Seafood Watch
Seafood Report

MONTEREY BAY AQUARIUM®

King crab
Paralithodes camtschaticus (red king crab)
Paralithodes platypus (blue king crab)
Lithodes aequispinus (golden king crab)

Seafood Watch AK King Crab © Monterey Bay Aquarium

West Coast Region

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About Seafood Watch® and the Seafood Reports

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from the Internet (seafoodwatch.org) or obtained from the Seafood Watch® program by emailing seafoodwatch@mbayaq.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices", "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Fisheries Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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I. Executive Summary

Three king crab species are of commercial importance around the world: red king crab (*Paralithodes camtschaticus*); blue king crab (*Paralithodes platypus*); and golden king crab (*Lithodes aequispinus*). They are generally distributed from the Sea of Japan to the Bering Sea, Aleutian Islands, and Gulf of Alaska. The red king crab has also been introduced into the Barents Sea. The U.S. (49%) and Russia (45%) are the primary sources of king crab in the U.S. market. In the U.S., the Bristol Bay red king crab fishery and the Aleutian Islands golden king crab fishery comprised 60% and 32% of the U.S. landings, respectively. In Russia, king crab is caught in the Russian Far East and the Barents Sea.

King crabs are moderately vulnerable to fishing pressure due to a moderate age at first maturity and sexual segregation during feeding periods. The Bristol Bay red king crab and Aleutian Islands golden king crab stocks, which comprise the majority (~92%) of the U.S. king crab fishery, are healthy. The Bristol Bay red king crab stock is not experiencing overfishing and biomass is above 100% B_{MSY}. Estimates of biomass for the Aleutian Islands golden king crab stock is unknown and therefore it is unknown if the stock is overfished; however, CPUE has increased since the early 2000s. In addition, the stock is not experiencing overfishing and the size/sex/age distribution is normal. Given this information, the status of the Bristol Bay red king crab and Aleutian Islands golden king crab stocks are considered to be healthy according to Seafood Watch®.

Moderate levels of king crab bycatch relative to landings occur in the directed Bristol Bay red king crab fishery (~16%) and the Aleutian Islands golden king crab fishery (~11%). This current level of bycatch has little impact on population levels. The crab pots used in the fishery are known to have moderate impacts to habitat. In addition, the fishery occurs over a moderate spatial scale. Management of the U.S. fishery is considered to be highly effective. The National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADF&G) regularly conduct stock assessments, collect fishery-dependent and independent data, and have implemented and enforced a suite of management measures, including guideline harvest levels (GHLs), size and sex limits, gear restrictions, fishing seasons, and observer coverage. In addition, ADF&G implemented a bycatch reduction plan and is responsive to changes in the fishery. Due to the moderate inherent vulnerability of king crabs to fishing pressure, healthy stock status, moderate levels of bycatch, moderate habitat impacts, and highly effective management, the U.S. king crab fishery is given an overall seafood recommendation of **Good Alternative**.

In the Russian Far East, most king crab stocks are at historically low abundance levels, including the western Kamchatkan stock of red king crab, which had been the largest stock in the region. Overfishing and illegal fishing are regularly occurring and deteriorating the stocks, making the stock status for king crab in this region a critical conservation concern. The large amounts of illegal fishing also mean that management is highly ineffective. Regulations are ignored, resulting in exceeded catch quotas, ineffective bycatch measures, and failing stock productivity. Due to the critical conservation concerns of stock status and ineffective management, the Russian Far East king crab fishery is given an overall seafood recommendation of **Avoid**.

In the Russian Barents Sea, the red king crab is a quickly spreading invasive species that is causing substantial ecosystem impacts, including adverse impacts on lumpsucker recruitment and health of the native cod and sea urchin populations. The fishery is managed using methods that would traditionally be deemed as highly effective, but because the fishery is based on a non-native, invasive species, existing management is not desirable. In addition, attempting to maintain or enhance abundance through management of a non-native species is a violation of Article 8(h) of the Convention on Biological Diversity (CBD), which states that "Contracting parties to the Convention should, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species" (Hansson 2002). Until the fishery is managed as an eliminated fishery, Seafood Watch© deems the management of the Barents Sea fishery to be a high conservation concern. Due to the high conservation concerns of the ineffective management regime and the non-native, invasive species' effects on the habitat and ecosystem, the Russian Barents Sea king crab fishery is given an overall seafood recommendation of **Avoid**

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ **U.S. (Bristol Bay red and Aleutian Islands golden king crabs) & Russian Barents Sea**			√ **Russian Far East**
Nature of Bycatch		√		
Habitat & Ecosystem Effects		√	√ **Russian Barents Sea**	
Management Effectiveness	√ **U.S. (all)**		√ **Russian Barents Sea**	√ **Russian Far East**

About the Overall Seafood Recommendation:

- A seafood product is ranked **Avoid** if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.
- A seafood product is ranked **Good Alternative** if the five criteria "average" to yellow (Moderate Conservation Concern) OR if the "Status of Stocks" and "Management Effectiveness" criteria are both of Moderate Conservation Concern.

- A seafood product is ranked **Best Choice** if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.

Overall Seafood Recommendation:

U.S. king crab (all fisheries):

Best Choice | **Good Alternative** | Avoid

Russian Barents Sea & Russian Far East king crab:

Best Choice | Good Alternative | **Avoid**

II. Introduction

King crabs are members of the family Lithodidae, the king and stone crab family, which is comprised of around 40 species. Of these, only three are of commercial importance around the world: red king crab (*Paralithodes camtschaticus*); blue king crab (*Paralithodes platypus*); and golden king crab (*Lithodes aequispinus*). King crabs are spiny in appearance, and have five pairs of legs: one pair of claws; three pairs of walking legs; and a fifth pair used to clean their gills. Female king crabs have distinctive fan-shaped tails, while the males have triangular tails (Blau 1997; Robert Otto, pers. comm.).

Fecundity of king crabs varies by species, geographic area, and body size. Red king crabs spawn annually and are highly fecund, producing clutches of 43,000–500,000 eggs, each about 1.0mm in diameter. The female carries the eggs for 11 months before eggs hatch in late spring (NMFS 2004c; NPFMC 1998). Female blue king crabs have larger eggs (1.2mm) and are less fecund, producing an average of 150,000 eggs per clutch (AFSC 2007). They are biennial spawners and carry their eggs for 14 months before eggs hatch in late spring (NMFS 2004c; NPFMC 1998). Female golden king crabs spawn throughout the year and produce even larger eggs (2.3mm), which are about 12 times the volume of red king crab eggs (NMFS 2004c; NPFMC 1998). Female golden king crabs are the least fecund; a 160mm female produces an average of 27,000 eggs (Jewett et al. 1985).

King crab eggs hatch as swimming larvae and are carried with the tides and currents. After several months, the larvae settle to the ocean bottom and molt into non-swimmers. Juvenile red king crabs (2–4 years of age) form pods for protection, consisting of thousands of crabs, and then migrate to deeper waters (NMFS 2004c; NPFMC 1998). Like all crabs, king crabs grow by shedding their hard outer shell in a process called molting. Adult males sometimes skip a molt and retain the same shell for one or two years (Blau 1997). Red king crabs grow to be the largest of the three species. The largest recorded male red king crab weighed 24 pounds and the largest female 10.5 pounds. Red king crabs can live up to 20–30 years of age (Blau 1997).

Adult red and blue king crabs migrate annually from nearshore to offshore and back. They migrate to shallow waters in the winter to spawn and then to offshore, deeper waters to feed. Adult king crabs segregate by sex on the feeding grounds (Blau 1997).

The three king crab species vary somewhat in their distribution (Figures 1 and 2). Red king crabs have the broadest distribution of the three species; their range includes eastern Korea to the northern coast of the Sea of Japan, into the Sea of Okhotsk, along the eastern shores of the Kamchatkan Peninsula, and throughout the Bering Sea, Aleutian Islands, and Gulf of Alaska (NPFMC 1998; NMFS 2004c). In the 1960s, Russian scientists intentionally introduced the red king crab into the Russian Barents Sea, and since then, the population has been expanding into Norway (Jorgensen et al. 2005). Red king crabs inhabit waters with depths of 300m or less. Blue king crabs have a discontinuous distribution in waters with an average depth of 70m from Hokkaido, Japan to Southeast Alaska. In the Bering Sea, they are found near King Island, St. Lawrence Island, St. Matthew Island, Pribilof Islands, and occasionally around Nunivak Island. In Asian waters, they are found in the Sea of Okhotsk, Tartar straits, and the northern part of the eastern Kamchatkan Peninsula, Cape Olyutorsky, the Koryak Coast, and Cape Navarin (NPFMC

1998; NMFS 2004c). Golden king crabs occur at depths of 300–1,000m on extremely rough bottoms, particularly coral bottoms. They are distributed from the Sea of Japan to the northern Bering Sea, around the Aleutian Islands, and southward to British Columbia (NPFMC 1998; NMFS 2004c). Figure 1 shows the distribution of king crabs throughout Alaska, and Figure 2 shows the distribution of red king crab throughout the world.

Figure 1. Distribution of U.S. king crab (Figure from Fisherman's Express, Alaska Seafoods, LLC 2006).

Figure 2. The distribution of red king crab (orange shading) throughout the world. Note the non-native distribution in the Russian and Norwegian southern Barents Sea (Figure from Jorgensen et al. 2005).

The Bristol Bay red king crab and Aleutian Islands golden king crab fisheries are responsible for the majority of the U.S. king crab landings, approximately 60% and 32%, respectively. The remaining king crab stocks are either closed due to poor or overfished stock status (including Pribilof Islands blue king crab, Pribilof Islands red king crab, St. Matthew Island blue king crab, Aleutian Islands red king crab, and Southeast red king crab), or contribute less than 3% of U.S. king crab landings. Alaska Department of Fish and Game (ADF&G) is responsible for the opening and closing of Alaskan king crab fisheries and setting guideline harvest levels (GHLs) for the fisheries. The National Marine Fisheries Service (NMFS) and North Pacific Fishery Management Council (NPFMC) have oversight of state management, and have authority to prevent overfishing, rebuild overfished fisheries, and establish essential fish habitat (EFH) (NPFMC 1998).

Red king crab is the predominant king crab species caught commercially in the Russian Far East and the Russian Barents Sea. The Russian Far East king crab fishery is managed under the State Fisheries Committee (Goskomrybolovstvo). They allocate quotas, develop and implement fisheries regulations, provide enforcement, and conduct fishery research (Ivanov 2002). In the Russian Barents Sea, the red king crab fishery is managed by Norway and Russia. These two

countries meet annually to set total allowable catch (TAC) limits for the red king crab stocks (Jorgensen et al. 2005; Robert Otto, pers. comm.).

The Barents Sea red king crab is a quickly spreading, non-native species. Non-native or invasive species are not addressed in standard fisheries methodologies. Several approaches have been taken to manage such a fishery. A portion of the Norwegian Barents Sea king crab fishery (west of 26°E) is "managed" as an elimination fishery (i.e., no management). World Wildlife Fund (WWF) in Norway agrees with this approach, stating that sustainable management of an invasive species is a clear violation of the Convention on Biological Diversity (CBD). Article 8(h) of the CBD states that "Contracting parties to the Convention should, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Hansson 2002). Similarly, the Marine Stewardship Council (MSC) recently denied undertaking an assessment of the Russian Barents Sea red king crab fishery on the basis that the species was introduced into the Barents Sea. When the MSC was formed, it decided not to certify fisheries based on introduced species. MSC has not yet formally made any recommendation regarding introduced species. However, due to the prevalence of the Russian Barents Sea king crab in the market place, Seafood Watch® includes it in our list of recommendations. Seafood Watch®'s guiding principles (Appendix 1) were developed for fisheries based on native species. When evaluating a fishery based on an invasive species, such as the Barents Sea red king crab, some of the sustainability benchmarks must be reversed. For example, removal of a target species in a traditional fishery can lead to substantial adverse ecosystem impacts; however, in a fishery based on an invasive species, removal of the target species is deemed beneficial, as its ongoing presence can negatively impact the ecosystem. Likewise, the goal of traditional fisheries management is to provide for sustainable, healthy fish stocks, whereas in a fishery based on an invasive species, managing for sustainable populations can actually threaten the native ecosystem. In these cases, Seafood Watch® concludes that the species should be managed in a manner that would lead to its eradication. This approach is taken throughout this analysis when evaluating the sustainability of Barents Sea king crabs.

In the United States, the Bristol Bay red king crab fishery (a native species) is not experiencing overfishing, and stock abundance is above 100% B_{MSY}. The Aleutian Islands golden king crab stock is only surveyed triennially, but the stock was stable from 1996 to 2003, catch per unit effort (CPUE) has increased in the population east of 174°W longitude, and the size/sex/age distributions are normal. Stock status of the Russian Far East king crab is unknown. The Russian Far East definition of overfishing is unclear and may not be directly analogous to the U.S. definition, but literature states that overfishing is occurring, as is poaching, both of which are deteriorating the stock. For the Russian Barents Sea king crab fishery, biomass relative to B_{MSY} and overfishing parameters are unknown; however, the stock index of legal males and mature females is high, the total stock index is increasing, and there is a strong year-class of pre-recruits, suggesting that this non-native continues to spread dramatically across the Barents Sea.

Scope of the analysis and the ensuing recommendation:
This report encompasses king crab fisheries in the United States and Russia, which together account for 94% of king crab sold in the U.S. market. The remaining 6% comes from Japan, China, Argentina, South Korea, Chile, Thailand, Canada, Denmark, Panama, Indonesia, Belgium, Ireland, Mexico, United Kingdom, British Virgin Islands, Philippines, and Peru. The

U.S. section of the report focuses on the Bristol Bay red king crab fishery and the Aleutian Islands golden king crab fishery due to the closure or minimal contribution of the other U.S. king crab fisheries to overall U.S. landings. The Russian king crab fishery occurs in the Far East and the Barents Sea.

