	-	-	-	-	-	-

[1] Represents registered diggers not actual diggers - no data available after 1977 due to statewide issuance of Interim Use Permits.

[2] Additional 985 pounds of hardshell clams harvested.

[3] Additional 1,506 pounds of hardshell clams harvested.

[4] Additional 1,496 pounds of hardshell clams harvested.

APPENDIX 2

Table 1. Catch and effort statistics for king crab in Area 'M', the Alaska Peninsula.

Year	No. Vssls	No. Lndgs	No. Crab	No. Pounds	Pots Lifted	CPUE	Avg. Wt.	Price Per Lb.
1947	NA	NA	18,800	141,000	NA	NA	7.5	NA
1948	NA	NA	518,500	3,363,000	NA	NA	6.5	NA
1949	NA	NA	205,500	3,476,000	NA	NA	12.0	NA
1950	NA	NA	270,000	2,124,000	NA	NA	7.9	NA
1951	NA	NA	86.500	599,000	NA	NA	6.9	NA
1952	NA	NA	32,400	298,000	NA	NA	7.6	NA
1953	NA	NA	38,400	380,000	NA	NA	10.0	NA
1954	NA	NA	31,666	316,660	NA	NA	10.0	NA
1955	NA	NA	164,069	1,640,688	NA	NA	10.0	NA
1956	NA	NA	421,651	4,221,496	NA	NA	10.0	NA
1957	NA	NA	668,709	6,687,092	NA	NA	10.0	NA
1958	NA	NA	724,595	7,245,947	NA	NA	10.0	NA
1959	NA	NA	568,303	6,166,974	NA	NA	10.9	NA
1960	NA	1,496	677,100	6,700,000	NA	NA	9.9	NA
1961	NA	959	419,354	3,900,000	NA	NA	9.3	NA
1962	NA	657	287,624	2,273,013	NA	NA	7.9	NA
1963	27	1,037	970,739	6,539,129	NA	NA	6.7	.09
1964	40	1,297	1,906,018	14,354,060	NA	NA	7.5	.10
1965	36	1,081	1,813,728	14,713,501	NA	NA	8.1	.10
1966	37	1,255	2,494,949	22,577,587	NA	NA	9.0	.10
1967	39	1,062	1,943,463	17,252,307	NA	NA	8.9	.19
1968/69	34	885	1,273,567	10,944,472	NA	NA	8.6	.34
1969/70	33	415	558,800	4,137,000	51,300	11	7.7	.25
1970/71	25	339	446,042	3,425,760	38,995	11	7.7	.25
1971/72	26	364	597,394	4,123,130	41,759	14	6.9	.28
1972/73	29	301	610,300	4,069,362	34,408	18	6.7	.NA
1973/74	36	389	658,632	4,260,674	53,642	12	6.9	.72
1974/75	36	318	644,054	4,572,101	44,951	14	7.1	.43
1975/76	37	248	367,221	2,605,310	35,104	11	7.2	.41
1976/77	26	122	125,778	958,069*	17,748	7	7.7	.61
1977/78	15	73	119,641	726,382	10,551	11	6.1	1.00
1978/79	33	226	520,168	3,093,859	31,142	17	5.9	1.27
1979/80	68	288	738,859	4,453,557	41,753	18	6.0	.92
1980/81	51	358	821,071	5,080,632*	54,114	15	6.2	.96
1981/82	56	341	515,882	3,168,689	51,776	10	6.1	1.40
1982/83	63	157	271,237	1,683,654	30,894	9	6.2	3.20
1983/84			N O	F I S H E R Y				
1984/85			N O	F I S H E R Y				
1985/86			N O	F I S H E R Y				
1986/87			N O	F I S H E R Y				
1987/88			N O	F I S H E R Y				
1988/89			N O	F I S H E R Y				
1989/90			N O	F I S H E R Y				
1990/91			N O	F I S H E R Y				
1991/92			N O	F I S H E R Y				

*Combined 6 1/2 inch and 7 1/2 inch seasons
NA = Not Available

Table 1. Chignik District Tanner crab catch and effort statistics.

Year	Vssls	Number Lndgs	No. Crab[1]	No. Pounds[1]	Pots Lifted	Avg. Wt.	CPUE	Price Pound[2]	Percent Recruits[3]
1968	-	-	-	21,100	-	.-	-	.-	.-
1969	-	-	-	38,100	-	.-	-	.-	.-
1970	-	-	-	2,800	-	.-	-	.-	.-
1971	-	-	-	152,300	-	.-	-	.-	.-
1972				Harvest Confidential					
1973	15	56	297,363	747,788	8,080	2.5	51	.16	.-
1974	25	115	1,586,560	4,054,873	28,083	2.6	57	.20	.-
1974/75	25	91	1,438,508	3,649,444	22,675	2.5	63	.14	.-
1975/76	35	288	2,724,509	6,926,161	52,381	2.5	52	.185	.-
1976/77	21	141	2,098,226	5,672,919	40,604	2.7	52	.33	.-
1977/78	32	140	1,725,042	4,693,830	38,414	2.8	45	.42	.-
1978/79	39	126	926,253	2,536,105	28,378	2.7	33	.55	.-
1979/80	42	155	2,340,004	3,517,920	54,627	2.6	25	.54	.-
1980/81	24	112	1,534,847	3,653,723	44,022	2.4	35	.64	65.6
1981/82	45	174	1,343,500	3,240,576	47,830	2.4	28	1.21	64.7
1983	48	136	1,432,029	3,497,370	60,210	2.4	24	1.12	65.1
1984	17	41	269,724	659,043	14,665	2.4	18	1.09	33.5
1985	15	27	162,448	375,476	15,708	2.3	10	1.42	51.2
1986	6	12	85,697	188,162	7,435	2.2	12	1.97	85.3
1987	10	20	89,329	195,060	7,052	2.2	13	2.28	90.1
1988	6	11	87,148	183,111	6,544	2.1	13	2.33	91.3
1989	6	34	142,470	323,120	9,845	2.3	15	3.05	95.0
1990				NO OPEN SEASON					
1991				NO OPEN SEASON					

[1] *Includes deadloss*
[2] *Computed only for live poundage where price information was available*
[3] *Recruits = newshell male crab from 137 to 163 mm carapace width*

Table 1. Historic shrimp harvest statistics.

Year	South Peninsula Vssls.	South Peninsula Lndgs.	South Peninsula No. Pounds	South Peninsula Price/Lb.	Chignik Vssls.	Chignik Lndgs.	Chignik No. Pounds	Chignik Price/Lb.
1968		Harvest Confidential					1,153,721	$ -
1969		Harvest Confidential					419,830	-
1970	4	173	4,398,800	.04	-	-	890,705	-
1971		Harvest Confidential				27	1,091,711	.04
1972/73	-	-	14,740,801	.07	-	-	4,829,117	-
1973/74	12	347	19,987,246	.07	33	277	51,673,788	.08
1974/75	22	387	26,145,720	.08	37	323	23,392,352	.08
1975/76	24	326	20,044,112	.09	50	334	24,435,480	.08
1976/77	19	424	37,148,932	.09	48	303	27,232,630	.10
1977/78	48	409	45,003,794	.13	50	271	26,512,791	.13
1978/79	23	108	9,418,276	.16	40	201	23,257,869	.17
1979/80	10	41	3,134,367	.21	35	195	23,722,330	.23
1980/81	-	-	CLOSED	-	54	148	12,843,270	.29
1981/82	-	-	CLOSED	-	3	4	70,948	.27
1982/83	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1983/84	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1984/85	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1985/86	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1986/87	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1987/88	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1988/89	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1989/90	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1990/91	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-
1991/92	-	-	NO DELIVERIES	-	-	-	NO DELIVERIES	-

Table 1. Tanner crab catch and effort statistics for South Peninsula District.

Year	Number Vssls.	Number Lndgs.	No. Crab[1]	No. Pounds[1]	Pots Lifted	Avg. Wt.	CPUE	Price Pound[2]	Percent Recruits
1967				3,100					
1968		155	36,835	110,610		3.0			
1969		173	221,946	606,178		2.7			
1970				2,093,600					
1971	17	242	813,610	2,140,585		2.6		.10	
1972				3,618,900					
1973	36	390	2,213,006	5,615,563	53,573	2.5	41		
1974	44	386	3,504,668	8,300,578	58,444	2.4	60		
1974/75	44	131	2,053,530	5,195,800	38,153	2.5	54	.14	
1975/76	36	288	2,724,509	6,926,161	52,381	2.5	52	.20	
1976/77	28	389	2,524,565	6,773,838	63,143	2.7	40	.32	
1977/78	36	374	2,847,948	7,446,270	70,587	2.6	40	.40	
1978/79	48	332	3,267,122	8,684,408	82,374	2.7	40	.51	65.8
1979/80	61	363	2,581,544	6,961,251	96,989	2.7	27	.54	39.5
1980/81	43	268	1,274,539	3,294,106	59,560	2.6	21	.58	34.7
1981/82	72	365	1,815,060	4,589,042	81,008	2.5	22	1.05	50.2
1983	82	230	1,144,096	2,863,798	70,524	2.5	16	1.20	55.4
1984	61	207	775,472	1,789,883	50,726	2.3	15	1.04	29.6
1985	52	184	1,097,182	2,549,686	47,465	2.3	23	1.42	73.0
1986	74	187	1,589,759	3,781,950	65,078	2.4	24	1.72	72.9
1987	54	106	950,300	2,400,784	37,511	2.5	25	2.03	56.1
1988	73	148	1,359,371	3,328,809	52,516	2.5	26	2.20	78.6
1989	65[3]	87	433,112	1,055,082	27,958	2.4	16	2.70	52.9
1990				NO OPEN SEASON					
1991				NO OPEN SEASON					

[1] *Includes deadloss*
[2] *Computed for live crab only*
[3] *One additional vessel was registered but did not fish in the District*

Table 1. Dungeness crab harvest statistics, Alaska Peninsula District.

Year	Vssls	Lndgs	No. of Crab[1]	No. of Pounds[1]	Pots Lifted	CPUE	Avg. Wt.	Price Per #
1968	NA	NA	434,142	1,259,013	NA	NA	2.9	NA
1969	NA	NA	411,000	1,056,000	NA	NA	NA	NA
1970	NA	NA	4,200	13,000	NA	NA	NA	NA
1971	NA	NA	3,900	11,000	NA	NA	NA	NA
1972	NA	NA	29,400	65,000	NA	NA	NA	NA
1973			Confidential					
1974			NO EFFORT					
1975			NO EFFORT					
1976			NO EFFORT					
1977			NO EFFORT					
1978			NO EFFORT					
1979			Confidential					
1980			NO EFFORT					
1981/82			Confidential					
1982/83	16	79	357,955	779,600	59,265	6	2.2	$ .75
1983/84	18	132	565,430	1,207,128	113,061	5	2.1	$ .97
1984/85	13	99	294,191	647,497	106,056	3	2.1	$ 1.38
1985/86	7	31	239,202	488,107	52,117	5	2.0	$ 1.26
1986/87	6	28	87,925	180,261	30,280	3	2.0	$ 1.05
1987/88	6	21	88,744	182,706	22,588	4	2.1	$ 1.11
1988			Confidential					
1989			Confidential					
1990	4	10	31,074	65,806	5,225	6	2.1	$ 1.53
1991	7	18	39,069	80,248	12,813	3	2.1	$ 1.24

NA = Not Available

[1] Includes deadloss

Table 1. Historic deliveries of octopus in the Alaska Peninsula District.

Year	Vssls.	Lndgs.	Pounds	Avg. Price
1980		Harvest Confidential		
1981		Harvest Confidential		
1982		Harvest Confidential		
1983		Harvest Confidential		
1984		NO FISHING		
1985		Harvest Confidential		
1986		NO FISHING		
1987		NO FISHING		
1988	30	185	43,332	$ .92
1989	27	122	14,890	$1.00
1990	20	83	11,504	$1.00
1991	30	106	21,812	$1.00

APPENDIX 3

DRAFT

BERING SEA/ALEUTIAN ISLANDS SHELLFISH FISHERIES AND GEAR UTILIZATION

PRESENTED TO THE ALASKA BOARD OF FISHERIES

DRAFT

BY

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BERING SEA/DUTCH HARBOR/ADAK

MARCH 1992

BRISTOL BAY, AREA 'T'

Description

The Bristol Bay king crab Statistical Registration Area 'T' includes all waters north of Cape Sarichef, east of 168° West longitude and south of the latitude of Cape Newenham and includes all waters of Bristol Bay.

Red King Crab

Japanese fishermen took king crab from the Bering Sea in the early 1930's and continued until 1940. Returning in 1953, they continued to fish until 1971. U.S. fishermen began taking king crab with trawl in 1947 with varying results for the next twenty years. It was not until the mid-seventies did the full scale fishery begin as we know it today. As stocks began to decline in other areas of the State, fishing effort continued to rise in the Bering Sea and a record 129.9 million pounds of king crab was landed in 1980.

In 1980, the Board of Fisheries made the Southeastern District, the area north of the Alaska Peninsula and the major king crab grounds, an exclusive registration area. The new area is called the Bristol Bay, Area 'T'. If a vessel fishes this area, it can not fish any of the other exclusive registration areas in the State.

As the area's king crab population increased in the late seventies, so did vessel and pot effort, rising to a record vessel effort in 1980 of 236 vessels, (Table 2). Although the 1981 National Marine Fisheries Service (NMFS) summer survey indicated a sharp decline in the stocks for the 1981 season, members of industry and staff felt that the survey had either missed the crab or computations were off. During this period a five day "bait up" was still allowed and vessels returning to port for registrations and tank inspections indicated a large population of crab.

Once the season opened and all gear and effort reached the fishing grounds, it became apparent early in the fishery that something dramatic had happened between the end of the 1980 fishery and the 1981 summer survey. Although the 1981 fishery had a 25 percent decrease in vessel effort there was only a 3 percent decrease in registered pots, (Table 2). Dock side sampling indicated a high percentage of post recruit crab and after a 40 day season, managers decided to close the 6.5 inch season and hold a 7 inch season to remove these older crab. This second season lasted 51 days and yielded only 1.5 million pounds for a total 1981 harvest of 33.5 million pounds, including 0.6 million pounds of deadloss, (Table 2).

During the early eighties, as the king crab stocks collapsed throughout the state, the groundfish fisheries were just beginning for domestic fishing vessels and many "crab" vessels made conversions and left the crab fisheries.

The Bristol Bay area was closed in 1983 due to the lowest population ever recorded but has started a slow recovery, the only area in the Westward region to be re-opened after being closed. Since the re-opening, vessel and pot effort has increased, primarily from the introduction of smaller vessels from the Alaska Peninsula, Kodiak and other areas of the state that have remained closed and the introduction of the new "large" class vessel, the mud-boat. During this time, additional catcher processors, vessels capable of fishing and processing their catch at sea, have entered the fishery. The number of catcher processors in the Bristol Bay fishery has risen from eight in 1982 to 25 in the 1991 fishery. In addition, floater processors that, prior to the late seventies processed the catch in local harbors, have moved to remote processing locations nearer the fishing grounds.

In 1987 vessel effort reached the 1980 effort of 236, but due to small quotas and short fisheries, the number of pots used in the fishery was 15,000 less than the 1980 season, (Table 2). Vessel effort has continued to increase and in 1991, a record 302 vessels registered over 89,000 pots.

In 1988, with information provided to the Board by the staff, an observer program for all processors was initiated in all king and *C. bairdi* crab fisheries. With large pot and vessel effort in this fishery, managers were no longer able to wait for shore side or floater processor deliveries to gather inseason data. To avoid an over harvest of the depressed stocks, decisions for closures had to be made, sometimes within three to four days of the opening. Now, with the introduction of the observer program and daily reporting requirements, managers have access to inseason catch information, but as harvest guidelines increased, so did effort levels and decisions based on only a few days' information are still being made so as not to over harvest the depressed stocks.

During the 1991 fishery, the catching ability of the fleet was estimated at over two million pounds per day. Actual harvest indicates that the daily harvest rate was in excess of 2.4 million pounds per day. The 1991 season also saw the re-introduction of crab vessels that had previously been in the groundfish fisheries. With the prospect of crab limited entry and the groundfish fisheries in the Bering Sea/Aleutian Islands closed for longer periods of time, these vessels felt they needed to show landings from the fishery to ensure themselves permits.

In addition to 25 fathom pot storage, a designated pot storage area is provided in the Bristol Bay area, allowing gear to be "staged" prior to the fishery. Prior to the 1990 fishery, gear was allowed to be stored on the fishing grounds for seven days after the closure with doors open and bait containers removed. In 1990, the season opening was changed to November. Because the *C. bairdi* Tanner crab fishery would follow seven days after the king crab closure, gear is allowed to be stored either as a king crab or Tanner crab pot for ten days. Unless delivering east of King Cove, all vessels have 24 hours to be at their delivery destinations.

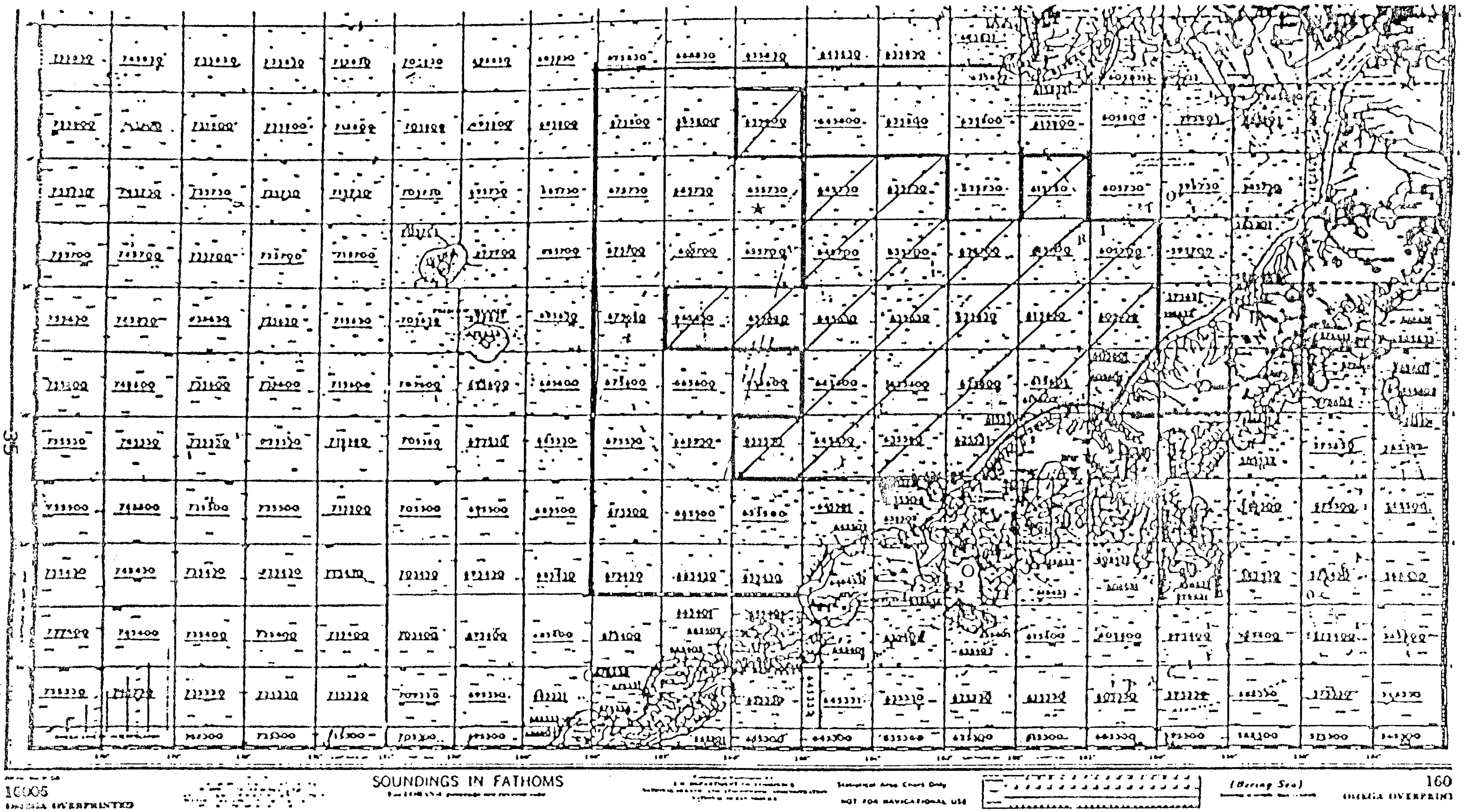

Figure 1. 1991 red king crab catch distribution in the Bristol Bay, Area "T".

BERING SEA, AREA 'Q'

Description

The Bering Sea king crab area, Statistical Area 'Q', includes all waters west of 168° West longitude to the U.S. Russian Convention Line of 1867 and north to the latitude of Cape Newenham at 58° 39' North latitude including the waters of the Chukchi Sea. This registration area is separated into the Pribilof and Northern Districts. The Northern District is further separated in two sections; the Norton Sound Section which includes all waters east of 168° West longitude and north of the latitude of Cape Romanzof, and the General Section which includes all waters not described in the Norton Sound Section.

Pribilofs

The first reported blue king crab catches were from the Pribilof Islands area in 1973. Eight vessels harvested 1.2 million pounds between the months of July and October.

Record catches were obtained during the 1980/81 season, when 110 vessels landed over 10.7 million pounds in a thirty day period (Table 2, Figure 1). The Area's opening is concurrent with the Bristol Bay red king crab opening, and after its closure, vessels re-register for and fish blue king crab.

During the 1980/81 and 1981/82 seasons, the harvest from the Pribilof District exceeded any of the previous season's harvest guidelines, primarily due to large amounts of gear and vessel effort, (Table 1).

National Marine Fisheries Service (NMFS) conducts annual surveys on these stocks and predicted a sharp decline in 1982. Although pot and vessel effort remained high until the 1984/85 season, catches decreased by as much as 50% and by the 1984/85 season, 16 vessels landed only 300,000 pounds.

Vessel and pot effort have greatly fluctuated from the 1984/85 season. Although season lengths increased dramatically during this time, catches were so poor that either the lower harvest guideline or mid-points were reached before the closures (Table 2).

In 1988 the NMFS survey indicated a sharp decline in legal males, and the season was closed by emergency order. Both the 1990 and 1991 survey information indicated a potentially fishable population of blue king crab, but the error associated with the population estimate was considerable. Because this fishery's opening was still in late September, after the St. Matthew fishery, Department staff felt that large pot and vessel effort would enter the area. This would create a similar situation in the St. Matthew fishery, where the season would last no more than a few days and being remote would not allow for adequate inseason management. After much discussion with NMFS and Department staff, the decision was made not to open the fishery.

St. Matthew

Before 1981, the St. Matthew area was fished prior to or after the Norton Sound red king crab fishery. Vessels and processors changed areas easily, and little time was lost between fisheries that were open concurrently. As the stocks in the Norton Sound area declined, more vessels and pots fished in the St. Matthew blue king crab fishery. Being extremely remote, this fishery has primarily been limited to larger vessels with one deck load of gear. Just as the blue king crab population began to decrease during the mid-eighties, vessel size began to increase as more "mud" boats entered the fishery as catcher processors. With the larger vessels the number of pots being registered also increased.

As in the Pribilof Area, error in the St. Matthew population estimate was also high causing the Department to manage the fishery conservatively. As the first king crab fishery of the new fishing year, much interest is expressed by the fleet. As the population estimates decreased, so did actual fishing time from as much as 38 days in 1981 to only 3 days in 1989 (Table 2).

During the 1990 fishery, managers expressed concern over the ability of adequately managing the fishery from long distances. Although all processing vessels carried observers and the observers reported daily, distance and atmospheric conditions limited inseason catch monitoring abilities. With a similar harvest guideline to the 1989 fishery, effort levels were expected to be equal to or greater than the 1989 fishery. Based on this information the Department had two choices; not to conduct the fishery or announce the closure of the fishery after vessel and pot effort were determined at time of registration. Both registrations and tank inspections are conducted on the fishing grounds. The latter choice was initiated, and based on the effort level, less than half that of 1989, a six day season occurred (Table 2). Effort level was kept low by industry, primarily due to their expectations of a small quota and large effort. Many operators expressed concerns about opening the fishery at all while others complained that had they known the fishery would last six days, they would have certainly entered the fishery.

The 1991 NMFS survey indicated a 41% increase in the harvestable population. Again, much doubt over the accuracy of the survey was expressed by Department biologists. The staff knew that when the large harvest guideline was announced, large effort could be expected. After evaluating the data and a postponement of the season for two weeks, the 3.2 million pound harvest guideline was announced. Industry was notified that they could expect a season similar to the previous year. Department biologists estimated the total number of pot pulls necessary to achieve the desired harvest of 3.2 million pounds and, based on effort levels and the average number of pots each vessel could pull per hour, the season length was projected for four days, and the closure was announced on the day the season opened.

For the first time since the fishery started, no Department personnel were on the grounds to monitor the fishery. Due to budget restraints and lack of field personnel, registrations and tank inspections were conducted in Dutch Harbor and St. Paul. Akutan was also designated, but due to weather, staff was unable to get to the location. Vessels there came either to Dutch Harbor or St. Paul and with tank inspections occurring 72 hours prior to the opening, did not miss being on the grounds when the season opened.

Due to its remoteness, the St. Matthew fishery is primarily a "deck load" fishery by the larger sized vessels that averaged 193 pots per vessel for the 1990 and

1991 seasons (Table 2). This year several vessels did store gear in the northern pot storage area, hoping to be able to set gear, run to the pot storage area sixty miles from the fishing grounds, and make it back in time to fish the additional gear before the closure. Under current regulations, there is no pot storage provision on the fishing grounds before or after the season. Vessels must deliver their crab within 24 hours on the fishing grounds or St. Paul and within 60 hours to Dutch Harbor. Running distance to St. Matthew from St. Paul is approximately 190 miles and Dutch Harbor 430 miles.

Table 1. Historic blue king crab catch Bering Sea, Area 'Q', Pribilof District.

Year	Vssls	Lndgs	Crab[1]	Pounds[1]	Pots Lifted	CPUE	Avg. Wt.	Average Length	Pounds Deadloss
1973/74	8	13	174,420	1,276,533	6,814	26	7.3	N/A	0
1974/75	70	101	908,072	7,107,294	45,518	20	7.8	157.8	0
1975/76	20	54	314,931	2,433,714	16,297	19	7.7	159.1	0
1976/77	47	113	855,505	6,611,084	71,738	12	7.7	158.1	0
1977/78	34	104	807,092	6,456,738	106,983	8	7.9	158.9	159,269
1978/79	58	154	797,364	6,395,512	101,117	8	8.1	159.3	63,140
1979/80	46	115	815,557	5,995,231	83,527	9	7.7	155.9	284,555
1980/81	110	258	1,497,101	10,970,346	167,684	9	7.3	155.7	287,285
1981/82	99	312	1,202,499	9,080,729	176,168	7	7.6	158.2	250,699
1982/83	122	281	587,908	4,405,353	127,728	5	7.5	159.8	51,703
1983/84	126	221	276,364	2,193,395	86,428	3	7.9	159.9	4,562
1984/85	16	25	40,427	306,699	15,147	3	7.6	155.45	0
1985/86	26	49	77,607	532,735	23,483	3	6.9	146.52	7,500
1986/87	16	25	36,988	258,939	15,800	2	7.0	N/A	5,450
1987/88	38	68	95,131	701,337	40,507	2	7.4	152.72	9,910
1988/89				SEASON	CLOSED				
1989/90				SEASON	CLOSED				
1990/91				SEASON	CLOSED				
1991/92[2]				SEASON	CLOSED				

[1]Deadloss included.

[2]10,869 pounds illegal red crab.

Table 2. Historic Bering Sea, Pribilof District blue king crab economic performance.

Year	GHL[1]	Season Total[1]	No. Pots Registered	No. of Vssls	No. of Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[2]	Season Length Days/Dates
1980/81	5-8	10.7	31,636	110	258	167,681	$ .90	$ 9.6	60-9/15-11/15
1981/82	5-8	9.1	25,408	99	312	176,168	$ 1.50	$13.6	47-9/10-10/28
1982/83	5-8	4.4	34,429	122	281	127,728	$ 3.05	$13.4	15- 9/10-9/25
1983/84	4.0[3]	2.2	36,439	126	221	86,428	$ 3.00	$ 6.6	10 - 9/1-9/11
1984/85	.5-1.0	0.3	3,122	16	25	15,147	$ 2.50	$ 0.1	15 - 9/1-9/16
1985/86	.3-0.8	0.5	6,038	26	49	23,483	$ 2.90	$ 1.4	26-9/25-10/21
1986/87	.3-0.8	0.3	4,376	16	25	15,800	$ 4.05	$ 1.2	55-9/25-11/20
1987/88	.3-1.7	0.7	9,594	38	68	40,507	$ 4.00	$ 2.8	86-9/25-12/20
1988/89			NO COMMERCIAL FISHERY						
1989/90			NO COMMERCIAL FISHERY						
1990/91			NO COMMERCIAL FISHERY						

[1]Millions of pounds.

[2]Millions of dollars.

[3]Set not to exceed 4,000,000 pounds.

Table 3. Historic blue king crab catch in the Northern District of statistical Area 'Q' (St. Matthew and St. Lawrence Islands).

Year	Vssls	Lndgs	Crab[1]	Pounds[1]	Pots Lifted	CPUE	Percent Oldshell	Avg. Wt.	Avg. Length	Pounds Deadloss
1977	10	24	281,665	1,202,066	17,370	16	7.0	4.3	130.4	129,148
1978	22	70	436,126	1,984,251	43,754	9	N/A	4.5	132.2	116,037
1979	18	25	52,966	210,819	9,877	5	80.8	4.0	128.8	56,147
1980					Confidential		N/A	4.7	N/A	
1981	31	119	1,045,619	4,627,761	58,550	18	N/A	4.4	N/A	53,355
1982	96	269	1,935,886	8,844,789	165,618	12	19.6	4.6	135.1	142,073
1983[2]	164	235	1,931,990	9,454,323	133,944	14	26.7	4.8	137.2	828,994
1983[3]	13	13	11,264	52,557	3,975	3	-	4.7	-	3,500
1984[2]	90	169	841,017	3,764,592	73,320	11	34	4.5	135.48	31,983
1984[3]			No	Reported	Landings					
1985[2]	79	103	484,836	2,427,110	51,606	9	9	5.0	138.98	2,613
1985[3]			No	Reported	Landings					
1986[2]	38	43	219,548	1,003,162	22,093	10	10	4.6	134.33	32,560
1986[3]			No	Reported	Landings					

continued...

Table 3. Historic blue king crab catch in the Northern District of statistical Area 'Q' (St. Matthew and St. Lawrence Islands), continued.

Year	Vssls	Lndgs	Crab[1]	Pounds[1]	Pots Lifted	CPUE	Percent Oldshell	Avg. Wt.	Avg. Length	Pounds Deadloss
1987[2]	61	62	234,521	1,075,179	28,440	8	5	4.6	134.13	400
1987[3]			No Reported Landings							
1988[2]	46	46	302,053	1,325,185	10,160	13	65	4.4	133.29	22,358
1988[3]			No Reported Landings							
1989[2]	69	69	247,641	1,166,258	30,853	8	9	4.7	134.55	3,754
1989[3]	5	9	1,652	4,518	2,402	-	-	-	-	0
1990[2]	31	38	391,405	1,725,349	26,264	15	4	4.4	134.28	17,416
1990[3]			No Reported Landings							
1991[2]	68	69	726,519	3,372,066	37,104	20	12	4.6	134.1	216,459
1991[3]			No Reported Landings							

[1]Deadloss included.

[2]St. Matthew.

[3]St. Lawrence - red and blue.

Table 4. Historic Bering Sea, Northern District (St. Matthew) blue king crab economic performance.

Year	GHL[1]	Season Total[1]	No. Pots Registered	No. Vssls	No. Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[2]	Season Length Days/Dates
1981	1.5-3.0	4.6	2,960	31	119	58,550	$ .90	$ 4.1	38-7/15-8/21
1982	5.6	8.7	21,894	96	269	165,618	$ 2.00	$17.4	15-8/01-8/16
1983	8.0	8.6	38,000	164	235	133,944	$ 3.00	$25.8	17-8/20-9/06
1984	2-4	3.7	14,800	90	169	73,320	$ 1.75	$ 6.5	7-9/01-9/08
1985	0.9-1.9	2.4	13,000	79	103	51,606	$ 1.60	$ 3.8	5-9/01-9/06
1986	0.2-0.5	1.0	5,600	38	43	22,093	$ 3.20	$ 3.2	5-9/01-9/06
1987	0.6-1.3	1.1	9,370	61	62	28,440	$ 2.85	$ 3.1	4-9/01-9/05
1988	0.7-1.5	1.3	7,780	46	46	10,160	$ 3.10	$ 4.0	4-9/01-9/05
1989	1.7	1.2	11,983	69	69	30,853	$ 2.90	$ 3.5	3-9/01-9/04
1990	1.9	1.7	6,000	31	38	26,264	$ 3.35	$ 5.7	6-9/01-9/07
1991	3.2	3.2	13,100	68	69	37,104	$ 2.80	$ 9.0	4-9/16-9/20

[1]Millions of pounds.

[2]Millions of dollars.

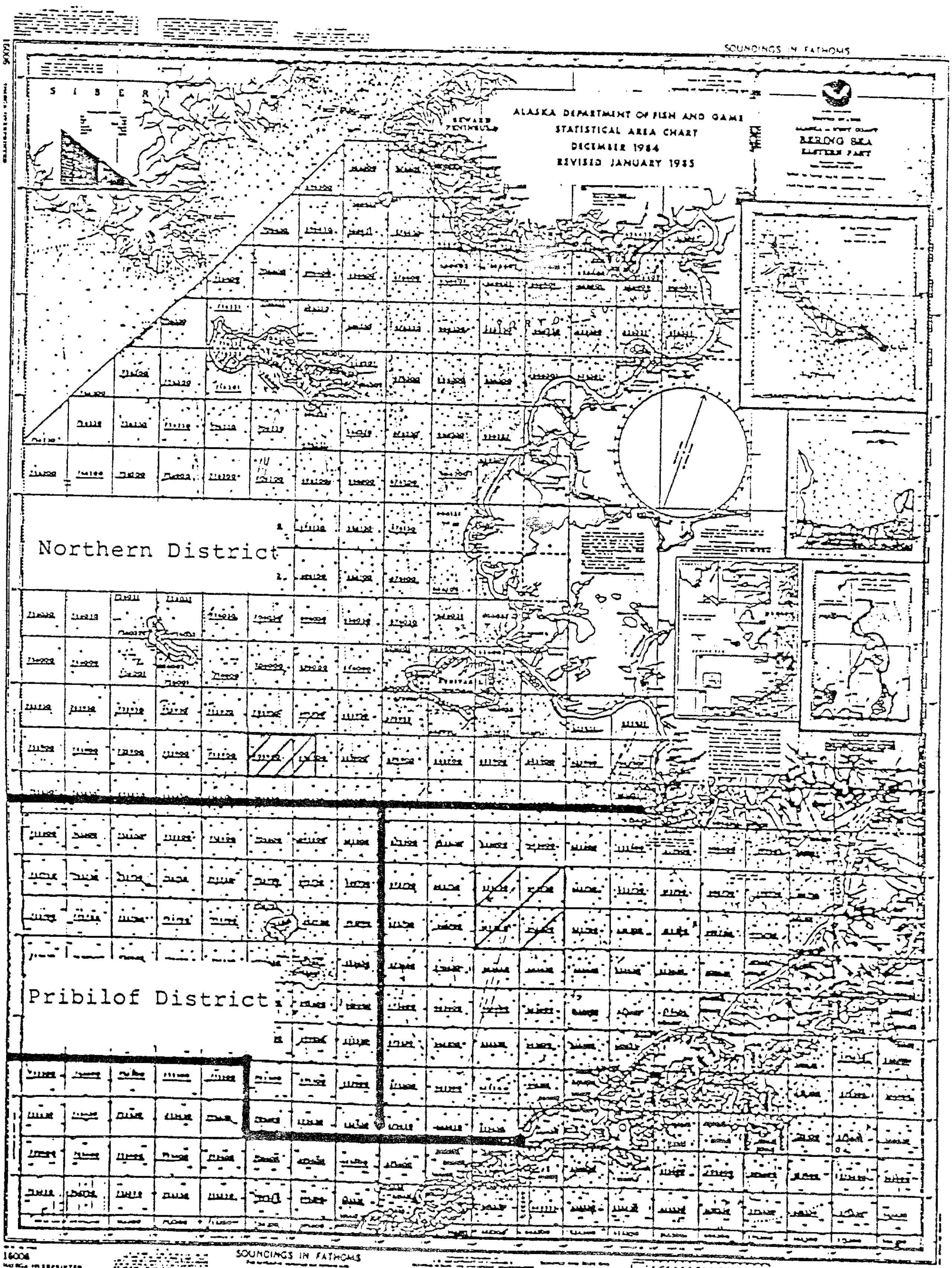

Figure 1. Bering Sea king crab registration Area "Q".

BERING SEA DISTRICT TANNER CRAB

Description

The Bering Sea District of Statistical Area 'J' includes all waters of the Bering Sea north of the latitude of Cape Sarichef and east of the U.S. Russian Convention line of 1867. This district has two Subdistricts; the Western and Eastern which includes the Norton Sound Section and the General Section, (Figure 1). Two Tanner crab species, *Chionoecetes bairdi* and *Chionoecetes opilio*, are commercially harvested in the Bering Sea District.

C. bairdi

The first American Tanner crab catches from the Bering Sea were reported incidental to the king crab fishery in 1968 and in 1974 a directed fishery began. Catches and effort rapidly increased and a record 66 million pounds was taken in the 1977/78 season, (Table 1). Although effort continued to increase in the fishery, catches began to slowly decline through the late seventies and early eighties as did the population estimates. By the 1983 season, the 5.3 million pound harvest was comparable to the first year of directed effort, (Table 1). Population estimates continued to decline in the early eighties and by 1986 the Department closed the fishery for the next two years.

The *C. bairdi* season was reopened in 1988, but catches were poor and soon after the opening, most effort moved west to the *C. opilio* grounds. This trend has continued in the fishery even through the 1991/92 season.

With the sharp decline and slow rebuilding of the Bristol Bay red king crab stocks which are fished on the same grounds as the *C. bairdi* stocks, the *C. bairdi* fishery had been closed in the early spring to protect the king crab during their mating and molting cycle. During the 1990 Board of Fish meeting, a March 31 regulatory closure was established to further protect the king crab in the area, as well as molting *C. bairdi*. In addition, at industry's request, the Board moved the opening of the Bristol Bay king crab season to November 1 and the opening of the *C. bairdi* season to seven days after the king crab closure. Prior to the adoption of the new opening the season for both species of Tanner crab had opened after the first of the year.

The area opening for *C. bairdi* is east of 166° West Longitude and gear used in the king crab fishery may be left on the grounds, in a stored condition for ten days. After registration and tank inspections vessels return to the grounds to bait and set their Tanner crab pots, the same ones used in the king crab fishery.

In years that this fishery has had large effort during late February and March, vessels have experienced problems with lost gear due to the intrusion of the ice edge onto the higher productive grounds. During the past several seasons, this was not been a problem due to the majority of the fleet leaving the area for the more lucrative *C. opilio* fishery to the west.

Just prior to the 1991/92 *C. bairdi* opening, industry representatives expressed concerns to the Department about the large effort, reduced quota and confined area that was open. Although the Bering Sea *C. bairdi* stocks are managed as one stock, the *C. bairdi* stocks west of 166° West Longitude does not open until January 15 along with the *C. opilio* fishery. Because of these concerns, an emergency order was issued opening the entire Eastern subdistrict west of 173° West Longitude to *C. bairdi*. The *C. opilio* fishery would still open by regulation on January 15.

There are two distinct species of Tanner crab in the Bering Sea. There is also a hybrid crab that results from the cross mating of these two and has characteristics of both, causing identification problems. The *C. bairdi* have a minimum commercial size limit across the carapace of 5.5 inches where the *C. opilio* size limit is 3.1 inches. Without proper identification of the two species and the hybrid, many undersized *C. bairdi* are harvested. In January, the Board of Fisheries adopted, by emergency regulation, eye color as the identifying characteristic to determine the minimum size limit of harvestable Tanner crab. Within a few days complaints arose about the regulation, and it was revised. A new emergency regulation was adopted identifying a dark red eyed crab with an "M" shaped mouth as a *C. bairdi*. All other crab without these characteristics were considered to be *C. opilio* and could be harvested at 3.1 inches or greater in shell width.

Table 1. Historic Bering Sea *C. bairdi* catch statistics by season.

Year	Vssls	Lndgs	Crab[1]	Pounds[1]	Pots Lifted	CPUE	Avg. Wt.	Avg. Width(mm)	% New Shell	Pounds Deadloss
1968	NA	7	6,400	17,900	1,400	5	2.8	-	-	NA
1969	NA	131	353,300	1,008,900	29,800	12	2.9	-	-	NA
1970	NA	66	482,300	1,014,700	16,400	29	2.1	-	-	NA
1971	NA	22	61,300	166,100	7,300	8	2.7	-	-	NA
1972	NA	14	42,061	107,761	4,260	10	2.6	-	-	NA
1973	NA	44	93,595	231,668	15,730	6	2.5	-	-	NA
1974	NA	69	2,531,825	5,044,197	22,014	115	2.0	-	-	NA
1975	28	80	2,773,770	7,284,378	38,462	72	2.5	-	-	NA
1976	66	305	8,949,886	22,341,475	141,179	63	2.5	-	-	NA
1976/77	83	541	20,251,508	51,455,221	297,171	68	2.5	-	-	NA
1977/78	120	861	26,350,688	66,648,954	516,350	51	2.5	152.8	88.0	218,099
1978/79	144	817	16,726,518	42,547,174	402,697	42	2.5	152.7	95.0	76,000
1979/80	152	804	14,685,611	36,614,315	488,434	30	2.5	151.4	90.0	56,446
1981	165	761	11,887,213	29,732,086	559,626	21	2.5	149.4	86.6	101,594
1982	125	791	4,830,980	11,008,779	490,099	10	2.3	148.8	85.4	138,159
1983	108	448	2,286,756	5,273,881	282,006	8	2.3	148.8	70.5	60,029
1984	41	134	516,877	1,208,223	61,357	8	2.3	146.5	40.0	5,025
1985	44	166	1,283,474	3,151,498	104,707	12	2.4	150.0	65.0	14,096
1986			SEASON CLOSED							
1987			SEASON CLOSED							
1988	98	248	987,059	2,210,394	112,334	8	2.5	143.5	70.2	10,724
1989	109	359	2,907,021	7,012,965	184,892	16	2.4	149.4	80.8	34,664
1990	179	1,032	10,717,924	24,549,299	711,137	15	2.3	148.1	96.5	87,475
1990/91	255	1,756	16,608,625	40,081,555	883,391	19	2.4	149.7	95.3	210,769
1991/92[2]	258	761	10,540,178	26,097,919	499,277	21	2.5	N/A	N/A	122,744

[1]Deadloss included.

[2]Preliminary figures.

Table 2. Historic Bering Sea *C. bairdi* Tanner crab economic performance.

Year	GHL[1]	Season Total[1]	No. Pots Registered	No. Vssls	No. Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[2]	Season Length Days/Dates
1979/80	28-36	36.5	40,273	152	804	488,434	$ .52	$ 19.0	189 -11/1-5/14
1981	28-36	29.6	42,910	165	761	559,626	$ .58	$ 17.2	88 - 1/15-4/18
1981/82	12-16	10.9	36,396	125	791	490,099	$ 1.06	$ 11.5	118 -2/15-6/15
1983	5.6	5.2	15,255	108	448	282,006	$ 1.20	$ 6.2	118 -2/15-6/15
1984	7.1	1.2	9,851	41	134	61,357	$ .95	$ 1.1	118 -2/15-6/15
1985	3.0	3.1	8,990	44	166	104,707	$ 1.40	$ 4.3	149 -1/15-6/15
1986		NO	COMMERCIAL			FISHERY			
1987		NO	COMMERCIAL			FISHERY			
1988	5.6	2.2	24,598	98	248	112,334	$ 2.17	$ 4.8	93 - 1/15-4/20
1989	13.5	7.0	36,245	109	359	184,892	$ 2.90	$ 20.3	110 -1/15-5/07
1990[3]	29.5	24.5	40,690	179	1,032	711,137	$ 1.85	$ 45.3	89 - 1/15-4/24
1990/91	42.8	39.7	70,076	255	1,756	883,391	$ 1.12	$ 44.5	154-11/20-3/25

[1]Millions of pounds.
[2]Millions of dollars.
[3]Winter fishing.

