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STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

JAY S. HAMMOND, GOVERNOR

AGENDA ITEM #7
January 1978

SUPPORT BUILDING - JUNEAU 99801

MEMORANDUM

DATE: January 13, 1978

TO: Council Members, Scientific and Statistical Committee, Advisory Panel

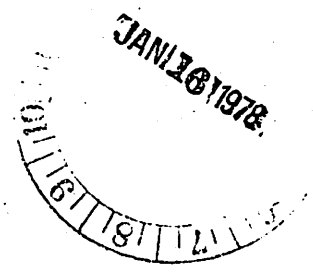
FROM: Don W. Collinsworth ^{pic} Manager Extended Jurisdiction Program

SUBJECT: Summary of King Crab Fisheries

As one item of business at this month's meeting of the North Pacific Fishery Management Council, the Council, in joint session with the S&S Committee and Advisory Panel, is scheduled to receive from the Drafting Team an "interim" report on the progress and development of the King Crab Fishery Management Plan.

The enclosed document, while not the text of the presentation, is a briefing document which you may want to review prior to the meeting and use as a reference to formulate questions of the Team during or after their presentation.

cc: Hutton
Herschberger



KING CRAB FISHERIES OFF THE COAST OF ALASKA

Briefing Report to the

North Pacific Fisheries Management Council,

Scientific and Statistical Committee, and

Advisory Panel

Prepared by

**Alaska Department of Fish and Game
Division of Commercial Fisheries**

January 13, 1978

INTRODUCTION

There are three species of king crab, red (Paralithodes comtschatica), blue (P. platypus), and brown (Lithodes aequispina), found in the waters off Alaska and the harvest of these crab is unique to this state.

The red king crab is the single most significant species in Alaska in terms of the total value to fishermen as well as to processors. In fact, it is twice as valuable as any one of the other major seafood species; i.e. salmon, halibut, Tanner crab, etc.

It is the purpose of this report to provide an introductory summary of this important king crab fishery and its management.

LOCATION OF FISHERY

King crab are located in the eastern Bering Sea and along the entire Pacific Coast of Alaska from Southeastern through the Aleutian Islands.

The waters off Alaska are divided into nine management areas (see Fig.1) with major fisheries occurring from lower Cook Inlet westward to Dutch Harbor and particularly in the eastern Bering Sea. The target species is red king crab which is found in abundance in all major areas. Blue king crab are fished as a target species near the Pribilof Islands and in Prince William Sound. Brown king crab are taken in Southeastern Alaska and in the Western Aleutians.

In general, king crab are caught on the continental shelf in depths less than 100 fathoms. Certain areas are extremely productive and a major portion of an entire management area's harvest may be caught within a fairly limited sub-area.

CATCH HISTORY

The domestic fishery started in 1920, but for 25 years catches and packs were sporadic and small. In 1947 U.S. trawlers began harvesting about a half million crab annually in the Bering Sea.

Foreign participation was initiated by the Japanese in 1930. During that year, 1 million crab were caught by a fleet of 12 small vessels fishing with tangle nets and processed by a factory mothership. Catches reached 2 million crab in 1933 but declined in succeeding years. The fishery was abandoned in 1940 prior to WW II. Japan's crab fleet was destroyed during the war and was not replaced until 1953 when she reentered the fishery. When Japan returned in 1953, the United States temporarily shifted its effort to stocks south of the Alaska Peninsula.

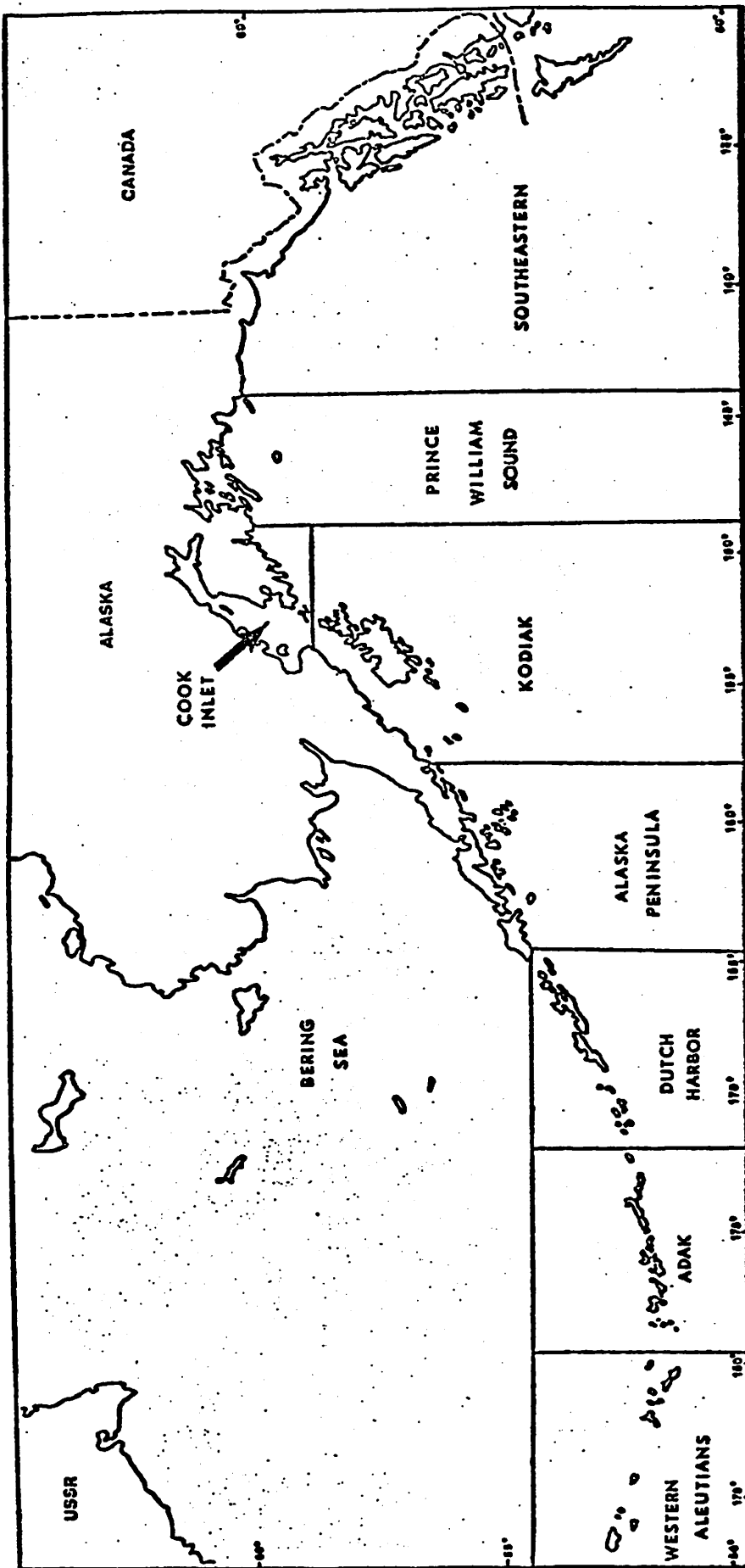


Fig. 1. The nine king crab management areas.

