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Crab Harvesting, Sustainability Issues, and International Trade: Insights from Russia

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Abstract: This article aims to analyze Russia's efforts, both domestically and internationally, to combat illicit crab harvesting and safeguard its marine resources. A comparison of total crab imports and allowable catch in Russian waters from 1990 to 2022 indicates a peak in shadow activities during the mid-2000s, with a cessation of large-scale illegal fishing observed since 2013. A narrative analysis of institutional shifts reveals that the bolstering of internal oversight, heightened accountability for harvesters, and enhanced global cooperation have been pivotal in fostering these positive dynamics. Concerning trends, however, emerged towards the beginning of the current decade, indicating potential instability within the legal framework of the crab industry. Persistent statistical discrepancies in trade with South Korea, diminishing institutional capacities within Russia to combat shadow activities, and heightened media scrutiny of illicit crab harvesting underscore the need for sustained vigilance in addressing both internal and external dimensions of this multifaceted problem.

Keywords: IUU fishing; aquatic bioresources; international trade; crab harvesting; Russian Far East

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Citation: Belov, A. Crab Harvesting, Sustainability Issues, and International Trade: Insights from Russia. *World* **2024**, *5*, 293–312. https://doi.org/10.3390/world5020016

Academic Editor: Manfred Max Bergman

Received: 5 March 2024
Revised: 28 April 2024
Accepted: 8 May 2024
Published: 10 May 2024

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1. Introduction

For several decades, the Russian fisheries sector has been suffering from the spread of illegal, unreported, and unregulated (IUU) fishing, tax evasion, and lack of investment. This situation was contrary to the developmental preferences of Russia, which included ensuring the sustainability of aquatic resources, expanding the supply of fish and seafood to the domestic market, developing export activities, increasing the value-added products exported abroad, and capitalizing on domestic shipbuilding capabilities to facilitate continuous renewal of the crab harvesting fleet [1]. It is not surprising that from the 1990s to the 2000s, several Russian experts expressed dissatisfaction with the prevailing system of using aquatic, forest, and other renewable natural resources [2].

Apparently, the shadow sector had reached its largest size in trade in the most expensive types of marine bioresources, such as crabs, shrimps, and salmon. Crab harvesting and trading became an area of drastic changes in the industry. From 2009 to 2015, in addition to several domestic controlling measures, Russia concluded bilateral agreements to prevent the illegal trade of crabs with major consumer countries such as China, the Republic of Korea, Japan, and the United States (US). These measures have reduced IUU fishing and improved the sustainability of the resource base.

In 2022, several significant actions were taken by crab-importing nations. This included the United States imposing a ban on seafood product imports originating from Russia and Japan withdrawing Russia's most-favored-nation (MFN) status for tariffs. The implemented actions were not specifically designed to combat IUU fishing directly, but they did diminish market access and profitability for all Russian sea products, potentially including components associated with IUU activities.

Despite some early successes in combating the shadow sector, careful analysis reveals that opportunities for illegal activities persist. Trade statistics suggest significant disparities between Russia's reported exports and its partners' reported imports of crab. Recent evidence indicates that institutional capacities to combat illegal harvesting remain inadequate

in Russia. Additionally, there is a growing number of domestic media reports on illicit crab deals (for further details, please refer to Section 5.3 of this paper). For these reasons, the progress in boosting exports of value-added products, enhancing domestic market supplies, and expanding tax revenues, investments, and orders for the homegrown shipbuilding industry is advancing at an exceedingly slow pace. Therefore, persistent efforts are required in these areas, both within the country and beyond [3].

The objective of this study is to analyze Russia's regulation of crab harvesting and trade, both domestically and with other Asian countries, with a focus on achieving sustainability. Following this Introduction, Sections 2–4 cover biological information on the crab species harvested in Russia, a description of the materials and methods used, and theoretical notes for narrative analysis of the shadow economy and IUU fishing. Section 5 presents an analysis and discussion, divided into three parts. In the first part, I introduce the main stages of IUU crab harvesting in Russia by comparing data on total imports from Russia with the total allowed catch (TAC). The second part looks at key domestic measures and trends in international cooperation with partner countries to prevent IUU crab harvesting. In the third part, I analyze the present state of factors influencing clandestine activities in crab-related business within Russia's Far Eastern basin. Finally, in the Conclusion, I summarize the results and highlight recently emerged elements of both domestic and foreign best practices that may be useful for the development of the Russian fishing industry.

2. Crab Species Harvested in Russia

This article delves into the complexities surrounding crab fishing and trade in the Russian Far East and Barents Sea. These regions boast a diverse array of crab species, 10 in total, which can be broadly categorized into three main groups: king crab, snow crab, and other crabs [4].

King crab:

- Paralithodes camtschaticus (red king/Kamchatka/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).

King crab stands out as the most valuable and economically appealing species, commanding high prices. Snow crab, on the other hand, dominates in terms of total tonnage caught, while other crab species are harvested in smaller quantities. The total allowable catch (TAC) serves as a gauge for assessable crab stocks, with the 2021 quota set at 100,330 tons. Among these allocations, 59,764 tons were allotted for snow crab, 40,067 tons for king crab, and 499 tons for other crab varieties.

The primary fishing grounds are concentrated in the Sea of Okhotsk, particularly its northern region, as well as in the western areas of Kamchatka and the Kuril Islands. In these regions, the total allowable catch was set at 22,463 tons for red king crabs and 30,151 tons for snow crabs. Additionally, 12,520 tons of snow crabs were permitted to be harvested in the Primorsky zone of the Sea of Japan, along with 7652 tons in the eastern part of Sakhalin. Beyond these Far Eastern locations, commercial fishing for crab commenced in the Russian zone of the Barents Sea in the late 2000s. In 2021, the TAC volumes in this area amounted to 10,940 tons for red king crab and 13,250 tons for snow crab [5].

During the 2000s, the proliferation of illicit crab fishing in the Russian Far Eastern basin resulted in harvesting surpassing the TAC, causing significant harm to king and snow crab populations. However, in the late 2000s and early 2010s, the implementation of fishing bans in critical areas, export limitations, and intensified efforts to combat illegal activities facilitated stock recovery. Consequently, the TAC nearly doubled, exceeding 100 thousand tons since 2018, compared to the minimum levels recorded from 2010 to 2012, which were less than 50 thousand tons.

