



Illegal Russian Crab

An Investigation of Trade Flow

Square crab pots are typically used in Alaska and occasionally in Russia to harvest king and snow crab.

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Executive Summary

World Wildlife Fund investigated the trade flow of illegal and legal crab harvested from Russian waters throughout the Pacific Rim to better understand the likelihood of U.S. importation of illegally harvested Russian crab, as well as conservation concerns associated with overharvest of crab from Russian waters. This report found the following:

- Official customs data from South Korea, Japan, China and the United States indicate that in 2013, these four countries (which account for nearly all of Russia's official crab exports) imported 1.69 times as much live and frozen crab from Russia as official Russian harvest levels. Over the past decade, the level of overharvest due to illegal crab harvesting was two to four times the legal limit, causing grave concern about the sustainability of several Russian Far East crab species.
- Foreign-flagged vessels harvest crab illegally in Russian waters, and some Russian-flagged vessels either overharvest or harvest crab illegally. Misdeclaring product quantities, off-loading undeclared product onto a transport vessel at sea, or delivering undeclared crab (or declared using fake documentation) directly to a foreign port are known techniques to launder crab. Foreign ports receiving Russian crab are typically in Japan and South Korea and are also likely to be intermediary stop-offs or final destinations for illegal Russian crab.
- WWF examined the Automatic Identification System (AIS) signals for 32 vessels believed to have delivered crab to Hokkaido, Japan in early 2012. Two foreign-flagged vessels showed a pattern that indicated harvesting in Russian waters and three foreign-flagged vessels approached the Russia-Japan maritime border, which could indicate transshipment. Five Russian-flagged vessels showed a pattern of possible harvesting in Russian waters and motoring directly to ports in Japan without stopping in a Russian port first to register the catch, therefore potentially violating Russian law (if crab or other seafood from Russian waters was off-loaded in Japan).
- Several species of crab are commercially important to both Alaska and Russian crab fisheries, but the highest value is garnered by red king crab (*Paralithodes camtschaticus*). King crab is consumed in large quantities in the United States with the source of this crab generally split between domestic harvests from Alaska and imports from Russia. On average over the last ten years, three-quarters of the king crab consumed in the U.S. market is from Russia. With 21% of total U.S. crab imports coming from Russia in 2012, the United States is likely importing crab that was harvested illegally.
- The current U.S. system for seafood imports is not able to detect or block every shipment of illegally harvested crab. Currently, seafood-tracking systems that verify legality are not in common practice.
- In recent years, Russia has worked to shrink the illegal crab problem by developing bilateral agreements with Japan and South Korea, developing a national plan of action to address illegal fisheries, and continued enforcement at-sea. Yet the problem is multilateral and it demands a multilateral solution.

Overview

Frozen, whole
red king crab.

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Encompassing over a million square miles, the Bering Sea is one of the world's most productive marine ecoregions, sustaining more than 500 species of fish, birds and mammals, hundreds of human communities. The Bering Sea supplies half the annual seafood catch for the U.S., and the Bering Sea and Sea of Okhotsk supply more than half of Russia's annual seafood catch. World Wildlife Fund (WWF) identified the Bering Sea, in a Global 200 conservation assessment, as "one of the most outstanding yet endangered marine environments, whose protection is essential for the preservation of the world's biodiversity" (Olson and Dinerstein 2002). Similarly, the Sea of Okhotsk is a highly productive marine ecosystem supporting an array of marine species, human uses and large-scale fisheries removals. The cold, upwelled waters in the Sea of Okhotsk support massive pollock, salmon and crab fisheries, which serve as an economic engine in the Russian Far East.

This high productivity, combined with the sheer remoteness and vastness of the western Bering Sea and Sea of Okhotsk, has exposed this area to illegal harvesting activities that are both lucrative and difficult to prevent. In response to increasing concern about the impact of illegal fisheries in these globally significant marine areas, in 2014 WWF experts investigated the trade flow of legal and illegal crab harvested in Russian waters using primary sources such as Russian crab stock assessments, publically accessible trade and customs data, interviews with experts and media sources to obtain a unique picture of the flows of legal and illegal crab products. Among other discoveries, WWF found that most Russian crab goes to Japan for consumption. Russian crab headed to the U.S. stops first in an Asian port, and China does not appear to play a major role in crab trade flows.

Based on extensive analyses of these data, WWF concludes that illegal crab harvest in Russia exceeded the legal limit between 1.7 and 4 times over the past decade. Official customs data indicate that both legal and illegal Russian crab is likely imported by South Korea, Japan and the United States. Foreign vessels and some Russian vessels illegally harvest crab, and this extreme overexploitation of crab causes grave concern about the sustainability of several Russian Far East crab species.

This report provides a comprehensive analysis of the drivers of Russian crab trade and existing loopholes that allow for the overharvest and illicit trade of Russian crab to continue. In particular, this report includes:

- an explanation of the method used to estimate illegal crab harvest volumes and analysis of crab trade data
- a description of known schemes for illegal crab harvest and trade and bilateral assessment/discussion of bilateral agreements between Russia and its main trade partners: South Korea, Japan, China and the United States
- a compilation of recently published Russian and international news reports that shows the complexity and pervasiveness of illegal crab harvesting from Russian waters and the depth of involvement by foreigners and Russians alike
- a description of conservation impacts of overexploitation of Russian crab
- recommendations for key stakeholders, including U.S. and Japanese governments and buyers

BOX 1**CRAB SPECIES OF RUSSIA & COMMON NAMES****King crab***Paralithodes camtschaticus* (red king / Камчатка / краб камчатский)*Paralithodes platypus* (blue king / краб синий)*Paralithodes brevipes* (spiny brown king / краб колючий)*Lithodes aequispinus* (golden king / brown king / краб равношипый)**Snow crab***Chionoecetes opilio* (opilio / queen / snow / краб-стригун опилио)*Chionoecetes bairdi* (tanner / snow / bairdi / краб-стригун берди/бэрда)*Chionoecetes angulatus* (triangle tanner / краб-стригун ангулятус)*Chionoecetes japonicus* (red snow / краб-стригун красный)**Other crab***Eriocheir sinensis* (hairy mitten / Японский мохнаторукий краб)*Erimacrus isenbeckii* (Japanese horsehair / краб волосатый четырехугольный)

Introduction

From the frigid marine waters of the Bering Sea and the Sea of Okhotsk, Russia and the United States (Alaska), produce almost 91,000 metric tons (200 million pounds) of legally caught crab each year. Besides the legal harvests illegal crab floods global markets, which causes artificially low prices for legal harvesters and overexploitation of Russian Far East (RFE) crab stocks that could otherwise be sustainably managed.

Media reports in Russian and international press frequently cover specific instances of illegal, unreported and unregulated fishing (IUU¹) of crab confiscated by Russian authorities or imported by Russia's main trade partners. Nikolai Fyodorov, head of the Russian Ministry of Agriculture, the body overseeing Russia's Federal Fishery Agency (Rosrybolovstvo), noted that Russia loses up to \$1 billion per

year from illegal fishing of all seafood species, including crab (Primamedia 2014b). This estimated loss was corroborated by Russia's Government Accountability Office, according to a report given at the September 2014 International Fishery Congress in Vladivostok. That report also noted that that this figure exceeds the net income of all Russian fisheries businesses in 2011 (14.4 billion rubles or \$470 million) and is more than 15% the annual turnover of all of Russia's fishery enterprises (127.8 billion rubles or \$4.2 billion) (Sukharensko et al. 2014).

This lost tax revenue, at least partially, flows to the foreign-flagged vessels that harvest crab illegally in Russian waters, and also to some Russian-flagged vessels that either overharvest or harvest crab illegally. Known techniques to launder and move illegal crab include transshipping, misdeclaring, falsifying documentation, and mislabeling. Foreign ports receiving Russian crab are typically in Japan and South Korea. These may serve as an intermediate stop-off or a final destination for illegal Russian crab that typically end up in Japan and the United States.

When illegal crab is internationally traded, it increases the world supply, depresses prices, and hence diminishes the competitiveness and viability of the legal crab industry. Illegal Russian crab is an important issue for Alaska's crab fishery, a \$910 million dollar industry, which competes directly with Russian crab, particularly king crab, in the United States and on the global market (McDowell Group 2013; Hermann and Greenberg 2006).² Several species of crab are commercially important to both the Alaskan and Russian crab fisheries (Box 1).

TABLE 1
PERCENT OF U.S. DOMESTIC MARKET SUPPLY OF FROZEN KING CRAB FROM U.S. (ALASKA) AND RUSSIA

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)

¹ This WWF report on crab uses the singular term 'illegal' interchangeably with the term IUU, which is to say the word 'illegal' used here is inclusive of unreported (i.e. overharvested), and unregulated fishing.

² Crab harvest from the state of Alaska is the United States' only domestic source of king and snow crab. As early as 1992, Russia overtook Alaska as the leading supplier of king crab to Japanese and U.S. markets. Meanwhile, in 1995 Russia overtook Alaska as the top snow crab exporter to Japan and in 2000 Russia overtook Alaska as the top snow crab supplier to the U.S. See Hermann and Greenberg (2006).



King crab legs and meat for sale in a Russian seafood market.

© WWF-US / Heather Brandon

The highest value of these species is garnered by red king crab (*Paralithodes camtschaticus*, known as Kamchatka crab in Russia). Three species of king crab (red, blue and golden) are consumed in large quantities in the United States.³ U.S. market sources of these three species of king crab historically have been split primarily between Alaska and Russia (Monterey Bay Aquarium 2010). WWF calculated that Alaska crab has supplied, on average for the past 11 years, only 16.9% of the U.S. domestic consumer market for king crab while Russia has supplied 77.5%, on average (see Table 1) (SeafoodNews 2014).

³ Common names are not universally used for many species and often are not the same names used within the industry from one country to another. Common names used by the U.S. seafood industry, for instance, would label three of these species as 'king' crab and only two as 'snow' crab. In the U.S., 'king' crab specifically refers to three species: red king crab (*Paralithodes camtschaticus*), blue king crab (*Paralithodes platypus*), and golden (or brown) king crab (*Lithodes aequispinus*). In Russia, however, the aggregate category 'king' crab is not used, with Russia instead using specific common names for each of the species that make up the U.S.'s 'king crab' grouping. Some foreign countries periodically use the term 'king' crab as it is a heavily used term in the U.S., where there is a large consumer market for crab. However, it appears that international usage is applied sometimes to the *Paralithodes* genus, thus leading to an asymmetric usage. Because the common term 'king' crab' (used in the U.S.) is not synonymous with *Paralithodes*, it can be unclear internationally which specific species of crab are being referenced. Meanwhile, with respect to 'snow' crab, Russian common names indicate that all four *Chionoecetes* species are commercially harvested under the term 'streegun' instead of 'snow.' Whereas, in the U.S., the common name 'snow' crab, often only refers to *Chionoecetes opilio*, but sometimes includes *Chionoecetes bairdi* with "Tanner" crab an alternate or second name for *C. bairdi*. The other two species of 'snow' crab that Russia considers part of its aggregate 'streegun' category (Triangle tanner crab and red snow crab) are not harvested in U.S. waters and thus are not normally considered as 'snow' crab. Therefore, 'snow' crab is an unclear common term for multiple species of the *Chionoecetes* genus. Importantly, this level of confusion with crab species naming goes beyond each country's crab industry norms, and also is present in each country's Customs classifications and trade data. When common names are used in trade data reporting or when groupings of species are not consistent among countries, it prevents a direct comparison of harvest, import and export data and complicates trade data analysis (see pages 22 and 23 for a more thorough discussion of the problems associated with current crab classification categories in Customs and trade data). Throughout this report, the terms 'king' and 'snow' are used only when they are accompanied by a clarification of which species each term encapsulates.

Because of the high rate of crab imports from Russia, Americans dining on king or snow crab may be consuming Russian crab, and if so, should be aware that a significant portion of crab from Russian waters could be illegal. Currently, government or private entities do not commonly use seafood-tracking systems that verify legality.

U.S. companies that import illegal crab from Russia, even if they do so unknowingly, may be held legally responsible with penalties ranging from product forfeiture to criminal prosecution. The U.S. Lacey Act prohibits trade in wildlife, fish (including seafood) and plants (including wood) that have been illegally taken, possessed, transported or sold. The most recent Lacey Act case involving illegal crab occurred in 2011. The U.S. company Harbor Seafood, Inc. forfeited \$2.75 million worth of king crab (see Box 2). The value of Harbor Seafood's forfeited imports represented 1.3% of the total value of United States' imports of Russian crab during that year.⁴

Importantly, Russia's domestic data, (such as official total allowable catch [TAC], catch and export volumes), portray a normal, regulated fishery that does not catch more than is allocated and does not export more than is caught (see Figure 1). However, illegal crab is not reflected in these domestic catch data or Russian export volumes. It was not until WWF looked at Japanese, South Korean, U.S. and other import data that major trade discrepancies became apparent in Russian crab trade quantities, with volumes far exceeding annual catch limits.

⁴ The United States imported \$ 218 million of Russian crab in 2010 and \$ 208 million in 2011.

BOX 2

THE U.S. LACEY ACT, FOOD AND DRUG ADMINISTRATION (FDA) REGULATIONS AND ILLEGAL CRAB

American companies and individuals that import illegally harvested seafood—knowingly or not—put themselves at risk of violating the United States Lacey Act (16 U.S.C. § 3371-3378). The Lacey Act also prohibits false labelling, such as improperly labelled packaging. The Act provides for criminal and civil penalties, which range from jail time to fines and forfeiture of seafood and vessels. In addition, products covered by the Lacey Act, including crab, that are taken in violation of a foreign government’s regulations are subject to forfeiture under the Lacey Act, 16 U.S.C. § 3374(a), on a strict liability basis. In a recent case, (*United States v. 144,774 Pounds of Blue King Crab*, 410 F.3d 1131 [9th Cir. 2005]) an innocent owner defense was raised in the forfeiture proceedings. The court held that under the Civil Asset Forfeiture Reform Act, 18 U.S.C. § 983, the innocent owner defense cannot be asserted when the property to be forfeited is “contraband or other property that it is illegal to possess.”

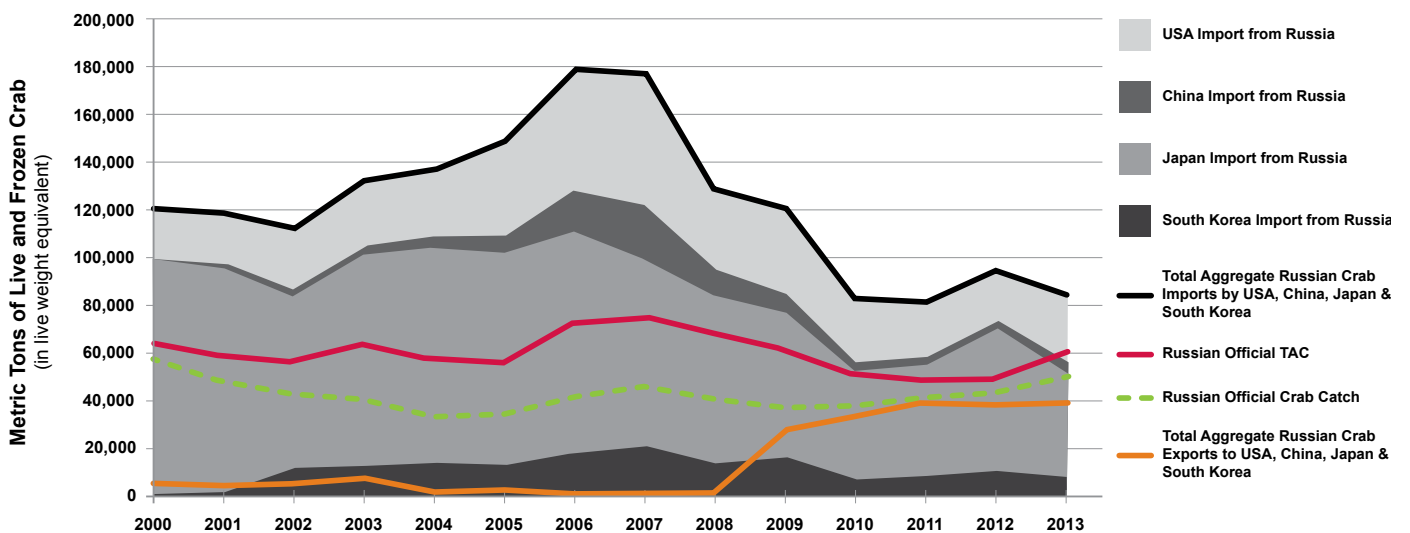
U.S. FDA regulations require food products entering the U.S. to be accompanied by information on its last processing facility, which must also be registered in advance with the FDA. Failure to comply with each FDA requirement is grounds for forfeiture. Forfeiture is a clear risk to U.S. seafood companies and individual employees which “fail to exercise reasonable care” in complying with importation regulations, including product origin, product labelling, packing lists, accurate invoices and facility registration. These obligations firmly rest with the U.S. importer.

A 2011 Lacey Act case involved Russian crab (*United States v. 112 Metric Tons of Frozen King Crab*, No. 11-334 [W.D. Wa.]) [filed Feb. 24, 2011] imported by a U.S. company, Harbor Seafood, Inc. The company attempted to import Russian blue king crab that had been harvested by vessels that did not possess enough crab quotas or were not permitted to harvest crab in Russia. The Russian crab was believed to be transshipped through South Korea before being imported into the United States. As a result of violations of the Lacey Act and FDA regulatory requirements, Harbor Seafood, Inc. forfeited \$2.75 million worth of crab in 2011, which it later bought back from the U.S. government at auction, essentially paying twice for the same crab. The case was settled in 2012.

Assistant U.S. Attorney Francis Franze-Nakamura notes (2014), “This case sends a message to importers who are not exercising reasonable care that what happened to Harbor Seafood, Inc. could happen to you. You could be looking at the complete loss of your shipment.”

Sources: NOAA (2012), *Seattle Times* (2011b), Alexander (2014), U.S. Department of Justice (2005)

FIGURE 1
RUSSIAN CRAB TAC, CATCH, AND EXPORT DATA (IN COLOR) WITH OFFICIAL IMPORT DATA (IN GRAYSCALE), 2000-2013⁵



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

⁵ The live weight equivalent (LWE) unit allows comparison between metric tons of live and frozen crab by converting the weight of frozen crab to its ‘live weight equivalent’. Conversion of frozen weight to its live weight equivalent is consistent with Russian and U.S. literature on the subject and assumes, on average, frozen crab weighs 60% of its live weight (TINRO 2014). This conversion is used throughout this paper to aggregate the frozen and live crab categories in trade data.

In recent years, Russia has worked to combat illegal fishing in its waters by developing bilateral agreements with Japan, South Korea and China, developing a National Action Plan to address illegal fisheries, including crab, and continuing enforcement at sea. Russia and the United States are working to develop a bilateral agreement regarding the mutual cooperation of the two nations to address IUU. Indeed, levels of illegal crab harvest have fallen from egregiously high amounts that were four times the legal limit in 2006 and 2007 to less than two times the legal limit in 2013. Despite these efforts, illegal crab continues to be harvested in Russian waters, with imports of Russian crab exceeding the official harvest volume by 1.7 times in 2013. As this report shows, the problem is multilateral and thus demands multilateral solutions.