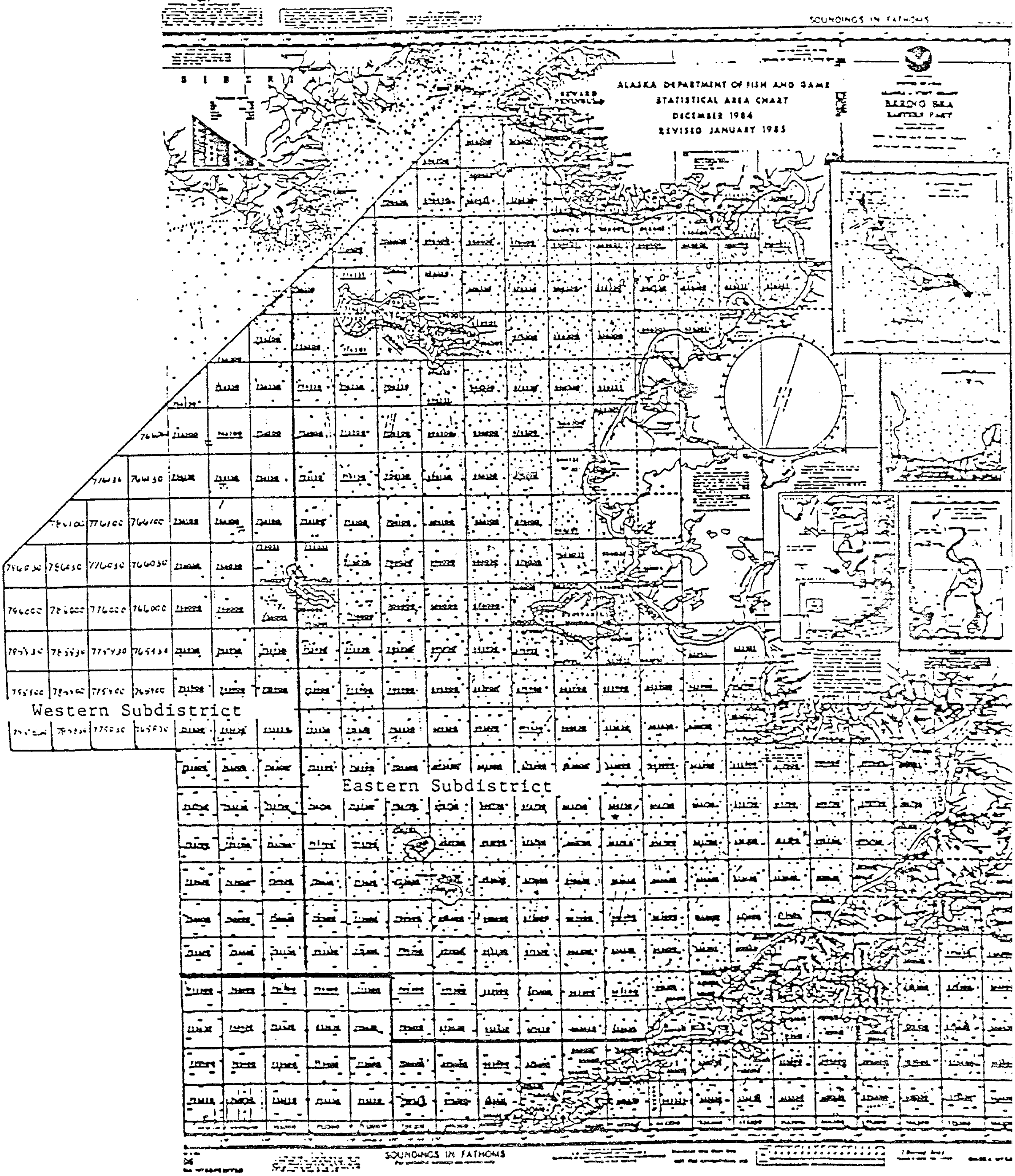

Figure 1. Bering Sea District of Statistical Area "J".

C. opilio

The *C. opilio* Tanner crab fishery occurs primarily around the Pribilof Islands,northwest of the Pribilofs and west of St. Matthew Island. This smaller but more abundant Tanner crab was first reported as an incidental catch to the 1977/78 *C. bairdi* fishery. With sharp declines in the *C. bairdi* fishery, and dramatic increases in both population and catch of these smaller Tanner crabs, this fishery has become of major importance to the crab industry and has filled both foreign and domestic market demands.

The 1978/79 season was the first year of a directed fishery and over 32 million pounds was landed, (Table 1). The season harvests increased for the next two years, over 52 million landed in 1981, but then dropped to only 26 million two years later and can be attributed to low prices and small effort as vessels fished for brown king crab in Adak, (Table 1). With the decline in the brown king crab stocks and both increased price and harvest guidelines beginning in the mid-eighties, effort and catch rapidly increased to a record harvest of over 325 million pounds of live crab delivered during the 1990/91 season, (Table 2). Record harvests are again predicted for the 1991/92 season that has a preseason harvest guideline of 333 million pounds. The population estimates seem accurate as over 29 million pounds of *C. opilio* is being landed weekly by the fleet of close to 300 vessels.

During the 1988 season, the ice edge began a rapid movement south during the month of March and covered all but a small area of the western subdistrict. The eastern subdistrict had been closed and with ice on the western subdistrict's grounds the fleet had no place to move. Emergency regulations established a pot storage area and the season was closed on March 29 until the area west of St. Matthew Island was free of ice, some six weeks later. Again, in 1991, the ice edge moved rapidly south catching some of the fleet north of the Pribilof Islands making them unable to move their gear fast enough or far enough south of the islands to get away from it. The Department estimated as many as 20,000 pots may have been lost, but most were probably recovered after the ice retreated.

Table 1. Historic Bering Sea *C. opilio* catch statistics by season.

Year	Vssls	Lndgs	No. Crab[1]	No. Pounds[1]	Pots Lifted	CPUE	% New Shell[2]	Avg. Wt.	Width (mm)[2]	Pounds Deadloss
1977/78	15	38	1,267,546	1,716,124	13,247	96	NA	1.4	NA	0
1978/79	102	490	22,118,498	32,187,039	190,746	115	83.0	1.5	113.1	759,173
1979/80	134	597	25,286,777	39,572,668	255,022	95	90.0	1.6	118.1	228,345
1981	153	867	34,415,322	52,750,034	435,742	79	79.2	1.5	117.0	2,269,979
1982	122	803	24,089,562	29,355,379	469,091	51	78.0	1.2	109.4	1,042,655
1983	109	462	23,838,149	26,128,410	287,127	83	NA	1.1	NA	1,324,466
1984[3]	52	367	21,009,935	26,813,074	173,591	138	78.0	1.1	105.4	798,744
1985[4]	75	718	52,903,246	65,998,875	372,045	120	80.0	1.3	108.0	1,064,184
1986[5]	88	992	76,499,123	97,984,539	543,744	141	73.7	1.3	109.5	1,392,933
1987	103	1,038	81,307,659	101,903,388	616,113	132	84.0	1.2	108.9	978,449
1988	171	1,285	105,716,337	134,060,185	766,907	137	71.2[6]	1.3	109.5	3,260,020
1989	168	1,341	112,618,881	149,455,848	663,442	178	85.2[6]	1.3	111.2	1,844,682
1990	189	1,565	128,977,638	161,821,350	911,613	139	97.4[6]	1.3	109.1	1,796,664
1991	228	2,788	265,123,960	328,647,269	1,391,583	188	95.1	1.2	110.2	3,464,036

[1]Deadloss included

[2]Southeast and Pribilof Districts only

[3]North of 58° reopened until 12-31

[4]West of 164° opened through 12-31

[5]Open only west of 164° W. longitude

[6]Eastern and Western Districts combined

Table 2. Historic Bering Sea *C. opilio* Tanner crab economic performance.

Year	CHL[1]	Season Total[1]	No. Pots Registered[2]	No. Vssls	No. Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[3]	Season Length Days/Dates
1979/80	N/A	39.3	35,503	134	597	255,022	$ .21	$ 83.0	307-11/1-9/03
1980/81	39.5-91	50.5	39,789	153	867	435,742	$ .26	$ 13.1	229-1/15-9/01
1981/82	16-22	28.3	35,522	122	803	469,091	$ .73	$ 20.7	167-2/15-8/01
1982/83	15.8	24.8	15,396	109	462	287,127	$ .35	$ 8.7	120-2/15-6/01
1983/84[4]	49.0	26.0	12,493	52	367	173,591	$ .30	$ 7.8	320-2/15-12/3
1984/85[4]	98.0	64.9	15,325	75	718	372,045	$ .30	$ 19.5	333-1/15-9/22 AND 10/9-12/31
1985/86[4]	57.0	96.6	13,750	88	992	543,744	$ .60	$ 60.0	252-1/15-9/24
1986/87	56.4	100.9	19,386	103	1,038	616,113	$ .75	$ 75.7	158-1/15-6/22
1987/88	110.7	130.8	38,765	171	1,285	766,907	$ .77	$100.7	120-1/15-3/29 AND 5/15-6/30
1988/89	132.0	147.6	43,607	168	1,341	663,442	$ .75	$110.7	112-1/15-5/07
1989/90	139.8	161.8	46,440	189	1,565	911,613	$ .64	$102.3	148-1/15-6/12
1990/91	315.0	325.2	76,056	228	2,788	1,391,583	$ .50	$162.6	159-1/15-6/23

[1]Millions of pounds.
[2]Same gear as *C. bairdi* fishery.
[3]Millions of dollars.
[4]Partial closures only.

DUTCH HARBOR, AREA 'O'

Description

The Dutch Harbor area or Statistical Area 'O', has as its eastern boundary the longitude of Scotch Cap Light on Unimak Island, and as its western boundary 171° West longitude. The 800 fathom depth contours are the seaward boundaries. Area "O" is further broken down into five fishing districts (Figure 1). Although red king crab is the primary target species, brown king crab production is on the increase.

Brown King Crab

Historically, Dutch Harbor brown king crab have been taken incidental to the red king crab fishery. Incidental catches of brown king crab were small and landings of red king crab may have included brown king crab prior to the 1981/82 season, but was not recorded separately. Interest in the fishery continued to grow as the red king crab stocks declined in the early eighties and by the 1982/83 season, 136 vessels landed 1.1 million pounds, (Table 2). In 1983 the red king crab fisheries throughout the Westward region with the exception of Adak, were closed. With a good market and essentially an unexploited stock, effort was directed to the brown king crab stocks. The fishery remained as a permit fishery until 1988, when a season opening date of September 1 was established.

The fishery developed as a single pot fishery, but due to the depth and type of bottom fished, vessels began experimenting with longlining pots. Regulations allowing the longlining of pots in the brown king crab fisheries was adopted in 1986. Vessel effort in this fishery had, by this time, dropped to only 13, but these vessels were all longlining vessels and fished almost exclusively for brown king crab.

Although vessel effort remains somewhat consistent, the average number of pots registered continues to increase, as does the number of pots pulled during the fishery.

The Dutch Harbor fishery occurs on grounds that were developed during the early 1980's. These grounds are somewhat limited, and with the introduction of longlined pots, vessels must compete for fishable grounds. Vessels will set strings that cover many different depths and miles of ocean floor. By regulation, these strings must be marked at both ends by a cluster of four buoys as well as a pole and a flag, but because of the distance involved between ends of a string, the buoys are not always visible and strings are often tangled as other vessels lay their ground lines across each other. Pots are often lost when the groundline breaks, but most fishermen make an effort to recover the gear, especially when additional pots are on the groundline.

This fishery opens concurrent to the St. Matthew blue king crab fishery on September 1, but most vessels do no try to fish the short St. Matthew area, a non-longline fishery, then move into Dutch Harbor. For the past several years, the area has been closed with or just after the closure of the Bristol Bay red king crab fishery. By this time, effort has left for the Adak brown and red king crab fisheries or is preparing to enter the Bering Sea Tanner crab fisheries.

Table 1. Historic brown king crab catch in Dutch Harbor statistical Area 'O'.

Season	Vssls.	Lndgs.	No. Crab[1]	No. Pounds[1]	Pots Lifted	CPUE	Percent Oldshell	Avg. Wt.	Average Length	Pounds of Deadloss
1981/82	6	16	22,666	115,715	2,906	8	3.8	5.1	158.1	8,752
1982/83	49	136	227,471	1,184,971	29,369	8	3.9	5.2	158.1	47,479
1983/84	47	132	328,353	1,810,973	29,595	11	NA	5.5	NA	45,268
1984[2]	13	67	327,440	1,521,142	24,044	14	NA	4.6	161.2	70,362
1985	13	67	410,977	1,968,213	34,287	12	16.0	4.7	155.7	38,663
1986	17	71	400,389	1,869,180	37,585	11	-	4.7	NA	9,510
1987	22	77	299,734	1,383,198	43,017	7	25.0	4.6	149.6	24,210
1988[3]	21	57	323,695	1,545,113	40,869	8	23.0	4.8	154.3	22,960
1989/90	13	70	424,067	1,852,249	43,345	10	30.0	4.4	150.9	17,421
1990/91	16	68	395,502	1,718,848	54,618	7	3.0	4.3	147.5	42,800
1991/92	11	50	335,647	1,447,732	40,604	8	4.0	4.3	147.9	45,100

[1] Includes deadloss

[2] Six inch permit season opened July 1

[3] Season opening date established September 1

ADAK, AREA 'R'

Description

Adak, Area 'R', is comprised of all continental shelf waters west of 171° W. longitude and east of the U.S./U.S.S.R. Convention Line, (Figure 1).

Red King Crab

The Adak area's red king crab fishery began in the 1960/61 season and rapidly expanded from a two million pound harvest that season to a harvest of over 21 million pounds just four years later. Because of the fishery's remoteness and the development of the closer Dutch Harbor area fishery, catches declined for two years, then again rebounded until the early seventies, (Table 1).

The fishery started a rapid decline beginning in the 1973/74 season and by the 1976/77 season, the area was closed. Department surveys of the historic red king crab areas in 1975, 1976 and 1977 concluded that several years of poor recruitment were the primary cause of the rapid decline. In addition, a shell disease and unusually high natural mortality in one of the major districts also contributed to the decline. Abundance surveys in the area have not been conducted on these stocks since 1977 and all information on the stocks are collected from observers on board floater and catcher processors.

Catches since the 1977/78 closure have not recovered to those of the late sixties and early seventies and have averaged only 1.2 million pounds for this period, (Table 1). Fluctuations in the catches since the 1980/81 season can primarily be contributed to the development of the brown king crab fishery in the same area and Tanner crab fisheries in the Bering Sea diverting effort from Adak. Catches of red king crab since the 1988/89 season have been reported primarily from the Semisopochnoi Island area and other historic grounds have not provided catches for several years.

In 1990, the Board of Fish adopted new regulations opening the Bristol Bay king crab season on November 1, the same day as both the Adak and Dutch Harbor area king crab openings. Prior to 1990, effort in the Adak king crab fisheries occurred after the closure of the Bristol Bay area in early October and before the holidays and the opening of the Bering Sea Tanner crab fisheries in January. Only seven vessels delivered red king crab in the 1990/91 season, and several of these vessels left the area within a few weeks after the opening and entered the Bering Sea *C. bairdi* fishery, (Tables 1 and 2).

The red king crab fisheries are still single pot fisheries, but incidental take occurs in the longline brown king crab fishery in this area. Through petition, the Board of Fisheries adopted regulations allowing the retention of red king crab in the Adak area's longline fishery. This regulation will be in effect for the 1992/93 season which opens in November.

As in other remote fisheries, the fishery is managed inseason through observer reports, and except for three of the last ten years has closed by regulation on February 15, (Table 2).

Brown King Crab

The first reported catch of brown king crab from the Adak area was during the 1975/76 season and was incidental to the red king crab fishery in the same area. Catches prior to this time could have occurred, but were not separated from the red king crab deliveries, (Table 1).

Until the 1985/86 season, the size limit for brown king crab was the same as red king crab, 6.5 inches. Based on information collected by the National Marine Fisheries Service (NMFS) on size at maturity, the Board of Fisheries lowered the brown king crab size limit to 6 inches. In addition, a season closure was established for August 15.

Catch rates and vessel effort increased rapidly as vessels entered the fishery between the Bristol Bay red king crab and Bering Sea Tanner crab seasons. A record catch of over 12.7 million pounds occurred in the 1986/87 season, the largest recorded to date. The 1990/91 low harvest can be attributed to low vessel effort as most catcher processors and larger vessels entered the Bering Sea Tanner crab fisheries. Only a few dedicated longline vessels are presently fishing in the Adak area and because of the reduced effort, present catch is also down.

Table 2. Historic Dutch Harbor brown king crab economic performance.

Year	GHL[1]	Season Total[2]	No. Pots Registered	No. Vssls.	No. Lndgs.	No. Pots Pulled	Ex-Vssl Value	Total Value[3]	Season Length Days/Dates
1981/82	N/A	0.1	-0-[4]	6	16	2,906	$ 2.05	$ 0.2	75-11/01-1/15
1982/83	N/A	1.1	-0-[4]	49	136	29,369	$ 3.00	$ 3.3	105-11/1-2/15
1983/84	N/A	1.8	4,514	47	132	29,595	$ 3.05	$ 5.5	105-11/1-2/15
1984/85	N/A	1.5	1,394	13	67	24,044	$ 1.35	$ 2.0	229-7/01-2/15
1985/86	N/A	1.9	1,479	13	67	34,287	$ 2.00	$ 3.8	121-7/1-10/31
1986/87	N/A	1.8	1,575	17	71	37,585	$ 2.85	$ 5.1	182-7/1-12/31
1987/88	N/A	1.4	3,591	22	77	43,017	$ 2.85	$ 4.0	62 -7/01-9/02
1988/89	N/A	1.5	4,215	21	57	40,869	$ 3.00	$ 4.5	93-9/01-12/04
1989/90	N/A	1.8	5,635	13	70	43,345	$ 3.50	$ 6.3	165-9/1-2/15
1990/91	N/A	1.7	5,225	16	68	54,618	$ 3.00	$ 5.1	68-9/01-11/09
1991-92	N/A	1.4	3,760	11	50	40,60[illegible]	$ 2.00	$ 2.8	74-9/01-11/15

[1]Based on historic catches, 1983/84 - 1991/92.
[2]Millions of pounds.
[3]Millions of dollars.
[4]Incidental catches to red king crab fishery.

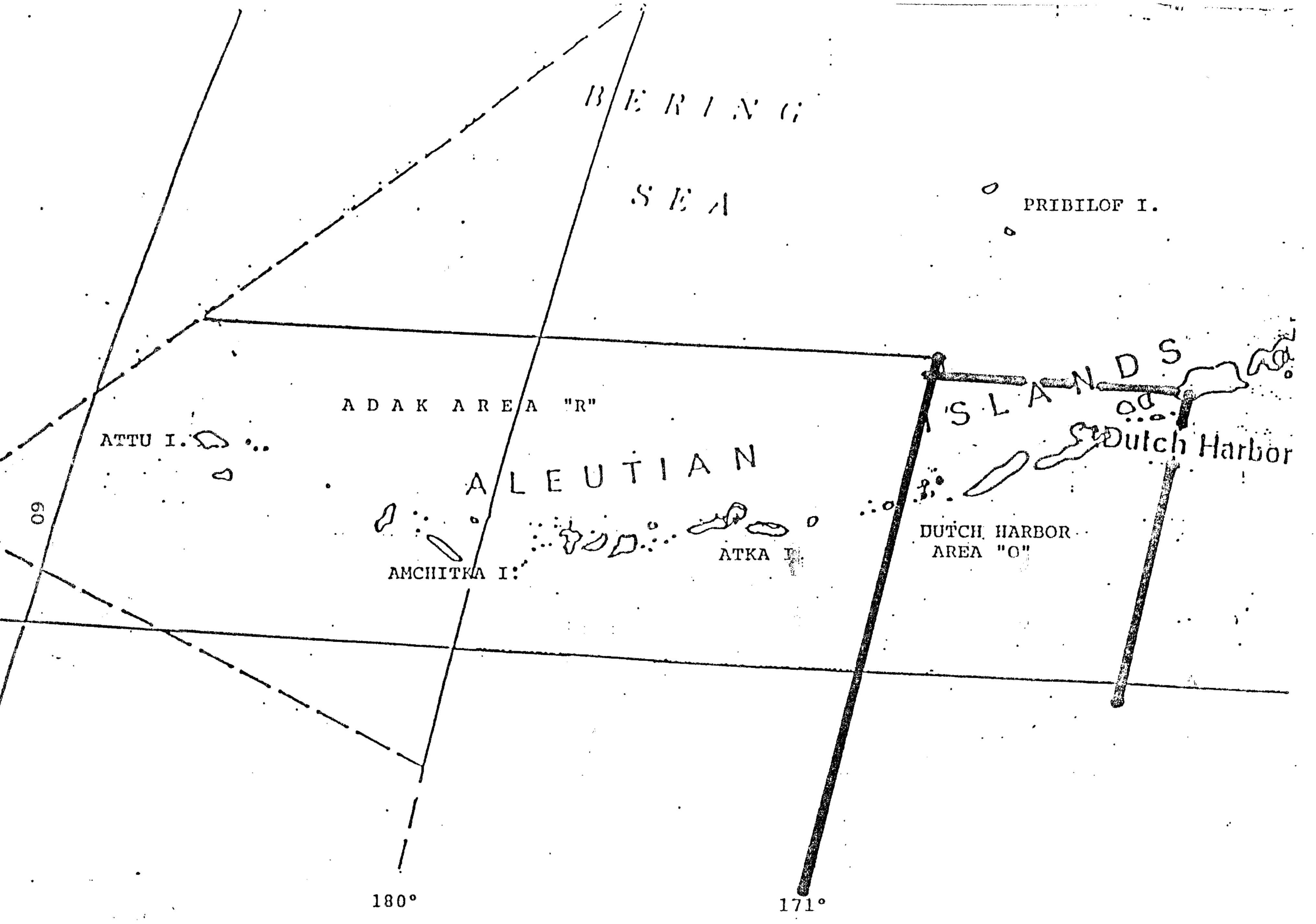

Figure 1. Dutch Harbor, Area "O".

No surveys are conducted on the Adak brown king crab stocks and the season has been allowed to remain open for over nine months since the 1985/86 season. As more information becomes available through the observer program, areas with higher effort are expected to be closed prior to the August 15 regulatory closure.

Gear loss problems are similar to those experienced in the Dutch Harbor brown king crab fishery, where most strings are probably recovered by the vessel by dragging for the groundline. As in Dutch Harbor, both ends of the string must be marked with a cluster of buoys and a flag pole.

Table 1. Adak, Area R, historic red king crab.[1]

Season	No. Vssls	No. Lndgs	No. Crab[2]	No. Lbs.[2]	Lifted	CPUE	Avg. Wt.	Recruits	Lngth	Dead-loss
1960/61	4	41	NA	2,074,000	NA	9	NA		NA	NA
961/62	8	218	NA	6,114,000	NA	NA	NA	NA	NA	NA
1962/63	9	248	NA	8,006,000	NA	NA	NA	NA	NA	NA
1963/64	11	527	NA	17,904,000	NA	NA	NA	NA	NA	NA
1964/65	18	442	NA	21,193,000	NA	NA	NA	NA	NA	NA
1965/66	10	431	NA	12,915,000	NA	NA	NA	NA	NA	NA
1966/67	10	90	NA	5,883,000	NA	NA	NA	NA	NA	NA
1967/68[3]	22	505	NA	14,131,000	NA	NA	NA	NA	NA	NA
1968/69	30		NA	16,100,000	NA	NA	NA	NA	NA	NA
1969/70	33	435	NA	18,016,000	115,929	NA	6.5	NA	NA	NA
1970/71	35	378	NA	16,057,000	124,235	NA	NA	NA	NA	NA
1971/72	40	166	NA	15,475,924	46,011	NA	NA	NA	NA	NA
1972/73[4]	43	313	3,461,025	18,724,144	81,133	43	5.4	50.9	NA	NA
1973/74	41	239	1,844,974	9,741,464	70,059	26	5.3	48.5	148.6	NA
1974/75	36	97	532,298	2,774,963	32,620	16	5.2	48.6	148.6	NA
1975/76	20	25	79,977	411,583	8,331	10	5.2	67.5	147.2	NA
1976/77					Closed					
1977/78	12	18	160,343	905,527	7,269	22	5.7	43.9	152.2	NA
1978/79[5]	13	27	149,491	807,195	13,948	11	5.4	56.7	NA	1,170
1979/80	18	23	82,250	467,229	9,757	8	5.7	42.8	152.0	24,850
1980/81	17	52	254,390	1,419,513	20,914	12	5.6	65.2	149.0	54,360
1981/82	46	106	291,311	1,648,926	40,697	7	5.7	55.5	148.3	8,759
1982/83	72	191	284,787	1,701,818	66,893	4	6.0	49.9	150.8	7,855
1983/84	106	248	298,948	1,981,579	60,840	5	6.6	30.4	157.3	3,833
1984/85	64	113	206,751	1,367,672	50,685	4	6.6	31.4	155.1	0
1985/86	35	89	162,271	906,293	32,478	5	5.6	40.0	152.2	6,120
1986/87	33	69	126,146	712,243	29,189	4	5.6	NA	NA	500
1987/88	71	109	211,712	1,213,933	43,433	5	5.7	65.3	148.5	6,900
1988/89	73	156	266,053	1,567,314	64,374	4	5.9	39.0	153.1	557
1989/90	56	123	196,070	1,118,566	54,513	4	5.7	NA	NA	759
1990/91	7	34	146,903	828,105	10,674	14	5.6	NA	NA	0
1991/92[6]	7	24	140,254	817,417	11,407	12	5.8	NA	NA	0

[1] Includes catch from former Area 'S' now Western Aleutians District 'R'.

[2] Includes deadloss.

[3] Area 'S' fishery began.

[4] Area 'S' continued until June.

[5] Area 'S' eliminated - added to Area 'R'.

[6] Preliminary figures.

Table 2. Historic Adak red king crab economic performance.

Year	GHL[1]	Season Total[2]	No. Pots Registered	No. of Vssls	No. of Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[3]	Season Length Days/Dates
1980/81	N/A	1.4	2,471	17	52	20,914	$ .92	$ 1.3	71 - 1/15-3/28
1981/82	N/A	1.6	8,698	46	106	40,697	$ 2.01	$ 3.2	107 -11/1-2/15
1982/83	N/A	1.7	9,535	72	191	66,893	$ 3.44	$ 5.9	76 -11/01-1/15
1983/84	N/A	2.0	11,752	106	248	60,840	$ 3.43	$ 6.9	36-11/10-12/16
1984/85	N/A	1.4	8,876	64	113	50,685	$ 2.10	$ 2.9	97 -11/10-2/15
1985/86	N/A	.9	5,910	35	89	32,478	$ 2.15	$ 1.9	107-11/01-2/15
1986/87	N/A	.7	6,897	33	69	29,189	$ 3.85	$ 2.7	107-11/01-2/15
1987/88	N/A	1.2	17,720	71	109	43,433	$ 4.00	$ 4.8	107-11/01-2/15
1988/89	N/A	1.6	23,927	73	156	64,374	$ 5.00	$ 8.0	34-11/01-12/04
1989/90	N/A	1.1	12,884	56	123	54,513	$ 4.20	$ 4.6	107-11/01-2/15
1990/91	N/A	.7	1,120	7	24	7,931	$ 4.00	$ 2.8	107-11/01-2/15

[1]No preseason GHL's.
[2]Millions of pounds.
[3]Millions of dollars.

Table 3. Historic brown king crab catch in Adak, Area R.

Season	Season Opened	Season Closed	Vssls	Lndgs	No. Crab[1]	No. Pounds[1]	Pots Lifted	Avg. Wt.	CPUE	Percent Newshell	Avg. Lngth	Min. Size	Price/ Pound	Deadloss
1975/76	11/01	12/18		Harvest	Confidential				NA	NA		6.5"	NA	NA
1976/77	01/07	04/15		Harvest	Confidential				NA	NA		6.5"	$ .75	NA
1977/78	02/20	03/20		Harvest	Confidential				NA	NA		6.5"	$1.30	NA
1978/79	02/21	10/01	0	0	0	0	0					6.5"		0
1979/80	01/15	04/01		Harvest	Confidential				NA	NA		6.5"	$ .65	NA
1980/81	01/15	03/28	4	4	11,523	58,914	700	5.1	17	97.6	158.4	6.5"	$ .90	5,000
1981/82	11/01	06/15	14	76	217,700	1,194,046	24,627	5.5	9	90.5	159.6	6.5"	$2.06	22,064
1982/83	11/01	04/15	99	501	1,509,001	8,006,274	150,103	5.3	10	92.4	158.2	6.5"	$3.01	220,743
1983/84	11/10	04/15	157	1,002	1,534,909	8,128,029	226,798	5.3	7	87.8	NA	6.5"	$2.92	171,021
1984/85	11/10	07/08	38	85	643,597	3,180,095	64,777	4.9	10	87.5	156.7	6.5"		125,073
1985/86[2]	11/01	08/15	49	386	2,052,048	11,124,759	202,401	4.5	12	86.3	151.3	6.0"		5,304
1986/87	11/01	08/15	62	525	2,923,947	12,798,004	392,185	4.4	7	69.1	149.5	6.0"	$3.00	276,736
1987/88	11/01	08/15	46	386	1,908,989	8,001,177	267,705	4.2	7	91.7	146.9	6.0"	$3.00	165,415
1988/89	11/01	08/15	74	455	2,165,508	9,080,196	280,732	4.2	8	91.2	149.1	6.0"	$3.20	122,251
1989/90	11/01	08/15	64	505	2,520,786	10,162,400	324,153	4.0	8	95.3	148.5	6.0"	$3.00	100,724
1990/91[4]	11/01	08/15	13	167	1,312,116	5,250,687	160,960	4.0	8	91.5	144.5	6.0"	$3.00	176,583
1991/92[3]	11/01	-	7	35	309,692	1,273,861	28,753	4.0	11	-	-	6.0"	$2.50	21,700

[1]Deadloss included

[2]Size limit reduced to six inches

[3]Season in progress

[4]Partial closure August 7

Table 4. Historic Adak brown king crab economic performance.

Year	GHL[1]	Season Total[2]	No. Pots Registered[3]	No. Vssls	No. Lndgs	No. Pots Pulled	Ex-Vssl Value	Total Value[4]	Season Length Days/Dates
1980/81	N/A	0.05	581	4	4	700	$ .90	$ 0.05	71 - 1/15-3/28
1981/82	N/A	1.2	2,647	14	76	24,627	$ 2.06	$ 2.5	227-11/01-6/15
1982/83	N/A	7.8	13,111	99	501	150,103	$ 3.01	$23.5	166-11/01-4/15
1983/84	N/A	8.0	17,406	157	1,002	226,798	$ 2.92	$23.4	157-11/10-4/15
1984/85	N/A	3.1	5,270	38	85	64,777	$ 2.00	$ 6.2	240-11/10-7/08
1985/86	N/A	11.1	7,057	49	386	202,401	$ 2.50	$27.8	288-11/01-8/15
1986/87	N/A	12.5	12,958	62	325	392,185	$ 3.00	$37.5	288-11/01-8/15
1987/88	N/A	7.8	10,687	46	386	267,705	$ 3.00	$23.4	289-11/01-8/15
1988/89	N/A	9.0	23,627	74	455	280,732	$ 3.20	$28.8	288-11/01-8/15
1989/90	N/A	10.1	14,724	64	505	324,153	$ 3.00	$30.3	288-11/01-8/15
1990/91	N/A	5.3	7,380	13	167	160,960	$ 3.00	$15.9	288-11/01-8/15

[1]No preseason GHL's.

[2]Millions of pounds.

[3]No separate registration from red king crab.

[4]Millions of dollars.

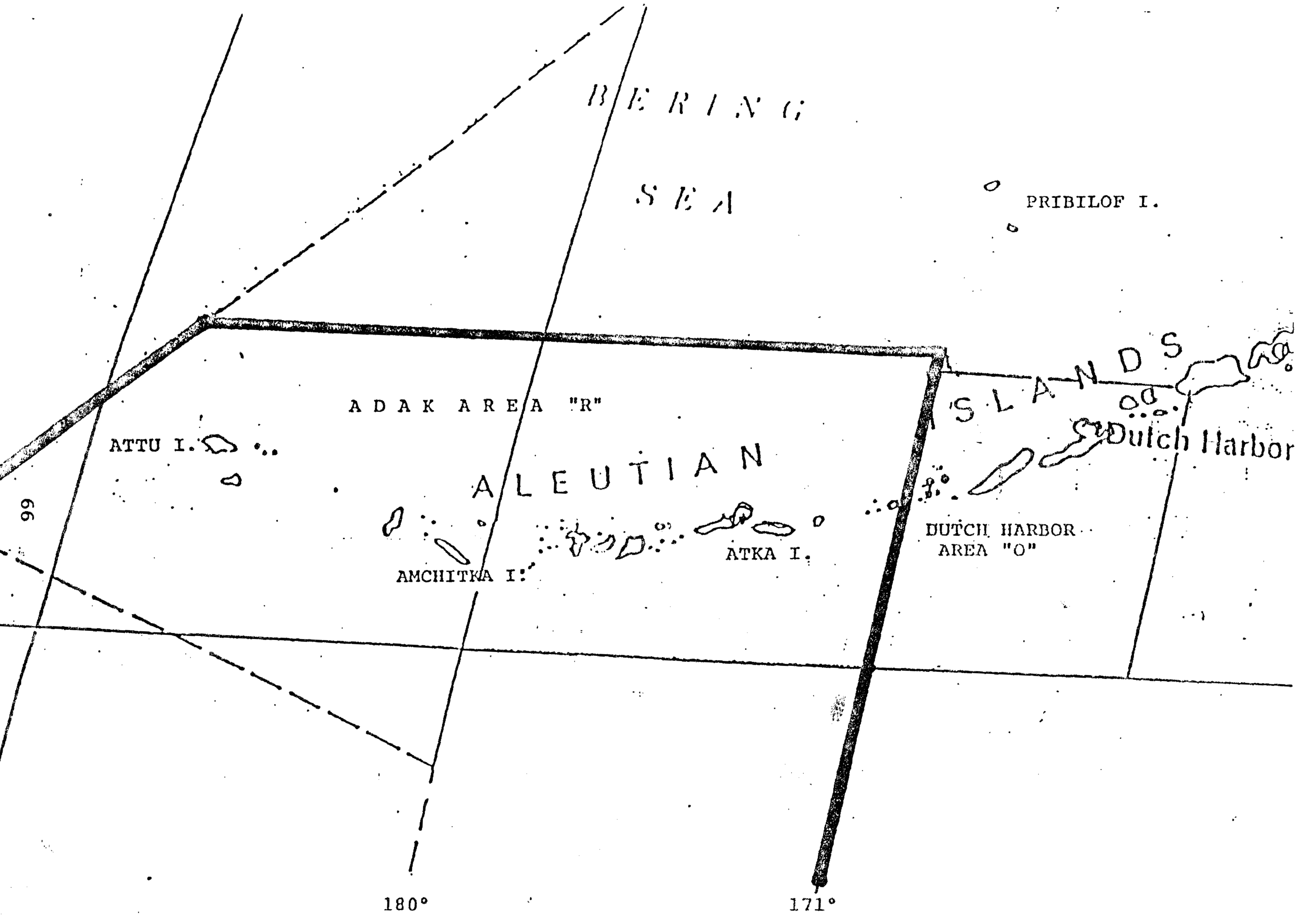

Figure 1. Adak, registration Area "R".

APPENDIX 4

ACCESSION NO.: 91-0553

ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU FISH PATHOLOGY LABORATORY, FRED DIVISION
3333 OLD GLACIER HIGHWAY, JUNEAU, AK. 99802
PHONE (907) 465-3577

REPORT OF LABORATORY EXAMINATION

LOT (YEAR, STOCK, SPECIES): Kodiak Island, Alaska Peninsula and Eastern Aleutian Tanner crabs Chionoecetes bairdi

SAMPLE DATES: 6/14 - 9/17/90

DATE SAMPLES RECEIVED: 10/24/90

CONTACT PERSON: David R. Jackson, Fishery Biologist

FACILITY: Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak, AK

SPECIMEN TYPE: Hemolymph smears (Diff-Quik stain) STATE: Dried on slides

STAGE: Adults and subadults

NUMBER IN SAMPLE: 1183 (464 female, 719 male) WILD: Yes

HISTORY/SIGNS: The Bitter Crab Syndrome (BCS) has been found in bairdi and opilio Tanner crabs from the Eastern and Western Bering Sea and infected opilio crabs have been brought for processing to the Eastern Aleutian area.

REASON FOR SUBMISSION: Ongoing distribution study of BCS in Alaskan waters which has not been done thoroughly around the Kodiak Island, Alaska Peninsula and Eastern Aleutian areas for bairdi crabs.

FINAL REPORT DATE: 2/8/91; revised 6/17/91

CLINICAL FINDINGS:
See attached data sheets for haul #s, sex, carapace width and shell condition. Hemolymph smears were made from up to six randomly chosen crabs from each haul (station). Prevalence of BCS within the remaining crabs or a subsample thereof was also determined at certain stations by visual inspection (Gross). Hemolymph smears from 288 apparent clinically diseased crabs were examined and 272/278 readable slides were confirmed as positive for the BCS dinoflagellate.

Kodiak Island	253/722	(35.0%) random slides were unreadable for BCS (smear too thin, cells distorted or shattered slide)
	17/469	(3.6%) random crabs positive with BCS
	14/17	vegetative stage (2-2+,7-3+,5-4+)
	3/17	prespore stage (2-4+, 1-5+)
	3/149	(2.0%) females positive with BCS
	14/320	(4.4%) males positive with BCS
	176/23,040	(0.76%) crabs grossly positive with BCS
	53/688	(7.7%) random crabs with varying degrees of bacterial rods in peripheral hemolymph (included many slides unreadable for BCS)

Dates	Location	BCS Prevalence Random		Gross[a]	
6/14-6/21/90	Northeast	0/77		0/4,298	
6/22-6/27/90	Eastside	0/85		1/4,897	(0.2%)
6/25-7/05/90	Southeast	0/85		5/2,202	(0.2%)
7/01-7/08/90	Southwest	15/81	(18.5%)	152/5,281	(2.9%)
8/27-9/16/90	Westside	2/141	(1.4%)	18/6,362	(0.3%)

Alaska Peninsula	219/820	(26.7%) random slides were unreadable for BCS (smear too thin, cells distorted or shattered slide)
	8/601	(1.3%) random crabs positive with BCS
	8/8	vegetative stage (2+)
	4/273	(1.5%) females positive with BCS
	4/328	(1.2%) males positive with BCS
	87/26,861	(0.3%) crabs grossly positive with BCS
	0/760	random crabs with bacterial rods in peripheral hemolymph (included many slides unreadable for BCS)

Dates	Location	BCS Prevalence Random		Gross[a]	
8/02-9/17/90	Morzhovoi Bay	0/85		0/4,081	
8/03/90	Sanak Island	0/15		3/331	(0.9%)
8/06-8/08/90	Cold Bay/Belkofsk	0/76		3/3,851	(0.08%)
8/09-8/13/90	Pavlof/Volcano Bay	3/149	(2.0%)	22/4,392	(0.5%)
8/14-8/18/90	Beaver/Balboa Bay	1/38		10/1,375	(0.7%)
8/17-8/18/90	West Nagai	0/11		5/237	(2.1%)
8/18-8/19/90	Stepovak Bay	0/22		5/1,095	(0.5%)
8/20/90	Ivanof Bay	3/18	(16.7%)	3/989	(0.3%)
8/21/90	Mitrofania Bay	1/22	(4.5%)	13/500	(2.6%)
8/22-8/24/90	Chignik Bay	0/54		3/3,792	(0.08%)
8/25/90	Kujulik Bay	0/18		0/920	
9/12-9/17/90	N. Mainland	0/93		20/5,298	(0.4%)

Eastern Aleutians	53/166	(31.9%) random slides were unreadable for BCS (smear too thin, cells distorted or shattered slide
	0/113	random crabs positive with BCS
	0/42	females positive with BCS
	0/71	males positive with BCS
	9/7,075	(0.1%) crabs grossly positive with BCS
	9/155	(5.8%) random crabs with bacterial rods in peripheral hemolymph (included many slides unreadable for BCS)

Dates	Location	BCS Prevalence Random	Gross[a]	
7/21/90	Akutan Bay	0/22	0/1,789	
7/21-7/23/90	Unalaska/Kalekta	0/18	3/1,146	(0.3%)
7/23-7/24/90	Beaver Inlet	0/17	1/1,861	(0.05%)
7/25/90	Usof Bay	0/9	0/605	
7/27/90	Cape Idak	0/7	0/13	
7/28/90	Inanudak Bay	0/3	0/9	
7/29/90	Pumicestone Bay	0/6	0/162	
7/29-7/30/90	Makushin Bay	0/31	5/1,487	(0.3%)
8/1/90	Akun Bay	0/0	0/3	

[a] Nearly all crabs observed to be clinically diseased were confirmed by hemolymph smear as positive for BCS. Although positive crabs with pre-spores appeared to predominate, total numbers of vegetative vs pre-spore infections could not be determined due to inadequate staining and poor cell morphology of the samples.

COMMENTS AND RECOMMENDATIONS:

The BCS in bairdi Tanner crabs was detected in all three general areas surveyed in the Gulf of Alaska. The randomly taken hemolymph smears often missed positive crabs, probably due to the smaller sample sizes. Subsampling within large hauls by sorting apparently normal and clinically diseased crabs followed by confirmation of positive crabs using hemolymph smears was more effective in determining whether the agent was present at a given sampling site. Observers were quite accurate in recognizing diseased crabs. In nearly all cases these crabs were in the terminal stages of the disease, consequently the detection prevalence is conservative since less severely infected crabs would appear more normal and could be missed. The parasite prevalence did not appear to differ appreciably between male or female crabs as observed with other studies of BCS.

The Kodiak Island area had the highest prevalence (3.6%) among the three general areas examined. The highest prevalence around Kodiak Island was from stations in the southwest quadrant seen in both randomly taken hemolymph smears and gross observation for clinically diseased crabs.

The Alaska Peninsula (AP) had only four positive areas by random sampling but again the sample sizes were small. Further subsampling of larger hauls indicated that nearly all stations in the AP area had some prevalence of diseased crabs ranging from 0.08% to 2.1% and 2.6% in Chignik Bay, West Nagai and Mitrofania Bay, respectively.

The least represented area in number of samples examined was the Eastern Aleutians (EL). None of the sites examined randomly from the EL were positive for BCS but when larger numbers of crabs were subsampled by gross observation at three stations, positive crabs were found.

An additional finding was a substantial number of randomly collected hemolymph samples each with an apparent bacteremia from the Kodiak (7.7%) and the EL (5.8%) areas. Bacterial rods in the peripheral hemolymph of crustaceans are generally considered to be opportunistic, gaining entry into a host debilitated by poor environmental conditions and/or mechanical injury. Such infection generally results in mortality. Crabs having BCS will commonly have a secondary bacterial infection, but in many of these samples BCS was not detected. These crabs were also not held for any significant amount of time which rules out sampling effort as the cause of stress/injury and infection. This suggests the bacteremia may have been due to other stressors including possible handling and injuries incurred through an intensive commercial fishery where sublegal sized or female crabs may be caught and sorted many times.

Further comparison of BCS prevalence from 1988-1990 in the Bering Sea and other related regions is presented in the 1990 Bering Sea report of Acc # 91-0542.

Should future samples be anticipated, the Juneau pathology staff need to be consulted regarding techniques for improving the quality of hemolymph smears and in shipping the samples so that more slides are useable.

