

Monterey Bay Aquarium Seafood Watch®

Commercially Important Crabs

Paralithodes camtschaticus (red king crab)

Paralithodes platypus (blue king crab)

Paralithodes brevipes (spiny brown king crab)

Lithodes aequispinus (golden king crab)

Chionoecetes opilio (opilio snow crab)

Chionoecetes bairdi (Tanner snow crab)

Chionoecetes angulatus (triangle tanner crab)

Chionoecetes japonicus (red snow crab)

Eriocheir sinensis (Chinese mitten crab)

Erimacrus isenbeckii (hair crab)



(Image courtesy Monterey Bay Aquarium)

Russian Far East

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About Seafood Watch®

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 www.seafoodwatch.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® 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.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guide and the Safina Center's online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught.

Avoid/Red: Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

¹ "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

Summary

Approximately 21% of all crab imports into the United States come from Russia, which makes up more than three-quarters of the U.S. domestic king crab market and almost 10% of the U.S. snow crab market (WWF 2014, NMFS 2014a). King crabs historically have been overfished in far eastern Russia (Dvoretzky and Dvoretzky 2014). Moreover, a recent investigation by the World Wildlife Fund (WWF) concluded that nearly twice the legal limit of crabs caught in the Russian Far East were harvested illegally (WWF 2014). Illegal, unreported, and unregulated (IUU) fishing of all seafood species in Russia costs the Russian government \$1 billion annually (WWF 2014). Because international trade data do not consistently identify crab imports and exports by genus and species, the WWF report was unable to identify the extent to which the IUU fishing affects each crab species (WWF 2014). Therefore, this Seafood Watch report covers 10 crab species (four king crabs, four snow crabs, Chinese mitten crabs, and hair crabs) that are known to be harvested in the Russian Far East and imported into the United States.

Table of Conservation Concerns and Overall Recommendations

Stock/Fishery	Management	Overall Recommendation
Red king crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Blue king crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Spiny brown king crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Golden king crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Opilio snow crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Tanner snow crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Triangle tanner snow crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Red snow crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Chinese mitten crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)
Hair crab: Russian Far East – pot/trap	Critical (0.00)	Avoid (0.00)

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative/Yellow** = Final score >2.2, **and** neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern², **and** no more than one Red Criterion, **and** no Critical scores, **and** does not meet the criteria for Best Choice (above)
- **Avoid/Red** = Final Score ≤2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern **or** two or more Red Criteria, **or** one or more Critical scores.

² Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

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Introduction

Scope of the Analysis and Recommendation

This report focuses on commercially important crab species caught in the Russian Far East (Bering Sea, Sea of Okhotsk, and Northern Sea of Japan, Figure 1). Specifically, it includes the following: king crabs (*Paralithodes camtschaticus* [red], *Paralithodes platypus* [blue], *Paralithodes brevipes* [spiny brown], and *Lithodes aequispinus* [golden]); snow crabs (*Chionoecetes opilio* [opilio], *Chionoecetes bairdi* [Tanner], *Chionoecetes angulatus* [triangle Tanner], and *Chionoecetes japonicas* [red]); Chinese mitten crab (*Eriocheir sinensis*); and hair crab (*Erimacrus isenbeckii*). The most common, commercially important species in the U.S. are king and snow crabs. However, international trade information does not consistently identify products to the species level (WWF 2014). As a result, this report covers all crab species harvested in the Russian Far East.