General Russian Crab Harvest & Total Allowable Catch Information

In Russia's waters, ten species of crab are commercially harvested (see Box 1). The Russian Federation maintains fishing zone jurisdictions and publishes yearly total allowable catch (TAC) levels for each of the ten species. Table 2 indicates Russia's overall TAC for crab as well as red king crab TAC as split between Russia's western Barents Sea (bordering Norway), and Russia's Pacific waters (Bering Sea and Sea of Okhotsk) in the Russian Far East (RFE). Red king crab and snow crab in the Barents Sea are non-native (see Box 3 on the history of Russia's commercial crab fishery in the Barents Sea), and therefore over-exploitation is not a conservation concern.

TABLE 2
RUSSIAN FEDERATION'S TOTAL ALLOWABLE CATCH (TAC) FOR CRAB, 2010-2014

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)

FIGURE 2
MAP OF RUSSIAN FAR EAST FISHING SUB-ZONES

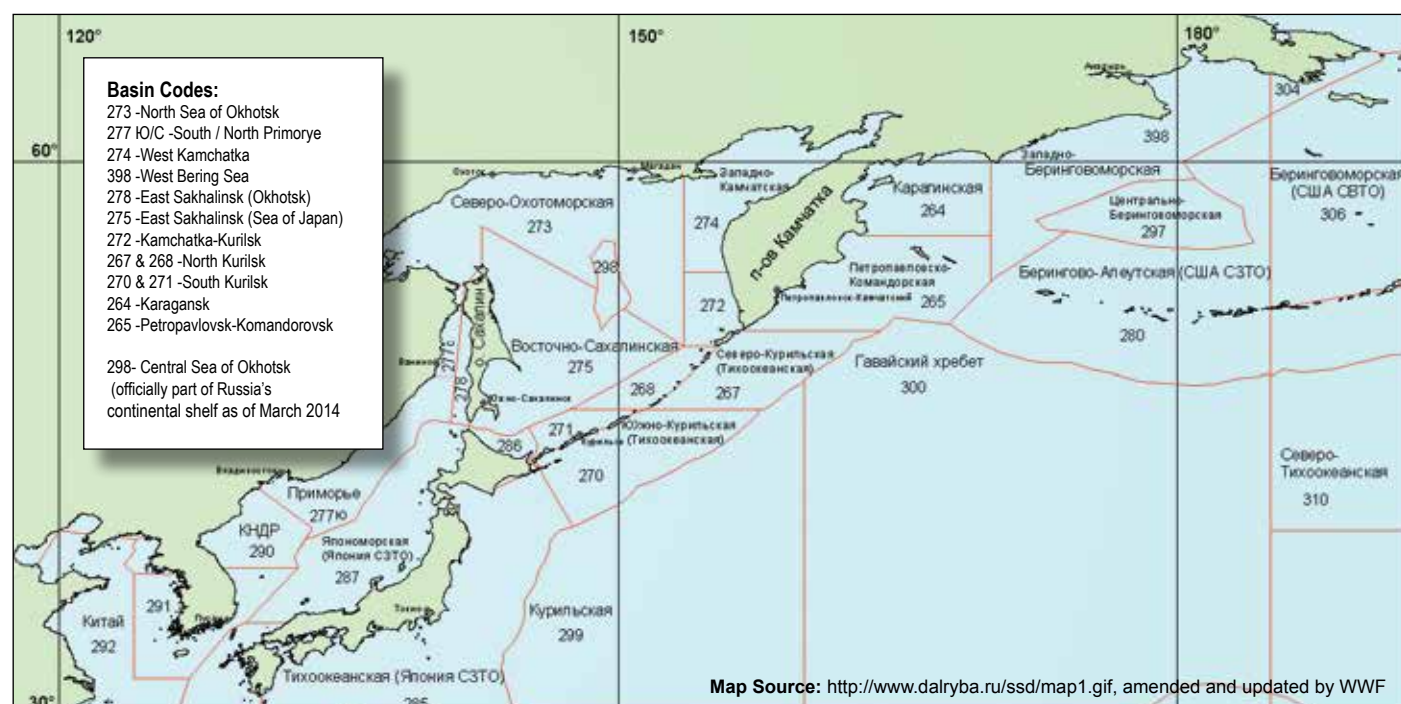
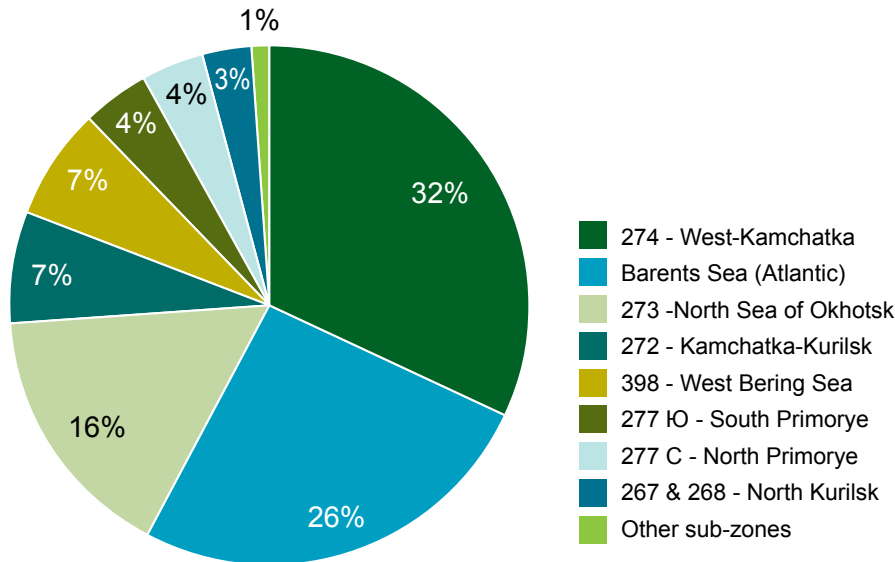


FIGURE 3 2014 KING CRAB TAC

By sub-zone Red, Blue, and Golden (3 spp.)

Total 2014 King Crab TAC = 24,698 mt



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

WWF focused primarily on legal and illegal commercial crab fisheries in the RFE, rather than in the Barents, because all crab species in the RFE are native and subject to potential overexploitation. Figure 2 depicts a map of the RFE fishing sub-zone basins in the North Pacific, and these sub-zones are referenced throughout this paper.

King Crab

Historically, red king crab was Russia's most commercially valuable species of crab and comprised about half of Russia's total crab harvest (Ivanov 2002). However this percent started to decline in the 1990s, and between 2001 and 2005 red king crab fell from 31.1% to 4.2% of the total TAC for all crab species (TINRO 2014).⁶ By the mid-2000s, it was clear that red king crab stocks in the Russian Far East had been heavily overexploited and were suffering from catastrophic decline.⁷

There are three main populations of red king crab in the Russian Far East: (1) Western Kamchatka and Kamchatka-Kuril Islands (Western Kamchatka population), (2) North-Okhotsk Sea, and (3) Primorye and Western Sakhalin (Dvoretzky and Dvoretzky 2014).⁸ In 2005-2006, due to the consistent overharvest of red king crab in the Far East, the historically abundant West Kamchatka and Kamchatka-Kurilsk harvest sub-zones (sub-zones

⁶ Between 1999 and 2006, the official harvest of red king crab fell by 17 times, from 33,000 to under 2,000 mt (from 73 million lbs. to under 4 million lbs.).

⁷ Also in the mid-2000s, the Barents Sea invasive red king crab population dramatically increased and a commercial red king crab fishery began there.

⁸ There are other smaller populations of red king crab in the Russian Far East; however, they represent a much smaller proportion of the total stock.

274 and 272 in Figure 2), home to the largest of these three populations and surveyed annually for over 30 years, were closed to commercial crab fishing. Although the fishery was re-opened briefly in 2007, the stock of red king crab continued to decline drastically.

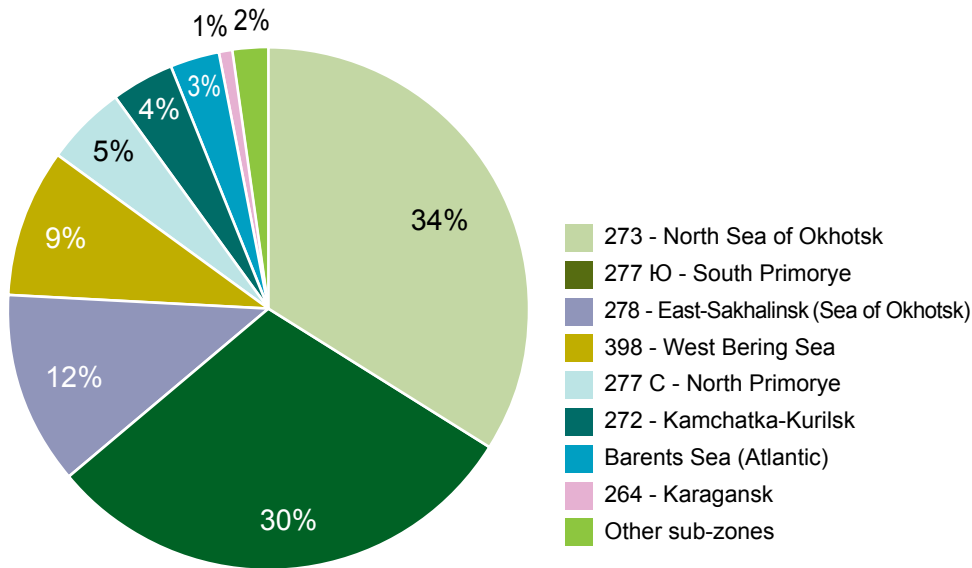
In 2008, West Kamchatka and Kamchatka-Kurilsk sub-zones were closed to king crab harvesting indefinitely. In 2013, the Russian Federal Fishery Agency determined that red king crab stocks in the West Kamchatka and the Kamchatka-Kurilsk sub-zones had sufficiently recovered and re-opened these areas to commercial crabbing, thus causing Russia's overall red king crab TAC to double from 2012 to 2013 (see Table 2). Additionally, with the re-opening of these sub-zones in 2013, the red king crab TAC in the RFE became higher than the TAC in the Barents Sea (National Fishery Resources 2014). Figure 3 indicates

that the most productive harvest areas for the three king crab species (red, blue and golden) is the West Kamchatka (sub-zone No. 274) with 32% of the total aggregate TAC for these species.

During the summer of 2014, Russia's Pacific Scientific Research Center for Fisheries and Oceanography (TINRO) officially petitioned the All-Russian Scientific Research Center for Fisheries and Oceanography (VNIRO) to substantially increase the red king crab TAC in the West Kamchatka and Kamchatka-Kurilsk sub-zones. The proposal to increase the previously set TAC from 3.3- to 6.1-thousand metric tons (mt) in the West Kamchatka sub-zone (7.2- to 13.4-million lbs.), and from 1.79- to 3.78-thousand mt (3.9- to 8.3- million lbs.) in the Kamchatka-Kurilsk sub-zone, was based on recent scientific surveys done by TINRO along with other Far Eastern fisheries research centers and was presented to VNIRO mid-summer 2014 (TINRO Center News 2014). At the time of this report's release in autumn 2014, the proposal had not been accepted by VNIRO and, hence, is not currently in effect, even though Russia's red king crab season opened September 1st of 2014. If accepted, this in-season TAC change would double Russia's total TAC for red king crab from 4.9 thousand mt to 9.9 thousand mt (10.8- to 21.8-million lbs.). Russia's 2014 red king crab season ends on December 31, 2014 and thus far it is unclear whether Russia's red king crab TAC will drastically increase partway through the 2014 season. Additionally, according to TINRO, blue king and golden king crab have had stable populations, with TAC levels for these species fluctuating between 3,000 and 4,000 mt (6.6 million and 8.8 million lbs.) through 2012.

FIGURE 4
2014 SNOW CRAB TAC

By Subzone - Opilio, Bairdi, Triangle Tanner & Red Snow (4 spp.)
Total 2014 Snow Crab TAC = 36,619 mt



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

Snow Crab

In connection with the decline of red king crab in the Far East basin, TINRO shifted its research in 2009 to the more productive snow crab species: opilio, red snow and bairdi (TINRO 2014). Opilio snow crab (*Chionoecetes opilio*) became the dominant legal crab fishery in Russia's Far East with stable TAC levels hovering around 20,000 mt (44 million lbs.) through 2014. Red snow crab (*Chionoecetes japonicas*) is found in abundance in the South Primorye sub-zone (sub-zone 277 IO in Figure 2) and in 2014 has the second highest TAC of the snow crab species, ranging from 10,500 mt (44.1 million lbs.) in 2010 to 7,500 mt (23 million lbs.) in 2014. Figure 4 indicates that the most productive harvest area for snow crab, according to the 2014 TAC is the North Sea of Okhotsk (sub-zone 273), with 34% of the total aggregate TAC for four snow crab species (opilio, bairdi, triangle Tanner and red snow).

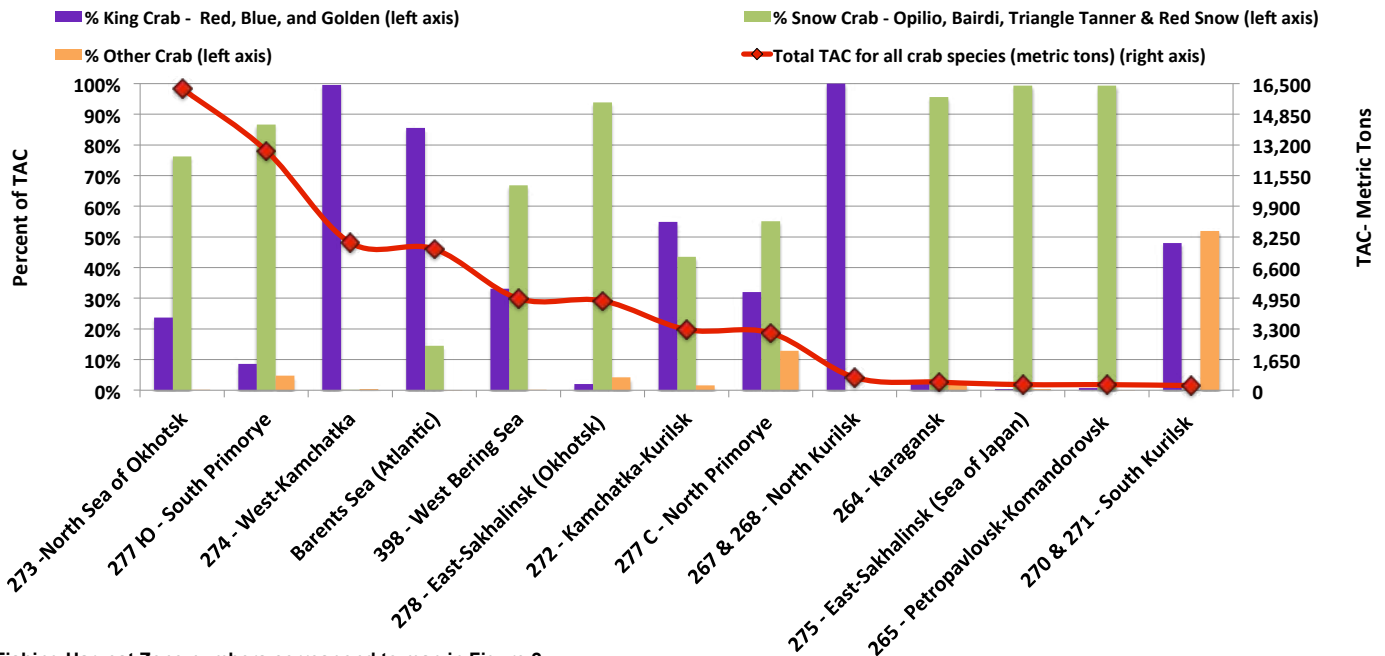
Figure 5 shows the distribution of the 2014 TAC for king and snow crab in each harvest sub-zone. The tallest blue bars indicate harvest zones with the highest share of king crab TAC in 2014. For example, in the West Kamchatka zone king crab is harvested almost exclusively (blue bar is 99%). The dots in the black line mark the total TAC amount for all crab species, which for West Kamchatka sub-zone is approximately 8,000 mt (17.6 million lbs.). Figure 5 depicts which sub-zones contain king crab (blue bar), snow crab (red bar), or both, and, separately, the absolute size of the TAC in each sub-zone.



Sorting of snow crab on deck
a crab harvesting vessel.

Photo courtesy of Josh Thomas

FIGURE 5
2014 RUSSIAN TAC BY FISHING SUB-ZONE AND BY PERCENT KING AND SNOW CRAB SPECIES



Fishing Harvest Zone numbers correspond to map in Figure 2.

Data sources: Russian Federal Fishery Agency –TAC (2014), TINRO (2014, 105)

BOX 3
CRAB IN RUSSIA’S BARENTS SEA

In the 1960s, Russia deliberately introduced red king crab as an alien species into the Barents Sea, bordering Norway in northwestern Russia. Red king crab stocks swelled as intended in the 1990s and 2000s, providing Russia with a new commercial fishery in 2004. As a commercial species, crab from the Barents Sea has provided only 10% of Russia’s crab on average. Yet, this consists mostly of red king crab; therefore, the Barents Sea is a substantial source of Russian-origin red king crab (see Table 2).

As the Barents Sea commercial red king crab fishery ramped up in the 2000s, red king crab abundance in the RFE declined significantly. However, these did not balance each other out. Overall, Russia’s nationwide TAC for red king crab fell by 82% between 2000 and 2010 (32,560 mt [71.8 million lbs.] in 2000 compared to 5,828 mt [12.8 million lbs.] in 2010).

A second invasive crab species has recently become the target of a new fishery in the Barents Sea: snow crab. In 2011, for the first time in history, the Russian Federal Fishery Agency issued a snow crab (*Chionoecetes opilio*) TAC of 1 mt in the Barents Sea for research purposes. By 2014, Barents Sea snow crab was commercially harvested under an initial TAC of 1,100 mt (2.4 million lbs.).

The Barents Sea now has two introduced crab species that have grown to levels high enough to allow for commercial harvesting. The conservation threat associated with invasive red king and snow crab in the Barents Sea is related to disturbing the native food web and ecosystem, and not related to unsustainable harvesting practices. Red king crab spread west from Russian waters and invaded Norway’s fjords. The crab are devouring benthic organisms including capelin and lumpfish eggs and commercially valuable scallops; eating cod from long line gear; tangling up gillnets; and potentially spreading a blood parasite to fish. Effects of the red king crab invasion and population explosion are more intense in the steep fjords of Norway than the more gently sloping Russian Barents Sea, but the reasons for that are not currently understood. Russian fisheries managers are intent on sustaining these invasive crab populations for long-term harvesting, while Norwegian fishery managers view the invasive crab with more caution since long-term impacts to native species, traditional fisheries and the marine ecosystem are largely unknown.