FISH HEALTH INVESTIGATORS: T. R. Meyers, G. Bishop

COPIES TO: R. Burkett, T. Meyers, G. Bishop, C. Botelho (Comm Fish), K. Imamura (Comm Fish)

Results of bitter crab sampling, Alitak Bay, Kodiak Island, 1991.

Haul	Number Sampled	Number Without Infection	Number Infected	Sample Incidence	Est. STN Population (crabs)	Estimated Number Infected
151	30	28	2	6.7%	22,010	1,475
152	30	30	0	0.0%	156,715	0
153	30	30	0	0.0%	185,865	0
154	21	16	5	23.8%	4,375	1,041
155	30	28	2	6.7%	524,723	35,156
156	30	29	1	3.3%	85,459	2,820
157	28	25	3	10.7%	154,391	16,520
158	27	14	13	48.1%	20,704	9,959
159	17	10	7	41.2%	7,929	3,266
160	28	16	12	42.9%	79,747	34,211
161	30	20	10	33.3%	297,982	99,228
162	30	12	18	60.0%	65,712	39,427
163	30	12	18	60.0%	93,570	56,142
164	30	28	2	6.7%	44,557	2,985
165	30	26	4	13.3%	71,461	9,504
166	30	29	1	3.3%	174,913	5,772
Totals	451	353	98	21.7%	1,945,556	317,506

Estimated infection rate in Alitak Bay = 16.3%

Population Estimates for Tanner Crab in the Kodiak Management Area by year.

Year	Females			Sublegal Males				Recruit	Postrecruit		Total	Total	Total
	Juv	Adult	Total	<70	70-91	92-114	>114		<165	>164	Legal	Male	Crab
ALITAK BAY													
1987	72046	66023	138069	87867	34360	555559	1322252	480627	8392	36821	525840	2525878	2663947
1988	54570	175023	229593	43052	13398	46326	545682	1361616	60722	75168	1497506	2145964	2375557
1989	1417026	220411	1637437	1290934	215516	191367	450680	253354	102851	77796	434001	2582498	4219935
1990	2753096	1159491	3912587	1797493	1247593	683345	637053	53127	43345	11567	108039	4473523	8386110
1991	399828	214788	614616	202529	211689	376169	466007	97159	18762	3185	119106	1375499	1990115

APPENDIX 5

1992 BERING SEA TEST FISHERY PROJECT OPTIONS

Leslie J. Watson
February 25, 1992
Westward Region Regional Staff Meeting

Introduction

The Bering Sea test fishery project is entering the third year of field studies and equipment testing. This research is funded solely by receipts from the sale of Bristol Bay red king crab caught during annual tagging surveys conducted by the Department. Project costs totalled $270,000 in 1990 and $667,000 in 1991. Projected costs for 1992 are anticipated to reach the 1991 level. For 1991 and perhaps 1992, additional Bering Sea king crab populations were/are to be assessed utilizing a portion of the test fishery receipts. In 1991, a tagging survey was conducted on Adak and Dutch Harbor brown king crab populations. Options for additional tagging surveys to be conducted in the summer of 1992 are discussed below.

The Bering Sea test fishery project was initiated in 1989 by Dana Schmidt and Bill Donaldson when they began investigating the feasibility of using non-visible, implantable (PIT) tags as an alternate tagging method for evaluating Bristol Bay red king crab population assessment trawl surveys conducted annually by NMFS. The primary goal of the study is to estimate the actual exploitation rate of legal male red king crab using PIT tag returns.

In the summer of 1990, approximately 6,750 pre-recruit and legal male red king crabs were PIT tagged. Half of these crabs were marked with visible, external (Floy) tags so that PIT tag retention could also be evaluated. Additionally, Floy tag recoveries were also to be used to stratify PIT tag returns and to compare returns of visible and non-visible tags. PIT and Floy tag recoveries were monitored during the subsequent November commercial fishery. Results from this study demonstrated that PIT tags were durable and recoverable over a 90 day period (RIR 4K91-21). Technical difficulties involving hand-held PIT tag scanners precluded analysis of PIT tag returns. To address this, work began in early 1991 for the development of automated PIT tag detection equipment that could be installed on crab processing facility waste lines.

In 1991 we applied our resources towards development and testing of two prototype PIT tag detectors, as we had no reliable means of recovering PIT tags from the 1991 commercial fishery. Both detectors worked quite well, with overall detection rates of 81% and 96% achieved under simulated processing conditions. In lieu of implanting 5 - 10 thousand PIT tags (at a cost of $5.75 each) during the 1991 survey, we Floy tagged approximately 7,500 pre-recruit and legal male red king crabs to assess factors such as sampling intensity, study location and size of study area, and visible tag returns. Data from these studies will reported in upcoming RIRs. Some aspects of the current status of PIT tag technology are discussed in the enclosed 2-11-92 Trip Report.

Options

At this point, we are evaluating the next steps in the study in both the short-term (1992) and long-term. Results from the 1990 and 1991 studies have demonstrated that the technical obstacles to full implementation of PIT tag technology can be overcome. Much of what needs to be done involves fine-tuning of the sampling plan, laboratory studies to confirm long-term PIT tag retention, assessment of other king crab fisheries that are suitable for PIT tag application, and prototyping of other PIT tag detectors to enable increased sampling of the commercial catch landed at processors where the current waste line design is inappropriate. Other factors requiring consideration include project momentum, endorsement/acceptance of the project by industry, duration of the project beyond 1992, ADF&G support, and cost. While keeping these items in mind, the options we see as most viable include a combination of 1, 2, 3, and 6 as listed below.

1. Semi-implementation of automated PIT tag technology in 1992. Implantation of 5 - 10 thousand PIT tags in Bristol Bay red king crabs in summer, 1992. A portion (25%) of the PIT tagged crabs would also be Floy tagged. Purchase 2 additional auto-detectors for total installation of 3 auto-detectors at Dutch Harbor processors (Westward Seafoods, Alyeska, and Unisea G2 facilities) for the November 1992 fishery. The combined production for these plants is estimated to be 15.6% to 21.5% of the total 1991 live catch. Permission to install auto-detectors will have to be secured at Alyeska and Unisea prior to equipment purchase. **Advantages** of this option are maintenance of project momentum and collection of data that would likely result in analysis applicable to the commercial fishery. The primary disadvantages might be inadequate overall sample size, and lack of confidence in proscribed study area.

2. Development of other prototype PIT tag auto-detectors in 1992. Other sites for auto-detectors where the current design is inappropriate include individual butcher blades, bar-type scanners mounted on conveyors, or helical scanners that encase waste troughs. Prototyping any of these involves significant costs, which will have to be weighed against costs for option 1. However, prototyping can be done after the 1992 survey/recovery effort when all costs have been audited.

3. 1992 PIT tag retention study. We are evaluating two options available to conduct controlled PIT tag retention rates for the next 1 to 2 years. We would tag and hold Bristol Bay red king crab and monitor PIT tag retention so that we can evaluate tag loss over time. Two facilities are available; IMS at Seward and the FITC here in Kodiak. The FITC would be more practical as we have our own staff to care for the crabs. However, IMS may be willing to take care of our crabs gratis if we can provide them with crabs necessary for their research. Cost of this project is unknown at this point.

4. Implement St. Matthew/Pribilof Is. blue king crab study. This study would begin in 1992 and would alternate with the Adak/Dutch Harbor study on even years. If a Floy tag effort is mounted for St. Matthew, how will tag return data be used as an aid to management to prevent over-fishing (in-season, post-season, or at all?). Survey data would provide length data from both areas to compare with annual NMFS trawl survey data (could we get this from observer data?).

5. Continue Adak/Dutch Harbor brown king crab study. This study would consist of an annual or biannual tagging/life history survey. Same questions regarding use of tag return and length frequency data as in option 4.

6. Discontinue all visible tagging projects except for Bristol Bay. The visible tagging effort we have mounted over the past two years has yielded useful information. However, it has also produced much of the same confounding data as other Westward tagging projects. Because resources are limited, we would prefer to focus available staff and funds on PIT tag implementation in Bristol Bay (options 1-3).

Discussion

We are soliciting a consensus opinion from the region as to the future of the PIT tag project. Pending that consensus opinion, the region has not yet committed itself in any one direction for the upcoming year. Is the project a priority for the region? Does the region perceive the value of the information from PIT tags in regards to exploitation rate estimation? Will the data be used if proven reliable? It is our belief that the project cannot proceed without the advice and advocacy of all regional shellfish staff.

Beyond 1992, the scope of the PIT tag application to Bering Sea king crab fisheries is only constrained by funding and staff support.

Distribution

Beers
Donaldson
Griffin
Jackson
Morrison
Nicholson
Nippes
Pengilly
Spalinger
Tracy
Ward

BERING SEA RESEARCH PROJECT REPORTS - 1992

1. Visible (Floy) and non-visible (PIT) tag retention experiments and automated PIT tag detection trials conducted on Bristol Bay red king crab in 1991. RIR. Pengilly/Watson/Beers. 3-15-92

2. PIT tag project overview and equipment demonstration. Abstract for the Proceedings of the International Symposium on Crab Rehabilitation and Enhancement. Watson. 3-15-92.

3. 1991 Bristol Bay red king crab tagging survey. TFR. Watson/Byersdorfer. 4-15-92.

4. Analysis/documentation of Floy tag returns from the 1991 Bristol Bay red king crab fishery. RIR. Watson/Pengilly/Beers. 5-1-92.

5. Technique paper on automated PIT tag detection equipment (in-depth view of the Infopet unit trials conducted at Dutch Harbor in November 1991). Journal paper. Pengilly/Watson. 7-1-92.

6. Summary of mandatory crab observer data, 1991-1992. RIR. Beers. 7-1-92.

7. 1991 Adak and Dutch Harbor brown king crab tagging survey. TFR. Blau et. al.[1]

8. Analysis/documentation of 1991-92 Adak and Dutch Harbor brown king crab Floy tag returns. RIR. Blau/Johnson/Beers.[1]

9. Analysis of crab bycatch in the Bering Sea domestic groundfish fishery, 1990-1991. RIR. Watson/Beers/Ackley[2]. 12-31-92.

10. An evaluation of the effectiveness of modified crab pots for increasing catch of Pacific cod and decreasing catches of halibut and crab. Report completed; prep. for submission to North American Journal of Fisheries Management. Carlile[3]/Dinnocenzo/Watson. 5-1-92.

11. Research report to the Alaska Board of Fisheries. RIR. Watson et al. 12-31-92.

12. Other reports as prioritized from staff meetings.

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[1]See 1992 Gulf shellfish project reports listing.

[2]PacFIN biometrician, Juneau - HQ.

[3]Region I biometrician.

- Advantages of PIT tags are:
1. can get good estimates of known precision on retention rate (1990 it was ~96% for 90 days, 1991 = ??% for 15 mos) using double-tagged (FLOY and PIT) crabs.
2. can get good estimate of known precision on detection rate given a PIT-tagged crab is caught. We want the precision to be as high as possible (>90%).

Still unknown is physical and behavioral effect of tagging on crabs? Pot avoidance, death, illness. Historical Kodiak data says no problema but recent data from Southeastern indicates otherwise.

HOW DO WE ESTIMATE THE HARVEST RATE USING MARK-RECAPTURE STUDY?

- Tag crabs in an area that is believed to be representative of the exploited population. Area T too large for $$ and time so we look at a smaller portion.

- Monitor crab deliveries for PIT tags at key areas and assume that those areas are representative of the whole.

- #H/#Tagged = harvest rate on tagged crabs; this gives us an estimate of harvest rate on the commercially-important portion of legal crabs.

- If we know the # tagged, the portion of the harvest monitored for tags, and the detection rate, we can generate an estimate the harvest rate with known precision.

If this all works out as we hope, we should know the harvest rate within 5% of the true harvest rate.

WHY CAN'T WE CALCULATE A POPULATION ESTIMATE FROM THIS STUDY?

- We can't afford to tag all the legal crabs in Area T or the entire geographic range of Bristol Bay RKC.

- Of the commercially-harvested crabs, we won't know how many were in the study area at the time of tagging survey.

- The fishery mgmt. plan sets the exploitation rate; this is what we need to know.

WHY ARE WE USING FLOY TAGS THIS YEAR?

- Using the same reasoning as for PIT tags to get an estimate of the exploitation rate in this year's fishery with a few gyrations (catcher processors versus catcher only).

- Useful for future PIT tag work -- migration, distribution of tagged crabs, long-term retention rate of PITs -- in landings; where should we monitor for PITS?

- Need visible tags to adjust PIT technology. Visible tag will be the standard by which we compare next year's PIT returns.

1991 Bristol Bay Red King Crab Tagging Project
Briefing 11-5-91 Dutch Harbor

PROJECT OBJECTIVES:

Long-term:

- Determine the harvest rate on Bristol Bay red king crab using tag recovery data;

- If possible, provide pre-season guidance in setting the Guideline Harvest Level (GHL). Use the tag return and commercial catch data together with trawl and/or pot survey data to set GHL, i.e., look at the trawl and pot survey CPUE as an index of abundance and use tag return data and commercial catch to calibrate the index.

- Provide information on mortality, i.e the transfer rate from pre-recruit to recruit; between season survivorship of legal crabs.

Short-term:

- Implement and evaluate present-day PIT tag technology--does the equipment work?

WHY ARE WE DOING THIS PROJECT?

- Where do GHLs come from?

1. Management plan says to take 20% of the mature males up to 60% of legal males.
2. The annual NMFS trawl survey gives a population estimate based on area-swept and then mgmt. plan is applied to the estimate for the calculation of the GHL.

- Area-swept is: every crab caught represents a calculated 32,000 crabs. For example, if 321 legal crabs are caught in the entire Area 'T', the GHL = ~20 million pounds. In 1989 and 1990, only 280 and 316 crabs were caught, respectively.

- Our best estimate of the RKC population is very unreliable. For example, this year one single tow had 350 legal crabs. If that tow had not been thrown out, the GHL could have exceeded 35-40 million pounds.

We are doing this project because, at season's end, whether or not the GHL is achieved, we still don't know what the actual harvest rate is. We only know how much is caught and can't assess what was done to the stock.

WHY ARE WE USING PIT TAGS?

- Visible Alternatives have known shortcomings:

1. Disc tags do not stay on crab thru molt.
2. Floy tags stay on thru molt but may be lost later due to wear, recovery rate can be influenced by cooperativeness of industry, and other human factors.

MEMORANDUM — STATE OF ALASKA

TO: Carl Rosier
Commissioner
Department of Fish and Game
Headquarters - Juneau

DATE: February 11, 1992

THRU: Denby Lloyd
Director
Division of Commercial Fisheries
Headquarters - Juneau

FROM: Leslie Watson
Fishery Biologist
Commercial Fisheries-Kodiak

SUBJECT: Trip Report for PIT Tag Meeting In Minnesota, January 27-31, 1992

I attended a 3 day meeting in Minnesota with personnel from NMFS, Infopet (PIT tag product design and distributor), and consultants to Infopet following the itinerary shown in Attachment I. Additionally, much ad hoc discussion occurred during the daily sessions, during evening dinners and on flights to and from Minnesota with NMFS personnel. My primary objectives were to:

1. obtain an independent assessment by Earl Prentice (NMFS) of the Crab Electronic Identification System (CEIS) built and demonstrated in Dutch Harbor last November by Infopet, including an overall assessment of Infopet's ability to meet ADF&G's future needs,

2. become familiar with the basic components of PIT tags and PIT tag detection systems along with current and near-future developments in PIT tag technologies.

It is intended that the information garnered from this meeting will be used as an aid for the development of a frame-work/schedule for the application of PIT tag technology to the Bristol Bay red king crab population and future applications to other Bering Sea king crab populations. In addition, Earl Prentice's evaluation of our project will be quite valuable in this effort since he has 8 years of experience implementing PIT tag technology on Columbia River salmonids. His current project is on a scale that the crab application could someday approach (approximately 150,000 PIT tags implanted annually). As an aid to reading this trip report, I've included a recent paper by Earl Prentice that not only details his application of PIT tag technology but summarizes how the PIT tag system works (Attachment II).

Tuesday, January 28

Much of the first day of the meeting involved a display of the Infopet corporate structure, as shown in Attachment III. Infopet is a distributorship for Trovan PIT tags and hand-held PIT tag readers and also engineers custom products for a wide variety of applications. The primary uses for the small PIT tags we use in the crab application are: 1) livestock identification, 2) pet identification, 3) identification of industrial products (tools, uniforms, etc.). Trovan is a subsidiary of AEG, a world-wide electronics and communication company based in Germany. Infopet went to great lengths to display the depth of their corporate structure as an indication of their commitment towards product development and stability of their product line. Evaluating Infopet as a sole source vendor becomes an important point to consider in our application as PIT tags are expensive (up to $5.75 per tag), durable (life-expectancy of 10 yrs+) and the animals we intend to tag (red king crab) are very long-lived (up to 20 yrs). Further, the overall PIT tag industry is fairly volatile, but there appears to be a general move towards some standardization of the operating frequency of the small (11-12 mm) PIT tags to around 125 kHz, a frequency that is relatively low but powerful enough for our intended application. There is great interest in this development since it is currently impossible to read PIT tags of one manufacturer using readers from another, which necessitates sole source selection.

My overall assessment of the Infopet-Trovan structure is that although Infopet appears to have a large corporate structure backing them, they are unlikely to derive sufficient benefits to mitigate the relatively high R & D costs associated with the learning process that Infopet will necessarily transit through on their way to providing us the equipment we need. However, this would likely be the case no matter which PIT tag company we selected.

For the remainder of the first day, Earl Prentice presented an overview of his PIT tag application to Columbia River salmonids. His program involves recapturing and identifying marked fish as they out-migrate through various hydro-electric dams on the river. He has developed his techniques to a very high degree using Destron/IDI (Boulder, CO) PIT tags and custom-designed reader (or passive interrogation) systems that he has modified at his own electronics shop. Earl's presentation was useful in two particular areas. First, he has clearly demonstrated a successful passive interrogation system for recapturing PIT tagged juvenile salmonids on a large scale with a reading efficiency of > 95%. Although there are many differences in the salmon dam project and the ADF&G crab project, there are sufficient similarities inherent to both projects, particularly in desired detection rate (>95%) and implementation in a wet environment. Second, he has been a full partner in the development of the PIT tag system by virtue of the fact that he has an electronics lab facility with several staff whose major task is PIT tag system engineering. This approach contrasts with the ADF&G approach; without the subsidization of the project by electronics/engineering staff, we can expect that any custom-designed system we chose will take longer and be more costly to produce. We should be able to take advantage of Earl's expertise and the overall advancement of PIT tag technology to help mitigate these costs. The basic elements to consider in a large-scale application are summarized in Attachment IV.

Wednesday, January 29

Most of the second day included very technical presentations concerning the Trovan hand-held reader system, transponder function, and antenna theory (Attachment V). I did not attend the Trovan Current Design Overview session as proprietary information was to be exchanged between Infopet and NMFS staff (ADF&G has not signed a confidentiality agreement with Infopet).

Kent Lindell (Infopet) reviewed the Crab Electronic Identification System (CEIS) developed for ADF&G last November (Attachment VI). The CEIS unit was the first system that Infopet engineered and was derived from the Trovan PIT tag/hand-held reader system. Approximately 15 people worked on the CEIS, including consultants and sub-contractors. The system was installed and demonstrated as per ADF&G specifications during November 1-11, 1991 in the Westward Seafoods crab facility in Dutch Harbor. The overall reading efficiency (or detection rate) of the system was 100% under test conditions. For simulated processing conditions, the detection rate was ~96%. Infopet was able to meet our customer acceptance goal of greater than 95% detection rate under test conditions. As with any prototype system, the weaknesses of the CEIS were apparent, especially in regards to the specific performance of some of the antenna arrays that did not capture PIT tags and the packaging of the antenna arrays and cables for the salt water cannery environment. A complete analysis of the CEIS testing will be reported in an upcoming Westward Region RIR.

This discussion provided an opportunity for Infopet engineers to explain how the unit was engineered and what aspects could be improved on in future units. It became apparent that the Infopet engineers, due to a lack of lead time, were not as familiar with the basic Trovan components they re-configured into the CEIS as they could have been. Also, they apparently did not take full advantage of the raft of consultants they had on retainer for full CEIS development. Ultimately, in order for ADF&G to get a better product in the future, 1) the Infopet engineers will need to complete basic testing of Trovan components and allow more lead time for development and production of future CEIS units and 2) ADF&G will have to construct better (tighter) product specifications to ensure the established performance (>95%

detection rate) is maintainable, i.e. unit durability. This discussion was very much a learning experience for all in attendance.

Demonstrations were held showing various tag detection units that Infopet tested for application to the crab system. Infopet has just begun to set up a testing lab, so much of what they did have was rudimentary. One particular piece of testing equipment was a variable speed, conveyor belt mock-up for use in evaluating both tag reading distance and speed. This would be very applicable to other crab waste systems where water flow speed might compromise tag reading efficiency. Demonstrations were also made illustrating the non-effect of fresh water on detection distance.

The 'round table' discussions with the University of Minnesota professors were technically very hard for me to follow. Suffice it to say that both of these people know a great deal more about antenna theory than the Infopet staff, and will be a great resource to Infopet if used properly. For example, much of the R & D for units like ours can be modeled and tested in a laboratory setting prior to final construction. A combination of academic and practical engineering should result in the overall reduction of expensive 'trial by error' methodology for the production of suitable crab tag detection systems and will be a large benefit to the ADF&G project.

The second day ended with a captivating presentation by Joe Masin, president of Electronic Identification Devices (EID). Mr. Masin is the force behind distribution and engineering of the Trovan product line in North America. As mentioned before, the small PIT tags we use are used primarily in animal identification and industrial applications for inventory control. Generally, these applications involve implantation of millions of PIT tags. Discussion focused on the ability of Trovan to provide a continuous supply of PIT tags along with a stable product line. For our application, we not only need the best product currently available, we need technology that will not become obsolete once full implementation has begun. This point is the focus of our current review of the feasibility of PIT tag applications to Alaska king crab population studies.

<u>Thursday, January 30</u>
The session began with a tour of Cross Technology, a small manufacturing and assembly plant that produces several of the components of the PIT tag. The company cuts silicon wafers from a template made in California into individual integrated circuits (chips), preparing them for attachment to copper antenna coils. The process is wholly automated; each chip is optically scanned for flaws prior to mounting on frames. The wiring of the chip for antenna attachment is mechanically done and is also scanned for

quality control. Once this is completed, the chip component is sent to Germany for attachment of the antenna coil and encapsulation in hermetically-sealed glass.

The machinery was expensive, very fast and accurate, and fascinating to watch. Most of the technicians were employed to keep the machinery maintained rather than doing the assembly by hand, which is what other PIT tag manufacturers do. Quality control of the chip is a big issue since there are nearly one trillion possible unique code combinations that can individually be encoded on a single chip. It appears that the Trovan product is of very high quality, and the investment ensuring that quality has been substantial. The Trovan product is the only one that is constructed solely by machinery from start to finish.

Infopet staff gave a presentation on the status of specifications for human exposure radio frequency (RF) safety levels. The products we are now using conform to current safety standards. All future products must meet these requirements by specification in bid requests by ADF&G. If Infopet is selected to engineer future products for us, there is an RF testing lab located in Minnesota that can certify the unit(s).

The last formal session of the meeting was a presentation by Dr. Phil Troyk from the Illinois Institute of Technology. He was the lead engineer responsible for the development of the Trovan hand-held reader system and offered lots of technical insight on the design and function of the system. It was very difficult for me to follow most of this discussion. It was evident that our intended application is quite feasible and could be approached from many different angles. Overall, Dr. Troyk conveyed that detection solutions arise from the constraints of magnetic geometry, which is just to say that you have to have a good understanding of what the projected magnetic field is. For our use, we are dealing with a salt water environment in conjunction with lots of electric motors and metal structures that will warp that antenna field. Necessarily, each unit we install has to be 'tuned' to the installment location.

In summary, I found this meeting informative on many levels, the nearly incomprehensible technical level notwithstanding. There was consensus that, with refinements, the technology is available to implement PIT tag technology to Alaska crab populations in the very near future. Results from our 1990 and 1991 studies have shown that technical obstacles can be surmounted to give us highly reliable data. If ADF&G is to pursue a successful implementation of PIT tag technology to Alaska crab population questions, we will have to:

1. take a hard look at the costs involved and resources available to implement the project. In other words, can we continue utilizing test fishery funds to accomplish our goals by securing a long-term commitment (5 yrs) with industry and necessary support from ADF&G staff?

2. lay out a time frame for full implementation,

3. assess our study area (can we make valid inferences about the portion of the Bristol Bay red king crab population we are tagging?),

4. fully evaluate what crab population information PIT tags will give us that no other method currently available will.

attachments

cc: Bill Nippes
Larry Nicholson

Attachment I

VISIT AGENDA
JANUARY 28-30, 1992

Visitors: Earl Prentice, National Marine Fisheries Service
Brad Peterson, National Marine Fisheries Service
Leslie Watson, Alaska Department of Fish and Game

Tuesday, January 28

InfoPet/Trovan/AEG background - Keith Myhre

Pit Tag System Description - Earl Prentice

Dinner - Radisson St. Paul (7:30)

Wednesday, January 29

Trovan Current Design Overview - Kent Lindell

Review of InfoPet Application Engineering - Kent Lindell

Demonstrations

Roundtable Discussions with University of Minnesota Professors
Dr. Marat Davidovitz and Dr. Ramesh Harjani

Trovan/AEG Production and Distribution Status - Joe Masin

Thursday, January 30

Cross Technology Tour

Human Exposure RF Safety Levels

Current Trovan Development Program - Dr. Phil Troyk

Open Discussions

A New Internal Telemetry Tag for Fish and Crustaceans

EARL F. PRENTICE
Coastal Zone and Estuarine Studies
Northwest Fisheries Center
National Marine Fisheries Service, NOAA
Manchester Field Station
P.O. Box 130
Manchester, Washington 98353

ABSTRACT

An ongoing cooperative agreement between the Bonneville Power Administration and the National Marine Fisheries Service was initiated in 1983 to evaluate the technical and biological feasibility of adapting a new identification system to salmonids. The system is based on a passive integrated transponder (PIT) tag. Each tag measures 12 mm in length by 2.1 mm in diameter and is uniquely coded with one of 34 billion codes. The tag's operational life is unknown at this time; however, it is thought to be 10 or more years. The tag can be detected and decoded in place, eliminating the need to anesthetize, handle, or restrain fish during data retrieval.

Biological tests indicate the body cavity of juvenile and adult salmonids is biologically acceptable for tag implantation. Comparisons between PIT-tagged and traditionally tagged and marked juvenile salmonids are discussed. Laboratory and field tests showed that the PIT tag did not adversely affect growth or survival, nor was there any appreciable tissue response to the tag. No evidence of infection due to tagging procedures was observed. Video-taped swim-chamber tests showed no significant effect of the PIT tag on respiratory rate, tail beat frequency, stamina, or post-fatigue survival of juvenile salmonids. Tag retention within the body cavity was near 100% for salmonids weighing from 2 to 10,000 g. Previously PIT-tagged mature salmon which were hand stripped of sperm and eggs showed high tag retention with no adverse tag-caused effects.

During their outmigration, PIT-tagged juvenile salmonids were successfully interrogated at two dams using automatic tag-monitoring equipment. All data were automatically recorded and stored by computer. PIT-tag reading efficiency was 96 to 100%, while reading accuracy was over 99%. The tag-monitoring equipment proved to be reliable under field conditions.

Special tagging considerations with Crustacea and preliminary testing of the PIT tag with two crustacean species are discussed, along with future applications of the PIT tag to fisheries research.

The recognition of an animal or a group of animals within a population is important for many reasons in fisheries research. Many types of tags and marks have been developed to aid biologists in recognizing animals (Rounsefell 1963, Farmer 1981). Unfortunately, no one technique has been totally satisfactory from a biological or technical standpoint. In 1983, the National Marine Fisheries Service began a study supported by the Bonneville Power Administration to evaluate the technical and biological feasibility of adapting a new identification system to salmonids. The system is based upon a passive integrated transponder (PIT) tag. This tag has the promise of eliminating some of the inherent problems with present tagging and marking systems. In addition to the research with salmonids, preliminary tagging studies have also been conducted with two crustacean species. This paper provides an overview of the basic tag operation, biological acceptability in test animals, field testing results, and a discussion of some of the possible applications of the PIT tag.

Tag operation

The PIT tag consists of an antenna coil that has about 1,500 wraps of a special coated, 0.0254-mm diameter copper wire. The antenna coil is bonded to a integrated circuit chip. The electronic components of the tag are encapsulated in a glass tube about 12 mm long and 2.1 mm in diameter (Fig. 1). Each tag is preprogrammed at the factory with one of about 34 billion unique code combinations. The tag is passive, having no power of its own, and thus must rely upon an external source of energy to operate. A 400-KHz signal energizes the tag, and a unique 40-50 KHz signal is transmitted back to the interrogation equipment where the code is immediately processed and displayed, transmitted to a computer via an RS-232 interface, and/or placed on printed hard copy. A portable hand reader (Fig. 2) or a fixed tag-monitor system is used to interrogate and display the tag code information. Data transfer rate is 4,000 bits/s. The interrogation range of the tag varies with the monitoring equipment used: Using a hand reader the reading range is up to 7.6 cm, while with a fixed full-loop interrogator the reading range of detection is about 18 cm (Fig. 3). The tag can be read through

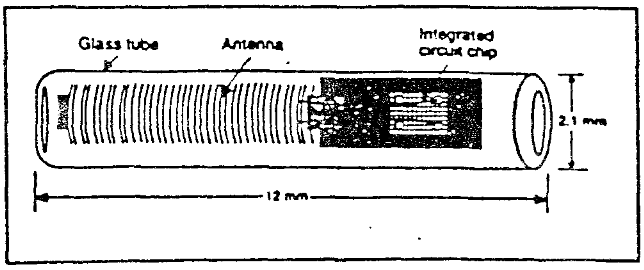

Figure 1
PIT tag.

In Sparks, A.K. (ed.), Marine farming and enhancement; Proceedings of the fifteenth U.S.-Japan meeting on aquaculture, Kyoto, Japan, October 22-23, 1986. NOAA Tech. Rep. NMFS 85, March 1990.

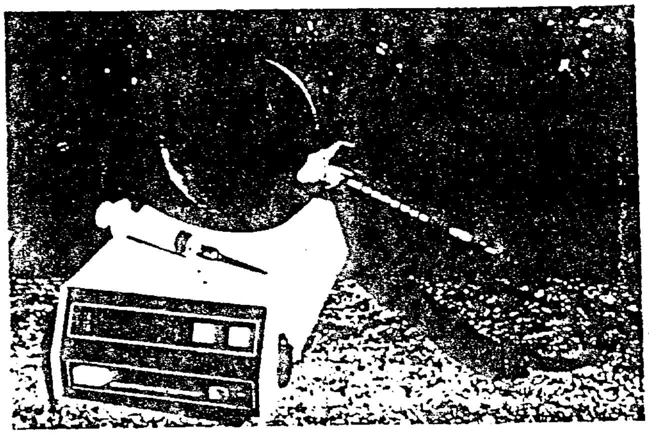

Figure 2
Portable hand-operated PIT-tag reader.

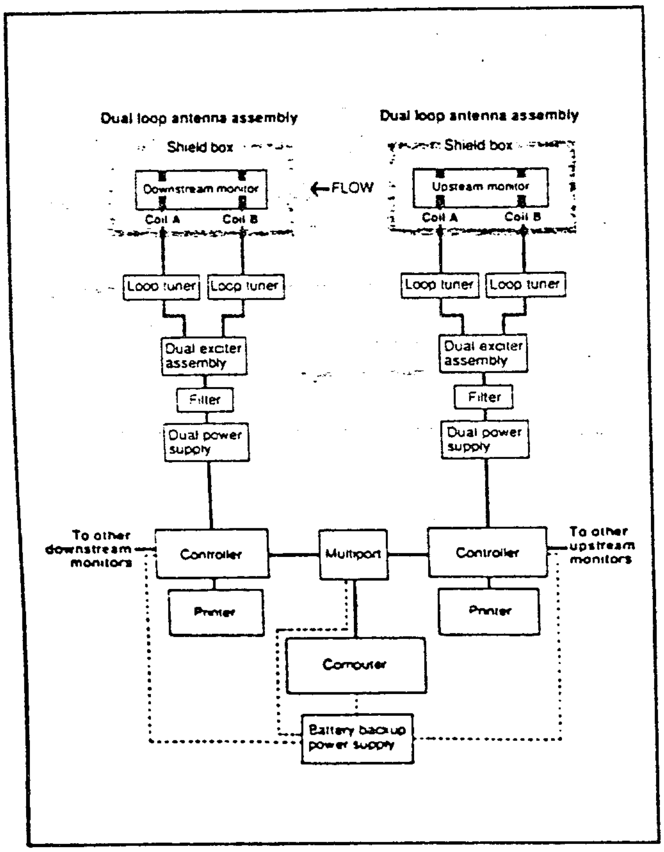

Figure 3
Typical PIT-tag monitoring system for dams.

soft and hard tissue, liquid (seawater and freshwater), glass, and plastic, but not through metal. Extreme heat or cold (60 to −90°C) does not appreciably affect detection or reading of the tag. Successful tag monitoring can take place at velocities up to 30 cm/s.

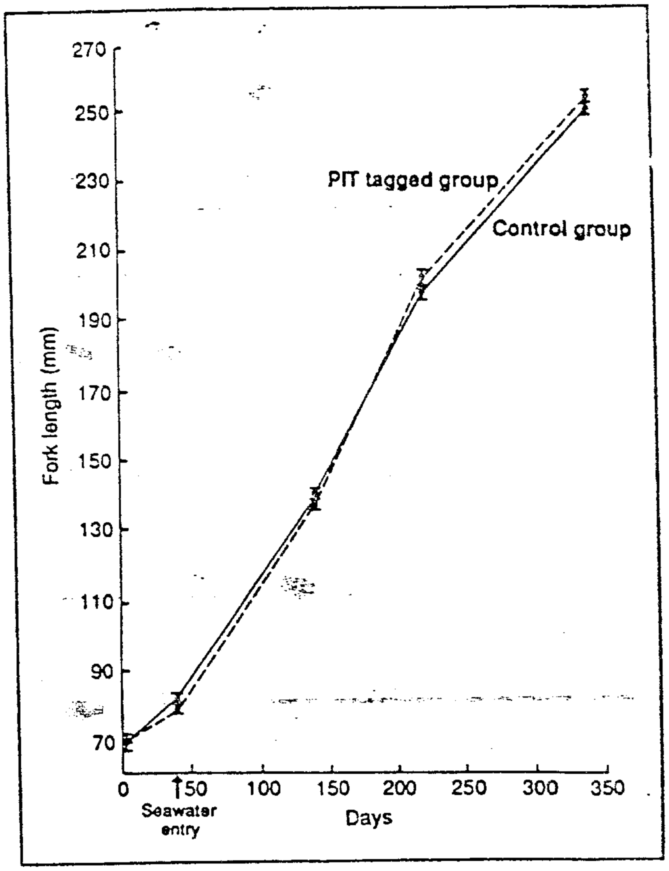

Figure 4
Comparison of length change between PIT-tagged (broken line) and control (solid line) fall chinook salmon (1984 brood) over time.

No special permits are required of the operator other than those obtained from the Federal Communications Commission (FCC) or their equivalent for the operation of low-powered transmitting devices. These permits pertain only to specialized monitoring systems and not the hand-held system already certified by the FCC. No special training or licensing of the operator is required to operate the tag-monitoring equipment.

PIT tag operational life is currently being investigated. Two 300-fish test groups of juvenile fall chinook salmon were established: One control group (no tag), and one tag group. All fish in each test group were weighed and measured at the time the test groups were established. The two test groups were maintained in freshwater until smolted and then transferred to seawater where they are being held in separate sea cages. Observations on growth, survival, and tag retention and operation were made at various intervals. Results after 250 days show no meaningful difference in growth (Fig. 4) or survival between groups of tagged and control fish. Tag retention and operation have been 100%. Because of the passive nature of the tag, an operational life of 10 years or more is expected.

Biological suitability: Salmonids

It is important that a tagging system does not alter growth, survival, behavior, or reproduction. In addition, tag longevity (tag retention and operational life) is an important consideration. Laboratory tests were conducted to examine these factors as they apply to the use of the PIT tag with salmonids. Juvenile and adult chinook (*Oncorhynchus tshawytscha*), Atlantic salmon (*Salmo salar*), and steelhead (*Salmo gairdneri*) were used in the studies. The fish ranged in weight from 2 to 10,000 g. All tags were injected into the body cavity using a modified hypodermic syringe and a 12-gauge needle (Prentice et al. 1986).

Tissue response

Adverse tissue response to the tagging needle and tag has been minimal. Tag-wound condition and tag placement within the body cavity were documented by sacrificing groups of juvenile fall chinook salmon over time (Table 1). In nearly 85% of the fish examined ($n = 195$) the tag wound was completely healed by day 40-45, with only a scar indicating the area of needle insertion. At the end of this same period, 7.3% of the fish had an open wound and 8.3% had a wound that was closed but slightly discolored. All fish ($n = 99$) sacrificed 97 days post-tagging showed complete healing of epidermal and subcutaneous tissue. A the termination of the study (day 127) an additional 102 fish were sacrificed; 99.2% had completely healed tagging wounds, 0.6% had open wounds, and 0.2% had wounds that were closed but discolored. The study also indicated that once the tag was injected into the body cavity, its location was stable over time. The majority of tags were found near the posterior end of the pyloric caeca.

Table 1

Summary of wound condition after tagging and tag location within the body cavity of juvenile fall chinook salmon over time with descriptions of wound condition and tag location codes.

Code	Days post-tagging 40-45	97	127
	Percent fish within a classification code		
Wound code[1]			
A	7.3	0	0.6
B	8.3	0	0.2
C	84.4	100.0	99.2
Tag location code[2]			
A	2.1	0	3.9
B	86.5	69.1	83.3
C	0.0	4.4	1.0
D	5.2	25.0	6.9
E	6.3	1.5	4.9

[1]A Open wound.
B Wound that is closed by a thin membrane and is healing; at times a slight red or pinkish coloration is noticeable in the area of the wound.
C Wound completely healed that may or may not be noticeable by presence of a scar. No red or pink coloration in the area of the wound.

[2]A Tag located between pyloric caeca and mid-gut.
B Tag located near abdominal musculature and often embedded in the posterior area of pyloric caeca near the spleen or in adipose tissue at the posterior area of pyloric caeca.
C Tag found in an area other than those noted; generally between mid-gut and air bladder or between liver and pyloric caeca.
D No tag present.
E Tag partially protruding through abdominal wall.

Effects of maturing fish

Numerous morphological and physiological changes take place as salmon mature. These changes may alter the response of fish to foreign material such as a PIT tag. Furthermore, it is necessary to know whether a tag placed in the body cavity would cause internal damage to eggs and whether a tag would be retained during spawning. A study addressing these issues was conducted using 21 male and 60 female maturing Atlantic salmon. The fish ranged in weight from 2,500 to 10,000 g and in length from 61 to 80 cm. All fish were PIT tagged intraperitoneally using the method of Prentice et al. (1986). The fish were examined several times prior to spawning to determine wound condition, tag retention, readiness to spawn, and general condition, and scanned for tag code using a hand-held scanning unit. When fish were determined to be ready to spawn, eggs were collected by hand stripping. Individuals that spawned were subject to 1-4 strippings.

During the study, no adverse tissue reaction was noted. All tagging wounds were closed and healing by the third day after tagging. No infection or discoloration was noted in the area of the tag. All 21 males matured, and milt was collected from each fish. Tag retention was 100% for the males. A total of 48 females were spawned. Tag retention was 83% for spawning females and 100% for non-spawners. Four tags were passed during the first stripping and four tags during the second-fourth stripping (Table 2). When a tag was passed, it was easily recognized among the eggs. The presence of tags caused no observable adverse effects on the eggs.

Table 2

Spawning dates and PIT-tag rejection by female Atlantic salmon.

Date spawned	No. females spawned	Cumulative no. spawned	No. tags not retained
21 Oct	21	21	1[a]
22 Oct	4	25	0
23 Oct	7	32	0
25 Oct	7	39	2[b]
29 Oct	3	42	3[c]
4 Nov	6	48	2[d]

[a]One tag not retained during 1st stripping.
[b]One tag not retained during 3d and 4th stripping.
[c]One tag not retained during 1st, 2d, and 4th stripping.
[d]Two tags not retained during 1st stripping.

Table 3
Comparison of survival, growth, and PIT-tag retention for the 1986 fall chinook salmon serial-tagging study.

Treatment* and test group	No. days	Test length (g)	Size (g) start	Size (g) end	Survival (%)	PIT-tag retention (%)
Control—well	202	135	4.9	24.9	100.0	—
Control—stream	200	135	5.1	24.8	99.0	—
PIT tagged						
well #1	201	139	3.2	20.5	99.5	100.0
well #2	200	135	5.1	27.4	100.0	100.0
well #3	201	134	7.1	25.9	100.0	100.0
well #4	200	137	9.7	32.6	97.0	100.0
stream #1	200	139	3.2	21.1	95.0	99.0
stream #2	200	135	4.8	22.6	98.0	100.0
stream #3	203	134	7.3	29.9	95.0	100.0
stream #4	202	137	10.0	30.3	98.0	100.0

*Well—constant temperature (10°C) pathogen-free artesian well-water rearing; stream—ambient temperature (9.3-14.4°C) Big Beef Creek surface-water rearing.

Growth and survival

Tests were conducted in 1986 using juvenile fall chinook salmon to determine the minimum size that could be successfully PIT tagged. Fish were tagged at four size ranges and held in separate holding containers (Table 3). The number of fish in each test group ranged from 200 to 203. Fish ranged in weight and length from 1.7 to 14.9 g and 56 and 120 mm, respectively, at the time of tagging. Two separate water supplies (well water and stream water) were used in the study to determine if exposure to water containing fish pathogens might affect tag-wound healing or tag retention. Four sets of weight and length data were obtained on each group of fish during a 134-139 day period. Tag retention was excellent for both groups (99-100%). Growth comparisons (both between the PIT-tagged well- and stream-water groups, and with the control groups) indicated slight differences in length and weight at some sampling periods. However, there appears to be no observable pattern to the differences, suggesting that the glass-encapsulated PIT tag does not compromise growth in juvenile salmonids reared in either well- or streamwater. Range of overall (134-139 days) survival of PIT-tagged fish was 97-100% in the well-water groups and 95-98% in the stream-water groups. Visual inspection of the data (Table 3) shows that mortality occurred in the smallest size groups of fish for both well- and stream-water groups. Examination of mortalities for both initial well- and stream-water groups showed perforation of the intestine as the cause of death. Four of the seven mortalities in the first stream-water test group occurred within the first 2 days after tagging and were from the first 10 fish tagged. Because this was the first group of fish to be tagged in the year, our tagging technique was not up to standard. Tagging technique was refined and no further problems with intestinal perforation was observed in the other test groups. Mortality in the larger size groups was variable (5% or less) and occurred primarily in the stream-water ..eld groups (Table 3). Visual examination indicated that these populations of fish were in various stages of smoltification. Reductions in immune response have been noted during smoltification (Maule and Schreck 1987). It is possible that exposure to pathogens in the stream water, and/or smoltification status itself, contributed to these mortalities. The data suggest that fish weighing 3 g (mean weight) or less, or those undergoing smoltification, experience a low mortality (5% or less) when PIT tagged.

Effects on swimming ability

Tests were conducted to evaluate the physiological/behavioral effects of the PIT tag on swimming ability in juvenile steelhead. The test were conducted in a modified version of a Blaska respirometer-stamina chamber described by Smith and Newcomb (1970) (Fig. 5). Two size ranges of fish were tested. The first group, tested in July 1985, averaged 81 mm in length and 6.5 g in weight. The second test group, in October 1985, averaged 112 mm in length and 17.2 g in weight. In both tests a random sample of fish ($n = 200$) was removed from the main population and intraperitoneally tagged with PIT tags using the procedures of Prentice et al. (1986). A control (non-tagged) group ($n = 200$) was also established from the main population at this time. Swimming tests were conducted on days 0 (same day as tagging), 1, 2, 3, 4, 7, 9, 11, 14, 17, 21, and 25, with 12 tagged and 4 control fish tested each day. All tests were recorded on video tape and monitored at slow speed to determine swimming stamina (time to impingement), tail-beat frequency per minute, respiratory rate (opercular rate/min), and stride efficiency (no. tail beats/min required to maintain a unit swimming speed of one body length/s). All tested fish (tagged and control) were held for 14 days post-test to establish stress survival profiles.

