

## Red King Crab

**Biology:** Red king crab (*Paralithodes camtschaticus*) is widely distributed throughout the Bering Sea and Aleutian Islands, Gulf of Alaska, Sea of Okhotsk, and along the Kamchatka shelf. King crab molt multiple times per year through age 3 after which molting is annual. At larger sizes, king crab may skip molt as growth slows. Females grow slower and do not get as large as males. In Bristol Bay, fifty percent maturity is attained by males at 120 mm CL and 90 mm CL by females (about 7 years). Red king crab in the Norton Sound area mature at smaller sizes and do not attain maximum sizes found in other areas. In Bristol Bay, red king crab mate when they enter shallower waters (<50 m), generally beginning in January and continuing through June. Males grasp females just prior to female molting, after which the eggs (43,000 to 500,000 eggs) are fertilized and extruded on the female's abdomen. The female red king crab carries the eggs for 11 months before they hatch, generally in April. Red king crab spend 2-3 months in larval stages before settling to the benthic life stage. Young-of-the-year crab occur at depths of 50 m or less. They are solitary and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and stalked ascidians. Between the ages of two and four years, there is a decreasing reliance on habitat and a tendency for the crab to form pods consisting of thousands of crabs. Podding generally continues until four years of age (about 65 mm), when the crab move to deeper water and join adults in the spring migration to shallow water for spawning and deep water for the remainder of the year. Mean age at recruitment is 8-9 years.

**Management:** Red king crab stocks in the Bering Sea and Aleutian Islands are managed by the State of Alaska through a federal king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so the State can change them following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. During the 1970s and 1980s, pre season guideline harvest levels were set at 20-60% of

**Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, by category.**

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
* Legal Gear	* Minimum Size Limits	* Reporting Requirements
* Permit Requirements	* Guideline Harvest Levels	* Gear Placement and Removal
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

legal male abundance based on several indicators of stock condition. Between 1989 and 1995, the State set guideline harvest levels for red king crab based on a mature male harvest rate of 20%, with a harvest cap of 60% of legal male abundance. In 1996, the harvest rate for Bristol Bay red king crabs was reduced to 10% of the mature males to allow stock rebuilding. A threshold of 8.4 million mature females, equating to an effective spawning biomass of 14.5 million pounds, has been established as a minimum benchmark for harvesting this stock. Current minimum legal size for Bristol Bay, Aleutian Islands, and Pribilof Islands red king crab is 165 mm, or 6.5 inches in carapace width. Minimum legal size for Norton Sound, St. Matthew, and St. Lawrence Island red king crab is 4.75" carapace width.



In addition to minimum size and sex restrictions, the State has instituted

numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Areas established for king crab are shown in the adjacent figure. Norton Sound has been designated a superexclusive area, meaning that vessels fishing this fishery are not allowed in other fisheries, and vice-versa. A 10-mile area around King Islands has been closed to commercial crabbing for local subsistence reasons. Observers are required on all vessels processing crab in the Bering Sea and Aleutian Islands area. Season opening dates are set to maximize meat yield and minimize handling of softshell crabs. The season opening date for Bristol Bay red king crab fisheries is November 1. Beginning in 1996, the Aleutian Islands area (formally Adak and Dutch Harbor) opens September 1. The Norton Sound summer season opens on July 1, and a though-the-ice fishery occurs from November 15 to May 15. Pot limits have been established based on vessel size and guideline harvest level. In Norton Sound, the pot limits are 50 for vessels >125 feet, and 40 for vessels <125 feet. A minimum size of 9" stretched mesh on one vertical panel is required for pots used in the Bristol Bay red king crab fishery. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.

**Stock Structure:** Three discrete stocks of red king crab are actively managed in the BSAI region: Bristol Bay, Norton Sound, and Aleutian Islands stocks. The Aleutian Islands stock consists of Adak and Dutch Harbor populations. Other populations of red king crab are found in the Pribilof Islands area, St. Matthew, and St Lawrence Island area, but are managed in conjunction with blue king crab fisheries. Red king crab stocks are managed separately to accommodate different life histories and fishery characteristics.