3. Material and Methods

This article utilizes data from 1990 to 2022 concerning the TAC for crabs in Russia. Information for the years 1990 to 1999 was taken from Russian media sources [6]. Data for the period from 2000 to 2013 originate from the World Wildlife Fund (WWF) report [4]. Data for 2014 to 2022 was derived from information released by the Russian government regarding the establishment of the TAC and was accessed through specialized websites of Russian fishing organizations (www.dalryba.ru; www.fishnet.ru; www.rybazdes.ru), as well as open databases of legal documentation (www.ppt.ru; www.rulaws.ru, all accessed on 16 April 2024).

Export figures for Russia and import data from foreign countries for crab ('mirror statistics') are sourced from the UN website at www.comtrade.un.org (16 April 2024). The data for frozen crab (HS code 030614) and live crab (HS codes 030624 for 1990–2017 and 030633 for 2018–2022) are compiled and analyzed. Import volumes are utilized as a proxy to estimate the total crab harvesting in Russian waters.

In Russia, harvesting crab beyond the TAC is strictly prohibited. Consequently, the article employs a comparison between crab TACs and crab imports from Russia by consumer countries as direct evidence of IUU fishing. Nonetheless, these data may not be sufficiently accurate due to the intricacies of illicit operations, particularly in this industry. Moreover, since 2013, the TAC in Russia has surpassed total imports, indicating a lack of direct evidence for shadow activity.

For this reason, direct comparisons of TACs and imports are complemented by a narrative analysis of the institutional features of the crab fishery and trade. To achieve this, indirect indicators suggesting the possibility of ongoing IUU activities after 2013 are considered. Among these, a key indicator is the comparison of the aforementioned 'mirror statistics' for the primary importing countries. Additionally, this paper briefly touches upon the dynamics of the state's institutional capabilities and the attention paid by the Russian media to illegal crab fishing. These last two indicators were chosen based on literature recommendations and data availability.

4. Theoretical Notes for Narrative Analysis: Exploring the Shadow Economy and IUU Fishing as an International Issue

Much scientific research has been devoted to the study of the shadow economy. Throughout the 1980s, most definitions of the shadow economy included all activity contributing to GDP that was unrecorded by available statistical methods [7]. In the 1990s, a growing interest in the field led to the identification of numerous components: legal and illegal, monetary- and barter-based, hidden and unreported [8]. Realizing the complex and diverse structure of the shadow economy, researchers began to talk about the difficulty or even impossibility of providing a precise definition [9]. In response, researchers seeking to deepen their analysis decided to limit its scope. In the 2000s, most work focused on what became a narrowly defined shadow economy: legal market activity hidden from authorities to reduce taxes and fees or to circumvent labor legislation and administrative regulation [10].

While most economists continued to specialize and narrow the sphere of their research, an opposing trend toward integration and a broad interpretation of shadow activity developed in the international rules of statistical observation. In particular, definitions and recommendations on statistical estimation of illegal, hidden, or underground pro-

duction appeared in the system of national accounts of 1993 (SNA93). Theoretically, all non-observed activities should be measured and included in GDP. However, in practice, statistical authorities in most countries conduct this only for the shadow and a fragment of the informal economy, leaving illegal activity completely out of their analysis. In certain cases, such as illegal fishing and logging, this leads to serious distortions and requires considerable adjustments.

According to some scholars, despite the large volume of theoretical and empirical work, the understanding of illicit trade remains incomplete. This is especially true for the division between the exchange of legal and illegal goods [11]. Most academic papers focus on the exchange of products of legal origin whose weight, quality, and price are incorrectly reported or not reported at all [12]. The same techniques are applied in the analysis of the different aspects of illicit trade, including the international variations, the factors influencing its spread, the various methods of estimation, and the economic consequences [13].

It turns out that, like the focus of shadow economy research on legal but concealed activity, the study of illicit trade has also focused on the international circulation of legal goods, the essential information about which is hidden or falsified in order to reduce transaction costs and circumvent existing regulations. Analysis of explicitly illegal trade (e.g., trade in drugs or the raw materials for their production, illegally extracted forest and natural marine resources, stolen cars, works of art) is much less frequent. This omission from the research makes it difficult to develop methods for the economic and statistical analysis of the informal sector, which in turn eliminates the public attention needed for the effective resolution of the resultant problems.

The aspect of the shadow economy that may be the hardest to subject to research is the unauthorized extraction of renewable natural resources, such as fish and other marine products, timber, and commercially viable species of wild plants or animals. The additional challenge comes from the lack of private property rights on these resources, which makes it especially difficult to organize or monitor their use [14].

In addition to these challenges, the complex classification of natural resource extraction should also be noted. The process can simultaneously include legal and illegal, regulated and unregulated, and shadow and informal activities. Take, for example, the extraction of crab by only one vessel in one area: within the established quota, it is legal; concealing part of the catch from tax or customs authorities is considered shadow; quota overfishing is illegal; and fishing by sailors for personal consumption would be classified as informal (unregulated) economic activity. Naturally, these classifications are not always easily disentangled. That is why the term IUU (illegal, unreported, unregulated) has recently become widely used in the specialized literature and the reports of international environmental organizations [15]. In fact, IUU fishing covers all unobserved activities for the extraction of marine natural resources. Obviously, this is a broader concept than that of a shadow economy (legal but hidden) or illicit trade (turnover of legitimate goods but having falsified characteristics).

The spread of IUU fishing is an acute international issue. As far as the state of the world's fisheries is concerned, in 2020, the global fish capture amounted to 90.3 million tons, of which 78.8 million tons were caught in marine waters (the field of our study) and 11.5 million tons in inland waters. These figures have remained virtually unchanged since the late 1980s, and the growth in consumption is provided by aquaculture products (82.1 million tons). It is estimated that 58.5 million people worldwide are engaged in marine fisheries on a permanent basis, 84% of whom are in Asia, 10% in Africa, and 4% in Central and South America. The activities for the extraction, processing, and sale of fish and seafood from these marine fisheries provide a source of livelihood for more than 600 million workers and their families. The top five fishing countries in the world accounted for 41.8% of all catches, including China (14.9%), Indonesia (8.2%), Peru (7.1%), the Russian Federation (6.1%), and the United States of America (5.4%).