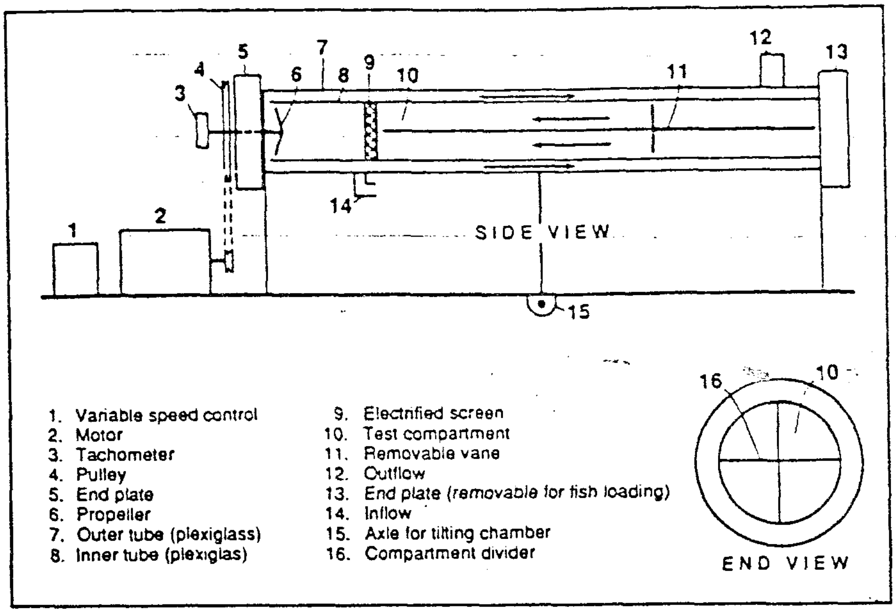

Figure 5
Blaska respirometer-stamina chamber.

The swimming stamina, stride efficiency, and respiratory rate data were compared between tagged and control fish, and between post-tag testing data using the non-parametric Mann-Whitney test. All data analyses followed the methods of Sokal and Rohlf (1981). The data indicated that neither the act of tagging nor the presence of the PIT tag compromised swimming stamina, stride efficiency, or respiratory rate of juvenile steelhead. In addition, post-test survival was not affected by the PIT tag, and tag retention was 100%. At the termination of the post-test holding period, all PIT-tagged fish were sacrificed and necropsies performed to determine tissue reaction to the tags. No adverse tissue reactions or tag migrations within the peritoneal cavity were noted.

Comparisons with traditional tagging and marking methods

A series of tests comparing the PIT tag to traditional methods of marking and tagging was conducted under field conditions using active, outmigrating spring chinook salmon, fall chinook salmon, and steelhead. The tests were conducted at Lower Granite Dam on the Snake River and McNary Dam on the Columbia River. The survival of PIT-tagged fish was compared with that of control fish (handled but not tagged), coded-wire tagged (CWT), CWT plus cold branded, and cold branded. Fish from all treatments were combined in a common holding cage, since each treatment could be recognized by its identifying mark or tag. Five replicates of 25 fish per treatment for a total of 125 fish per replicates were used in the 1985 test. In the 1986 tests, 20 fish per treatment were used for a total of 100 fish per replicate. The fish were held for 14 days in five cages that received a continuous supply of untreated ambient river water. The fish were examined daily for mortality.

No difference in survival between fish injected with the PIT tag and in the other treatment groups was noted at the end of 14 days of holding (Table 4). Mortality varied between dams but not between test groups at a dam. All PIT-tagged fish showed complete closure of the tagging wound at the end of 14 days. No infection or fungus was observed around the tagging would prior to healing.

Table 4
Summary of tests comparing the survival of PIT-tagged fish with that of traditionally tagged and marked fish at dams along the Snake and Columbia rivers.

Location	Species	Days observed	Survival (%) Control	PIT	Cold-branded	CWT	CWT + cold-branded
Lower Granite (1986)	Spring chinook	14	95	98	96	97	99
Lower Granite (1986)	Steelhead	14	100	99	100	99	97
McNary (1986)	Spring chinook	14	86	83	86	80	89
McNary (1986)	Steelhead	14	89	87	93	91	94
McNary (1986)	Fall chinook	14	64	65	59	68	66
McNary (1985)	Fall chinook	14	96	87	94	92	93

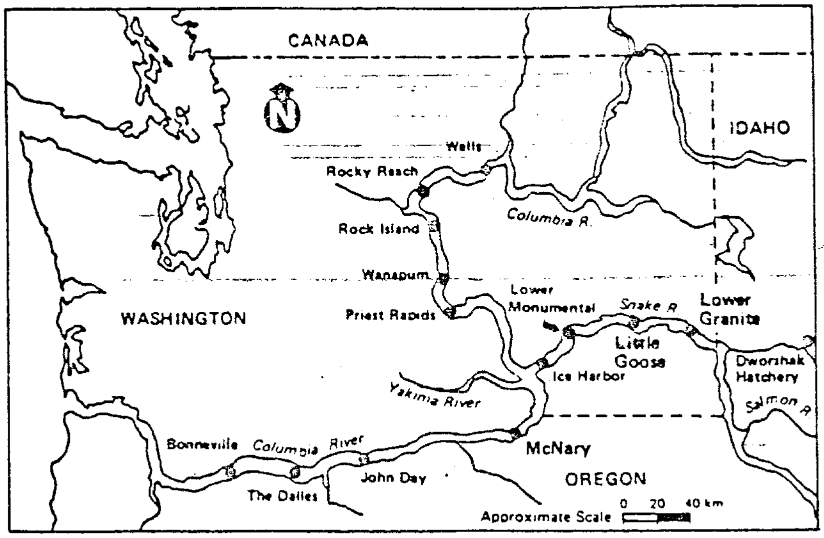

Figure 6
Location of hydroelectric dams on the Snake and Columbia rivers.

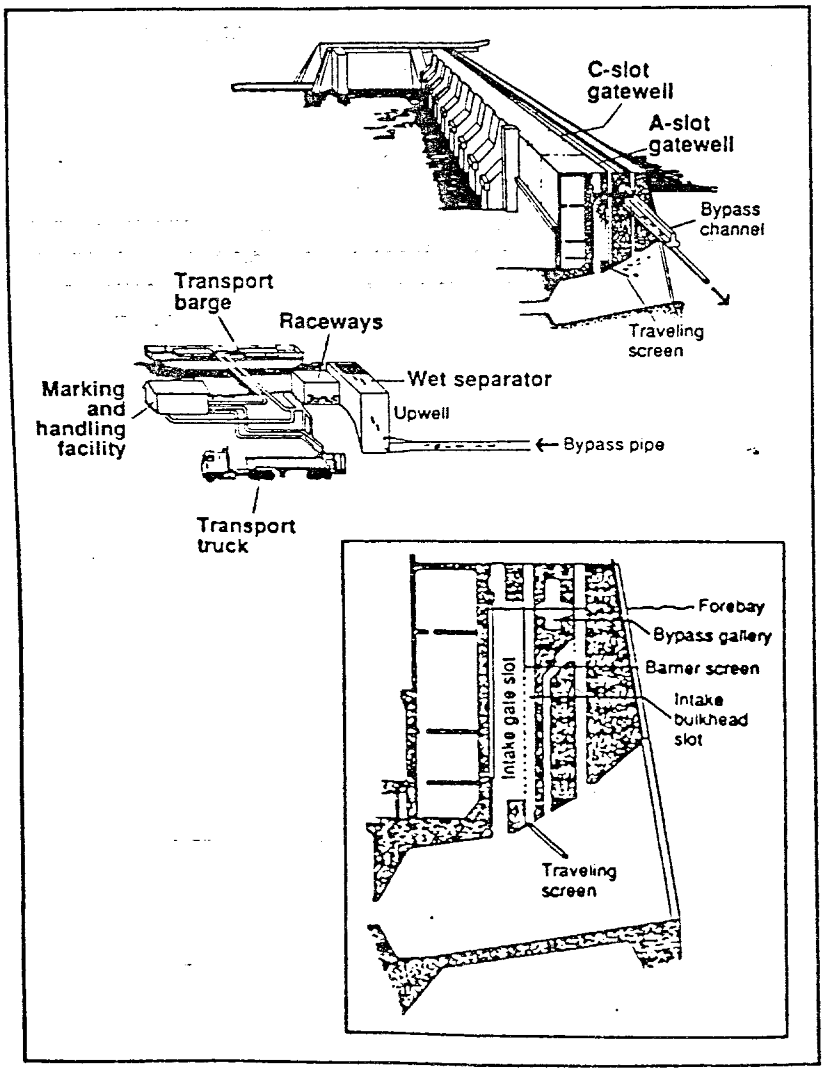

Figure 7
Typical hydroelectric dam with juvenile salmon collection facilities.

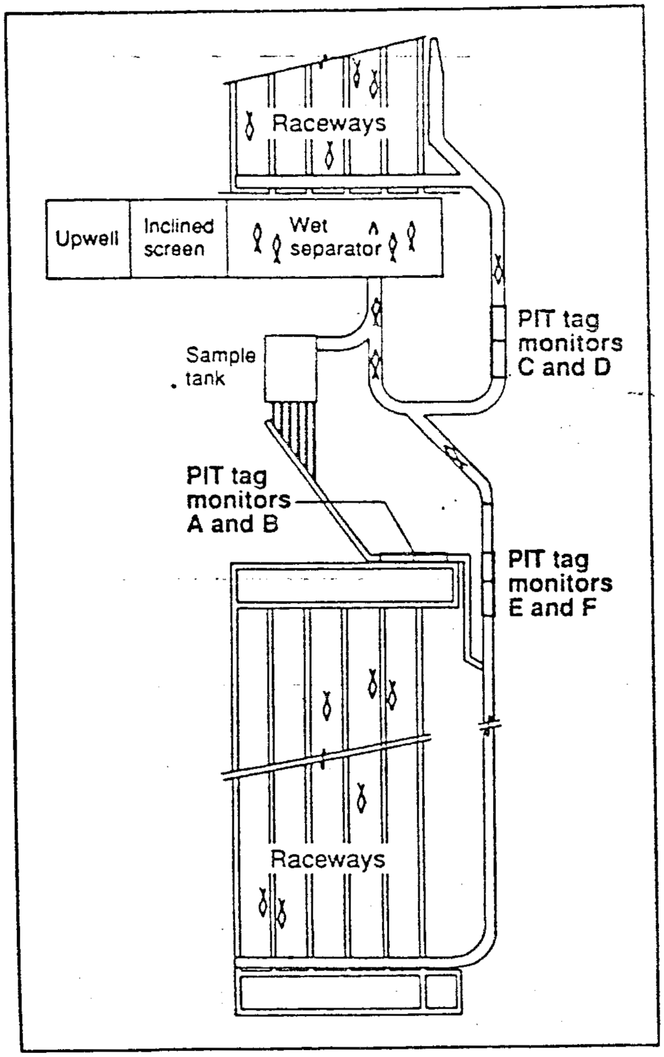

Figure 8
Location of PIT-tag monitors at Lower Granite Dam, Snake River.

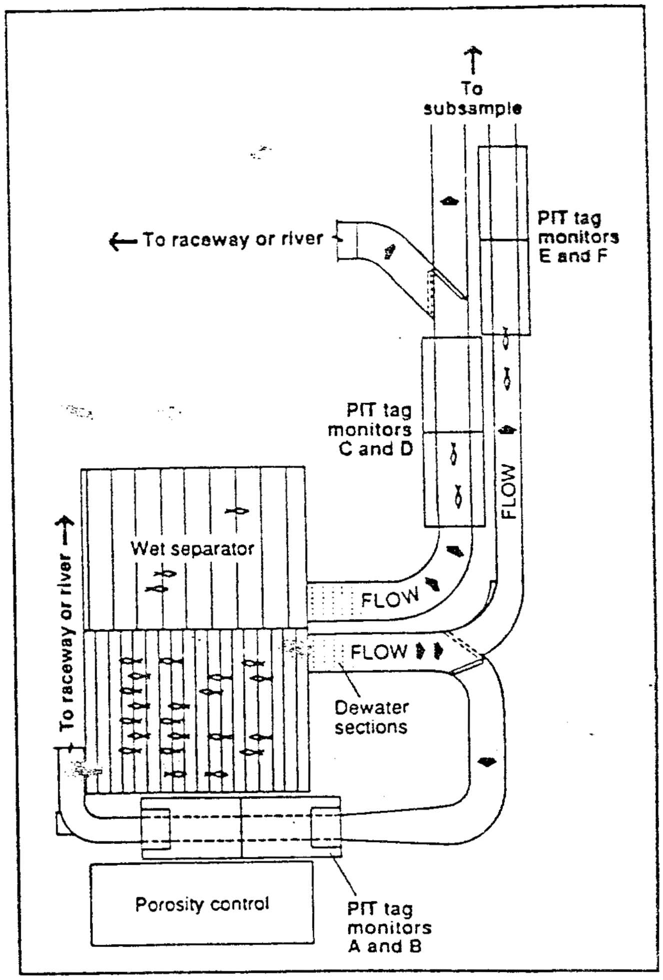

Figure 9
Location of PIT-tag monitors at McNary Dam, Columbia River.

Tag detection at dams

Outmigrating salmonids on the Columbia River system are confronted with a number of hydroelectric dams that cause decreased migration rates and increased mortality (Fig. 6). Several of these dams have been modified to collect and/or divert migrants around them as a method of increasing overall survival in the system. The collection facility generally consists of a series of traveling screens that divert fish from the dam's turbine intakes and eventually into a gallery of pipes that lead to a wet separator (Fig. 7). The separator reduces the volume of water carrying the fish and removes debris. Fish are then diverted either to a raceway for later transport downstream via truck or barge, or directly to a barge for transportation downstream, or back into the river. A subsample of the fish exiting the wet separator is diverted into a holding tank and then to an observation room where they are examined for tags and marks.

Traditionally, methods such as branding and coded-wire tagging (CWT) have been used to evaluate outmigration success. However, because of the unique features of the PIT tag, it could be used in place of the traditional methods, generating better results statistically while using significantly fewer fish. With this goal in mind, prototype PIT-tag monitoring systems were installed at two dams. The monitors were located at the juvenile fish collection facilities at Lower Granite Dam on the Snake River and McNary Dam on the Columbia River. The monitors were placed in positions insuring that 100% of the fish exiting the wet separator were monitored (Figs. 8, 9).

A series of tests was conducted to evaluate the operational reliability, tag reading accuracy (correct decoding of the tag), and reading efficiency (percent tagged fish detected) of the dam PIT-tag monitors. Migrating juvenile spring chinook salmon, fall chinook salmon, and steelhead were used as experimental animals. The tests consisted of releasing 480 PIT-tagged fish in front of the tag monitors. Tag detection efficiency ranged from 96 to 100%, while tag reading accuracy was over 99%. The monitoring equipment remained in an active state at the dams for up to 7 months without major problems. The PIT-tag monitoring system proved to be reliable, efficient, and accurate under field conditions.

Table 5

Summary of data obtained from the release of PIT-tagged and cold-branded fish into McNary Dam Reservoir, Columbia River, 1985 and 1986.

Year	Species	Treatment	Total fish tagged and branded	Pre-release mortalir ,%)	Total fish handled	No. fish observed	Percent observed	SD (%)
1985	Fall chinook	Branded	4,000	2.3	13,239	53	19.4*	9
1985	Fall chinook	PIT tag	400	1.5	400	64	16.2	4
1986	Fall chinook	Branded	5,000	3.8	201,670	95	27.4*	4
1986	Fall chinook	PIT tag	500	3.6	500	142	28.4	1
1986	Spring chinook	Branded	5,000	1.5	154,826	194	38.9*	10
1986	Spring chinook	PIT tag	500	1.0	500	318	63.6	2

*Expanded value to correct for subsampling at the dam.

Table 6

Summary of data obtained from the release of PIT-tagged and cold-branded fish from Dworshak National Fish Hatchery, Snake River, 1986.

					Monitor location					
					Lower Granite Dam			McNary Dam		
Species	Treatment	Total fish handled	Total released	Pre-release mortality (%)	No. fish observed	Expanded*	Percent observed	No. fish observed	Expanded*	Percent observed
Spring chinook	Branded	41,584	40,675	2.2	474	4,659	11.5	362	3,402	8.9
Spring chinook	PIT tagged	2,500	2,450	2.0	464	—	18.9	264	—	10.8
Steelhead	Branded	35,372	35,025	1.0	571	7,061	20.2	39	389	1.1
Steelhead	PIT tagged	2,466	2,424	1.7	928	—	38.1	45	—	1.8

*No. fish observed multiplied by a factor to correct for subsampling at the dam.

Additional tests comparing branded and PIT-tagged juvenile migrants (fall chinook salmon, spring chinook salmon, and steelhead) were made in the field. The fish were released into the Snake River of McNary Dam Reservoir and monitored as they passed through either Lower Granite Dam or McNary Dam juvenile collection and monitoring facilities. In order to obtain sufficiently accurate information on the branded fish, large random subsamples of migrating juveniles, some of which were branded, were diverted into collection chambers. The subsampled fish were anesthetized and examined visually for brands. On the other hand, PIT-tagged fish were automatically interrogated as they passed by a dam equipped with a PIT-tag monitor system. As each PIT-tagged fish was detected, the tag information, time, date, and location of the fish was automatically entered into a computer and printer. Tables 5 and 6 summarize the results of these tests. Because branded fish were subsampled, they were detected at a much lower rate than PIT-tagged groups. An expansion factor was applied to the brand information to obtain an estimation of the true number of branded fish collected (expanded observation value). Since the retrieval of PIT-tag information is based on the monitoring of 100% of the fish passing the collection facility at a dam, no expansion factor is required and 90-95% fewer PIT-tagged fish are needed for a study. Pre-release mortality in the branded and PIT-tagged fish was similar for each test. Use of the PIT tag also allowed the handling of substantially fewer fish than did the branding technique to obtain statistically similar results. Fish in the brand treatment were handled at the time they were branded and again while being examined at the collection facility, along with many nonbranded fish. PIT-tagged fish, on the other hand, were handled only at the time of tagging. It is concluded that the PIT-tagged fish were not compromised by the tag when released into a river or reservoir and that the PIT tag offers substantial gains in efficiency over branding for many applications.

PIT tagging of crustaceans

Permanent identification using external tags and marks for Crustacea has been difficult because of frequent molting. External tags and marks are often lost at the time of molting or can interfere with the molting process, thus altering the animal's behavior or physical well-being. Internal coded wire (CWT) tags can eliminate the problem of tag loss at molting but require the host to be sacrificed to retrieve the tag information (Prentice and Rensel 1977). The new PIT tag has the potential to eliminate these problems. Preliminary experiments using the PIT tag with two species of Crustacea, *Macrobrachium rosenbergii* and *Cancer magister*, have been conducted. The prawns ($n = 58$) ranged in carapace length from 11 to 41 mm and in weight from 1.5 to 45.3 g. The crabs ($n = 52$) ranged in width from 64 to 130 mm and in weight from 44.4 to 273.2 g. All crabs were tagged in the thoracic sinus (hem..coel) while the prawns were tagged in either the thoracic sinus or abdominal musculature. Results for both species showed that the tag was retained through molting and the tag information could be obtained rapidly without sacrificing the tagged animal.

Future applications

Based upon biological and technical information gathered to date and its unique characteristics, the PIT tag will become a valuable tool for a variety of applications in the laboratory and field. Its use will not be limited to salmon, prawns, and crabs but will be applicable to any animal that can accept and retain the tag without compromise. Examples of advantages and applications of the PIT tag include: (1) Individual identification of broodstock; (2) use with groups of animals where serial measurements, e.g., growth, of individual animals are required without sacrificing the animal; (3) reduction in the number of replicated treatments in a study because each animal is uniquely numbered and can be treated as a replicate; and (4) the ability to physically combine different treatments, since individual animals can be identified, removing the variable of rearing-container effect. Other applications might include use in behavioral studies where the movement of animals can be monitored automatically or through capture-recapture methods. It is conceivable that one could monitor bottom-dwelling PIT-tagged individuals through a grid monitor or a monitor system mounted to an underwater sled.

The main limitation to the use of the PIT tag, other than cost and physical and operational constraints, lies, as with most tools, in our imagination. The PIT tag is only the first generation of a number of sophisticated identification systems growing out of our computer age. We must utilize the full potential of these new tools if we are to meet the many challenges of fisheries enhancement and aquaculture.

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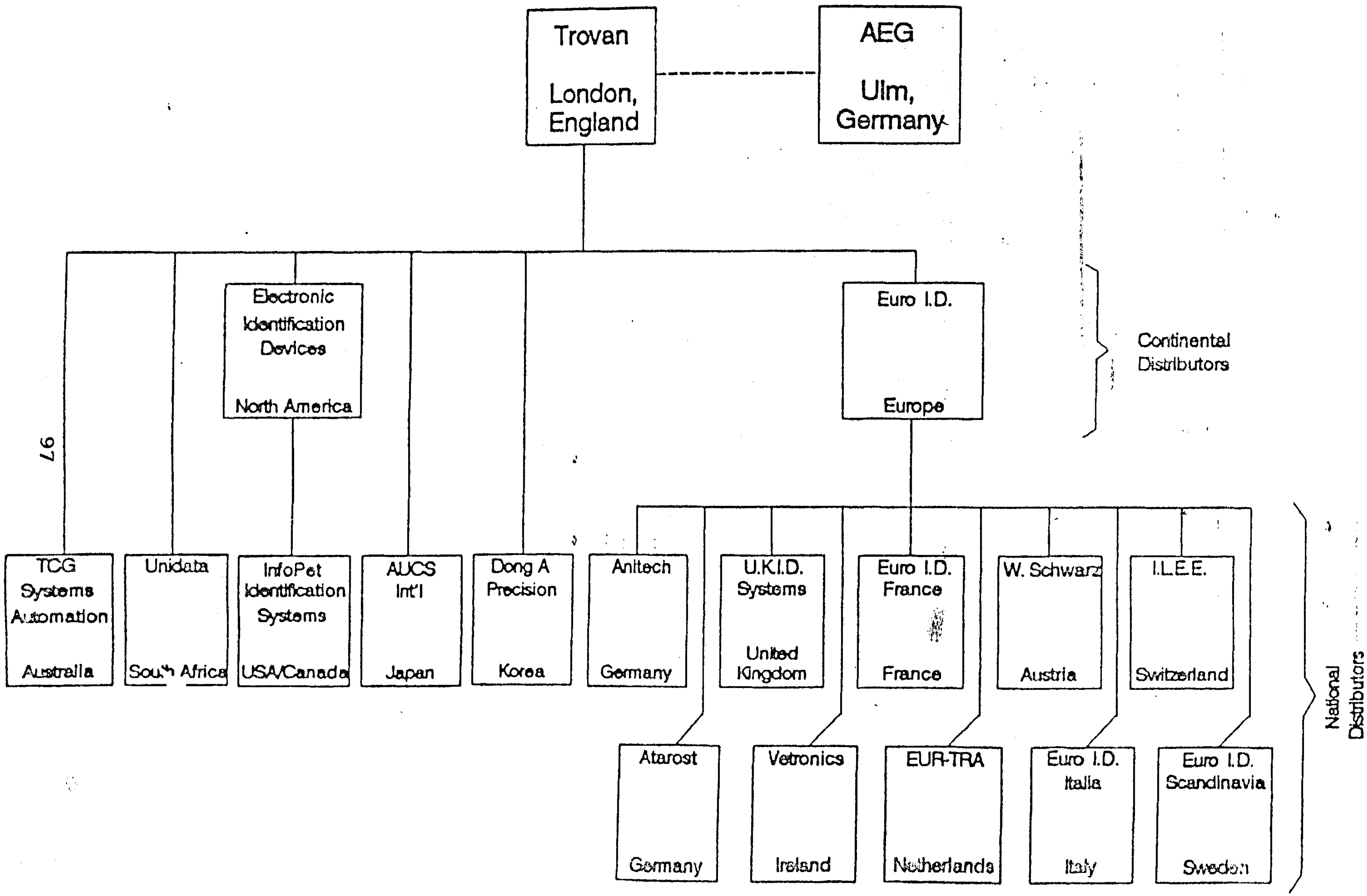
Trovan Manufacturing and Distribution



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Attachment III

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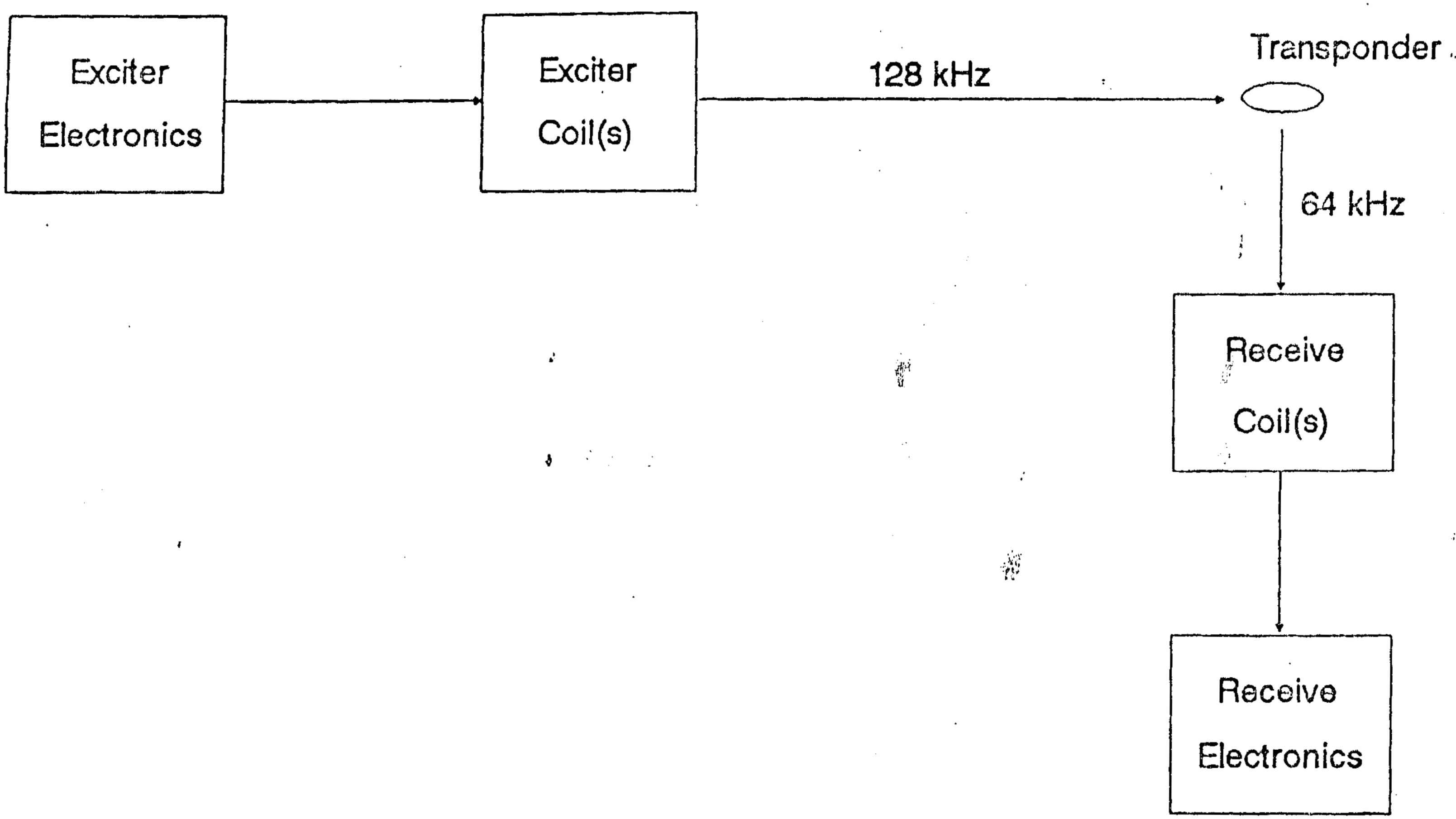
Trovan Transponder System



Attachment V

APPENDIX 6

Reports concerning the use of sausage-shaped artificial collectors (SACs) and red king crabs.

1. Blau, S.F., W.E. Donaldson and S.C. Byersdorfer. 1990. Development of artificial collectors for late larval thru early benthic stages of red king and Tanner crabs. Alaska Dept. Fish & Game, Div. Comm. Fish., Region. Info. Rpt. 4K90-29, Kodiak, Alaska.

2. -----, S.C. Byersdorfer, D.C. Schmidt, W.E. Donaldson and B.A. Johnson. 1992 (in press). First-year indexing of postlarval red king crab abundance by use of artificial collectors in Chiniak Bay, Alaska, 1990. Alaska Dept. Fish & Game, Div. Comm. Fish., Tech. Fish. Rpt., Juneau, Alaska.

3. -----. 1992 (in press). Kodiak kings in a SAC: ADF&G biologists find a new way to collect crabs. Alaska Dept. Fish & Game, Div. Comm. Fish., Prof. Paper-046, Juneau, Alaska.

4. ----- and S.C. Byersdorfer. 1992 (in press). Sausage-shaped artificial collector developed in Alaska to study young-of-red king crabs. Alaska Dept. Fish & Game, Div. Comm. Fish., Prof. Paper-054, Juneau, Alaska. (Note this paper has been submitted to the Bulletin of Marine Science for possible publication.)

5. Donaldson, W.E., S. Byersdorfer, D. Pengilly, and S.F. Blau. 1991. Growth of red king crab in artificial habitat collectors at Kodiak, Alaska. Alaska Dept. Fish & Game, Div. Comm. Fish., Prof. Paper-028, Juneau, Alaska. (Note this paper has been submitted to the Journal of Shellfish Research for possible publication.)

6. Schmidt, D., S.C. Bysersdorfer, S.F. Blau and W.E. Donaldson. 1992 (in press). Review of recruitment of the red king crab in the Gulf of Alaska. Proc. International Sympos. Crab Rehabilitation & Enhancement, Kodiak, Alaska.

APPENDIX 7

1) Definition of *C. bairdi* in respect to *opilio* and define a long term goal

2) Excessive effort levels

3) Size limit on hair crab

4) Molt history for Tanner crab, frequency and "terminal molt"

5) Recruitment bottlenecks

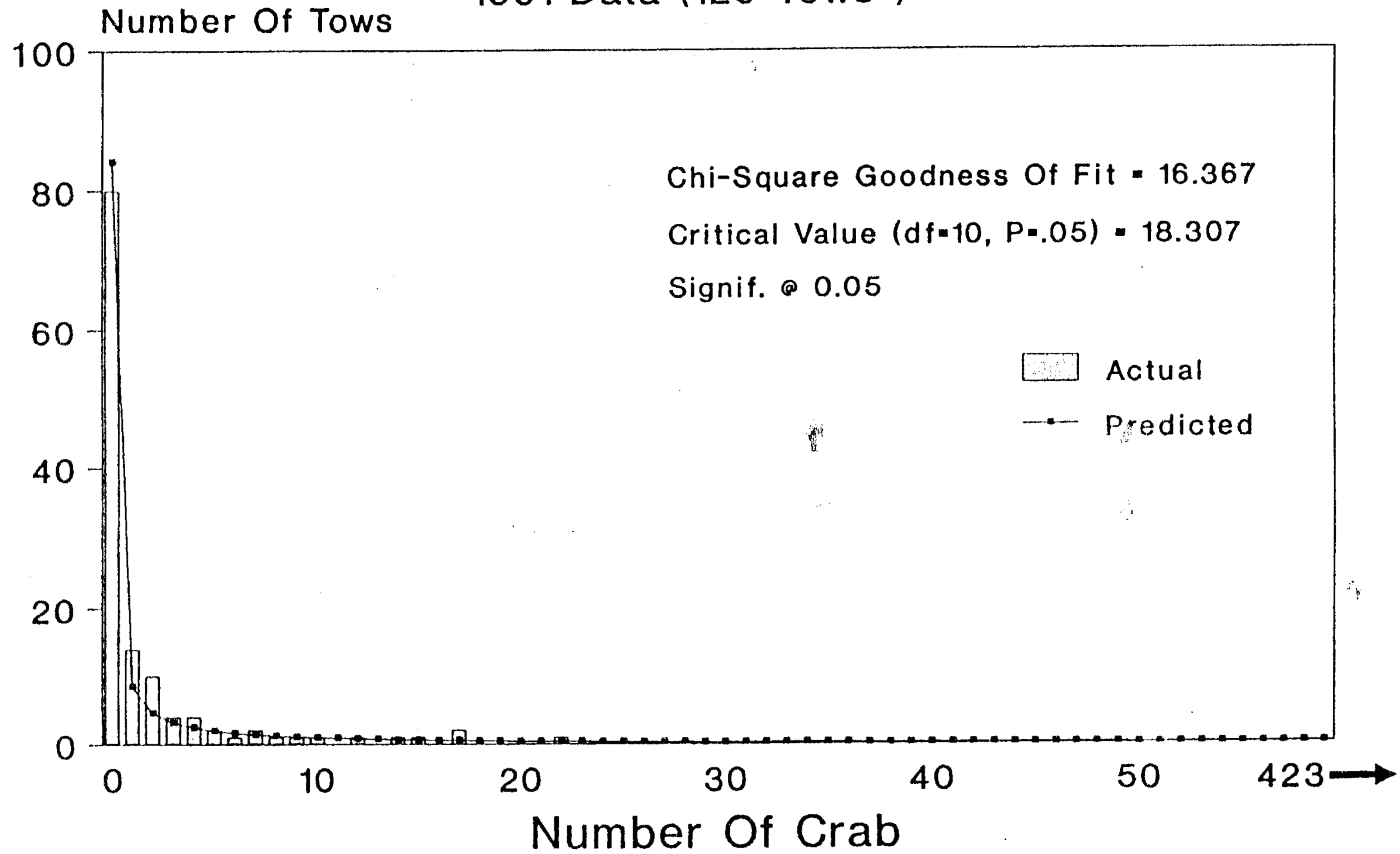
6) Bering Sea crab population assessments

7) Effect of bitter crab or diseases on population

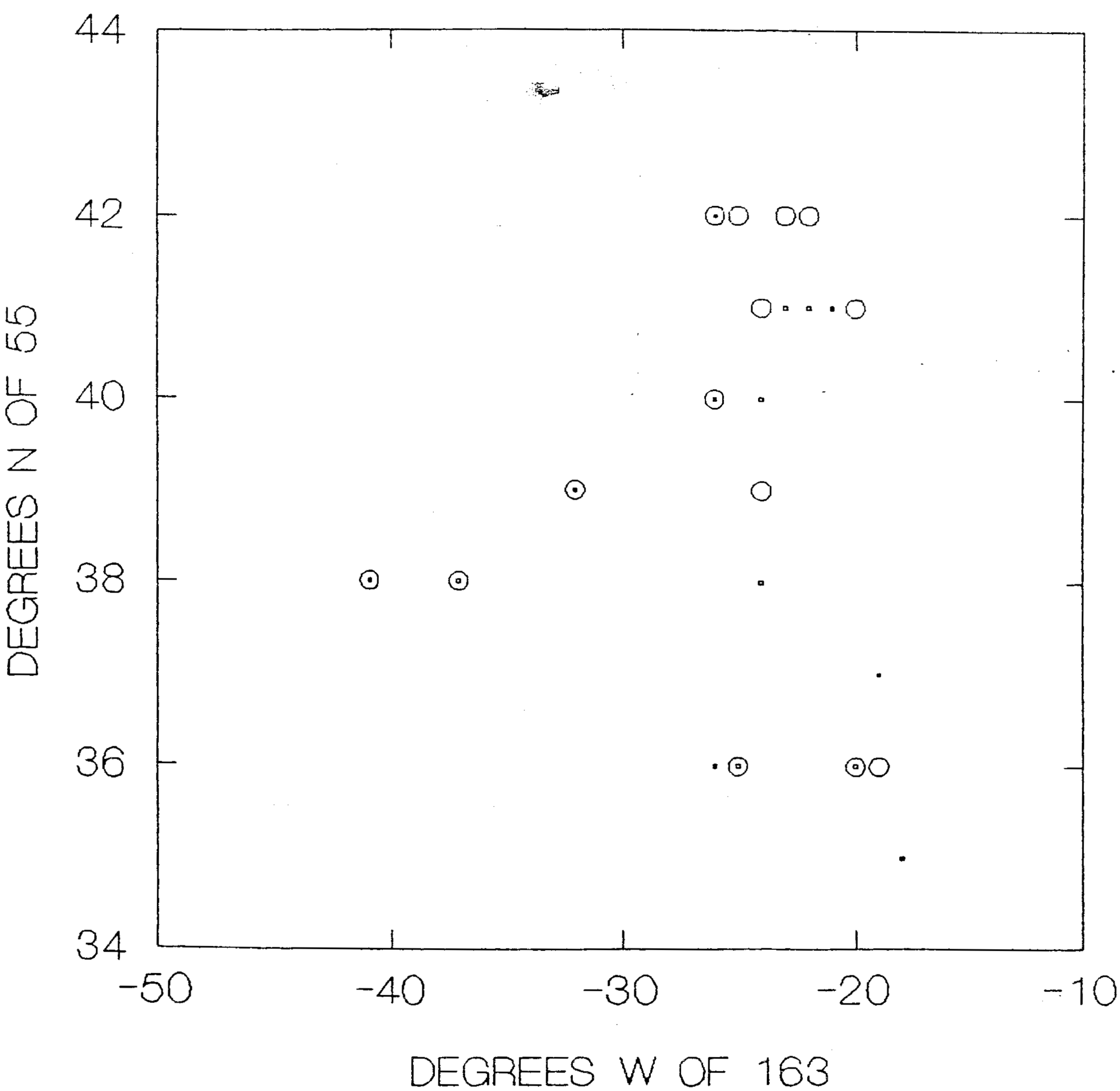
APPENDIX 8

Comparison EBS Legal Male Distribution With Negative Binomial Model

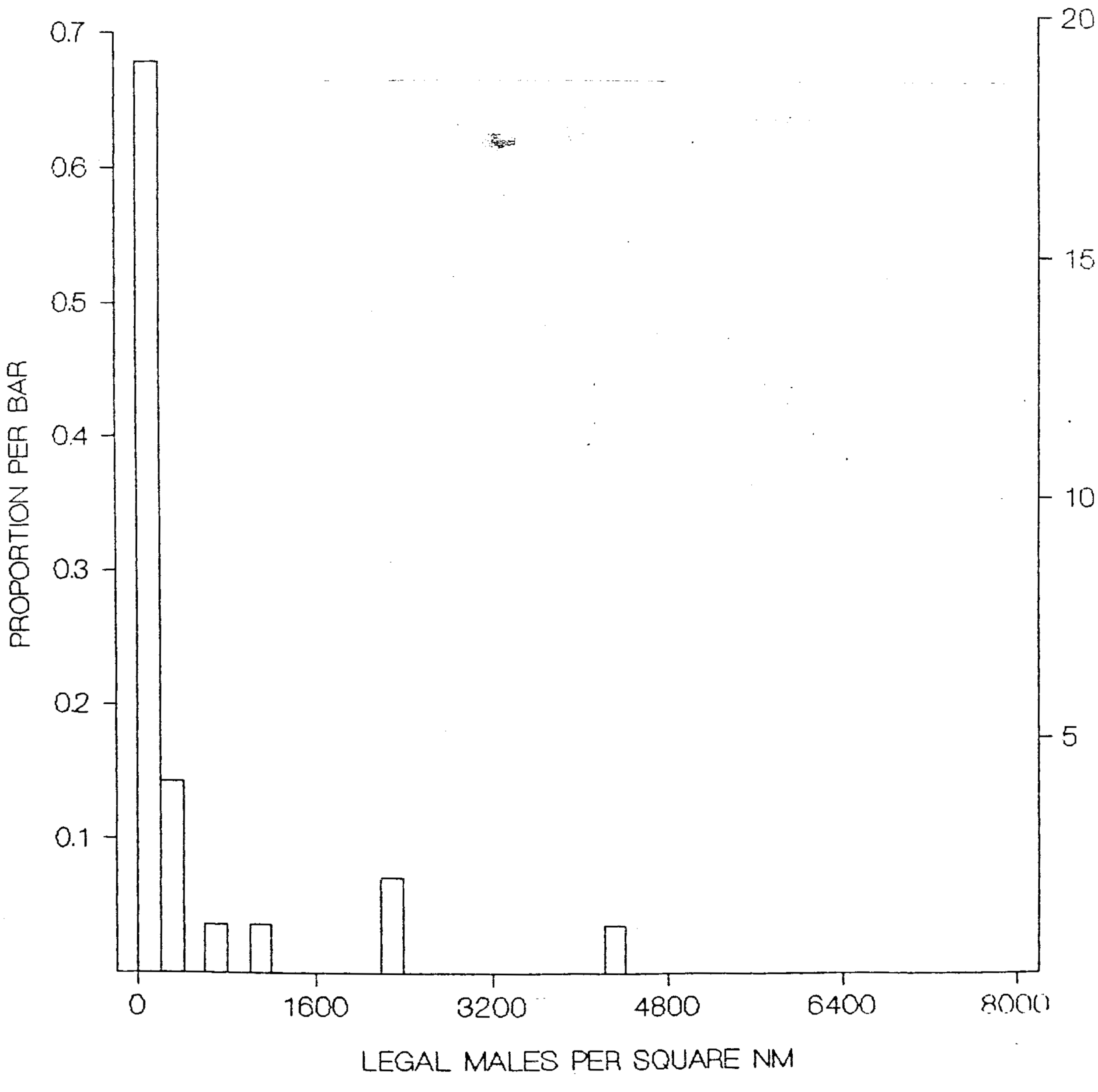
1991 Data (129 Tows*)