Availability of Science

In the United States, NMFS conducts annual trawl surveys on four king crab stocks (Bristol Bay red king crab, St. Matthew Island blue king crab, Pribilof Islands red king crab, and Pribilof Islands blue king crab). ADF&G surveys the Norton Sound, eastern Aleutian Islands red king crab, and Gulf of Alaska red king crab fisheries annually. The remaining fisheries, including the Aleutian Islands golden king crab fishery, are not assessed on a regular basis. Bycatch data from the Bering Sea and Aleutian Islands (BSAI) crab fisheries are available from the Mandatory Shellfish Observer Program.

In the Russian Far East, the State Fisheries Committee (Goskomrybolovstvo) and State fisheries research institutions conduct fishery research. Recently, Russia's shellfish research program has experienced reductions in research personnel, the research fleet, far-sea research activities, and trawl surveys (Ivanov 2002). Historical data and biological reference points that provide an indication of the stock's health are not available. In addition, bycatch data for the Russian Far East fishery are not available. In the Russian Barents Sea, the Joint Norwegian-Russian Fisheries Commission has been conducting regular research surveys since 1994; however, historical data and biological reference points are not available. Bycatch data for this fishery are also not available.

Market Availability

Common and market names:
King crab is known by its respective common names of red king crab, blue king crab, and golden king crab, but blue king crab can also be sold as red king crab, and golden king crab can also be sold as brown king crab. King crab is also known as Alaskan king crab. When used for sushi or sashimi, red, blue, and golden king crab is commonly sold as *kani*.

Seasonal availability:
Frozen king crab is available year round; fresh king crab is available during the fishing seasons. The Aleutian Islands golden king crab fishing season occurs from mid-August through mid-May, and the Bristol Bay red king crab fishing season occurs from mid-October through mid-January (NPFMC 2005a; Barnard and Pengilly 2006). The Russian Barents Sea fishing season occurs from September through February (Norwegian Ministry of Fisheries and Coastal Affairs 2006b).

Product forms:
King crabs are delivered live to the docks and then cleaned, cooked, and frozen prior to shipping (Blau 1997). King crab is primarily sold as frozen cooked legs (split or whole) and claws (Environmental Defense 2006). They are also sold as fresh cooked sections (Seafood Bounty 2006). The meat is snow white and tastes sweet, moist, and rich. The body meat is flakier than the leg meat (Trident Seafood 2006).

Import and export sources and statistics:
The United States (49%) and Russia (45%) are the primary sources of king crab sold in the United States. Japan, China, and Argentina each provide 1% to the U.S. market, and the remaining 3% of king crab sold in the U.S. comes from South Korea, Chile, Thailand, Canada, Denmark, Panama, Indonesia, Belguim, Ireland, Mexico, United Kingdom, British Virgin Islands, Phillipines, and Peru (Figure 3) (NMFS 2004a &b).

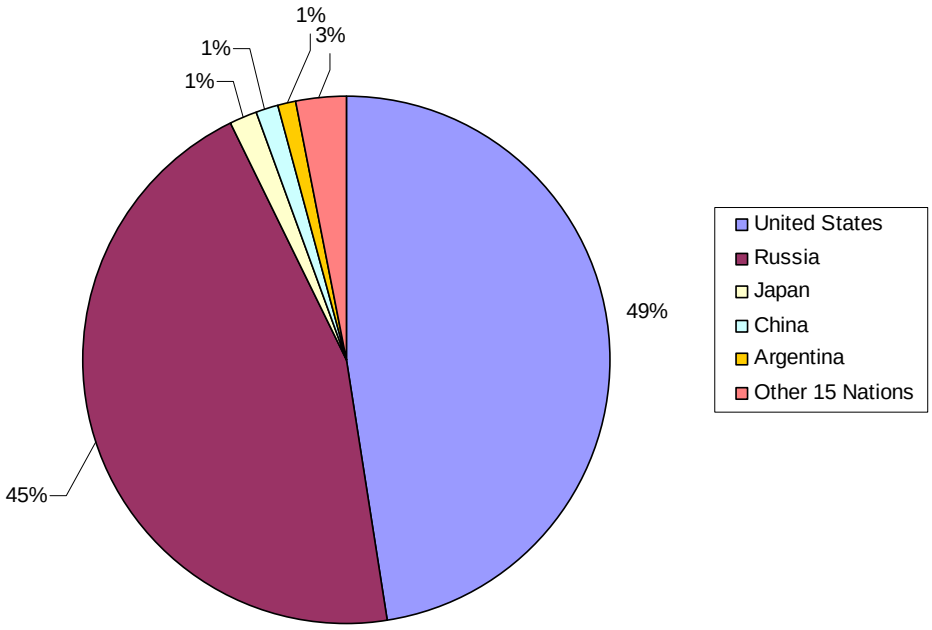

Figure 3. Sources of king crab sold in the United States, 2004 (Data from NMFS 2004a&b).

III. Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species

Criterion 1: Inherent Vulnerability to Fishing Pressure

Red, blue, and golden king crabs have varying life history characteristics (Table 1). The intrinsic rate of increase and growth rate for king crabs are unknown. In Bristol Bay, about 50% of male and female red king crabs reach sexual maturity at 120mm carapace length (CL) and 90mm CL, respectively, and about 7 years of age. Red king crabs in Norton Sound reach sexual maturity at smaller sizes and do not grow as large as in other areas. In the Pribilof Islands, 50% of male and female blue king crabs mature at 108mm CL and 96mm CL, respectively, and about 5 years of age. St. Matthew Island blue king crabs reach sexual maturity at smaller sizes and do not get as large as in other areas. For golden king crabs, size at sexual maturity depends on latitude, with crabs in northern latitudes maturing at smaller sizes. Around St. Matthew Island, 50% of male and female golden king crabs mature at 92mm CL and 98mm CL, respectively. Further south, in the Pribilof and western Aleutian Islands, 50% of males and females reach sexual maturity at

107mm CL and 100mm CL, respectively. Even more southerly in the eastern Aleutian Islands, 50% of males and females mature at 130mm CL and 111mm CL, respectively. No age correlations for these sizes were provided in the literature, but based on the ages for red and blue king crabs, Seafood Watch® assumes the age of sexual maturity for the golden king crab to be 5–10 years (NMFS 2004c; NPFMC 1998).

Red king crabs are the largest of the three species. The largest recorded male and female red king crabs weighed 24 and 10.5 pounds, respectively; however, this tends to vary by fishing area. Red king crabs can live up to 20–30 years of age (Blau 1997). The maximum size and age of blue and golden king crabs has not been documented in the literature.

Red king crabs spawn annually and are highly fecund, producing clutches of 43,000–500,000 eggs. Their eggs are small in size (1.0 mm), and the female carries the eggs for 11 months before hatching in late spring (NMFS 2004c; NPFMC 1998). Female blue king crabs have larger eggs (1.2mm) and are less fecund, producing an average of 150,000 eggs per clutch (Otto and Cummiskey 1985). They are biennial spawners and carry their eggs for 14 months before hatching in late spring (NMFS 2004c; NPFMC 1998). Female golden king crabs spawn throughout the year and produce even larger eggs (2.3mm), which are about 12 times the volume of red king crab eggs (NMFS 2004c; NPFMC 1998). The female golden king crabs are the least fecund; a 160mm female produces an average of only 27,000 eggs (Jewett et al. 1985).

Red king crabs exhibit pod aggregations and sexual segregation, which increase their vulnerability to fishing pressure. From 2 to 4 years of age, red king crabs form pods for protection, consisting of thousands of crabs, and migrate to deeper waters. Podding behavior has yet to be demonstrated for blue and golden king crabs. Additionally, adult red and blue king crabs have annual migrations to shallow water in the spring for spawning and deep water in the summer for feeding. The males and females segregate during feeding periods (NMFS 2004c; NPFMC 1998).

The distribution of the three king crabs varies considerably, with red king crab having the greatest range. The species is found from eastern Korea to the northern coast of the Sea of Japan, into the Sea of Okhotsk, along the eastern shores of the Kamchatkan Peninsula, and through the Bering Sea, Aleutian Islands, and Gulf of Alaska. In the 1960s, Russian scientists also intentionally introduced the red king crab into the Russian Barents Sea, and since then it has been expanding into Norway. Red king crabs only inhabit waters with depths of 300m or less. Blue king crabs have a discontinuous distribution in waters with an average depth of 70m from Hokkaido, Japan to Southeast Alaska. In the Bering Sea, they are found near King Island, St. Lawrence Island, St. Matthew Island, Pribilof Islands, and occasionally around Nunivak Island. In Asian waters, they are found in the Okhotsk Sea, Tartar straits, and northern part of the eastern Kamchatkan Peninsula, Cape Olyutorsky, the Koryak Coast, and Cape Navarin. Golden king crabs occur at depths of 300–1,000m on extremely rough bottoms, particularly coral bottoms. They are distributed from the Sea of Japan to the northern Bering Sea, around the Aleutian Islands, and southward to British Columbia (NMFS 2004c; NPFMC 1998).

Table 1. Life history characteristics of king crab

Species	Intrinsic Rate of Increase (r)	Age at Maturity	Growth Rate	Max Age	Max Size	Fecundity	Species Range	Special Behaviors	Sources
Red king crab	Unknown	7 years	Unknown	20–30 years	Male: 24 lbs Female: 10.5 lbs	43,000–500,000 eggs annually	Japan to Alaska, and Barents Sea	Juvenile pods; sexual segregation	Blau 1997; NMFS 2004c; NPFMC 1998
Blue king crab	Unknown	5 years	Unknown	Unknown	Unknown	Average 150,000 eggs biennially	Japan to Southeast Alaska	Sexual segregation	Blau 1997; Otto and Cummiskey 1985; NMFS 2004c; NPFMC 1998
Golden king crab	Unknown	Males: 92 -130 mm CL Females: 98 -111 mm CL	Unknown	Unknown	Unknown	30,000 eggs annually	Japan to British Columbia	None	Hoyt and Shirley 2000; McBride et al. 1992; NMFS 2004c; NPFMC 1998

Synthesis

The intrinsic rate of increase and growth rate for all three species of commercial king crab are unknown. However, they all do have a moderate age at first maturity and relatively high fecundity. Maximum age and size are also not known for blue and golden king crabs, but the red king crab has been shown to be moderately long-lived. Red and blue king crabs exhibit several behaviors that increase their vulnerability to fishing pressure, such as pod aggregations by juvenile red king crab and sexual segregation by adult red and blue king crabs. Due to their moderate age at maturity and these special behaviors, king crabs are considered to be moderately vulnerable to fishing pressure.

Inherent Vulnerability Rank:

Resilient | **Moderately Vulnerable** | Highly Vulnerable

Criterion 2: Status of Wild Stocks

United States

The National Marine Fisheries Service (NMFS) annually surveys four king crab stocks in Alaska: Bristol Bay red king crab; Pribilof Islands red king crab; Pribilof Islands blue king crab; and Saint Matthew Island blue king crab. The Alaska Department of Fish and Game (ADF&G)

uses the data for stock assessment and setting of total allowable catch (TAC). Eastern Aleutian red king, Norton Sound red king, and Gulf of Alaska red king crab are surveyed annually by ADF&G. ADF&G surveys the remaining Alaskan king crab stocks on a more limited basis, and has insufficient data on stock abundance to determine minimum stock size threshold (MSST) (NPFMC 2006).

Four king crab stocks have recently been closed to fishing (Table 2). The Pribilof blue king crab fishery was closed after the 1998 fishing season due to low abundance. Based on the 2009 NMFs bottom trawl survey, the estimated total mature male biomass increased from 0.29 million pounds in 2008 to 1.28 million pounds in 2009. However, the 2009/2010 mature male biomass at mating is projected to be 1.13 million pounds, which is about 12% of B_{MSY}, and there is no indication of recruitment. The stock was designated as overfished in 2002 and is still designated as such in 2010 (NPFMC 2010; NMFS 2010). The Pribilof red king crab fishery was closed after the 1998 fishing season due to poor precision of abundance estimates, poor fishery performance, and concerns over bycatch of Pribilof blue king crabs. The fishery remains closed but the 2009 survey estimated that mature male biomass was 4.46 million pounds, and the fishery is no longer considered to be overfished (NPFMC 2009; NMFS 2010).

The Aleutian Islands red king crab fishery is composed of the Dutch Harbor and Adak fishing areas and was closed in 2000, 2001, and 2004 through 2006. The fishery is composed of the Dutch Harbor and Adak fishing areas. The Dutch Harbor red king crab fishery began in 1961, peaking at 33 million pounds in 1966. Catch declined after 1966 until a secondary peak of 17.7 million pounds in 1980, after which the stock declined again and has not yet recovered. The Adak red king crab fishery began in 1960, peaking at 21 million pounds in 1964. Catches began declining after 1972. During 1977–1993, catches were low but stable. Since 1993, the stock has been declining (ADF&G 2001). The fourth king crab fishery that has been closed is the Southeast red king crab fishery, which was also closed due to low stock abundance.

Table 2. Stock status of the four closed Alaskan king crab fisheries

Stock	Population abundance	Status	F/F_{MSY}	Abundance Trends	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Pribilof Islands blue king crab	2009 biomass (1.28 million lbs) below B_{MSY} (9.28 million lbs)	Overfished	Fishery closed	Long-term and short-term decline	Normal	Low	NPFMC 2009;	**Poor**
Pribilof Islands red king crab	2009 biomass below B_{MSY}	Not overfished	Fishery closed	Long-term decline; short-term decline since 2007	Declining mature male abundance	Moderate	NPFMC 2009	**Poor**
Aleutian Islands red king crab	Low stock size	Undefined	Fishery closed	Long-term and short-term decline	Low abundance of females and pre-recruits	High	NPFMC 2006; NPFMC 2009	**Poor**
Southeast red king crab	Below minimum threshold	Rebuilding	Fishery closed	Long-term and short-term decline	Normal	High	ADF&G 2006c	**Poor**

These four fisheries historically have not contributed a large portion to overall U.S. king crab landings. Combined, they accounted for approximately 20% of the Alaskan king crab catch from 1983 to 1997. The Southeast red king crab fishery has historically been negligible. The Bristol Bay red king crab and the Aleutian Islands golden king crab fisheries, which are still open, made up approximately 80% of the catch from 1983 to 1997 (Table 3) (ADF&G 2001).