Approximately 78% of the extracted aquatic bioresources fall into the sphere of foreign trade. The main exporters are China, Norway, Vietnam, Thailand, and the United States

(35%). World exports in 2020 reached USD 151 billion. Of this amount, 53% was traded by developing countries, for which the export of aquatic bioresources in monetary terms exceeded the total supply of agricultural products. In imports, more than half of the total volume is accounted for by the European Union (34%), the US (15%), and Japan (9%) [16]. These figures illustrate the concentration of fisheries' production in developing countries and consumption in the developed world.

What stands out from the long list of similarly organized industries is the high proportion of IUU fishing. This term first emerged in the early 1990s and originally meant the illegal actions of foreign ships in other countries' exclusive economic zones (EEZ). In the 2000s, the concept of IUU fishing expanded significantly and began to be used to refer to all types of activities that were not observed by traditional statistical methods. The illegal aspect of IUU fishing includes the extraction of aquatic bioresources in violation of the law or binding decisions of regulatory organizations—for example, exceeding quotas. The unreported aspect includes all types of misinformation to the authorities—in particular, for the purpose of tax evasion. The unregulated aspect, by definition, is not covered by the current regulations—most often, fishing by vessels without a flag outside the exclusive economic zones and areas of operation of special organizations and agreements [17].

The first publication with the "IUU fishing" keyword in the Web of Science bibliometric database appeared in 2001, and by the end of the February 2024, 196 relevant scientific articles were indexed. Of these, 170 (87%) were placed in the categories of environ-mental studies, fisheries, and marine freshwater biology issues; 121 (62%) were written by authors affiliated with Australia, Canada, and the US; and 83 (42%) were published in the last five years. The analysis of the texts of the 86 most cited open access sources showed that 57% of the authors considered IUU fishing to be an international, rather than a national, problem and suggested appropriate ways to reduce this activity. Obviously, the conclusion on the trans-national nature of IUU fishing is widely supported by the international academic community [18].

The reasons for the spread of IUU fishing can be divided into two broad groups. The first combines the general factors for the existence of shadow activities, including fishing as a special case. For example, it has been established that the degree of penetration of IUU fishing directly correlates with several dependent variables, including the level of GDP and the quality of the social environment, as measured by the human development index [19]. The lack of financial and institutional resilience, which is common in developing countries, results in lower costs and risks for illegal fishing than the potential benefits for lawful behavior. This creates a profit opportunity and becomes the main incentive for illegal activities.

The second group of reasons is associated with the specifics of the industry, and above all, with the differences in national approaches to fisheries regulation. Some countries establish and enforce numerous rules (from timing, objects, and areas of fishing to the number, size, and equipment of vessels), while others do not see the need or do not have the means to enforce them. As a result, the waters of some states are turning into de facto open zones, and the fight against IUU activities falls upon international organizations. A long and ever-expanding list of other reasons includes excess fishing capacity, the existence of flags and ports of convenience, the high cost of maritime surveillance, the mimicry of illegal activities, the confusion in marketing systems, and the mismatch of customs procedures between exporters and importers [20].

Not surprisingly, despite significant funding, advanced technology, and sophisticated methods, current estimates of IUU fishing are somewhat fragmented. The most cited figures in the scientific literature for global IUU fishing are 11–26 million tons by volume, USD 10–USD 23 billion total value, and 13–31% of the annual marine catch [21]. These data were obtained by the British government in 2003 through expert assessments of the share of IUU activity by integrating approximately 300 cases from 54 exclusive and 15 high seas areas, accounting for half of the world's catches. The best results to date are provided by direct observation of the production and supply chains of the largest consuming countries,

which makes it possible to determine the share of IUU supplies in fish imports in the range of 20–32% for the USA in 2011 and 24–36% for Japan in 2015 [22,23].

Most often, Atlantic tuna, Pacific salmon and crab, Antarctic catfish, and other commercially attractive or poorly protected species are the objects of shadow activity. The highest proportion of IUU fishing (more than 30%) is observed in the waters off the Atlantic coast of North Africa and South America, as well as in Northeast Asia. In the Northeast Asia zone, which includes the Far Eastern fishery basin of Russia, up to 45% of salmon [24] and up to 25% of crab and shrimp [25] are harvested by the shadow sector.

Obviously, illegal activities of this magnitude have serious consequences. In the economic sphere, these include loss of income from sales, transportation, exports, etc.; undermining the resource base of sustainable fishing; reducing the gross output and investment; and increasing the need for subsidies and dependence on foreign aid [25]. From an ecological perspective, there is a decrease in stocks, slow recovery and complete disappearance of certain types of aquatic bioresources, and damage to ecosystems and human habitats [26]. In the social sphere, there is a loss of jobs, destruction of traditional ways of life, malnutrition, deterioration in working conditions, and an increase in related crimes—corruption, forgery, smuggling, illegal migration, modern slavery, and piracy [27,28].

Perhaps the most obvious result of illegal harvesting is the depletion of stocks (by a third in the last 40 years) and the extinction of certain species. More than 30% of the world's aquatic bioresources have already been exploited to levels exceeding the possibilities of natural reproduction. Not surprisingly, in the United Nations (UN) Sustainable Development Goals (target 14.4), IUU fishing has been identified as a dangerous and destructive practice, and the main steps to eliminate it were planned to be taken in the first years of the current decade [29].

Among the actions to prevent IUU fishing, experts mention various efforts on monitoring, control, and surveillance (MCS), with a special emphasis on international measures related to the observance of existing international arrangements [30,31]. The main agreements are the fundamental UN Convention on the Law of the Sea (1982) and the specialized UN Fish Stocks Agreement (1995). Important documents adopted within the Food and Agriculture Organization (FAO) are the Compliance Agreement (1993); the Code of Conduct for Responsible Fisheries (1995); the International Plan of Action to Prevent, Deter, and Eliminate IUU Fishing (2001); the Agreement on Port State Measures (PSMA, 2009); the Guidelines for Flag State Performance (2014); and the Voluntary Guidelines for Catch Documentation Schemes (2017).