* EBS crab range based on 1980-1991 data

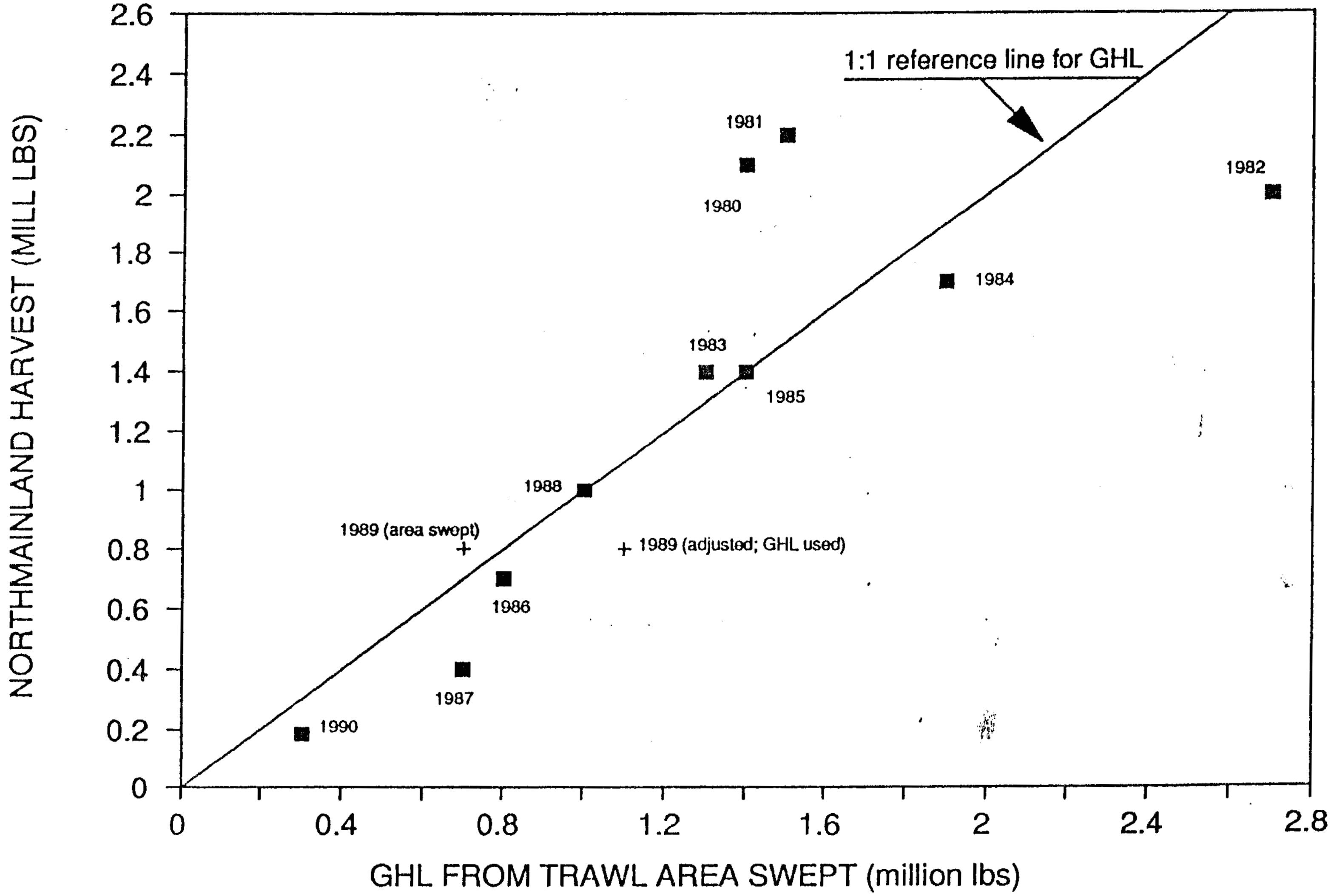


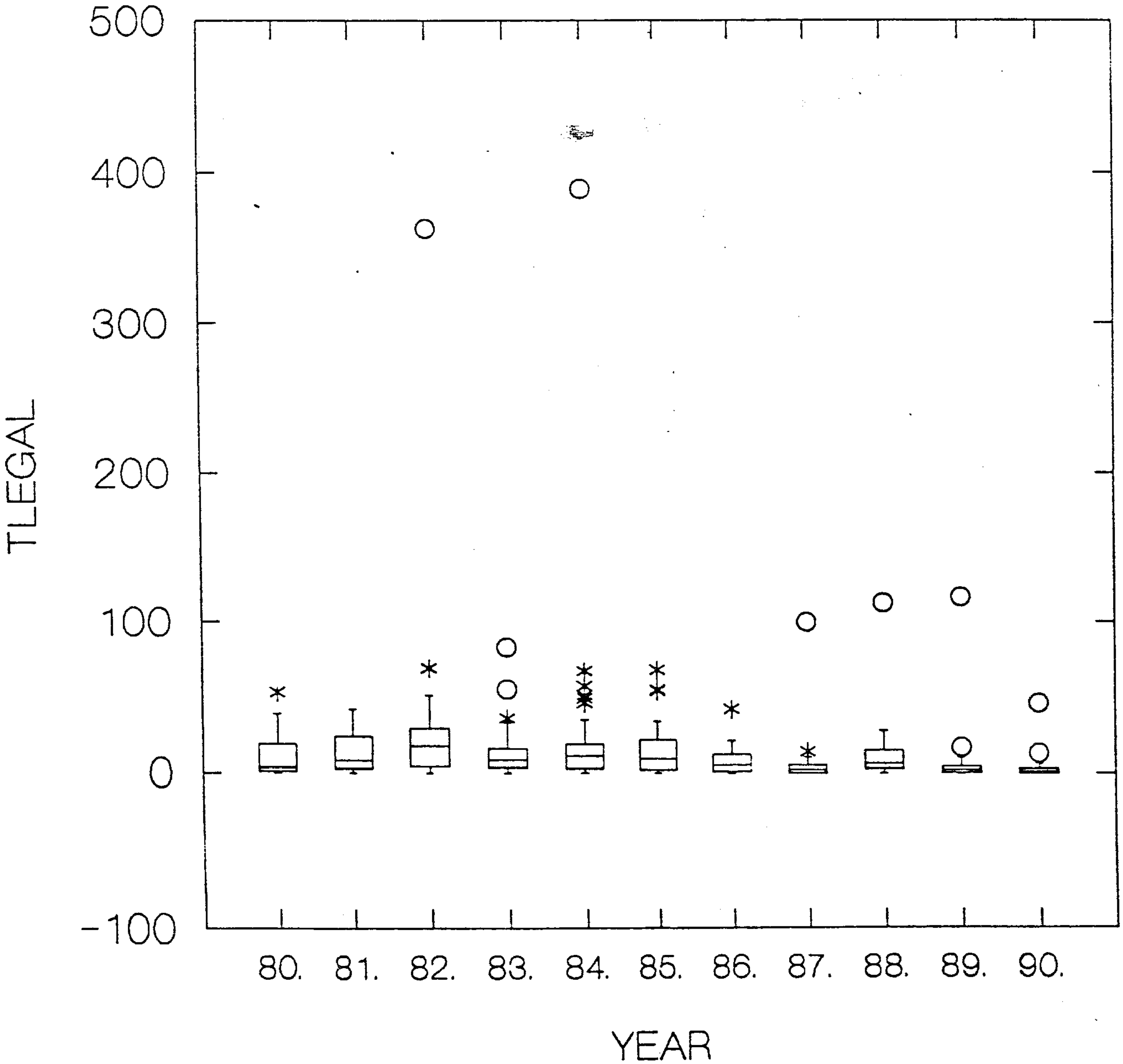
44
42
40
38
36
34
-50
-40
-30
-20
-10
DEGREES N OF 55
DEGREES W OF 163


0.7
0.6
0.5
0.4
0.3
0.2
0.1
PROPORTION PER BAR
20
15
10
5
0
1600
3200
4800
6400
8000
LEGAL MALES PER SQUARE NM

NORTH MAINLAND GHLS VS HARVEST

1980 TO 1990



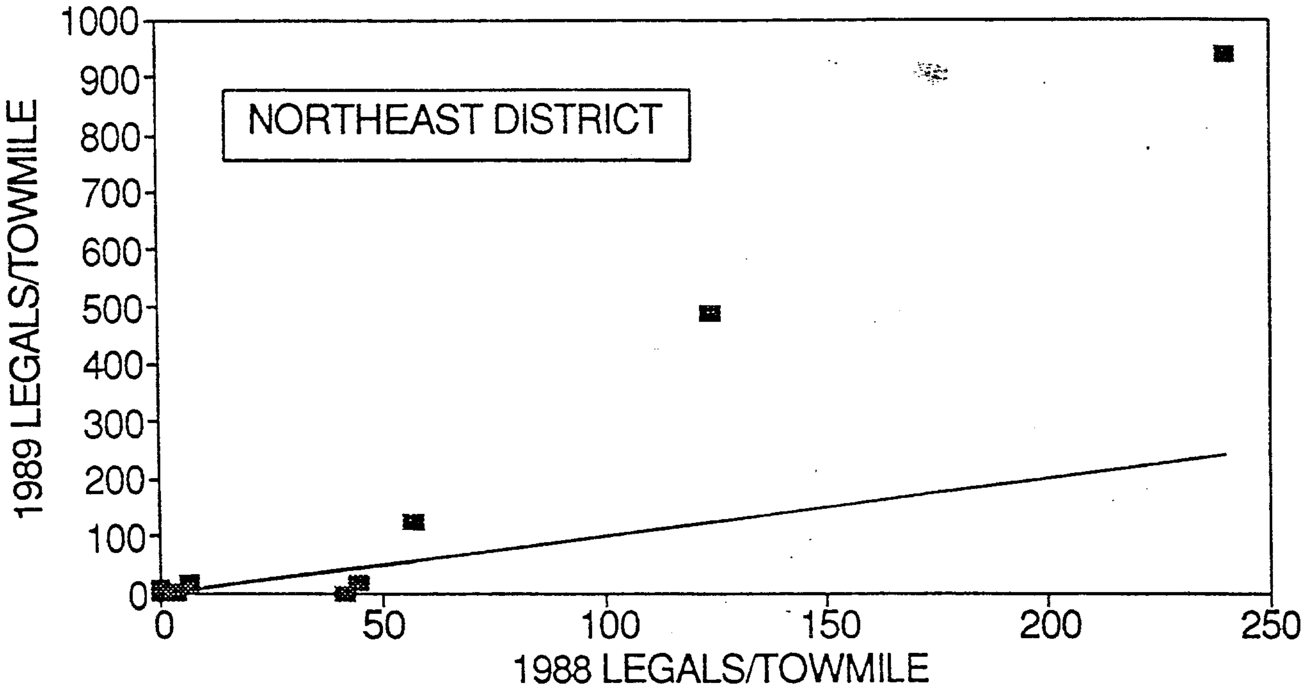


500
400
300
200
100
0
-100
TLEGAL
80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90.
YEAR

NE District

KODIAK TRAWL SURVEY

STATION-BY-STATION COMPARISON



88-89 GHL = .4

88-89 HARV = .5

89-90 GHL=1.0

89-90 HARV=.5

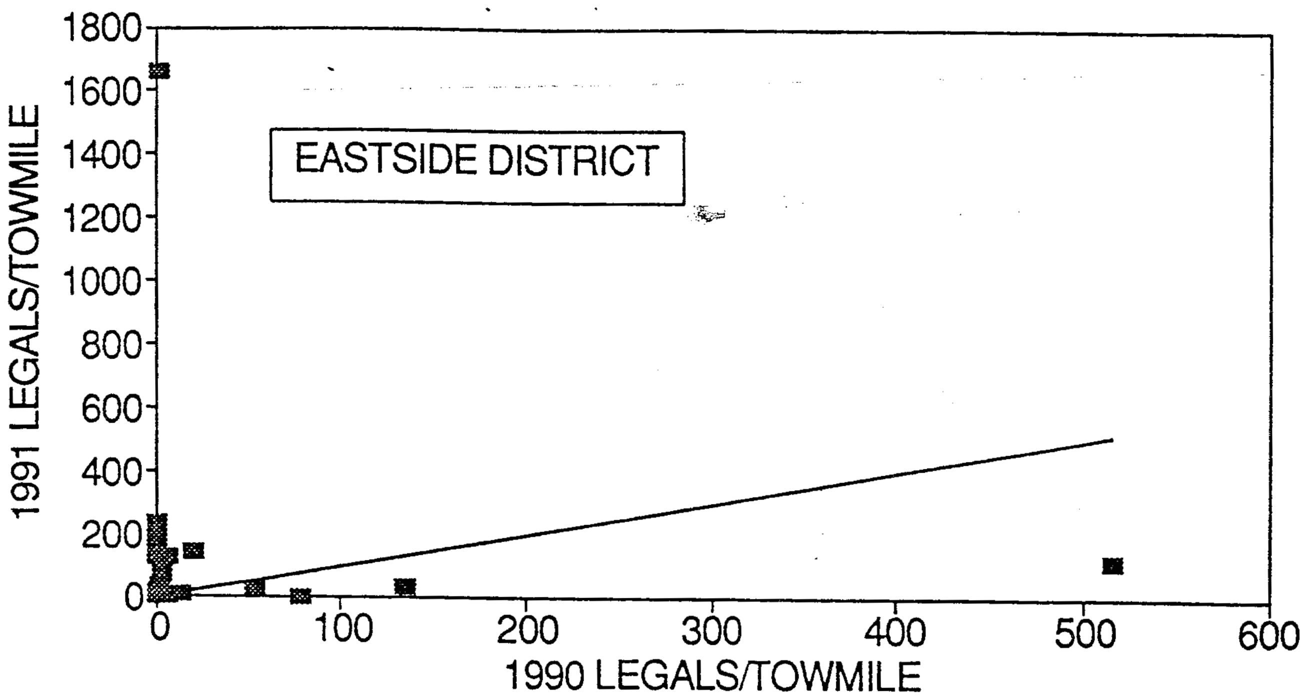
'89 CPUE = '88 CPUE

~37 stations

1098 in Chiniak

KODIAK TRAWL SURVEY

STATION-BY-STATION COMPARISON



90-91 GHL=.8

90-91 HARV =.8

'91 CPUE = '90 CPUE

91-92 GHL=1.8*

91-92 HARV=2.0

*20% HARVEST RATE

APPENDIX 9

Report to the Alaska Board of Fisheries

Economic Impacts of Alternative Pot Limits to Bristol Bay Red King Crab and Bering Sea *C. opilio* Fishermen

Executive Summary

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March 1992

Introduction

The State of Alaska, through its Board of Fisheries (board) and Department of Fish and Game (department), manages the commercial king and Tanner crab fisheries of the Bering Sea and Aleutian Islands (BSAI) under the terms of a cooperative fishery management plan (FMP) written by the North Pacific Fishery Management Council (council) and approved by the U.S. Secretary of Commerce in June 1989. The goal of the FMP is to maximize the overall long-term benefit to the nation of BSAI stocks of king and Tanner crab by coordinated federal and state management. The state is authorized to use pot limits to attain the biological conservation objective and the economic and social objectives of the FMP following criteria listed in the FMP. In establishing pot limits, the state can consider: (1) total vessel effort relative to Guideline Harvest Level (GHL); (2) probable concentrations of pots by area; (3) potentials for conflict with other fisheries; (4) potential for handling mortality of target or nontarget species; (5) adverse effects on vessel safety, including hazards to navigation; (6) enforceability of pot limits and; (7) analysis of effects on industry.

On March 20, 1991, the Board of Fisheries generated an agenda change request to broadly notice the public that the topic of pot limits would be discussed at the board meeting scheduled for March 1992. At that meeting, the board may take action on pot limits for the BSAI king and Tanner crab fisheries. The board has asked the department to review available information on the numbers of king and Tanner crab pots that are fished and/or lost in the Bering Sea, and to provide information on the subject of pot limits as management tools for the crab fisheries.

There are three types of BSAI crab fisheries for which pot limits may be considered. The first type of crab fishery, such as the Norton Sound red king crab and Pribilof Islands blue king crab fisheries, has GHLs so small that, without some means to predetermine fishing effort and make estimates of daily catch rates, the department is reluctant to open the fisheries at all. The management objective for these fisheries is to reduce total effort to a level at which the fisheries can be opened and managed with an acceptable risk of overfishing. Management alternatives include the status quo, with no pot limits; opening with a predetermined, fixed season length based on the preregistered number of vessels and the preseason GHL; and fixing the total number of pots each year based on the GHL and necessary management considerations with per vessel pot limits based on the number of preregistered vessels.

The Bristol Bay red king crab fishery is an example of the second type of fishery. These are high value, high effort fisheries in which increases in the number of vessels and pots, combined with moderate GHLs, have led to derby style fishing with increasingly shorter seasons and increasingly difficult inseason management.

The department believes that these fisheries must extend for sufficient time for inseason data collection and analysis to occur, and extending season length is the management objective. Management alternatives include the status quo of no pot limits; a fixed number of pots per vessel; variable pot limits per vessel; and fixed or variable pot limits per vessel with an overall limit on total pots for the fishery.

The Bering Sea *Chionoecetes opilio* fishery is an example of a third type of fishery where fast moving ice conditions can result in excessive pot loss, especially when vessels fish more than a single load of pots. The ability to move gear over a reasonable period of time to limit pot loss is the management objective. Management alternatives in addition to the status quo include fixed and variable per vessel pot limits.

The analysis presented in this document considers the likely economic impact on the industry of fixed and variable per vessel pot limits in the Bristol Bay red king crab and Bering Sea *C. opilio* fisheries. A serious limitation on the use of individual vessel pot limits as a method for lengthening crab fishing seasons, is that they do little to fix the total amount of gear being fished in the absence of constraints on additional vessels entering the fisheries. The North Pacific Fisheries Management Council is considering a moratorium on commercial fishing vessels allowed in fisheries under council jurisdiction. Because all options the council is presently considering would allow mobility of vessels among fisheries, there would be a large pool of potential new entrants to the crab fisheries even with a moratorium.

Economic Evaluation

Pot limits can impact economic performance by altering vessel gross returns and/or operating costs. In addressing the revenue impacts, it should be recognized that pot limits are not intended to decrease annual fleet harvest. This would imply that pot limits should not reduce total fleet gross revenues. However, there will be gainers and losers if a pot limit is implemented, and the gains and losses on the revenue side will occur through redistribution of harvest within the fleet. Who gains and who loses harvest share will be determined by the impacts of pot limits to the relative fishing power of vessels within the fleet.

Vessel cost data are not available, and thus the impact of a pot limit to the cost side of a vessel operation cannot be directly evaluated. However, the primary underlying source of cost changes will be adjustments to vessel participation time in the fisheries. Thus, the relative impact to a vessel's cost can be evaluated by examining the changes in either season length or vessel participation time that accompanies imposition of pot limits.

Accordingly, the economic impacts to the Bristol Bay and Bering Sea fleets were assessed by examining the allocative impacts of pot limits to fleet harvest (revenue effects), and changes in season length or vessel participation time (cost effects) that accompany pot limits. The economic analysis was conducted in two stages. First, econometric models of vessel performance were estimated for the Bristol Bay king crab fishery and the Bering Sea *C. opilio* fishery. The models relate vessel potlifts and harvests to the number of pots fished, and either season length or vessel participation time, as well as other factors. In the second stage of the analysis, the econometric models were used to simulate fleet and vessel performance under various pot limit scenarios.

In order to illustrate the distributional impacts of pot limits to the fleets, simulation results are presented by vessel size classes. The fleet was divided into three vessel size classes: "Small," less than 90 feet in length; "Medium," equal to or greater than 90 feet but less than 135 feet in length; and "Large," equal to or greater than 135 feet in length.

Bristol Bay Red King Crab Fishery

Vessel performance under two pot limit regimes, fixed pot limits and pot limits based on proportional reductions in pot numbers, were simulated for the Bristol Bay king crab fishery. The simulations were based on 1990 Bristol Bay fishery conditions. The fixed limits set an upper bound on the number of pots that a vessel could fish. The constraints were binding on only those vessels that registered pot numbers in excess of the simulated 300, 250, and 200 pot limits. Vessels fishing fewer than the fixed limits were assumed not to increase their number of pots fished. The proportional limits, in contrast, affected all vessels that participated in the 1990 fishery, reducing each vessel's pot numbers by a constant percent of the number of pots registered for each vessel in 1990. Three proportional limits were simulated, 11.85, 20.68, and 33.17 percent. The proportions were set such that the total number of pots in the simulated fishery under the proportional limits corresponded to that of the fixed limits (i.e. the fixed 300, 250, and 200 limits decrease total pots in the fishery by 11.85, 20.68, and 33.17 percent).

The simulations were conducted by first imposing a given pot limit, and then adjusting season length such that simulated annual fleet harvest (not individual vessel harvest) was unchanged. The results were then compared to the status quo simulation of fishery performance in the absence of a pot limitation.

The segment of the fleet included in simulation was composed of 14.1 percent large vessels, 52.8 percent medium size vessels, and 33.1 percent small vessels.[1] This sample was representative of the entire 1990 fleet, which was composed of 16.25 percent large vessels, 51.67 percent medium size vessels, and 32.08 percent small vessels.

The impacts of the fixed and proportional pot limit regimes to the average number of pots fished by each of the vessel size classes are illustrated by Figure 1 and Figure 2, respectively. Examination of Figure 1 reveals that the fixed pot limits reduced the differences which existed between the number of pots fished by vessels in different size classes. The impacts were not evenly distributed among vessel classes--large vessels incurred a significantly greater reduction in numbers of pots than either of the other two size classes. This occurred because more large vessels carried pots in excess of the limits than did the medium and small vessels. To the extent that pot numbers reflect vessel fishing power, changes across vessel classes in the average number of pots fished reflect changes to the composition of relative fishing power within the fleet; the relative fishing power of the small and medium size classes increased vis-a-vis the large vessel class.

In contrast, examination of Figure 2 reveals that, under the proportional pot limits, the reduction in pots was more evenly distributed among the vessel size classes. Each vessel size class incurred the same proportional reduction in pots. However, in absolute terms, the pot limits impacted each of the vessel size classes differently. For example, in moving from the status quo (no pot limit) to the 11.85 percent reduction limit, large vessels lost approximately 40 pots, while medium and small vessels lost approximately 35 and 27 pots, respectively.

The impact of pot limits to vessel gross returns was examined by comparing changes in average vessel harvests that accompanied the imposition of pot limits. Given a constant exvessel price, changes in vessel harvest directly translate to changes in gross vessel revenue. In examining the harvest results, recall that total fleet harvest remains unchanged, implying that total gross revenue to the fishery is not impacted by the pot limit. Thus, changes in harvest reflect a "zero sum game" where the loss in harvest for one vessel, or one vessel size class, becomes the gain of another vessel size class.

Figure 3 and Figure 4 provide average harvest by vessel size class under both the fixed and proportional pot limit regimes, respectively. The two pot limit regimes

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[1] Vessel size classes are: "Small," less than 90 feet in length; "Medium," equal to or greater than 90 feet but less than 135 feet in length; and "Large," equal to or greater than 135 feet in length. Vessels were deleted from estimation and simulation due to missing data, or reported variable values that were judged to be outliers.

had significantly different distributional impacts on vessel harvest and therefore vessel revenues.

Fixed pot limits had the effect of reallocating from large vessels to small vessels, leaving medium vessels virtually unaffected. The large vessel class lost harvest share under each of the fixed pot limits. Given a 300 pot limit, the harvest of large vessels declined 9.09 percent, relative to the status quo. In real terms, average large vessel harvest declined by 9,929 pounds. At $3.25 a pound, this would translate to a loss in gross revenue of $32,270 per vessel. At the 250 and 200 pot limits, average large vessel harvest declined by 12.34 percent and 15.08 percent, respectively. The corresponding decreases in gross revenue were $43,818 and $53,537 per vessel. The proportional decline in harvest for large vessels was always less than the proportional decrease in the average number of pots. For example, the 9.09 percent decline in harvest under the 300 pot limit accompanied a 21.45 percent decline in pots. This should not be surprising. Economically rational vessels would always remove the least effective pots when confronted with a required pot reduction. This implies that the percentage reduction in harvest will be less than the percentage reduction in pot numbers. Also, increased season length mitigates the impact of fewer pots on large vessel harvest.

Average harvest by medium size vessels was virtually unchanged by the imposition of the fixed pot limits (Figure 3.) The increases in season length that accompanied the pot limits almost entirely offset the reduced effectiveness of fishing fewer pots.

The beneficiary of the fixed pot limit was clearly the small vessel size class. A limit of 300 pots increased average small vessel harvest by 6.6 percent, or 4,582 pounds. Assuming a price of $3.25 a pound, the harvest increase would translate to a $14,891 increase in average small vessel gross revenues. Limits of 250 and 200 pots increased average small vessel harvest by 10.47 percent and 14.29 percent, respectively, or $23,630 and $32,248.

The proportional pot limits had a less pronounced distributional impact among the fleet than the fixed pot limits. Large vessels still lost harvest share and small vessels gained harvest share. However the impacts to harvest were small. As with the fixed limits, medium vessel harvest was relatively unchanged.

Average large vessel harvest was reduced by 2.06 percent, 3.9 percent, and 5.7 percent under the 11.85, 20.68, and 33.18 percent reduction pot limits, respectively. Assuming an exvessel price of $3.25 per pound, these harvest changes translate to respective reductions in gross revenue of $7,320.56, $12,749.10, and $20,393.33 per vessel.

Average small vessel harvest, in comparison to the status quo, increased by 2.08 percent, 3.62 percent, and 5.79 percent under the 11.85, 20.68, and 33.18 percent reduction pot limits, respectively. At the most restrictive limit of 33.18 percent reduction, the increase in harvest was 4,018 pounds, or $13,058.60 exvessel value.

One measure of the effectiveness of effort in the fishery is weight per unit effort (WPUE) defined as pounds of crab per potlift. WPUEs under the fixed and proportional pot limit regimes are reported in Figure 5 and Figure 6, respectively. WPUE, in general, declined by similar magnitudes for all vessel classes under each of the pot limit regimes (the only exceptions were slight increases to small vessel WPUEs under the 300 and 250 pot limits). The pot limits acted to reduce the effectiveness of fishing effort in the fleet.

Caution should be taken not to confuse the terms fishing effectiveness and efficiency. Efficiency relates to the production of a given harvest at the least cost. Vessel cost data, however, were unavailable and therefore were not incorporated in this analysis. Fishing effectiveness, as used here, relates to the quantity harvested within a specified period of time. Effectiveness of fishing effort can be improved by investment in gear and equipment (even though such an investment may not be efficient). This seems to have been the practice of many vessel owners in the Bristol Bay fleet, who have invested in additional equipment and gear (e.g. larger vessels and more crab pots) in an attempt to maintain or increase vessel harvest shares. The fixed pot limit may significantly decrease the returns associated with this investment.

One of the management objectives for pot limits is to increase the number of observations available for inseason stock assessment. The number of available observations is related to the number of times pots are lifted. Figure 7 and Figure 8 show the lifts per pot under the fixed and proportional pot limit regimes. The reported figures indicate that both pot limit regimes were equally effective in providing additional information for inseason stock assessment.

The results presented in Figure 7 and Figure 8 were predicated on the number of vessels and pots in the 1990 fishery. Given the pot limits examined by the simulations, entry of new vessels into the fishery would increase the total pots in the fishery and reduce the number of lifts per pot necessary to take a fixed GHL. Therefore, to maintain a constant number of pots and achieve the increased lifts per pot, pot limits would have to be adjusted according to fleet size. This implies that pot limits will have to be flexible, adjusting up or down depending on vessel registration. Pre-registration deadlines would need to be established so that vessel and gear effort could be accounted for prior to the season opening.

The final area to be addressed is pot limit impacts to vessel costs. As noted, vessel cost data are not available. Therefore, impacts to vessel costs were assessed by examining the changes in season length that accompany the pot limits. The proportional increases in season length that accompanied each of the pot limits are provided in Table 1. The two pot limit regimes, fixed and proportional, resulted in similar increases in season length. This implies that vessel cost impacts will be comparable under either policy. The results indicated that only moderate increases in season length will accompany the introduction of pot limits. Therefore, to the extent that cost increases are proportional to season length changes, vessel cost increases should be minimal.

There may be beneficial aspects of pot limits to fishermen. Pot limits may reduce long run investment in pots. Actual harvest levels relative to Guideline Harvest Levels may increase, on average, as a result of improved inseason information available to managers. Additionally, injuries to crew members, and lost revenue due to accidents and breakdowns may be reduced by having a longer season, if the longer season and reduced amount of gear translates into less intense fishing methods.

The results presented above represent short term impacts to the fishery. In the long run, vessel entry and exit may be affected by the pot limits. Pot limits may decrease the fleet size by decreasing the fishing effectiveness of vessels, and therefore, returns to vessel investment. In contrast, the reduced fishing power of the existing fleet may provide an incentive for other vessels to enter the fishery. This study did not address these long run impacts of pot limits.

Extrapolating future fishery performance from simulation results requires the assumption that existing, pre-pot limit, fishing practices and strategies continue into the future. This has not been found to be the case in other fisheries when gear restrictions have been imposed. Fishermen, under similar circumstances, have adjusted their fishing practices to compensate for the imposed regulation. For example, fishermen in the king crab fishery could potentially switch to larger pots in response to a pot limit. Such adjustments would interfere with managements' ability to obtain the desired outcome from the proposed regulation.

Bering Sea *C. opilio* Fishery

Historical simulations of Bering Sea *C. opilio* fleet performance under fixed and proportional pot limits were conducted, given 1990 fishery and fleet characteristics. The fixed limits of 300, 250, and 200 pots directly correspond to the previous Bristol Bay king crab fleet simulations. Also, in accordance with the king crab simulations, the proportional limits of 5.35, 13.67, and 27.16 percent reductions were chosen such that there was a correspondence between the total number of pots in the fishery under the proportional and fixed pot limits.

In contrast to the king crab simulations, season length was not adjusted in the Bering Sea *C. opilio* fishery simulations. This resulted in simulated fleet harvest declining, given the implementation of a pot limit. Season length was not a constraining factor in the *C. opilio* fishery and was not included as a variable in the model. Vessel participation time was included in the model instead. However, it is uncertain how different vessels will adjust their fishery participation time if a pot limit is imposed. In actuality, it is assumed that fleet fishery participation time will increase in response to the pot limit, and that the allowable harvest will be taken.

The segment of the fleet included in simulation was composed of 14.42 percent large vessels, 60.58 percent medium size vessels, and 25.00 percent small vessels.[2] This sample was representative of the entire 1990 fleet, which was composed of 16.34 percent large vessels, 58.17 percent medium size vessels, and 25.49 percent small vessels.

The impact of the fixed and proportional pot limit regimes to the number of pots fished by the vessel size classes are illustrated in Figure 9 and Figure 10. Figure 9 reveals that the 300 pot limit primarily impacted the large vessel size class. It was not until the pot limit was reduced to 250 pots that medium vessels were substantially affected, and only the 200 pot limit had a substantial impact to small vessels.

The impact of the fixed pot limits to the relative fishing power of each of the vessel size classes was underscored by the proportional reductions to average pot numbers across the size classes. Large vessels, incurring a significantly greater reduction to pot numbers than the other size classes, had their relative fishing power within the fleet significantly reduced by the fixed pot limits.

By construction, the proportional pot limits reduce the pot numbers of each of the vessel size classes by the same percentage (see Figure 10). Differences did exist, however, in the absolute number of pots each vessel class lost. For example, large vessels lost approximately 18 pots under the 5.35 percent reduction limit, whereas medium and small vessels lost approximately 14 and 13 pots, respectively.

The distributional impacts of the proportional limits on absolute numbers of pots per vessel differed from that of the fixed limits. Large vessels lost fewer pots under each of the proportional limits in comparison to the corresponding fixed limits. Medium vessels lost more pots under the proportional limits than the

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[2] Only those vessels included in original model estimation are included in simulation. Vessels were deleted from estimation due to missing data, or reported variable values that were judged to be outliers. Additionally, catcher-processors were not included in estimation and, therefore, are not included in simulation.

corresponding fixed limits, though the differences were small. Small vessels, however, lost a substantially greater number of pots under the proportional limits.

The average vessel harvest by size class, under the two pot limit regimes, are presented in Figure 11 and Figure 12, respectively. In many ways the results are qualitatively similar to those of the king crab fishery. Average reductions in vessel harvest under both pot limit regimes were relatively moderate in comparison to the reductions in pot numbers. This would imply that average vessel fishery participation time, and hence average vessel costs across the fleet, would also increase moderately under either pot limit regime. Additionally, as with the king crab simulations, the two pot limit regimes had different distributional impacts on harvest across vessel size classes. The large vessel size class incurred significantly greater harvest reductions under the fixed limits than the other two size classes. In contrast, the proportional pot limits more evenly distributed harvest reductions across the vessel size classes.

In actuality, total fleet harvest will not be decreased by a pot limit. It is safe to assume that the allowable harvest will be caught by the fleet. To accomplish this, the fleet would have to exert additional effort by increasing the amount of time spent participating in the fishery. Increases in fishing time impose additional costs on fleet vessels. The extent to which fishing time will be increased depends on individual vessel strategy.

One possibility is that all vessels will increase their fishing time by equal proportions. In this case, we might expect that the proportional reductions in harvest would represent an upper bound on the proportional increase in vessel participation time in the fishery. This would imply that under the fixed 300, 250 and 200 pot limits, time spent in the fishery would increase by proportions approaching the 3.4 percent, 8.43 percent and 16.67 percent decreases in harvest, respectively. Cost changes under the proportional limits would be similar, approaching the 2.95 percent, 7.66 percent, and 15.59 percent harvest reductions that accompany the 5.35, 13.67 and 27.16 percent limits, respectively.

Given the aforementioned scenario, it is reasonable to expect an outcome in the *C. opilio* fishery similar to that reported earlier in the king crab fishery. Under the fixed limits, large vessels would only be able to gain back a portion of their lost harvest. Small vessels, which incur the lowest harvest reduction, would experience an increase in their harvest share. Medium size vessel harvest would probably increase moderately as a consequence of this segment of the fleet controlling a larger portion of total fishery pots.

An alternative scenario would involve vessels basing the additional amount of time spent in the fishery on their individual harvest reduction. In this case, under the fixed limits, large vessels which incur much heavier reductions in harvest than the other vessel classes, would have to increase their participation time by a significantly greater amount than the other vessel size classes. As a consequence, this vessel class would incur the greatest cost increases from the pot limit. Under the proportional pot limits, all vessel classes would incur similar cost increases since all vessels incur similar proportional decreases in harvest.

It is evident that, under any scenario, large vessels are going to incur a disproportionate reduction in their net operating revenue under the fixed limits. The reduction may come from decreases in harvest, and therefore gross revenue, or it may come from having to increase fishing time by more than the other vessel size classes, and therefore through greater cost increases. In contrast, under the proportional limits, all vessel size classes will incur similar percentage declines in net revenue.

The impact of the pot limits to vessel fishing effectiveness is reflected by the changes in WPUE, which are reported in Figure 13 and Figure 14. The fixed limit affected large vessel WPUE more severely than the proportional pot limits. Conversely, the proportional limits had a greater impact on medium and small vessel WPUE than the fixed limits. However, in all cases, the reductions in WPUE differed only moderately between the proportional and fixed regimes.

The decreases in fleet WPUE were relatively small in comparison to the decrease in pot numbers. This is interpreted as an indication that abundant *C. opilio* stocks diminish the benefits associated with fishing additional pots. For example, fishing additional pots allows for an increase in pot soak time. However, desired soak time, and therefore gains from additional pots, would be expected to decrease as stock abundance increases. A second benefit of fishing additional gear is that it allows for pots to be placed in several locations on the fishing grounds. But here again, increases in stock abundance may be expected to decrease the gains in searching efficiency from dispersing pots in several locations.

A pot limit in the Bering Sea *C. opilio* fishery may be expected to provide some of the same benefits to fishermen as those mentioned in the king crab fishery discussion. Pot limits may reduce long run investment in pots by reducing the number of pots vessels fish, and the number of pots vessels lose. Additionally, pot limits may protect future stocks by decreasing stock mortality associated with "ghost fishing".

Some of the same caveats that were associated with the king crab simulation apply to *C. opilio* simulations. All results were predicated upon 1990 fishery conditions and past fishermen behavior. Changes in fleet characteristics and/or fishery characteristics may be expected to lead to different outcomes. Additionally, fishermen can be expected to adjust their fishing strategy in response to the pot limits. For example, fishermen may increase the size of pots fished, which would partially offset the ability of the pot limits to decrease the number of pots lost, as larger pots would mean fewer pots could be moved in a single load. Finally, the number of vessels in the fishery may increase. However, unlike the king crab fishery, this outcome may not severely decrease the effectiveness of a pot limit. The primary management concern in the *C. opilio* fishery is not the total number of pots in the fishery, but rather the number of pots individual vessels carry.

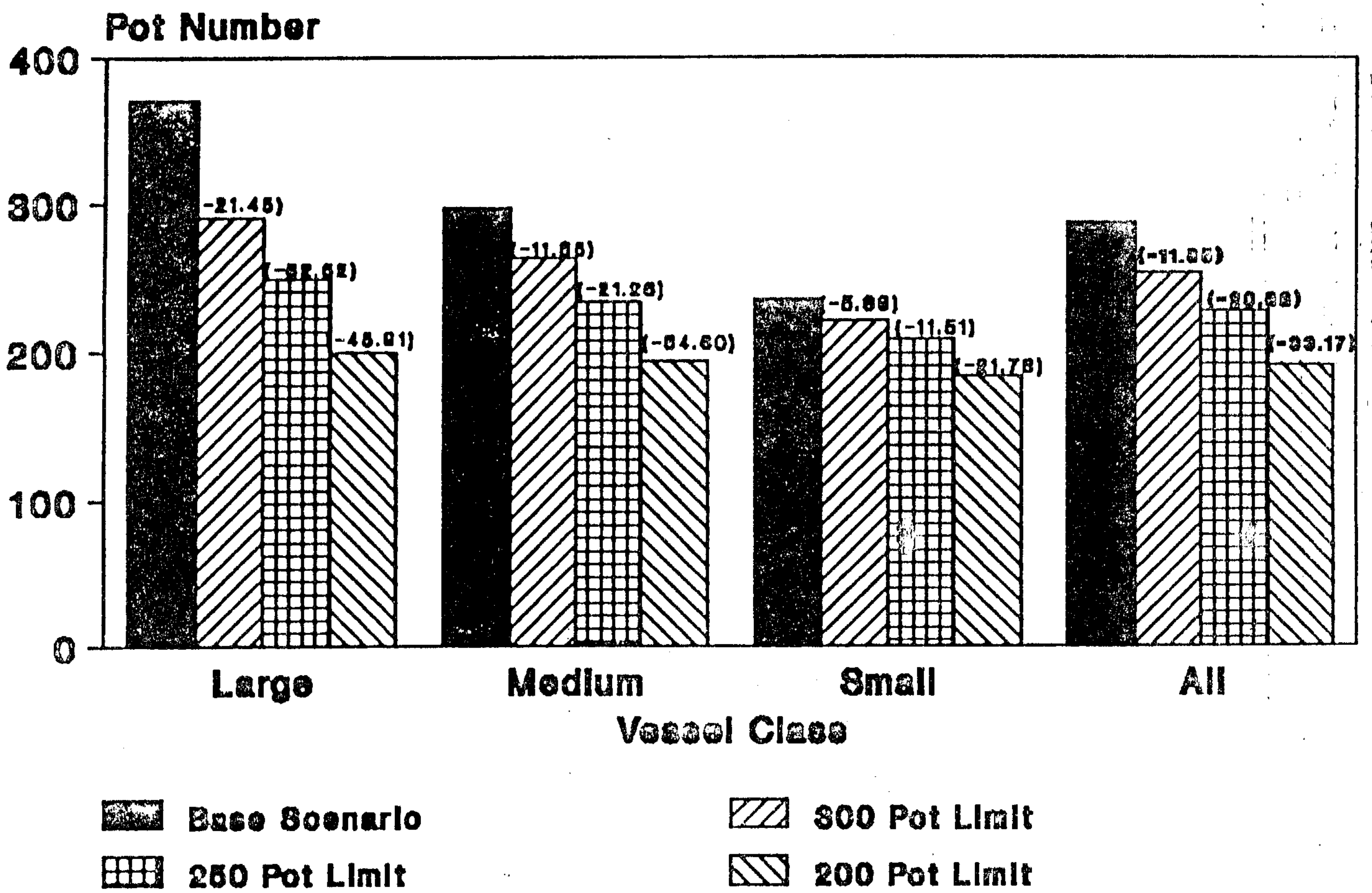

FIGURE 1. Bristol Bay Red King Crab Fishery: Average Pot Numbers by Vessel Size Class, Large, Medium, Small, and Fleet Average (All), for Fixed Pot Limits (300, 250, 200); Percentage Changes in Pot Numbers from the Base Scenario are in Parentheses.

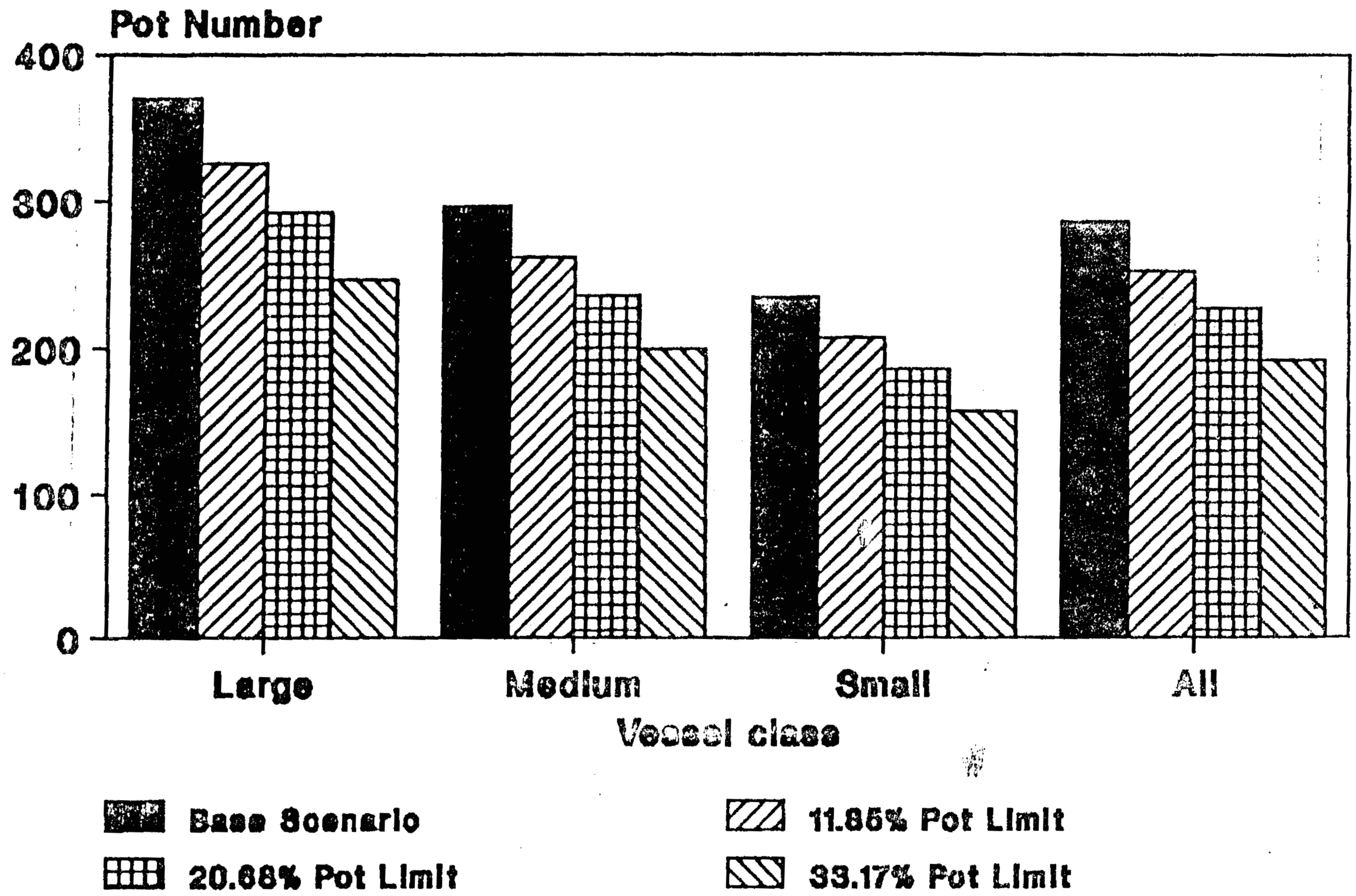

FIGURE 2. Bristol Bay Red King Crab Fishery: Average Pot Numbers by Vessel Size Class, Large, Medium, Small, and Fleet Average (All), for Proportional Pot Limits (11.85%, 20.68%, and 33.17%).