Sources: Fisheries.no (n.d.), Institute of Marine Research (2013), Barents Observer (2014), Sundet (2014)



Russia's Crab Trade and IUU Prevention Efforts

Emptying snow crab from a pot.

Photo courtesy of Josh Thomas

SECTION HIGHLIGHTS

Illegal crab is harvested by foreign-flagged vessels and some Russian-flagged vessels, yet it is unclear which set of vessels is the greater contributor to illegal harvest amounts. Russia has implemented laws and developed a National Action Plan to address IUU in an attempt to gain control over the criminal activity in Russian Far East waters.

The Beginning of Russia's Illegal Crab Industry

Russia's domestic demand for crab products in any form is minimal.⁹ Thus, the principle goal for the Russian crab industry is to export crab for sale in foreign markets where demand is high. Prior to 1991, during the Soviet period, fishing was highly regulated and the fishing industry was tightly controlled. However, beginning in the early 1990s with the break-up of the Soviet Union, the newly formed Russian government was unable to effectively control and enforce fisheries management within its territorial waters. Due to weak domestic governance and enforcement as well as the high international demand for Russian crab,

⁹ Recently, in Moscow, St. Petersburg and some RFE markets there has been an observed increase in demand for products made from crab around New Year's Eve. Nevertheless, overall domestic demand for crab continues to be low due to product availability and high price.

there was an explosion of illegal, unreported and unregulated fishing for crab within Russia's territorial waters (Newell 2004).

Methods of Illegal Crabbing

Once harvested, illegal crab is then laundered to appear that it has legal origin. Known techniques for laundering illegal crab include misdeclaring quantities, mislabeling products, creating false documentation, and bribery. There are many anecdotal stories and news reports on specific instances of how illegal crab fishing takes place. There appear to be two primary methods for harvest and transport:¹⁰

- 1) by Russian-flagged vessels, which harvest more than their legal quota. They can either (intentionally or unintentionally) misdeclare their product, off-load undeclared product onto a transport vessel at sea, or deliver undeclared crab directly to a foreign port (See Box 4); or
- 2) by a vessel that does not have legal rights to harvest crab but does so anyway. Vessels in this category can be owned, operated or flagged by Russia, or they could be a foreign-flagged vessel. Russia does not give out permits or quotas for crab harvesting to any foreign-flagged vessels in its Exclusive Economic Zone (EEZ) (See Boxes 5 and 6).

¹⁰ Russian crab is caught live and can either be stored within a vessel's hold for two to four weeks, or be frozen onboard a vessel (with or without first flash cooking). Even with recirculating water in the vessel's hold (common on Russian and U.S. vessels), there is some standard loss due to crab dying when live crab are held in tanks onboard a vessel.

BOX 4**RUSSIAN-FLAGGED VESSELS CITED FOR ILLEGAL CRAB HARVESTING**

April 2014 – Sea of Okhotsk A freezer trawler vessel, *Kamchatka Salmon*, chartered for scientific research by the government-run Kamchatka Research Institute of Fisheries and Oceanography (KamchatNIRO) was inspected and impounded in Petropavlovsk-Kamchatsky to await trial for illegal crab harvesting. The Russian-flagged and crewed vessel had 27 mt (59,525 lbs.) of blue king crab and 13.5 mt (29,762 lbs.) of additional crab products in unmarked boxes on board. Crab, vessel and fishing documents were seized. Both the captain of the vessel and KamchatNIRO were cited in violation of harvesting aquatic biological resources. If found guilty, KamchatNIRO faces administrative penalties and vessel confiscation. **Source:** Fishkamchatka (2014a)

March 2014 – Barents Sea Lovozero district court in the Murmansk Region, found the captain of the Russian-flagged vessel *Angel* guilty of overharvesting at least 1,344 individual red king crabs with a value, including damages, of 1,122,240 rubles (\$33,281) in the Barents Sea. The vessel's captain is required to compensate the federal budget in full as well as pay an additional fine of 100,000 rubles (\$2,965).

Source: Regnum News (2014b)

January 2014 – Sea of Okhotsk The Russian-flagged freezer trawler *Andrey Smirnov* was detained for possessing illegal crab. Border patrol inspectors found 4.1 mt (9,039 lbs.) of processed blue king crab on board the *Andrey Smirnov*. The captain of the vessel was cited in violation of harvesting aquatic biological resources and if found guilty would face administrative penalties as well as vessel confiscation. The *Andrey Smirnov* was seized previously by Russia's federal authorities in October 2012 after border guards found 40 mt (80,000 lbs.) of undocumented frozen cooked crab legs. Additionally, border guards determined that the vessel had disabled its positioning system for a few days, and thus authorities were unsure where the crab had been harvested. **Source:** Interfax Russia (2012), Primamedia (2014a)



King crab shoulder and legs for sale in a Russian seafood market. © WWF-US / Heather Brandon

BOX 5**FOREIGN-FLAGGED VESSELS POACHING CRAB IN RUSSIA'S FAR EAST**

September 2014 – A vessel flagged in the Republic of Togo named *Katraps* attempted to evade a Russian Border Patrol vessel. *Katraps* was unmarked, unresponsive to radio contact, failed to broadcast anti-collision signals and raced away from the Border Patrol. Upon inspection, *Katraps* contained fragments of crab, was equipped to transport live crab, yet had no documentation or permission to fish within the Russia's EEZ. *Katraps* was crewed by 13 people – 11 Russians and 2 Ukrainians – and the ship owner was registered in Belize. The vessel was impounded in the port of Petropavlovsk-Kamchatsky. **Source:** Fishkamchatka (2014b)

May 2014 – In the Sea of Okhotsk, the Russian Border Guard detained the Belize-owned, Cambodian-flagged vessel *Oikhon* carrying crab, crab-harvesting gear, and a crew of 16 Russians and two Indonesians. *Oikhon* had no documents entitling them to harvest any other fish species in Russia's EEZ, nor were authorities notified when the vessel entered Russian waters. The vessel was escorted to the port of Petropavlovsk-Kamchatsky for trial for violating laws governing the production of living aquatic resources and protection of fisheries. **Source:** Border Guard of Kamchatka Krai (2014)

February 2014 – The fishing vessel *Satsunan*, sailing under the flag of Saint Kitts and Nevis, fled from a Russian Border Guard vessel and helicopter for over two hours, all the while the Russian and Ukrainian crewmembers dumped crab overboard in the Cape Mosolov area off Primorsky Krai. Once apprehended, 200 kg (441 lbs.) of opilio snow crab were found, the freezers were full of frozen herring crab bait, and the *Satsunan* captain was identified as a repeat offender of illegal fishing offenses. The *Satsunan* was escorted to the port of Nakhodka. **Source:** Russian News (2014)

November 2013 – Russian Border Service division of the Federal Security Service (FSB) shot at and stopped the Cambodian-flagged vessel *Iskander* from fleeing Russia's EEZ. The vessel's crew were visibly throwing crab over the deck during the chase. The crew consisted of 14 Russian citizens and four Indonesian nationals. The vessel was also equipped for harvest and transport of crab and carried frozen herring, common crab bait. **Source:** RIA News (2013b)

October 2013 – The Russian Border Guard nabbed the Belize-flagged vessel *Freedom* for illegally harvesting, storing and transporting 10,501 live crabs (15 mt or 33,069 lbs.). The Russian captain pled guilty in Petropavlovsk-Kamchatsky city court, and was sentenced to two years in jail and was required to relinquish his captain's license for four years. However, in January 2014, the Kamchatka prosecutor gave the *Freedom's* captain total amnesty and released him from jail, citing the 20th anniversary of the Russian Federation's Constitution as the reason. The vessel owner, a company named "Benefit Limited," was ordered to pay a fine of twice the value of the catch and the costs—a total of more than 12 million rubles (\$344,000)—and the vessel *Freedom* was seized by officials. **Sources:** Regnum News (2014a, 2014c), My Petropavlovsk-Kamchatskiy News (2014), KamInform (2014)

Current Russian Measures to Deter Illegal Crabbing

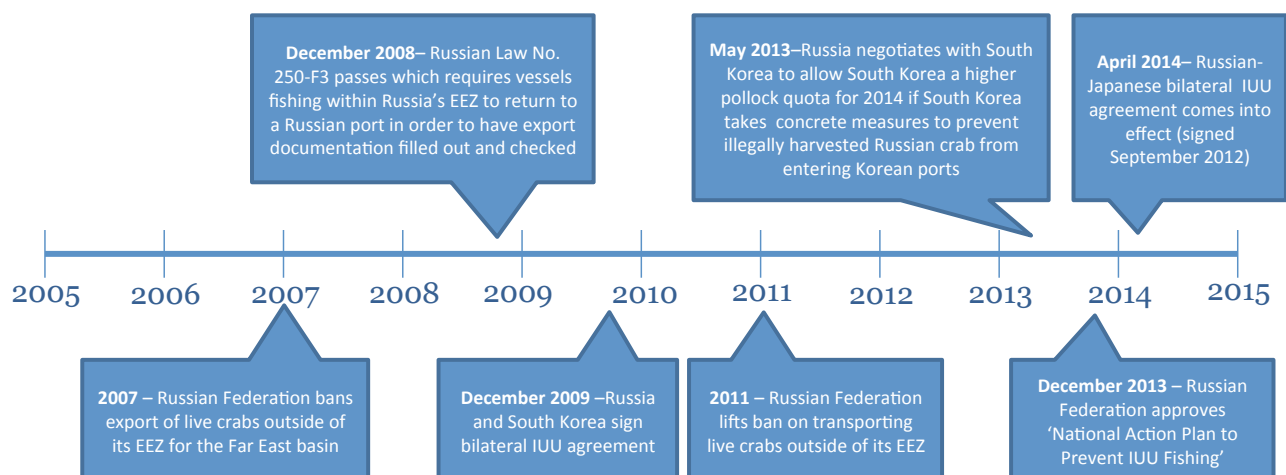
By the mid-2000s, overexploitation of crab from Russia's Far East waters was widespread. This fishing pressure diminished stocks of red king crab and other crab species, causing a deficit, which severely impacted Russia's legal crab industry. Beginning in 2007, in an attempt to establish stronger state control over the illegal crab industry, the Russian government began to implement a series of measures that were intended to curb illegal harvesting of crab (see Timeline below).

In mid-2007, Russia banned the export of live crab of all species caught in Russia's EEZ, a move it would rescind in 2011 in part due to the unintended and undesirable incentives it gave to increase crab poaching (Agrobel 2007; Jinji 2007; Russian Federal Fishery Agency 2011). In December 2008, Russian Law No. 250 –F3 mandated all vessels fishing within its EEZ wishing to export their catch to return first to a Russian port to have their export documentation filled out, checked and filed.¹¹

In addition to these export requirements, around this time the Russian government began discussing bilateral agreements with the main importing countries of Russian crab: Japan, South Korea, China and the United States. Bilateral agreements now have been signed between Russia and Japan, China and South Korea. The status of these bilateral agreements is given below. Russia and the U.S. have been discussing an IUU agreement for several years, and in September 2014 the agreement language was finalized in a closed meeting between the two countries.

In December 2013, the Russian Ministry of Agriculture, under the Fishing Industry Development Federal Program, approved a National Action Plan to prevent IUU fishing.¹² According to the Russian Government (2013), the National Action Plan prescribes the following steps that Russia should take in order to “eliminate the causes and the conditions that contribute to the development and growth of illegal, unreported, and unregulated fishing:

- analyze Russian legislation for compliance with international law and submit proposals for optimizing it to the government, in particular, to ensure the regulation of the acceptance, loading, transportation, storage and unloading of biological water resources; to regulate the procedure for chartering fishing vessels; to inspect vessels that sail under foreign flags in Russian seaports; and to properly mark fishing vessels and fishing equipment;
- strengthen control over biological water resource trade;
- create a system to monitor the origin of biological water resources at all stages of their moving;
- introduce electronic log books and e-signatures for fishing vessel captains;
- take measures to prevent Russian nationals from participating in illegal, unreported, and regulated fishing or supporting it;
- develop international cooperation in preventing illegal, unreported and unregulated fishing and illegal biological water resource trade;
- strengthen administrative and criminal punishment for the violators of Russian legislation on fishing and on the preservation of biological water resources;
- take regular preventative measures to expose and stop the illegal production of biological water resources.”



¹¹ As is customary in Russia, after a law is initially signed and then published in the *Rosyiskaya Gazeta*, it becomes official and enforceable, and thus the Russian port landing requirement went into effect December 9, 2008. See *Rosyiskaya Gazeta* (2008).

¹² National plans of action to prevent, deter and eliminate IUU Fishing are called for by the Food and Agriculture Organization (FAO) International Plan for the same, adopted by FAO member States in 2001. Virtually all of the provisions in Russia's National Plan are called for in the International Plan. The international plans were supposed to be done in 2004, although many countries still are working on them.

For Russia, this necessary, yet ambitious, set of domestic goals represents an important step for a government that has recognized the corruption and widespread illegal activity in its fisheries sector for years and has failed to bring about significant changes until recently.

In February and March 2014, government officials from the Ministries of Agriculture, Fisheries, Development of the Far East, and Federal Service for Veterinary and Phytosanitary Surveillance led a series of meetings with local Far East administrators and representatives of seafood businesses in Vladivostok to develop practical measures for several of the aforementioned goals. The agencies agreed that an initial necessary step was to develop cooperative joint measures in order to achieve traceability of fish and seafood products. One initiative discussed was the introduction of electronic “veterinary” certifications that would provide full traceability of the supply chain from sea to consumer (Primamedia 2014b). Officials at the meetings also discussed the need for the Russian Federal Fishery Agency to partner with law enforcement agencies and other authorities to conduct audits of all transportation routes, places of storage and processing locations of fish and seafood (Russian Ministry of Agriculture 2014). Nikolai Fyodorov, the head of Russia’s Ministry of Agriculture, noted “it is necessary to organize and display our work so that the general perception of Russian authority, fisherman, and the image of the entire industry as ‘one of the most criminalized sectors’ is left behind and a new image of fisherman is perceived by the public” (Ibid., para. 11).



Snow crab.

Photo courtesy of Josh Thomas

BOX 6

AIS SIGNALS SHOW POSSIBLE ILLEGAL ACTIVITY BY BOTH FOREIGN AND RUSSIAN VESSELS

WWF’s Smart Fishing Initiative and Navama* examined the Automatic Identification System (AIS) signals for 32 vessels believed to have delivered crab to Hokkaido, Japan in early 2012. Twenty-five vessels were foreign-flagged, and of those 25 only six broadcast AIS. Failing to broadcast an AIS signal is not illegal, but some vessels could be attempting to intentionally avoid detection. Of those six foreign-flagged vessels with AIS turned on, two vessels showed a pattern that indicated harvesting in Russian waters, and three approached the Russia-Japan maritime border, which could indicate transshipment.

WWF and Navama were not able to determine patterns for the other 19 vessels because the AIS signals were not broadcast. Seven of the 32 vessels investigated by WWF and Navama were Russian-flagged vessels. All seven Russian-flagged vessels broadcast AIS signals. The AIS signals indicated that five out of the seven Russian-flagged vessels showed a pattern of possible harvesting in Russian waters. Additionally, patterns also showed direct transit of these vessels to ports in Japan without stopping in a Russian port first to register the catch, therefore potentially violating Russian law (if crab or other seafood harvested from Russian waters was off-loaded in Japan). WWF and Navama were not able to ascertain the comparative volume of crab removals conducted by Russian-flagged illegal harvesters versus foreign-flagged illegal harvesters.

In 2014, TINRO noted “the quantity of vessels flagged by a third country, which illegally fished for crab in Russian waters and then landed their product in Japan or South Korea, had considerably decreased as a result of the actions of the Federal Marine Inspection and Border Service” (TINRO 2014, 105). However, WWF was unable to find additional enforcement information with respect to foreign-flagged vessels that could support or dispute this claim.

*Navama is a Germany-based technology company dedicated to nature conservation. See <http://navama.com>

Partner Country Trade Information and IUU Bilateral Initiatives

SECTION HIGHLIGHTS

Russia's main trade partners for crab—South Korea, Japan, United States and China—have each attempted to address the crab IUU problem in a unilateral or bilateral manner. The complexity of crab trade routes indicates that a multilateral effort would provide the most comprehensive approach for blocking illegal crab from entering the global market.

Entrance to Avacha Bay,
Petropavlovsk-Kamchatskii, Russia.

© WWF-US / Heather Brandon

Russia's four main foreign markets for crab are Japan, South Korea, the United States and China (see Figure 6). The market demand for Russian crab differs in each country, as does each country's bilateral initiative with Russia to decrease the supply of illegal crab. The following sub-sections describe trade with and between each of Russia's four main crab trade partners.

South Korea

South Korea's port city of Busan is a hub for Russian crab deliveries and stop-overs, both legal and illegal. Indeed, the Russian government's official newspaper periodically covers instances of illegal crab uncovered by authorities in Busan (See Box 7). Russian and South Korean trade data from 1999 to 2008 indicate a pattern—official Russian exports are far below South Korean imports. Yet, beginning in 2009, this trend reversed and Russia's official exports to South Korea far exceeded official Korean imports. Figure 7 shows officially reported customs trade data for Russia's trade with South Korea and the United States. Such an uncharacteristic trade discrepancy (including the immediate and drastic reversal of reported trade volumes) warrants further discussion.