**Bristol Bay Stock:** Area swept estimates of abundance for the Bristol Bay red king crab stock are obtained through the NMFS annual bottom trawl surveys. A length-based analysis, developed by the Alaska Department of Fish and Game, incorporates survey and commercial catch and observer data into more precise abundance estimates. Abundance estimates generated by this model are used to set guideline harvest levels. After declining abundance throughout the 1960s and reaching a low during the years 1970-1972, recruitment to the Bristol Bay red king crab stock increased dramatically in the mid- and late 1970s. Recruitment was much lower during the 1980s and 1990s. By 1994, recruitment was about 1/20th of what it was in 1977. Since then, the length-based model indicates a slight but steady increase in the abundance of small males and females.

During the fishery's heyday, new all-time record landings were established in each year from 1977 to 1980 (peaking at 129.9 million pounds). This was followed by a stock collapse in 1981 and 1982 leading to a total closure of the Bristol Bay fishery in 1983. In 1984, the stock showed some recovery and a limited fishery was reestablished. Between 1984 and 1993, the fishery continued at levels considerably below those of the late 1970s. Annual landings during this period ranged from 4.2 million to 20.4 million pounds.

**Abundance of legal males (millions of crab from LBA model), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of Bristol Bay red king crab, 1980-1996.**

<u>Year</u>	<u>Abundance</u>	<u>GHL</u>	<u>Catch</u>
1980	44.2	70.0 - 120	129.9
1981	9.5	70.0 - 100	35.1
1982	2.9	10.0 - 20	3.0
1983	2.5	0	0
1984	2.3	2.5 - 6.0	4.2
1985	1.8	3.0 - 5.0	4.2
1986	4.3	6.0 - 13.0	11.4
1987	6.7	8.5 - 17.7	12.3
1988	8.3	7.5	7.4
1989	9.7	16.5	10.3
1990	10.1	17.1	20.4
1991	8.5	18.0	17.2
1992	6.6	10.3	8.0
1993	5.8	16.8	14.6
1994	4.5	0	0
1995	5.1	0	0
1996	5.9	5.0	8.4
1997	5.9	7.0	8.8

Note: abundance through 1994 included Pribilof area red king crab.

After 1993, the stock declined again, and no fishery occurred in 1994 and 1995. Pot limits have been established based on vessel size and harvest level.

**Total harvest (thousands of pounds) of red king crab from the Dutch Harbor, Adak, and Norton Sound area, 1980-1996.**

<u>Year</u>	<u>Dutch Harbor</u>	<u>Adak</u>	<u>Norton Sound</u>
1980	17,661	1,420	1,190
1981	1,393	1,649	1,380
1982	5,155	1,702	230
1983	431	1,982	370
1984	0	1,368	390
1985	0	908	430
1986	0	712	480
1987	0	1,214	330
1988	0	1,567	240
1989	0	1,119	250
1990	0	828	190
1991	0	951	0
1992	0	1,266	70
1993	0	698	336
1994	0	197	328
1995	0	36	323
1996	0	0	220
1997	0	0	93

The Bristol Bay red king crab fishery is prosecuted using mesh covered pots (generally 7 or 8 foot square) set on single lines. Over 280 vessels participated in the Bristol Bay red king crab fishery in recent years when a guideline harvest level was established (1991-1993). The season begins on November 1, and generally has lasted less than 10 days in recent years. These crab average about 6.5 pounds and fetch a high ex-vessel price; \$3 to \$5 per pound was paid during the 1989-1993 fisheries. Total ex-vessel value ranged from \$40,000,000 to \$100,000,000 in those years.

**Norton Sound and Aleutian Islands Stocks:** Surveys of these populations are not regularly conducted, and abundance is not estimated each year. Consequently, aside from years when surveys are conducted, fisheries for these stocks are generally managed based on catch history and in-season catch performance monitoring.

Prior to 1977, red king crab were taken in Norton Sound for subsistence uses only. Commercial landings peaked at 3 million pounds in 1979, and declined to average about

300,000 pounds annually. The 1995 summer fishery was prosecuted by 48 vessels which landed 323,000 pounds. Average weight of crab landed was 3 pounds with an ex-vessel price of \$2.87 per pound. A winter fishery occurs from November 15 to May 15. Holes are chopped through the ice, and pots are tended by fishermen on snow machines. In 1995, 42 fishermen participated in the commercial fishery, harvesting 7,538 red king crabs. These crabs were sold locally fresh (or fresh frozen) for \$6 each, or shipped live to Anchorage. A winter subsistence fishery is prosecuted by local people either using hand lines or with commercial-style pots set through the ice. In 1995, 57 subsistence fishermen harvested over 4,000 crabs.