Japan's annual catches in the eastern Bering Sea remained near 8.5 million pounds through 1959. At that time Japan increased her effort and extended the fishing season.

The U.S.S.R. entered the fishery with one coal-burning mothership in 1959, increasing its level of activity with three large new vessels by 1963. The combined catch of these two countries peaked at about 58 million pounds in 1964 (see Fig.2). U.S. fishermen increased their effort for king crab in the Bering Sea in the late 1960s as stocks in the Gulf of Alaska became more heavily exploited. In the late 1960s and early 1970s, total catch declined to less than half of the peak years of 1962-64, principally as a result of bilateral arrangements which reduced the foreign catch. After 1971, the U.S.S.R. no longer participated in the fishery. Japan, after 4 years of very low catches, did not fish for king crab after 1974.

From 1953 through 1958 domestic king crab annual harvests averaged 9 million pounds statewide. Starting in 1959 harvests increased markedly to a peak in 1966 of 152 million pounds (see Fig.3).

By this peak in 1966, exploitation had forced many of the king crab fisheries to rely on one age class to support them and statewide production dropped to only 52 million pounds in 1970. During the 1970s the Alaskan Board of Fisheries and ADF&G started to rebuild the stocks by applying the concept of a multi-age class fishery. With this philosophy and large harvests in the Bering Sea area, the statewide harvest since 1974 has been about 100 million pounds annually.

The Kodiak management area dominated the State's harvests until 1969 and peaked in 1966 with 96 million pounds. Since 1971 the Bering Sea management area has had the greatest catch with over 70 million pounds harvested in both 1976 and 1977. These latest catches have been twice as large as the combined catches from all other management areas in the State.

The king crab catch, value, and participation (numbers of vessels and landings) for each management area and year (1969-76) are shown in Table 1.

VALUE OF CATCH

The statewide annual ex-vessel value since 1953 is shown in Fig. 4. The value has closely tracked the catch trends (ajoining figure) except for a relatively high value in 1973 stemming from an unusually high price.

A more detailed picture of the harvest value is shown in Table 2 where the value of king crab is compared to the totals of all shellfish and all fish (crab, salmon, halibut, etc.). Since 1969 king crab has accounted for 68 percent of the total value from all shellfish. This proportion has ranged from 59 percent to as high as 76 percent during the 1969-76 period. King crab accounted for 28 percent of the value of all the fisheries in the State in 1976. These values help demonstrate the significance of the fishery.

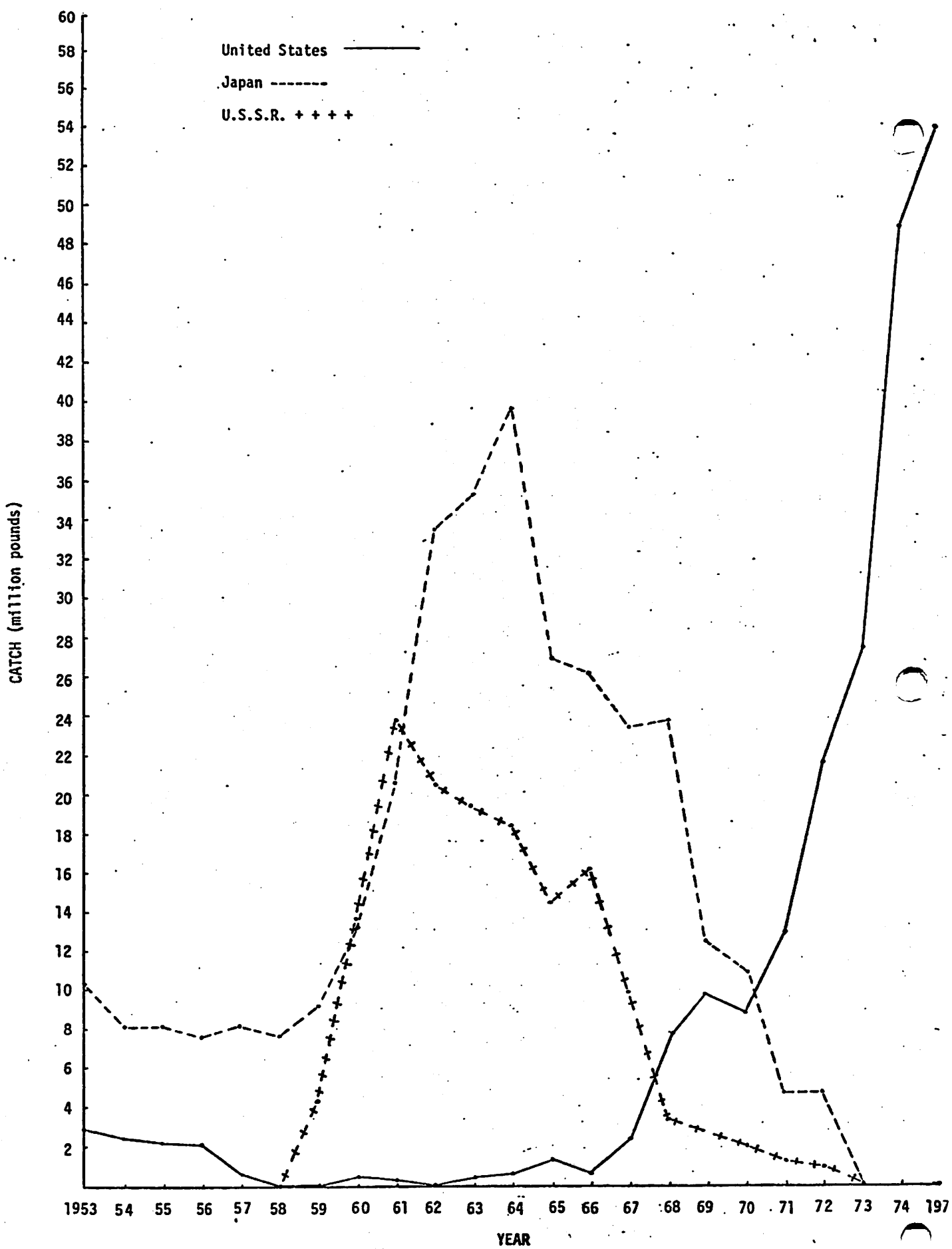


Figure 2. Annual king crab catches in the Eastern Bering Sea by the United States, Japan and U.S.S.R. from 1953 to 1975.