In late 2008, Russia mandated that all catch on board a vessel, including crab, must be checked in a Russian port for customs clearance and documentation. This increased the chances that Russia's official exports to South Korea began to reflect the real quantities of legal exports that had probably always been

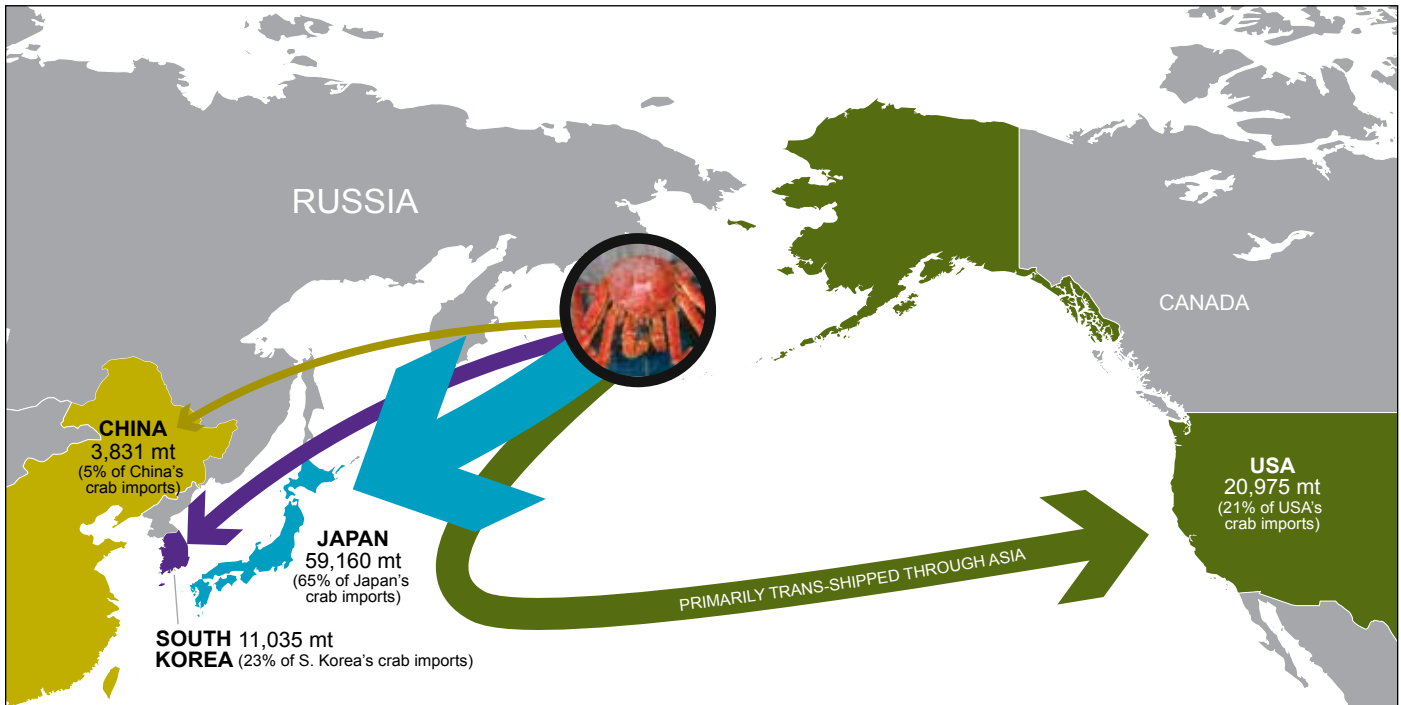
exported from Russia but had not been registered officially by Russian Customs (note that prior to 2009, Russian Customs consistently reported negligible exports to all its trade partners; see Figure 1).¹³

However, with Russia's new port landing requirement to have export documentation checked and filed, Russia's official export data did not increase to an approximate level equal to that of South Korea's officially reported imports from Russia. Instead, Russia's post-2008 export volumes indicate that Russia registered higher volumes of crab exports than South Korea reported importing. This could be due to the fact that U.S. imports of Russian crab list one of several Asian ports as intermediate stops, with Busan, South Korea appearing often in U.S. Customs data.

Russian Customs likely registers crab as exported to South Korea, but South Korea is merely a stop-off port for crab that is ultimately going to the U.S., and South Korean Customs does not register the crab as official imports. Meanwhile, U.S. Customs might indicate the same crab (that Russia says it exports to South Korea) as U.S. imports from Russia, not South Korea. The practice of goods stopping off in various ports is not illegal, yet the practice provides opportunity for mixing or laundering illegal crab.

¹³ Since Russia's actual extent of exports of crab were not reported by Russian Customs until 2009, this indicates that up until then the Russian government also had foregone collecting any export taxes or fees associated with its lucrative crab exports.

FIGURE 6
2012 PRIMARY MARKETS FOR IMPORTS OF RUSSIAN LIVE AND FROZEN CRAB, LIVE WEIGHT EQUIVALENT METRIC TONS



Sources: Data – Global Trade Atlas (2014), Crab picture – © Hartmut Jungius / WWF – Canon

It is unknown whether these intermediate stop-overs in South Korea are simply for transport vessels to re-fuel, and the crab never leaves the vessel, or whether the stop-overs involve processing, packaging, labeling or other handling, all of which could provide opportunities to either mix, mislabel or otherwise launder illegal crab into shipments of legal crab before the product continues on to a final destination (See Trade Complexity for further discussion). Box 7 highlights an example covered by Russian media of methods used to transship illegally harvested Russian crab to South Korea.

To address the illegal crab trade, South Korea and Russia signed the first bilateral intergovernmental agreement designed to prevent illegal seafood entering foreign ports in 2009.¹⁴ Unfortunately, according to Russia's TINRO Center (2014), the bilateral agreement has proven largely ineffective (See Box 8). For example, TINRO noted in its 'Crab Forecast 2014':

“At a Russian-Korean consultation on the implementation of the “Agreement with Korea” in the middle of November 2012, the Korean side informed the Russian delegation that they found warehouses in South Korea with at least 6,000 metric tons of crab [13.2 million lbs.], which up until that time had not been counted at all as imports from any country in the world” (2014, 110).

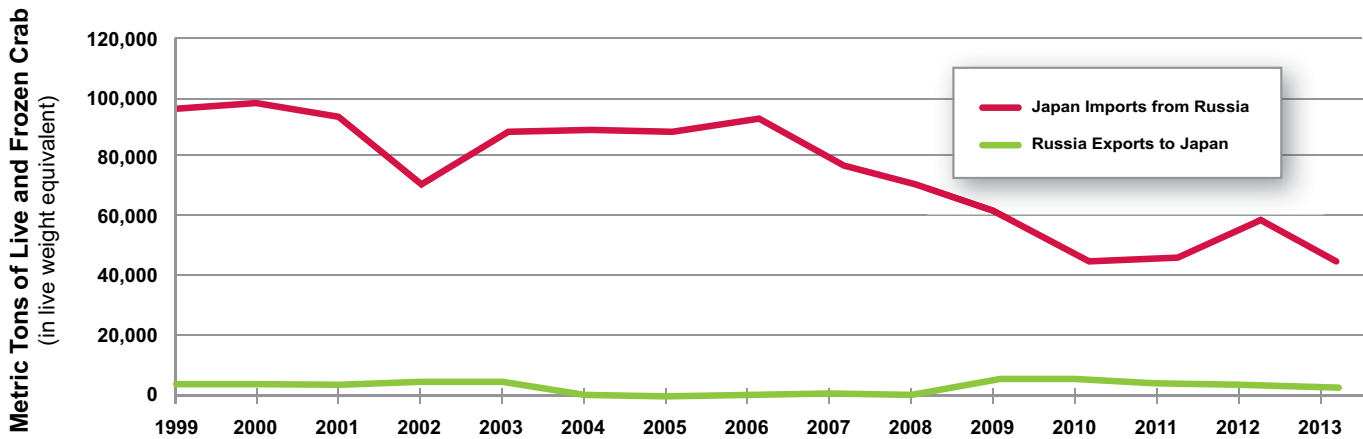
BOX 7 EXAMPLE OF ILLEGAL TRANSHIPMENT FROM RUSSIA TO SOUTH KOREA

April 2013 - Russian authorities in the Magadan city court imposed fines on joint-stock company 'Hayryuzovskiy RKZ-1' for illegally transshipping more than 50 mt (110,231 lbs.) of blue king crab from Russian waters to South Korea. The king crab was harvested by vessel *Solomon*, then transferred to another vessel *Dezhnyovo*, a refrigerated seiner-trawler, where the crab was then processed, flash cooked, frozen and finally transferred to the refrigerated tramper vessel *Buzanski*, which delivered the crab to Busan, South Korea. The fines imposed on the Russian company exceeded 2.5 million rubles (\$ 74,000), but federal authorities only received 700,000 rubles (\$ 20,000).
Source: Kamlnform (2013)

Russian and Korean authorities continue to discuss the problem and potential solutions (Fishnews 2013a). In March 2013, South Korean representatives observed that crab was still illegally imported into South Korean ports without the required Russian documentation. Yet South Korea skirted responsibility by suggesting that there are individuals and groups in Russia that benefit from illegal crab fishing and that a unified

¹⁴ The agreement was signed on 22 December 2009 (entered into effect 22 June 2010) and is titled “Agreement between the Governments of the Russian Federation and the Republic of Korea on the partnership to eradicate illegal, undocumented, and unregulated fishing of living marine resources.”

FIGURE 8
RUSSIAN EXPORTS AND JAPANESE IMPORTS OF RUSSIAN CRAB, 1999-2013



Data Source: Global Trade Atlas (2014)

and 2013, Japan's imports of Russian crab were, on average, 15 times higher than Russia's reported crab exports to Japan.¹⁷ While trade discrepancies occur frequently (see Estimation of Crab IUU), this consistently large discrepancy warrants further investigation, because trade discrepancies may be attributed to illegal product flow, for example, if crab was laundered either before or upon entering Japan.

Interestingly, Russia's 2008 port-landing requirement does not appear to correspond to any substantial change in Japanese-Russian bilateral trade data, as was seen in the South Korea-Russian trade data. While Russia's registered crab exports to Japan did increase nine-fold from approximately 600 mt (1.3 million lbs.) in 2008 to 5,800 mt (12.8 million lbs.) in 2009, it pales in comparison to Japan's reported imports from Russia for those years, which in 2008 was 70,000 mt (154 million lbs.) and in 2009 was 60,000 mt (132 million lbs.). Between those same two years (2008-2009), Russia-South Korea trade data indicate that Russia's reported exports to South Korea increased from approximately 1,000 mt to 22,000 mt (2.2 million to 48.5 million lbs.)—a twenty-two-fold increase, while South Korea's imports only marginally increased from 13.7 thousand mt to 16.3 thousand mt (from 30 million to 35.9 million lbs.). One possible explanation for why Russia's late 2008 port landing requirement is seen so dramatically in Russia's exports to South Korea, but not in Russia's exports to Japan, could be that most of Japan's imports of crab from Russia are, in fact, illegally sourced from Russian waters and were delivered straight to Japanese ports without Russian authorization.¹⁸

¹⁷ The most recent reported year in trade data statistics, 2013, indicated that Japan's crab imports were 20 times higher than Russia's exports of crab to Japan.

¹⁸ This is not to say that all of Russia's exports to South Korea were legal. As media reports (Boxes 7 and 8) indicate, there are high volumes of illegally sourced Russian crab landing in South Korea, too.

In 2012, Japan and Russia signed a bilateral agreement on IUU.¹⁹ This agreement was exclusively directed toward the prevention of illegal harvesting and trade of illegal Russian crab into Japan (TINRO 2014). Although signed in 2012, the agreement did not enter into force until April 2014. Because two years passed between the signing and implementation of the agreement, with many postponed implementation start dates, several U.S. and Russian news sources reported that illegal crab deliveries to Japan were heightened between 2012 and 2014, and that illegal crab flow would begin to shift to other countries with less stringent import requirements as a result of impending Japanese enforcement (RIA News 2013a; Undercurrent News 2014a; Stopcrabmafia 2014).²⁰ In addition, since April 2014, there have been reports of increased instances of Russian vessels poaching crab in Japan's EEZ, which indicates that Russian "vessels are apparently trying to shift fishing grounds for illegal catch into Japanese EEZ in an apparent bid to circumvent the reinforced surveillance by the Russian border police" (Seafood News 2014; see also Legal Information Service 2014).

In September 2014, as part of the implementation of their bilateral agreement and to harmonize their import and export procedures, Russia and Japan agreed upon mandating that legality certificates accompany live crab imports into Japanese ports. Certificates of legality will be mandated beginning December 10, 2014 (Fishkamchatka 2014c). Despite the fact that the extent to which various steps taken by Russia and Japan to implement their bilateral agreement cannot be evaluated fully, the progress that Russia and Japan have made since April 2014 indicates the willingness of both governments to tackle the illegal crab trade between the two countries.

¹⁹ In September 2012, during the Asia-Pacific Economic Cooperation (APEC) Summit in Vladivostok, Russia and Japan signed the "Agreement between the Government of the Russian Federation and the Government of Japan on the Protection, Efficient Use, and Management of Living Resources in the North East part of the Pacific Ocean and the Prevention of Illegal Trade of Living Resources."

²⁰ This is called "displacement" and is a common phenomenon when enforcement increases in one place and remains weak elsewhere.

United States

While Russian crab directly competes with Alaskan crab on the world market and in the United States, legal Russian crab helps maintain the supply of crab to the global market (Figure 9). In 2012, one fifth of the United States' imports of crab came from Russia, yet Russia customs data indicate no exports to the U.S. (Figure 7). One explanation of this trade discrepancy is described under the 'South Korea' heading of this section: Russian Customs might register crab as exports to South Korea, but South Korea is rather a stop-off port for crab that is ultimately going to the U.S. This type of trade is sometimes referred to as triangular trade, which means that products may stop-off at one or more intermediate ports before reaching their final destination.

While triangular trade is a legal trade practice (with no required harmonization of customs records between the various countries), it can provide opportunities for the mixing of legal and illegal products and laundering of illegal products. Furthermore, another plausible explanation for some of the

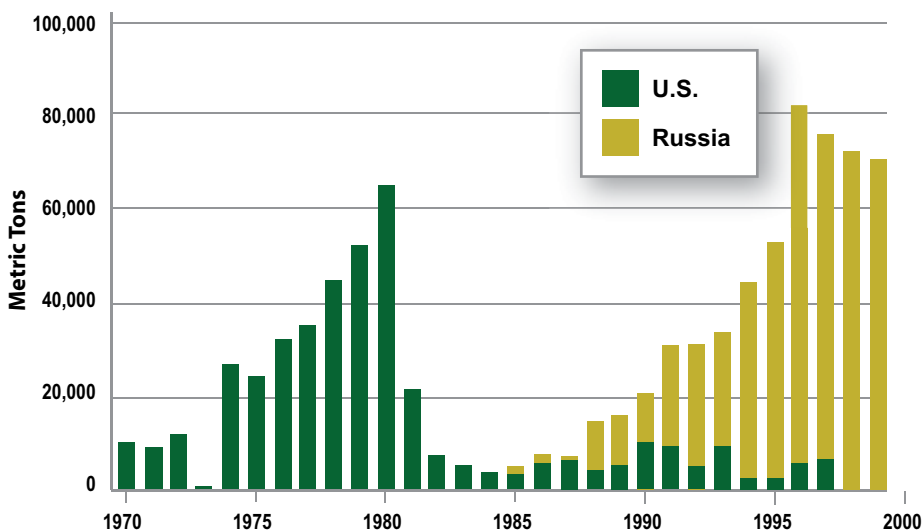
they might be purchasing illegal crab and unwittingly contributing to perpetuating these illegal activities.

To address the problem of illegal Russian crab, the Russian and United States governments have conducted official meetings for the last several years in order to develop a U.S.-Russian bilateral agreement for IUU, which would specifically address crab as well as other seafood. While no bilateral agreement has been signed between the two countries to address IUU, news coverage indicates that discussions periodically take place (most recently in September 2014 in Vladivostok, Russia) and the agreement is in the final stages of development (Undercurrent News 2013b; Fishnews 2013b; VNIRO 2012; NOAA 2011a).

Despite the lack of a specific bilateral agreement between the two countries, in 2013, Russia and the U.S. signed a Joint Statement that is not legally binding but does allow for information sharing regarding the biological resources of the Bering Sea more generally (NOAA 2013). Additionally, the U.S. Department of

Commerce, U.S. Coast Guard, U.S. Department of Justice, Department of Homeland Security, U.S. Department of State and U.S. Customs and Border Protection have worked closely with the Russian Coast Guard and other Russian enforcement officials to help successfully prosecute cases of illegal crab imports under the U.S. Lacey Act (See Box 2) (NOAA 2011b). Therefore, the U.S. and Russia have successfully collaborated in the past on specific investigations and enforcement cases. While the Lacey Act has resulted in some significant convictions for imports of illegally caught seafood, the fact is that prosecutors rely on outside information to initiate investigations, prosecutions are resource-intensive and border inspection of imports are extremely limited.^{21 22}

FIGURE 9
RED AND BLUE KING CRAB HARVEST, U.S. AND RUSSIA, 1970–1999



Source: Newell (2004, 53)

trade discrepancy is that part of U.S. imported Russian crab is illegal (see 'Trade Complexity' for further discussion).

If illegal Russian crab enters the U.S. market, it reduces the price of crab in the United States, which hurts the Alaska crab industry (APRN 2014; Carlton 2013; Hermann and Greenberg 2006). According to the Alaska Bering Sea Crabbers (2014), an industry association of crab harvesters, Alaska crabbers have lost an estimated \$600 million since 2000 due to the competition from illegal crab on the global and American markets. While there are news articles about Americans who might conclude to import illegal Russian crab into the United States (Box 9), U.S. consumers of king and snow crab are likely unaware

Unfortunately, overall diplomatic relations between the U.S. and Russia have recently deteriorated such that the U.S. Coast Guard (a branch of the U.S. military) is not allowed to meet with their Russian counterparts. This diplomatic barrier could be a serious detriment to joint IUU enforcement cooperation. Fortunately, other U.S. agencies are currently not barred from communicating or meeting with

²¹ U.S. Customs and Border Patrol officials inspect less than 2% of all imports of seafood and these inspections focus on species identification and food safety, not on identifying illegally caught fish.

²² As noted earlier, the 2011 U.S. Lacey Act case against Harbor Seafood, Inc. for importing \$2.75 million worth of Russian crab that was suspected to be illegal into the United States represented just 1.3% of the U.S.'s total crab imports from Russia in 2011.

BOX 9**A HIGH PROFILE INSTANCE OF ALLEGED ILLEGAL RUSSIAN CRAB IMPORTATION TO THE U.S.**

U.S. citizen and Bellevue, Washington resident Arkadi Gontmakher emigrated from Ukraine and in 1999 founded a U.S.-based import business called “Global Fishing” that became one of the top importers of Russian crab in the early 2000s. According to the Seattle Times, “in 2002, Gontmakher was involved in an extended legal battle over more than 144,000 lbs. [65 mt] of Russian crab, seized by National Oceanic and Atmospheric Administration (NOAA) fishery agents in Blaine, because it allegedly had been caught and transported in violation of Russian law” (Seattle Times 2011a). Nevertheless, Gontmakher’s company became the largest importer of Russian king crab into the U.S. and “sold \$147 million in king crab to American consumers” in one year (Seattle Times 2011c). In 2006, Global Fishing’s imports of Russian king crab exceeded U.S. harvest of king crab in Alaska.

The Seattle Times reported that Gontmakher became involved in another “high-profile criminal case that once reached from Moscow to Seattle, where the U.S. Attorney’s Office sought to gather evidence to help the Russian prosecution and in 2008 also launched its own grand-jury investigation of Gontmakher’s company.” (Seattle Times 2011a).

In 2007, while on a business trip in Russia, Gontmakher was detained by authorities, incarcerated for more than three years, and charged with “conspiring with a Russian partner to import some 50 million pounds [22.7 thousand mt] of illegally caught crab, worth about \$200 million, which was offloaded in South Korea and then shipped to the United States” (Seattle Times 2011a). Gontmakher noted “I was buying all my crab from a seafood warehouse in South Korea—after the Russians caught it, pre-processed it and delivered it there, with proper customs declarations, acceptance certificates and other papers proving the origin and legality of the product. I didn’t have any crab fishing ships, I was only a wholesale buyer.” (CNN 2010).