Harvest of red king crab from the Dutch Harbor area began in 1961, and peaked at 33 million pounds in 1966. Thereafter, harvests declined, averaging about 11 million pounds annually through 1976. A secondary peak harvest occurred in 1980 with 17.7 million pounds taken, after which the stock collapsed and has not recovered. No red king crab fishery has been allowed in this area since 1983.

The Adak red king crab fishery began in 1960, and peaked at 21 million pounds in 1964. Catches remained high at about 16 million pounds annually through 1972. During 1977 to 1993, landings were low (about 1 million pounds annually) but stable. Since then the stock has declined. A small portion of the red king crab harvest in this area is taken as bycatch in the golden king crab longline pot fishery. The majority, however, is harvested by golden king crab vessels with single line pots in a directed fishery. The 1995 fishery was prosecuted by 10 vessels, which harvested 36,000 pounds of red king crab with an ex-vessel value of \$5.50 per pound. Average weight of landed crab was 7 pounds. No fishery was allowed in 1996 or 1997.

## Blue King Crab

**Biology:** Blue king crab (*Paralithodes platypus*) has a discontinuous distribution throughout their range (Hokkaido Japan to Southeast Alaska). In the Bering Sea, discrete populations exist around the Pribilof Islands, St. Matthew Island, and St. Lawrence Island. Smaller populations have been found around Nunivak and King Island. Blue king crab molt multiple times as juveniles. Skip molting occurs with increasing probability for those males larger than 100 mm carapace length. Average molt increment for adult males is 14 mm. In the Pribilof area, 50% maturity of females is attained at 96 mm (about 3.8 inches) carapace length, which occurs at about 5 years of age. Blue king crab in the St. Matthew area mature at smaller sizes (50% maturity at 81 mm CL for females) and do not get as large overall. Blue king crab have a biennial ovarian cycle and a 14 month embryonic period. Juvenile blue king crab require cobble habitat with shell hash. These habitat areas have been found at 40-60 m around the Pribilofs Islands. Unlike red king crab, juvenile blue king crab do not form pods, instead relying on cryptic coloration for protection from predators. Adult male blue king crab occur at an average depth of 70 m and an average temperature of 0.6°.

**Management:** Blue king crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are

frameworked so the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State generally sets pre-season guideline harvest levels for blue king crab based on a mature male harvest rate of 20%. Threshold levels have been established for these stocks, below which a fishery will not occur. A threshold level of 0.77

million crabs >119 mm CL has been established for the Pribilof stock; the St. Matthew threshold is 0.6 million males >104 mm CL. Current minimum legal size for the Pribilof District blue king crab is 6.5" in carapace width. Minimum legal size for blue king crab in the St. Matthew Island area is 5.5" carapace width.



In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for BSAI crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing king and Tanner crab in the BSAI. Season opening dates are set to maximize meat yield and minimize handling of softshell crabs. The season opening date for Pribilof District blue king crab fishery is September 15. In 1995, a combined GHL for red king and blue king crab fisheries in the Pribilof District was established. Pot limits have been established based on vessel size; the current pot limits are 50 for vessels >125 feet, and 40 for vessels <125 feet in the Pribilof District. In the St. Matthew area, the current pot limits are 75 for vessels >125 feet, and 60 for vessels <125

### Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, by category.

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
* Legal Gear	* Minimum Size Limits	* Reporting Requirements
* Permit Requirements	* Guideline Harvest Levels	* Gear Placement and Removal
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
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feet. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism. Also, for the Pribilof district, king crab pots must have 1/3 of one vertical surface comprised of 9" stretched-mesh webbing.

**Stock Structure:** Two discrete stocks of blue king crab are actively managed in the BSAI region: the Pribilof Islands and St. Matthew Island stocks. Other smaller populations of blue king crab are found in the vicinity of St. Lawrence Island and Nunivak Island, as well as isolated populations in the Gulf of Alaska. Blue king crab stocks are managed separately to accommodate different life histories and fishery characteristics.

**Pribilof District Stock:** Abundance estimates for the Pribilof Islands blue king crab stock are obtained through the NMFS annual bottom trawl surveys using an area-swept method. Survey data indicate a series of good recruitment in the early 1970s. Recruitment fell off in the early 1980s, but improved signs of recruitment were observed in the early 1990s. Recent survey data indicate that total stock size has generally increased over the past 10 years.