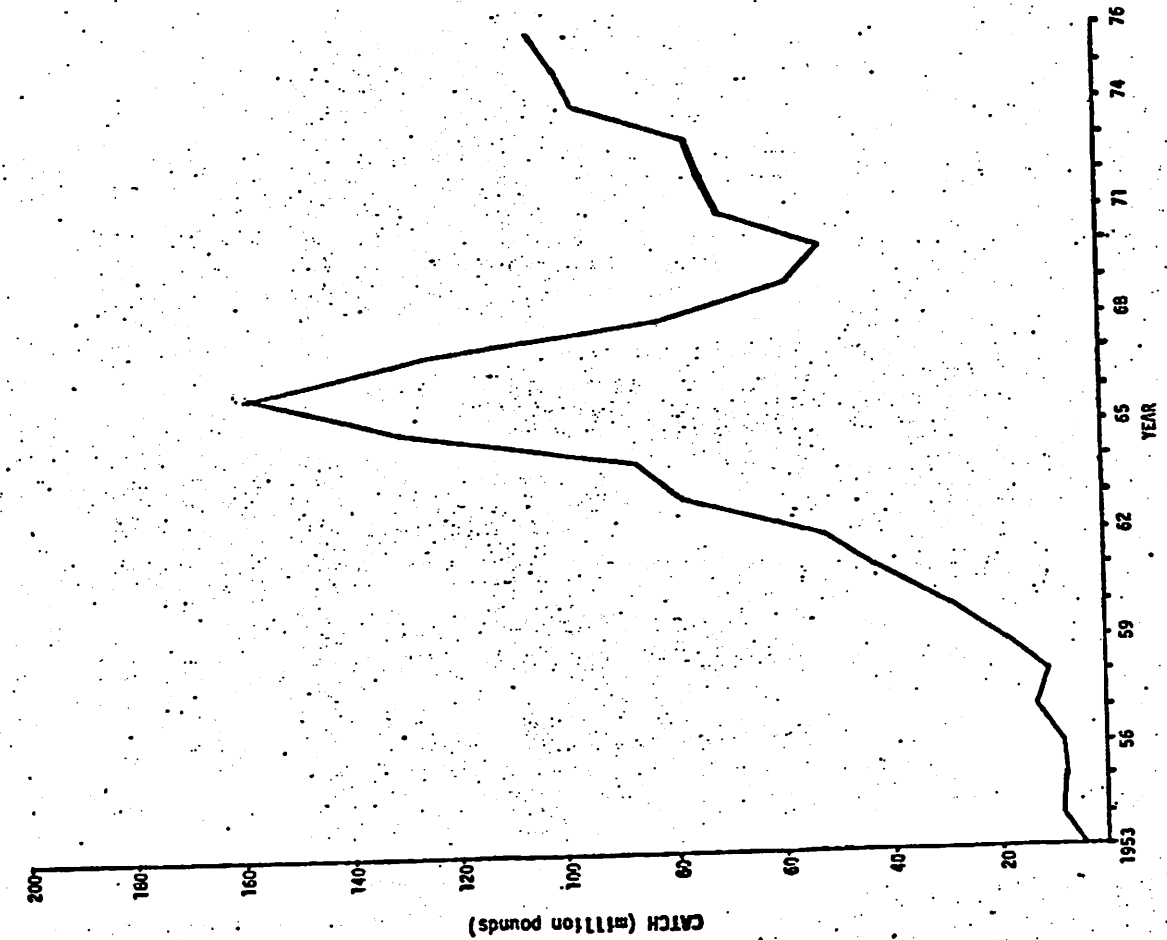


Fig. 3. Alaska king crab landings, 1953-76.

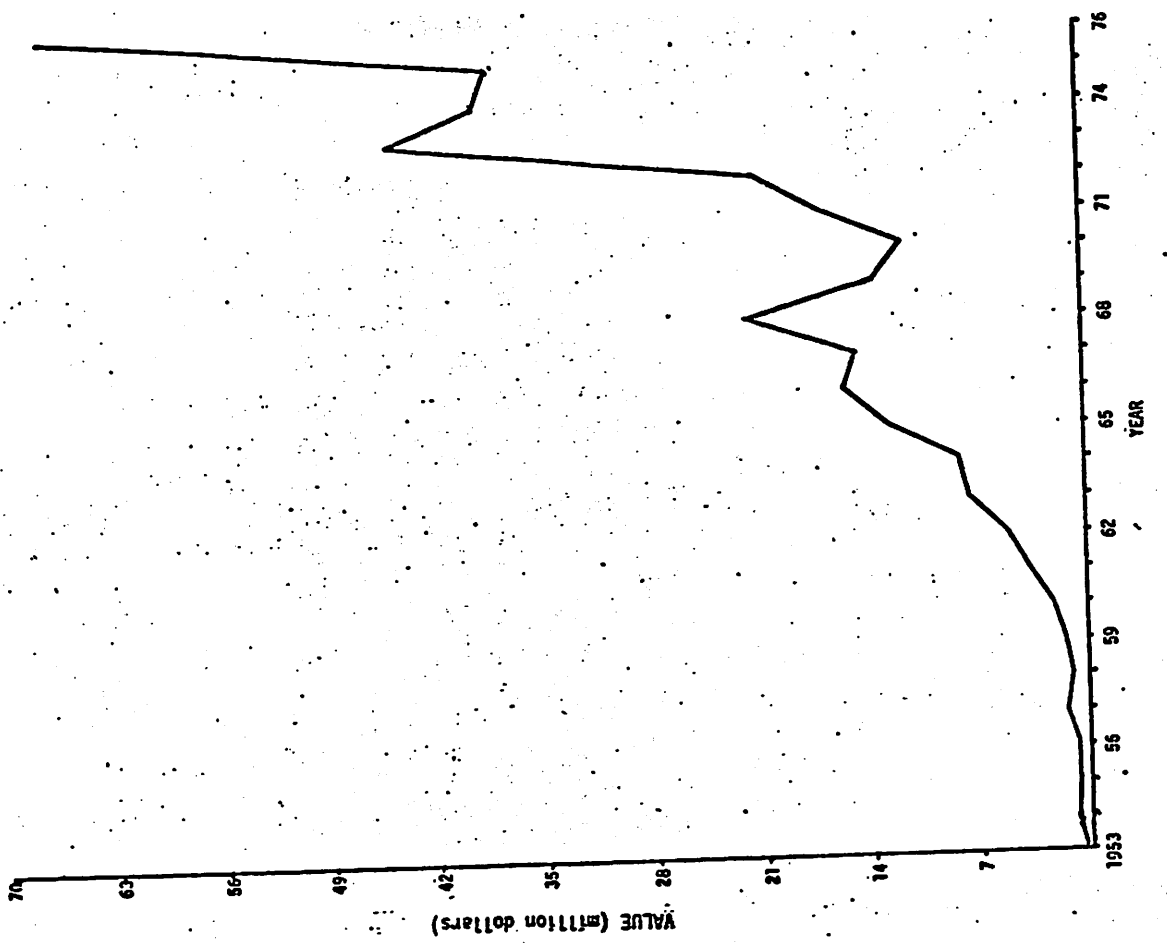


Fig. 4. Ex-vessel value of king crab in Alaska, 1953-76.

Table 1. Alaska king crab catch, value and participation by area and year (not by season).
Compiled by Commercial Fisheries Entry Commission (domestic fishery only).