At the regional level, self-governing fishing organizations—coordinating regional fishery bodies (RFBs) and managing regional fishery management organizations (RFMOs)—are supposed to play the main role in preventing IUU fishing, collecting information, and coordinating fishing in the context of covered water areas of the high seas. Their creation began in the 1970s, along with the expansion of commercial fishing in remote areas of the world's oceans; by 2020, there were 69 active RFBs and 42 RFMOs. The powers of these organizations are gradually expanding to include a wide range of control and regulatory functions, ranging from the registration of ships and the assessment of fish stocks to the dissemination of best practices and the analysis of data on port calls.

Within the individual states, after the adoption of the International Action Plan for the Prevention of IUU fishing in 2001, the main producing and consuming countries developed specifying documents at their national levels. By the beginning of the 2010s, a sophisticated system for monitoring the legality of imported aquatic bioresources appeared in the EU and the US. Actions in Russia, in particular, included the strengthening of trade and customs control, streamlining the allocation of fishing quotas, the conclusion of bilateral agreements with main importing countries (Japan, Korea, China, the US, etc.), joint initiatives for port state control (Russia–Norway) [32], the adoption of a national plan to combat IUU fishing, and the ratification of the earlier-mentioned PSMA in 2020 (please refer to Table 1 for further details).

At first glance, an effective and multilevel system of regulation was created. In reality, most of the measures taken were declarative in nature, and even those were rarely implemented in full, especially in developing countries. Therefore, the PSMA, which was the world's first binding international agreement specifically designed to combat illegal fishing by controlling the legality of incoming ships and cargo, was considered an effective measure [33]. The PSMA entered into force on 5 June 2016, which was declared the International Day to Combat IUU Fishing. It currently brings together 66 Parties and has been ratified by major fish importers such as the EU, the US, and Japan.

Theoretically, subject to proper implementation, the agreement allows the effective closure of IUU products' access to the national distribution system, especially in large countries with significant economic and institutional potential [34]. However, as practice shows, the solution to this difficult task may require the use of a more diverse set of measures. Let us explore this thesis using the Russian crab trade as an example.

5. Analysis and Discussion

5.1. IUU Harvesting and Trade in Crab in Russian Pacific Basin

World exports of sea crustaceans in 2022 reached about 3.6 million tons (USD 35.0 billion), with the main portion (66% by value) accounted for by frozen products, and the remaining part (34%) supplied live. Exports of frozen and live shrimp, crabs, and other marine invertebrates came to 275.0 thousand tons (USD 3.5 billion). Russia's share in the total exports of crab and shrimp by weight and value was 23.2% and 35.1%, respectively, for frozen products and 28.5% and 47.1% (the data for Russia pertains to the year 2020), respectively, for live products. The main importers of frozen seafood delicacies were Japan (36.7%), the US (33.3% by weight), and the Republic of Korea (12.4%), while live crabs were imported mainly by China (55.0%) and the Republic of Korea (39.0%) [35].

Crab fishing in the waters of the Russian Far East began in the 1870s. For a long time, this was performed exclusively by Japanese ships. Their activity peaked in 1929 when 110,000 tons of king crabs were harvested. The first Soviet crab catcher (though built in Japan and with a Japanese crew) started operating in 1928. After that, crab harvesting by Japanese ships began to decline and completely stopped by 1940. In the 1950s and 1960s, the Soviet Union harvested small quantities of king crabs using outdated Soviet and Japanese equipment. An unprecedented program of crab relocation from the Sea of Okhotsk to the Barents Sea implemented in those years led to the emergence, half a century later, of a new valuable fishing objective for fishermen in the Arkhangelsk and Murmansk regions and then in neighboring Norway. In the 1970s–1980s, several high-capacity fishing vessels and floating canneries appeared in the waters off the Russian Far East, starting the large-scale harvesting of a wide range of crustaceans [36]. The extraction, processing, and export of crabs were effectively monopolized by the Dalmoreprodukt State Enterprise. Not surprisingly, during the Soviet period, crab fishing "was well regulated and carried out under strict control" [4].

The reorganization of state monopolies in the early 1990s led to the rapid growth of private companies, which greatly expanded the production and export of crabs. The growing Russian supply was supported by the robust foreign demand. It seemed that ideal conditions had arisen in the North Pacific and in the Northeast Asia region for the formation of a highly profitable market dominated by Russian players. Unfortunately, in the chaotic institutional environment, Russia failed to formulate either ownership rights to aquatic bioresources or the rules for their use. Meanwhile, powerful groups of influence had been formed in partner countries that were interested in the non-transparent nature of business. As a result, much of the crab trade was hidden in the shadows.

The shadow sector has reached its greatest extent in the relations between Russia and Japan. This statement is supported by all existing assessments of the IUU crab business: an analysis of mirror statistics of the two countries, a comparison of the total imports of Russian crabs by major consumers with total allowable catches (TACs), as well as direct observation of production and marketing relations of Japanese importers.

In particular, the gaps in the indicators of customs statistics on Russian exports and Japanese imports of crab and shrimp for 1994–2002 amounted to almost 600 thousand tons and USD 52.5 billion [6]. As control was restored and the responsibility of crab harvesters increased, the gaps in Russian and Japanese data gradually decreased from 30 to 188 times in the 1990s to 2000s to 10 to 20 times in the 2010s and 3 to 4 times in 2015–2018. The peak of statistical discrepancies was reached in 2000, when the Japanese customs officials reported the import of 78.1 thousand tons of crab, while the Russians confirmed the export of 2.4 thousand tons. However, even after decades of combating IUU fishing, data gaps persisted, far exceeding the inevitable technical discrepancies and consequences of shipments through third countries. This indicated a steady desire of harvesters and exporters to underestimate the size and cost of the catch or hide part of it from Russian customs and environmental authorities.