During the late 1970s, landings of blue king crab from the Pribilof District increased to peak at 11 million pounds in the 1980-81 season. This was followed by a rapid decline in the early 1980s, leading to a total closure of the fishery in 1988. No fishery occurred from 1988-1994. By 1995, stock conditions had improved such that a combined GHL for red and blue king crab of 2.5 million pounds was established.

Like the Bristol Bay red king crab fishery, the blue king crab fisheries are prosecuted using square, mesh covered pots (generally 7 by 7 foot square pots - "7 by 7's" or larger) set on single lines. In 1995, 119 vessels participated in the Pribilof District red and blue king crab fishery. The season began on September 15 and lasted 7 days. Blue king crab fetched \$3 per pound exvessel, making the total fishery worth \$3.6 million. Average weight of blue king crab harvested was 7.3 pounds. For 1997, 48 vessels, including one catcher-processor, fished Pribilof blue king crabs. The 1997 season lasted 14 days and yielded crabs with an average weight of 7.5 pounds, valued at \$2.82 per pound exvessel.

**Abundance of legal males (millions of crab from catch-survey estimates), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of Pribilof District blue king crab, 1980-1997.**

<u>Year</u>	<u>Abundance</u>	<u>GHL</u>	<u>Catch</u>
1980	5.32	5.0 - 8.0	11.0
1981	3.20	5.0 - 8.0	9.1
1982	1.77	5.0 - 8.0	4.4
1983	1.04	4.0	2.2
1984	0.71	0.5 - 1.0	0.3
1985	0.65	0.3 - 0.8	0.5
1986	0.51	0.3 - 0.8	0.3
1987	0.41	0.3 - 1.7	0.7
1988	0.25	0	0
1989	0.19	0	0
1990	0.49	0	0
1991	1.00	0	0
1992	1.13	0	0
1993	1.21	0	0
1994	1.12	0	0
1995	1.22	2.5	1.3
1996	0.88	1.8	1.1
1997	0.82	1.5	0.7

Note: Since 1995, GHL includes both red and blue king crab combined.

**St. Matthew Stock:** Abundance estimates for the St. Matthew blue king crab stock are obtained through the NMFS annual bottom trawl surveys using an area-swept method. Survey data indicated the presence of relatively high numbers of juvenile males in the late 1970s. These crabs recruited to fisheries in the early 1980s. Recent survey data indicate that the stock is at average abundance levels, but may be declining slightly.

**Abundance of legal males (millions of crab from catch-survey estimates), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of St. Matthew District blue king crab, 1980-1997.**

<u>Year</u>	<u>Abundance</u>	<u>GHL</u>	<u>Catch</u>
1980	2.90	na	na
1981	3.78	1.5 - 3.0	4.6
1982	4.98	5.6	8.8
1983	3.41	8.0	9.5
1984	1.70	2.0 - 4.0	3.8
1985	0.99	0.9 - 1.9	2.4
1986	0.54	0.2 - 0.5	1.0
1987	0.84	0.6 - 1.3	1.1
1988	1.09	0.7 - 1.5	1.3
1989	1.53	1.7	1.2
1990	1.82	1.9	1.7
1991	2.39	3.2	3.4
1992	2.47	3.1	2.5
1993	2.61	4.4	3.0
1994	2.54	3.0	3.8
1995	2.30	2.4	3.2
1996	3.13	2.4	1.1
1997	4.10	5.0	4.6

Harvest of blue king crab from the St. Matthew District began in 1977, peaking at 9.5 million pounds in 1983. This was followed by reduced harvests in the late 1980s. By the early 1990s, abundance of large males had increased and GHLs were increased to over 3 million pounds.

In 1995, a total of 90 vessels (1 catcher-processor, 89 catcher vessels) participated in the St. Matthew blue king crab fishery. The season began on September 15 and lasted 5 days, during which time, 3.2 million pounds were landed. Blue king crab fetched \$2.32 per pound exvessel, making the total fishery worth \$7.1 million. The average crab size was 4.8 pounds. In 1997, 117 vessels participated and harvested 4.6 million pounds in 7 days. Crab averaged 4.9 pounds each and brought \$2.21 per pound exvessel, making the total fishery worth \$9.8 million.