YEAR	MANAGEMENT AREA	NO. of VESSELS	NO. of LANDINGS	POUNDS (thousands)	METRIC TONS	EX-VESSEL VALUE (thousand dollars)
1969	Southeastern	35	433	1,895	860	567
	Prince William Sound	19	80	48	22	13
	Cook Inlet	40	737	2,778	1,260	722
	Kodiak	142	1,294	12,996	5,895	3,498
	Alaska Peninsula	63	472	4,942	2,242	1,334
	Dutch Harbor	58	376	7,492	3,398	1,648
	Adak	16	44	2,456	1,114	516
	Western Aleutians	59	409	15,607	7,079	3,277
	Bering Sea	69	366	10,018	4,544	2,204
	TOTAL			4,211	58,232	26,414
1970	Southeastern	31	228	578	262	158
	Prince William Sound	12	52	94	43	26
	Cook Inlet	53	825	3,888	1,764	1,089
	Kodiak	115	958	12,077	5,478	3,382
	Alaska Peninsula	45	415	3,685	1,672	921
	Dutch Harbor	57	363	10,719	4,862	2,573
	Adak	7	18	664	301	153
	Western Aleutians	52	308	11,761	5,335	2,705
	Bering Sea	57	326	8,594	3,898	1,719
	TOTAL		3,493	52,060	23,615	\$12,726
1971	Southeastern	19	180	571	259	200
	Prince William Sound	20	74	144	65	43
	Cook Inlet	54	974	4,158	1,886	1,247
	Kodiak	87	649	11,896	5,395	3,569
	Alaska Peninsula	31	438	4,218	1,913	1,097
	Dutch Harbor	38	307	11,110	5,039	2,777
	Adak	6	8	219	99	44
	Western Aleutians	56	447	25,631	11,626	5,639
	Bering Sea	56	423	12,847	5,827	2,569
	TOTAL		3,506	70,794	32,109	\$17,185
1972	Southeastern	19	265	943	428	382
	Prince William Sound	25	196	296	134	121
	Cook Inlet	51	1,089	4,572	2,074	1,509
	Kodiak	88	707	15,480	7,022	5,882
	Alaska Peninsula	33	437	4,338	1,968	1,301
	Dutch Harbor	68	384	11,297	5,124	2,937
	Adak	4	7	118	54	29
	Western Aleutians	46	302	16,117	7,311	4,190
	Bering Sea	74	797	20,963	9,509	5,241
	TOTAL		4,184	74,124	33,624	\$21,592
1973	Southeastern	31	263	874	396	629
	Prince William Sound	22	135	208	94	135
	Cook Inlet	66	1,239	4,349	1,973	2,870
	Kodiak	131	869	14,404	6,534	9,507
	Alaska Peninsula	39	511	4,780	2,168	3,107
	Dutch Harbor	59	386	12,723	5,771	7,634
	Adak	10	50	615	279	314
	Western Aleutians	52	369	10,631	4,822	5,847
	Bering Sea	68	573	28,240	12,809	14,685
	TOTAL		4,395	76,824	34,846	\$44,728
1974	Southeastern	32	228	583	264	246
	Prince William Sound	21	63	85	39	52
	Cook Inlet	81	1,360	4,602	2,087	2,163
	Kodiak	161	1,266	23,031	10,446	10,134
	Alaska Peninsula	37	504	4,497	2,040	1,799
	Dutch Harbor	87	441	13,069	5,928	5,097
	Adak	15	35	721	327	281
	Western Aleutians	24	49	614	279	240
	Bering Sea	105	940	49,374	22,396	19,256
	TOTAL		4,886	96,576	43,806	\$39,268
1975	Southeastern	28	175	436	198	217
	Prince William Sound	10	79	53	24	24
	Cook Inlet	67	673	2,886	1,309	1,183
	Kodiak	170	1,572	24,101	10,932	10,845
	Alaska Peninsula	40	442	2,933	1,330	1,202
	Dutch Harbor	81	398	15,049	6,826	5,719
	Adak	5	12	255	116	89
	Western Aleutians	37	145	2,571	1,166	900
	Bering Sea	104	826	52,112	23,638	18,239
	TOTAL		4,322	100,396	45,539	\$38,418
1976	Southeastern	25	181	338	153	251
	Prince William Sound	12	82	17	8	9
	Cook Inlet	79	1,086	4,954	2,247	3,171
	Kodiak	194	1,332	17,522	7,948	12,546
	Alaska Peninsula	28	193	882	400	564
	Dutch Harbor	74	359	11,471	5,203	7,112
	Adak	11	22	114	52	70
	Western Aleutians	9	20	272	123	166
	Bering Sea	142	1,501	70,411	31,938	43,631
	TOTAL		4,776	105,981	48,072	\$67,520

Table 2. Landings and ex-vessel value of king crab, all shellfish, and all fish in Alaska. 1969-76

Year	King Crab	All Shellfish	All Fish
	-----thousand pounds-----		
1969	58,232	128,556 (45)	384,994 (15)
70	52,060	150,647 (35)	542,247 (10)
71	70,794	182,631 (39)	451,779 (16)
72	74,124	199,236 (37)	401,463 (18)
73	76,824	265,001 (29)	465,563 (17)
74	96,576	273,309 (35)	465,507 (21)
75	100,396	249,303 (40)	444,309 (23)
76	105,981	316,697 (33)	614,345 (17)
	-----thousand dollars-----		
1969	13,779	18,513 (74)	68,028 (20)
70	12,726	18,404 (69)	96,989 (13)
71	17,185	23,137 (74)	77,403 (22)
72	21,592	28,412 (76)	86,121 (25)
73	44,728	68,350 (65)	146,271 (31)
74	39,268	66,913 (59)	149,490 (26)
75	38,418	55,813 (69)	128,799 (30)
76	67,520	95,930 (70)	245,218 (28)

Numbers in parentheses represent the proportion of king crab

Source: Commercial Fisheries Entry Commission

The red king crab is the preponderant species in the king crab harvest. It is also the single most valuable species of fish harvested in Alaska. Ex-vessel values in 1975 for dominant species are:

<u>Species</u>	<u>Million Dollars</u>
King crab (red crab only)	36
Red (sockeye) salmon	19
Pink (humpback) salmon	16
Halibut	15
Chum (dog) salmon	11
Shrimp (all species)	8

With its large catches in recent years, the Bering Sea management area obviously records the greatest ex-vessel values. The values in 1976 from king crab and the total of all other fisheries for each management area are given in Table 3. There is much diversity between areas. The average king crab landing value per vessel ranged from only \$800 in Prince William Sound to \$307,000 in the Bering Sea in 1976.

Considering only those vessels in each management area whose greatest king crab catch came from that area (middle columns of Table 3), then the average value per vessel in the Bering Sea was \$374,000. This value, on the average, was 74 percent of the total value from all the fisheries the vessels participated in; signifying that these dominant Bering Sea vessels participated primarily in the harvesting of king crab.

Analysis of vessel ownership shows that a significant proportion of the catch value is attributed to vessels whose registered owner's mailing address is outside of Alaska. In fact, one half of the king crab value (statewide) was caught by vessels whose registered owner's address was in the State of Washington (see Table 4).