It should be noted that not all statistical discrepancies can be attributed to shadow activity. The technical details explain much of the observed imbalances. With this in mind, when assessing IUU activity, more accurate results are obtained by comparing the total figures for crab imports by all consumer countries and Russian catch quotas or figures for a total allowed catch (TAC). Since harvesting in excess of the TAC is prohibited, and domestic consumption of crab products is insignificant, the difference between the two mentioned values can be considered a quite accurate indicator of IUU fishing.

A comparison of data on crab imports from Russia by foreign importers and the TAC in Russian waters for 1990–2022 allows us to divide this period into three distinct stages: (1) from 1990 to 1995, the TAC exceeded imports; (2) between 1996 and 2013, crab imports surpassed the TAC; (3) since 2014, a new phase has dawned in the Russian crab industry (Figure 1).

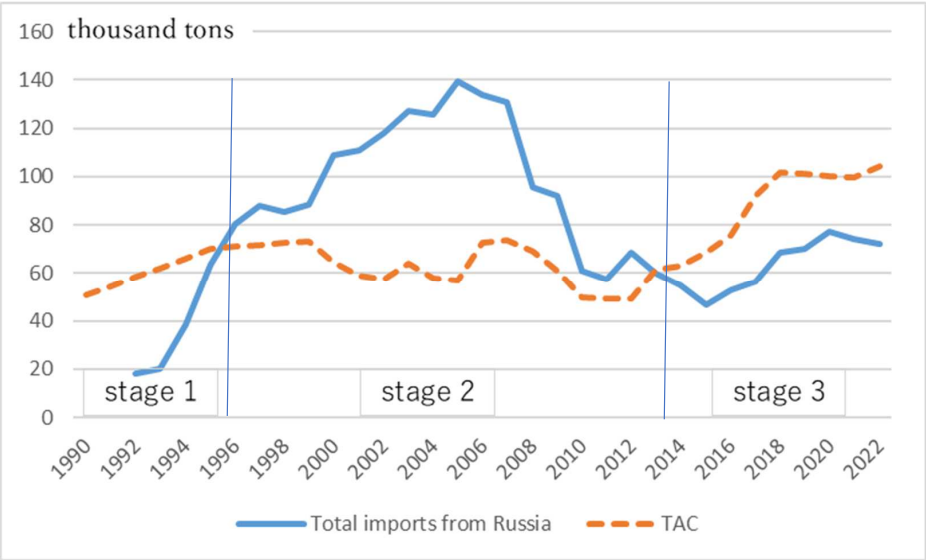


Figure 1. Imports of crab from Russia by international partners and total allowable catch (TAC) of crab in Russian waters (thousand tons). Sources: author's creation using the data of comtrade.com (imports from Russia by the countries of the world, HS codes 030614 and 030624/030633) and fish.gov.ru (accessed on 19 April 2024) (TAC).

As Figure 1 shows, in 1990–1995, the TAC exceeded imports. This suggests that in these years, Russia possessed significant crab resources but suffered from a shortage of harvesting and transport vessels. At the beginning of the 1990s, a number of crab fishing companies in Russia started to buy used crab fishing boats from the US and Japan. The imported ships made it possible to quickly increase crab harvesting and export.

During 1996–2013, crab imports exceeded the TAC. As fishing over the TAC is not permitted under the law, this overharvesting can be considered evidence of shadow activity.

The cumulative excess of imports over the permitted volume of fishing during this period reached 693.1 thousand tons, or USD 6.9 billion at minimum price (USD 10 per kg). For comparison, this was more than 10 times higher than the gross volume of investments attracted to the fishing industry in the Far Eastern region of Russia for the specified period. The largest excess of total imports over the TAC (84.5 thousand tons) was recorded in 2005, when the total import (139.4 thousand tons) overshot the TAC (56.9 thousand tons) by a factor of 2.4. Evidently, this was the time when the magnitude of shadow activities in the harvesting and trade of Russian crabs was at its peak [6].

Slightly different figures can be obtained through the direct observation of importers' operations. Such research was conducted only in Japanese ports. This method estimated the amount of illegal Russian crabs delivered to Japan in 2015 to be in the range of 2540–3735 tons [23]. Regardless of the estimation techniques, the IUU harvesting of Russian crabs was comparatively large, and a considerable amount of the illegally obtained crabs was sold to foreign customers.

The long-term shadow activity at this scale has led to a variety of negative consequences. Russian government organizations have repeatedly raised the issue of economic issues associated with IUU fishing. However, there has been no comprehensive assessment of the related losses. Even the authoritative Accounts Chamber of the Russian Federation, in its analysis popular with the media and after carefully studying the issue, very evasively reported that the estimated costs of the illegal export of aquatic bioresources from the Russian Far East in 2012 were "more than USD 1 billion, excluding lost payments, taxes, and duties" [37].

Many negative consequences were reflected both in emotional media broadcasts (and even in detective novels and serial TV dramas) and in numerous scientific publications [38]. In Japan, the greatest public attention attracted the deterioration of the social, sanitary, and criminal situation in Hokkaido, where, during the peak period of the 1990s–2000s, Russian crab carrier ships annually made 7000–9000 port calls and 140,000–170,000 crewmembers went ashore [39]. In Russia, the criminogenic impact of illegal fishing was talked about relatively less frequently, probably because even the dangers of crab-related business paled against the background of the rising crime rates in the Far Eastern coastal regions. The issues of economic losses, as well as environmental problems associated with the widespread decline of the once numerous crab populations, were raised more often. Ironically, the greatest damage, probably irreparable by natural means, was done to the crab reserves by poaching and illegal supplies to Japan around the South Kuril Islands, which, in 2018–2019, have become the subject of active Russian–Japanese negotiations on the territorial issue.