Table 3. Commercial catch of Alaskan King Crab, 1983–1997 Mean (pounds) (Table from ADF&G 2001).

Stock	Mean pounds	Percentage of landings
Bristol Bay Red	10,588,912	44%
Pribilof Island Blue	838,746	3%
St. Matthew Blue	3,029,877	13%
AI (Dutch + Adak) Red	989,799	4%
AI (Dutch + Adak) Golden	8,518,525	36%
Total	23,965,859	

Due to many of the fishery closures mentioned above, the proportion of king crab catch from the Bristol Bay red king crab and Aleutian Islands golden king crab fisheries catch has increased, accounting for (on average) 92% of the catch from 2000 to 2004 (Table 4) (ADF&G 2006b). Therefore, the U.S. section of this report focuses on these two stocks and excludes the other five stocks mentioned above.

Table 4. Recent 5-year average catch for Alaska commercial king crab fisheries. Averages are for the period 2000–2004 (Table from ADF&G 2006b).

Stocks	Catch (pounds)	Remarks	Percent of Total Harvest
Bristol Bay red	11,521,254		60%
Aleutian Islands golden	6,198,473		32%
Southeast golden	564,133		3%
Aleutian Islands red	405,093	00-01 and 04 closed	2%
Norton Sound red	300,819		2%
Southeast red	241,452	00 and 04 closed	1%
Southeast blue	1,322		0.01%
St. Matthew blue	0	00–04 closed	0%
Pribilof blue	0	00–04 closed	0%
Pribilof red	0	00–04 closed	0%
Total	19,232,546		100%

Bristol Bay red king crab

Total allowable catch (TAC) for the 2008/2009 season was restricted to 20.3 million pounds. This value was only slightly less than the previous season's (2007/2008) TAC of 20.4 million pounds (NPFMC 2009).

Total biomass for the Bristol Bay red king crab have remained relatively low over the past two decades, especially in comparison to values seen in the 1970s (721.1 million pounds in 1978). The record low was 66.3 million pounds in 1985. Since then, biomass has shown a general upward trend, with an estimate of 196.5 million pounds in 2009 (Figure 4) (NPFMC 2009).

Mature male biomass (MMB) in 2009 was 95.2 million pounds (Figure 5), well above the B_{MSY} proxy (B_{35}%) of 68.5 million pounds (MMB/B_{35}% = 1.39). Additionally, the total catch for the 2008/2009 season (23.1 million pounds) was less than the overfishing level ($OFL_{2008/2009}$) of 24.2 million pounds, and short-term biomass trends are up (NPFMC 2009). Currently, this stock is not overfished and not experiencing overfishing (NPFMC 2009; NMFS 2010). Given this information, Seafood Watch® considers the Bristol Bay red king crab stock to be healthy.

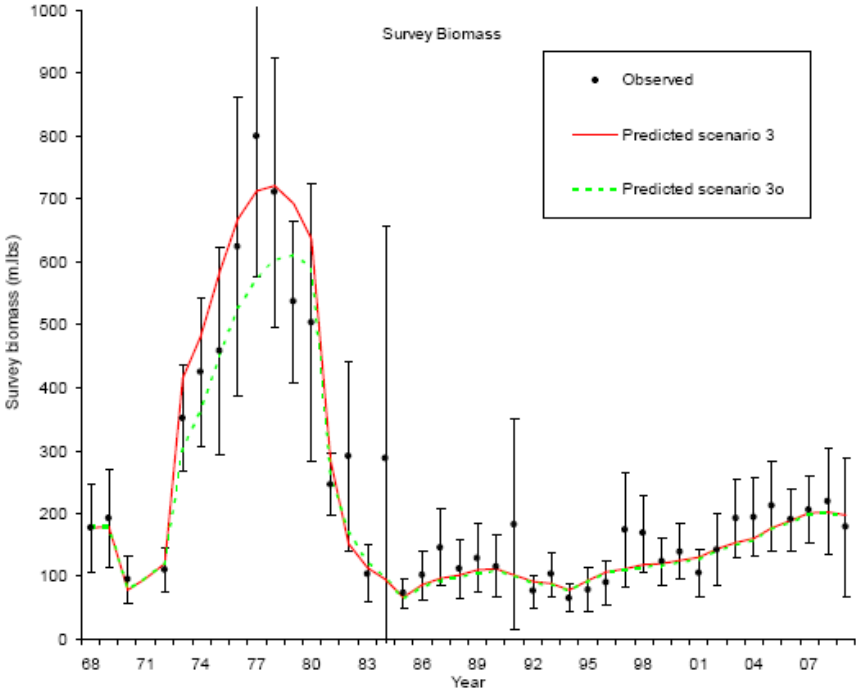

Figure 4. Predicted and observed survey biomass (million pounds) for Bristol Bay red king crab stock (Figure taken from NPFMC 2009).

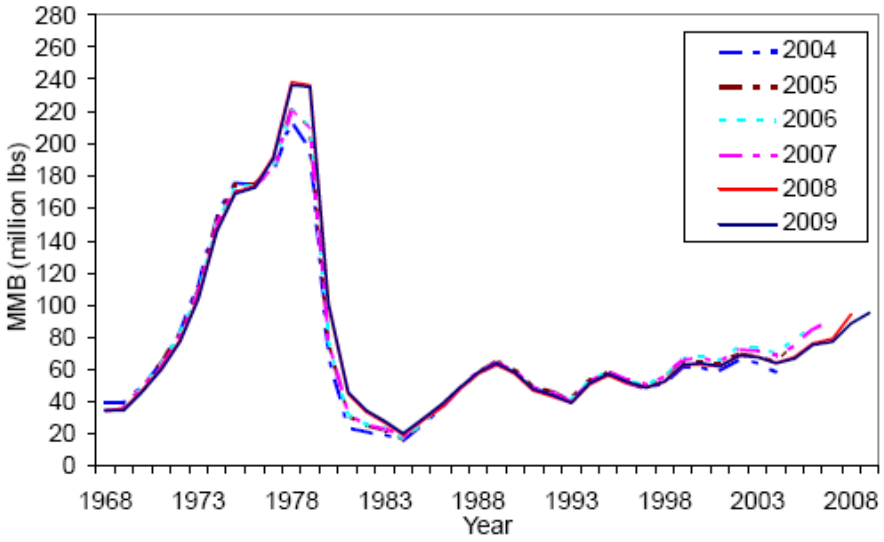

Figure 5. Mature male biomass (million pounds) for Bristol Bay red king crab stock (Figure from NPFMC 2009).

Aleutian Islands golden king crab

Golden king crab habitat is not suitable for trawl surveys; therefore, the Aleutian Islands golden king crab stock is not routinely surveyed. As such, current abundance estimates and subsequent estimates of MSST are not available for the golden king crab stock (NMFS 2004c; NPFMC 2006). The 1996–2003 golden king crab fishery performance and observer data from the area east of 174°W longitude, however, indicated that the stock was stable. In contrast, ADF&G observer data indicated a decline in the catch of sublegal males since 2000 (NPFMC 2004). Fishery data, observer data, and tag recovery information were used to establish the TAC of 5.7 million pounds since the 1998/1999 fishing season (NPFMC 2009). This TAC value remained as such until March 2008, when the Alaska Board of Fisheries set the TAC for this stock at 5.985 million pounds. CPUE for the 2008/2009 fishing season (based on fish ticket data) in the Aleutian Islands was 24.8 crabs per pot lift, the highest on record (beginning in the 1970s) (Figure 6) (NPFMC 2010).

At present, neither biomass estimates nor recruitment trends are available for the Aleutian Islands golden king crab stock (NPFMC 2010). However, there is adequate evidence that a sharp increase in CPUE of retained legal males during the recent fishery seasons was not due to a sharp increase in legal-size male recruitment (NPFMC 2009).. B_{MSY} and MSST estimates are not available for this stock. ADF&G is developing a catch-survey model, using data from the commercial fishery and triennial surveys, to provide more information for assessing stock status and harvest rate. In the Aleutian Islands west of 174°W longitude, fishery catch statistics have remained relatively stable since the 1996 fishing season. CPUE for the golden king crab has increased since the early 2000s (Figure 6). According to the National Marine Fisheries Service second quarter 2010 Status of Fisheries states that the Aleutian Islands golden king crab stock is not experiencing overfishing and its overfished status is unknown (NMFS 2010).

Due to the stable populations east and west of 174°W longitude, the increase in CPUE, the absence of overfishing, and the normal size/sex/age distributions, Seafood Watch® also considers the status of the Aleutian Islands golden king crab stock to be healthy.

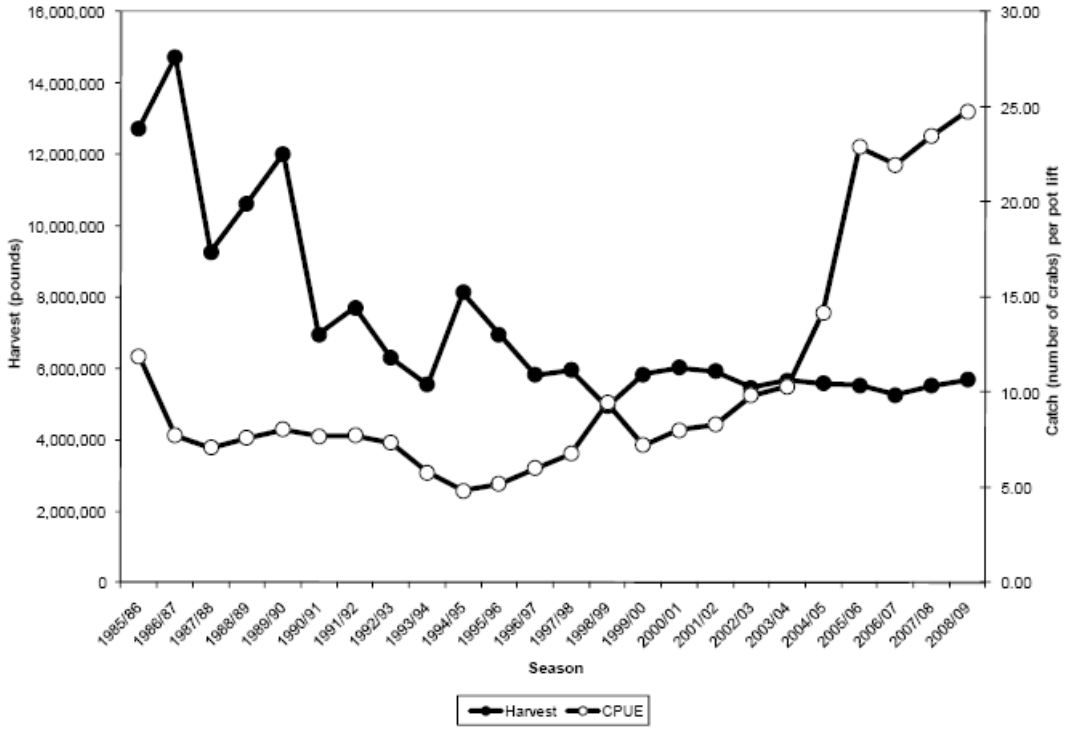

Figure 6. Retained catch (harvest in pounds) and catch (number of retained legal crabs) per pot lift (CPUE) in the Aleutian Islands golden king crab fishery, 1985/86–2008/09 seasons (Figure taken from NPFMC 2010).

Russian Far East

In the Russian Far East fishery, the western Kamchatka area provides about 90% of the total catch of red king crab. Hundreds of vessels participate in this fishery, resulting in high fishing pressure, exploitation of new red king crab stocks, and pressure from the industry on scientists and managers. Due to the large number of participants in the fishery, fishing methods are not uniform; therefore, CPUE cannot be used to estimate stock abundance. In addition, the large number of participants makes management difficult and competition within the fishery high (Ivanov 2002). Additionally, Russia's shellfish research program has recently experienced challenges, including reductions in research personnel, the research fleet, far-sea research activities, and trawl surveys. TACs are often determined by intuition and oriented to fishery production rather than stock abundance (Ivanov 2002). Red king crab harvests in the Russian Far East fishery have historically been unstable (Figure 7).

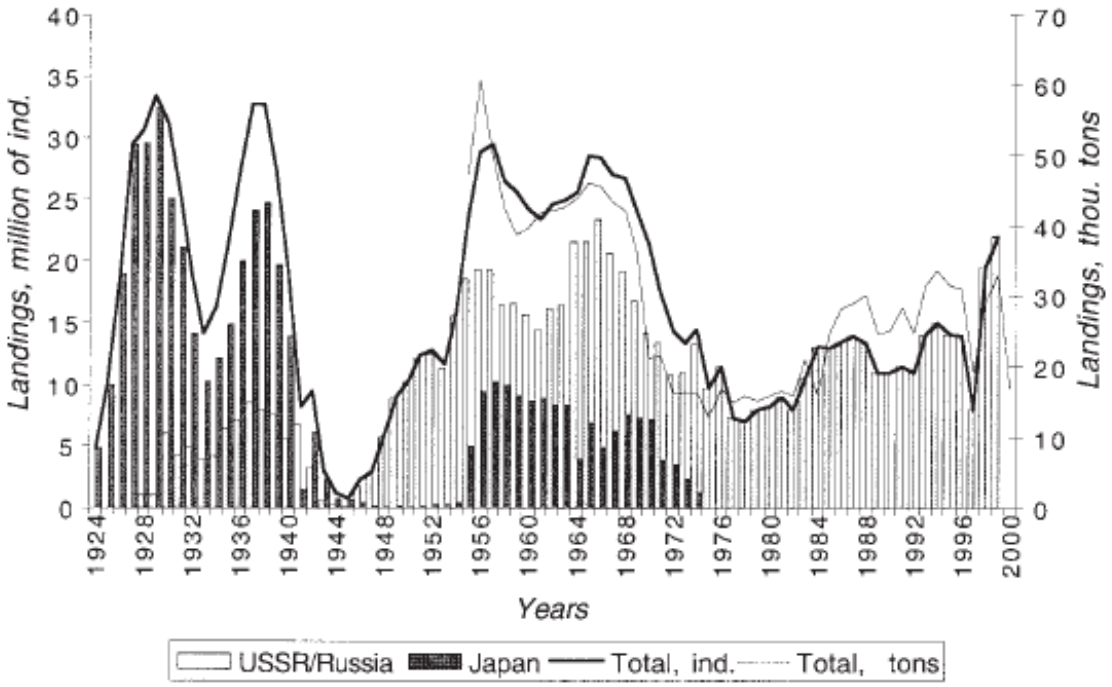

Figure 7. Landings of red king crabs in 1924–1999 by Japan and USSR/Russia off western Kamchatka (Figure from Ivanov 2002, modified from Slizkin and Safanov 2000).