The Alaska Department of Fish and Game applied catch-survey analysis to St. Matthew Island and Pribilof Islands blue king crab stock beginning in 1996. It is particularly suited for blue king crabs that occupy untrawlable areas.

## Golden King Crab

**Biology:** Golden king crab (*Lithodes aequispinus*), also called brown king crab, range from Japan to British Columbia. In the Bering Sea and Aleutian Islands (BSAI), golden king crab are found at depths from 200 m to 1,000 m, generally in high relief habitat such as inter-island passes. Size at sexual maturity depends on latitude, with crabs in the northern areas maturing at smaller sizes. In the St. Matthew area, golden king crab are 50% mature at 92 mm carapace length (males) and 98 mm carapace length (females). In the Pribilof and western Aleutian Islands area, 50% maturity of males is attained at 107 mm (about 3.5 inches) carapace length and 100 mm (about 3.3 inches) carapace length for females. Further south, in the eastern Aleutian Islands, fifty percent maturity is attained at 130 mm carapace length (males) and 111 mm carapace length (females). Little information is known about the biology of a related species, scarlet king crab (*Lithodes couesi*), found in the Bering Sea and Aleutian Islands area. This species occurs in deep water and have been harvested incidental to golden king crab and *Chionoecetes tanneri* fisheries. A total of 13,871 pounds of scarlet king crab were harvested in 1995. In 1997, 7,170 pounds of scarlet king crab were landed.

**Management:** King crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP and under Council control, (2) those that are frameworked so that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. Current minimum legal size for golden king crab is 6.0 inches in carapace width

### Management measures implemented for the BSAI king and Tanner crab fisheries, as defined in the federal crab FMP, by category.

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
* Legal Gear	* Minimum Size Limits	* Reporting Requirements
* Permit Requirements	* Guideline Harvest Levels	* Gear Placement and Removal
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
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for Area O; elsewhere in the Bering Sea minimum size is 5.5" cw. Minimum size for *L. couesi* is 5.5 inches. As with other king crab, only males are harvested. Maximum allowable fishing mortality for the mature male golden king crab stock, as established by the FMP, is  $F_{OFL} = F_{MSY} = M$ .

In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. For Bering Sea golden king crabs, a commissioners permit is also required. Areas established for king crab are shown in the adjacent figure. Observers are required on all vessels processing king and Tanner crab in the BSAI. By regulation, observers are also required on all vessels fishing for golden king crab in the Aleutian Islands. Observers collect needed biological data and also provide enforcement monitoring for the longline fishery. Season opening dates are set to maximize yield per recruit and minimize handling of softshell crabs. The season opening date for golden king crabs in the Aleutian Islands area is September 1. By regulation, pots

used in the Aleutian Islands golden king crab fishery must be longlined to reduce gear loss. A minimum of 10 pots must be linked together. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 5.5" rings are required on pots used in golden king crab fisheries. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.

**Stock Structure:** Several discrete stocks of golden king crab are thought to exist in the BSAI region. Until 1996, the Aleutian Islands stock was separated into two management areas, Adak and Dutch Harbor. The entire area is now managed as one area; Dutch Harbor Area O. Based on historic landing data, two golden king crab stocks have been identified and are managed as the Sequam and Adak stocks separated at 174° W longitude.

**Bering Sea and Aleutian Islands Stocks:** Abundance estimates for golden king crab are not available as no surveys have been routinely undertaken. Golden king crab are found over habitat not suitable for trawl surveys. Pot surveys and fishery performance are utilized as indices of abundance, however.

The golden king crab fishery is prosecuted using mesh covered pots set on longlines. There is no limit to the number of pots a vessel can fish at one time. In recent Adak golden king crab fisheries, vessels set an average of 500 pots, with larger vessels generally fishing more pots.

A total of 34 vessels participated in the 1994-1995 Adak golden king crab fishery. The fishery lasted 288 days, with a total harvest was 6.4 million pounds. Average weight of golden king crab harvested was 4.1 pounds in the Adak area. These crab were worth \$3.33 per pound exvessel, for a total season value of \$20.3 million.