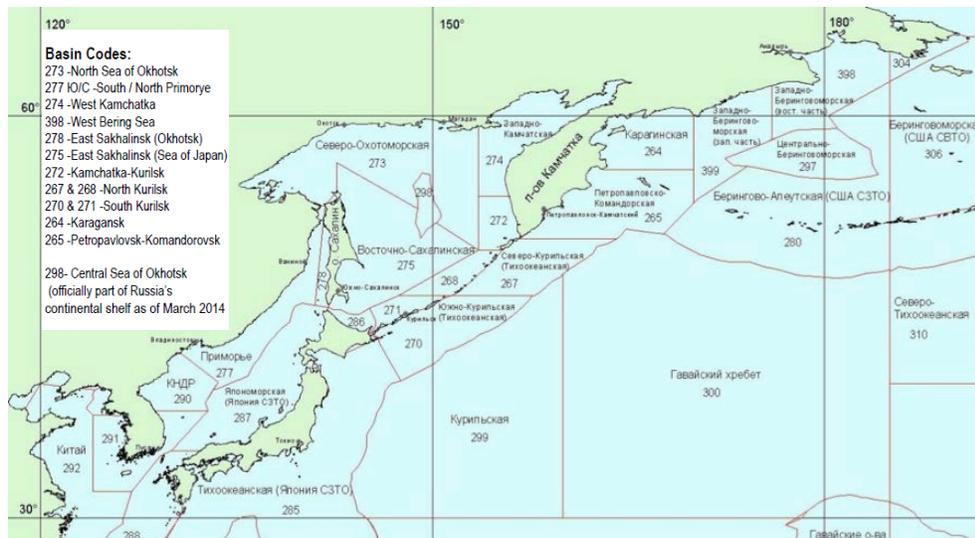


Figure 1. Fishing zones in the Russian Far East, from WWF (2014).

Species Overview - Life History

Snow and king crabs are characterized by a wide carapace and long legs—five pairs including the claws—and are found in Arctic waters. King crabs are native only to the North Pacific, while snow crabs are more widely distributed in both the North Pacific and North Atlantic oceans (NOAA FishWatch). The largest of the species, red king crabs, can grow to 24 lbs (ADFG 2015).

King and snow crabs have high fecundity (up to 500,000 eggs), but their long lifespans (20 years or more), long brooding times (11–24 months), and late ages of maturity (4–10 years) can make their stocks vulnerable to fishing pressure (Hall and Thatje 2009) (NMFS 2010). Moreover, their highly synchronous, shortened spawning periods can result in high fluctuations in recruitment and increased risk of Allee effects (Emond, Sainte-Marie et al. 2015). Adults and juveniles will aggregate in preferred habitats, making them more susceptible to overfishing. The hyperstability of catches per unit effort (CPUEs) targeting crabs in these aggregations can mask population declines that result from overfishing (Erisman, Allen et al. 2011).

The Chinese mitten crab (*Eriocheir sinensis*, family Varunidae) has a square-shaped carapace that can reach a maximum of 10 cm wide, and dense patches of hair-like bristles on its claws (Gollasch 2010). Native to Russia and Asia, they are catadromous, living mostly in freshwater and migrating to estuarine areas to breed and spawn. Females over-winter in the deep open ocean (Gollasch 2010). Chinese mitten crabs now also occur in Europe (with a well-established population in Germany) and North America as an invasive species (Gollasch 2010). Their high tolerance to marine pollution and euryhaline conditions render them among the world's 100 worst invasive species (Gollasch 2010).

Like the Chinese mitten crab, hair crabs (*Erimacrus isenbeckii*, family Cheiragonidae) have a square-shaped carapace and are covered with short bristles (Armetta and Stevens 1986). The hair crab ranges throughout the North Pacific, usually inhabiting silty bottoms at depths between 30 and 200 m (Armetta and Stevens 1986) (Nagao and Munehara 1996). Adult crabs move offshore during the warmer months when inshore water temperatures increase (Armetta and Stevens 1986). They feed on decapods and isopods and are preyed upon by flatfish and salmon (Armetta and Stevens 1986). Fecundity averages between 40,000 and 50,000 eggs, with a maximum of 160,000 (Armetta and Stevens 1986). Their relatively slow reproductive rates (every 3 years) and late age of maturity (4 years for males) make their populations vulnerable to overfishing, which has occurred in northern Japan (Armetta and Stevens 1986) (Nagao and Munehara 1996).