In December 2010, a 12-person jury in Russia’s Kamchatka Peninsula unanimously acquitted Gontmakher. Less than one week later “he was charged with an almost identical set of criminal violations,” which, according to a Russian senior investigator, included “(laundering the profits from selling) crab products in 2006-2007 fished in Russia’s exclusive economic zone, without having proper permission.” (CNN 2010).

Gontmakher had health problems and due to this as well as petitions the Russian government received from U.S. Congressional officials, Russia agreed to release Gontmakher so that he could seek medical treatment in Moscow (Seattle Times 2011c). Upon release, he disregarded Russian orders to remain in Russia and escaped to the U.S. in mid-February 2011. The Seattle Times noted that while “the businessman maintained his innocence, Gontmakher also was secretly under criminal investigation by U.S. authorities, who sought to assist Russian prosecutors.” (2011c).

For many Russians, Gontmakher remains in the public eye as he has subsequently sued Russian courts demanding financial compensation for the money he and his company lost as a result of his imprisonment in Russia. This issue remains sensitive in Russia, as the United States is seen as being complacent in its fight against illegal Russian crab entering the U.S. market. **Sources:** Seattle Times (2011a; 2011c), CNN (2010)

Russian colleagues, and discussions of the bilateral crab IUU agreement have continued to progress.

China

China plays a major role for other (non-crab) seafood imports from Russia (e.g., whitefish, salmon) and is heavily involved in re-processing and re-exporting many of Russia’s marine species (Clarke 2009). In December 2012, Russia and China signed a bilateral agreement to cooperate in preventing, deterring and eliminating IUU fishing and trade (Fishnews 2012; Vietnam Association 2013).

However, with respect to crab, only five percent of China’s crab imports come directly from Russia (3,800 mt or 8.4 million lbs., with a value of \$14 million in 2012) and there is no major trade discrepancy or anecdotal evidence that China plays a bigger role than official customs data indicate. The extent to which illegal Russian crab is shipped to China, either via direct trade, or via re-exports and transshipments is not discernable from currently available trade information.

With respect to the possibility that China plays a role in laundering Russian crab into the United States market (either via direct or triangular trade), the United States does import substantial quantities of crab from China (\$141 million worth of crab in 2012), most of which was processed crab meat. Of the \$141 million worth of U.S. crab imports from China in 2012, \$1 million was king crab (almost all as frozen crab sections) and \$25.5 million was snow crab (one-quarter of that was frozen crab sections, while the rest was processed and canned).²³ In the same year, China’s main suppliers of frozen crab were Canada (52%), United States (25%), Russia (7%), South Korea (5%), Chile (2%), and Argentina (1%); therefore, the catch location of the crab that the U.S. imports from China is unclear.²⁴

²³ The remainder (and majority) of the U.S.’s \$141 million crab imports from China in 2012 consisted of frozen and processed crab whose species are listed within HS Codes as either Chinese swimming crab, any crab within the *Callinectes* genus, or totally unspecified.

²⁴ The United States exports large volumes of Alaska-caught snow crab (\$103 million worth in 2012) and to a lesser extent king crab to China. The degree to which China is re-exporting Alaska crab or mixing it with other crab is also unclear.



Crab harvesting vessel on the rough and icy Bering Sea.

Trade Complexity

SECTION HIGHLIGHTS

Triangular trade, re-processing, and re-export are legal trade practices, yet can lead to supply chain murkiness and provide opportunity for mixing illegal and legal products or other seafood laundering mechanisms.

Photo courtesy of Josh Thomas

Triangular Trade – Crab Stop-off in Asian Ports before Coming to the U.S.

The international trade of crab, like the international trade of any primary commodity, is part of a larger system of global trade and shipping and is thus subject to the same trade norms and practices as other traded goods. Triangular trade or a trade route where goods are shipped through one or more countries en route to their final destination is a common global trade practice. In the case of triangularly traded crab, the seafood product might remain on board a vessel which simply stops off in a free trade and economic zone in a foreign port, or it may be offloaded, consolidated, and then re-loaded onto a different vessel that brings the product to its final destination. Triangular trade appears to be a legal trade dynamic that creates murkiness in a product's supply chain. This opacity can be compounded by mismatched customs data, as each trade partner could account for trade through this third country differently.

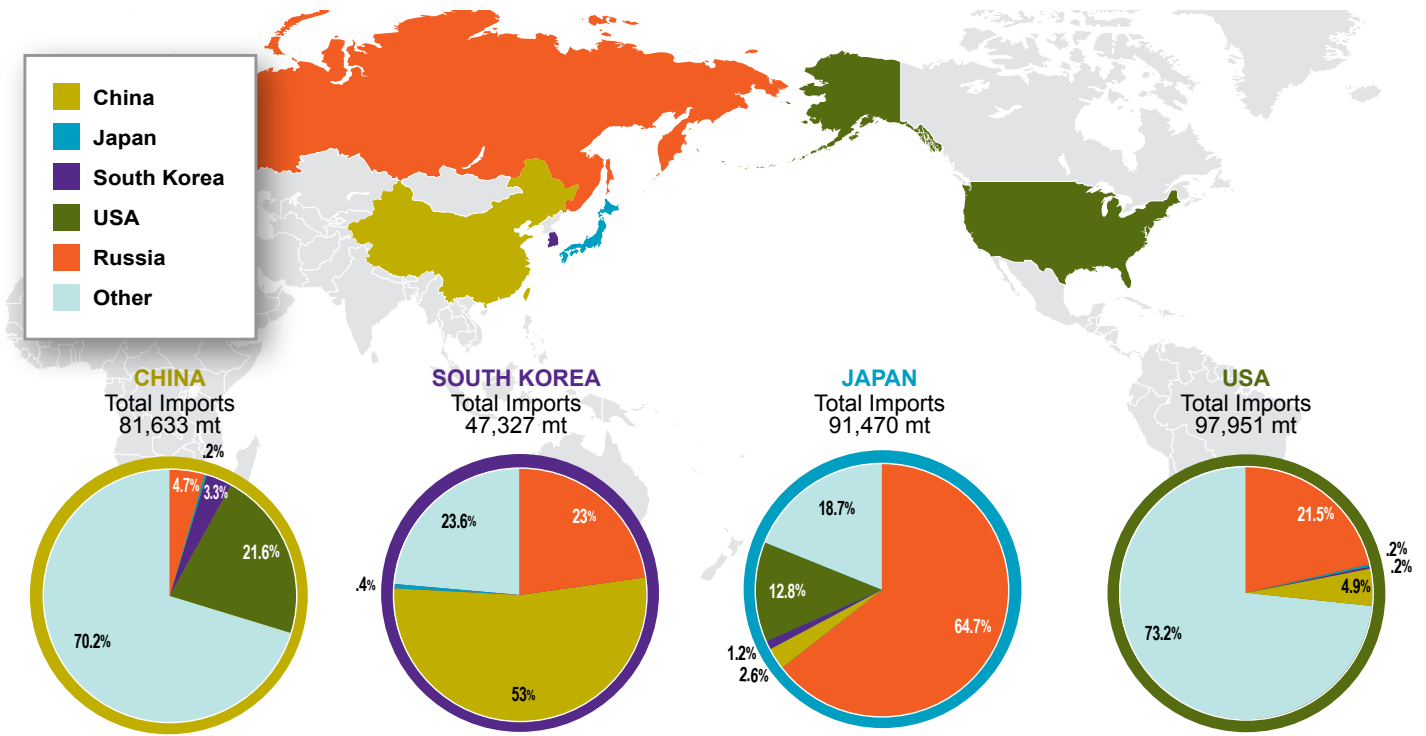
For instance, take the specific example mentioned in the previous section on Russia-South Korea, and Russia-U.S. trade data discrepancies. Russia's crab trade with the United States via South Korea illustrates triangular trade well. Indeed, Russia registered no exports of crab to the United States in 2012. At the same time, the United States registered 21% of its total crab imports as Russian origin in the same year. At least part of this trade discrepancy is likely due to triangular trade.

According to Russian Customs, in 2012, frozen and live crab exports were destined for South Korea (84.5%), Japan (7.5%), and China (0.4%).²⁵ Russia's TINRO Center (2014, 98 - 100) explains Russia's imprecise customs data accounting as well as why bilateral trade discrepancies exist and why the official documented trade partner as registered by Russian Customs might also be incorrect:

The Country of Export for [Russian] Federal Customs Statistics counts the country that is indicated on the 'Customs Cargo Declaration.' In reality, products having passed through Customs in Russia may be sent not to the country that was indicated by the Customs Cargo declaration, but to a different country. For example, in the Customs Cargo Declaration it indicates that the destination country for exports is South Korea. But the products may be sent directly to Japan (or to a different country). Moreover, products may be delivered to South Korea in compliance with the Customs Cargo Declaration. But the cargo then transits to, for instance, the U.S.A. or Japan. In this case, products wouldn't be counted in the statistical imports of South Korea, but instead would be counted as imports from Russia in that country, where the procedures of import are performed (in this case, either U.S.A. or Japan).

²⁵ According to Russian Customs, in 2012, Russia's only other remaining live and frozen crab exports went exclusively to the Netherlands (7.2%) and United Kingdom (0.5%) and negligible quantities of live crab went to Italy and France.

FIGURE 10
PACIFIC RIM CRAB IMPORTS BY CHINA, SOUTH KOREA, JAPAN AND THE U.S. IN 2012



Data Source: Global Trade Atlas (2014)

This is particularly problematic for supply chain traceability because vessels whose final destination is the U.S. often list Asian ports, such as Wakkanai, Japan and Busan, South Korea, as intermediate ports in their U.S. customs declarations.²⁶ Many of these ports are notorious for their complicity and contribution to the laundering, storage and shipment of illegal crab into the global supply chain. Each node of the supply chain could be an opportunity to launder crab, with the primary questionable nodes for U.S. imports of Russian crab being South Korea and Japan. Once Russian illegal crab is laundered into the legal supply chain of crab, it would appear in official trade statistics; however, imports may not be registered to the correct trade partner. Figure 10 indicates the registered origin of aggregated live and frozen crab imports by China, South Korea, Japan and the United States in 2012.

Triangular trade adds complexity to trade routes, yet it can be entirely legal. Product traceability systems could serve to make this complexity transparent to traders, buyers, governments and consumers (see Recommendations).

²⁶ WWF has a subset of fine-scale United States Customs crab import trade data for the years 2007-2013. These Customs records include U.S. companies' imports of Russian crab and indicate that South Korean and Japanese ports are commonly listed as 'Ports of Departure,' even though the commodity itself is listed under the commodity description as 'Russian crab.'

Re-processing and Re-export

A common practice in the global trade of primary commodities is to process and thus substantially alter an original product (for example, process frozen crab into canned crab) and then re-export that product in its converted form. This secondary processing, where the product is altered and then re-exported, can also contribute to the murkiness of the supply chain. It also provides the opportunity to mix legal and illegal crab, or re-label, re-package or otherwise launder illegal crab to make it appear legal. For U.S. imports, re-processing and re-export also serve to obfuscate the country of catch because U.S. Country of Origin Labeling rules do not require this information for processed seafood.

While re-exports are common practice in the global system of international trade, it is unclear to what extent these multi-country value chains facilitate the entry of illegal product into international commerce. Certainly these practices and the reporting discrepancies and supply chain murkiness that they create make supply chain traceability and other anti-IUU initiatives difficult to implement and enforce. What is known is that illegal crab enters the supply chain but legal and common trade practices make the detection of illegally harvested products extremely difficult. However, comparisons of official trade data from each country can be used to help decipher where crab laundering may be taking place.

Estimation of Crab IUU

SECTION HIGHLIGHTS

During the past decade, WWF estimates illegal crab harvest ranged from approximately 1.7 to 4 times the legal harvest limit. This is seen in the trade data, and WWF's estimates are on par with other illegal crab harvest estimates. After analyzing trade data for king crab specifically, WWF estimates that U.S. and Japanese imports of Russian king crab were approximately double the legal Russian TAC in 2010-2012.

Frozen, whole red king crab at market.

© WWF-US / Heather Brandon

Method for Estimating IUU and Data Limitations

The methodology widely used to determine IUU estimates is to identify the differences in receiving countries' official customs import volumes and compare that to official data from the country of export (TAC, harvest/catch/landing data or export data) (Willock 2004). One must also take into account domestic consumption, but in this case, it has been documented that the domestic consumption of crab is low which means that Russia exports most of its crab harvest (TINRO 2014). This enabled WWF to compare crab import data to official harvest amounts and Russian export figures.

Estimates of IUU activity typically involve bilateral country-to-country trade data. For reasons demonstrated above, however, related to the inaccuracies and complexities of trade routes in the Asia Pacific Region, country-to-country comparisons of trade data are not reflective of the true multinational trade routes for crab. For this analysis, aggregated trade data from Russia's main crab trade partners were used.²⁷ Therefore, import data was used from the following four countries: Japan, South Korea, China and the United States. Live and frozen crab imports from Russia were aggregated and

then compared to Russia's TAC and officially reported (legal) harvest/catch data for all crab species.²⁸

The difference between Russia's crab catch (harvest) or export quantities and the collective imports of receiving countries cannot be entirely labelled as illegal product. All international trade statistics contain discrepancies. With respect to bilateral trade, one country's reported exports are rarely identical to its trading partner's reported imports of that product. Some factors that lead to trade discrepancies are normal (legal) and have justifiable explanations, while others are abnormal and can be the manifestation of illegal, unreported or unregulated harvest and trade. There appears to be little research into the underlying causes of international trade discrepancies in the seafood sector, and there is an absence of what might be considered a 'normal' trade discrepancy, or of ways to account for factors other than illegality that contribute to trade discrepancies.²⁹ Given this lack of understanding, WWF's estimate of illegal crab volumes reflects total observed trade discrepancies and may be somewhat overestimated.

²⁸ In order to sum frozen and live crab imports, a conversion ratio was used that assumes the frozen weight is, on average for all crab species, 60% of the live weight. This is the same conversion ratio for live (round) weight equivalent for crab that is used by TINRO.

²⁹ This necessary, but missing, depth of understanding of the international trade of seafood is an obvious recommendation for further research and an oversight of current IUU seafood research at-large. In this regard, there is much to be gained by looking at the problems and research related to the international trade in other primary commodity sectors. For example, Eastin and Perez-Garcia (2003) sought to better understand trade discrepancies in forest products and might be used as a foundation in parallel research for interpreting normal and abnormal reasons for discrepancies in seafood trade data.

²⁷ Even though Russia does register some frozen crab exports to the United Kingdom (0.5% of Russia's total live weight equivalent metric ton weight for frozen and live crab), and miniscule live crab exports to France and Italy, these markets are not considered Russia's primary trade partners.

TABLE 3
RATIO OF AGGREGATE IMPORTS BY JAPAN, UNITED STATES, CHINA, AND SOUTH KOREA TO RUSSIA’S TAC (1) & HARVEST (2)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Imports / TAC - WWF (1)	1.86	1.99	1.97	2.11	2.40	2.63	2.45	2.38	1.86	1.96	1.64	1.66	1.93	1.38
Imports / Harvest - WWF (2)	2.07	2.46	2.63	3.21	4.01	4.26	4.35	3.83	3.10	3.27	2.14	1.97	2.15	1.69

Data Sources: TINRO (2014; 2013; 2011), Russian Federal Fishery Agency –TAC (2014), Russian Federal Fishery Agency –Harvest Data (2014), Global Trade Atlas (2014)

There are various sources of TAC³⁰, production (legal or official harvest/catch)³¹ and export data³² for Russian crab with no single source being comprehensive enough to supply all three sets of data. Ideally, for purposes of analysis, the TAC levels, production levels and levels of trade would be reported in a way that could allow for comparison. The following variables affect the resolution (specificity) of data:

- a) TAC or harvest area reported by incongruous regions (for instance, United National Food and Agricultural Organization [UN FAO] zones vs. Russia’s harvest zone jurisdictions).
- b) Species specificity between datasets (for instance, records are kept by genus and species for TAC, but Russia’s harvest data are aggregated whereas trade data use Harmonized System (HS) codes that are different for each country).
- c) Incomplete documentation of trade partner chain (i.e. a country’s Customs department registers the product being exported to one country, while the Customs department of the actual importing country registers the product as imports from a different country).
- d) Poor HS Code specificity in trade data (global standards require identical nomenclature through the first six digits of an HS code. Countries are required to assign two more digits [not required to be globally standardized], for a total of eight digits at the tariff-rate line level. Countries can elect to assign two more digits [for a total of ten digits] if it is warranted). See the Appendix for a detailed evaluation of crab-specific HS codes used by Russia and its primary crab trade partners.

For this analysis, data were compiled for all Russian commercial crab species for several reasons. First, WWF was only able to obtain Russian catch data that had been aggregated to all crab (i.e. not species specific). Second, with regard to trade

data, not all importing countries specify more than the six-digit HS code. Without the utilization of the total available ten digits of an HS code, species specificity cannot be discerned. Third, there is a discrepancy in the common and scientific names of crab species used by each country. Finally, TINRO identifies that illegal fishing is present in all of Russia’s commercially valuable crab fisheries, including bairdi, opilio, and Japanese hair crab (TINRO 2014; 2013; 2011).

Estimation of Illegal Crab Amounts (All Crab Species)

This WWF report provides an estimate of potential Russian crab IUU based on analysis of trade data discrepancies of select reporting countries’ imports of Russian crab compared to Russia’s total allowable catch (TAC)—identified by WWF (1), and select reporting countries’ imports of Russian crab compared to Russia’s official harvest catch of crab—identified by WWF (2) (Table 3).

Table 3 lists the number of times crab may have been harvested beyond the TAC or legal catch amount. In 2013, reported Russian crab imports by South Korea, Japan, China, and the United States exceeded Russia’s TAC by 38 percent, and exceeded Russia’s officially reported legal crab harvest by 69 percent.