<u>Year</u>	<u>Dutch Harbor</u>	<u>Adak District</u>	<u>Pribilof District</u>	<u>Saint Matthew</u>
1980	na	59	0	na
1981	116	1,194	8	na
1982	1,185	8,006	70	na
1983	1,811	8,128	856	194
1984	1,521	3,180	0	0
1985	1,968	11,125	trace	0
1986	1,869	12,798	4	0
1987	1,383	8,001	26	424
1988	1,545	9,080	3	160
1989	1,852	10,162	7	4
1990	1,719	5,251	0	0
1991	1,448	6,254	6	0
1992	1,357	4,916	3	trace
1993	915	4,636	67	0
1994	1,750	6,378	89	13
1995	1,994	4,897	conf.	1
	Aleutians Area O			
	<u>East</u>	<u>West</u>		
1996	3,256	4,665	329	conf.
1997	3,564	628	179	0

The 1995 Dutch Harbor golden king crab fishery was prosecuted by 17 vessels. The season opened on September 1, and lasted 38 days. A total of 2 million pounds were landed at an exvessel price of \$2.60 per pound. Average weight of Dutch Harbor golden king crab was 4.6 pounds.

## Tanner Crab

**Biology:** Tanner crab (*Chionoecetes bairdi*) are distributed on the continental shelf of the North Pacific Ocean and Bering Sea from Kamchatka to Oregon. Off Alaska, Tanner crab are concentrated around the Pribilof Islands and immediately north of the Alaska Peninsula, and are found in lower abundance in the Gulf of Alaska. Size at 50% maturity, as measured by carapace width, is 110 mm for males and 90 mm for females in the Bering Sea. The corresponding age of maturity for male Tanner crab is about 6 years. Growth during the next molt increases the size of males to about 120-140 mm. Mature male Tanner crabs may skip a year of molting as they attain maturity. Natural mortality of adult Tanner crab is estimated at about 25% per year ( $M=0.3$ ). Tanner crab females are known to form high-density mating aggregations, or pods, consisting of hundreds of crabs per mound. These mounds may provide protection from predators and also attract males for mating. Mating need not occur every year, as some female Tanner crabs can retain viable sperm in spermathecae up to 2 years or more. Females have clutches of 50,000 to 400,000 eggs. Little information is known about the biology of two other closely related species of Tanner crab found in the Bering Sea and Aleutian Islands area. The grooved Tanner crab (*Chionoecetes tanneri*) and triangle Tanner crab (*Chionoecetes angulatus*) occur in deep water (>400 fathoms) and have been commercially harvested only in the past few years.

**Management:** Tanner crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so that the State can change

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	* Registration Areas	

following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State sets pre-season guideline harvest levels for Tanner crab based on a mature male harvest rate of 40%. Minimum legal size for Bering Sea Tanner crab, *C. bairdi*, is 5.5 inches carapace width. Minimum legal sizes for other Tanner species are: *C. tanneri* 5.0 inches; *C. angulatus* 4.5 inches.



In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing king and Tanner crab in the BSAI. Season opening dates are set to maximize meat yield and minimize handling of softshell crabs. The season opening date for the Bering Sea Tanner crab fishery is November 1. Pot limits have been established for the *C. bairdi* Tanner crab fishery based on vessel size; the current pot limits are 250 for vessels >125 feet, and 200 for vessels <125 feet. In the Bering Sea, a 3" maximum tunnel height opening

for Tanner crab pots is required to inhibit the bycatch of red king crab. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 5.0" rings, or 1/3 of the web on one panel of 7 1/4" stretched mesh, is required on pots used in Tanner crab fisheries. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism. In years when no GHL is established for the Bristol Bay red king crab stock, the Tanner crab fishery is restricted to the area west of 163° W longitude.

**Stock Structure:** Tanner crab (*C. bairdi*) are managed into 3 separate stocks: eastern Bering Sea, eastern Aleutian Islands, and western Aleutian Islands. The grooved Tanner crab (*C. tanneri*) fishery is likewise regulated by these management areas.

**Eastern Bering Sea Stock:** The eastern Bering Sea Tanner crab (*C. bairdi*) stock is currently at very low abundance. The 1995 NMFS bottom trawl survey indicated relatively low levels of juveniles, pre-recruits, females, and large males. Data indicate poor recruitment in coming years.