Fisheries

The 2014 total allowable catch (TAC) for all Russian crabs caught in the Far East Basin was just over 55,000 mt, nearly all of which was allocated to snow (64%) and king crabs (33%) (WWF 2014). Historic overfishing of king crab stocks in the northeastern Sea of Okhotsk, Western Kamchatka, prompted the Russian government to close the area from 2005 to 2006 (Dvoretzky and Dvoretzky 2014). It was briefly reopened to crab fishing in 2007, but a year later was closed indefinitely (WWF 2014).

IUU Fishing

Illegal, unreported, and unregulated (IUU) fishing of crabs in the Russian Far East is almost twice the total allowable catch (TAC) (WWF 2014). Illegal fishing can include overharvesting or illegal harvesting by Russian or foreign-flagged vessels. Poor enforcement, tracking, and recordkeeping can facilitate the laundering of illegal crabs transferred at sea or transported directly to foreign ports (WWF 2014). Bilateral agreements between Russia and its major crab importers (South Korea, Japan, China, and the United States) have reduced IUU fishing by half, but the IUU crab harvest remains very high. It is thus not sustainable and has the potential to collapse the stocks.

U.S. Market

Crab consistently ranks among the top 10 seafood species consumed per capita in the U.S. (NFI 2015); the most valuable species is red king crab (WWF 2014). Approximately 21% of all crab

imports into the United States come from Russia, which supplies on average more than three-quarters of the U.S. domestic king crab market and almost 10% of the U.S. snow crab market (Table 1) (WWF 2014, NMFS 2014a).

Table 1. Percent of U.S. market supply of frozen king crab from Alaska and Russia, from WWF (2014).

Year	Percent from U.S. (Alaska)	Percent from Russia
2003	19.0%	79.5%
2004	21.1%	72.3%
2005	12.7%	82.3%
2006	5.6%	89.7%
2007	11.3%	83.6%
2008	16.9%	77.4%
2009	15.3%	80.8%
2010	23.5%	73.6%
2011	19.7%	78.0%
2012	21.4%	69.5%
2013*	19.8%	65.8%
11-yr avg.	16.9%	77.5%

*For 2013, Alaskan king crab TAC level used as a proxy for U.S. commercial landings due to lack of 2013 official catch data.

Data sources: NOAA (2014a, 2014b), Global Trade Atlas (2014)

In 2014, the United States imported 15,500 metric tons of crab meat from Russia, worth nearly \$260 million (NMFS 2014a). Of this, king crabs were the majority (67%, worth \$218 million) while less than one-third (worth \$37 million) were snow crabs. There was no distinction between U.S. imports caught in the Russian Far East and those caught in the Barents Sea. Thus, the U.S. imported 75% of the total 2014 Russian king crab TAC (Far East and Barents Sea combined, Table 2) (WWF 2014). For snow crabs, U.S. imports in 2014 were just under 10% of the total combined Russian TAC for all crabs other than king crabs (Table 2) (WWF 2014, NMFS 2014a).

All values in metric tons	2010 TAC		2011 TAC		2012 TAC		2013 TAC		2014 TAC	
	Total Crab	Red King Crab	Total Crab	Red King Crab	Total Crab	Red King Crab	Total Crab	Red King Crab	Total Crab	Red King Crab
TOTAL	49,831	5,828	49,075	5,460	49,097	7,371	61,396	14,241	62,748	13,722
Total in Far East Basin	45,830	1,828	45,074	1,460	43,596	1,871	55,395	8,241	55,148	7,222
Total in Barents Sea	4,000	4,000	4,001	4,000	5,501	5,500	6,001	6,000	6,000	6,500
Percent of TAC that is in the Barents Sea	8.0%	68.6%	8.2%	73.3%	11.2%	74.6%	9.8%	42.1%	12.1%	47.4%

Data Source: Russian Federal Fishery Agency – TAC (2014)

Table 2. Total allowable catch (TAC) for the Russian Far East and Barents Sea, 2010-2014 from WWF (2014).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at <http://www.seafoodwatch.org>.