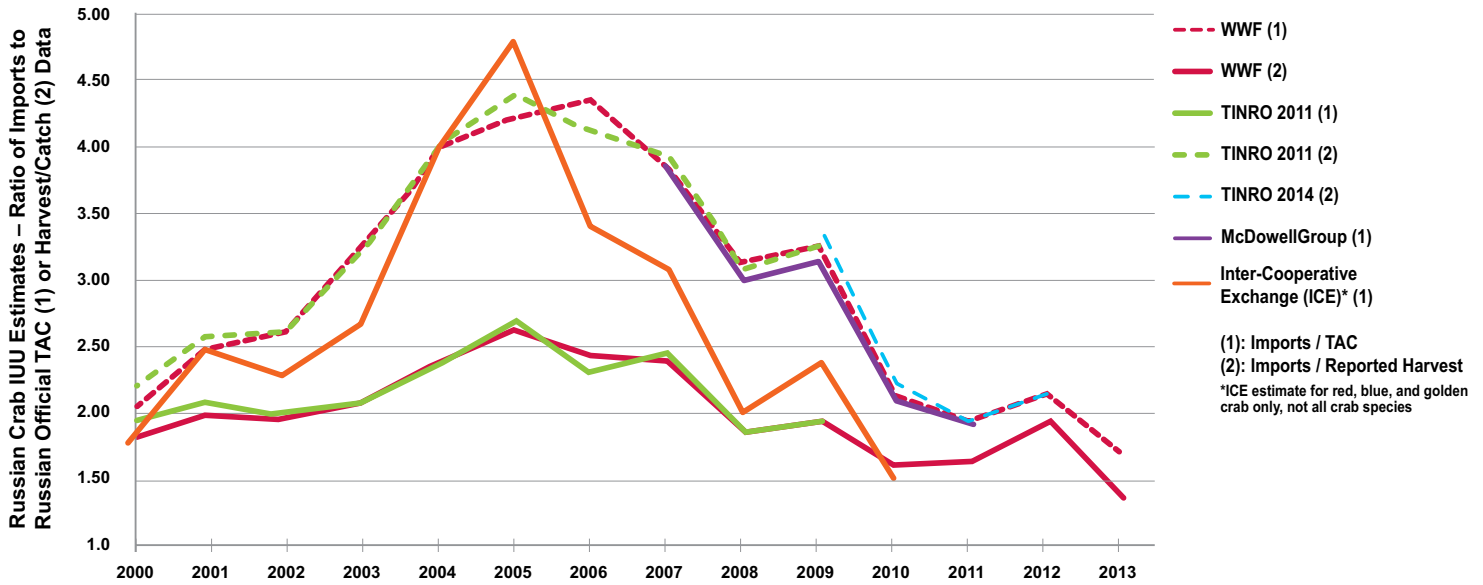
These overages (i.e., the number of times aggregated import data exceed Russia’s data) can then be compared to other sources’ estimates of trade discrepancies regarding Russian crab overharvest and potential IUU. The utility of comparing aggregated imports to both of Russia’s domestic crab industry indicators is to establish a plausible range of illegal crab volumes. Figure 11 shows the above WWF estimates for crab overexploitation are within the range of other sources’ estimates for Russian illegal crab catch.

³⁰ Russian TAC data (including adjustments) was compiled from TINRO (2014) and Russian Federal Fishery Agency – TAC (2014).

³¹ Russian official harvest/catch data were compiled from Russian Federal Fishery Agency – Harvest Data (2014).

³² Trade data were compiled from Global Trade Atlas (2014).

FIGURE 11
VARIOUS ESTIMATES OF DISCREPANCIES OF IMPORTS OF RUSSIAN CRAB VS. RUSSIAN TAC/ HARVEST, 2000-2013



Data Sources: TINRO (2014), McDowell Group (2012), Inter-Cooperative Exchange (2011)

Estimation of Illegal King Crab (Four Species)

In order to establish an estimate for Russian king crab over-harvest, only a subset of the trade data could be used without aggregating HS codes from various countries. Only Japan and the United States have relatively well-defined HS codes beyond the six-digit level.³³

However, comparing Japan and U.S. import statistics for ‘king crab’ is still problematic; while two out of the three species (red king crab and blue king crab) are both contained within each country’s HS code, each country’s classification of this particular HS code also contains one additional species of crab that is not contained in the other’s classification.³⁴

³³ While South Korea does have a ‘king crab’ eight-digit HS code classification for its frozen crab (03061420), it does not have one for live crab, and it is evident looking at trade data that there are king crab that likely end up in the ‘other crab’ HS code classification, thus making comparative analysis with South Korea difficult.

³⁴ Specifically, at the eight-digit level Japan’s HS Code classification 03061401 (frozen) and 03062411 (live) is designated as ‘king crab’ (*Paralithodes* spp.) and thus contains the three species of crab that are within the *Paralithodes* genus. Meanwhile, the United States, at the ten-digit level of HS Code classification, reports frozen king crab (0306144010) and does not specify a genus. In the United States, three species are most often classified under ‘king crab’: two in the *Paralithodes* genus (red and blue king), and one in the *Lithodes* genus (golden king), so we assume that these three species are recorded in the U.S.’s ten-digit HS code 0306144010.

Comparing Japanese and United States’ imports of these subsets of ‘king crab’ to the aggregated Russian TAC level for the identical subsets of species allows for consistent analysis.³⁵ Table 4 highlights the number of times each country has imported the ‘king crab’ subset in excess of Russian legal TAC quantities. It is important to remember that each analysis is separate from the other and considers Russia’s total TAC for the species indicated. The analysis assumes that Russia is only exporting crab to one country, either Japan or the United States, but not both together. The numbers in Table 4 cannot necessarily be added together, but when considered together in context, these numbers indicate that imports of “king crab” by Japan and the U.S. far exceed the Russian TAC.

The excess level of imports presumes that Japan is the only importer of those select species, which in practice is not the case given that the United States also imports two out of the three species in high quantities. For example, in 2012, Japan imported twice the legal TAC level of red, blue and spiny brown crab from Russia, and in the same year, the United States imported 88% of all of Russia’s TAC for red, blue and golden king crab. Although these two numbers (2.07 and 0.88) cannot be added together, these numbers show that king crab is likely exploited between two and three times the TAC in 2012.

³⁵ TAC is used for this analysis because no species-level harvest/catch data could be obtained.

TABLE 4
RUSSIA-JAPAN (TOP) AND RUSSIA-U.S. (BOTTOM)
BILATERAL COMPARISON OF OFFICIAL IMPORT DATA
COMPARED TO RUSSIAN TAC

	2010	2011	2012
Live weight equivalent metric tons of Japan's Imports of <i>Paralithodes</i> spp. (3 species: red, blue and spiny brown) / Russian TAC for those 3 species	1.08	1.3	2.07
Live weight equivalent metric tons of USA's Imports of <i>Paralithodes</i> spp. (3 species: red, blue and golden) / Russian TAC for those 3 species	1.15	1.02	0.88

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

Crab harvesting vessel
on the Bering Sea.

Photo courtesy of Josh Thomas

Conservation Impacts of Crab Overexploitation

Bering Sea crab boat.

SECTION HIGHLIGHTS

Crab in the Russian Far East is at risk of collapse due to the overharvest caused by illegal fishing. Recently, the red king crab fishery in West Kamchatka was closed for five years to allow for rebuilding. Continued illegal overharvest could result in the severe decline of crab stocks in the Russian Far East.

Photo courtesy of Josh Thomas

Crab Management Overview

Russian Far East crab stocks are assessed through scientific trawl surveys (typically performed annually), and stock assessment models from regional research institutes (including TINRO) combined with fishery dependent (catch) data the TACs are set for each sub-zone. Historically, Russia's TAC setting process left incentive for fisheries scientists to take bribes and thus the TAC levels were not necessarily based on science (Thorsteinson 2011; Allison 2002).

Currently, the TAC setting process results from a scientific estimation of a maximum sustained yield based on crab stocks' dimensional structures, calculated total biomass and numbers of females, males and recruits (juveniles). The fishing mortality rate (the rate at which crab are removed from the stock by harvesting) is set at or below 20% in stable populations, and is reduced to 10% in rebuilding populations. In calculating harvest limits, illegal harvests are taken into account, yet no additional information is available regarding how estimations of illegal harvest are made or are taken into account (Korostelev 2014).

Since the break-up of the Soviet Union in 1991, the Russian government has repeatedly modified the allocation processes. In the early 2000s, Russia began granting quotas (shares of the total TAC, by species) to individual companies for a period of five years based on each company's prior three years of catch volumes (Thorsteinson 2011). Companies harvest this quota using vessels that are either company-owned or leased. The duration of quota shares was altered in 2008 to ten years. The most recent ten-year quota allocation, 2009-2018, specifies which companies have fishing quotas by species and fishing sub-zone (Russian Federal Fishery Agency 2008).

Overharvest

The most direct negative biological impact of the illegal crab fishery in Russia is overfishing. Based on trade data, WWF estimates that the illegal crab harvest amount has been at least double, in some years quadruple, the legal harvest amount. Depending on the year, red king crab is harvested at a rate between one to almost three times over the TAC; snow crab (*opilio* and *bairdi*) is similarly overharvested (TINRO 2014). Long-term overharvest can be seen in the trade data for the past decade (see Figure 1).

Excessive removal of male crab can skew the sex ratio, making it impossible for the few remaining male crab to fertilize the much higher number of female crab. Sex ratio disparity is thought to have contributed to the collapse of the Kodiak red king crab fishery (Bechtol and Kruse 2009; Juneau Empire 2007).

Susceptible Crab Aggregations

Characteristics of adult red king crab (age 8 to 30 years) can be exploited (or overexploited) by harvesters. Juvenile and adult crabs seasonally migrate and congregate for protection from predation (juveniles), to inhabit preferred habitat, and to mate (adults) (Ivanov 2002). All crab harvesters target known crab aggregations to ensure a high catch-per-unit effort (CPUE). Because of this aggregating tendency, the CPUE for crab could remain stable while the abundance and range of a crab stock shrinks (Erisman et al. 2011). Hyperstability, as this is called, is one reason why catch data alone is not a good indicator of crab abundance or the health of a stock (Rose and Kulka 1999).

All legal crab harvesters target known adult male aggregation areas. Illegal harvesters target these areas also whether or not they are closed to the legal fishery. The West Kamchatka sub-zone, the area that once had the highest abundance of red king crab in the Russian Far East, was closed for five years (2008 through 2012) due to conservation concerns. Illegal harvesters may have crabbed in this area during the closed period, which may have slowed the rebuilding of that stock.

Reduced Crab Fecundity

In the legal Russian crab fishery, the harvest season is September 1 to December 31. Female and juvenile crab cannot be retained. To facilitate maximum reproduction, females are not harvested (one male can mate with multiple females so it is believed that males can be harvested without lowering a population's reproductive potential). Females and juveniles are also typically smaller and therefore of lower market value.

The illegal crab fishery is not confined by these Russian harvest rules. Japanese port-landing records include Russian-origin female and juvenile crab, as well as year-round live crab landings, illustrating that Russian fisheries management policies established to protect crab reproduction may be ignored by illegal harvesters to the detriment of crab stocks (Karaivanov 2012).

Regime Shifts and Food Web Instability

King crab, being very large, are major predators, scavenging along the ocean floor for bivalves and other epibenthic biota. This scavenging behavior stirs up benthic sediments. Crab and crab larvae are also preyed upon; Pacific cod is the main predator of red and blue king crab (North Pacific Fishery Management Council 2011). Overexploitation of king crab in the Russian Far East could have food web impacts such as an increase in epibenthic fauna abundance or a decrease in cod abundance, although these indirect impacts are not known.

Persistent overexploitation of a top benthic predator has caused regime shifts in other marine ecosystems, such as excessive removal of cod in the North Atlantic (Frank et al. 2005). Similarly, the red king crab fishery around Kodiak Island in Alaska experienced overexploitation and a climate regime shift simultaneously, which caused the crab population to crash and fail to rebuild (Bechtol and Kruse 2009). Red king crab was so heavily exploited in the 1970s around Kodiak Island that the sex ratios were likely skewed, which decreased reproduction and recruitment. At the same time, the North Pacific experienced a larger climatic shift, which brought warmer waters to the area, creating favorable conditions for Pacific cod, which prey on juvenile crab. Overharvest, combined with an external factor (a period of warmer water), resulted in a regime shift where crab was no longer abundant enough to sustain a commercial crab fishery. Time and area closures were not effective in reversing the decline; the fishery was closed in 1983. The Kodiak Island red king crab fishery did not rebuild, and there is no commercial fishery today.

Detrimental Fishing Behavior Driven by Market Pressure

External market forces drive the behavior of illegal crab harvesters (see Box 10 on Japanese horsehair crab). These external market forces include demand for large crab (live) and crab legs (frozen), demand for clean shelled (no/few barnacles or scratches, marks or missing claws) crab and crab legs (both live and frozen), and demand for crab around the Christmas and New Year holidays (live and frozen). Illegal crab harvesters probably prefer to harvest large crab (usually male) and clean-shell crab because they fetch the highest price.


High-grading for these more desirable individuals likely occurs in the illegal crab fishery and may also occur in the legal crab fishery (on-board observer coverage in the legal Russian crab fishery is 3 to 5%). High-grading is problematic because large female crab are the most fecund (have the most eggs) and will only mate with large males. If body size has a heritable component, selective removal of the largest individuals (male or female) will result in evolution of the population toward smaller mean body size and the loss of genetic diversity (Allendorf et al. 2004).

In summary, crab in Russia's Far East is almost certainly being overfished and has been overfished for ten or more years. Due to illegal fishing, the Russian Far East crab fishery is at risk of not leaving enough males for mating, depleting lucrative crab aggregations and local populations and failing to protect closed areas from harvest pressure. Overharvest resulted in the closure of the red king crab fishery in the West Kamchatka harvest sub-zone for five years. Continued overharvest could result in the collapse of crab stocks in part or all of the Russian Far East, could alter the ecosystem and food web systems within that same range and crab could become scarce for human consumption and predators alike.

BOX 10

JAPANESE HORSEHAIR CRAB: AN EXTREME EXAMPLE

While historically red king crab has been the most valuable crab species in Russian waters, there is high demand for many of Russia's other crab species, and thus all crab species face pressures related to IUU fishing. Foreign imports of most of Russian crab species greatly exceed Russia's own official TAC and production. For instance, Russia's TAC for Japanese horsehair crab (*Erimacrus isenbeckii*) has recently been low at 90-471 mt (198 thousand to 1 million lbs.), but the Japanese horsehair crab is in high demand in Japan and thus Japanese imports exceeded Russia's official TAC by 24.8 times in 2010. Importantly, TINRO acknowledges that high rates of IUU fishing persists for all Russian crab species and is prompted by the high demand, and hence high market value, for Russian crab, particularly in Japan and the United States. **Source:** TINRO (2014)



A full crab pot being pulled up from the bottom of the sea to a crab boat for harvest.

Recommendations

Photo courtesy of Josh Thomas

The illegal harvest of Russian crab is of major international concern. This WWF report shows that Russian crab continues to be harvested at unsustainable levels due to the continued prevalence of illegal crab fishing in Russian waters. In addition to documenting the scale of Russian illegal crab catch and the attempts of bilateral agreements to deter illicit activities, Boxes 2-10 highlight specific examples of illegal crab fishing which, taken together, show that illegal harvesting of crab continues to be a problem both in the Russian Far East and in the Barents Sea, and is perpetrated both by Russian nationals and foreigners.

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. As this WWF report shows, without accurate assessments and control of IUU activity, Russian crab populations could be susceptible to catastrophic decline. This precarious situation needs immediate attention and multilateral action.

WWF encourages those involved in the management, harvest, policy, trade and consumption of crab to take action and insist that crab be traceable to verifiably legal sources. In order to achieve this goal, WWF recommends the following:

FOR LEGAL RUSSIAN HARVESTERS

The Far East Crab Catchers Association publically speaks out against the illegal crab fishery on behalf of its members.³⁶ The Association and its constituent companies should continue to advocate for more stringent protocols and regulations in order to eradicate IUU fishing and related corruption from the industry. The Association is also contemplating Marine Stewardship Council (MSC) certification, which would provide a thorough third-party assessment of stock health. Additionally, MSC Chain of Custody certification would provide assurances to buyers and consumers of product source and legality.

- **Harvesters should join the Far East Crab Catchers Association to bolster support and lobby for reform.**
- **The Far East Crab Catchers Association should attempt to become MSC certified.**

FOR U.S. AND JAPANESE IMPORTERS/BROKERS/BUYERS OF RUSSIAN CRAB

FOR U.S. BUYERS - Under the Lacey Act, the responsibility of legality lies with the importer, and thus importers should use due diligence to determine the provenance and supply chain of crab. Buyers should not only insist that they need to see verified documentation on the location of catch (not just place of

³⁶ The Far East Crab Catchers Association is currently led by Aleksandr Pavlovich Duplyakov.

landing/export) from their suppliers but also conduct site visits with their suppliers.

FOR JAPANESE BUYERS - Under the bilateral agreement and the foreign exchange laws, importers are responsible for eliminating illegal Russian crab from the Japanese seafood market (Japan Fisheries Agency 2014). Companies should ensure supply chain legality and should support their suppliers to move towards sustainable production.

FOR BOTH U.S. AND JAPANESE BUYERS

- **Require the correct documentation, including catch certification.**
- **Support the establishment of transparent traceability systems for all seafood, including crab.**
- **Support MSC certification of crab harvesters.**

FOR THE RUSSIAN GOVERNMENT AND RUSSIAN FEDERAL FISHERY AGENCY

The Russian national plan for addressing IUU should be implemented. Catch/Harvest documentation should contain information on the specific species and specific zone (or sub-zone) of the origin of catch, in addition to listing the place of landing/export. It is unknown whether daily catch reports include this level of detail because they are not publicly available. This information and the daily catch reports should be made publicly available so that anyone can verify the daily vessel reports and importers of Russian crab can verify the legality of their crab imports.

- **Improve quota and landings documentation and make the information available to the public for verification.**
- **Require all legal crab vessels to regularly broadcast a signal that can be monitored by satellite, and monitor signals as an enforcement mechanism.**
- **Seek improved partnerships between agencies to implement Russia's national plan of action to combat IUU fishing.**
- **Introduce a new law that makes it an offense for Russian nationals (citizens and companies) to be involved in IUU activities, regardless of the flag state of the fishing vessel or support vessel involved.**

FOR THE U.S. GOVERNMENT

The Presidential Task Force on Combating Illegal, Unreported and Unregulated Fishing and Seafood Fraud should recommend the creation of, under current law, a globally harmonized and comprehensive system to ensure that all seafood sold in the United States is fully traceable to verifiably legal sources.

Such a system should be capable of addressing Russian illegal crab as well as other IUU fishing activities. A final system of verifiable traceability and proof of legality should be built to help streamline existing import and food safety requirements and processes, should mirror the data transmission requirements that already apply to U.S. domestic fishermen, should be flexible enough to withstand the passage of time and should encourage industry innovation. A system for verifiable traceability and proof of legality should incorporate the following concepts: catch documentation and traceability requirements for all seafood sold in the U.S., adequate digital tracking and/or recordkeeping, refusal of entry for all seafood products that fail to provide evidence of legal origin, and a verification system structured around risk-based and random audits. The President should adopt such recommendations following the Task Force submission and should direct relevant agencies to promulgate regulations, through a public process, to meet basic system objectives.

- **Presidential Task Force on IUU Fishing and Seafood Fraud recommends, and President Obama adopts, a comprehensive system based on concepts of proof of legality, traceability, and verification to ensure that all seafood sold in the United States is fully traceable to verifiably legal sources. Task Force agencies then promulgate regulations to meet system objectives.**

FOR THE JAPANESE, SOUTH KOREAN, AND U.S. GOVERNMENTS

Bilateral agreements may be a productive starting place, but based on the connectivity of trade between Russia, Japan, South Korea and the United States, it is imperative that a multi-lateral working group and initiative be adopted among the four countries. This multilateral initiative could be used to create a unified system throughout the Pacific Rim for all Russian crab importing countries, consistent and harmonized with existing, relevant systems in those individual countries.