The Bering Sea Tanner stock has undergone two large fluctuations. Catches increased from 5 million pounds in 1965 to over 78 million pounds in 1977. After that, the stock declined to the point where no fishery occurred in 1986 and 1987. The fishery reopened in 1988, and landings increased to over 40 million pounds in 1990. Another decline ensued, and the 1995 Tanner crab season produced only 4.2 million pounds. The 1995 fishery was prosecuted by 196 vessels and lasted 15 days. Average weight of crab landed was 2.3 pounds valued at \$2.80 per pound exvessel. Total value of the 1995 fishery was \$11.7 million. In 1994 and 1995, fishing was prohibited east of 163° W to reduce bycatch of red king crab. In 1996, 196 vessels harvested 1.8 million pounds of Tanner crab in the directed fishery (12 days) and incidental to a red king crab fishery (4 days). Average weight was 2.5 pounds valued at \$2.50 per pound. Due to the depressed nature of the stock and predominance of old shell crab, no fishery was allowed in 1997.

**Abundance of large males (millions of crab  $\geq 5.3$ " from NMFS trawl survey), pre-season guideline harvest levels (millions of pounds), and total catches (millions of pounds, including deadloss) of Bering Sea Tanner crab (*C. bairdi*), 1980-1996.**

<u>Year</u>	<u>Abundance</u>	<u>GH</u> L	<u>Catch</u>
1980	31.0	28 - 36	36.6
1981	14.0	28 - 36	29.6
1982	10.1	12 - 16	11.0
1983	6.7	5.6	5.3
1984	5.8	7.1	1.2
1985	4.4	3.0	3.1
1986	3.1	0	0
1987	8.3	0	0
1988	17.4	5.6	2.2
1989	42.3	13.5	7.0
1990	53.7	72.3	64.6
1991	45.5	32.8	31.8
1992	52.8	39.2	35.1
1993	27.2	19.8	16.9
1994	20.0	7.5	7.8
1995	13.3	5.5	4.2
1996	12.5	6.2	1.8

Note: abundance through 1988 included Pribilof area Tanner crab.

**Aleutian Islands Stock:** The Tanner crab stock of the Aleutian Islands is very small, and populations are found in only a few large bays and inlets. As such, the fishery is limited. Annual harvests in the Aleutian Islands area were 200,000 to 800,000 pounds through 1985. Thereafter, stocks declined, and landings were reduced. Alaska Department of Fish and Game trawl surveys indicated a dramatic decline from 1991 to 1994. No landings were made in either area in 1995. Due to depressed stocks, no fishery was allowed in the Eastern Aleutians in 1996 or 1997.

Fisheries for deepwater species of Tanner crab have been developing in recent years. A directed fishery for grooved Tanner crab began in 1993, and about 200,000 pounds were landed in 1995. These crab weighed an average of 1.9 pounds, and sold for \$1.50 per pound exvessel. Less than 3 vessels reported landings of

*C. angulatus* in 1995 and 1996, and consequently, catches are confidential. There were no landings of *C. angulatus* in 1997.

**Total harvest (thousands of pounds) of Tanner crab (*C. bairdi*) from the Aleutian Islands area, 1980-1996.**

<u>Year</u>	<u>Western AI</u>	<u>Eastern AI</u>
1980	221	886
1981	839	655
1982	488	740
1983	384	548
1984	163	240
1985	207	166
1986	43	167
1987	141	160
1988	149	310
1989	49	326
1990	15	172
1991	8	50
1992	conf.	99
1993	0	119
1994	0	167
1995	0	0
1996	conf.	0
1997	0	0

**Total harvest (thousands of pounds, deadloss included) of deepwater Tanner crab (*C. tanneri*) from the BSAI, by management area, 1993-1997.**

<u>Year</u>	<u>Western AI</u>	<u>Eastern AI</u>	<u>Bering Sea</u>
1993	0	conf.	659
1994	conf.	759	332
1995	146	882	1,005
1996	conf.	106	106
1997	0	0	0

## Snow Crab

**Biology:** Snow crabs (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. Snow crab are not present in the Gulf of Alaska. In the Bering Sea, snow crabs are common at depths less than 200 meters. The eastern Bering Sea population within U.S. waters is managed as a single stock, however, the distribution of the population extends into Russian waters to an unknown degree. While 50% of the females are mature at 50 mm, the mean size of mature females varies from year to year over a range of 63 mm to 72 mm carapace width. Females cease growing with a terminal molt upon reaching maturity, and rarely exceed 80 mm carapace width. Males similarly cease growing upon reaching a terminal molt when they acquire the large claw characteristic of maturity. The median size of maturity for males is 65 mm carapace width (approximately 4 years old). Males larger than 60 mm grow at about 20 mm per molt, but individuals vary widely in this regard. Female snow crabs are able to store spermatophores in seminal vesicles and fertilize subsequent egg clutches without mating. At least two clutches can be fertilized from stored spermatophores, but the frequency of this occurring in nature is not known. Snow crab feed on an extensive variety of benthic organisms including bivalves, brittle stars, crustaceans (including other snow crabs), polychaetes and other worms, gastropods, and fish. In turn, they are consumed by a wide variety of predators including bearded seals, Pacific cod, halibut and other flatfish, eel pouts, sculpins, and skates.