Since 2014, the Russian crab business has entered a new stage of development. The TAC figures have again exceeded total imports. In a sense, the ratio of imports to TAC returned to that of the early 1990s (Figure 1). This can be attributed to three reasons. First, the TAC was increased by almost 60%, from an average of 62.5 thousand tons in 1990–2015 to 104.2 thousand tons in 2022. The rise in the TAC was primarily linked to the recovery and near quadrupling (from 38 mln to 151 mln individuals) of crab populations following both a partial ban (2005–2007) and a complete ban (2008–2012) on the harvesting of the endangered red ring crab in the Sea of Okhotsk basin [40]. Second, crab imports decreased from a maximum of 139.4 thousand tons in 2005 to 72.1 thousand tons in 2022. This occurred due to tightened control in importing countries and a significant increase in prices. Third, shadow activities were considerably reduced through the long-term efforts of the Russian government and partner countries. Some traces of IUU fishing are still present in the crab trade, but the most acute period of rampaging illegal harvesting and trafficking has definitely ended [3].

We should point out once again that the excess of TAC over total imports indicates that there are available crab reserves but not enough vessels for harvesting and transporting them. In the early 1990s, insufficient crab fishing boats were acquired from abroad, but thirty years later, this fleet is completely worn out. Meanwhile, shipbuilding capacities have appeared in Russia, ready to provide fishermen with newly built and capable vessels.

An extensive program for building new crab harvesters in Russian shipyards began in the second half of the 2010s. This suggests that the crab business in Russia has completed a full cycle, starting from liberalization, growth, and widespread IUU fishing to a more sustainable age of regulation, stability, and transparent development.

Since the early 1990s, the harvesting and trading of Russian crabs have gone through several developmental stages. During this time, the growth of shadow activities attracted the most attention from academic circles and the media. Let us try to trace why a large illegal sector appeared in the crab trade, how it was eliminated, and what is required to prevent IUU fishing in the future.

5.2. From IUU Harvesting to Sustainable Fishery

The Russian authorities took active domestic and international countermeasures to restore law and order in crab-related business. In particular, since 2000, systematic work has begun in the country to improve fishing control and the TAC distribution mechanism. Unfortunately, the procedure for the auction sale of quotas, introduced in 2001, led to the opposite results—a reduction in investment opportunities, resale of quotas, a surge in the activity of foreign vessels under flags of convenience, and a further expansion of the IUU business. In 2008, catch quotas were issued for a period of 10 years to law-abiding companies with a positive history of transparent business and investments in fishing vessels and on-shore processing facilities.

In general, the strengthening of control over the extraction of valuable aquatic bioresources has yielded both positive and negative results [3]. Total fish catches in Russia over the past decade have increased from 4.0 million tons in 2010 to 4.88 million tons in 2022. However, domestic fish retail sales in 2014–2022 in real terms decreased by 10–15% annually due to the sharp rise in prices. The fish consumption per capita, which peaked at 24.8 kg in 2013, dropped to 21.6 kg in 2022.

A significant share of catch was exported. Its value increased from USD 1.4 billion in 2000 to USD 6.1 billion in 2022. The main consumers of Russian aquatic bioresources were China (USD 1.8 billion or 35%), the Republic of Korea (USD 1.7 billion or 32%), and Japan (USD 0.4 billion or 8%). These three countries accounted for about 75% of export deliveries. It should be noted that most of the Russian fish entering China were processed into fillets and semi-finished products, which were then supplied back to Russia (USD 0.3 billion a year) or to the markets of Europe and the US. At the same time, the main share of Russian exports was low-processed frozen fish, the export of which increased from 0.8 million tons in 2000 to 1.95 million tons in 2022. Export supplies of fish fillets or other finished products either decreased or slightly increased over this period.

One unexpected outcome of the increased control of crab harvesting has been a reduction in imports by major international buyers compared to the peak period in the mid-2000s. Prices rose in foreign markets, and the price competitiveness and share of Russian products decreased. Inside the country, crab resources were depleted; fishing industry and regional budgets lost significant revenues; and fraud, corruption, and other abuses spread among fishers, exporters, and regional authorities. Hundreds of companies stopped operations, thousands of people changed jobs (and many joined the ranks of poachers). In 2000, 188 companies, 380 ships, and more than 10,000 sailors were engaged in crab harvesting. By 2016, these figures had dropped to 60 companies, 100 ships, and 3000 sailors [41]. Experts note that each sailor at sea provided work to approximately five workers at onshore processing factories. Therefore, since the early 2000s, approximately 42,000 jobs could have been lost in the crab business. It seems that the fight against IUU crab harvesting in Russia inflicted "collateral damage" to small-scale fisheries, as was reported in several other countries [42].

By 2030, the development of Russian fisheries aims to achieve the following ambitious goals: a total catch of 5.4 million tons, domestic consumption of fish and seafood at 25 kg per person per year, a 65% share of high value-added products in total fish product output, and a 50% average profitability for the industry [1]. A simultaneous increase in

catches by 15% compared to 2018, a 27.5% jump in domestic consumption, and a doubling of exports require significant gains in the efficiency of the use of marine resources, sales in the domestic market, and the production of processed fish for export [1].

To achieve these goals, in 2011, industry enterprises received generous tax benefits. This allowed them to increase profitability from 5.2% in 2005 to 43.8% in 2018. Consequently, the financial situation of Russian fisheries has improved. Annual amounts of profits in 2010–2018 increased from 5.6 to 48.2 billion rubles, and the share of unprofitable enterprises decreased from 38.7 to 17.3%. Given the high profitability of the crab business, it can reasonably be assumed that the situation in the crab sector turned out to be even more favorable. With the simultaneous growth of production and revenue, the attractiveness of the crab business has increased, and competition has become more intense for entry into the industry. Investments in fisheries began to grow, the amount of which over the same period increased from 4.7 to 16.4 billion rubles in Russia as a whole and from 2.2 to 11.4 billion rubles in five crab-harvesting provinces of the Russian Far East province.

In the second half of the 2010s, the devaluation of the ruble sharply increased the profitability of exports, especially of valuable crabs, whose share in Russian fishing exports in 2020 reached 36.1%. The financial situation of harvesting companies has improved so much that in 2018, half of the crab quotas were sold through auctions, and proceeds were reverted to the federal budget. The other half was distributed over the upcoming 15 years, that is, for the period 2019–2034. The return of quota auctions caused a backlash from fishers, but the government advocated the importance of quota supply to new players in the industry, which means increased competition, efficiency, investment, and supply to the domestic market.