VALUE OF PRODUCTION

The value of king crab production (at processor's level) in 1976 exceeded \$100 million for the first time. Table 5 compares the product value of king crab to the totals of all shellfish and all fish since 1969. On the average, king crab production value was 56 percent of all shellfish and 23 percent of all fish in 1976.

King crab production in terms of product form (section, meat, can) is shown in Table 6. Canned and meat production have been stable in the last few years while production of the section form has increased and accounted for 63 percent of the total product value in 1976.

Table 3. Exvessel Value¹ From King Crab And All Other Fisheries For 1976.

Management Area	For Vessels Fishing King Crab ² In The Given Management Area ²			For Vessels Whose Dominant King Crab Catch ³ Was In The Given Management Area ³			Total Exvessel Value From All Fisheries ⁴ (thousand dollars)		
	Number of Vessels	Exvessel Value of King Crab From The Area (thousand dollars)		Number of Vessels	Exvessel Value of King Crab From The Area (thousand dollars)		Total Value	Average Value/Vessel	% of Value That Was King Crab
		Total Value	Average Value/Vessel		Total Value	Average Value/Vessel			
Southeast	25	251	10	24	170	7	2,347	98	7
Prince William Sound	12	9	.8	12	9	.8	546	46	2
Cook Inlet	79	3,171	40	77	2,909	38	5,675	74	51
Kodiak	194	12,546	65	180	11,563	64	24,008	135	48
Alaska Peninsula	28	564	20	24	486	20	3,169	132	15
Dutch Harbor	74	7,112	96	21	3,376	161	5,939	283	57
Adak	11	70	6	0	-	-	-	-	-
Western Aleutians	9	166	18	0	-	-	-	-	-
Bering Sea	142	<u>43,631</u> 67,520	307	<u>108</u> 446	40,383	374	54,230	502	74

1 Exvessel value was derived from average prices applied to pounds landed - (Prices do not necessarily include all bonuses and payments in kind)

2 Vessels that fished in more than one area are included in each area that they fished.

3 Vessels are placed in the area where their greatest dollar value was caught.

4 Includes king crab from other management areas and salmon, Tanner crab etc.

Table 4. Catch and value (1976) for vessels whose owner's mailing address lies within the respective areas.

Area	Number of Vessels	Pounds Landed (thousand)	Ex-vessel Value (thousand dollars)	Average Value Per Vessel (thousand dollars)	Total Value From All Fisheries ¹ (thousand dollars)	Percent of Total Value That is King Crab
Resident						
Southeast Prince William Sound	25	1,593	1,016	41	3,276	31
Cook Inlet	18	471	319	18	1,075	30
Kodiak	82	11,226	7,274	89	9,951	73
Alaska Peninsula ²	173	25,951	17,401	101	29,921	58
Dutch Harbor	32	5,098	3,212	100	6,620	49
	13	6,493	4,098	315	4,613	89
	<u>343</u>	<u>50,832</u>	<u>33,320</u>	<u>97</u>	<u>55,456</u>	
Nonresident						
Washington	88	52,889	33,521	381	38,793	86
Other states ³	8	852	564	71	929	61
	<u>96</u>	<u>53,741</u>	<u>34,085</u>	<u>355</u>	<u>39,722</u>	

1 King crab, Tanner crab, salmon, halibut, etc.

2 Includes one owner from the Bering Sea. There were no owners in the Adak and Western Aleutians management areas

3 Oregon, Idaho, California and Wisconsin

Source: Commercial Fisheries Entry Commission and ADF&G Alaska Vessel Register.

Table 5. Value and poundage of king crab production (at processors' level) relative to all shellfish and all fish. 1969-76.

Year	King Crab	All Shellfish	All Fish
	-----thousand dollars-----		
1969	26,582	42,765 (62)	144,200 (18)
70	24,836	47,487 (52)	213,932 (12)
71	32,352	53,819 (60)	198,658 (16)
72	44,045	77,380 (57)	202,951 (22)
73	72,868	142,480 (51)	307,587 (24)
74	48,410	94,754 (51)	254,366 (19)
75	83,838	131,506 (64)	293,192 (29)
76 ¹	100,552	178,926 (56)	452,267 (22)
	-----thousand pounds----- (product weight)		
1969	12,824	29,666 (43)	189,008 (7)
70	14,842	36,347 (41)	284,802 (5)
71	17,147	37,827 (45)	239,061 (7)
72	19,794	49,082 (40)	201,829 (10)
73	28,581	82,806 (35)	227,380 (13)
74	25,512	69,290 (37)	247,752 (10)
75	40,350	78,814 (51)	216,767 (19)
76 ¹	38,831	95,591 (41)	283,111 (14)

Numbers in parentheses represent the proportion of king crab.

¹ Preliminary

Source: ADF&G, Catch and Production Statistics leaflet.

Table 6. King crab production and wholesale value.

Year	Section ¹	Meat ¹	Canned	Total
	-----thousand pounds----- (product weight)			
1969	2,196	9,272	1,356	12,824
70	6,712	7,041	1,089	14,842
71	6,290	9,884	973	17,147
72	8,965	9,803	1,026	19,794
73	19,358	8,277	946	28,581
74	14,473	10,229	810	25,512
75	34,689	4,587	1,074	40,350
76 ²	31,714	6,144	973	38,831
	-----thousand dollars-----			
1969	2,091	18,569	5,922	26,582
70	7,671	14,148	3,017	24,836
71	7,560	21,912	2,880	32,352
72	14,795	25,292	3,958	44,045
73	33,035	33,738	6,095	72,868
74	16,500	27,045	4,865	48,410
75	68,078	11,493	4,267	83,838
76 ²	63,600	32,534	4,418	100,552

1 Fresh/frozen form

2 Preliminary

Source: ADF&G Catch and Production Statistics leaflet, various issues.

With the Bering Sea being the dominant catch area, the processing industry has shifted a major portion of its effort to the Dutch Harbor area. In 1976, 60 percent of the king crab production (dollar value) came from the Dutch Harbor management area. Table 7 compares 1976 production by product form and management area.

CONSUMPTION, IMPORTS, EXPORTS

Catch records show that physical production reached a historical high in 1966 when 159.2 million pounds of king crab were landed. The ex-vessel value of this record catch (in 1966 dollars) was \$15.6 million. The catch for 1976 was 106 million pounds and had a value (in 1976 dollars) of \$67.5 million. Deflating the value of these two catches by the wholesale price index (all commodities, 1967=100) shows that even though the 1976 catch was approximately one third less in physical terms its value was over twice as great, \$15.7 million compared to \$36.9 million for 1966 and 1976 respectively.

The total supply of king crab (live weight), which was accounted for by landings, imports, and exports, was 65 million pounds in 1969 compared to 97 million pounds in 1976. The U.S. king crab consumption per capita, measured on the basis of live weight, has increased from .32 pound in 1969 to .45 pound in 1976.