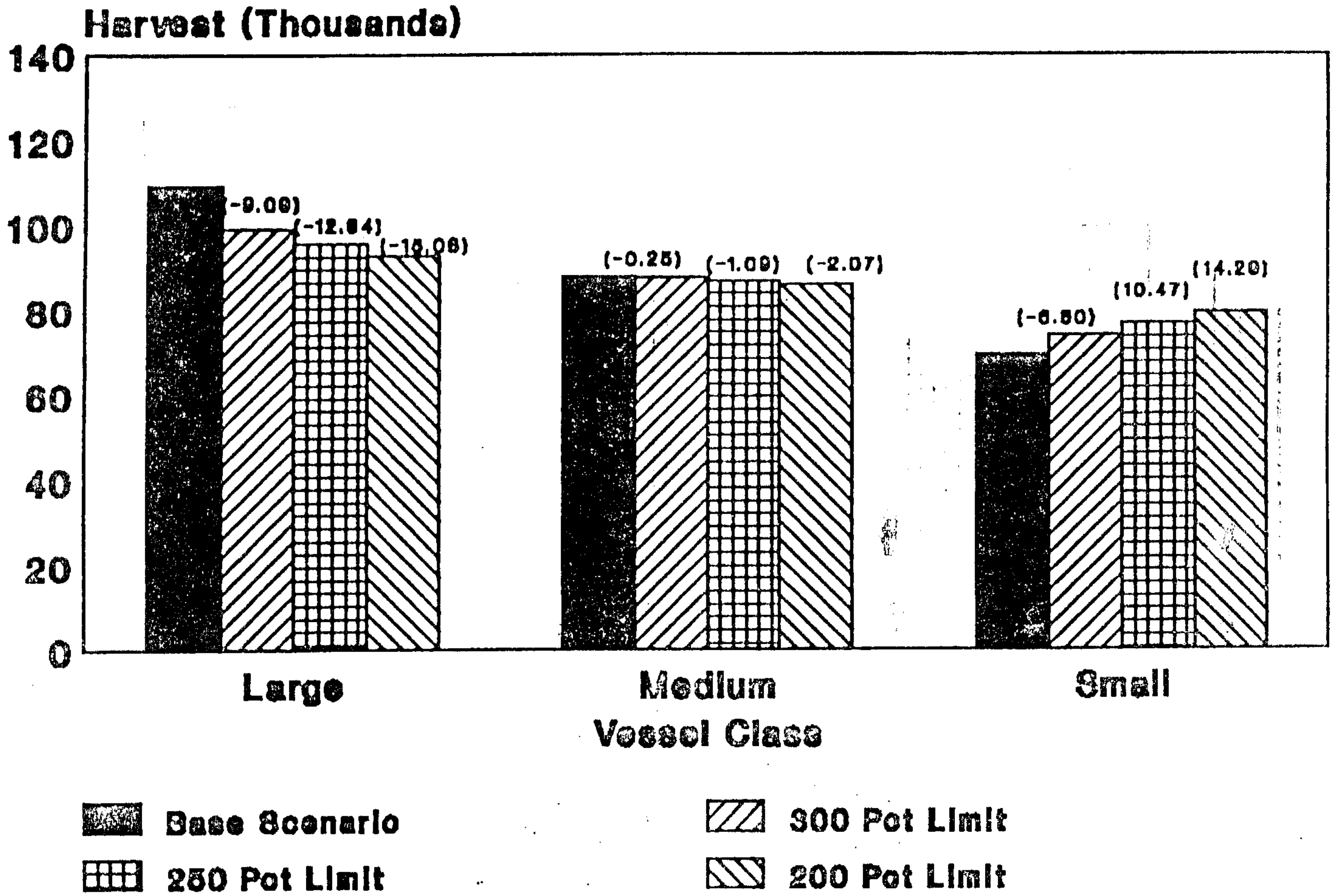

FIGURE 3. Bristol Bay Red King Crab Fishery: Average Harvest by Vessel Size Class, Large, Medium, and Small, for Fixed Pot Limits (300, 250,and 200). Percentage Changes in Harvest from the Base Scenario are in Parentheses.

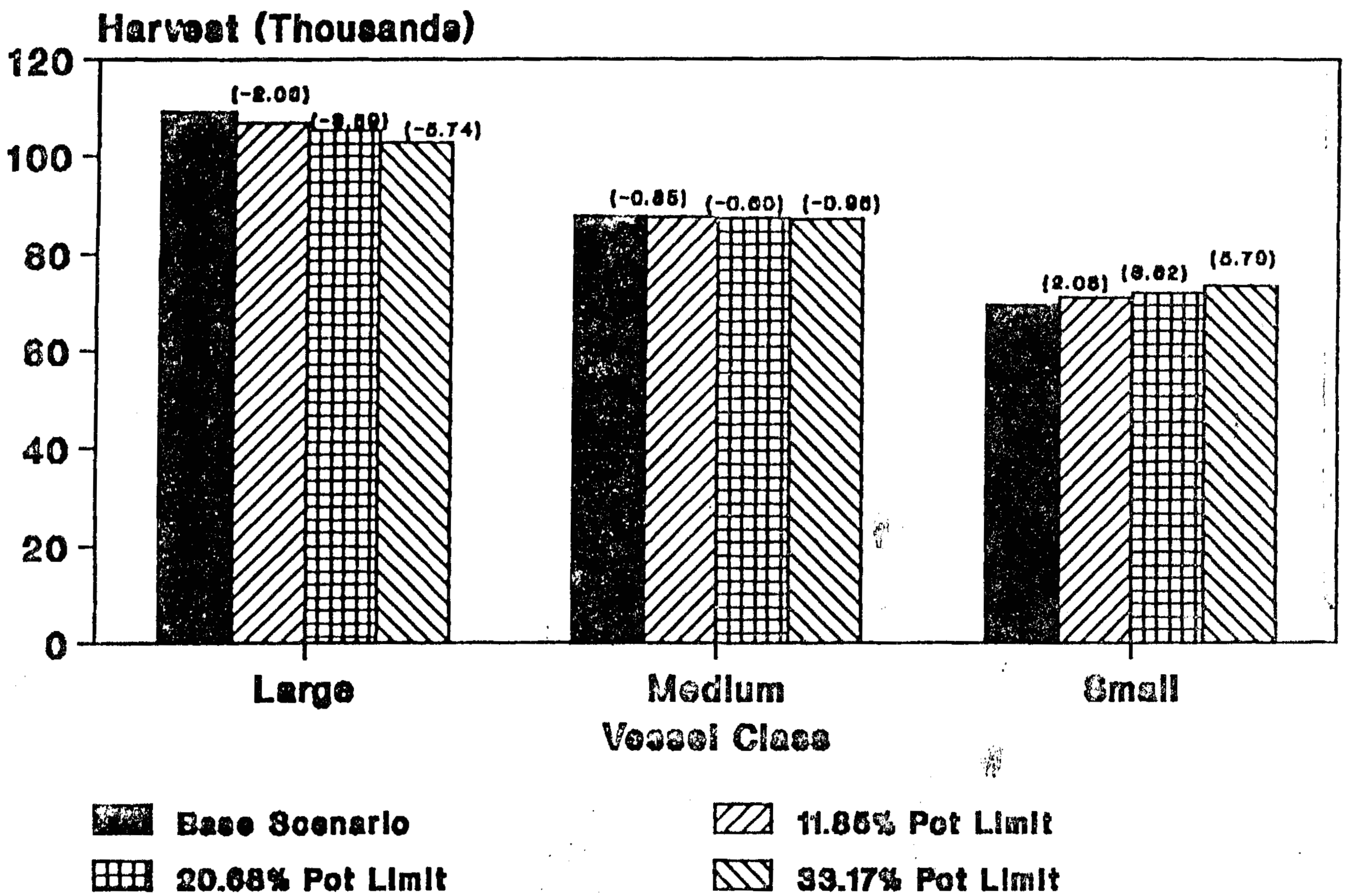

FIGURE 4. Bristol Bay Red King Crab Fishery: Average Harvest by Vessel Size Class, Large, Medium, and Small, for Proportional Pot Limits (11.85%, 20.68%, and 33.17%). Percentage Changes in Harvest from the Base Scenario are in Parentheses.

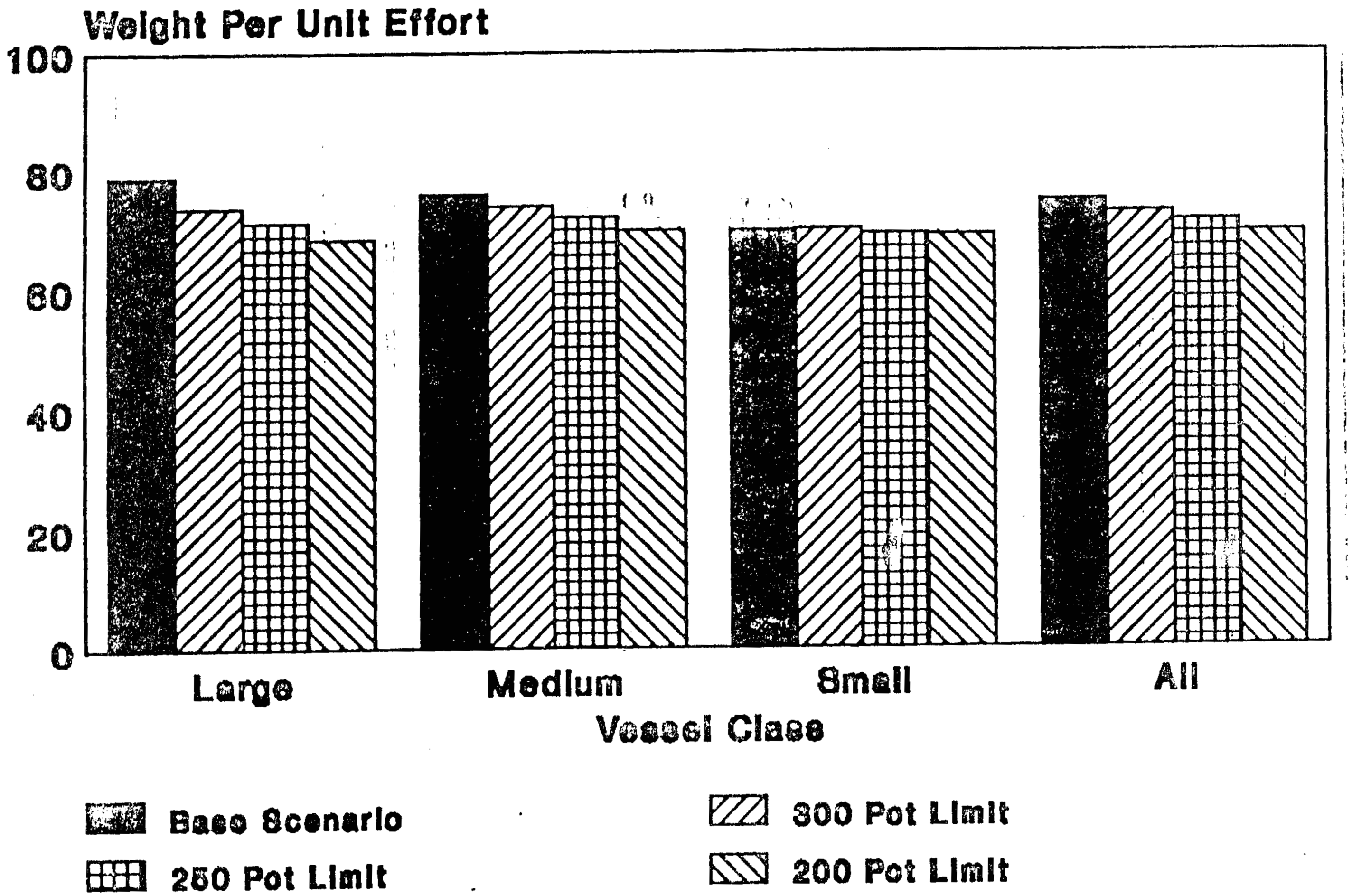

FIGURE 5. Bristol Bay Red King Crab Fishery: Average Weight Per Unit Effort by Vessel Size Class, Large, Medium, and Small, and Fleet (All), for Fixed Pot Limits (300, 250, 200).

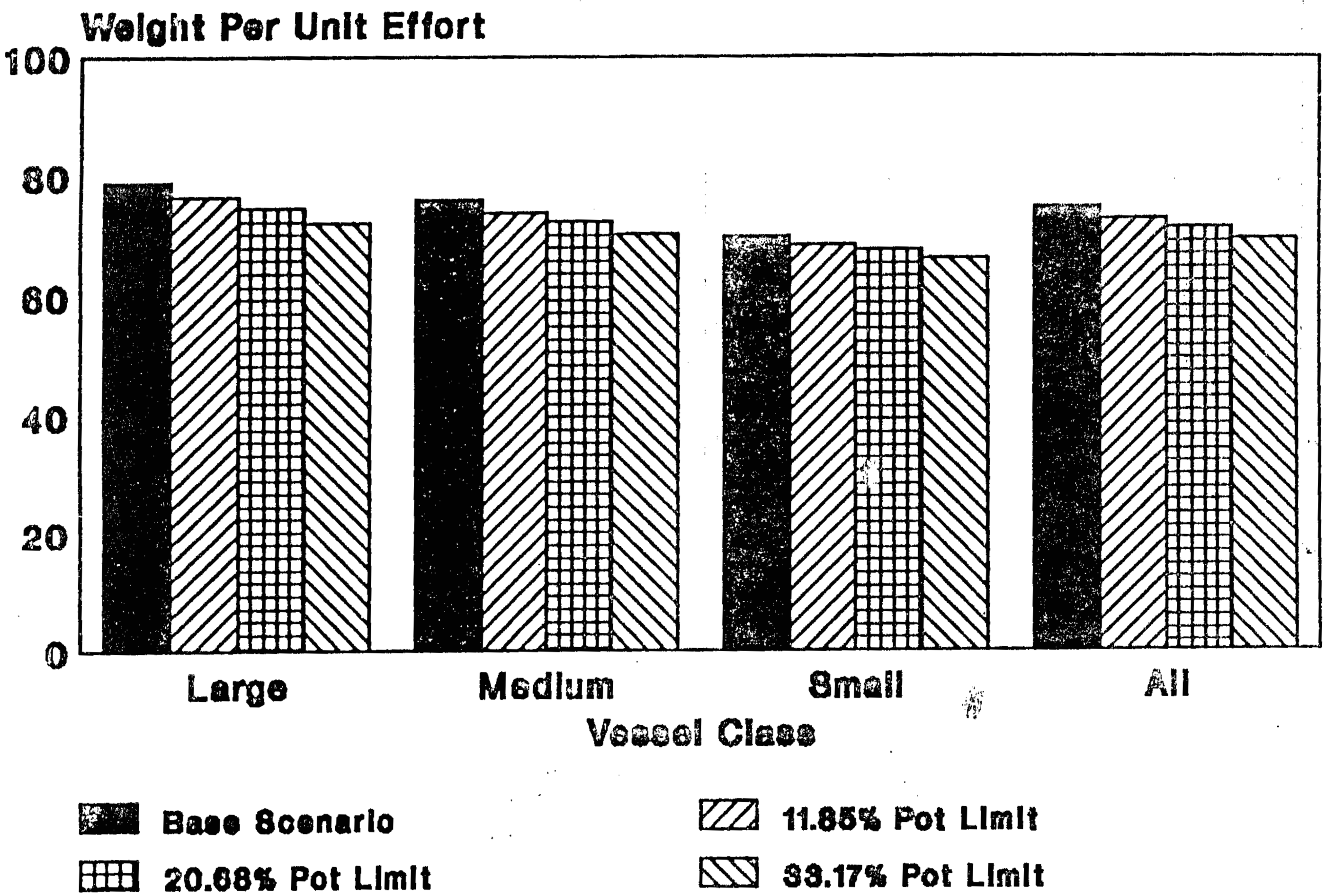

FIGURE 6. Bristol Bay Red King Crab Fishery: Average Weight Per Unit Effort by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Proportional Pot Limits (11.85%, 20.68%, and 33.17%).

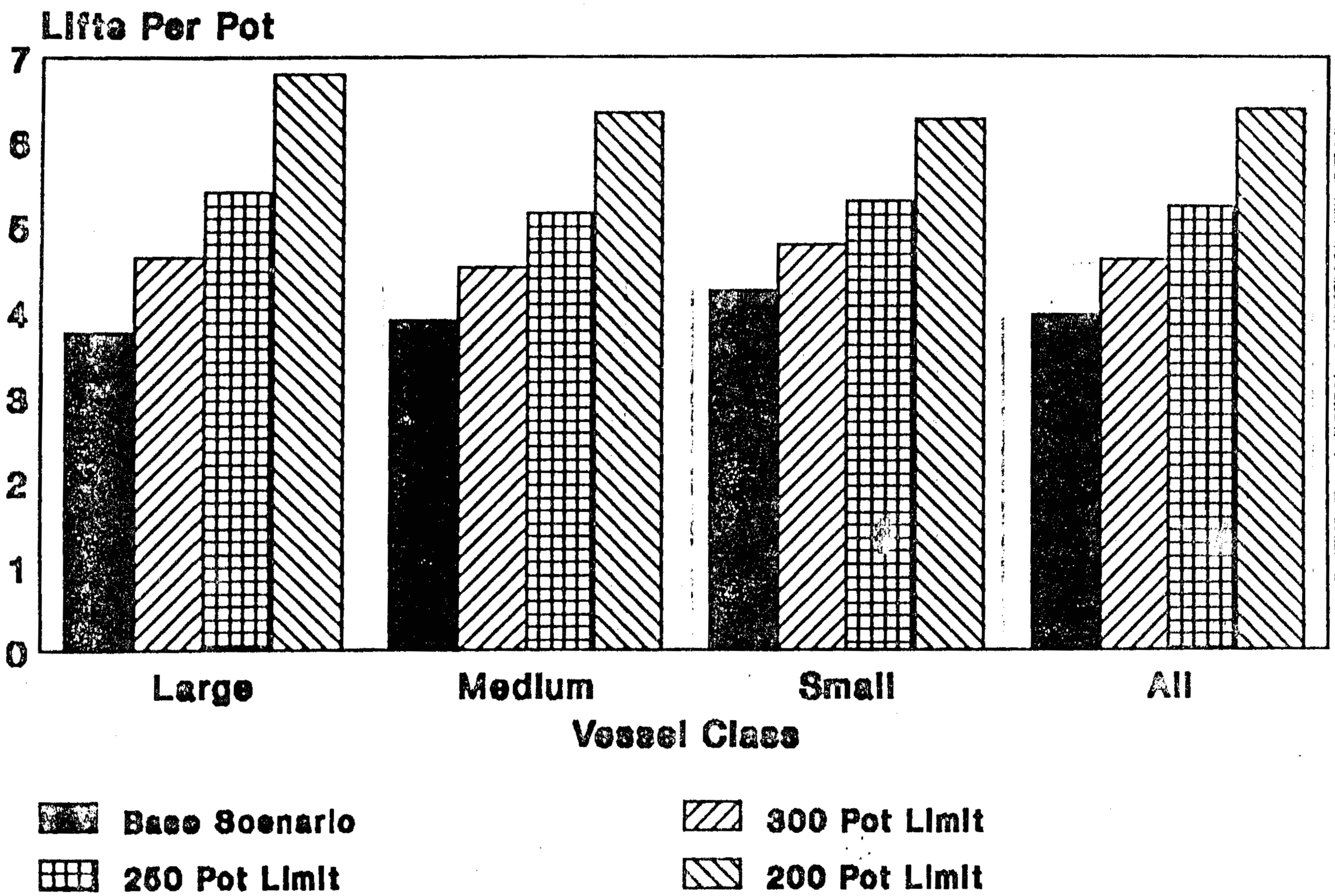

FIGURE 7. Bristol Bay Red King Crab Fishery: Average Lifts Per Pot by Vessel Size Class, Large, Medium, Small,and Fleet (All), for Fixed Pot Limits (300, 250, 200).

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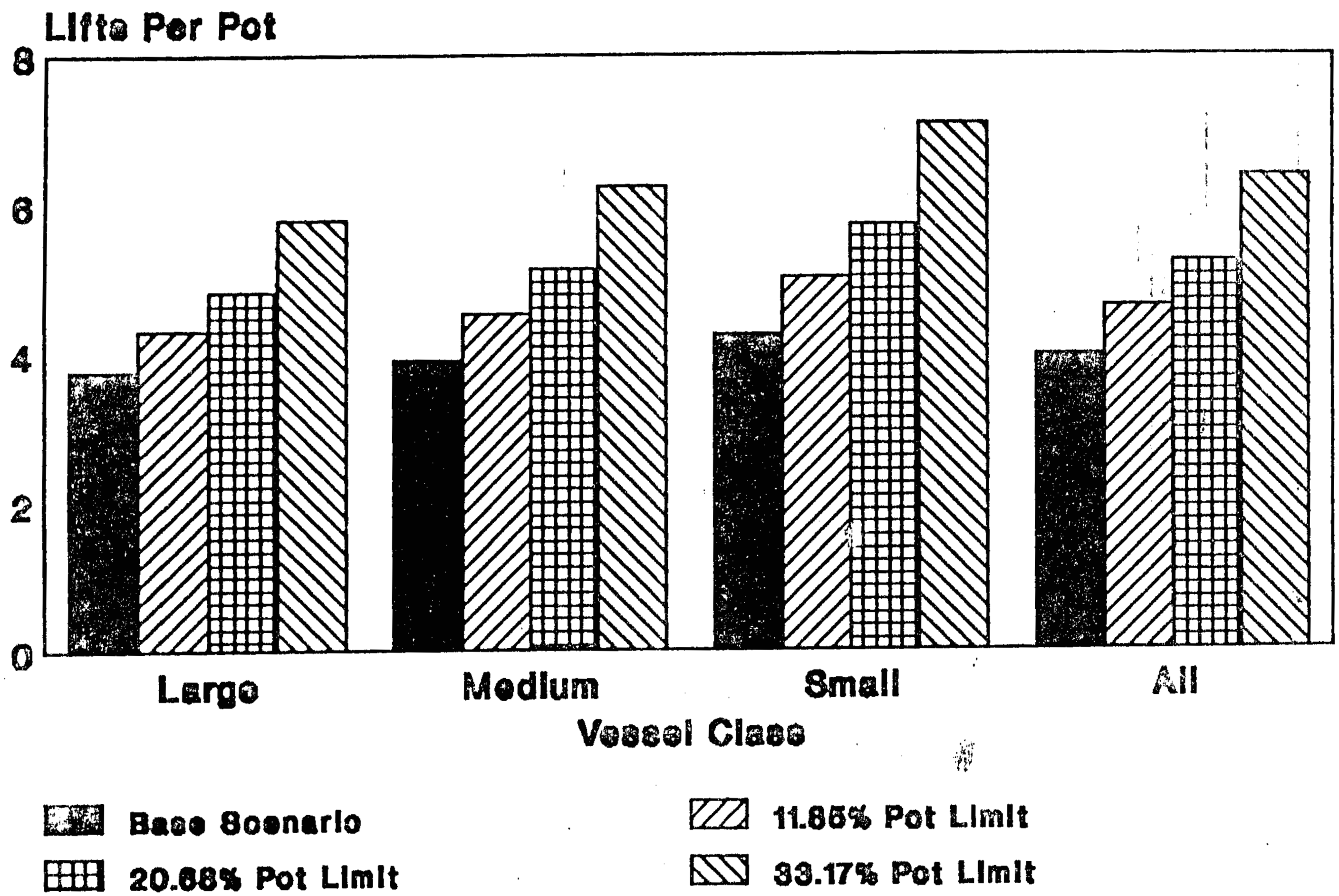

FIGURE 8. Bristol Bay Red King Crab Fishery: Average Lifts Per Pot by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Proportional Pot Limits (11.85%, 20.68%, and 33.17%).

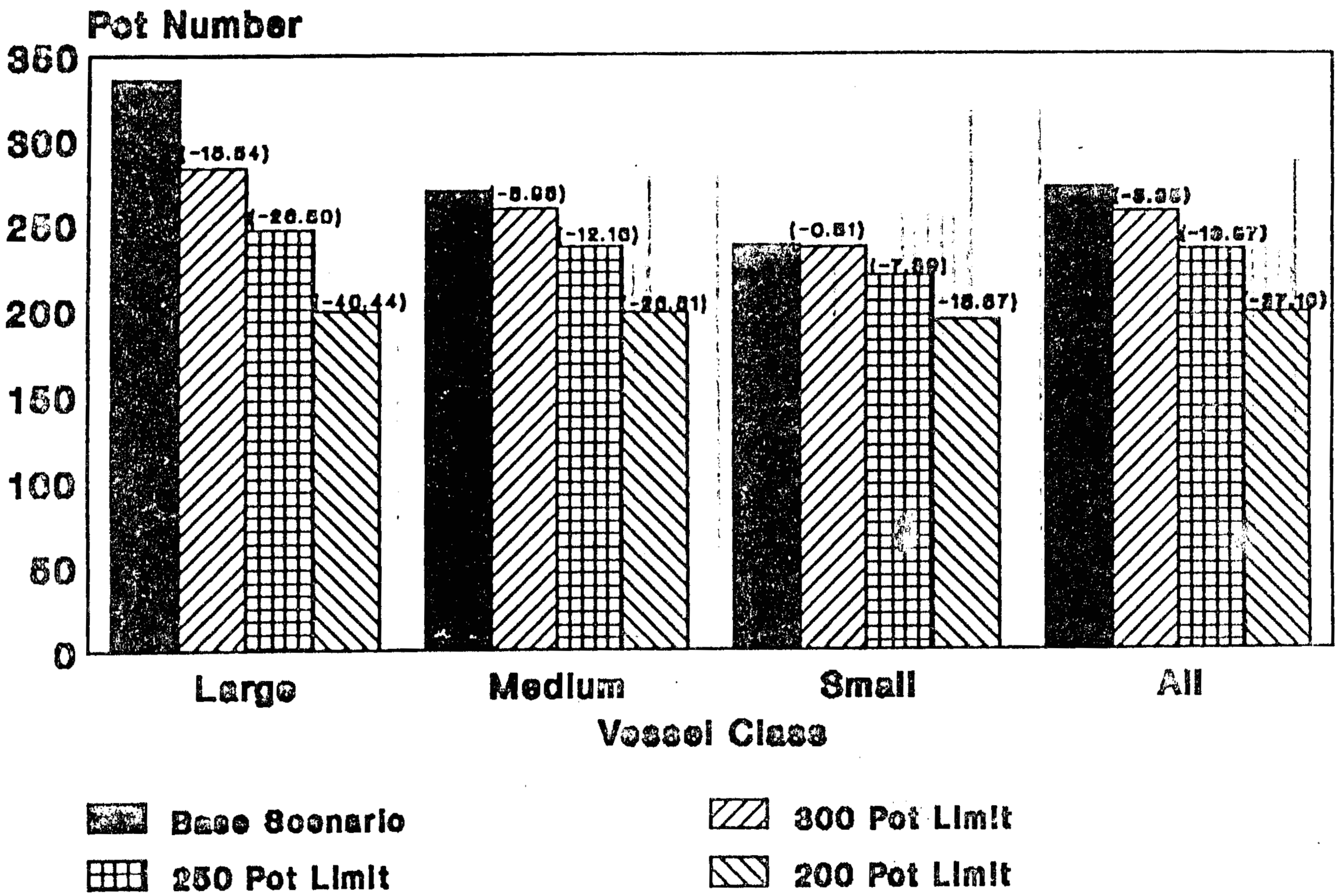

FIGURE 9. Bering Sea *C. opilio* Fishery: Average Pot Numbers by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Fixed Pot Limits (300, 250, 200). Percentage Changes in Pot Numbers from the Base Scenario are in Parentheses.

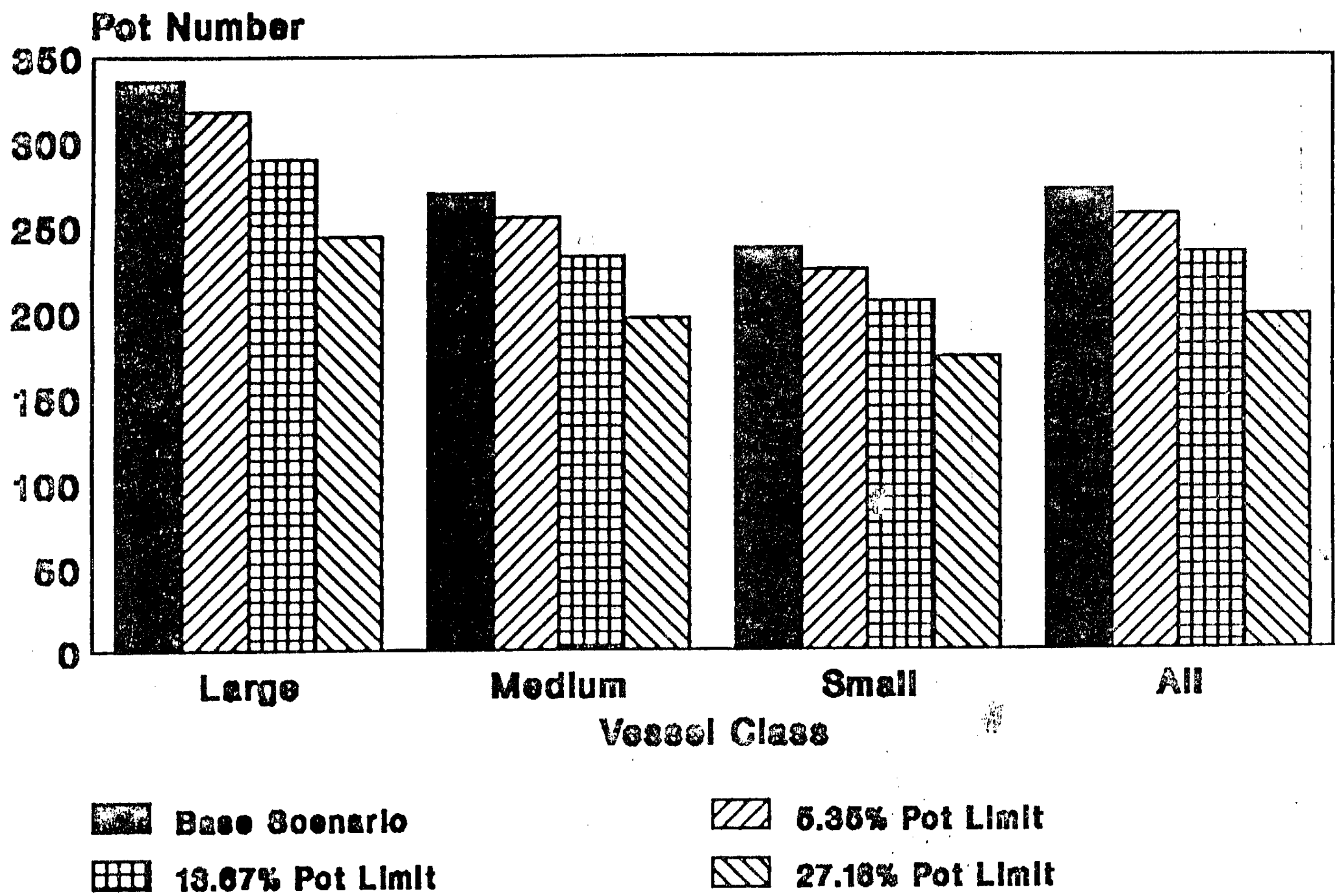

FIGURE 10. Bering Sea *C. opilio* Fishery: Average Pot Numbers by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Proportional Pot Limits (5.35%, 13.67%, and 27.16%).

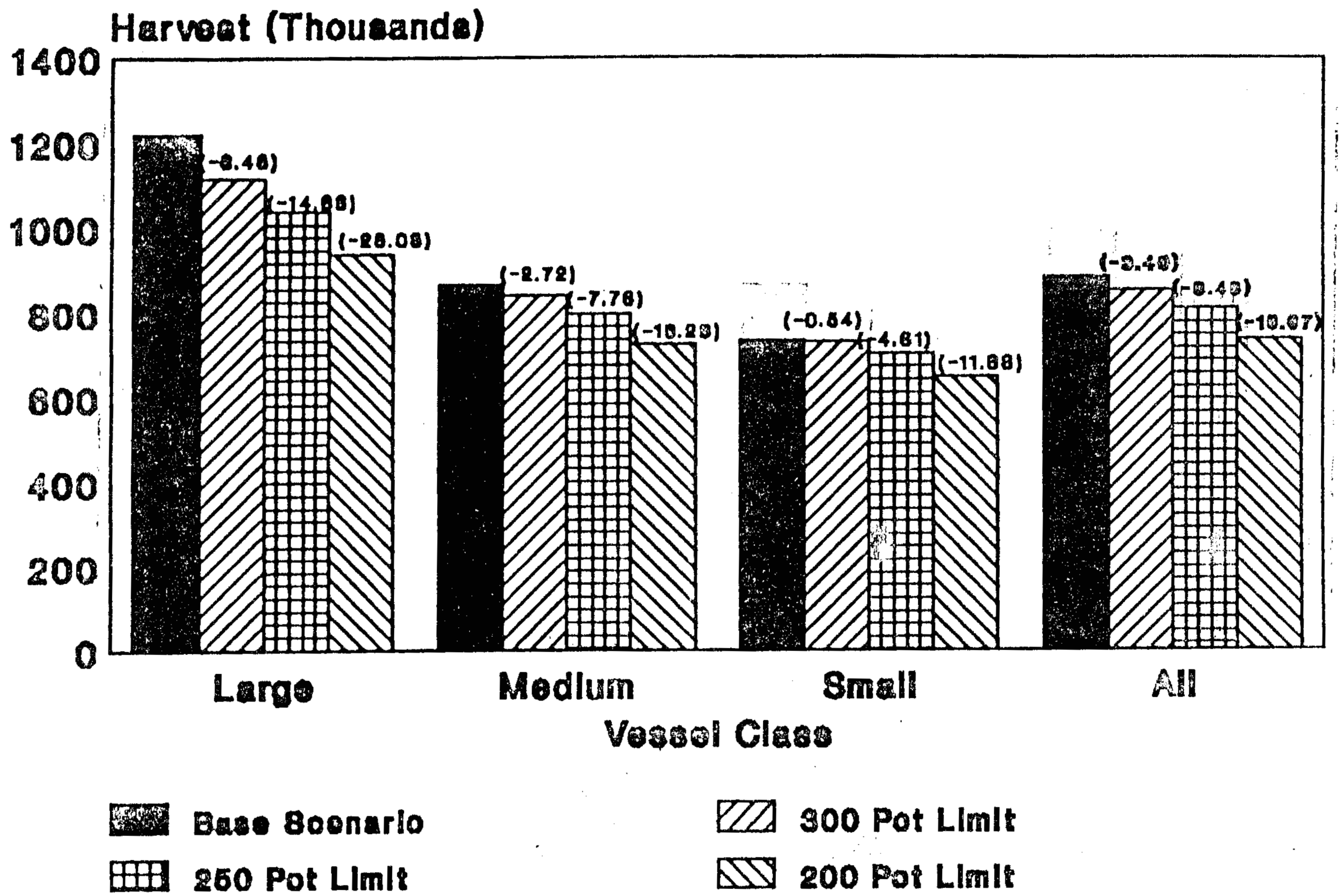

FIGURE 11. Bering Sea *C. opilio* Fishery: Average Harvest by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Fixed Pot Limits (300, 250, and 200). Percentage Changes in Harvest from the Base Scenario are in Parentheses.

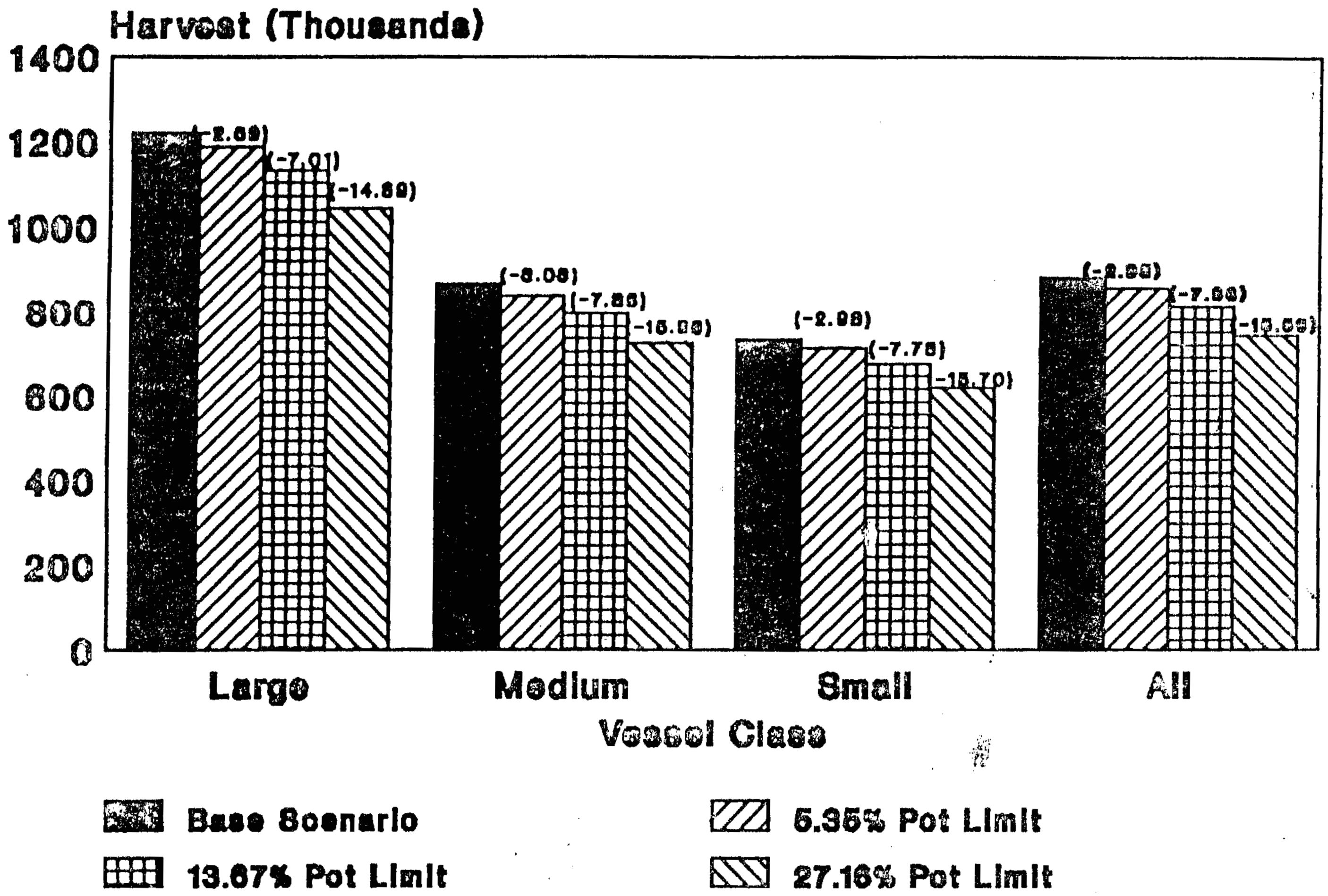

FIGURE 12. Bering Sea *C. opilio* Fishery: Average Harvest by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Proportional Pot Limits (5.35%, 13.67%, and 27.16%). Percentage Changes in Harvest from the Base Scenario are in Parentheses.

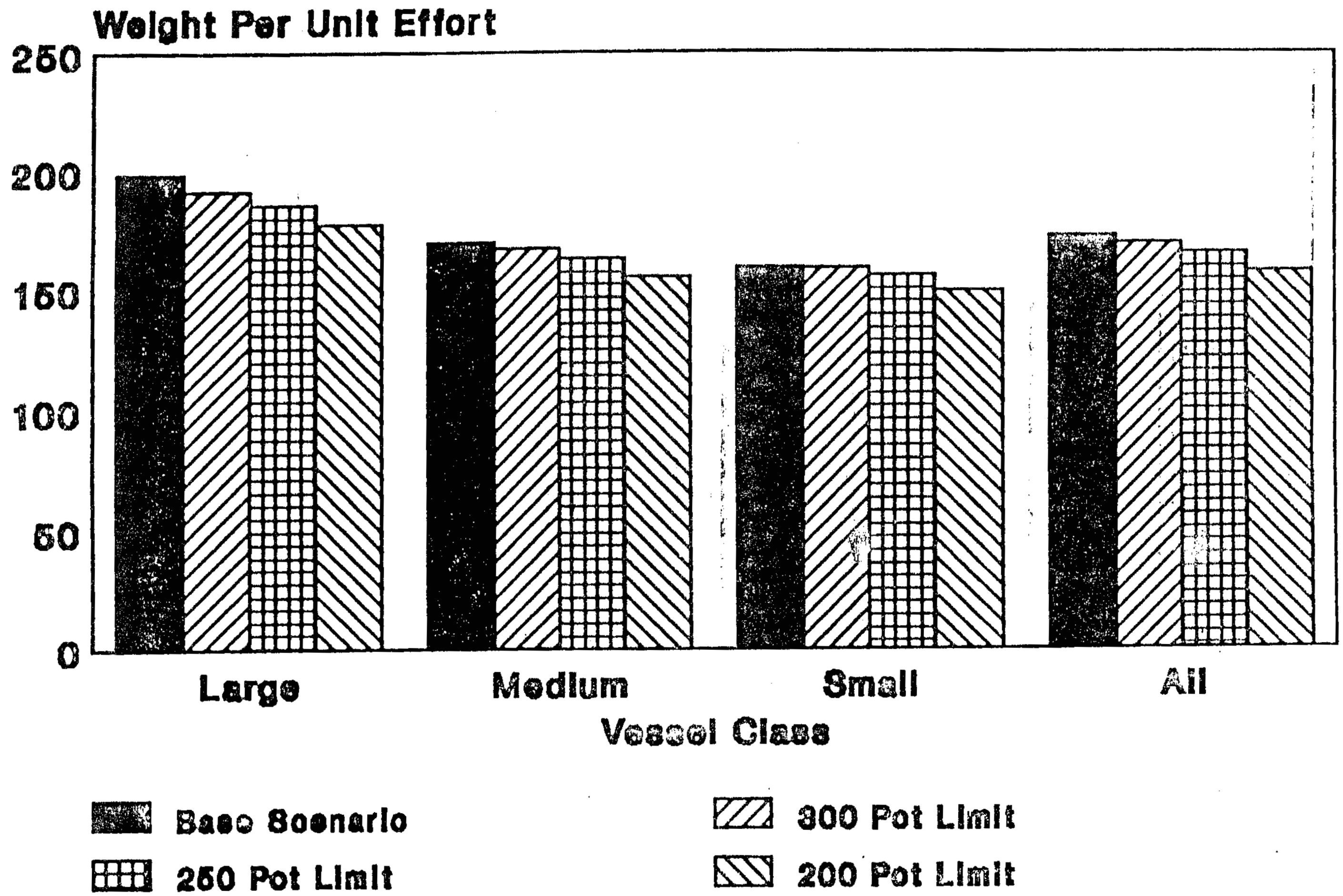

FIGURE 13. Bering Sea *C. opilio* Fishery: Average Weight Per Unit Effort by Vessel Size Class, Large, Medium, Small, and Fleet (All), for Fixed Pot Limits (300, 250, 200).