One of the complex problems in the development of the fishing industry was the poor condition of harvesting, processing, and transport vessels, the average age of which was approaching 30 years, and its wear and tear exceeded 80%. Even during the most acute crisis of the 1990s, the fishing industry received significant amounts of Russian and foreign investments, new European-built super-trawlers were introduced, and the crab harvesting fleet was re-equipped at the Pacific shipyards. The total volume of investments is very difficult to estimate. However, it is known that in 1990–1996 only, the guarantees of the Russian government for the construction of trawlers in Spain amounted to USD 1.5 billion, and only one of the shipbuilding companies in Seattle reported on the renovation of 20 Russian ships for USD 0.5 to USD 1.8 million [43]. However, the fleet's harvesting capacity quickly exceeded the available resources; the stocks declined, and catches became unstable. The IUU countermeasures added increased political pressure and organizational confusion. Investors began to leave the industry, and this continued until the end of the last decade.

In 2016, the Russian government began stimulating the construction of new vessels by subsidizing 25% of their costs. In addition, a quarter of all fishing quotas have been withdrawn from regular distribution and have been given to companies dedicated to building new vessels. As a result, in 2016–2022, investment in the industry almost tripled compared to the previous year, and more than 30 new ships were laid down at domestic shipyards. These plans included at least 16 crab-fishing vessels, the first of which was launched on 26 December 2018 [44].

An important feature of the IUU crab business is its rapid internationalization. Since the early 1990s, IUU shipments of crab to Japan and other countries of Northeast Asia were carried out by Russian or foreign ships, often built or refurbished at docks on both sides of the Pacific. The construction and repair were financed by attracting funds from international financial markets, the ships were supplied in cheap foreign ports (the largest service base originated in the Korean city of Busan), and the proceeds were transferred to the accounts of foreign banks and invested in real estate in a number of countries where life was comfortable [6]. Moreover, violations of the law were noted at each stage of this process: fishing and export rules in Russia, foreign exchange settlements and transportation of seafood in Japan, customs clearance in Korea, tax laws in the US, and banking procedures

in Cyprus, among others. Obviously, the problem of crab harvesting and trade has acquired an international character, and its solution requires multilateral actions [4].

Under these circumstances, Russian authorities turned to their foreign partners in crab-importing countries for help. In 2001, they convinced the Japanese authorities to start checking Russian customs declarations with suppliers and transferring data to Russia. Unfortunately, two years later, this cooperation ended due to dissatisfaction on the Russian side with the timing and quality of the information provided and on the Japanese side with the spread of corruption and a large number of forged documents. From 2006 to 2013, Russia banned king crab harvesting around Sakhalin and Kamchatka due to depleted resources. From 2007 to 2011, it prohibited the export of live crabs to Japan. In 2008, it introduced a mandatory customs clearance of EEZ catches on the territory of Russia to replace the previous procedure for the free export of crabs caught outside the territorial waters. Significant measures adopted by Russia to combat IUU harvesting of crab are outlined in Table 1.

Table 1. Key measures by Russia to combat IUU harvesting of crab.

Measure	Year
Implementation of a partial ban (2005–2007) followed by a complete ban (2008–2012) on the harvesting of the endangered red ring crab in the Sea of Okhotsk basin [1]	2007–2012
Enhancement of trade and customs control, mandating customs clearance for all catches within Russian territory, irrespective of the fishing zone [2]	2008
Establishment of a satellite monitoring center to track fishing vessel activities [3]	2008
Signing of bilateral agreements with importing countries, including South Korea in 2009; North Korea, China, and Japan in 2012; and the US in 2015 [4]	2009–2015
Signing of the PSMA [5] (ratification in 2020 [6])	2010
Establishment of a Fisheries Improvement Project (FIP) between the American non-profit Sustainable Fisheries Partnership (SFP) and the largest crab harvesting association in Russia, the Far East Crab Catchers Association (CCA) [7]	2011
Creation of a national plan to combat IUU fishing [8]	2013
Initiation of the certification process for the CCA's crab harvesting according to Marine Stewardship Council (MSC) standards [9]	2016
Commencement of the phased introduction of digital labeling for fish products [10]	2022

[1] See [45] for further details. [2] Available online: URL https://rg.ru/documents/2008/06/07/tamozhnya-suda-dok.html (accessed on 19 April 2024). [3] Available online: URL https://www.cfmc.ru/about/ (accessed on 19 April 2024). [4] Available online: URL https://crab-dv.ru/sovershenstvovanie-promyisla/international-agreements.html (accessed on 19 April 2024). [5] Available online: URL http://ips.pravo.gov.ru/?docbody=&prevDoc=102931046&backlink=1&&nd=602131496 (accessed on 19 April 2024). [6] Available online: URL https://rg.ru/documents/2020/12/11/ratifikacia-dok.html (accessed on 19 April 2024). [7] Available online: URL https://crab-dv.ru/en/fip-russian-crab/fip-russian-crab.html (accessed on 19 April 2024). [8] Available online: URL http://government.ru/docs/9385/ (accessed on 19 April 2024). [9] Available online: URL https://crab-dv.ru/en/fip-russian-crab/fip-russian-crab.html (accessed on 19 April 2024). [10] Available online: URL https://fish.gov.ru/news/2022/01/26/czifrovaya-markirovka-rybnoj-produkczii-budet-oprobovana-s-1-aprelya-2022-goda/ (accessed on 19 April 2024). Sources: author's compilation based on the aforementioned references.

In parallel, cooperation with the main importing countries has expanded. In 2008–2015, Russia signed bilateral agreements on the prevention of IUU fishing with the states of the Korean Peninsula, Japan, China, and the US [39]. Mutual control obligations were confirmed in the already mentioned PSMA framework [45]. With the introduction of these and other measures by December 2015, according to news agencies and heads of border control agencies, "large-scale deliveries of poacher crabs to the ports of Japan. . .practically ceased", and "poachers were completely squeezed out of the economic zone of the Russian Federation" [46].

These developments were confirmed by statistical analyses. Starting in 2008, after the introduction of the mandatory customs clearance of the catch in Russian territory, the gap between mirror data on crab exports by Russia and imports from Russia had steadily narrowed and, by 2015, had decreased to the level of inevitable technical discrepancies (Figure 2).