Imports of king crab peaked in 1971 at 9 million pounds. However, imports have declined rapidly (in response to the withdrawal by Japan and the USSR from the Bering Sea area) and only 15,000 pounds were imported in 1975 (primarily from Japan).

Exports have increased from 1 million pounds in 1969 to 16 million pounds in 1973, with 9 million pounds being sold to foreign markets in 1976. The major destinations of the U.S. king crab exports were Japan, Netherlands, Belgium, and Canada with 29, 24, 14, and 12 percent of the total export value in 1976 respectively. The total export value of king crab in 1969 was only \$1 million, but has increased significantly since that time and was over \$13 million in 1976. Table 8 shows U.S. king crab supply and consumption per capita.

VESSELS AND GEAR

The size of the vessels used in the king crab fishery vary from small skiffs fishing a few crab pots in sheltered bays close to processors to large 180-foot vessels equipped with salt water circulating live tanks, fishing 500 pots several hundred miles from the nearest processor. In the past several years vessels have been constructed not only to catch king crab, but to process the catch on board the vessel.

Beginning in 1973 new vessels have been designed and constructed specifically

Table 7. King Crab Production by Management Area, 1976

Area	Number of Processors	Sections		Meat		Canned		Total King Crab Value Thousand Dollars
		Thousand Pounds	Thousand Dollars	Thousand Pounds	Thousand Dollars	Thousand Pounds	Thousand Dollars	
Southeast	6	140	187	63	280	0	0	467
Cook Inlet ¹ (& PWS)	6	1,685	4,123	410	2,188	0	0	6,311
14 Kodiak	14	10,862	17,990	249	1,249	799	3,899	23,138
Alaska Peninsula	4	3,196	6,914	680	4,193	174	519	11,626
Dutch Harbor ²	<u>15</u>	<u>15,831</u>	<u>34,386</u>	<u>4,742</u>	<u>24,624</u>	<u>0</u>	<u>0</u>	<u>59,010</u>
Totals	45	31,714	63,600	6,144	32,534	973	4,418	100,552

1 Confidentiality forced the lumping of the two small processors in Prince William Sound with another management area.

2 Includes communities of Dutch Harbor, Unalaska, Akutan, Captains Bay. Confidentiality forced the lumping of one processor that worked the Bering Sea and Adak areas.

Source: ADF&G Preliminary Catch & Production Statistics. 1976, Juneau

Table 8. U.S. king crab supply and consumption per capita.

Year	Population	Landings	Imports ^{a/}	Exports ^{a/}	Total ^{b/} Supply	Consumption Per Capita
	million persons	-----thousand pounds----- (live weight)				pounds
1969	202.677	58,232	7,715	1,157	64,790	.32
70	204.878	52,060	5,070	1,873	55,257	.27
71	207.053	70,794	8,990	1,151	78,633	.38
72	208.846	74,124	1,795	2,514	73,405	.35
73	210.410	76,824	500	16,220	61,104	.29
74	211.901	96,576	45	8,139	88,482	.42
75	213.540	100,396	15	7,161	93,250	.44
76	215.120	105,879	-	9,303	96,576	.45

a/ Converted to live weight based on the following factors:

meat to live 5.0
fresh/frozen sections to live 1.818

b/ Total supply is not adjusted for beginning and ending stocks.

Source: Population: U.S. Bureau of Economic Analysis, Survey of Current Business, 1977.

Landings: Commercial Fisheries Entry Commission

Imports: FAO Yearbook of Fishery Statistics and Japan Tariff Commission publications

Exports: U.S. Bureau of Census, U.S. Exports/Schedule B Commodity by country, FT 410, various issues.

to fish king crab in the Bering Sea. These vessels vary in length from 90 to 120 feet and are capable of fishing in adverse weather conditions. The vessels carry 200,000 - 300,000 pounds of crab and 200 king crab pots. These vessels are being built at a rate of at least one a month, and the shipyards have orders to last three years.

At one time, tanglenets and trawls were employed in the fishery, but by custom and law, the pot has evolved as the fishing unit. Size of pots are variable, but the standard pot consists of a heavy metal frame 7 x 7 x 3 feet covered with synthetic webbing and weighing approximately 700 pounds. Crab enter through two tunnels and drop into the body of the pot.

The pots are usually baited with frozen herring, set on the bottom, and left for at least 1 day before being pulled. Legal male crab are sorted into the vessel's live tanks, with the females and undersized males returned to the sea. The tanks are equipped with a pumping system that ideally changes the water at least every 30 minutes. The crab may be held in these tanks for a week or more until delivery. The live crab are either transferred to the processor's holding facilities or immediately processed.

CURRENT MANAGEMENT OBJECTIVES AND STRATEGIES

During the recent history of the king crab fishery, there have been employed three management strategies (systems of management) used to achieve two explicitly defined principal objectives. These objectives are in addition to those mandated under Title 16, Alaska Statutes, which deals with the protection, maintenance, improvement and extension of Alaska's fish and game resources. Prior to 1970, the objective was one of providing a maximum sustainable yield (MSY) harvest, with a management philosophy which was oriented to a recruit fishery. This proved unsatisfactory and in July, 1970, the Alaska Board of Fish and Game adopted a new policy and objective which called for the "Development and establishment of a stable fishery, insofar as possible, eliminating the extreme fluctuations in catch that have at times characterized this fishery." This objective was to be achieved by developing and maintaining a broad base of various age classes of legal size male king crab, with the intent of insuring breeding success as well as making available to the fishery various classes of crab. In order to do this, rigid catch quota system was introduced and used in combination with season, area, sex, size and gear restrictions.

In January of 1975, the Board of Fish and Game adopted a new statement of policy on the management of the king crab resource. They maintained the objective of "stability", but introduced some additional clarifying language and the concept of a flexible quota system oriented to guideline harvest levels and rapid in-season adjustments responding to current stock conditions. This policy remains in effect, and has governed the action of the Board of Fisheries and the Alaska Department of Fish and Game since its adoption. Because of its importance in understanding the current management system employed by the

*State; the full text of the 1975 policy statement has been appended to this paper as appendix .

REGULATORY MEASURES

The king crab resource in Alaska is managed by a complex of regulatory measures that have been developed as the commercial fishery has increased its capacity to harvest the resource. The fishery is managed by fishing seasons, specification of type and quantity of gear, sex limitation, size limits, fishing area restrictions, and harvest levels.

Fishing Seasons. To sustain optimum levels of king crab production, seasonal closures are required during certain periods of their life cycle. Closed seasons encompass molting, breeding and egg hatching periods.

Type of gear. Legal gear for king crab is defined as pots, ring nets, or scuba. These gear types are all selective in that non-legal crab (females and undersized males) may be released unharmed. If non-selective gear were employed (trawls, tangle nets) many non-marketable crab would be harvested with high mortalities occurring during the catching procedure.

Quantity of gear. Limitations on the quantity of gear per vessel are applied in four management areas to protect the "small boat" fisheries from exploitation by larger vessels capable of transporting and fishing large numbers of pots.