Criterion 3: Management Effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:

- *Score > 3.2 = Green or Low Concern;*
- *Score > 2.2 and ≤ 3.2 = Yellow or Moderate Concern;*
- *Score ≤ 2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern.*

Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Factor 3.1: Harvest Strategy

Scoring Guidelines

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'

- *5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered.*
- *4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*
- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective.'*
- *0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.*

Criterion 3 Summary

Stock/Method	Management of Retained Species	Overall Recommendation
Red king crab: Russian Far East – pot/trap	0.00	Red (0.00)
Blue king crab: Russian Far East – pot/trap	0.00	Red (0.00)
Spiny brown king crab: Russian Far East – pot/trap	0.00	Red (0.00)
Golden king crab: Russian Far East – pot/trap	0.00	Red (0.00)
Opilio snow crab: Russian Far East – pot/trap	0.00	Red (0.00)
Tanner snow crab: Russian Far East – pot/trap	0.00	Red (0.00)
Triangle tanner snow crab: Russian Far East – pot/trap	0.00	Red (0.00)
Red snow crab: Russian Far East – pot/trap	0.00	Red (0.00)
Chinese mitten crab: Russian Far East – pot/trap	0.00	Red (0.00)
Hair crab: Russian Far East – pot/trap	0.00	Red (0.00)

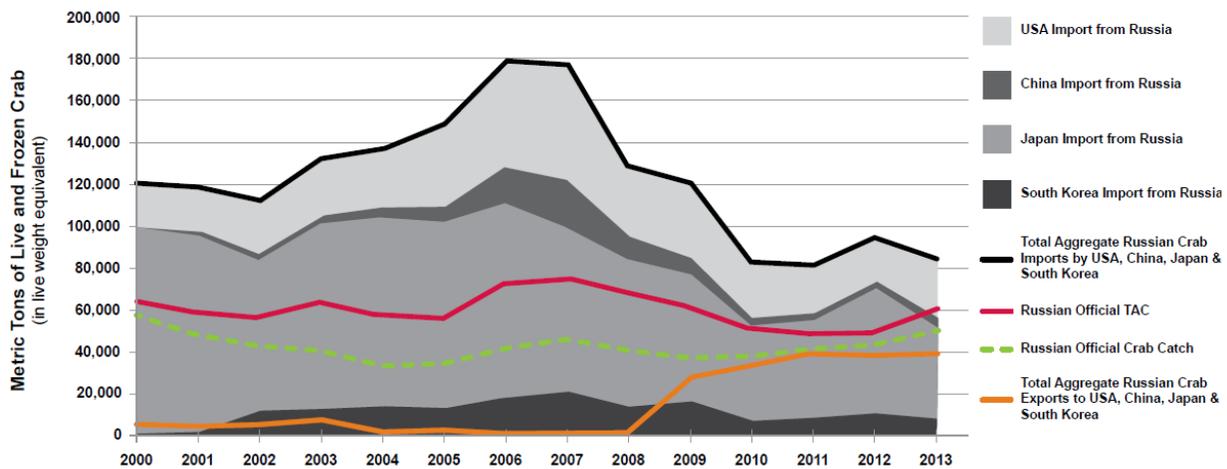
Factor 3.1 Assessment

Critical Concern – More than 25% of the product is caught illegally

A 2014 WWF investigation of the legal and illegal crab harvest in the Russian Far East revealed that between 2003 and 2013, IUU fishing was between 1.7 and 4 times higher than sustainable levels (WWF 2014). IUU fishing drives down global crab prices by flooding the market with cheaper product. This in turn decreases the sustainability of the legal crab fishing industry (in both Russia and the United States) and thwarts efforts to responsibly and sustainably manage Russian crab stocks (FAO 2001) (WWF 2014) (NOAA 2015). Illegal crabbing can occur when Russian vessels exceed the total allowable catch (TAC) or harvest illegally, or when foreign vessels fish illegally in Russian waters (WWF 2014). The crabs can then be laundered in one of the following ways:

1. Transshipping: this occurs when illegally caught crabs are offloaded from one vessel to another, and then sent to a foreign port. The illegal crabs are mixed with crabs that are caught legally, making it impossible to distinguish between the two. Often, crabs are transferred from a vessel to a processing ship. The processed product is then shipped to an intermediary country where it is also intermingled with the legal product. Evidence of transshipping illegally caught Russian crab was gathered by comparing Russian export data with the import records of other countries (Figure 2). The WWF (2014) detected

large discrepancies between the amount of crab exported from Russia compared with the amount imported into South Korea, Japan, and China (Figure 2). For example, between 2009 and 2013, Japanese imports of Russian crab were 15 times higher than Russian export data indicated (WWF 2014). All Russian crabs imported into the United States go through South Korea or Japan. This triangular trade can mask the blending of illegally caught crab with legal product by decreasing the transparency of the supply chain (WWF 2014). It is thus impossible for the U.S. to distinguish crabs that were caught legally from those caught illegally. Moreover, Russia attributes the exported crabs to the intermediary country and therefore has no records of crab exports to the United States, even though the United States identifies imported crabs from Russia.



Data Sources: Russian Federal Fishery Agency–TAC (2014), Russian Federal Fishery Agency–Harvest Data (2014), Global Trade Atlas (2014)

Figure 2. Russian crab TAC, catch, and export data (in color) and official import data (in grayscale), 2000–2013, from WWF (2014). The live weight equivalent (LWE) assumes frozen crab weighs 60% of its LWE, allowing for comparison between metric tons of live and frozen crab (WWF 2014).

2. Mis-declaring product quantities, falsifying documents, and mislabeling: murkiness in the supply chain can conceal the reprocessing (altering the original product after import) and subsequent re-export of illegal crab. Altering and repackaging of the products enables the falsification of labels and paperwork. It is then easy for large quantities of illegal crab to enter the market undetected under the guise of being labeled as legal.

Quantifying crab landings and trade information, both legal and illegal, has several challenges (WWF 2014). First, these data are not collected by just one agency. According to WWF (2014), Russian TAC information is compiled by Russia’s Pacific Scientific Research Center for Fisheries (TINRO) and the Russian Federal Fisheries Agency. The Russian Federal Fisheries Agency also compiles harvest information, but trade data were compiled from the Global Trade Atlas. Second, the Russian Federal Fisheries Agency does not identify landings to the genus and

species level, although the TAC does, and the specificity of the Harmonized System (HS) trade data codes differs by country (WWF 2014). This also can contribute to confusion in the supply chain, facilitating the falsification and mislabeling of documents. Finally, the mismatch in the information recorded by importing countries versus exporting countries (e.g., U.S. and Russian import/export records) makes it challenging to determine the quantity, origin, and destination of the product (WWF 2014). This lack of consistency in HS data does not allow us to distinguish which crab species are most susceptible to IUU fishing and imported into the U.S. Thus, this Seafood Watch Report includes multiple crab species that occur in the Russian Far East and are imported into the U.S.

Russia has attempted to address IUU crab fishing through separate bilateral agreements with South Korea, Japan, China, and the United States (WWF 2014). Although these agreements have reduced IUU crab harvest by half, IUU fishing is still nearly double the official Russian landings records (WWF 2014). “The continued prevalence of illegal crab harvesting means that there is high uncertainty about the overall ecological health of Russia’s native crab populations in the Far East” (WWF 2014, p. 28). As a result of the continued very high levels of IUU fishing of crabs in the Russian Far East ($\geq 25\%$), all crabs imported into the United States from the Russian Far East are considered “critical” and thus an “Avoid” recommendation.

Acknowledgements

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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