- **Establish an IUU initiative between Russia, South Korea, Japan and United States specifically to address IUU crab as an immediate short-term measure and adopt harmonized regulations as a longer-term goal.**
- **Require seafood imports, including crab, to show verifiable evidence of legality, supported by digital tracking and/or recordkeeping.**

FOR ALL GOVERNMENTS

Government agencies should appeal to the World Customs Organization (WCO) to require more increased harmonization for products, like crab, that are nearly impossible to track to the species-level with only the required eight-digit code (of which only six-digits are harmonized). Two implications arise with regard to HS codes for crab:

Crab is particularly problematic due to the fact that there are multiple species of crab that are often combined under common names (i.e. 'king crab' often includes three species in the U.S., see Appendix). Given that the first division within the HS code system is to have a frozen/live split, this takes up all of the six-digits required to be harmonized (030614 for frozen crab and 030624 for live crab). If two more digits were required to be harmonized (eight total), then the seventh and eighth digits could be used to enumerate all crab species around the world individually by genus and species (if there are less than 99 species around the world).

Having species-level harmonization codes requires inspectors, customs officers, law enforcement and others involved in the movement of the specific goods to be trained to identify with high accuracy the given product. Relevant governments should understand these limitations and advocate for increased funding for the training of its public servants to deal with all illegal seafood.

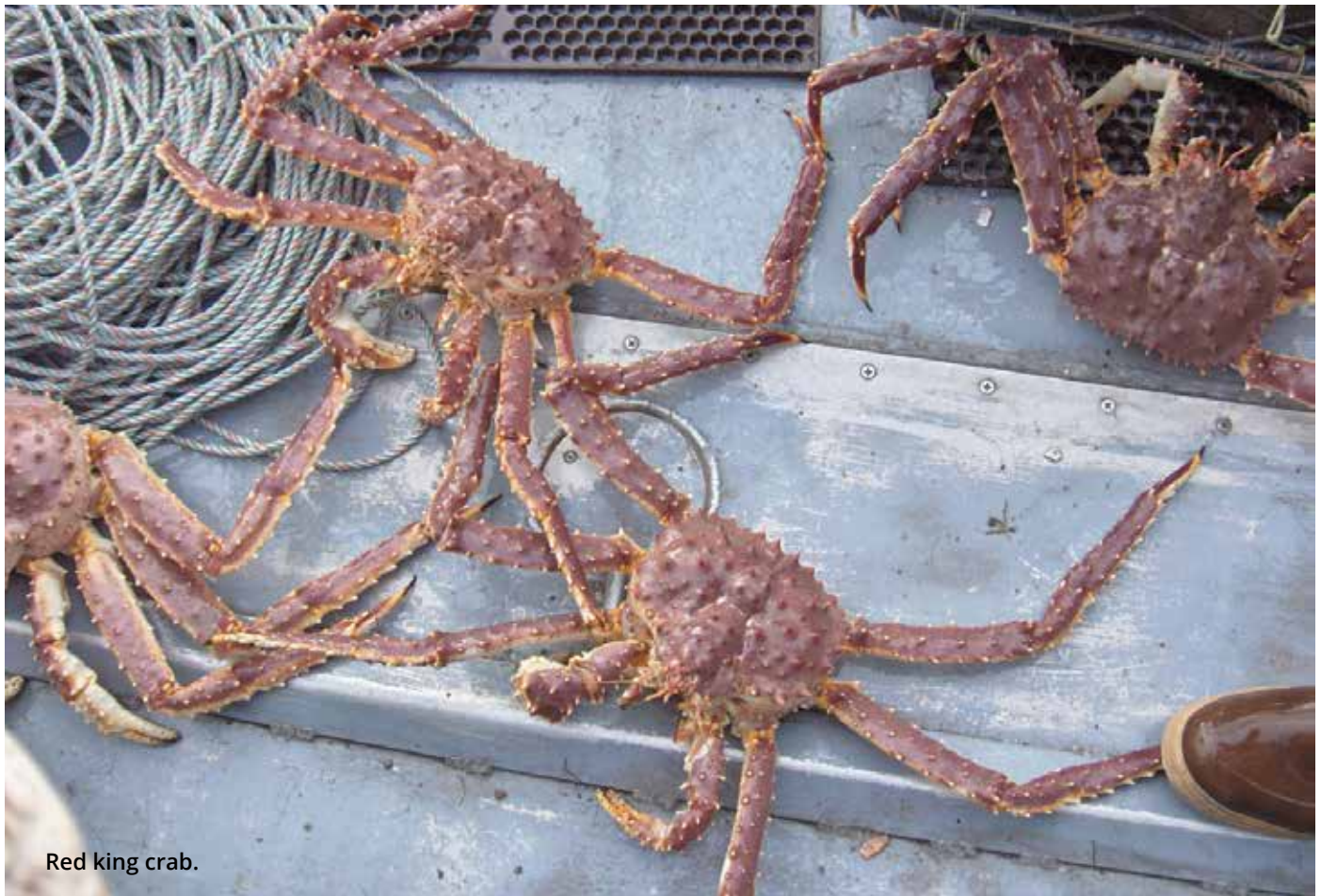
- **Improve Harmonization System (HS) Codes for all North Pacific crab as well as for other fish and seafood species that indicate large trade discrepancies between trade partners and are also suspected IUU fisheries.**

- **Share trade data (imports, exports, forecasts, and TACs).**
- **Share enforcement intelligence in real time, including vessel movements.**
- **Harmonize more than the trade codes between countries: harmonize appropriate laws, vessel markings, recording of vessel movements, etc.**

FOR CONSUMERS OF KING AND SNOW CRAB:

Consumers of crab should inquire about the origin of crab and, if it is Russian crab, ask the supplier about the measures taken to ensure its legality.

- **Buy and eat only legal crab, and ask for verification of legality.**
- **Lobby your government to require that country of catch information on all seafood (processed and fresh), including crab, be available to consumers.**



Red king crab.

References

- Agrobel. 2007. "Ministry of Agriculture banned the export of live crab beyond the Exclusive Economic Zone of the Russian Federation" (in Russian). May 30. Agricultural Portal of Belarus (Agrobel). <http://www.agrobel.by/ru/node/6724>
- Alaska Bering Sea Crabbers. 2014. "99 million lbs. illegal Russian crab affects American Jobs" (pamphlet). 5470 Shilshole Ave. NW, Suite 505, Seattle, WA 98107. www.Alaskaberingscraabbers.com
- Alexander, Kristina. 2014. "The Lacey Act: Protecting the Environment by Restricting Trade." United States Congressional Research Service (CRS) Report 7-5700, R42067. <http://fas.org/sgp/crs/misc/R42067.pdf>
- Allendorf, F. W., P.R. England, G. Luikart, P.A. Ritchie, and N. Ryman. 2008. "Genetic effects of harvest on wild animal populations." *Trends in Ecology and Evolution*. Vol. 23, No. 6: 327-337.
- Allison, Tony. 2002. "The Crisis of the Region's Fishing Industry," in *Russia's Far East: A Region at Risk*, eds. Judith Thornton and Charles E. Ziegler, 139-164 (Ch. 6). Seattle: University of Washington Press.
- APRN. 2014. "Senate Considers Treaties to Go After Fish Piracy" 12 February. Liz Ruskin for Alaska Public Radio Network (APRN). <http://www.alaskapublic.org/2014/02/12/senate-considers-treaties-to-go-after-fish-piracy/>
- Barents Observer. 2014. "Snow crabs have found niche in Barents Sea ecosystem." March 12. <http://barentsobserver.com/en/nature/2014/03/snow-crabs-have-found-niche-barents-sea-ecosystem-12-03>
- Bechtol, W.R. and G.H. Kruse. 2009. Reconstruction of historical abundance and recruitment of red king crab during 1960-2004 around Kodiak, Alaska. *Fisheries Research* 100: 86 – 98.
- Border Guard of Kamchatka Krai. 2014. "Communication of Public Relations of the Russian Border Guard of Kamchatka Krai" (in Russian). September. <http://www.svrpu.ru/officialnoe/press/2014/9.shtml>
- Carlton, Jim. 2013. "Alaskan Crabbers Get Pinched by Poachers." *Wall Street Journal*. April 3. <http://online.wsj.com/news/articles/SB10001424127887323361804578390981749873930>
- Clarke, Shelley. 2009. "Understanding China's Fish Trade and Traceability Systems." TRAFFIC East Asia Report. 98p. www.traffic.org/fisheries-reports/traffic_pub_fisheries9.pdf
- CNN. 2010. "U.S. tycoon faces new criminal charges in Russia." December 31. <http://www.cnn.com/2010/WORLD/europe/12/31/russia.crab.king/>
- Dvoretzky, A.G. and V.G. Dvoretzky. 2014. "Red King Crab in Russia: Population, Fisheries, and Symbionts." In *King Crabs of the World: Biology and Fisheries Management*. ed. Bradley G. Stevens, 501-516 (Ch. 16). New York: CRC Press.
- Eastin, I. and J. Perez-Garcia. 2003. "Discrepancies in forest products trade statistics." *The Forestry Chronicle* 79: 1084-1092
- Erisman, B.E, L.G. Allen, J.T. Claisse, D.J. Pondella II, E.F. Miller, and J.H. Murray. 2011. "The illusion of plenty: hyperstability masks collapses in two recreational fisheries that target fish spawning aggregations." *Canadian Journal of Fisheries and Aquatic Science* 68: 1705-1716.
- Fisheries.no. No date. "Red King crab (*Paralithodes camtschaticus*)." The Norwegian Ministry of Trade, Industry and Fisheries. http://www.fisheries.no/Ecosystems-and-stocks/marine_stocks/shellfish/red_king_crab/#.VC9-fecpdpg
- Fishkamchatka. 2014a. "Kamchatka Salmon' with crab" (in Russian). April 29. <http://www.fishkamchatka.ru/?cont=long&id=49076&year=2014&today=29&month=04>
- Fishkamchatka. 2014b. "Another crab poacher-FOC vessel is detained by Kamchatka border guards" (in Russian). September 11. <http://www.fishkamchatka.ru/?cont=long&id=50878&year=2014&today=11&month=09>
- Fishkamchatka. 2014c. "Information on how to import/export live marine resources to Japan" (in Russian). September 19. <http://www.fishkamchatka.ru/?cont=long&id=50977&year=2014&today=19&month=09>
- Fishnews. 2012. "Poached harvest will be blocked on its way into the Chinese market" (in Russian). December 7. <http://fishnews.ru/news/20095>
- Fishnews. 2013a. "South Korea informed Russia on the "crabby" issue" (in Russian). March 11. <http://fishnews.ru/news/20695>
- Fishnews. 2013b. "Russia and the USA discuss an anti-poaching agreement" (in Russian). December 5. <http://fishnews.ru/rubric/brakonerstvo/7572>
- Fishnews. 2014. "The return of the crab king" (in Russian). August 28. <http://www.fishnews.ru/rubric/krupnyim-planom/8641>
- Frank, K.T., B. Petrie, J. S. Choi, and W. C. Leggett. 2005. Trophic Cascades in a Formerly Cod-Dominated Ecosystem. *Science*. Vol. 308 (5728): 1621-1623.
- Franze-Nakamura. Francis. 2014. Personal communication. February 4.

Global Trade Atlas. 2014. Global Trade Information Service (subscription required). www.gtis.com/gta

Hermann, Mark and Joshua Greenberg. 2006. "An International Market Model for Red King (*Paralithodes camtschaticus*), Blue King (*P. platypus*), Golden King (*Lithodes aequispinus*), Tanner (*Chionoecetes bairdi*) and Snow (*Chionoecetes opilio*) Crab." NPRB Project 423 Final Report & ADFG Final Report (NOAA Award NA17FN1273). 181 pages. http://doc.nprb.org/web/04_prjs/fo423_final_report.pdf

Inter-Cooperative Exchange (ICE) – illegalcrab.com. 2011. "IUU (Illegal, Unreported, and Unregulated) Fishing: An Introduction to a Persistent Problem for Alaskan Crab Fisheries." Table 1. <http://illegalcrab.com/page4/>

Institute of Marine Research. 2013. "Red King Crab." Published May 4, 2004 and updated October 10, 2013. <http://www.imr.no/temasider/skalldyr/kongekrabbe/en>

Interfax Russia. 2012. "International crew has been held hostage by the shipowner on a fishing trawler that was arrested in Kamchatka" (in Russian). December 4. <http://www.interfax-russia.ru/FarEast/print.asp?id=364968&sec=1672&type=news>

Ivanov, Boris G. 2002. "Red King Crab (*Paralithodes camtschaticus*) in the Eastern Okhotsk Sea: Problems of Stock Management and Research." In *Crabs in Cold Water Regions: Biology, Management, and Economics*. Alaska Sea Grant College Program -AK-SG-02-01, 651-680.

Japan Fisheries Agency. 2014. "The New Procedures to Import Crab" (In Japanese カニを輸入する場合の新たな確認手続きについて-Kanivoyunyusurubaainoaratanatetsuzukinitsuite). Japan Fisheries Agency and Ministry of Economy, Trade and Industry. February 2014. http://www.jfa.maff.go.jp/j/kakou/import/pdf/setsumeikai2_shiryou.pdf

Jinji, Naoto. 2007. "Are Trade Restrictions an Effective Means of Resource Conservation?" Column 0167. Research Institute of Economy, Trade and Industry (RIETI). http://www.rieti.go.jp/en/columns/a01_0220.html

Juneau Empire. 2007. "Disappearance of Kodiak king crab still a mystery." March 19. www.juneauempire.com/stories/031907/sta_20070319006.shtml

KamInform. 2013. "Crab for Koreans" (in Russian). April 12. Kamchatka Information Service. http://kamchat.info/novosti/krab_dlya_korejcev/

KamInform. 2014. "The captain of a poaching vessel escaped punishment, but his employer must pay Kamchatka 4.4 million rubles" (in Russian). January 28. Kamchatka Information Service. http://kamchat.info/novosti/kapitan_brakon_erskogo_sudna_izbezhnal_nakazaniya_blagodarya_20-letiyu_konstitucii_a_ego_rabotodatel_dolzhen_kamchatke_4_4 mln_ru/

Karaivanov, Alexey A. 2012. "Actual Problems of Russian Crab Exports to Japan." *Shimane Journal of North East Asian Research*. No. 23 (March 2012): 59-64. ISSN 1346-3810. http://hamada.u-shimane.ac.jp/research/organization/near/41kenkyu/kenkyu23_data/Karaivanov_Alexey_A.pdf

Korostelev, Sergey. 2014. Personal communication. September 3.

Legal Information Service (RAPSI). 2014. "Russian captain arrested in Japan on suspicion of illegal crab fishing." September 24. http://rapsinews.com/judicial_news/20140924/272182504.html

McDowell Group. 2012. "Alaska Seafood Industry Update." Presentation to the ASMI CAP Meeting – August 15, 2012. Prepared for the Alaska Seafood Marketing Institute (ASMI) by Andy Wink, McDowell Group, Inc. <http://www.alaskaseafood.org/industry/private/bcmaterials/documents/CAP-Presentation-Overall-Aug2012.pdf>

McDowell Group. 2013. "Economic Value of the Alaska Seafood Industry: A report prepared for the Alaska Seafood Marketing Institute." July 2013. 83p. <http://pressroom.alaskaseafood.org/wp-content/uploads/2013/08/AK-Seafood-Impact-Report.pdf>

Monterey Bay Aquarium. 2010. "Seafood Watch King Crab Report." Updated August 23, 2010. http://www.seafoodwatch.org/cr/cr_seafoodwatch/content/media/mba_seafoodwatch_kingcrabreport.pdf

Moscow Times. 2011. "U.S. crab mogul fears Magnitsky's fate." February 10. <http://www.themoscowtimes.com/news/article/crab-mogul-fears-magnitskys-fate/430713.html>

My Petropavlovsk-Kamchatskiy News. 2014. "Crabs are free, "Freedom" under arrest" (in Russian). January 30. <http://pkmy.ru/krabov-na-svobodu-fridom-pod-arest/>

National Fishery Resources, 2014. "To Science, Opilio Crab Pose Interesting Questions" (in Russian). March 31. http://www.nfr.ru/archive/news/2014/news_detail.php?ELEMENT_ID=13544

Newell, Joshua. 2004. *The Russian Far East: A reference guide for conservation and development*. McKinleyville, Calif: Daniel & Daniel, Pub, Inc.