In a study in 2001 Pavlov and Talberg (2001 as cited in Ivanov 2002) stated that the western Kamchatka red king crab population was in a "critical state" due to several changes within the population. First, selective fishing has resulted in a decrease in the proportion of large males and a shift in the sex ratio. Second, concentrations of legal-size males and young crabs have shifted areas. Third, red king crabs in the southern areas have been replaced by Tanner crabs. Fourth, the proportion of barren (non-egg bearing) females and soft-shelled male red king crabs has increased, causing a reduction in reproductive potential. Finally, a high incidence of parasites has been found in red king crabs (Ivanov 2002).

Since the mid-1990s, poaching and other violations of fisheries legislation have been rampant in the Russian Far East fishery. As a result of poaching, the Russian Far East does not have reliable landings data (Ivanov 2002). The Russian Far East definition of overfishing is unclear and may not be directly analogous to the U.S. definition, but it is reported to be occurring (Svec and Muran 2006). The western Kamchatka red king crab fishery is in state of collapse. The stock declined in the late 1990s and early 2000s due to natural fluctuation of crab abundance, but has not improved since. This continued decline is probably a result of an increase in poaching intensity; fishermen began to harvest undersized males and females in addition to legal-size males (Ivanov, email to Robert Otto, September 27, 2004). According to Bean (2000), illegal fishing is reported to be deteriorating the western Kamchatka king crab stock at an "alarming" rate.

Within a king crab population, crabs are often found to be missing one or more claws for a variety of reasons. Crabs can regenerate their claws, but claws take 4 to 7 molts to re-grow to full-size. In commercial fisheries, where claws are the most important part of the crab, fishermen

discard de-clawed crabs back into the ocean. Researchers at the Kamchatka Research Institute for Fisheries and Oceanography and the Institute of Marine Biology in the Far-East Branch of Russian Academy of Sciences found that near the Koryak coast in the Bering Sea, where intense fishing occurs, there is a high number of de-clawed males, which are not able to mate. As a result, researchers have seen a reduction in reproductive potential, which will eventually lead to a decrease in population abundance (Selin et al. 2001).

Given the lack of survey data, unreliable landings data, reported alarming deterioration of the stock, reduced reproductive potential, and occurrence of overfishing and poaching, Seafood Watch® considers the status of the Russian Far East king crab stock to be a critical conservation concern.

Russian Barents Sea

In the 1960s, Russian scientists introduced the red king crab to the Barents Sea to create a new, valuable commercial resource (Jorgensen et al. 2005). Since then, the crab population has spread throughout the Russian Economic Zone and into the Norwegian Economic Zone (Figure 8) (Sundet and Sokolov 2006). The red king crab has established an expanding, self-reproducing population in the Barents Sea (Sennikov 1989 as cited in Gudimov et al. 2003).

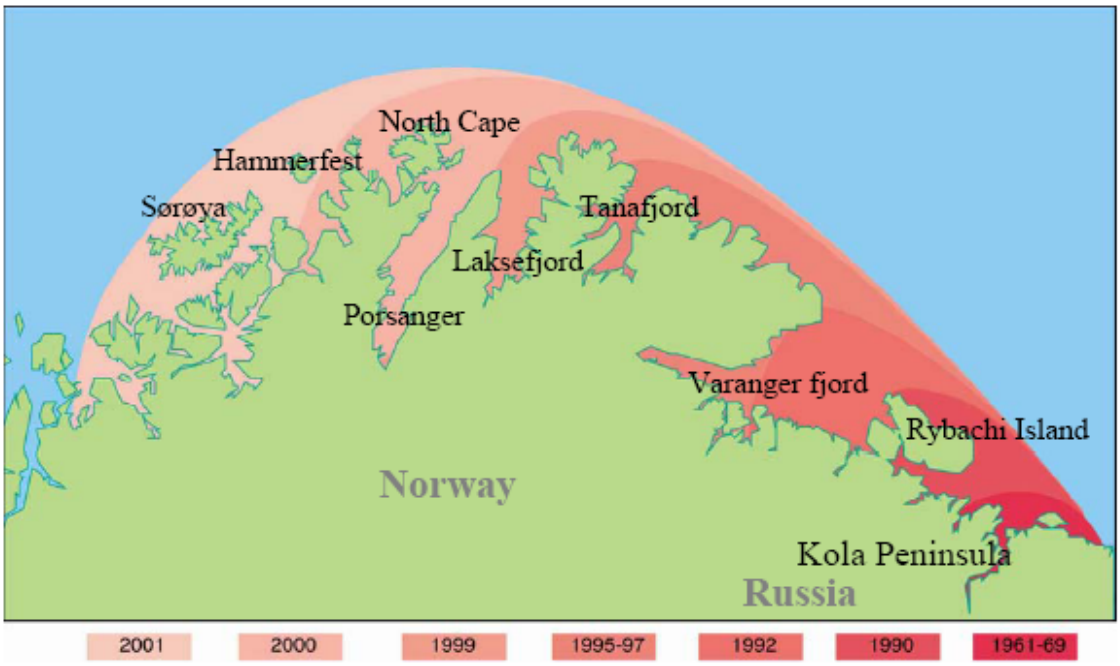

Figure 8. Distribution and spread of the red king crab from area of release (red) and westward expansion (Figure from Sundet and Sokolov 2006).

For the 2006 Barents Sea king crab fishery, Russia and Norway agreed on a Russian quota of 3 million crabs and a Norwegian quota of 300,000 crabs (Norway Ministry of Fisheries and Coastal Affairs 2006c). This report only addresses the Russian portion of the fishery because 90% of the catch from the Barents Sea king crab fishery is taken by Russia.

Russian and Norwegian scientists conduct regular research surveys to study the biology and distribution of the red king crab (Berenboim et al. 2003). The 2005–2006 Russian Barents Sea king crab stock was assessed using trap and trawl surveys. In the autumn 2005 survey, researchers found only one dense concentration of mature females, but the February 2006 survey found dense concentrations of mature females along the entire Murman coast, and increasing concentrations further east (Figure 9).

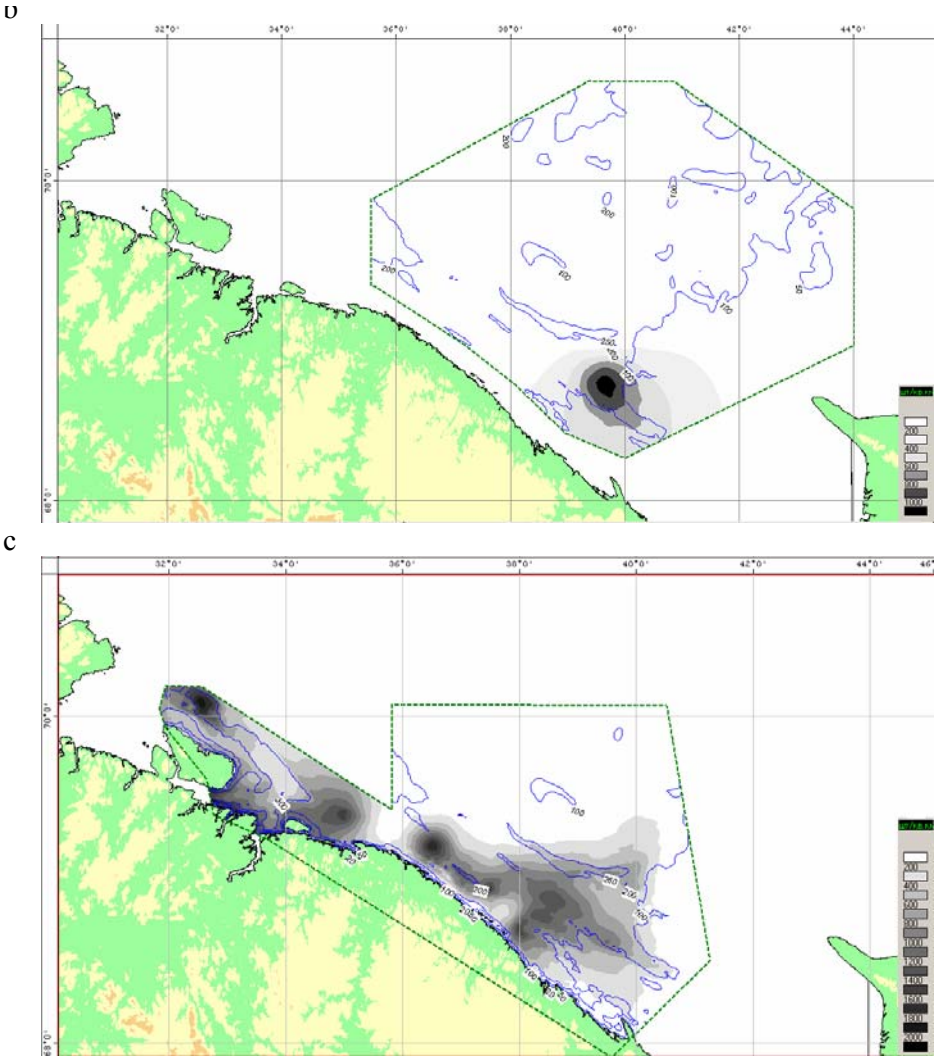

Figure 9. Distribution of red king crab mature females with carapace width 130–149mm: top—October 2005; bottom—February 2005 (Figures from Sundet and Sokolov 2006).

Scientists do not use estimates of B_{MSY} or F_{MSY} in assessing the king crab stocks. Instead, Russian scientists and managers use recruitment to the stock, total stock index, and stock index of legal males, pre-recruits, and egg-carrying females to determine stock abundance and health of the fishery. The stock index of legal males has substantially increased since 1995, and has fluctuated since 2003 but is currently estimated to be at one of the highest historical levels (Table 5). The size and stability of recruitment varies greatly from area to area. From 2003-2005, abundance of pre-recruits (<150mm carapace width) was low in the southeast waters of the

Barents Sea. However, the trap and diving surveys in the autumn of 2005 and spring of 2006 revealed a strong year-class with 100-130mm carapace width (CW). Trawl surveys are conducted to determine total stock index. The king crab total stock index from 2001-2005 increased in the eastern areas and remained stable in the western areas (Sundet and Sokolov 2006).

Table 5. Estimates of legal males based on the surveys for 1995–2006 in the Russian Economic Zone (REZ) and Norwegian Economic Zone (NEZ) (Data from Sundet and Sokolov 2006).

Years	Number of legal males (CW >150mm)
1995	255,000
1996	167,000
1997	316,000
1998	801,000
1999	1,508,000
2000	1,513,000
2001	1,494,000
2002	3,271,000
2003	13,365,000/24,000,000**
2004	9,600,000*
2005	11,500,000/21,875,000**
2006	16,596,000**

* from data on crab bycatches
** from data on trap surveys

Biomass relative to B_{MSY} and overfishing parameters are unknown for the Barents Sea red king crab fishery, and there is a moderate degree of uncertainty in stock status. However, the stock index of legal males and mature females is high, the total stock index is increasing, and there is a strong year-class of pre-recruits. Given this information, the status of the Russian Barents Sea king crab stock is considered to be healthy from a traditional fishery perspective. However, because Barents Sea red king crab is non-native and invasive, considerable conservation concerns exist. These are addressed explicitly in the "Effects of Fishing Practices on Habitats and Ecosystems" and "Effectiveness of the Management Regime" sections.

Table 6. Stock status of king crab.

Stock	B/B_{MSY}	Occurrence of Overfishing	F/F_{MSY}	Abundance Trends/CPUE	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Bristol Bay Red King Crab	95.2 million pounds/68.5 million pounds = 1.39	Overfishing not occurring	Overfishing not occurring	Long-term increase, short-term increase	Normal	Low	NPFMC 2006; Forrest Bowers pers. comm.; NPFMC 2009; NMFS 2010	**Healthy**
Aleutian Islands Golden King Crab	Undefined	Overfishing not occurring	Unknown	Eastern: increase in CPUE Western: increase in CPUE	Normal	Moderate	NPFMC 2006; NPFMC 2009; NPFMC 2010; NMFS 2010	**Healthy**
Russian Far East	Unknown but likely to be low	Overfishing occurring	Unknown but likely to be >1.0	Unknown	Skewed in western Kamchatka	High	Bean 2000; Svec and Muran 2006; Ivanov 2002	**Critical**
Russian Barents Sea	Unknown but likely to be at or above B_{MSY}	Unknown	Unknown	Increase in total stock index	High stock index of legal males and mature females, and a strong year-class of pre-recruits	Moderate	Sundet and Sokolov 2006	**Healthy***

* Strong fishery stock measures are offset by the introduced status of red king crab in the Barents Sea. Intentionally released, non-native species are a high conservation concern from an ecosystem perspective. See more information in the "Effects of Fishing Practices on Habitats and Ecosystems" section.

Synthesis

The 2009 estimated total male mature biomass of the Bristol Bay red king crab stock is well above MSST and B_{MSY}. The stock is not overfished, and overfishing is not occurring. The long and short-term abundance trends are up. Given this information, the status of the Bristol Bay red king crab stock is considered to be healthy.

Estimates of biomass for the Aleutian Islands golden king crab stock is unknown and therefore it is unknown if the stock is overfished; however, CPUE has increased since the early 2000s. In addition, the stock is not experiencing overfishing and the size/sex/age distribution is normal.

Given this information, the status of the Aleutian Islands golden king crab stock is also considered to be healthy.