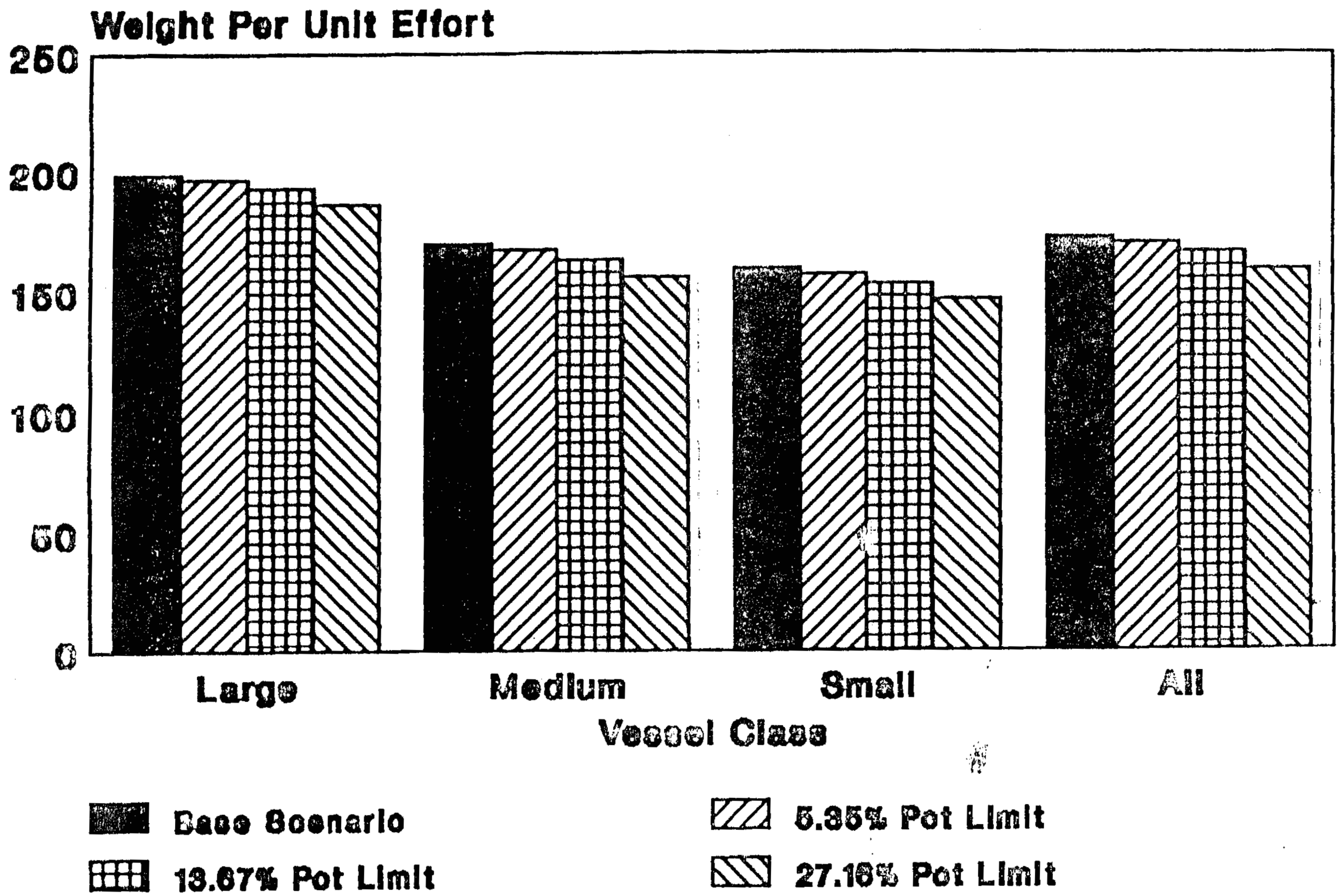

FIGURE 14. Bering Sea *C. opilio* Fishery: Average Weight Per Unit Effort by Vessel Size Class, Large, Medium, and Fleet (All), for Proportional Pot Limits (5.35%, 13.67%, 27.16%).

POT LIMIT		DAYS%
FIXED:	300	9.44
	250	16.61
	200	26.83
PROPOR.:	11.85	9.90
	20.68	17.00
	33.17	27.50

Table 1. Bristol Bay Red King Crab Fishery, Percentage Change in Season Length (DAYS%) Under Fixed Pot Limits (300, 250, and 200 pots), and Proportional Pot Limits (11.85%, 20.68%, and 33.17%)

APPENDIX 10

STATE OF ALASKA

MANDATORY SHELLFISH OBSERVER PROGRAM REPORT

TO

ALASKA BOARD OF FISHERIES

MARCH 1992

BY

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INTRODUCTION

In April 1988 the Alaska Board of Fisheries adopted regulations requiring onboard observers on all vessels which processed king crab and *C. bairdi* Tanner crab in waters of Alaska. This action was prompted by Alaska Department of Fish and Game (ADF&G) staff reports which suggested illegal processing of undersize and female crab by at sea processors, based on consistently higher production rates of catcher processors compared to catcher only vessels. These regulations resulted in creation of the Mandatory Shellfish Observer Program which first deployed observers in the September 1988 Bristol Bay red king crab fishery. Primary goals of the program were to determine the legality of the landed and processed product, collect shell size, age and condition information from delivered product and to collect bycatch data from the pots being fished.

Although regulations dealing with the Observer Program were intended to apply statewide, activity has focused on crab fisheries in the Bering Sea and Aleutian Islands, where essentially all at sea processing of crab occurs. Regulations require all observer activity for a fishery be handled in the management area of that fishery, consequently all observer activity in 1991 was handled by ADF&G Observer Program staff in Dutch Harbor.

In spring of 1990 the Alaska Board of Fisheries adopted regulations which broadened mandatory observer coverage to include those vessels processing *C. opilio*. These changes were made due to reports of undersized *C. bairdi* being processed as *C. opilio.*

OBSERVER PROGRAM GUIDELINES

Observer Program guidelines were originally defined and remain in regulation form. These guidelines clearly outline responsibilities of the contractor, ADF&G, and the observer (Figure 1).

According to regulation, cost of observers are borne by industry, with vessels hiring observers through third party contractors.

Contractors

Contractors are required to hire, train and provide all observer logistical support including food, accommodations, sampling equipment, travel to and from vessels, and to and from ADF&G briefings and debriefings conducted within the management area of the fishery. Contractors secure contracts directly with vessel owners/operators, and deploy observers.

ADF&G

The Alaska Department of Fish and Game is responsible for establishing observer qualification and conflict of interest standards and sampling procedures. ADF&G is also charged with review and approval of observer training programs, observer testing, certification (and decertification), briefing, debriefing, analysis of observer data and program progress reports.

Observer

Observer qualifications include a minimum of a Bachelor of Science degree in the Natural Sciences or prior experience as an National Marine Fisheries Service observer.

Observers are required to undergo ADF&G approved training and pass a written and practical certification exam administered by Observer Program staff in Dutch Harbor. Observers may not have a financial interest in the observed fishery or assigned vessel. Observers are limited to no more than 90 days duty on a specific vessel in any 12 month period. Observers who are inactive for more than 12 consecutive months loose their certification, but may become recertified by reexamination.

1991 SEASON OVERVIEW

Vessel Effort and Observer Coverage

During the period January 1, 1991 through January 15, 1992 Mandatory Shellfish Program observers made 270 trips and logged 325 observer man months at sea. This is a dramatic increase over 1990 levels when observers made 117 trips and logged 120 man months at sea.

Large increases in the number of observer trips and observer man months at sea were due in large part to the *C. opilio* fishery in the Bering Sea which required observer coverage for the first time in 1991. An increased number of at sea processors and corresponding trips also contributed to higher levels of observer activity. From 1990 to 1991 vessel trips for catcher processors increased from 71 to 191 and for floating processors from 24 to 74 (Table 1).

Bering Sea Opilio. Observers made 155 trips on 45 different processor vessels (28 catcher processors and 17 floating processors) and logged 220 man months at sea. This fishery accounted for 57% of total observer trips and 68% of observer man months for 1991. Table 2 summarizes vessel trips and observer activity, by fishery for 1991.

Dutch Harbor Brown King. Observers made five observer trips on four different catcher processors and logged seven observer man months at sea during this fishery. This was approximately 2 percent of observer trips and man months for 1991.

St. Matthew Blue King. Observers made 11 trips on 11 different processing vessels (9 catcher processors and 2 floating processors) and logged 5 man months at sea. This fishery accounted for 4% of total observer trips and 1.5% of observer man months for 1991.

Bristol Bay Red King. Observers made 37 trips on 37 different processor vessels (25 catcher processors and 12 floating processors) and logged 20 man months at sea. This fishery accounted for almost 14% of total observer trips and 6% of observer man months for 1991.

Adak Brown King. Observers made a total of 10 trips on 5 different catcher processors and logged almost 8 man months at sea. This accounted for less than 4% of total observer trips and 3% of man months at sea.

Bering Sea Bairdi. Observers made 52 trips on 40 different processor vessels (28 catcher processors and 12 floating processors) and logged over 65 man months at sea. This fishery accounted for over 19% of the total observer trips and 20% of observer man months for 1991.

OBSERVER PROGRAM ACTIVITIES

Observer Briefing and Debriefing Activity

Observer Program activities increased dramatically in 1991 as a result of expanded observer coverage and additional processing vessels. In 1991 (January 1 through December 31) ADF&G Observer Program staff in Dutch Harbor conducted 264 observer briefings and 337 debriefings (includes mid trip debriefings). This is approximately double the level conducted in 1990, and over six times the level conducted during the program's first year of operation in 1988 (Figure 2).

Briefing, debriefing and mid trip debriefing activity remained high throughout the fall, winter and spring months corresponding to the opening of the Dutch Harbor brown king crab fishery on September 1 and the closure of the *C. opilio* fishery on June 23 (Figure 3).

Briefing times (time spent with one observer for one briefing) ranged from 5 to 105 minutes. The overall yearly average for all briefings was 46 minutes. Debriefing times ranged from 5 to 145 minutes, with the yearly average 40 minutes. Mid trip debriefings (observer meets with ADF&G staff for data review when vessel is in town for supplies, repairs etc.) ranged from 10 to 210 minutes, with the overall average 41 minutes. Average brief, debrief and mid trip debrief times by month are listed in Table 3 (Figure 4).

Observer Exams, Certification and Decertification.

During 1991, four observer certification exams were administered by Observer Program staff in Dutch Harbor. Of the 56 candidates which tested for observer certification during 1991, 54 successfully passed the written and practical portions of the exam and were given probationary certification. In 1988 only 85, of 103 candidates which tested, passed the exam and were certified. In 1989 46 of 52 candidates passed and became certified. In 1990 28 of 31 candidates successfully passed the certification exam. Currently 120 observers remain certified.

Since the programs inception in 1988 85 observers have been placed in "inactive status" due to inactivity in 12 continuous months. An additional 19 observers have been decertified for failure to comply with Observer Program standards. Table 4 summarizes Observer Program certification exams, number of observers tested, certified and decertified from 1988 to present.

Observer Data and Evidence Collection

Evidence (physical and or photographic) was collected on 50 of the 270 observer trips conducted in 1991. This represents evidence collection on 18.5% of all observer trips for all fisheries combined. Evidence collected by fishery in 1991 is summarized in Table 5 and Figure 5.

In the Bering Sea *C. opilio* fishery evidence was collected on 30 of the 155 trips, approximately 60% of total evidence collected by observers during 1991. In the Bering Sea *C. bairdi* fishery evidence was collected on 11 of 52 trips, accounting for 22% of evidence collected. In the Bristol Bay red king crab fishery evidence was collected on 6 of the 37 observer trips, accounting for 12% of observer collected evidence for 1991. While evidence was collected on three of the 10 observer trips conducted on Adak brown king crab, no evidence was collected by observers in the Dutch Harbor brown king crab or St. Matthew blue king crab fisheries during 1991.

Biological data on legal and sublegal catch rates and size composition of the retained and discarded catch (bycatch) was collected by all observers on all trips conducted in 1991. Specific information on numbers of size frequency and bycatch samples collected is not available at this time.

Problems with the Observer Program

Many problems within the observer program in the first several years of operation have been resolved through tightening of regulations and better cooperation between industry, observer contractors, observers and ADF&G. However, some problems continue to plague the program.

Industry/Vessels. The greatest problems with industry center around the current structure of the program and the resulting pressure vessel owners and operators can exert on contractors and observers to circumvent many program regulations. Current regulations require contractors to make observer vessel assignments. While current regulations do not allow vessels to make requests for specific observers, there is nothing in regulation which prohibits a vessel from refusing to accept a specific observer. Consequently, an observer who collects evidence on a vessel or gains a reputation for refusing to allow illegal activity on board his or her assigned vessel can be denied assignments or "black listed".

Contractors. The current program structure places tremendous preasure on contractors, in the interest of maintaining vessel contracts, to make observer assigmnments and other decisions regarding observers according to demands of contracting vessels or companies. This is in violation of current regulations and allows vessels indirect control over observer placement. Under the current contracting and observer deployment system, an observer willing to allow illeagle activities on board their assigned vessel would creates fewer problems for that vessel and consequently that vessel's contractor.

Observers. Once again, program structure places the observer in a compromised position between requirements of ADF&G (which includes documenting illegal activities and collecting evidence) and possible pressure from the vessel to over look violations in order not to be denied access to the vessel on future assignments. These pressures can come from the vessel or the contractor as mentioned above.

An additional problem concerning observers is a growing trend toward cross over employment as crew members on commercial crabbing vessels. Current conflict of interest regulations only prohibit certified observers from duty on vessels for which they have a vested interest. Currently some observers, immediately upon completion of an observer trip aboard a vessel, are returning to that same vessel as a paid crew member. This situation raises serious questions about observer conduct (what he or she might have been willing to over look in order to gain employment on the vessel) and an individuals ability to be an objective observer immediately after working as a paid crew member on a commercial vessel. It is also questionable whether observers, exposed to the highly confidential fishing information (catch rates and exact fishing locations etc.), should be allowed free participation as paid crew members where such privileged information could be inappropriately used.

SUMMARY

Observer program activity increased dramatically in 1991, due mostly to the additional coverage required for the Bering Sea *C. opilio* fishery and an increased number of processing vessels. This increase occurred both in observer activity (number of trips and observer man months at sea) and Observer Program activity (briefing, debriefing etc).

Observer Program activity was limited to that which occurred from the ADF&G office in Dutch Harbor. Four observer certification exams were given and 54 observers were certified during 1991. Eighty five observers were taken out of active observer status for failure to make an observer trip in 12 consecutive months. Since the program's start, 19 observers have been decertified for failing to adhere to programs standards.

Observers collected evidence (physical and or photographic) on 18.5% of all observer trips during 1991. The Bering Sea *C. opilio* fishery accounted for 60% of all evidence collected.

Problems with the observer program continue to center around the third party contractor system of obtaining and deploying observers. Many of the problems dealing with observer placement could be minimized if observer deployment were done by ADF&G instead of contractors who have a vested interest in staying on good terms with contracting vessels.

Table 1. Summary of vessel trips, observer trips, observer man months at sea, number of active contractors, and numbers of briefings/debriefings from 1988 to 1991.

Year	--Trips--		Observer Trips	Active Observers	Man Months	Man Mo. /Observer	Contractors	--Total--	
	C/P	F/P						Brief	Debrief
1988	37	11	65	N/A	119.1	1.8	8	44	43
1989	70	27	104	N/A	125.3	1.2	6	128	124
1990	71	24	117	N/A	120.8	1.0	7	150	127
1991	191	74	270	106	325.3	1.7	6	267	337[a]

[a]Includes midtrip debriefings.

Table 2. Summary of vessel trips, observer trips and observer man months at sea by fishery for the year of 1991.

Fishery	--Trips-- C/P	F/P	Observer Trips	Percent of Total Obs. Trips	Man Months	Percent of Total Obs. Man Months
Bering Sea Opilio	108	47	155	57.4	220.5	68.0
Dutch Harbor Brown King	4	0	5	1.9	7.0	2.1
St. Matthew Blue King	9	2	11	4.1	4.8	1.5
Bristol Bay Red King	25	12	37	13.7	20.0	6.0
Adak Brown King	8	0	10	3.7	7.8	2.4
Bering Sea Bairdi	37	13	52	19.2	65.2	20.0
Totals	191	74	270	100.0	325.3	100.0

Table 3. Number and average time in minutes of briefing, debriefing and mid trip debriefing sessions by month from January 1991 through January 1992.

Date	--Briefing--		--Debriefing--		--Mid trip--		---Range---		
	No.	Ave. Time	No.	Ave. Time	No.	Ave. Time	Brief	Debrief	Mid trip
Jan. 91	45	41	29	45	0	0		N/A	
Feb. 91	8	34	7	34	15	72	20- 60	15- 60	15-210
Mar. 91	32	35	24	36	32	30	15- 95	5-135	15- 60
Apr. 91	29	33	26	36	9	29	15- 55	10-120	15- 60
May 91	26	30	29	30	6	26	10- 60	15-145	15- 30
June 91	8	25	40	33	3	32	5- 65	15- 65	30- 35
July 91	5	27	8	44	1	15	10- 35	20- 90	60- 80
Aug. 91	3	65	4	89	0	0	45- 90	55-120	0
Sep. 91	11	37	10	34	1	30	20- 60	20- 60	30- 30
Oct. 91	38	62	3	57	2	70	15- 95	30- 80	60- 80
Nov. 91	45	47	45	43	4	23	15- 85	5- 90	15- 45
Dec. 91	14	56	23	54	16	50	30- 90	5-130	10-100
Jan. 92	45	65	13	46	18	43	20-140	25- 80	15- 60
Totals[a]	309		261		107		5-105	5-145	10-210[b]
Average[c]		46		40		41			

[a]Overall total sessions: 677.

[b]Overall range of minutes per session: 42.

[c]Overall average of minutes per session.

Table 4. Mandatory Shellfish Observer Program candidates by exam including numbers passed, numbers currently certified, inactive and decertified.

---Exam--- No.	Date	Number of Candidates	Number Passed	Numbers Currently Certified	/Inactive[a]	/Decertified[b]
1	09/10/88	32	30	6	20	4
2	09/14/88	57	44	8	29	7
3	09/23/88	14	11	2	8	1
4	08/24/89	52	46	13	28	5
5	10/24/90	20	18	18	0	0
6	10/26/90	3	2	2	0	0
7	12/18/90	8	8	7	0	1
8	01/24/91	15	15	15	0	0
9	04/16/91	4	2	2	0	0
10	05/05/91	11	11	11	0	0
11	10/22/91	26	26	25	0	1
12	01/07/92	11	11	11	0	0
Totals		253	224	120	85	19

[a]Decertified due to 12 month observer employment inactivty.

[b]Decertified due for nonconformity to Shellfish Observer Program standards.

Table 5. The number of vessels, observer trips and observer trips where evidence was collected, by fishery from January 1 to December 31, 1991.

Fishery	Vessels F/P	Vessels C/P	Observer # of Trips	Evidence Collected	Percent[a] of Total
Bering Sea Opilio	17	28	155	30	60.0
Dutch Harbor Brown King	0	4	5	0	0
St. Matthew Blue King	2	9	11	0	0
Bristol Bay Red king	12	25	37	6	12.0
Adak Brown King	0	5	10	3	6.0
Bering Sea Bairdi	12	28	52	11	22.0
Totals	43	94	270	50	100.0

[a]Percentage of total evidence collected for the year of 1991.

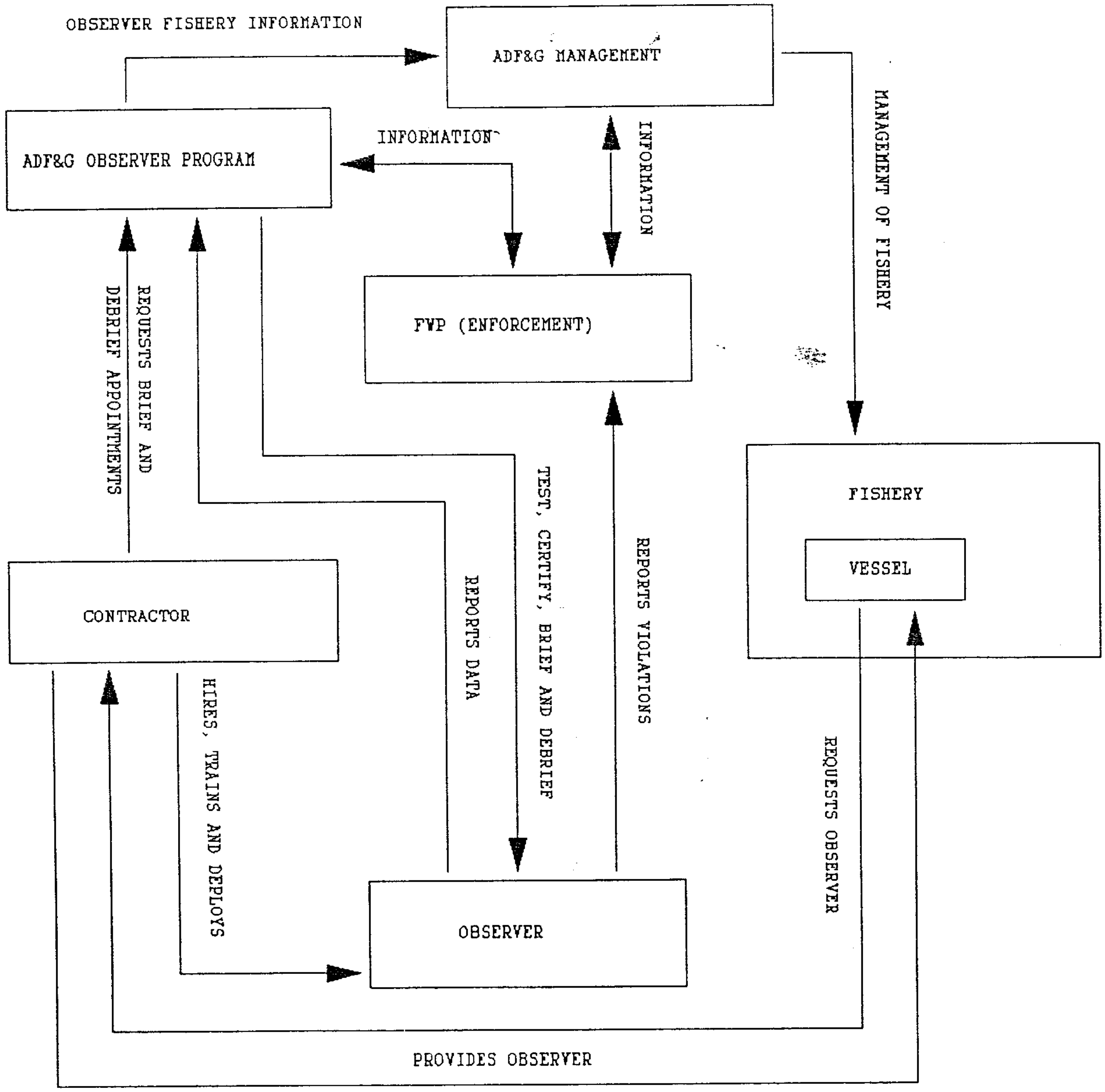

Figure 1. State of Alaska Mandatory Shellfish Observer Program organization flow diagram.

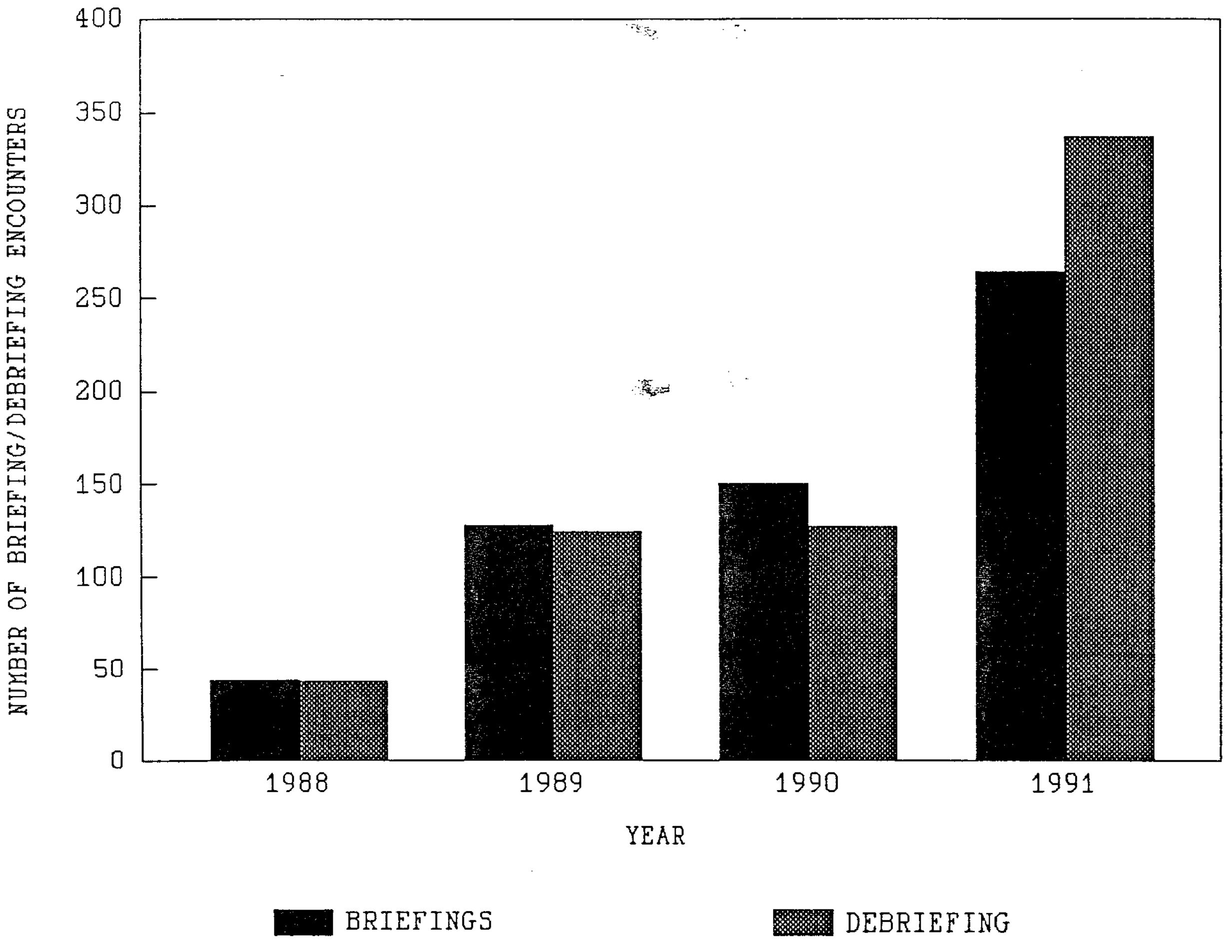

Figure 2. Number of briefing and debriefing sessions by year from 1988 to 1991.

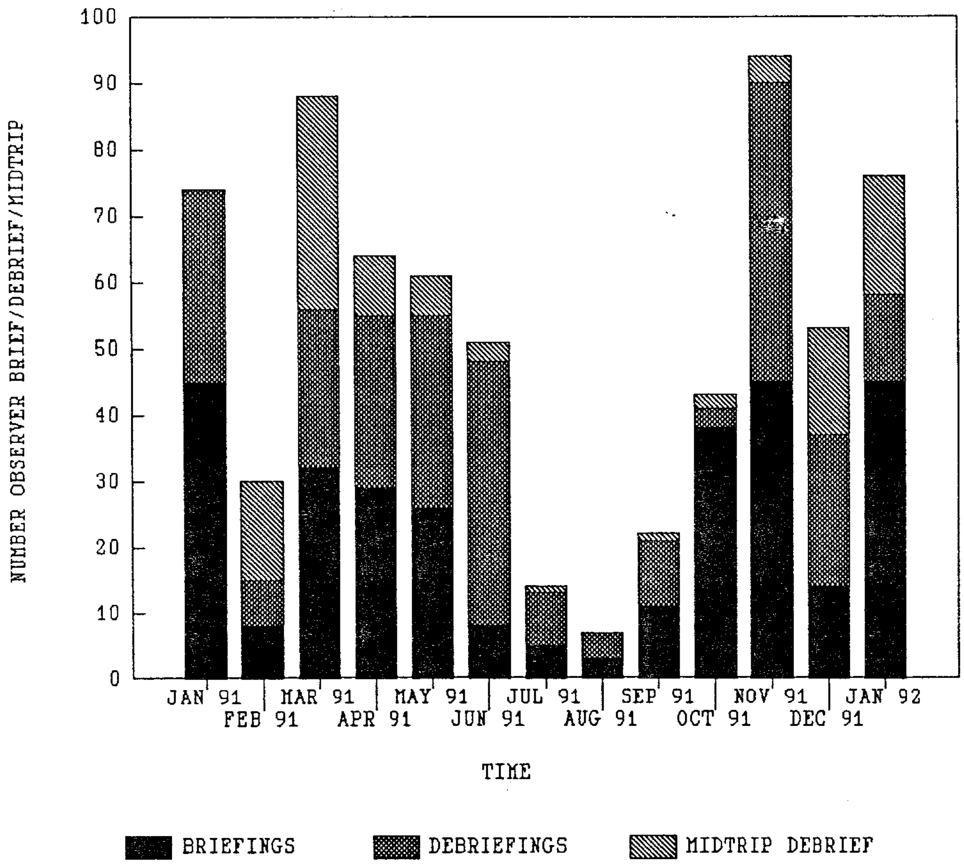

Figure 3. Number of observer sessions by month and session type (brief, debrief, midtrip debrief), January 1, 1991 to January 15, 1992.

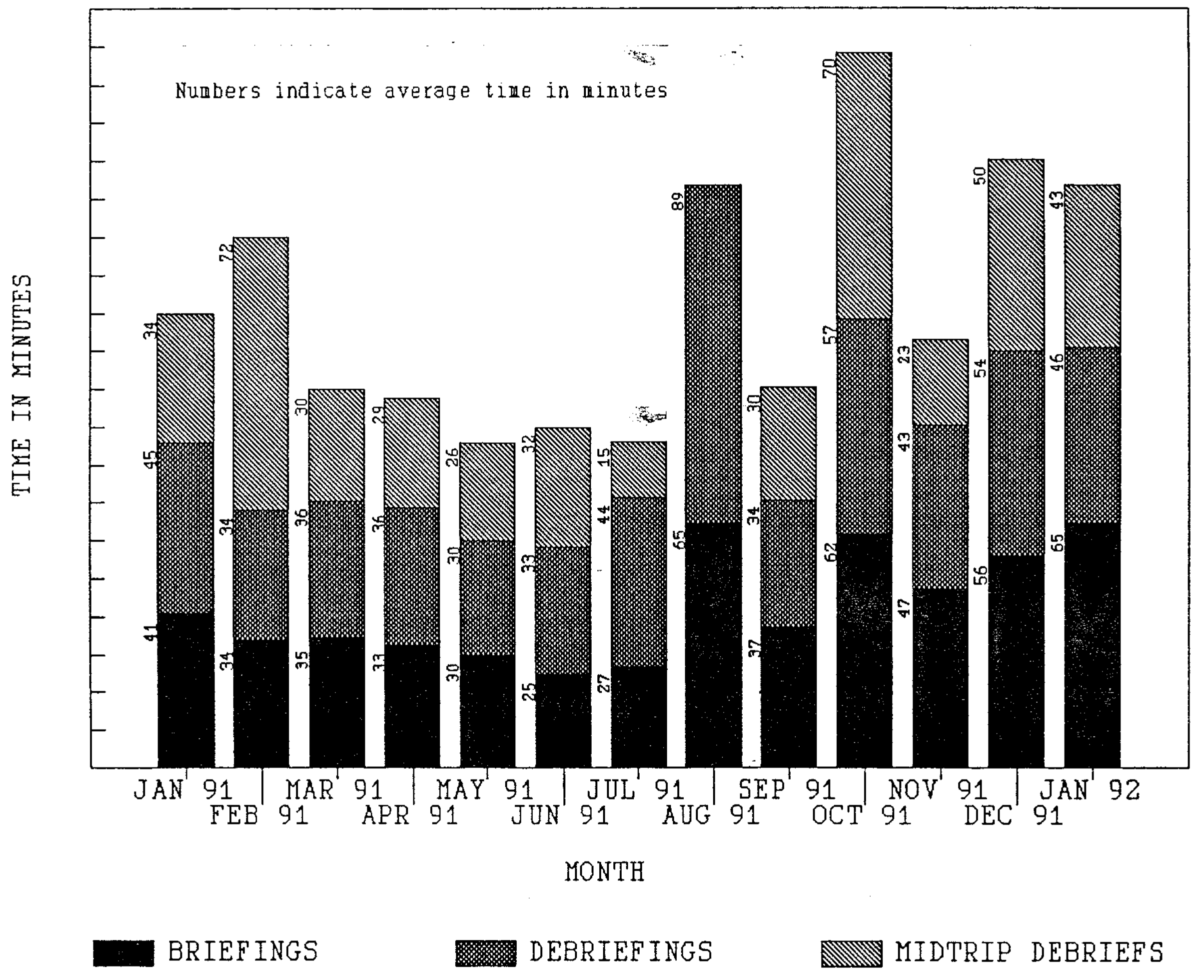

Figure 4. Average time in minutes spent with observers by month and session type (brief, debrief or midtrip debrief) conducted by ADF&G Observer Staff, January 1991 through January 1992.

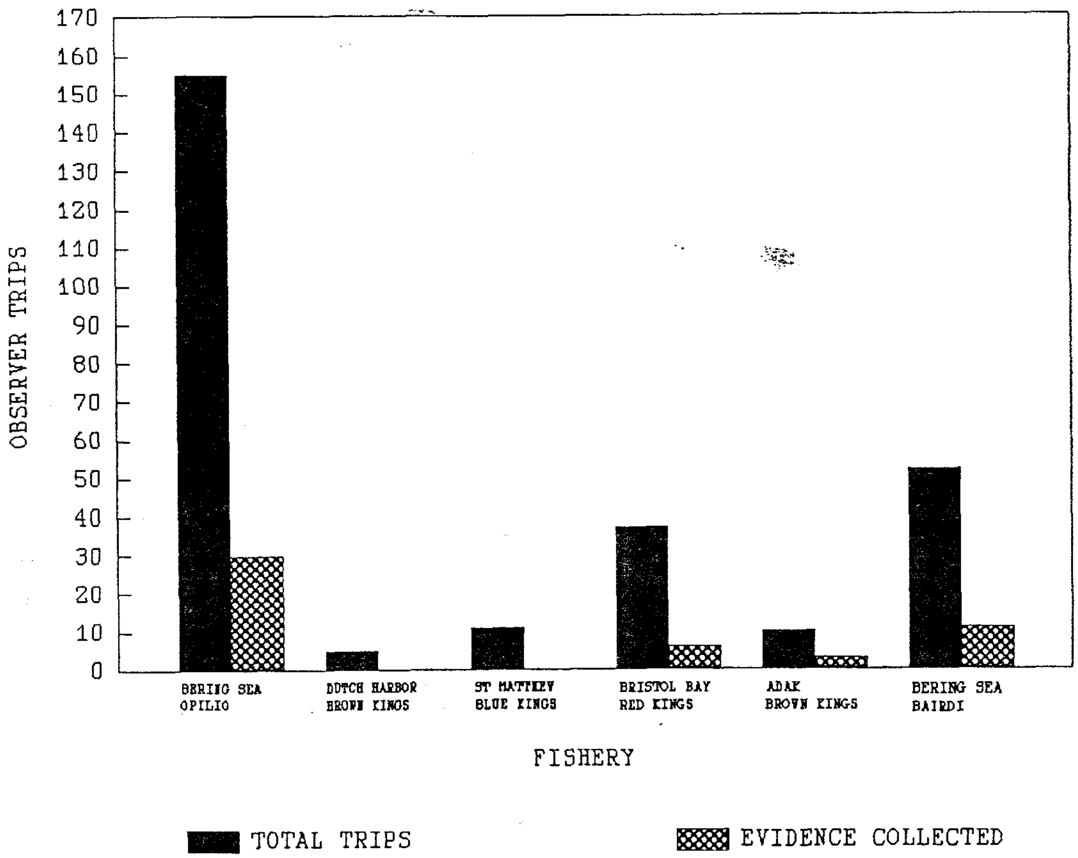

Figure 5. Number of observer trips and observer trips where evidence was collected, by fishery from January 1, 1991 to January 15, 1992. Bering Sea Bairdi data does not include data from the 1990 season that occured in 1991.

APPENDIX 11

FY 93 BUDGET AND PROGRAM OVERVIEW

DIVISION OF COMMERCIAL FISHERIES

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January 24, 1992

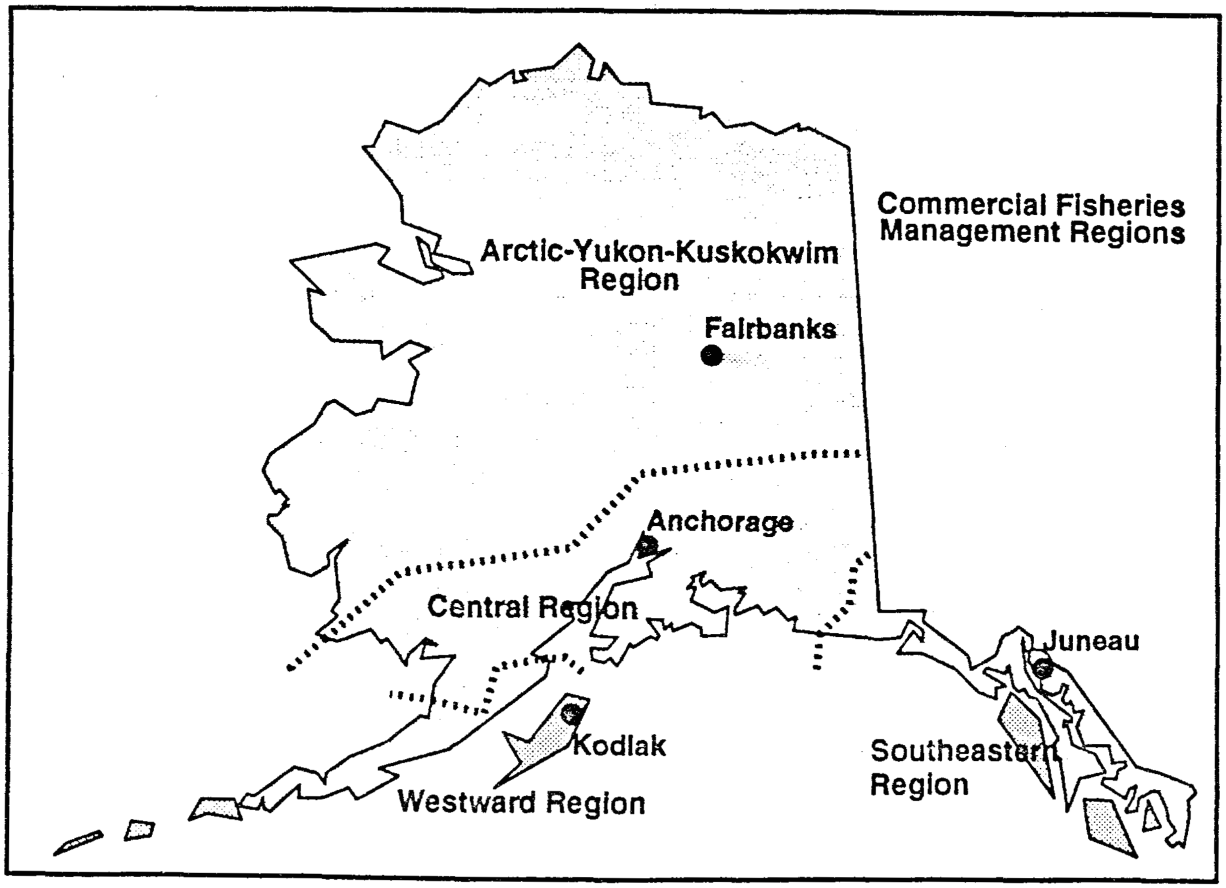
FY 93 BUDGET OVERVIEW

DIVISION OF COMMERCIAL FISHERIES
DEPARTMENT OF FISH AND GAME

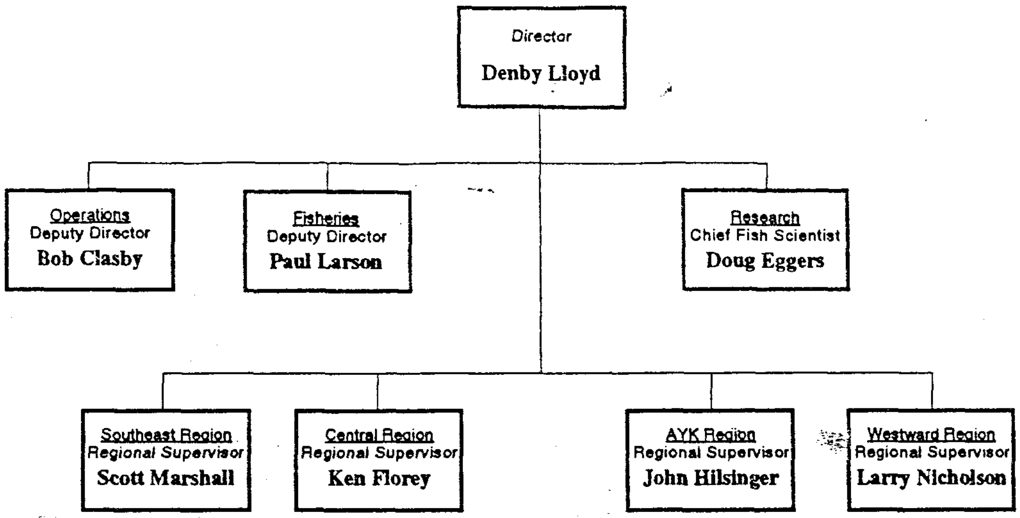
DIVISION FUNCTIONS and ORGANIZATION:

The Division of Commercial Fisheries is responsible for the management of the state's commercial, subsistence, and personal use fisheries. It also plays a major role in management of fisheries in the 200 mile Exclusive Economic Zone off Alaska and in international fisheries negotiations. The division carries out its mission by maintaining brood stock levels capable of producing optimum resource yield, preventing the overharvest of specific depressed stocks, identifying appropriate harvest methods, and minimizing incidental harvests of non-targeted species or stocks. The division also implements decisions of the Board of Fisheries that allocate fishery resources among various users. Data needed to make resource decisions are obtained by monitoring fishing effort and landing records, and by research studies of the distribution, species composition, availability, and reproductive requirements of fish populations.

The division is organized into a Headquarters Office located in Juneau and four regions: Southeastern, Central, Westward, and Arctic-Yukon-Kuskokwim.



COMMERCIAL FISHERIES ORGANIZATION



Southeastern Region and Headquarters

Location	PFT	PPT
Juneau Hq	31	3
Douglas Reg	37	27
Douglas Area	4	14
Craig	0	5
Haines	1	13
Hoonah	0	1
Hyder	0	1
Ketchikan	6	29
Klawock	0	1
Pelican	0	1
Petersburg	10	18
Port Alexander	0	1
Sitka	8	17
Snettisham	0	2
Wrangell	1	4
Yakutat	1	8
	99	145

Central Region

Location	PFT	PPT
Anchorage Reg	17	7
Cordova	10	23
Dillingham	5	30
Galena	0	0
Homer	7	8
King Salmon	2	28
Soldotna	6	34
Tutka Lagoon	0	1
	47	131

Arctic-Yukon Kuskokwim Region

Location	PFT	PPT
Anchorage	18	9
Anvik	0	4
Bethel	5	24
Emmonak	0	14
Fairbanks	4	15
Kotzebue	1	9
Nome	3	13
Saint Mary's	0	10
	31	98

Westward Region

Location	PFT	PPT
Kodiak	31	58
Belkofsky	0	1
Chignik	1	8
Cold Bay	0	4
Dutch Harbor	4	9
King Cove	0	4
Bear River	0	2
Sand Point	1	7
Port Moller	0	3
	37	96

Division Totals

Comm Fish	180	338
Special Proj	34	132
	214	470

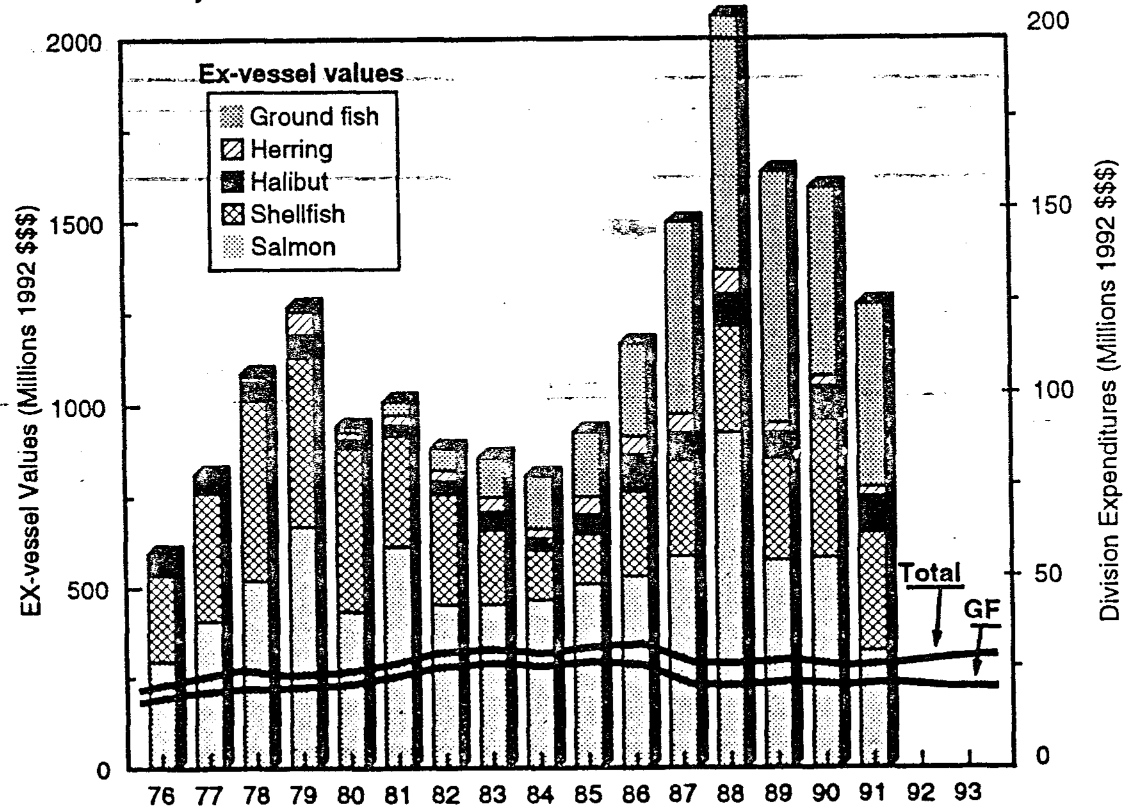
The above organizational chart shows key headquarters and region staff for FY 93, as well as office staffing levels. Note that temporary positions are included with permanent part time (PPT) positions in the above table.