Sex limitations. Protection of the female king crab population from harvest, if accompanied by the maintenance of a mature male population adequate to insure total fertilization of mature females, should guarantee that there will be no adverse effects due to harvest on the reproductivity of the king crab stock. The harvest has therefore been restricted to only males.

Size limits. King crab can probably be marketed profitably at the age and size of maturity. However, a minimum size limit assures that male crab have at least one opportunity to mate before entering the fishery.

Additionally, there is evidence that biomass weight loss from natural mortality of male king crab between the size at maturity and the size one or two molts (years) later is more than compensated by the increased growth (weight) of the surviving crab. Potential economic benefit will accrue from the resultant weight gain.

For these reasons, sexually mature king crab should be protected through the imposition of a minimum legal size that will allow male crab one or two opportunities to breed before being recruited into the fishery.

Harvest levels. Guideline harvest levels serve to inform the industry of the potential extent of the fishery. These levels are normally expressed as ranges to give the manager the flexibility to adjust the harvest during the season based on

catch per effort, indices of abundance from research results, or variation in shell condition.

Registration areas. Exclusive registration areas help to reduce the rate of harvest and serve to prevent economic dislocation of a certain segment of the industry dependent on a stock (s), particularly if the character of the fishing fleet and the industry that depends on it would not allow movement to another area.

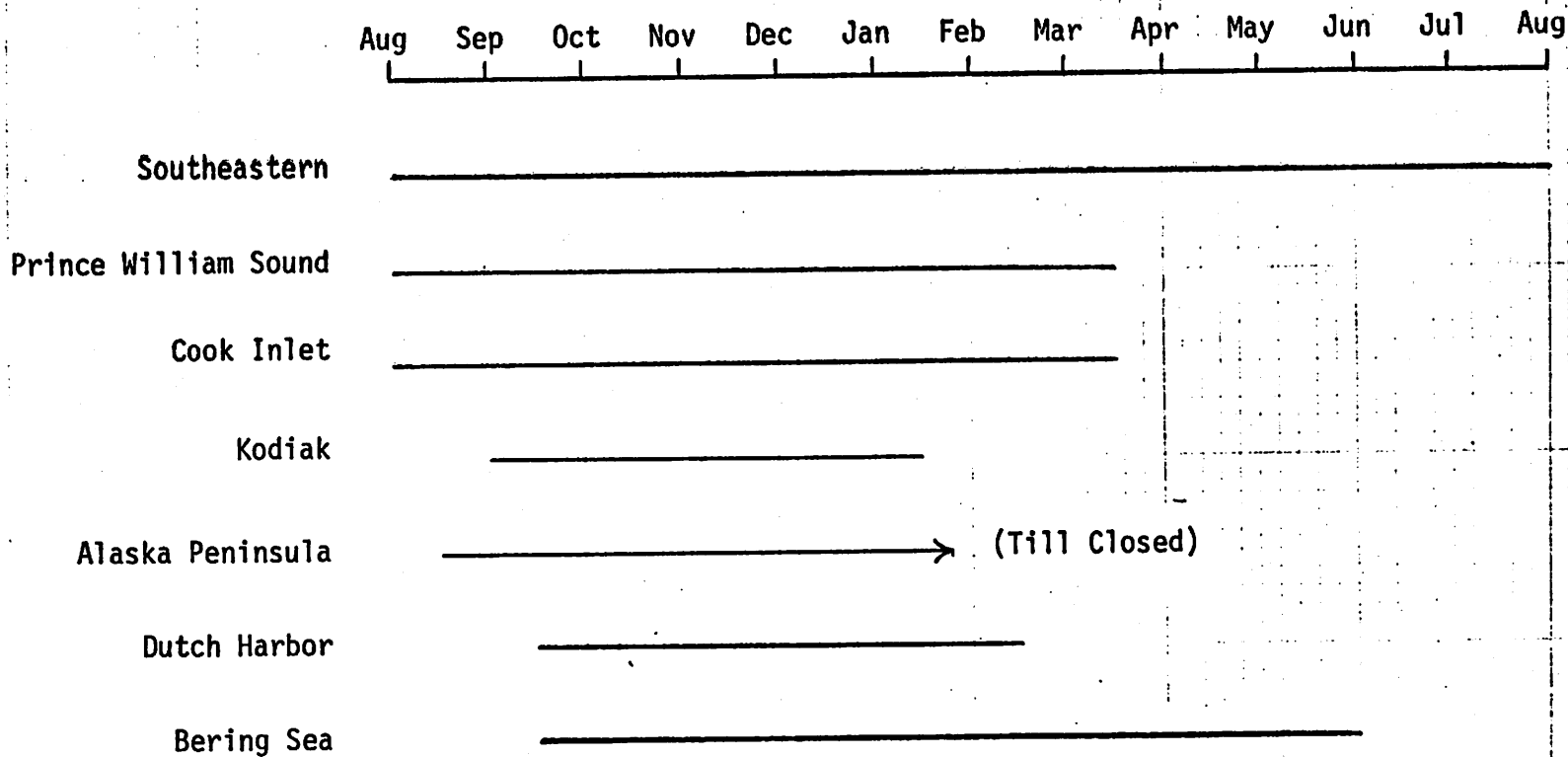
No vessel or gear may be registered in more than one exclusive registration area during a registration year. A vessel and gear may be registered for any or all of the non-exclusive registration areas together with one exclusive registration area during any registration year except that a vessel and/or gear registered for Cook Inlet may not be used to fish king crab in any other registration area.

Major regulations for each king crab management area (1977) are shown in Table 9 and Fig. 5.

Table 9. King Crab Regulations for each Management Area. 1977.

Area	Size Limit (inches)	Registration Area	Guideline Harvest Level (million lbs)	Pot Limit
Southeastern	7 & 8 width	Exclusive	1.0	60
Prince William Sound	5 length	Exclusive	0.5	60
Cook Inlet	7 & 8 width	Completely Exclusive	5.0	75
Kodiak	7 & 8 width	Exclusive	10.0 - 19.0	75
Alaska Peninsula	6 1/2 & 7 1/2 width	Exclusive	1.7 - 3.3	None
Dutch Harbor	6 1/2 & 7 1/2 width	Exclusive	8.0 - 14.5	None
Adak	6 1/2 width	Nonexclusive	0.25 - 2.5	None
Western Aleutians	6 1/2 width	Nonexclusive	None	None
Bering Sea	6 1/2 width	Nonexclusive	60.0 - 93.0	None

Source: ADF&G Commercial Shellfish Regulations - 1977



All areas may close earlier by emergency order.
 Adak and Western Aleutian area are opened and closed by emergency orders.
 All areas (except Kodiak) have special seasons opened and/or closed by emergency order
 in addition to the one shown.

Source: ADF&G Commercial Shellfish Regulations - 1977

Fig. 5. King Crab Seasons - 1977

MANAGEMENT OBJECTIVES FOR THE NPFMC's KING CRAB FMP (1978/79)

There are certainly a multitude of objectives (biological, social, economic, and ecological) which any individual or group may propose for the management of Alaska's king crab resource, and there is little doubt that there would be variability in any such listing. Even if the list were to coincidentally contain the same set of objectives it seems certain that the relative importance, or the trade-off weights of each objective, would not be the same for each individual or group. Ultimately, the Council, based upon the information provided them by the drafting team, their advisory committees, testimony from industry and other members of the public, coupled with their personal experiences, must select a single set of objectives which is consistent with the intent of the law (FCMA, 1976) and will result in the greatest overall benefit to the Nation.