The Russian Far East king crab stock is not regularly surveyed due to cuts in the Russian shellfish research program. Overfishing and poaching are occurring in the fishery. Rampant poaching makes landings data unreliable, and is reported to be deteriorating the stock at an alarming rate. In addition, the western Kamchatka red king crab stock is in a state of collapse due to several changes within the population. Given this information, the status of the Russian Far East king crab stock is considered to be a critical conservation concern.

In the Russian Barents Sea red king crab fishery, biomass relative to B_{MSY} and overfishing parameters are unknown, and there is a moderate degree of uncertainty in stock status. However, the stock index of legal males and mature females is high, the total stock index is increasing, and there is a strong year-class of pre-recruits. Given this information, the status of the Russian Barents Sea king crab stock is considered to be a low conservation concern. These strong fishery stock measures are offset, however, by the introduced status of red king crab in the Barents Sea. Intentionally released, non-native species are a high conservation concern from an ecosystem perspective. This issue is detailed further in the "Effects of Fishing Practices on Habitats and Ecosystems" section.

Status of Wild Stocks Rank:

Bristol Bay red, Aleutian Islands golden, & Russian Barents Sea king crab stocks:

Healthy Moderate/Rebuilding Poor Critical

Russian Far East king crab:

Healthy Moderate/Rebuilding Poor **Critical**

Criterion 3: Nature and Extent of Bycatch

Seafood Watch® defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for, and managed in some way.

United States
Female king crabs and sublegal male king crabs comprise the majority of bycatch in U.S. king crab fisheries. With the implementation of the crab rationalization program in 2005, some legal males have also become bycatch due to highgrading (discarding low quality males). All bycatch of illegal king crabs and low quality male king crabs are discarded at sea (NMFS 2004c).

The ADF&G observer program collects bycatch data from observed vessels in the Bering Sea and Aleutian Islands fisheries, including the Bristol Bay red king crab and Aleutian Islands golden king crab fisheries. Bycatch in king crab fisheries differs from bycatch in finfish fisheries in that the discard mortality rate of crabs is substantially lower than that of finfish. The majority of finfish die before being discarded at sea, whereas king crab bycatch has only an 8% mortality rate (NPFMC 2005a). Seafood Watch® applies this mortality rate to overall bycatch rates when determining the level and conservation concern of the bycatch in the king crab fisheries.

Bristol Bay red king crab

Seafood Watch® calculated the percent of king crab bycatch relative to landings in the 2005 Bristol Bay red king crab fishery using the following steps: 1) total landings of red king crab were divided by the average weight of a red king crab to obtain landings in numbers of crabs; 2) total numbers of red king crabs caught as bycatch were divided by total landings in numbers of crabs to obtain the percent of crab bycatch relative to landings (196%); 3) as not all crabs caught as bycatch die, the percent of dead crab bycatch relative to landings in the fishery was determined by multiplying total bycatch numbers by the discard mortality rate of red king crabs (8%); 4) the number of dead king crab bycatch was divided by total landings in numbers to obtain the percent of dead bycatch relative to landings (16%) (Table 7). It should be noted that the average weight per crab used in the calculation is the weight of a retained male, which is larger than the average female or sublegal males. Therefore, the 16% represents the maximum percentage of dead bycatch relative to landings in the 2005 Bristol Bay red king crab fishery.

Table 7. Bycatch estimates for red king crab in the 2005 Bristol Bay red king crab fishery. Note calculations are based on NPFMC 2005a, ADF&G 2006a, and Barnard & Burt 2006 data.

A	B	C	D	E	F	G	H
Total target species bycatch (numbers of crabs)	Total landings (pounds)	Average weight per crab (pounds)	Total landings (numbers of crabs) B/C	Percent bycatch relative to landings A/D	Mortality rate	Dead bycatch (numbers of crabs) A * F	Percent dead bycatch relative to landings (numbers of crabs) G/D
5,724,919	18,300,000	6.25	2,928,000	**196%**	8%	457,994	**16%**

The Observer Program for the Bristol Bay red king crab fishery also recorded the numbers of non-target species caught and discarded in the 1,855 pot lifts sampled during the 2005 Bristol Bay red king crab fishery (Table 8). These include a wide variety of animals, such as other species of crabs, Pacific cod, Yellow fin sole, and invertebrates (Barnard and Burt 2006).

Table 8. Bycatch numbers for non-target species in 2005 Bristol Bay red king crab fishery Observer Program sample (Data from Barnard and Burt 2006).

Species	Catch
Tanner crab	1,060
Snow crab	266
Tanner x snow crab hybrid	49
Hair crab	3
Blue king crab	3
Snail (unidentified)	5963
Pacific cod	643
Yellowfin sole	268
Hermit crab (unidentified)	247
Great sculpin	128
Sea star (unidentified)	117
Pacific halibut	81
Sea jelly (unidentified)	80
Sculpin (unidentified)	68
Brittle star (unidentified)	47
Leech (unidentified)	41
Sponge (unidentified)	28
Spiny head sculpin	21
Sea cucumber (unidentified)	16
Rockfish (unidentified)	15
Bigmouth sculpin	11
Lyre crab	10
Basket star (unidentified)	8
Walleye pollock	8
Pygmy cancer crab	7
Kelp crab (unidentified)	5
Octopus (unidentified)	3
Arrowtooth flounder	2
Flatfish (unidentified)	2
Invertebrate (unidentified)	2
Mussel (unidentified)	2
Yellow Irish lord	2
Pacific herring	1
Scallop (unidentified)	1
Skate (unidentified)	1
Shrimp (unidentified)	1
Flathead sole	1
Starry flounder	1
Total	9,212

Seafood Watch® calculated the percent bycatch of non-target species relative to the number of legal red king crabs landed in the Observer Program sample as 18% (Table 9). This represents an estimate of the percent bycatch of non-target species relative to total Bristol Bay red king crab landings.

Table 9. Percent of non-target species bycatch in the 2005/2006 Bristol Bay red king crab fishery Observer Program sample.

A	B	C
Total number of legal red king crabs landed in the sample	Total bycatch of non-target species in sample	% of non-target species bycatch relative to sample landings B/A
50,736	9,212	18%

Estimated total bycatch in the Bristol Bay red king crab fishery relative to landings, including 16% dead red king crab and 18% non-target species, is 34%.

Aleutian Islands golden king crab

The bycatch estimate for the 2005 Aleutian Islands golden king crab fishery had not yet been published as of the writing of this report. As a result, the bycatch assessment for the fishery is based on the 2004 estimate. As with the Bristol Bay red king crab fishery, above, Seafood Watch® used the total numbers of golden king crabs caught as bycatch, the average weight per golden king crab, and the total landings of golden king crab to calculate the percent of dead golden king crab bycatch relative to landings in the 2004 Aleutian Islands golden king crab fishery (11%) (Table 10). The average weight per golden king crab used in the calculations is, as with red king crab, the weight of a retained male, which is larger than the average female or sublegal males. Therefore, the 11% value resulting for golden king crab represents the maximum percentage of bycatch relative to landings in the 2004 Aleutian Islands golden king crab fishery.

Table 10. Bycatch estimates for golden king crab in the 2004 Aleutian Islands golden king crab fishery. Note calculations are based on Alaska BOF 2005 and Barnard & Burt 2006 data.

A	B	C	D	E	F	G	H
Total target species bycatch (numbers of crabs)	Total landings (pounds)	Average weight per crab (pounds)	Total landings (numbers of crabs) B/C	Percent bycatch relative to landings A/D	Mortality rate	Dead bycatch (numbers of crabs) A * F	Percent dead bycatch relative to landings (numbers of crabs) G/D
1,837,000	5,700,000	4.3	1,325,581	**139%**	8%	146,960	**11%**

The Observer Program for the Aleutian Islands golden king crab fishery also recorded the numbers of non-target species caught and discarded in the 2,312 pot lifts sampled during the 2004 Aleutian Islands golden king crab fishery (Table 11). As with the red king crab fishery, these include a wide variety of animals, such as other species of crabs, Pacific halibut, and invertebrates (Barnard and Burt 2006).

Table 11. Bycatch numbers for non-target species in 2004 Aleutian Islands golden king crab fishery Observer Program sample (Data from Barnard and Burt 2006).

Species	Catch	Species	Catch
Plexauridae (unidentified)	18	Yellow Irish lord	4
Primnoa spp.	15	Barnacle (unidentified)	4
Crypthelia spp.	14	*Cyclohelia* spp.	4
Cup coral (unidentified)	13	Scale worm (unidentified)	4
Scallop (unidentified)	13	Turbot (unidentified)	4
Greenland turbot	13	Oregon triton	3
Sea anemone (unidentified)	12	Crinoid (unidentified)	3
Soft coral (unidentified)	12	Walleye pollock	3
Atka mackerel	12	*Ideogorgia* spp.	3
Errinopora spp.	12	*Javiana* spp.	3
Arthrogorgia spp.	11	*Bigmouth sculpin*	3
Lepidisis spp.	10	Hermit crab (unidentified)	3
Rockfish (unidentified)	10	Invertebrate (unidentified)	3
Grenadier (unidentified)	10	*Stylantheca* spp.	3
Anthomastus spp.	9	*Clavularia* spp.	2
Coral (unidentified)	9	Bryozoan (unidentified)	2
Arrowtooth flounder	9	Hydroid (unidentified)	2
Primnoidae (unidentified)	9	Sea spider (unidentified)	2
Tunicate (unidentified)	9	*Fungiacyanthus* spp.	2
Rougheye rockfish	8	Pribilof welk	2
Calcigorgia spp.	8	Scaled crab	2
Pacific ocean perch	8	*Lillipathes* spp.	1
Sea jelly (unidentified)	8	Bivalve (unidentified)	1
Black coral (unidentified)	7	Circumboreal toad crab	1
Snailfish (unidentified)	7	Tubeworm (unidentified)	1
Leech (unidentified)	7	Sablefish	1
Distichopora spp.	6	Sea anemone (unidentified)	1
Shortspine thornyhead	6	Sea raspberry	1
Sea cucumber	6	*Anthoptilum spp.*	1
Flatfish (unidentified)	5	Dover sole	1
Hydrocoral (unidentified)	5	Bamboo coral (unidentified)	1
Cup coral (unidentified)	4	Lampshell (unidentified)	1
Octopus	4	Nudibranch (unidentified)	1
Mussel (unidentified)	4	Prowfish	1
Sculpin (unidentified)	4	Shrimp (unidentified)	1
		Total	**317**

Seafood Watch® calculated the percent bycatch of non-target species relative to the number of legal golden king crabs landed in the Observer Program sample to be 0.06% (Table 12). This represents an estimate of the percent bycatch of non-target species relative to total Aleutian Islands golden king crab landings.

Table 12. Percent of non-target species bycatch in the 2004 Aleutian Islands golden king crab fishery Observer Program sample.

A	B	C
Total number of legal golden king crabs landed in the sample	Total bycatch of non-target species in sample	% of non-target species bycatch relative to sample landings B/A
41,644	317	1%

Estimated total bycatch in the Aleutian Islands golden king crab fishery relative to landings, including 11% dead golden king crab and approximately 1% non-target species, is 12%.

The reviewed literature did not report population consequences of king crab bycatch in the Bristol Bay red king crab or Aleutian Islands golden king crab fisheries; however, in determining the number of dead king crab bycatch in the respective fisheries each year, it is possible to estimate the relative impacts of bycatch on the populations (NPFMC 2006). Approximately 2% of the Bristol Bay red king crab population dies as a result of being discarded as bycatch (Table 13). This percentage was calculated by dividing the bycatch mortality (which was calculated in Table 7) by the population abundance. In addition, ADF&G takes population level consequences of bycatch into account in stock assessment modeling and TAC setting. Based on this information, Seafood Watch® assumes that red king crab bycatch in the Bristol Bay red king crab fishery has little impact on the stock.

Table 13. Impact of bycatch mortality on Bristol Bay red king crab population abundance (Data from Table 7 and NPFMC 2005a).

A	B	C	D	E
Bycatch mortality (numbers of crabs)	Population abundance (pounds)	Average weight per crab (pounds)	Population abundance (numbers of crabs) B/C	Percent of population that dies as a result of bycatch A/D
457,994	157,200,000	6.25	25,152,000	2%

Stock biomass is unknown for the Aleutian Islands golden king crab so Seafood Watch® could not determine the impact of golden king crab bycatch on the Aleutian Islands golden king crab population. It is assumed, however, to be similar to that of the Bristol Bay red king crab population.

Other species caught as bycatch in the Alaskan king crab fisheries (Tables 8 and 11), such as Pacific cod and Pacific halibut, have very high abundance relative to their estimated bycatch numbers in the king crab fisheries. Therefore, the small losses as a result of bycatch in the king crab fisheries are predicted to have little impact on species abundance and diversity (NMFS 2004c).

The 2005 Bristol Bay red king crab fishery was the first fishery completed under the Bering Sea/Aleutian Islands (BSAI) Crab Rationalization Program. Previously, participants in the BSAI crab fisheries competed for a share of the harvest. The program put an end to this “race for the

fish" by allocating harvest quota shares. One of the program's goals was to reduce bycatch of females and sublegal males. Unfortunately, bycatch was not reduced, and the numbers of legal males caught and discarded increased from 80,000 in 2002 (the highest estimate for total discarded legal males among any of the 1999–2004 seasons) to 677,000 crabs during the 2005/2006 season. Participants were guaranteed a share of the quota; therefore, they had more time to fish and could select the high-quality males from the catch and discard the low-quality males. This practice is known as "highgrading" (Barnard and Pengilly 2006). The estimated number of discarded red king crabs in the 2005 Bristol Bay red king crab fishery is the second highest of all of the estimates from the 1995 to 2005 fishing seasons (Table 14). However, ADF&G lowered the 2006/2007 TAC by approximately 5% due to the increase in handling mortality of legal-sized male red king crabs in the 2005/2006 fishery (ADF&G 2006e).

Table 14 (Table from NPFMC 2006)

Bycatch of Bristol Bay red king crabs (numbers of crab) in Bering Sea fisheries, 1995-2005.