FUNDING HISTORY AND FISHERY VALUES:

The exvessel value of Alaska's commercial fisheries for 1991 is estimated to be about $1.2 billion, a $261.3 million decrease from the 1990 value. The 1991 exvessel value of the salmon fishery was $309.3 million, while the values for groundfish, herring, halibut and shellfish were, $479.4, $26.0, $94.3 and $313.0 million respectively.

Ex-vessel Values of Alaska's Commercial Fisheries, and Expenditures by the Division of Commercial Fisheries.

(All amounts shown as real dollar amounts inflation adjusted to the 1992 US Urban Consumer's Price Index)

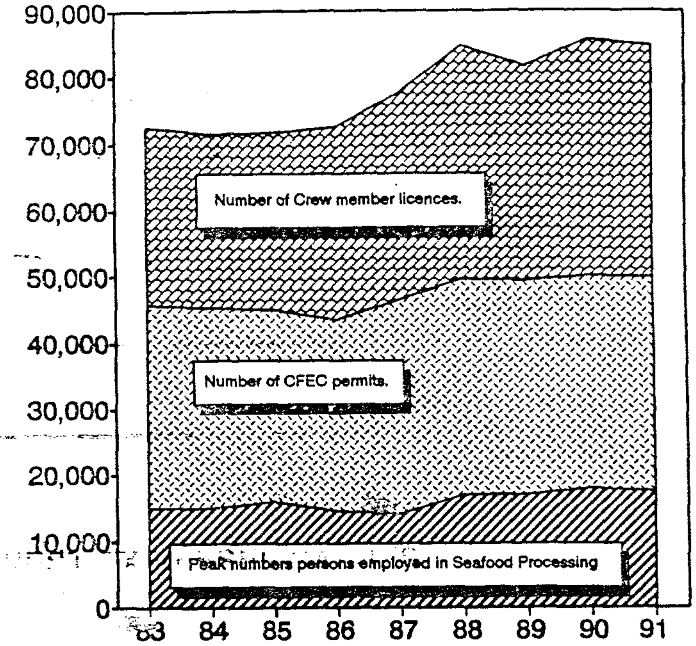


The division's budget has remained fairly stable during recent years, although there have been losses to the programs due to budget cuts in FY 90 and FY 92, as well as the effects of inflation. In dollar amounts, the division's FY 93 GF Budget Request is a historical high, surpassing the FY 85 budget by $214.9. However, when adjusted for inflation, the FY 93 request has only 75% of the purchacing power of the FY 85 spending levels, and is actually just about equal to the FY 80 budget, (see graph on page 15).

Based on the number of fishing licenses issued and an estimate of jobs in the processing industry, more than 25 percent of the working age population of the state is directly involved in the fish processing and harvesting sector of the industry. An even higher percentage are involved if one counts businesses indirectly associated with the fishing industry.

The number of people actively engaged in the commercial fishing industry has been gradually increasing. The graph on the right gives an indication of that growth expressed as number of Commercial Fisheries Entry Commission fishing permits issued, the number of people licensed to crew on fishing vessels and tenders, and the number of people employed in the fish processing sector.

Fisheries Employment



The fishing industry is important to Alaskan communities. For many small coastal communities, commercial fishing is the major source of cash, whether it be direct or indirect. The boroughs and cities of the state receive a share, about one-half, of the state's fish tax. Their share of the FY 91 tax was $18.2 million. For many small communities, their share likely represents a significant portion of their tax base.

CHANGES TO FY 92 BUDGET:

The division has not made any substantive changes between the way the FY 92 budget was authorized and the way it is being spent. The division was required to reduce its General Fund service level by about $1.7 million below that provided in FY 91. Reductions were made in salmon, herring, groundfish, and crab projects around the state, most of which were relatively new enhancements to existing programs.

FY 93 BUDGET REQUEST:

The FY 93 Governor's budget request will allow the division to continue the level of services it provided in FY 92. Those programs and projects that are being operated during FY 92 will be operated again in FY 93. The Governor's FY 93 budget request also contains funding for a number of new or expanded projects. All but one of these projects will be supported by general funds.

<u>Bering Sea/Aleutians Crab</u> $141.5

Biological information on crab landed at shore side processing facilities will be collected, and quality of similar information collected at sea will be improved. Such information is critical to the setting of preseason harvest levels and ensuring that the allowable harvest is not exceeded.

Kuskokwim Herring $42.5

Herring returning to the five Kuskokwim Area herring fisheries will be sampled for biological information. The local herring stocks are currently experiencing a decline in recruitment. It is important that the Kuskokwim herring program be improved to ensure that the stocks are not over harvested and that the stocks be rebuilt.

Prince of Wales Island Herring Pound Fishery $44.8

During its winter 1990/1991 meeting, the Board of Fisheries established a herring roe-on-kelp in pounds fishery that will take place in the waters off Prince of Wales Island. This increment will provide the funds needed to manage that fishery, which has a potential exvessel value of $1.2 million.

Norton Sound Crab Fishery $22.5

This increment will provide the funds needed to reopen the Norton Sound summer red king crab fishery. The last time the fishery was open, 1990, about $580 thousand worth of crab were harvested.

US/Canada Pacific Salmon Treaty $884.2

This increment provides increased federal funds for a number of US/Canada Pacific Salmon Treaty activities such as assessment of wild chinook stocks in southeastern Alaska, estimates of the contribution of British Columbia stocks to the southeastern Alaska fisheries, identification of Yukon River stocks, improved escapement estimations for Yukon River stocks, and improved information on subsistence salmon uses along the Yukon River.

The following "flow chart" details the development of the FY 93 General Fund budget request starting with the FY 92 Governor's request:

FY 92 Governor's Request	FY 92 Legislative Additions	FY 92 Conference Committee	Governor's Vetoes	FY 92 Authorized	FY 93 Adjustments	FY 93 Adusted Base	Increments/ Decrements	FY 93 Governor's Request
19,345.5	1,815.3	21,160.8	(1,725.6)	19,435.2	728.5	20,163.7	248.9	20,412.6

FY 92 LEGISLATIVE ADDITIONS

311.2	Industry Support
197.9	Vessels
240.9	EEZ Fisheries
53.3	Fisheries Initiatives
379.6	Public Service
67.7	Crab Observers
148.4	Subsistence Surveys
100.0	Yukon Coop Management
70.9	Noatak Sonar
40.0	Chilkat Sockeye
50.0	DIPAC CWT
19.1	Willow Creek Wier
38.3	Kuskokwim Herring
98.0	Bycatch Stock ID
1,815.3	TOTAL

GOVERNOR'S VETOES

311.2	Industry Support
197.9	Vessels
240.9	EEZ Fisheries
53.3	Fisheries Initiatives
289.9	Public Service
67.7	Crab Observers
148.4	Subsistence Surveys
100.0	Yukon Coop Management
70.9	Noatak Sonar
40.0	Chilkat Sockeye
50.0	DIPAC CWT
19.1	Willow Creek Weir
38.3	Kuskokwim Herring
98.0	Bycatch Stock ID
(1,725.6)	TOTAL

INCREMENTS/DECREMENTS

141.5	Bering Sea Crab
42.5	Kuskokwim Herring
44.8	PWI Herring Pounds
22.5	Norton Sound Crab
8.5	Computer Chargeback
-10.9	GF/Match
248.9	TOTAL

COMPONENT REQUEST FUNDING SOURCES

19,922.7	General Fund
489.9	General Fund Match
673.3	Federal Fund
1,944.7	Test Fish Fund
23,030.6	TOTAL REQUEST

MAJOR ISSUES:

The following are several major issues that confront the state's commercial, subsistence, and personal use fishery management programs for FY 93 and beyond.

Vessel Maintenance: The division has five large research and support vessels, with a total replacement value in excess of $ 10 million, that require regular maintenance and periodic overhaul. These vessels are integral to a variety of finfish, shellfish, and groundfish stock assessment programs as well as provide platforms for inseason management of several specific fisheries. Maintenance must be provided to protect this capital investment and to assure safety and efficiency of the vessel support program. In addition, one of the vessels, the R/V Steller, has recently been found to be unstable to the degree that it has been pulled out of service. It will most likely have to be replaced with a new vessel.

Groundfish Management: Federal and cooperative management of groundfish in the Exclusive Economic Zone (EEZ) off Alaska (3-200 miles) is quickly becoming so complicated that the state is loosing the ability to protect its legitimate interests. Allocation of allowable harvests and limitation of impacts on state-managed resources are issues of great import to Alaska residents, yet which are not adequately addressed with current fiscal resources.

Genetic Stock Identification: Ascribing harvests of mixed-stock fisheries to stock of origin is fundamental to the protection and optimal exploitation of distinct reproductive populations; such stock ID work is also increasingly important in allocation, bycatch, and interception disputes. Although existing stock ID methods have shown general patterns, new more reliable techniques (such as use of genetic markers) will be necessary to adequately address the detailed questions being asked.

Developing Fisheries: In recent years there has been a growth in exploitation of previously underutilized species such as sea cucumbers, sea urchins, and clams. These growing industries, however, are exploiting stocks not normally assessed or managed by the division. In order to best take advantage of these development opportunities, more assessment and management planning will be required.

Bering Sea Herring: Western Alaska herring stocks support locally important commercial and subsistence fisheries, yet some of the stocks themselves are showing signs of decline. Existing rudimentary aerial survey techniques may not be sufficient to assure adequate protection, and certainly will not provide for optimal utilization, of these distant fishery resources.

Pink Salmon Quality: As exemplified in 1991, it would be desirable for management of commercial fisheries to account not only for spawning escapement and harvest of optimum numbers, but also assist the industry in harvesting fish of high quality. Pink salmon harvested some distance away from their natal streams can be of higher quality than those harvested in terminal areas. But such distant harvests present real risks of overexploiting some stocks in mixed-stock fisheries. Studies to distinguish separate stocks at distances from spawning streams, combined with marketability analyses for quality, will be necessary to achieve an optimum balance.

Shellfish Stock Assessment: Almost all of the king, Tanner, and Dungeness, as well as other shellfish, stocks in Alaska are managed on very rudimentary information about stock status, reproductive potential, and optimum exploitation rate. This has resulted in very conservative management in many areas and has allowed for some boom and bust cycles in the past. Given lower prices for salmon in recent years, shellfish fisheries hold substantial potential for increased income and revenue, but such expansion will require significant increases in assessment information and management precision.

U.S./Canada and Southeast Salmon: Currently much of the salmon management and research program in southeast Alaska relies upon federal funding pursuant to the Pacific Salmon Treaty and ongoing U.S./Canada negotiations. If any substantial portion of those federal funds were lost, either through competition with other participants in the treaty process, lack of annual Congressional appropriation, or other circumstance, then the southeast salmon program would be at risk. The challenge will be to wean core management and research projects off this federal funding and to secure stable state funding to assure an adequate program.

CAPITAL REQUESTS:

As of the date of this document, the Governor has not finalized the Capital Improvement Projects Budget request.

LEGISLATION:

The division did not request the introduction of any legislation this year.

DIVISION FUNDING
(Thousands of dollars)

Funding	FY93 Gov.	FY92 Auth.	FY91 Auth.	FY90 Auth.	FY89 Auth.	FY88 Auth.
Gen. Fund	$20412.6	$19435.2	$19804.9	$18473.2	$18569.6	$16699.1
GF/Prog. Rec.	2141.8	2141.8	1504.0	1607.4	1487.4	1173.4
Fed. Rec.	6332.7	5076.5	4573.6	4302.7	4278.0	4282.7
F&G Fund	381.4	381.4	181.4	0.0	0.0	0.0
I/A Rec	271.5	271.5	267.4	264.7	231.0	372.6
TOTAL	29540.0	27306.4	26331.3	24648.0	24566.0	22497.8
Personnel						
PFT	214	216	204	198	195	194
PPT	454	465	479	488	491	479
Temp.	16	16	16	16	16	0
Staff Months	4120	3948	4102	4049	4049	3837

COMMERCIAL HARVEST EX-VESSEL VALUES
(millions of dollars)

Fishery	1991	1990	1989	1988	1987	1986
Salmon	$309.3	$540.0	$505.0	$780.0	$473.0	$414.0
Herring	26.0	26.9	24.2	55.9	42.7	38.5
Halibut	98.1	85.0	76.1	74.5	60.9	79.4
Groundfish	479.4*	479.4	606.8	673.9	423.5	197.9
DAP	479.4*	450.0	402.0	254.9	118.6	24.1
JVP	0.0*	29.4	204.8	419.0	304.9	173.8
Shellfish	313.0	352.0	274.0	244.1	213.5	182.0
TOTAL	1,222.0	1,483.3	1,486.1	1,828.4	1,213.6	911.8

TAX REVENUES GENERATED BY FISHING THE INDUSTRY
(Thousands of dollars)

	FY 91	FY 90	FY 89	FY 88	FY 87	FY 86
Fish Proc. Taxes	$41,365.2	$38,242.9	$41,338.0	$29,237.5	$26,605.1	$21,104.4
Salmon Enhacement Tax	6,149.0	6,520.3	9,544.0	5,768.8	4,444.1	4,263.1
Seafood Marketing Tax	3,275.0	3,264.6	3,349.3	2,669.9	1,460.2	1,121.9
Marine Fuel Tax	10,073.5	9,235.1	7,208.0	5,294.4	5,372.9	5,289.7
CFEC Licence Fees	5,902.8	4,928.8	4,789.4	4,433.7	3,251.4	3060.0
TOTAL	66,765.5	62,191.7	66,228.7	47,404.3	41,133.7	34,839.1

INDUSTRY & FISHERIES EMPLOYMENT

	1991	1990	1989	1988	1987	1986
CFEC Permits	32,594	32,215	32,416	32,669	32,540	29,144
Vessel Licenses	17,580	17,417	16,963	16,574	16,262	15,389
Crew Member Licenses	34,906	35,588	32,433	35,207	31,159	29,904
Processors & Buyers	559	541	517	526	502	510
Processing Employment	17,400	17,850	17,000	16,900	14,000	14,400

* Note: All 1991 value and industry figures are preliminary. Groundfish values for 1991 are not available as of this writing. Prices and landings for groundfish were similar in 1990 and 1991.

Distribution of the state's fish tax collected in FY 91 by borough and by city. A total of $29.3 million was collected, of which $18.2 was distributed to Alaska's boroughs and cities.

Distribution to Boroughs	
Aleutians East	$2,392,602.44
Anchorage	150,583.98
Bristol Bay	1,990,090.89
Haines	196,473.53
Juneau	19,541.43
Kenia	994,574.73
Ketchikan	323,382.44
Kodiak	1,295,920.62
Lake & Peninsula	1,207,092.74
NW Arctic	2,694.86
North Star	902.57
Sitka	505,543.47

Distribution to Cities	
Akutan	$572,507.92
Atka	178,607.10
Bethel	37,573.09
Chignik	245,674.27
Clark's Point	129,476.50
Cordova	529,110.11
Craig	39,969.79
Dillingham	280,603.96
Emmonak	9,302.50
False Pass	6,719.24
Goodnews Bay	17,404.50
Homer	126,648.63
Hoonah	58,882.51
Kenai	302,455.00
Ketchikan	252,977.11
King Cove	456,604.19
Kodiak	874,193.19
Kotzebue	2,730.34
Larson Bay	91,283.18
Old Harbor	3,162.08
Pelican	172,183.44
Petersburg	729,582.29
Saint George	12,177.04
Saint Mary's	7,120.77
Saint Paul	748,352.59
Sand Point	87,628.74
Seldovia	7,280.75
Seward	283,903.81
Togiak	99,573.81
Unalaska	2,067,793.37
Valdez	368,659.24
Whittier	22,276.20
Wrangell	57,488.55
Yakutat	235,272.67
All other cities	11,180.80

Division of Commercial Fisheries Budget by Management Region and Species, (Commercial Fisheries Component only; Special Projects are not included).

	FY 92 Authorized	FY 93 Base	FY 93 Incs/Decs	FY 93 Request
Southeastern Region				
Groundfish	510.8	526.6	-0.6	526.0
Herring	536.1	568.6	43.6	612.2
Salmon	3,278.4	3,366.2	-22.4	3,343.8
Shellfish	534.2	569.4	0.0	569.4
Total	$4,859.5	$5,030.7	$20.6	$5,051.3
Central Region				
Groundfish	25.8	27.3	0.0	27.3
Herring	825.4	865.0	0.0	865.0
Salmon	3,917.9	4,102.5	0.0	4,102.5
Shellfish	557.6	564.7	0.0	564.7
Total	$5,326.7	$5,559.4	$0.0	$5,559.4
AYK Region				
Groundfish	0.0	0.0	0.0	0.0
Herring	465.1	479.4	42.5	521.9
Salmon	2,934.8	3,049.9	0.0	3,049.9
Shellfish	42.8	45.4	22.5	67.9
Total	$3,442.7	$3,574.7	$65.0	$3,639.7
Westward Region				
Groundfish	0.0	0.0	0.0	0.0
Herring	286.6	300.3	0.0	300.3
Salmon	2,817.6	2,935.7	0.0	2,935.7
Shellfish	2,427.7	2,516.2	108.3	2,624.5
Total	$5,531.9	$5,752.2	$108.3	$5,860.5
Headquarters Office				
Groundfish	290.2	297.7	1.7	299.4
Herring	478.5	473.5	0.9	474.4
Salmon	1,619.1	1,642.2	5.2	1,647.5
Shellfish	504.6	497.7	0.7	498.4
Total	$2,892.4	$2,911.2	$8.5	$2,919.7
Totals by Species				
Groundfish	826.8	851.6	1.1	852.7
Herring	2,591.7	2,686.9	86.9	2,773.8
Salmon	14,567.9	15,096.5	-17.1	15,079.4
Shellfish	4,066.9	4,193.3	131.5	4,324.8
Component Total	**$22,053.2**	**$22,828.2**	**$202.4**	**$23,030.6**

Note: Halibut are included in "Groundfish" in these figures.

Exvessel Values of Alaska's Commercial Fisheries, and Expenditures by the Division of Commercial Fisheries, (in Millions of dollars).

	Exvessel Values						Division Expenditures	
year	Salmon	Shell Fish	Halibut	Herring	Ground Fish	Total Value	GF	Total
76	119.7	97.3	20.5	2.5	1.1	241.1	**6.2**	**7.6**
77	176.4	153.2	17.6	2.7	1.6	351.5	**7.7**	**9.3**
78	241.2	230.6	23.4	7.2	3.3	505.7	**8.9**	**11.3**
79	346.8	239.0	32.9	32.7	6.3	657.7	**10.0**	**11.8**
80	254.1	265.3	13.5	12.2	8.9	554.0	**11.7**	**13.7**
81	397.3	196.9	19.3	18.6	24.0	656.1	**14.3**	**16.6**
82	309.7	211.7	24.9	20.2	40.9	607.4	**17.1**	**19.9**
83	320.2	146.6	35.3	28.9	78.0	609.0	**18.4**	**21.1**
84	343.1	102.1	24.9	19.8	107.2	597.1	**18.5**	**21.1**
85	389.0	106.3	40.3	38.0	137.5	711.1	**20.2**	**23.2**
86	414.0	182.0	79.4	38.5	197.9	911.8	**19.9**	**24.3**
87	473.0	213.5	60.9	42.7	423.5	1,213.6	**16.1**	**21.0**
88	780.0	244.1	74.5	55.9	[illegible]73.9	1,828.4	**16.9**	**21.9**
89	505.0	274.0	76.8	24.2	606.8	1,486.1	**18.5**	**23.7**
90	540.0	352.0	85.0	26.9	479.4	1,483.3	**18.6**	**23.4**
91	309.3	313.0	94.3	26.0	479.4	1,222.0	**19.8**	**25.0**
92	-----	-----	-----	-----	-----	-----	**19.4**	**27.3**
93	-----	-----	-----	-----	-----	-----	**20.4**	**29.5**

NOTES:

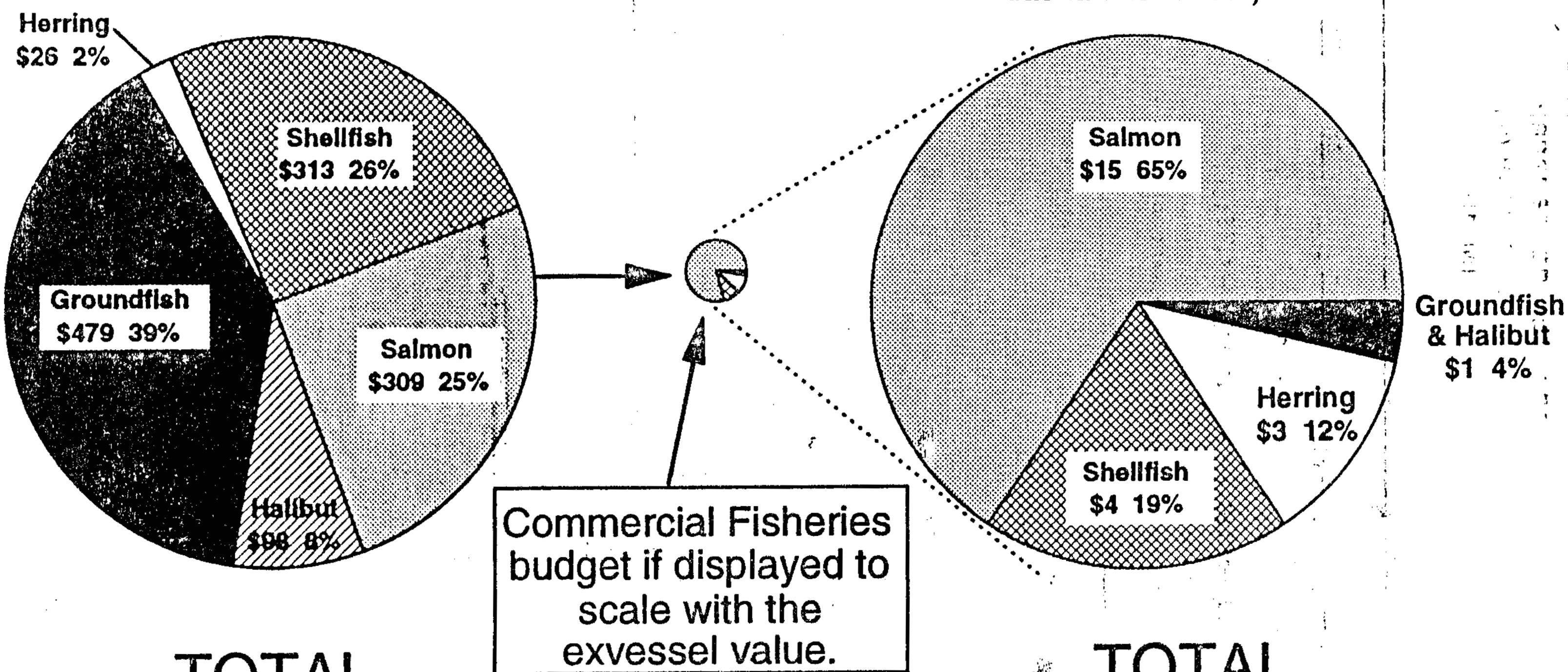
1) Nominal amounts displayed in the above table. Real (inflation adjusted nominal amounts) are shown on the graph on page 3.
2) Exvessel values do not include Washington landings or fish caught by foreign fleets.
3) Exvessel values are reported by calendar year, Division expenditures are by fiscal year. The Division authorized amount is shown for FY 92 and the Governor's request is shown for FY 93.
4) 1990 and 1991 exvessel values are considered preliminary, and may be subject to revision.

1991 Exvessel Values of Alaska's Commercial Fisheries

(Millions of dollars paid to fishermen for catches in Alaska waters.)

FY93 Commercial Fisheries Component Budget

(Millions of dollars spent by the division to manage various Alaskan fisheries.)



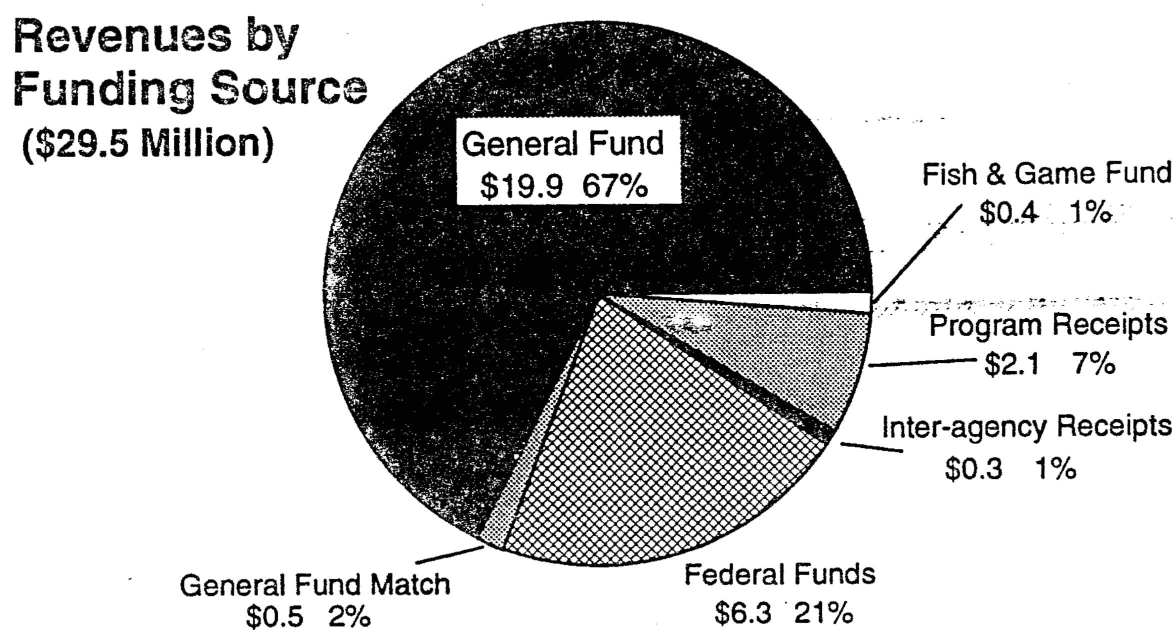
TOTAL
$1,222.0

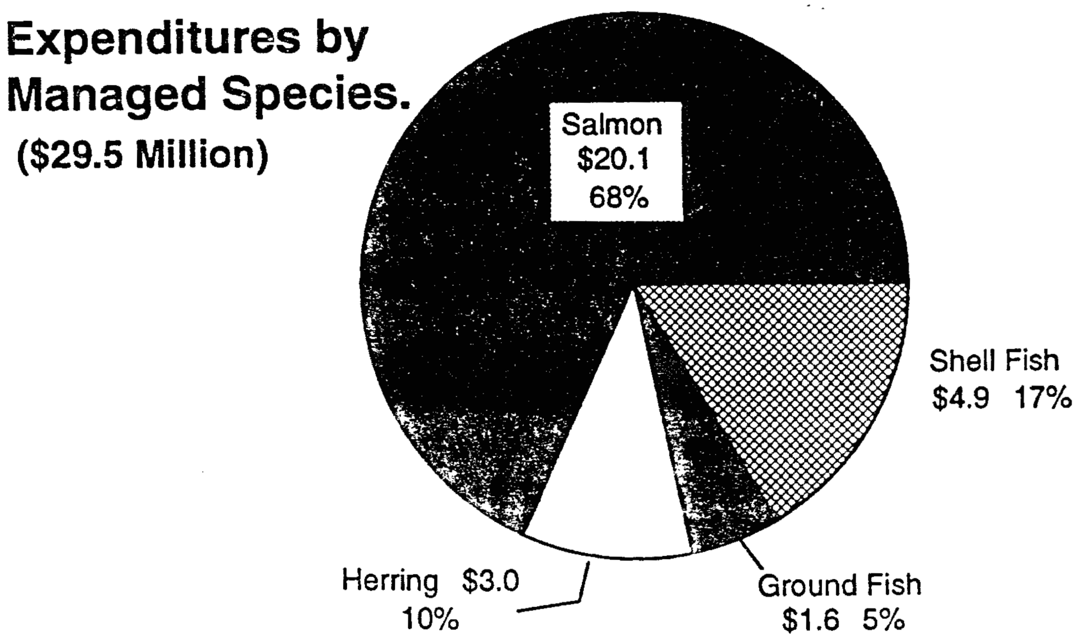
Foriegn fleet and Washington landings not included

TOTAL
$23.0

Commercial Fisheries Component only. Special Projects are not included.

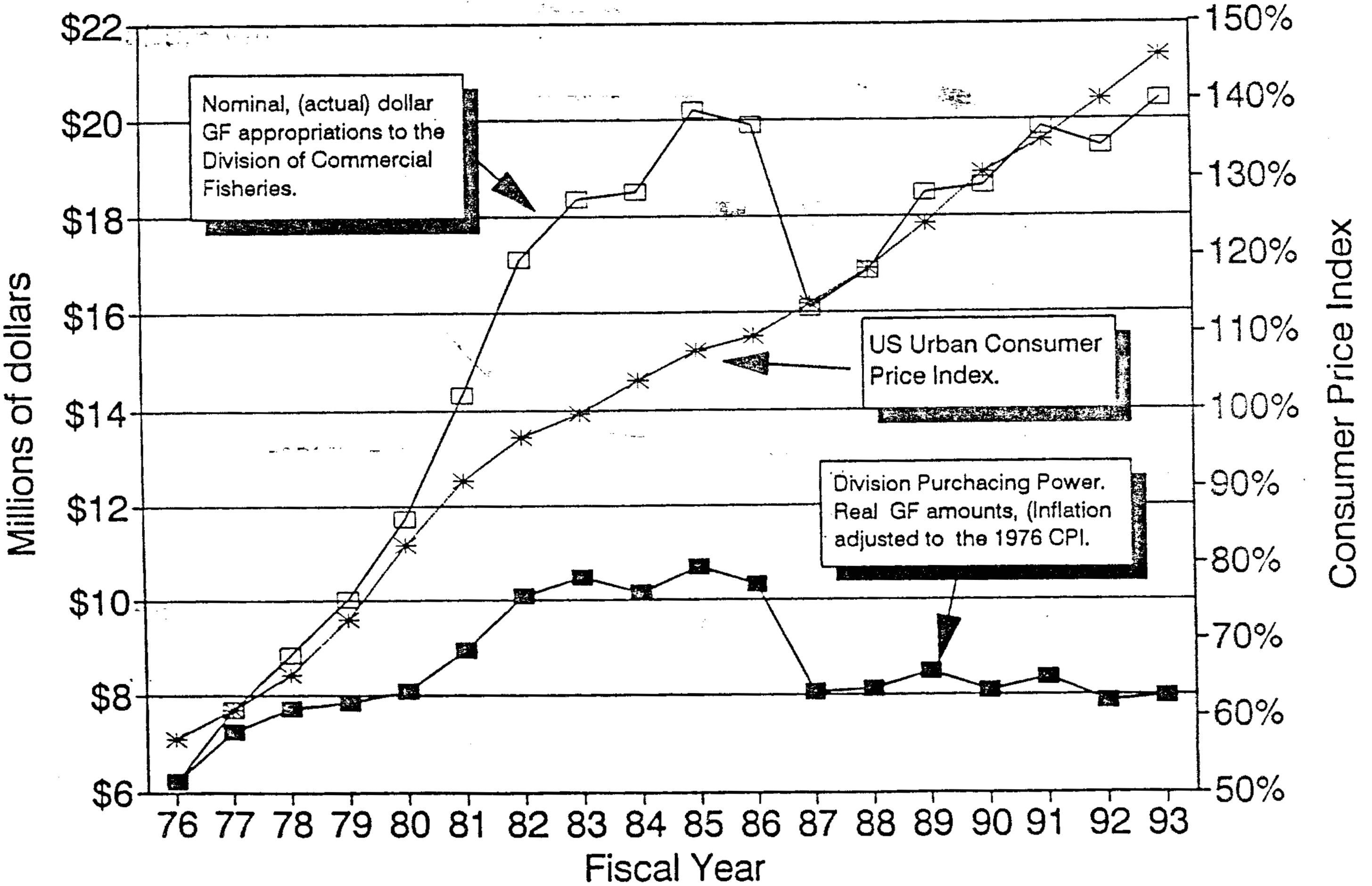
FY 93 Budget by Revenue Source and by Species for the Division of Commercial Fisheries
(Millions $$$)





Division of Commercial Fisheries GF Budget

1976 - 1993 Nominal amounts and
Inflation adjusted figures shown.



APPENDIX 12

SUBJECT: Comparing FY/91 and FY/92 Westward Regional Budgets

Funding Source	FY/91	FY/92
1. G.F. (plus salmon P.R.)	4,860.2	4,897.5
2. Bering Sea Tagging	270.1	664.2
SUBTOTAL	5,130.3	5561.7
3. Special Projects		
a. Oil Spill	243.3	141.5
b. I.P.H.C.	21.3	0.0
c. N.O.A.A.	90.0	116.6
d. Crab Catcher	15.0	16.7
e. Terror Lake	22.0	0.0
f. Pac-Fin	45.6 **	171.2 **
g. Pot Cod	12.4	0.0
4. Vessel C.I.P.	81.0	49.0
5. Line 500, Hdqts Increase	26.0	*
TOTALS	5,686.9	6,071.5

* Increased Costs in FY/92	= Line 100 (5% salary) =	210.2
	= Adak Brn Crab Tagging =	394.1
		604.3

** PAC-FIN crosses Fiscal year boundaries which complicates accounting.

In summary the FY/92 total Westward Regional Budget of 607[illegible] minus 5% salary increases -210.2 and Adak Brown Crab Surve[illegible] -394.1 would be 5,467.2 If we compare FY/91 (5686.9) to [illegible] (5,467) we have actually lost 219.0 Actual impact to the Westward Region includes either eliminating or reducing 15 projects. Within these projects 24 seasonal employees len[illegible] annual employment will be reduced and four positions cut.

FY/92

FISHERY UNIT = Kodiak Crab #3600

PROJ#	LEDGER	PROJECT	PFT	OTHER	72000	73000	74000	75000	77000	TOTAL	GF	FED	PR	IA	GFM	MONTHS	PRINT ORDER
CF-938	11009381	Crab Management & survey	154.8	105.9	9.0	8.5	9.0	4.5	0.0	291.7	291.7	0.0	0.0	0.0	0.0	46.0	No order
CF-942	11009421	King and Tanner Crab Research	144.1	0.0	3.0	5.0	4.5	0.0	0.0	156.6	156.6	0.0	0.0	0.0	0.0	24.0	No order
TF-946	641-9441	Crab Pot Buoy Stickers	0.0	0.0	0.0	0.0	10.0	0.0	0.0	10.0	0.0	0.0	10.0	0.0	0.0	0.0	
TOTAL		Kodiak Crab	299.0	105.9	12.0	13.5	23.5	4.5	0.0	458.3	448.3	0.0	10.0	0.0	0.0	70.0	
			404.8														

FISHERY UNIT = Bering Sea/Aleutians Crab #3800

PROJ#	LEDGER	PROJECT	PFT	OTHER	72000	73000	74000	75000	77000	TOTAL	GF	FED	PR	IA	GFM	MONTHS	PRINT ORDER
CF-956	11009561	Mandatory Observer Coord.	78.6	50.6	10.8	4.7	7.0	0.0	0.0	151.7	151.7	0.0	0.0	0.0	0.0	21.8	No order
CF-957	11009571	Fishery Monitoring BSA Crab	193.9	113.6	11.2	4.8	22.0	0.0	0.0	345.5	345.5	0.0	0.0	0.0	0.0	58.0	No order
CF-972	11009721	Bering Sea Shellfish Research	34.8	45.7	1.0	0.0	0.0	0.0	0.0	81.5	81.5	0.0	0.0	0.0	0.0	12.6	No order
TF-960	74119751	Bering Sea Crab Test Fishing	13.0	85.4	25.4	393.7	21.0	125.5	0.0	664.1	-0.1	0.0	664.2	0.0	0.0	13.2	No order
TOTAL		Bering Sea/Aleutians Crab	320.3	295.4	48.4	403.2	50.0	125.5	0.0	1242.8	578.6	0.0	664.2	0.0	0.0	105.6	
			615.7														

FY 93 Agency Request Budget. Submitted December 1991

Num	Code	Project	Costs	PFT Costs	Total L100	L200	L300	L400	L500	Total	GF	FED	PR	GF Match	MM	Project Mangager
[redacted]																
[redacted]																
3600	**Kodiak/Chignik Crab**															
CF-938	11009381	Crab Management & survey	161.4	113.7	275.1	9.0	8.5	9.0	4.5	306.1	306.1	0.0	0.0	0.0	46.0	William Nippes
CF-942	11009421	King and Tanner Crab Resea	149.2	0.0	149.2	3.0	5.0	4.5	0.0	161.7	161.7	0.0	0.0	0.0	24.0	Bill Donaldson
TF-946	641-9441	Crab Pot Buoy Stickers	0.0	0.0	0.0	0.0	0.0	10.0	0.0	10.0	0.0	0.0	10.0	0.0	0.0	Bill Nippes
Total Kodiak/Chignik Crab			310.6	113.7	424.3	12.0	13.5	23.5	4.5	477.8	467.8	0.0	10.0	0.0	70.0	
3800	**Bering Sea/Aleutians Crab**															
CF-956	11009561	Mandatory Observer Coord.	81.4	52.4	133.8	10.8	4.7	7.0	0.0	156.3	156.3	0.0	0.0	0.0	21.8	Bill Nippes
CF-957	11009571	Fishery Monitoring BSA Cra	202.1	118.1	320.3	11.2	4.8	22.0	0.0	358.3	358.3	0.0	0.0	0.0	58.0	Bill Nippes
CF-972	11009721	Bering Sea Shellfish Researc	35.8	29.0	64.8	3.7	0.0	0.0	0.0	68.5	68.5	0.0	0.0	0.0	9.2	Leslie Watson
TF-960	74119751	Bering Sea Crab Test Fishing	15.5	89.9	105.4	25.4	399.1	87.3	62.8	680.0	0.0	0.0	680.0	0.0	13.2	Leslie J. Watson
Adj Base Bering Sea/Aleutians Crab			334.8	289.5	624.3	51.1	408.6	116.3	62.8	1,263.1	583.1	0.0	680.0	0.0	102.2	
Increment IN-954 Crab Monitoring			0.0	49.0	49.0	11.3	1.0	20.0	0.0	81.3	81.3	0.0	0.0	0.0	11.8	Ken Griffin
Increment IN-956 Mandatory Observer Coord			0.0	45.8	45.8	14.4	0.0	0.0	0.0	60.2	60.2	0.0	0.0	0.0	9.0	Rance Morrison
Decrement Non-GF Cola Adjustment			0.0	0.0	0.0	0.0	0.0	0.0	(33.2)	(33.2)	0.0	0.0	(33.2)	0.0	0.0	Bob Clasby
FY93 Request Bering Sea/Aleutians			334.8	384.3	719.1	76.8	409.6	136.3	29.6	1,371.4	724.6	0.0	646.8	0.0	123.0	

FY 93 Agency Request Budget. Submitted December 1991

[redacted]

Proje Num	Ledger Code	Project	PFT Costs	PPT Costs	Total L100	L200	L300	L400	L500	Total	GF	FED	PR	GF Match	MM	Project Mangager
		Region 4 FY93 Adjusted Base														
		Westward Region Administration	833.2	136.0	969.1	43.5	165.4	89.7	30.8	1,298.5	1,298.5	0.0	0.0	0.0	176.0	
		Kodiak Salmon	396.5	448.7	845.2	6.6	90.3	70.5	4.3	1,016.9	985.7	0.0	31.2	0.0	166.0	
		Chignik Salmon	75.5	212.4	287.9	8.3	33.1	44.0	0.0	373.3	311.3	0.0	62.0	0.0	50.5	
		Peninsula/Aleutians Salmon	283.3	223.1	506.5	12.3	102.8	103.1	0.9	725.6	677.6	0.0	48.0	0.0	90.0	
		Kodiak Herring	0.0	52.9	52.9	3.0	16.5	11.5	6.1	90.0	90.0	0.0	0.0	0.0	10.7	
		Peninsula/Aleutians Herring	0.0	10.3	10.3	0.0	1.0	1.3	0.0	12.6	12.6	0.0	0.0	0.0	2.0	
		Kodiak/Chignik Crab	310.6	113.7	424.3	12.0	13.5	23.5	4.5	477.8	467.8	0.0	10.0	0.0	70.0	
		Bering Sea/Aleutians Crab	334.8	289.5	624.3	51.1	408.6	116.3	62.8	1,263.1	583.1	0.0	680.0	0.0	102.2	
		Westward Vessels	298.0	32.9	330.9	1.2	29.5	130.0	2.8	494.4	494.4	0.0	0.0	0.0	42.0	
		Region 4 Adjusted Base totals	2,532.0	1,519.4	4,051.4	138.0	860.7	589.9	112.2	5,752.2	4,921.0 ✓	0.0	831.2	0.0	709.4	
		Increments & decrements	0.0	94.8	94.8	25.7	1.0	20.0	(33.2)	108.3	141.5	0.0	(33.2)	0.0	20.8	
		Region 4 FY 93 Request Funding	2,532.0	1,614.2	4,146.2	163.7	861.7	609.9	79.0	5,860.5	5,062.5	0.0	798.0	0.0	730.2	
		FY92 Allocation			3,835.5	138.0	856.3	527.2	174.9	5,531.9	4,741.4	0.0	814.5	0.0	704.4	
		Difference (93-92)			310.7	25.7	5.4	82.7	(95.9)	328.6	321.1	0.0	(16.5)	0.0	25.8	

Notes:

2) OMB computed a COLA adjustment of $721.3 which was added to the Divisions FY 93 Base, of which $663.9 was GF and $57.4 was non-GF. The $57.4 is above the amounts the division expects to recieve from those funding sources, and is therefore decremented from the FY93 Request, with no actual impact on program funding. The $663.9 was used to fund salary increases.

4.741
141
310
5192

Westward Admin

PacFIN 1992-93 Proposal Summary Sheet

Alaska Department of Fish and Game

for

The Pacific Coast Fisheries Data Committee

BASE

Sub-task	Title	$1000s 91-92	92-93
5.A.	Groundfish Data Analysis	98.8	110.4
5.B.	Database Access	63.5	63.5
5.C.	Age Reading Lab	60.0	59.0
5.D.	Dockside Sampling	14.8	14.8
6.A.	Crab Fishery Data Analysis and Reporting	136.4	173.9
6.B.	Enhanced Crab Fishery Data Processing	47.5	-0-
	TOTAL:	419.9	421.6
INCREMENTS			
5.XA.	Groundfish Data Analysis		30.2
5.XC.	Age Reading Lab		27.9
6.XA/B.	Crab Dockside Sampling/Data Entry		26.8

173.9
26.8
200.7

Changes for 1992-93

1. Approximately $31k has been converted from equipment for GIS processing to bycatch analyst: moved from 6.A. to 5.A.

2. Three months biologists time (Kodiak) moved from 5.A. to 6.A.

3. Projects 6.A. and 6.B. combined into single crab data project.