The drafting team, in consultation with its Advisory Panel representatives, has agreed upon a set of three objectives to present the Council for their consideration. While the language used to describe the objectives may need to be refined and elaborated on, the intent should be apparent. The three objectives are:

1. Establish stability and eliminate, to the extent practicable, fluctuations in annual harvest. (Basically, this objective is the same as that which has been adopted by the Board of Fisheries, and has guided their regulatory decision making since 1970).
2. Maintain and avoid disruption of existing social and economic structures where the fishery has developed and evolved over a period of years as reflected by community characteristics, processing capability, fleet size and distribution. (This may be a short run objective if it is determined that the benefits to be derived from some specified efficiency objective will outweigh the cost of potential adverse economic and social impacts on regionalized fisheries. This objective recognizes that fleets, processing facilities, and communities have developed under a certain set of institutional and regulatory arrangements. This pattern of development may well have been different under an alternative set of conditions and may have been better or worse given one's perspective. Nevertheless, there has been investment in capital and equipment within the king crab industry, both harvesting and processing, as well as in the support and service sectors in the various communities where this fishery is conducted, which has lead in turn to a certain distribution of the benefits derived from this fishery. Rapid change, of the institutional and regulatory system, could have very serious economic and social impacts, and therefore changes should be set in a time frame which will allow people to adjust with a minimum of personal, social and economic disruption).
3. Maximize benefit/cost ratios (or cost effectiveness) for public investment in development, research, management, and enforcement of the king crab fishery. (This objective recognizes the responsibility of public agencies

to use the taxpayers' dollars in such a way as to achieve the greatest social benefit for the funds invested. It requires that expenditures on research, management, development, and enforcement be undertaken in such a manner that the incremental investment in each will result in the benefits from each being equated at the margin).

SUMMARY

The king crab fishery is unique to Alaska and red king crab is the single most significant species in the state in terms of total values to fishermen and processors.

Since 1975 there has been no foreign participation. The domestic harvest peaked in 1966 at 159 million pounds. Two-thirds of that harvest came from the Kodiak area. Reliance on one age class forced the statewide harvest to drop to only 52 million pounds in 1970. In the years to follow the Alaska Board of Fisheries and ADF&G began to rebuild the stocks by applying the strategy of a multi-age class fishery. With this philosophy and large harvests in the Bering Sea area, the statewide annual harvest since 1974 has been approximately 100 million pounds.

Since 1971 the Bering Sea has been the dominant harvest area with catches over 70 million pounds -- twice as large as the combined catches from all other areas in the State.

The ex-vessel value of the harvest in 1976 was about \$68 million. Deflating the values of the record catch in 1966 and the catch in 1976 by the wholesale price index (1967 = 100) shows that even though the 1966 catch was approximately one-third less in terms of poundage, its value was over twice as great as the 1966 catch.

With the large catches in the Bering Sea, the Dutch Harbor area has replaced Kodiak as the dominant king crab processing center. In recent years the production of crab sections has increased and accounted for 63 percent of the total product value in 1976.

Prior to 1970 the management objective was to provide for a maximum sustainable yield with a management philosophy oriented to a recruit fishery. Since this proved unsatisfactory the Alaska Board of Fish and Game adopted a new policy calling for the "Development and establishment of a stable fishery, insofar as possible, eliminating the extreme fluctuations in catch that have at times characterized this fishery". This objective is to be achieved by developing and maintaining a broad base of various age classes of legal size male king crab.

The strategy applies a flexible quota system oriented to guideline harvest levels and rapid in-season adjustments in combination with season, area, sex, size and gear restrictions.

ALASKA BOARD OF FISH AND GAME

STATEMENT ON KING CRAB RESOURCE MANAGEMENT POLICY

It is the policy of the Board of Fish and Game and the Department to manage Alaska's king crab fishery in a manner that establishes stability and eliminates, as much as possible, extreme fluctuations in annual harvests that have at times characterized this fishery.

The achievement of such management depends on the maintenance of crab stocks that are comprised of a broad base of various age-classes of legal size crab rather than creating an industrial dependency upon a recruits-only harvestable resource. By maintaining a fishery on several year classes the ups and downs associated with strong and weak year classes would tend to dampen.

The method of management is based on the assessment of stock composition parameters resulting in regulatory "guideline harvest levels" and represents the desire of the department to depart from a system of fixed quotas in king crab management to a system of flexible quota ranges. A flexible guideline harvest system must be founded on biological considerations from an adequate data base.

It is the policy of the department to manage the resource conservatively while information for instituting the management method is being gathered, developed and refined. Stocks should be monitored annually to provide information reflecting indices of abundance of prerecruits, recruits and postrecruits for proper determination of current and subsequent guideline harvest levels. When a strong year class enters the fishery, the harvest level should be increased, but not so high as to prevent an appropriate portion of the strong year class from carrying over to be harvested in subsequent years.

The benefits of a flexible system of guideline harvest levels should be most apparent when weak classes enter the fishery. If previous stronger year classes have been partially protected by the guideline harvest levels, there will be enough older crabs to substantially reduce the decline in the catch and broodstock abundance that would result from incoming weak year classes.

When adequate information on the status of king crab stocks has been available, the department has permitted the fishery to harvest additional older crab nearing the end of their life span, when such crab were considered as surplus to the breeding requirements of the stocks.

Some points to consider in the argument for drafting a separate FMP for herring in the Bering Sea:

- (1) The herring fishery is a developing fishery;
- (2) Pressure by U.S. fishermen against herring stocks is accelerating faster than on any other Bering Sea finfish stock due to an increased demand for herring and herring products.
- (3) As competition for the herring resource develops, management of the fishery will become more complex. Some of the reasons for that include:
 - (a) FCZ catches by foreign fishermen of herring mixed with groundfish stocks in fisheries directed on other species;
 - (b) Directed efforts on herring by foreign fishermen in the FCZ both offshore and inshore;
 - (c) Directed efforts on herring by U.S fishermen in inshore areas, and increasing interest in offshore areas;
 - (d) Subsistence effort and demand inshore.
- (4) The inter-relationships of the above could be the source of contention concerning the conduct of the fishery. IF herring is separated from the proposed FMP for groundfish, a management plan for groundfish other

than herring could be developed with relative ease.

IF herring is included in the proposed Groundfish FMP, and IF complications arise concerning herring, the entire plan could be delayed.

Anticipating an accelerated growth in the herring fishery precludes problems of undetermined degree which will have to be resolved to the detriment of the time frame for implementing a Groundfish FMP if herring is included.

The importance of this fishery as an emerging new industry for U.S. fishermen demands that any FMP implemented be as good an effort as can be mustered.