Year	Directed crab pot	Groundfish Trawl	Groundfish fixed gear	Scallop dredge	Total
1995	0	44,934	3,257	0	48,191
1996	605,000	30,967	75,675	0	711,642
1997	985,000	50,711	25,579	0	1,061,290
1998	4,593,800	42,003	7,017	146	
1999	957,800	84,709	8,968	1	1,026,178
2000	1,701,000	70,787	39,754	2	1,653,542
2001	2,419,100	58,552	19,000	0	2,496,652
2002	1,677,800	89,955	27,477	2	1,795,234
2003	5,808,200	91,937	13,531	0	5,913,668
2004	2,470,868	78,742	15,014	0	2,564,624
2005[3]	5,724,919	111,249	19,723	2	5,855,893

The bycatch estimate for the 2005 Aleutian Islands golden king crab fishery had not been published as of the writing of this report; therefore, the impact of the Crab Rationalization Program on bycatch in this fishery is unknown, but it is assumed to be similar to that of the Bristol Bay red king crab fishery.

Evidence suggests that discard of bycatch species in the Alaskan king crab fisheries does not substantially impact the ecosystem. A mass-balance model of the Bering Sea (Trites et al. 1999) estimated that total catch biomass was 1% of the total system biomass (excluding detritus); therefore, removals are likely to have an insignificant effect on the ecosystem (NMFS 2004c).

Bycatch discards could possibly direct energy to different parts of the ecosystem than would naturally occur. For example, seabirds may have access to certain organisms that are discarded in the fishery, to which they would not normally have access. This redirection of energy has not been estimated for crabs (NMFS 2004c).

Russian Far East
Bycatch estimates for the Russian Far East king crab fishery and the associated population and ecosystem impacts have not been reported in the reviewed literature.[1]

Russian Barents Sea
Bycatch estimates for the Russian Barents Sea king crab fishery and the associated population and ecosystem impacts have not been reported in the reviewed literature. The available literature only discussed bycatch of king crabs in other fisheries, particularly gillnet fisheries for cod and lumpsucker.

Synthesis
In the 2005 Bristol Bay red king crab fishery, the percent of dead king crab bycatch relative to landings was approximately 16%, and the percent of non-target species bycatch relative to total landings was approximately 18%. In the 2004 Aleutian Islands golden king crab fishery, the percent of dead bycatch relative to landings was 11%, and the percent of non-target species bycatch relative to total landings was approximately 1%. Available literature did not report population consequences of king crab bycatch in the Bristol Bay red king crab fishery or the Aleutian Islands golden king crab fishery; however, only 2% of the Bristol Bay red king crab population is estimated to have died as a result of being discarded as bycatch. Other species caught as bycatch in the Alaskan king crab fisheries, such as Pacific cod and Pacific halibut, have very high abundance relative to their estimated bycatch numbers in the king crab fisheries. Seafood Watch® therefore assumes that bycatch of red king crab and non-target species has an insignificant effect on species abundance. Stock biomass is unknown for the Aleutian Islands golden king crab; thus, Seafood Watch® was not able to estimate the impact of golden king crab bycatch on the Aleutian Islands golden king crab population.

Since the implementation of the Crab Rationalization Program in 2005, bycatch has increased in the Alaskan king crab fisheries as a result of highgrading. The program only began, however, during the 2005/2006 fishing season; therefore, it is too soon to determine if bycatch will continue to increase as the program advances. The bycatch estimate for the 2005 Aleutian Islands golden king crab fishery was not published as of the writing of this report; therefore, the impact of the Crab Rationalization Program on bycatch in this fishery cannot be determined at this time. Bycatch in the Bristol Bay red king crab and Aleutian Islands golden king crab fisheries, therefore, ranks as a moderate conservation concern. Seafood Watch® will continue to follow bycatch in the Alaskan king crab fisheries. If bycatch continues to increase due to highgrading, as it did in the 2005/2006 fishing season, and results in dead bycatch becoming greater than landings, bycatch in the Alaskan king crab fisheries will become a high conservation concern.

[1] Seafood Watch© generally gives a bycatch sustainability ranking of "moderate" to fisheries that lack bycatch data. However, if bycatch of the fishery in another region is a high conservation concern, then Seafood Watch© would choose to be precautionary and assume that bycatch in the fishery with unknown amounts of bycatch is also a high conservation concern. In the case of king crab, bycatch is a moderate conservation concern in the U.S.; therefore, Seafood Watch® assumes it is likely to be similar in the Russian Far East, resulting in the Russian Far East receiving a bycatch sustainability ranking of moderate.

Bycatch information for the Russian Far East and Russian Barents Sea king crab fisheries are unknown, but Seafood Watch® assumes bycatch in these fisheries is of the same order of magnitude as in the U.S. king crab fisheries (unless proven otherwise). Seafood Watch® therefore considers bycatch in the Russian Far East and Russian Barents Sea fisheries to be a moderate conservation concern.

Nature of Bycatch Rank:

All U.S., Russian Far East, and Russian Barents Sea king crab fisheries:

Low | **Moderate** | High | Critical

Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems[2]

Pots are the only fishing gear used in king crab fisheries. King crab pots are larger than pots used in other crab fisheries, and are made of 600 to 700-pound steel frames covered with varying sizes of nylon mesh. Each pot is baited with chopped fish (e.g., herring), squid, or clams. Each pot is then attached by a line to a surface buoy that marks its location, and lowered to the ocean bottom. The pots generally soak for one to two days when fishing for red or blue king crabs, and longer when fishing for golden king crabs. Hydraulic systems set and retrieve the pots (Woodby et al. 2005; Blau 1997). By regulation, longlined pots must be used in the Aleutian Island golden king crab fishery to reduce gear loss in the deep, rocky bottoms of the inter-island passes that golden king crabs inhabit. A minimum of 10 pots must be lined together. These pots are set using a ramp over the stern of the boat (NPFMC 1998; ADF&G 2006d).

Habitat Effects

Pots are less damaging than trawls or dredges because pots are not highly mobile, so although they are bottom gear, they have contact with a substantially smaller area of the seafloor than dredges or trawls. Pots can affect habitat, however, because they do not always remain entirely stable on the seafloor. They bounce off the seafloor in the presence of large swells, and get dragged across the ocean bottom when being removed, especially during a storm or when pots are stuck in the sand (Morgan and Chuenpagdee 2003).

Morgan and Chuenpagdee (2003) conducted a study, using existing information and expert knowledge on bycatch and habitat damage, to gauge the relative severity of impacts associated with all commercial fishing gears and compare and rank the overall ecological impact of each gear type. They found that pots generally have a “medium impact” on physical structure and a “low impact” on biological habitat (seafloor organisms), resulting an overall ranking of “medium impact” (Figure 10).

[2] A portion of this section was taken verbatim from the Seafood Watch Coldwater Shrimp Report written by Santi Roberts. The report is available at: http://www.mbayaq.org/cr/cr_seafoodwatch/content/media/MBA_SeafoodWatch_ColdwaterShrimpReport.pdf

Figure 5 Experts' Impact Rating, Survey Severity Ranking, and Policy Implications

GEAR CLASS	HABITAT IMPACTS: Physical	HABITAT IMPACTS: Biological	BYCATCH: Shellfish & crabs	BYCATCH: Finfish	BYCATCH: Sharks	BYCATCH: Marine mammals	BYCATCH: Sea birds & turtles	MANAGEMENT CATEGORY (Policy responses)
Trawls – bottom	5	5	3	5	2	2	2	HIGH IMPACT (Very Stringent)
Gillnets – bottom	3	2	1	4	3	4	3	
Dredges	5	5	4	2	1	1	1	
Gillnets – midwater	1	1	1	4	4	5	5	
Pots and traps	3	2	4	2	1	3	1	MEDIUM IMPACT (Moderately Stringent)
Longlines – pelagic	1	1	1	3	4	3	5	
Longlines – bottom	2	2	1	4	3	1	2	
Trawls – midwater	1	1	1	3	2	2	2	LOW IMPACT (Least Stringent)
Purse seines	1	1	1	2	2	3	2	
Hook and line	1	1	1	2	3	1	2	

KEY: 5 VERY HIGH IMPACT 4 HIGH IMPACT 3 MEDIUM IMPACT 2 LOW IMPACT 1 VERY LOW IMPACT

Figure 10. Experts' Impact Rating, Survey Severity Ranking, and Policy Implications (Figure from Morgan and Chuenpagdee 2003).

The extent of bottom impacts from pots depends on the type of bottom habitat where the setting and retrieval of pots occurs (NMFS 2004c). Red king crab fisheries take place in sandy or silty bottom areas at depths of 300m or less. Blue king crabs are found at similar depths but in harder bottom areas (cobble, gravel, and rock ledges). Golden king crabs are found at depths of 300m to 1000m in extremely rough bottom areas, frequently on coral bottom areas (NMFS 2004c; NPFMC 1998).

Eno et al. (2001) studied the effects of pots set over a wide range of sediment types. They observed that mud communities fully recovered from pot impact within 72–144 hours of pot removal. Hauling the pots along the ocean bottom during pot removal left a track in the sediments, but biological abundance within the area was not affected. This conclusion is based on the physical manifestation of crab pot disturbance, but not on a solid evaluation of changes in infaunal organisms. It is important to note that although abundance may not be substantially impacted, crabs near or on the outside of pots could become injured (e.g., leg loss). Also, the pots used in the study are much lighter and smaller than those used in the king crab fisheries. Therefore, king crab pots may have a larger impact on habitat than the Eno et al. (2001) study showed (NFMS 2004c).

Soft sediments are less likely to be impacted than hard structures that rise above the seafloor (Quandt 1999). The most likely impacts from the setting and retrieval of pots in muddy and sandy bottom areas of the red king crab fisheries are injury or mortality of crabs near or on the outside of pots, and disturbance to female mating aggregations (Stevens et al. 1994 as cited in

NMFS 2004c). Other organisms may be impacted as well, including sea onions (*Boltenia ovifera*), which provide important habitat for juvenile red king crabs. Crab pot fishing in the BSAI occurs in areas with a high abundance of sea onions; fishing in these areas could negatively impact these organisms, thereby limiting recruitment of juvenile king crabs (Stevens and Kittaka 1998 as cited in NMFS 2004c).

The setting and retrieval of crab pots, especially longline pot gear, is thought to have larger impacts on the hard, rocky bottom areas where blue and golden king crab fisheries occur, than on the softer bottoms where red king crabs are found. These hard bottom areas are home to attached invertebrates, including corals, sponges, and sea stars, which provide food and shelter for crabs and fish. Corals are more vulnerable to adverse impacts from fishing gear than sand and mud bottom habitat (Barnette 2001). Once damaged, recovery of corals may take decades or longer (Roberts and Hirshfield 2004). Damage is inflicted where the pots rest directly on the corals, and also during hauling if the gear is not hauled directly up but rather dragged for some distance over the seabed. The latter is likely where several pots are strung alone a line, as is the case with the Aleutian Islands golden king crab fishery. The dragging action of the connecting line (called the trotline) can itself cause damage, potentially shearing corals and other structural organisms off at their base. The area swept by trotlines during recovery is orders of magnitude higher than the cumulative area of the pots themselves (Appledorn et al. 2000). As a precaution against the damage caused by longline pots, the North Pacific Fishery Management Council (NPFMC) has closed six Aleutian Islands coral gardens to all bottom contact fishing gear, including crab pots (NPFMC 2005b). In addition, ADF&G has closed areas near St. Matthew Island to protect juvenile crab, which by default also protects habitat (65 FR 168).

The impact of fishing gear on habitat also depends on the spatial scale of the fishery, because although each pot may have a small impact, the cumulative effect of thousands of pots can be larger (Morgan and Chuenpagdee 2003). Approximately 15,000 pots were registered during the 2005/2006 Bristol Bay red king crab fishing season alone (Lowe and Knapp 2006), and the king crab fisheries cover a moderately large geographic area, including the North Pacific and the Barents Sea, increasing the likelihood of greater cumulative effects.

Ecosystem Effects

Alaska

There is no demonstrated evidence that removal of king crabs from the ecosystem disrupts the food web. King crab fisheries may have other ecosystem impacts, but these effects have not been well studied or documented. Some concern exists that targeting the large male crabs in the fisheries may be altering the genetic diversity of the stocks, though currently there is no research to support this concern (NMFS 2004c). Genetic studies on crab populations have not been completed (NMFS 2004c). As previously mentioned, the setting and retrieval of crab pots in the blue king crab and golden king crab fisheries may negatively impact attached invertebrates, such as sea onions, corals, and sponges. These animals provide shelter and habitat to other organisms such as crabs and fish. Ecosystem effects from adverse impacts to these invertebrates due to king crab fishing, however, are not well known (NMFS 2004c).

Russian Far East
Impacts of the Russian Far East king crab fishery on the marine food web or the ecosystem are unknown, but are assumed to be similar to those in the Alaskan king crab fisheries.

Russian Barents Sea
In the Barents Sea, red king crab is a quickly spreading invasive species, which raises concern that they may be having substantial impacts to the habitat and ecosystem. The Barents Sea red king crab has few predators and is considered to be an omnivore, eating such prey items as capelin eggs, cod larvae, sea urchins, molluscs, worms, and other crabs (Bevanger 2006; Jorgensen 2006). In addition, adult crabs can quickly migrate from areas with low food availability to areas with more abundant food, and thus are capable of exploiting large areas of the sea bottom (Jorgensen 2006).

Scientists and marine research organizations, such as the Institute of Marine Research, have recently begun to study the impacts of the invasive red king crab on the ecosystem, of which there are conflicting evidence and view points. Savinov (2000) found no evidence that the red king crab is having negative impacts on the Barents Sea ecosystem, and the Murmansk Institute of Marine Biology recently released a report refuting assumptions that the Barents Sea red king crab is damaging biofauna and bottom habitat (Sackton 2006a). Another study, conducted in 2003 by the Polar Research Institute of Marine Fisheries and Oceanography (PINRO) in the Motovsky Bay of the Barents Sea, showed no effect of the red king crab on total benthic biomass or biodiversity. The study also found no evidence that haddock were being negatively impacted by competition with red king crab for food. However, the study found that consumption of some groups of organisms by red king crabs has led to a shift in species dominance within the community (Anisimova et al. 2005). Russian studies revealed that Barents Sea red king crabs eat fish and fish eggs, which raises concerns about them feeding on capelin in the region's spawning grounds (Jorstad et al. 2002). Results of the 2003 PINRO study showed, however, that red king crab does not impact recruitment of capelin (Anisimova et al. 2005).