NOAA. 2014a. "Commercial Fisheries Statistics: Annual Trade Data by Product, Country/Association." NOAA National Marine Fisheries Service (NMFS) Office of Science and Technology. <http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/applications/annual-product-by-countryassociation>

NOAA. 2014b. "Commercial Fisheries Statistics: Annual Commercial Landing Statistics." NOAA National Marine Fisheries Service (NMFS) Office of Science and Technology. <http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/>

NOAA. 2013. "Joint Statement of the Under Secretary of Commerce for Oceans and Atmosphere and Administration for the National Oceanic and Atmospheric Administration (NOAA), United States of America, and the head of the Federal Fishery Agency of the Russian Federation on Enhanced Fisheries Cooperation." http://www.nmfs.noaa.gov/ia/slider_stories/2013/04/statement_signed.pdf

- NOAA. 2012. United States v. 112 Metric Tons of Frozen King Crab, No. 11-334 (W.D. Wa.) Consent Judgement of Forfeiture (filed 4/24/12). Case 2:11-cv-00334-JLR. NOAA Office of General Counsel. http://www.gc.noaa.gov/documents/2012/2012_D.Ct._King_Crab_Consent_Judgment_of_Forfeiture_ocr.pdf
- NOAA. 2011a. "NOAA, Federal Agencies Partner with the Russian Government to Stop Alleged Illegal Fishing." March 9. http://www.nmfs.noaa.gov/ole/newsroom/stories/11/federal_agencies_partner_russian_gov_illegal_fishing.htm
- NOAA. 2011b. "Leveling the Playing Field: NOAA's Plan to Combat Illegal Fishing in 2012." National Oceanic and Atmospheric Administration. http://www.nmfs.noaa.gov/ia/iuu/level_play_field.pdf
- North Pacific Fishery Management Council. 2011. Fishery Management Plan for Bering Sea Aleutian Islands King and Tanner Crabs, 229.
- Olson, D. M. and E. Dinerstein. 2002. "The Global 200: Priority ecoregions for global conservation." *Annals of the Missouri Botanical Garden* 89(2):199-224.
- Primamedia. 2014a. "The vessel "Andrey Smirnov" has been detained in the Sea of Okhotsk for poaching" (in Russian). January 16. <http://primamedia.ru/news/dv/16.01.2014/329335/sudno-andrey-smirnov-zaderzhano-v-ohotskom-more-za-brakonerstvo.html>
- Primamedia. 2014b. "Electronic Certification will beat IUU Fishing in the Far East" (in Russian). March 21. <http://primamedia.ru/news/economics/21.03.2014/344382/nnn-promisel-na-dalnem-vostoke-pobedit-elektronnaya-sertifikatsiya-rosselhozna.html>
- Regnum News. 2014a. "The captain of a foreign vessel was convicted for illegal fishing for crab in Kamchatka and then given amnesty" (in Russian). January 28. <http://regnum.ru/news/1759461.html>
- Regnum News. 2014b. "Murmansk captain will pay more than 1 million rubles for illegal harvesting of crabs" (in Russian). March 17. <http://regnum.ru/news/1778960.html>
- Regnum News. 2014c. "Kamchatka court confiscated the ship of a foreign company" (in Russian). May 29. <http://regnum.ru/news/1807807.html>
- RIA News. 2013a. "Japan Got 30 Times More Russian Crab than Russia 'Exported.'" August 20. <http://en.ria.ru/russia/20130820/182872588.html>
- RIA News. 2013b. "Russian Coast Guard opens fire to stop crab poachers." November 25. <http://en.ria.ru/russia/20131125/184974745/Russian-Coast-Guards-Open-Fire-to-Stop-Crab-Poachers.html>
- Rose, G.A and D.W. Kulka. 1999. "Hyperaggregation of fish and fisheries: how catch-per-unit-effort increased as the northern cod (*Gadus morhua*) declined." *Canadian Journal of Fisheries and Aquatic Science* 56: 118-127.
- Rossiskaya Gazeta*. 2008. "Federal Law of the Russian Federation from December 3, 2008, No. 250-F3" (in Russian). December 9. <http://www.rg.ru/2008/12/09/rybolovstvo-dok.html>
- Rossiskaya Gazeta*. 2012. "Korean police intercepted a smuggling channel of king crab imports" (in Russian). November 30. <http://www.rg.ru/2012/11/30/krab-site-anons.html>
- Russian Federal Fishery Agency - Harvest Data. 2014. "Catch Statistics of Marine-Biological Resources" (in Russian). <http://fish.gov.ru/activities/Pages/Statistics.aspx>. Example document (for 2011 & 2012 catch data): <http://fish.gov.ru/activities/Documents/f407-0%20%D1%8F%Do%BD%Do%B2%Do%Bo%D1%80%D1%8C-%Do%B4%Do%B5%Do%BA%Do%Bo%Do%B1%D1%80%D1%8C%202012.pdf>
- Russian Federal Fishery Agency – TAC. 2014. "Database of Legislative Actsof the Russian Fishery Federal Agency" (in Russian). http://89.107.122.151/bpa/bpa_s.asp?d11=01&d12=01&d13=2008&Ni=%EE%E1%F9+%E4%EE%EF%F3%F1%F2%E8%EC+%F3%EB%EE%E2&Txt=%F3%F2%E2%E5%Fo%E4%2C%EF%Fo%E5%E4%E5%EB%E8%F2%FC&Kl=24&Kl_V=%CE%C4%D3&PgC=25&nb=0
- Russian Federal Fishery Agency . 2011. "Live crab's VISA will open" (in Russian). May 6. <http://fish.gov.ru/presscentre/news/Pages/%Do%BD%Do%BE%Do%B2%Do%BE%D1%81%D1%82%D1%8C%05705.aspx>
- Russian Federal Fishery Agency . 2008. "Order No. 306-DK: On approval of share quotas (catch) of aquatic biological resources for the implementation of commercial fishing (except for coastal fisheries) on the continental shelf of the Russian Federation" (in Russian). <http://base.consultant.ru/cons/cgi/online.cgi?req=doc;base=EXP;n=519327>
- Russian Government. 2013. "Approval of the National Action Plan to Prevent, Preclude and Stop Illegal, Unreported and Unregulated Fishing." In English: http://government.ru/en/dep_news/9386; in Russian: http://government.ru/dep_news/9386 .
- Russian Ministry of Agriculture. 2014. "The Fight against IUU" (in Russian). March 18. http://www.mcx.ru/news/news/v7_show/21692.285.htm
- Russian News. 2014. "In the Sea of Japan the vessel with the Russian-Ukrainian crew." April 2. <http://rupaper.com/post/23809>
- SeafoodNews. 2014. "Alaska accounted for 21% of king crab sections in U.S. market in 2013; Russia 63%." September 3. <http://www.seafoodnews.com/Story/942880/Alaska-accounted-for-21-percent-of-king-crab-sections-in-US-market-in-2013-Russia-63-percent>
- SeafoodNews. 2014. "Crab poaching by Russians in Japanese EEZ rises rapidly, reflecting more enforcement in Russia." August 26. <http://seafoodnews.com/Story/941930/Crab-poaching-by-Russians-in-Japanese-EEZ-rises-rapidly-reflecting-more-enforcement-in-Russia>

- Seattle Times*. 2011a. "Local king-crab king ailing after detention in Russia." February 28. http://seattletimes.com/html/localnews/2014359757_russiancrabo1m.html
- Seattle Times*. 2011b. "U.S. agents seize \$2.75M worth of Russian king crab." February 28. http://seattletimes.com/html/localnews/2014360311_noaaseizure.html
- Seattle Times*. 2011c. "Russia presses U.S. on how Bellevue crab king returned home." April 24. http://seattletimes.com/html/localnews/2014866828_arkadi25m.html
- Seattle Times*. 2012. "Judge: Russia owes Bellevue businessman an apology –and rubles." October 29. http://seattletimes.com/html/localnews/2019556578_gontmakher30m.html
- Stopcrabmafia. 2014. "The Exchange of Notes About the Delayed Start of the Agreement on Combating IUU Fishing between Russia and Japan" (in Russian). March 19. <http://stopcrabmafia.ru/?p=954#more-954>
- Sukharenko, A.N., A.E. Turovets, M.B. Zhernovoi, and O.V. Khrenkov. 2014. "The Illegal Trafficking of Marine Biological Resources in the Russian Far East as a Threat to Russia's Economic Security: Monograph" (in Russian). International Fisheries Congress: Vladivostok. 68 pages. <http://www.fishkamchatka.ru/doc/nnn-oborot-2014.pdf>
- Sundet, Jan. 2014. "Red King Crab in the Barents Sea". In *King Crabs of the World: Biology and Fisheries Management*. ed. Bradley G. Stevens, Ch. 15. New York: CRC Press.
- Thorsteinson, Anne. 2011. "The Evolution of Property Rights in Russia's Far East Fisheries." Unpublished working paper. University of Washington. Received via personal communication.
- TINRO. 2011. *Russia's Pacific Scientific Research Center for Fisheries Crab Forecast for 2011* (in Russian). Vladivostok, Russia.
- TINRO. 2013. *Russia's Pacific Scientific Research Center for Fisheries Crab Forecast for 2013* (in Russian). Vladivostok, Russia.
- TINRO. 2014. *Russia's Pacific Scientific Research Center for Fisheries Crab Forecast for 2014* (in Russian). Vladivostok, Russia.
- TINRO Center News. 2014. "News about us: Specialists proposed increases to red king crab quotas" (in Russian). July 27. <http://www.tinro-center.ru/home/novosti/smionasspecialistypredloziliuvelicitkvotuylovakamcatskogokraba>
- Undercurrent News. 2014a. "Wakkanai crab traders expect big economic contraction as illegal crab shifts to Korea." April 1. <http://www.undercurrentnews.com/2014/04/01/wakkanai-crab-traders-expect-big-economic-contraction-as-illegal-crab-shifts-to-korea/>
- Undercurrent News. 2014b. "Russian researchers advise near doubling in Kamchatka king crab TAC." July 29. <http://www.undercurrentnews.com/2014/07/29/russian-researchers-advise-near-doubling-in-kamchatka-king-crab-tac/>
- Undercurrent News. 2013a. "South Korea, Russia fail to sign quota agreement." April 29. <http://www.undercurrentnews.com/2013/04/29/south-korea-russia-fail-to-sign-quota-agreement/>
- Undercurrent News. 2013b. "Russia, U.S. pledge to sign IUU agreement." May 6. <http://www.undercurrentnews.com/2013/05/06/russia-us-pledge-to-sign-iuu-agreement/>
- Undercurrent News. 2013c. "Russia cuts South Korea pollock quota in half." May 21. <http://www.undercurrentnews.com/2013/05/21/russia-cuts-south-korea-pollock-quota-in-half/>
- U.S. Department of Justice. 2005. Brief for the United States in opposition: Deep Sea Fisheries, Inc. and Deep Sea Harvesters, Inc. Petitioners v. United States of America. On Petition for a writ of certiorari to the United States Court of Appeals for the Ninth Circuit. <http://www.justice.gov/osg/briefs/2005/oresponses/2005-0315.resp.pdf>
- Vietnam Association. 2013. "Russia certifies crab shipments to China, Japan." September 7. Vietnam Association of Seafood Exporters and Producers. http://www.seafood.vasep.com.vn/Daily-News/378_8151/Russia-certifies-crab-shipments-to-China-Japan.htm
- Vietnam Seafood Trade. 2013. "Korea says only an import certificate system in the U.S., Japan will solve King crab poaching problem." March 7. <http://vietfish.org/20130306102133419p49c82/korea-says-only-an-import-certificate-system-in-the-U.S.-japan-will-solve-king-crab-poaching-problem.htm>
- VNIRO. 2012. "The 23rd Session of the Russian-American Advisory Committee on Fisheries was held" (in Russian). September 10. <http://www.vniro.ru/news/20120910a>
- Willock, Anna. 2004. "Using Trade and Market Information to Assess IUU Fishing Activities." Organization for Economic Cooperation and Development (OECD). <http://www.oecd.org/tad/fisheries/31484051.pdf>

APPENDIX: Harmonized System (HS) Commodity Codes for Crab									
***** Cells highlighted in red indicate that at least 1 of the 3 species of King Crab (Kamchatka Red, Blue, or Golden/Brown) ARE contained in the HS Code									
***** Cells highlighted in pink indicate that any 1 of the 3 species of King Crab (Kamchatka Red, Blue, or Golden/Brown) MAY BE contained within the HS Code									
0306 - Crustaceans, molluscs and other aquatic invertebrates, live or frozen									
After the 6-digit HS Code, the following countries use the following codes:	Russia	China	Japan (IMPORTS)	Japan (EXPORTS)	South Korea	United States	Canada (IMPORTS)	Canada (EXPORTS)	
0306 14 (Frozen Crab) Crabs, Including In Shell, Cooked By Steaming Or By Boiling In Water, Frozen	0306 14 30 (00) - Frozen Crabs, "Paralithodes Cambraticus, Chionoecetes Spp." And "Callinectes Sapidus", Whether In Shell Or Not, Incl. Crabs In Shell, Cooked By Steaming Or By Boiling In Water	0306 14 10 - Frozen Fresh-water Swimming Crabs (蟹)	0306 14 02 (00) - IMPORTS ONLY - King Crabs (Paralithodes Spp.), Frozen	0306 14 00 (00) EXPORTS ONLY - Crabs, Frozen	0306 14 10 (00) - Crab meat (at 10-digit level split by airtight (11), and not airtight containers (12) and other (90)).	0306 14 30 (00) Crabmeat, Frozen (any crab species)	0306 14 00 (00) IMPORTS ONLY - Crabs, frozen in shell or not, including boiled in shell (at 10-digit level split by King Crabs (10), and Snow Crabs (20) and Dungeness Crabs (30), and Crabs NESO) (90).	0306 14 00 EXPORTS ONLY - Crabs, frozen, in shell or not, including boiled in shell	
	0306 14 30 (00) - Frozen Crabs, "Cancer Pagurus", Whether In Shell Or Not, Incl. Crabs In Shell, Cooked By Steaming Or By Boiling In Water	0306 14 00 - Crabs, Including In Shell, Frozen	0306 14 02 (00) - IMPORTS ONLY - Snow Crabs (Chionoecetes Spp.), Frozen	0306 14 10 (00) EXPORTS ONLY - Crabs, Frozen, Smoked	0306 14 20 (00) - King Crabs (at 10-digit level split by airtight (11), and not airtight containers (12) and other (90)).	0306 14 40 (00) - Crabs, Nesoi, Including Cooked By Steaming Or By Boiling In Water, Frozen (at 10-digit level split by Frozen King Crabs, except crabmeat (10), and Frozen Snow Crabs, except crabmeat (20), and Frozen Dungeness Crabs, except crabmeat (30), and Frozen Crabs NESO), except crabmeat (30)	0306 14 10 (00) IMPORTS ONLY - King Or Snow Crabs For Processing, Frozen, In Shell Or Not, Incl Boiled In Shell	0306 14 10 EXPORTS ONLY - Crabs, Snow (Queen), Frozen	
	0306 14 90 (00) - Other Frozen Crabs, Whether In Shell Or Not, Incl. Crabs In Shell, Cooked By Steaming Or By Boiling In Water (Excl. Paralithodes Cambraticus, Chionoecetes Spp., Callinectes Sapidus, And "Cancer Pagurus")	0306 14 90 - Other Frozen Crabs	0306 14 02 (00) - IMPORTS ONLY - Swimming Crabs (Portunus Spp.), Frozen	0306 14 90 (00) EXPORTS ONLY - Crabs, Frozen, But Not Smoked	0306 14 30 (00) - Blue Crabs (at 10-digit level split by airtight (11), and not airtight containers (12) and other (90)).	0306 14 90 (00) - IMPORTS ONLY - Crabs, Excl For Processing, Frozen, In Shell Or Not, Incl In Shell Crabs In Water, Etc. (at 10-digit level split by Frozen King Crabs, except for processing (10), and Frozen Snow Crabs, except for processing (20), and Frozen Dungeness Crabs (30), and Frozen Crabs NESO) (90).	0306 14 90 (00) - IMPORTS ONLY - Crabs, Excl For Processing, Frozen, In Shell Or Not, Incl In Shell Crabs In Water, Etc. (at 10-digit level split by Frozen King Crabs, except for processing (10), and Frozen Snow Crabs, except for processing (20), and Frozen Dungeness Crabs (30), and Frozen Crabs NESO) (90).	0306 14 20 EXPORTS ONLY - Crabs, Dungeness, Frozen	
			0306 14 02 (00) - IMPORTS ONLY - Crabs, Other Than King Crabs (Paralithodes Spp.) And Snow Crabs (Chionoecetes Spp.), Frozen		0306 14 90 (00) - Other Crabs (at 10-digit level split by airtight (11), and not airtight containers (12) and other (90)).			0306 14 90 EXPORTS ONLY - Crabs, Frozen, NESO	
			0306 14 10 (00) - IMPORTS ONLY - Crabs, Frozen, Smoked						

APPENDIX: Harmonized System (HS) Commodity Codes for Crab								
***** Cells highlighted in red indicate that at least 1 of the 3 species of King Crab (Kamchatka Red, Blue, or Golden/Brown) ARE contained in the HS Code								
***** Cells highlighted in pink indicate that any 1 of the 3 species of King Crab (Kamchatka Red, Blue, or Golden/Brown) MAY BE contained within the HS Code								
0306 - Crustaceans, molluscs and other aquatic invertebrates, live or frozen								
After the 6-digit HS Code, the following countries use the following codes:	Russia	China	Japan (IMPORTS)	Japan (EXPORTS)	South Korea	United States	Canada (IMPORTS)	Canada (EXPORTS)
0306 24 (Live Crab) Crabs, Live, Fresh, Chilled, Dried, Salted Or In Brine, Or Cooked By Steaming Or Boiling In Water, Or Not Frozen	0306 24 10 - Crabs 'Paralithodes Cambraticus, Chionoecetes Spp.' And 'Callinectes Sapidus', Whether In Shell Or Not, Live, Dried, Salted Or In Brine, Incl. Crabs In Shell, Cooked By Steaming Or By Boiling In Water	0306 24 10 - Non-Frozen Crabs, For Cultivation	0306 24 11 - IMPORTS ONLY King Crabs (Paralithodes Spp.), Live, Fresh Or Chilled	0306 24 10 (0) EXPORTS ONLY - Crabs, Not Frozen	0306 24 10 (00) - Crabs, Live, Fresh, Or Chilled In 10-digit level split by Live, Fresh Or Chilled (00), Blue Crab (10), Snow Crab (20), and Other (90).	0306 24 20 (00) Crabmeat, Not Frozen	0306 24 00 - IMPORTS ONLY - Crabs, Not Frozen, In Shell Or Not, Including In Shell Cooked In Water, Etc	0306 24 00 - EXPORTS ONLY - Crabs, Not Frozen
	0306 24 30 (00) - Crabs 'Cancer Pagurus', Whether In Shell Or Not, Live, Dried, Salted Or In Brine, Incl. Crabs In Shell, Cooked By Steaming Or By Boiling In Water	0306 24 91 - Non-Frozen Fresh-Water Crabs	0306 24 12 (0) - IMPORTS ONLY Snow Crabs (Chionoecetes Spp.), Live, Fresh Or Chilled (10-digit level split by Snow Crabs (Chionoecetes Spp.), Live, Fresh Or Chilled (0), Red Snow Crabs (Chionoecetes Spp.), Live, Fresh Or Chilled (1), and Other Snow Crabs (Chionoecetes Spp.), Live, Fresh Or Chilled (9)).	0306 24 10 (0) EXPORTS ONLY - Crabs, Not Frozen, Smoked	0306 24 20 (00) - Crabs, dried.	0306 24 40 (00) - Crabs, Not Frozen, Except Crabmeat	0306 24 10 - EXPORTS ONLY - Crabmeat, Not Frozen	
	0306 24 80 (00) - Other Crabs, Whether In Shell Or Not, Live, Fresh, Chilled, Dried, Salted Or In Shell, Cooked By Steaming Or By Boiling In Water (Excl. 'Cancer Pagurus')	0306 24 92 - Non-Frozen Swimming Crabs	0306 24 13 (0) - IMPORTS ONLY Swimming Crabs (Portunus spp.), Live, Fresh Or Chilled	0306 24 90 (0) EXPORTS ONLY - Crabs, Not Frozen, But Not Smoked	0306 24 30 (00) - Crab, Salted Or In Brine.			0306 24 20 - EXPORTS ONLY - Crabs, Not Frozen, In shell, including bottled in shell
	0306 24 90 - Cooked By Steaming Or By Boiling In Water (Excl. 'Paralithodes Cambraticus, Chionoecetes Spp.', 'Callinectes Sapidus', And 'Cancer Pagurus')	0306 24 99 - Non-Frozen Crabs, NESOI (Not Elsewhere Specified or Indicated)	0306 24 14 (0) - IMPORTS ONLY Horseshair Crab, Live, Fresh Or Chilled	0306 24 90 (0) EXPORTS ONLY - Crabs, Not Frozen, But Not Smoked	0306 24 40 (00) - Crab, In containers (at 10-digit level split by: In Airtight Containers (11), Not In Airtight Containers (12), Other (90)).			
			0306 24 15 (0) - IMPORTS ONLY - Mitten Crabs, Live, Fresh Or Chilled					
			0306 24 19 (0) - IMPORTS ONLY - Other Crabs, Other Than King Crabs, Live, Fresh Or Chilled					
			0306 24 20 (0) - IMPORTS ONLY - Crabs, Dried, Salted Or In Brine					
			0306 24 50 (0) - IMPORTS ONLY - Crabs, Smoked					



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