**Management:** The Bering Sea snow crab stock is managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State sets pre-season guideline harvest levels for snow crab based on a

**Management measures implemented in the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, by category.**

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
* Legal Gear	* Minimum Size Limits	* Reporting Requirements
* Permit Requirements	* Guideline Harvest Levels	* Gear Placement and Removal
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

58% for snow crab larger than 4 inches. Although the minimum legal size for snow crab is 78 mm (3.1 inches), the fishery has generally harvests crabs over 4 inches in carapace width.



In addition to minimum size and sex restrictions, the State has numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing crab in the BSAI. Season opening dates are set to maximize yield per recruit and minimize handling of softshell crabs. The season opening date for snow crab fisheries is January 15. Pot limits have been established based on vessel size; the current pot limits are 250 for vessels >125 feet, and 200 for vessels <125 feet. A 3"

maximum tunnel height opening for snow crab pots is required to inhibit the bycatch of red king crab. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 3.75" rings are required on snow crab pots or, instead of rings, 1/3 of one vertical mesh panel can be 5" stretched mesh. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.

**Stock Structure:** Snow crab are thought to be one stock throughout its range in the BSAI area. However, management the area is divided into two subdistricts, and NMFS estimates abundance and sets GHL by subdistrict.

**Eastern Bering Sea Stock:** Abundance of large male snow crab increased dramatically from 1983 to 1991, but has since declined. The 1993 NMFS Bering Sea trawl survey indicated the total abundance of large males (over 4 inches) at 135 million crab, a 48% decrease from 1992. Small (3-4") legal-size males also declined in abundance, consistent with the decline in large males observed since 1991. The 1995 NMFS bottom trawl survey indicated relatively low levels of large male crab. However, the survey indicated an 88% increase in the numbers of pre-recruits, and a 44% increase in the number of large females. These signs of strong recruitment were apparent in the 1996 survey, as survey results indicated the number of large crab doubled.

Catch of Bering Sea snow crab increased from under 1 million pounds in 1974 to over 315 million pounds in 1992. The 1992 peak catch was followed by reduced landings thereafter. The 1995 opilio fishery was prosecuted by 253 vessels. The season began on January 15 and lasted 33 days. A total of 74 million pounds were landed. Average weight of crab retained was 1.2 pounds worth \$2.43 per pound exvessel. Total value of the 1995 snow crab fishery was \$180 million exvessel.

Increased landings occurred in recent years due to good recruitment of sublegal males. In 1997, 119.4 million pounds of snow crab were harvested. Average weight of crab taken was 1.2 pounds. A total of 226 vessels have participated. Exvessel price was \$0.79/lb, for a total fishery value of \$92.5 million. The 1998 fishery opened with a GHL of 234 million pounds, of which 3.5% was allocated as community development quota, CDQ.

**Abundance of large males (millions of crab  $\geq 4.0$ " from NMFS trawl survey), pre-season guideline harvest levels (millions of pounds), and total catches (millions of pounds, including deadloss) of Bering Sea snow crab, 1980-1998.**

<u>Year</u>	<u>Abundance</u>	<u>GHL</u>	<u>Catch</u>
1980	na	n/a	39.6
1981	na	39.5 - 91.0	52.8
1982	na	16.0 - 22.0	29.4
1983	na	15.8	26.1
1984	na	49.0	26.8
1985	153	98.0	66.0
1986	75	57.0	98.0
1987	83	56.4	101.9
1988	151	110.7	134.0
1989	171	132.0	149.5
1990	187	139.8	161.8
1991	420	315.0	328.6
1992	484	333.0	315.3
1993	256	207.2	230.8
1994	135	105.8	149.8
1995	72	73.6	75.3
1996	69	50.7	65.7
1997	172	117.0	119.4
1998	306	234	239.9