Stronger evidence exists that the red king crab is indeed having adverse impacts on the Barents Sea ecosystem, however (Bevanger 2006; Kirby 2003). Jorgensen (2005) conducted a laboratory study of red king crab foraging on the commercial Iceland scallop (*Chlamys islandica*). The study demonstrated intense foraging pressure on native epifaunal scallop communities by red king crabs during the crabs' early life history stages and post-mating/molting period. This, in addition to the abundance of red king crabs and the estimate of scallop biomass in the Barents Sea, suggests that the red king crab can substantially reduce the abundance of flat-bodied prey in the Barents Sea, such as the Iceland scallop (Jorgensen 2005).

The Barents Sea red king crab also appears to be having adverse effects on lumpsucker recruitment, and the health of the native cod and sea urchin populations. Research conducted by the Institute of Marine Research in Norway indicates that red king crabs may be negatively impacting lumpsucker recruitment by feeding on their eggs (Norwegian Ministry of Fisheries and Coastal Affairs 2006). One of the most abundant parasites of red king crabs in the Barents Sea is the leech *Johanssonia arctica*, which is a vector for a blood parasite of marine fish (*Trypanosoma murmanensis*). Trypanosome infections in cod are substantially higher in areas with high red king crab abundance than in adjacent areas. Because red king crabs promote an

increase in the population of *J. arctica*, they may be responsible for the increase in the trypanosome infection rate (Hemmingsen et al. 2005; Matishov et al. 2004). This increase is expected to cause a corresponding decrease in cod abundance within the next several years (Matishov et al. 2004).

Additionally, Gudimov et al. (2003) conducted studies on the effects of red king crab populations on benthic communities of the Murmansk coast in the Barents Sea. They found that sea urchins (*Stronglyocentrotus droebachiensis* and *S. pallidus)* are part of the principal diet of red king crabs, and that the Barents Sea red king crab population can consume annually at least one-sixth of the coastal population of the genus *Stronglyocentrotus*. This suggests that the Barents Sea red king crab is having an adverse effect on the health of the coastal *Stronglyocentrotus* population (Gudimov et al. 2003).

Under normal circumstances, removal of a target species can have adverse ecosystem impacts, and Seafood Watch® considers those impacts to be a high conservation concern. For a fishery based on a non-native species, however, sustaining the population of the target species causes adverse ecosystem impacts (as detailed above), and removal of the species is critical from the perspective of the conservation of the ecosystem. As such, Seafood Watch® considers the current Barents Sea red king crab stock (which is a low concern from a traditional stock status perspective) to have severe effects on the ecosystem.

Synthesis

Crab pots are known to have a moderate impact on habitats and ecosystems. Crab pots are more stationary than other types of fishing gear, such as bottom trawling or dredging; however, they can bounce off the seafloor or get dragged across the bottom during pot removal. Pots used in the red king crab fisheries (U.S. Bristol Bay, Russian Far East, and Russian Barents Sea) are set on sandy or silty bottom areas, which are moderately resilient to disturbance. Pots used in the golden king crab fisheries (U.S. Aleutian Islands) are set on rocky bottoms, and frequently coral bottoms. These hard bottom areas have a low resilience to disturbance by fishing gear; once damaged, recovery of corals may take decades or longer (Roberts and Hirshfield 2004). Moreover, the king crab fisheries are of a moderate scale, occurring from eastern Russia to Alaska and the Barents Sea, increasing the potential for cumulative impacts of the fishing gear. Removal of king crabs in the U.S. fisheries is not known to substantially disrupt the food web or cause substantial ecosystem changes. Given the moderate gear effects, low to moderate resilience to disturbance, and lack of substantial ecosystem impacts, the United States Bristol Bay and Aleutian Islands king crab fisheries are considered to have moderate effects on the habitat and ecosystem.

In the Russian Far East, impacts of the king crab fishery on the marine food web or the ecosystem are unknown, but are assumed to be similar to those in the Alaskan king crab fisheries. Given the moderate gear effects, moderate resilience to disturbance, and unknown ecosystem impacts, the Russian Far East king crab fishery is also considered to have moderate effects on the habitat and ecosystem.

In the Russian Barents Sea, the red king crab is a quickly spreading invasive species that is causing substantial ecosystem impacts, including adverse effects on lumpsucker recruitment and

the health of the native cod and sea urchin populations. Given this information, Seafood Watch® considers the Russian Barents Sea red king crab fishery to have severe effects on the habitat and ecosystem.

Effect of Fishing Practices Rank:

All U.S. king crab fisheries; Russian Far East king crab fisheries:

Benign | **Moderate** | Severe | Critical

Russian Barents Sea king crab fisheries:

Benign | Moderate | **Severe** | Critical

Criterion 5: Effectiveness of the Management Regime

United States

The Alaskan king crab fisheries are managed under the Bering Sea and Aleutian Islands (BSAI) King and Tanner Crab Fishery Management Plan (FMP). The NPFMC developed this FMP in 1989, and has amended it several times since. The FMP gives the State of Alaska, through ADF&G, the responsibility for the opening and closing of fisheries and setting guideline harvest levels (GHLs). NMFS and NPFMC have oversight of state management, and have authority to prevent overfishing, rebuild overfished fisheries, and establish essential fish habitat (EFH). The NPFMC's Crab Plan Team coordinates management between NMFS and the State of Alaska, develops FMP amendments, and prepares the annual stock assessments (NPFMC 1998).

NMFS annually surveys four king crab stocks in Alaska: Bristol Bay red king crab; Pribilof Islands red king crab; Pribilof Islands blue king crab; and Saint Matthew blue king crab. ADF&G uses information from the annual surveys to determine stock abundance and set the GHLs. Historically, catch quotas have not been exceeded.

ADF&G surveys eastern Aleutian Island red king crab, Norton Sound red king crab, and Gulf of Alaska red king crab on an annual basis, and the remaining Alaskan king crab stocks on a limited basis. The agency has insufficient data on stock abundance in these areas to determine minimum stock size threshold (MSST) for any of these stocks (NPFMC 2005a). Western Aleutian Island red king crab has been surveyed by ADF&G periodically, most recently in 2006 in Petrel Bank (Forrest Bowers, pers. comm.). ADF&G only surveys a small, but commercially important, portion of the Aleutian Islands golden king crab fishery every three years. No surveys are conducted in the Aleutian Islands west of 174° W longitude. Due to lack of survey data, the fishery is managed using weekly processor reports of landed catch and observer reports on average weight and catch rate information (NPFMC 2005a).

Pots are the only gear allowed in the king crab fisheries. The FMP for king crab prohibits the use of trawls and tanglenet gear in the crab fisheries due to their destruction of benthic habitat and

high bycatch mortality rates. NPFMC also has closed six Aleutian Islands coral gardens to all bottom contact fishing gear, including crab pots, to protect sensitive coral habitat (NPFMC 2005b). In addition, ADF&G closed areas near St. Matthew Island to protect juvenile crabs, which by default also protects habitat (65 FR 168).

All pots must have escape rings or mesh panels to allow female and sublegal male crabs to escape. Pots also must have biodegradable panels to reduce ghostfishing by lost gear. The State of Alaska set a limit of 450 pots per vessel for the 2005 Bristol Bay red king crab fishery (NPFMC 1998; Bowers 2003). There is currently no pot limit in the Aleutian Islands golden king crab fishery (Alaska BOF 2005)

Alaskan king crab fisheries are not allowed to retain any female crabs (unless a surplus has been determined), or male crabs below a minimum size limit. The minimum size limit for Bristol Bay red king crab is 165mm CW, and for Aleutian Islands golden king crab 152.5mm CW (Bowers 2003; Granath 2003). This maximizes reproductive potential for females, and provides males with at least one opportunity to mate with females before capture. The State of Alaska can adjust the size limit based on a variety of biological considerations, such as size at maturity and growth rates (NPFMC 1998).

ADF&G establishes fishing seasons to avoid sensitive periods of the crabs' life cycle, including molting and mating (NPFMC 1998). Fisheries are closed when quotas are reached, and the NPFMC and NMFS have established closed king crab areas to limit incidental catch of king crabs in the groundfish trawl fisheries and protect various life stages of king crabs and their associated habitats. On January 1, 1997, NPFMC and NMFS implemented the Red King Crab Savings Area, which is closed to non-pelagic trawling throughout the year to protect adult red king crab habitat. The area east of 162°W in Bristol Bay, which is critical habitat for red king crab juveniles, is also closed to trawling, except for an area that remains open from April 1 to June 15. In January 1995, NPFMC and NMFS established the Pribilof Islands Habitat Conservation Zone, which prohibits trawling to provide protection of blue king crab habitat and mitigate habitat impacts caused from groundfish trawl fisheries (NPFMC 2005a).

NMFS and ADF&G have also implemented measures to reduce bycatch and ghostfishing in the king crab fishery, including escape rings, biodegradable mesh panels, and pot limits. In addition, stock assessment models and harvest strategies incorporate bycatch mortality estimates to ensure that bycatch does not negatively impact stock abundance (NMFS 2004c).

The NPFMC developed the BSAI Crab Rationalization Program (effective April 1, 2005) to end the "race for fish" and to increase efficiency. The 2005 Bristol Bay red king crab fishery was the first fishery to be completed under the rationalization program. The program is a limited access system that balances the interests of several groups that depend on the fishery. Annual quota shares (QS), processor quota shares (PQS), and individual processing quotas (IPQ) are allocated based on historical activity within the fishery. The program also includes incentives to participate in fishing cooperatives. Community interests are protected by regional landing and processing requirements, and a Community Development Quota (CDQ) Program, which allocates 7.5% of GHLs to CDQ groups. The State of Alaska manages these CDQ groups with NMFS oversight (NMFS 2004c).

The effectiveness of the BSAI Crab Rationalization Program has yet to be determined. Two of the program's goals were to slow the race for fish and reduce bycatch in the BSAI crab fisheries. The first goal was met, as the program effectively slowed the pace of the fisheries. The 2005 Bristol Bay red king crab fishing season lasted 3 months, instead of the less than one-week seasons that were typical during 1996–2004. The program was not successful at reducing bycatch, however, and bycatch actually increased under the rationalized fisheries (Barnard and Pengilly 2006). ADF&G responded to the increase in handling mortality of legal-sized male red king crabs in the 2005/2006 fishery by lowering the 2006/2007 TAC by approximately 5% (ADF&G 2006e). As the rationalization program has only been in place for one fishing season, it is also unclear if the increase in bycatch will continue.

A healthy abundance of all of the king crab stocks has not been maintained over time. Although the Bristol Bay red king crab and Aleutian Islands golden king crab stocks have been maintained, five stocks have been closed to fishing due to low abundance, including the Pribilof Islands blue king crab, Pribilof Islands red king crab, Saint Matthew Islands blue king crab, Aleutian Islands red king crab, and Southeast red king crab stocks. The Pribilof blue king crab fishery was closed after the 1998 fishing season due to low abundance, and for the past three years the stock has been at historically low abundance levels. The Pribilof red king crab fishery was closed after the 1998 fishing season due to poor precision of abundance estimates, poor fishery performance, and concerns over bycatch of Pribilof blue king crabs. The Saint Matthew Island blue king crab fishery was closed after the 1998 fishing season due to low total mature biomass and its overfished status. The 2006 estimate shows that the stock is back up to the minimum stock size threshold (MSST), but biomass needs to double for the stock to be considered "rebuilt"[3] (Figure 5) (NPFMC 2006). The Aleutian Islands red king crab fishery was closed in 2000, 2001, and 2004 through 2006 due to poor fishery performance (ADF&G 2001). The Southeast red king crab fishery has also been closed due to low stock abundance (ADF&G 2006b).

Many of the declines in king crab abundance are related to factors other than fishing, and as such do not signify poor management of the resource. Evidence of this is provided by the absence of stock recovery in the king crab fisheries in Kodiak and the eastern Aleutian Islands despite long-term fishery closures. Essentially there has been no human caused mortality on some of these stocks, yet they have not increased in abundance (Forrest Bowers, pers. comm.).

Russian Far East

King crab fisheries in the Russian Far East are managed under the State Fisheries Committee (Goskomrybolovstvo). The Committee allocates quotas, develops and implement fisheries regulations, provides enforcement, and conducts fishery research. State fisheries research institutions (TINRO, SakhNIRO, Khabarovsk branch TINRO, KamschatNIRO, MagdanNIRO, ChukotNIRO, and VNIRO) produce forecast reports, which include TAC recommendations. Academic institutions, universities, and industrial research institutions cannot participate in the forecast, which means the forecasts and TAC recommendations have a government bias and are not as scientifically rigorous as they would be otherwise. Goskomrybolovstvo can allocate quotas different from the ones in the forecast, but this rarely happens. In 1998, the State

[3] The St. Matthew Island blue crab fishery is considered rebuilt when total mature biomass reaches 22 million pounds (NPFMC 2006).

Ecological Expertise, a commission consisting of biologists from various institutions (none of them from Fisheries Department institutions), began participating in fisheries management. This commission provides expert review of the forecast, particularly the TAC recommendations. The makeup of the commission (i.e., there being no members from the Fisheries Department institutions) reduces complete control of the Fisheries Department over TAC regulation and management. After the TACs are set, Goskomrybolovstvo distributes the quotas, in addition to industrial quotas for coastal catch, industrial quotas in the exclusive economic zone (EEZ), scientific research quotas, and small ethnic group quotas. Companies acquire quotas in the EEZ for five years. Five-year quotas are also allocated for coastal fishing through an auction, which involves a three-year credit background check on the fishing companies (Ivanov 2002).

The state fisheries research institutions, which pay a lot of attention to the opinions of fishing enterprises who provide funds for research, propose fishery regulations. The regulations must be approved by the Scientific Board of a regional institute and then by the Scientific Board of VNIRO. The Kamchatka king crab fisheries must follow several regulations. Only crab pots and traps are allowed, but there are no pot limits. Crabbing is banned during seasons of intensive molting. The minimum legal size of red king crab is 15cm CW, except for the 13cm CW limit in the Ayan-Shantarskiy Islands. Incidental bycatch of crabs in other fisheries cannot exceed 2% by weight of the targeted species. In the crab fisheries, sublegal and female incidental catch cannot exceed 0.2% of the daily catch. The Russian regional fisheries management agencies (also known as Rybvod bodies) are in charge of monitoring and enforcement of the regulations (Ivanov 2002).

Recently, Russia's shellfish research program has experienced challenges, including reductions in research personnel, the research fleet, far-sea research activities, and trawl surveys. In addition, the state fisheries research institutions are under increasing pressure from the fishing enterprises (Ivanov 2002). According to Ivanov (2002), a researcher at VNIRO, TACs are highly subjective, determined on intuition, and oriented to fishery production rather than monitoring stock abundance.

Despite management efforts, catch quotas are exceeded and stock conservation measures are counteracted due to high levels of poaching. As a result of the stock declines in the mid-1990s, fishermen began to fish for sublegal male crab and females (Ivanov 2002). Russian fishermen often catch crabs in Russian waters, but then transfer their catches to Japanese boats in neutral waters (Yasmann 2006). The actual Kamchatka red king crab catch is thus 3 to 4 times the official landings (WWF Russia 2006). In 2005, unreported Russian exports of crab to their four major destinations (Japan, U.S., South Korea, and China) equaled approximately 100,000 metric tons (Svec and Muran 2006). According to the Economic Development and Trade Minister, German Gref, illegal king crab catch ranges from $2.5 billion to $5 billion a year (Medetsky 2001). In 2004, TINRO concluded that "a real control of fishery for crabs in the water of Russia does not exist"(Ivanov, email to Robert Otto, September 27, 2004).

Russian Barents Sea

The Barents Sea red king crab is managed as a joint stock between Norway and Russia through the Joint Norwegian-Russian Fisheries Commission (Jorgensen et al. 2005). The Commission was established under the Agreement of April 11, 1975, and the Agreement of October 15, 1976.

The Commission meets annually to set TACs for all of the stocks jointly managed by the two nations. The TACs are based on recommendations by the International Council for the Exploration of the Sea (ICES), in which both Norwegian and Russian scientists participate (Norwegian Ministry of Fisheries and Coastal Affairs 2006c). The TAC that is set for the Barents Sea red king crab fishery is divided between Norway and Russia based on the standing stock in each nation's EEZ.

Two U.S. companies own 80% of the total quota of Barents Sea king crab (40% each). They have built all of the equipment (converted trawlers) for the Russian sector of the fishery. They have set a minimum size length (150mm CW), do not allow the catch of female crabs, require a 10-inch escape web on all pots, and set the opening and closing dates of the fishery (Darryl Pedersen, pers. comm.).

The majority of the Barents Sea red king crab fishery is managed to provide a long-term sustainable harvest (Jorgensen et al. 2005). A portion of the Norwegian Barents Sea king crab fishery (west of 26°E longitude) is "managed", however, as an elimination fishery (i.e., no management). World Wildlife Fund (WWF) in Norway agrees with the elimination approach, stating that sustainable management of invasive species is a clear violation of the Convention on Biological Diversity (CBD). Article 8(h) of the CBD states that "Contracting parties to the Convention should, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Hansson 2002). Under normal circumstances (a fishery based on native species), Seafood Watch® would deem the management practices of the Barents Sea red king crab fishery to be "highly effective", but because the fishery is based on a non-native species, and the inherent high conservation concern of ecosystem impacts caused by this non-native species, management is considered to be "ineffective" relative to the desire and need to eliminate this species from the ecosystem.

In addition, conflicting claims of illegal fishing within the Russian Barents Sea king crab fishery exist. The Alaskan king crab industry claims that large amounts of illegal fishing (almost 30 million pounds of crab) occur in the Russian Barents Sea king crab fishery. The Alaska Crab Coalition estimates that the majority of the illegal crab comes into the U.S. (Bauman 2006). However, not everyone agrees that illegal fishing is taking place in the Barents Sea king crab fishery. A recent analysis comparing U.S. import data and Russian quotas did not provide evidence of overfishing (Sackton 2006b). The analysis suggests that illegal crab could be coming, however, from the Russian Far East. In addition, the two major legal quota holders have several American crew members on each of the vessels in their king crab fleet, and the companies claim that the crew would report any illegal fishing. These two companies believe that the Alaskan king crab fishery is claiming that illegal fishing occurs in the Russian Barents Sea king crab fishery because they do not like the increased competition (Sackton 2006b).

Although it remains unclear if illegal fishing of king crab occurs in the Barents Sea, illegal fishing in other Barents Sea fisheries does occur. As a result, in 2005, Norway and Russia agreed to establish a new subcommittee to improve follow-up on cases of suspected overfishing, to clarify documentation requirements for prosecution, and to improve coordination of investigations. The subcommittee will consist of representatives from both countries' inspection

bodies, police and public prosecution authorities, and customs and tax authorities. (Norwegian Ministry of Fisheries and Coastal Affairs 2005 & 2006c).

Table 15. Commercial harvest management measures for the king crab fishery.

Fishery	Management Jurisdictions & Agencies	Total Allowable Landings/ GHL	Size Limit	Gear Restrictions	Trip Limit	Area Closures	Sources
United States	NMFS, NPFMC, ADF&G	Bristol Bay red: 18.3 million pounds; Aleutian Islands golden: 5.7 million pounds	Bristol Bay red king crab: 165mm CW; Aleutian Islands golden king crab: 152.5mm CW	Trawls and tanglenet gear prohibited; escape mechanisms on pots; pot limits	None	Red King Crab Savings Area, area east of 162°W in Bristol Bay, Pribilof Islands Habitat Conservation Zone, closures during sensitive biological periods, habitat closure in AI, closure of key juvenile blue king crab habitat during snow and Tanner crab fishery	NPFMC 2005a; NPFMC 1998; NMFS 2004c; Bowers 2003; Granath 2003
Russian Far East	State Fisheries Committee of the Russian Federation (Goskomry-bolovstvo)	TAC is set but not reported; annual catch >30,000t	15cm CW	Only crab pots/traps allowed; no pot limits; no direct ban on catching females	None	Northern Closed Area; areas closed during seasons of intensive molting	Petry and Muran 2003; Ivanov 2002
Russian Barents Sea	Joint Norwegian-Russian Fisheries Commission	3,300,000 crabs	132mm CL/ 150mm CW	Only pots allowed	None	None	Sundet and Sokolov 2006; Darryl Pedersen, pers. comm..

Synthesis

United States

NMFS conducts annual surveys of four king crab stocks in Alaska, including the Bristol Bay red king crab fishery. ADF&G uses this information to determine stock abundance and set GHLs. Historically, these catch quotas have not been exceeded. ADF&G surveys eastern Aleutian Islands red king crab, Norton Sound red king crab, and Gulf of Alaska red king crab on an annual basis and the remaining Alaskan king crab stocks on a limited basis, and has insufficient data on stock abundance to determine MSST. Surveys of the Aleutian Islands golden king crab fishery are only conducted on a small portion of the area every 3 years. NMFS, NPFMC, and ADF&G have implemented a suite of management measures, including GHLs, size and sex limits, gear restrictions, fishing seasons, and observer coverage. ADF&G has successfully maintained productivity of the two most commercially important fisheries, the Bristol Bay red king crab fishery and the Aleutian Islands golden king crab fishery. Five stocks remain closed, however, due to low stock abundance—many of the declines that led to these closures are due to factors other than fishing. NMFS and ADF&G recently implemented the Crab Rationalization Program to increase efficiency in the fishery and to reduce bycatch. While the program has slowed the race for fish, bycatch has increased rather than decreased. The program has, however,

only been in place for one fishing season, thus it is too early to determine if this increase in bycatch will continue. In addition, ADF&G responded to the increase in handling mortality of legal-sized male red king crabs by lowering the 2006/2007 TAC by approximately 5%. NMFS and ADF&G also require biodegradable mesh panels and escape mechanisms on all pots, which have been successful in reducing bycatch of female and sublegal male king crabs. Due to regular, robust stock assessments, bycatch reduction plans, and responsive management, Seafood Watch® considers management of the U.S. king crab fisheries to be highly effective.

Russian Far East

Although Goskomrybolovstvo sets TACs, closes the king crab fishery during molting seasons, sets a minimum size limit, and limits bycatch, the large amounts of illegal fishing that take place counteract these management measures. Illegal fishing results in quotas being exceeded, bycatch measures being ineffective, regulations being ignored, and stock productivity not being maintained. In addition, reductions in research activities and trawl surveys means increased uncertainty in stock abundance. Given this information, management of the Russian Far East king crab fishery is considered to be a critical conservation concern.

Russian Barents Sea

The Russian Barents Sea king crab stock is surveyed annually, and the Joint Norwegian-Russian Fisheries Commission sets TACs annually based on recommendations by ICES (which includes both Norwegian and Russian scientists). The two major quota holders in the Barents Sea red king crab fishery have implemented rules to protect the resource, including size and sex restrictions, and escape mesh on all pots. Each of their vessels has American crew members on board to act as observers and to provide enforcement of regulations. Traditionally, Seafood Watch® would deem these management practices to be "highly effective"; however, because the fishery is based on a non-native species, and because of the inherent high conservation concern of ecosystem impacts caused by non-native, invasive species, existing management measures are not desirable. In addition, attempting to maintain or enhance abundance through management of a non-native species is a violation of Article 8(h) of the Convention on Biological Diversity (CBD), which states that "Contracting parties to the Convention should, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Hansson 2002). Until the fishery is managed as an elimination fishery, Seafood Watch® deems the management of the Russian Barents Sea red king crab fishery to be a high conservation concern.

Effectiveness of Management Rank:

All U.S. king crab fisheries:

Highly Effective | Moderately Effective | Ineffective | Critical

Russian Far East king crab fisheries:

Highly Effective | Moderately Effective | Ineffective | **Critical**

Russian Barents Sea king crab fisheries:

Highly Effective | Moderately Effective | **Ineffective** | Critical

IV. Overall Evaluation and Seafood Recommendation

The U.S. king crab fishery is given an overall seafood recommendation of **Good Alternative** due to the moderate inherent vulnerability of king crabs to fishing pressure, moderate levels of bycatch, moderate habitat impacts, and highly effective management. King crabs are moderately vulnerable to fishing pressure due to a moderate age at first maturity and sexual segregation during feeding periods; the Bristol Bay red king crab and Aleutian Islands golden king crab stocks, which comprise the majority (~92%) of the U.S. king crab fishery, are healthy; a moderate level of bycatch relative to landings occurs in the Bristol Bay red king crab fishery (~16%) and the Aleutian Islands golden king crab fishery (~11%) (the current level of bycatch has little impact on population levels); the crab pots used in the fishery are known to have moderate impacts to habitat, and the fishery occurs over a moderate spatial scale; and NMFS and ADF&G regularly conduct stock assessments, collect fishery-dependent and independent data, and have implemented and enforce a suite of management measures, including guideline harvest levels (GHLs), size and sex limits, gear restrictions, fishing seasons, observer coverage, and bycatch reduction measures.

The Russian Far East king crab fishery, on the other hand, is given an overall seafood recommendation of **Avoid** due to the critical conservation concerns of stock status and ineffective management. Stock status of the Russian Far East king crab is unknown; however, overfishing and illegal fishing are regularly occurring and deteriorating the stock, making it a critical conservation concern. The large amounts of illegal fishing also mean that management is highly ineffective. Regulations are ignored, resulting in exceeded catch quotas, ineffective bycatch measures, and failing stock productivity.

The Russian Barents Sea king crab fishery is also given an overall seafood recommendation of **Avoid** due to the high conservation concerns of the ineffective management regime and the non-native, invasive species' effects on the habitat and ecosystem. In the Russian Barents Sea, the red king crab is a quickly spreading invasive species that is causing substantial ecosystem impacts, including adverse impacts on lumpsucker recruitment and the health of the native cod and sea urchin populations. The fishery is managed using methods that would traditionally be deemed as highly effective, but because the fishery is based on a non-native, invasive species, existing management is not desirable. In addition, attempting to maintain or enhance abundance through management of a non-native species is a violation of Article 8(h) of the Convention on Biological Diversity (CBD), which states that "Contracting parties to the Convention should, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species" (Hansson 2002). Until the fishery is managed as an eliminated fishery, Seafood Watch® deems the management to be a high conservation concern.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ **U.S. (Bristol Bay Red and Aleutian Islands golden king crabs) & Russian Barents Sea**			√ **Russian Far East**
Nature of Bycatch		√		
Habitat & Ecosystem Effects		√	√ **Russian Barents Sea**	
Management Effectiveness	√ **U.S. (all)**		√ **Russian Barents Sea**	√ **Russian Far East**

Overall Seafood Recommendation:

U.S. king crab (all fisheries):

Best Choice | **Good Alternative** | Avoid

Russian Barents Sea & Russian Far East king crab:

Best Choice | Good Alternative | **Avoid**

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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VI. Appendices

Appendix I. Stock Status Update

August 23, 2010 by Dana Wingfield

- According to the 2009 stock assessment of the Bering Sea and Aleutian Islands king crab, fisheries, the Bristol Bay red and Aleutian Islands gold crab stocks are not overfished and overfishing is not occurring. According to Seafood Watch®, both stocks are still considered to be healthy.
- The 2009 NPFMC assessment also determined that the Pribilof Islands blue king crab was overfished, as estimated remains below the MSST. The Pribilof red king crab stock has remained low. In 2009, biomass estimates for both Pribilof stocks were below BMSY, and short and long-term abundance trends were still in decline. According to Seafood Watch®, the Pribilof blue and red king crabs stocks are still considered to be in poor condition.
- The Aleutian Islands red king crab stock is still considered having a low stock size, as the fishery has been closed since the 2003/2004 season. Short and long-term trends in abundance are in decline. According to Seafood Watch®, the Aleutian Islands red king crab stock is still considered to be in poor condition.
- This information did not result in an overall recommendation change for U.S. king crab.