Figure 2. Exports of crab from Russia and imports by international partners (thousand tons). Sources: author's creation using the data of comtrade.com (exports of Russia and imports from Russia by the countries of the world, HS codes 030614 and 030624/030633).

A comparison of total crab imports and TAC indicates a change in dynamics: since 2013, fewer crabs have been exported from Russia than are allowed to be caught by TAC. In addition, indirect indicators of IUU activity began to decrease as well: the number of Russian media publications on the illegal fishing of crabs significantly decreased [6]. Based on these data, it appears that the era of widespread poaching and illegal exports has indeed ceased. This assessment aligns with findings from other research conducted by influential environmental organizations [40].

5.3. Dynamics of IUU Crab Harvesting since 2014

The cessation of large-scale illegal, unreported, and unregulated (IUU) crab harvesting and trade does not signify the complete eradication of all illicit activities. In this section, I aim to analyze the status of crab-related business since 2014. Indirect evidence indicates that a significant portion of the crab industry continues to operate in the shadows.

To some extent, this outcome is natural, considering the significant changes in the territorial, entrepreneurial, and foreign trade structure of the crab industry since the 2010s. Firstly, in the Far Eastern fishing basin, against the background of a certain restoration of crab resources, the permitted harvesting volumes more than doubled (from 43.6 to 104.2 thousand tons in 2011–2022). In addition, the share of the Barents Sea in the extraction and distribution of resources has increased markedly. Commercial fishing in this area began 15 years ago, and in 2022, the TAC was set at 11.6 thousand tons, representing approximately 40% of the red king crab quota permitted for harvest in Russian waters.

Then, harvesting enterprises and the structure of the crab business changed significantly. In 2000–2016, as we mentioned earlier, the number of crab harvesting companies, vessels, and sailors engaged in fishing decreased by about 70%. The number of crab harvesting companies hit the bottom in 2016 and, since then, increased to 94 in 2018 and 105 in 2020. After the introduction of the auction sale of half of the TAC quotas in 2018, a significant portion of them were acquired by large companies that had the necessary financial resources. It is not surprising that the share of small- and medium-sized enterprises among crab fishers has decreased, and the share of new large players has expanded. Their appearance has led to a serious change in the existing business environment and has given hope for the concentration of investment, increasing value-added products, and introducing more transparent harvesting and exporting of valuable marine resources.

Finally, there have also been significant changes in the composition of countries importing crabs from Russia. In particular, according to customs statistics, the share of Japan stabilized at 36.8% in 2017 and 36.7% in 2022 for frozen crabs, while the share of the US in the same period decreased from 46.2% to 33.3%. A large and rapidly growing market for live crabs has emerged in China, where Russia exported 20.1 thousand tons in 2022 against 0.19 thousand tons five years earlier. China, therefore, emerged as a major consumer, importing 55% of live crabs from Russia. Japan, on the other hand, took strict measures to curb IUU supplies and reduced imports of live crabs from Russia from 9.3 to 2.3 thousand tons. The Republic of Korea has secured the role of being the center for logistics and transshipments in the Far Eastern live crab trade. In particular, in 2022, Russian exports of live products to this country amounted to 14.2 thousand tons (39.0% of the total volume), and substantial volumes were re-exported to the US, Japan, and China. However, the available data from the comtrade.com database do not provide satisfactory statistical confirmation (imports from South Korea were not reported by the mentioned countries). This indicates both the shortcomings of statistical accounting and the expansion of non-transparent tripartite operations [4,39].

In such an environment, some indirect evidence suggests the possibility of shadow transactions in the crab-related business. I would like to start with significant discrepancies that remained in mirror-based customs statistics between Russia's data for the export and importers' data for the import of crabs (Figure 3).

Very clearly, Japan and the US systematically reported a higher tonnage of crab imports than Russian-reported exports (Figure 3a,f). South Korea declared considerably lower imports compared to Russian exports of frozen crabs (Figure 3c). Undoubtedly, to a certain extent, these discrepancies reflect a varying degree of accuracy in the customs statistics and differences in both accounting and the processing of sea cargo. Yet, the scale and duration of the inconsistencies far exceed the inevitable technical components and the consequences of deliveries through third countries [3]. Therefore, some evident signs of shadow activity are still present in the widely available statistics.

This indicates that despite major changes in the business environment, there was a steady desire for crab harvesters and traders to underestimate the size and value of the catch or hide part of it from customs and environmental authorities.

Indeed, most fishing companies promptly adhered to the new fishing regulations, ensuring transparent and lawful operations. Nevertheless, these regulatory measures introduced additional costs, reduced profitability, and dampened incentives for business reform. In my opinion, this is exemplified by the modest pace of the certification process for the Far East Crab Catchers Association's (CCA) harvesting, striving to meet Marine Stewardship Council (MSC) standards. According to the CCA's official website, the process was initiated in 2016, and the certificate was issued in October 2023, valid until 2028, marking the culmination of seven years of intensive and demanding work [47].

Furthermore, there is a minor group of enterprises for which control costs exceed the acceptable level of profit, leading to economically justified illegal activities. These companies often engage in illegal fishing and are constantly developing new methods for its practice. For example, in the early 2020s, many crab poachers began using transport ships to smuggle their IUU cargo from the Russian Federation to ports in Japan and the Republic of Korea. Poachers also exploit ships sailing under flags of convenience, as these vessels are subject to less stringent controls ([48], p. 8). These practices, known for decades, have managed to endure despite the new circumstances.

I must acknowledge that the aforementioned points regarding reduced incentives for business reform and increased motivation to engage in illegal activities do not address the exact new methods of illicit behavior, such as underreporting or concealing catches from customs authorities in the presence of electronic logbooks, videotaping inspectors, and satellite controls. Perhaps these methods can only be uncovered through costly and time-consuming on-site inspections similar to those conducted in previous research [4,23]. However, I believe it is possible to confidently assert that the strengthening of control and

the expansion of international cooperation to prevent IUU harvesting of crab have yielded significant but not entirely sustainable results.

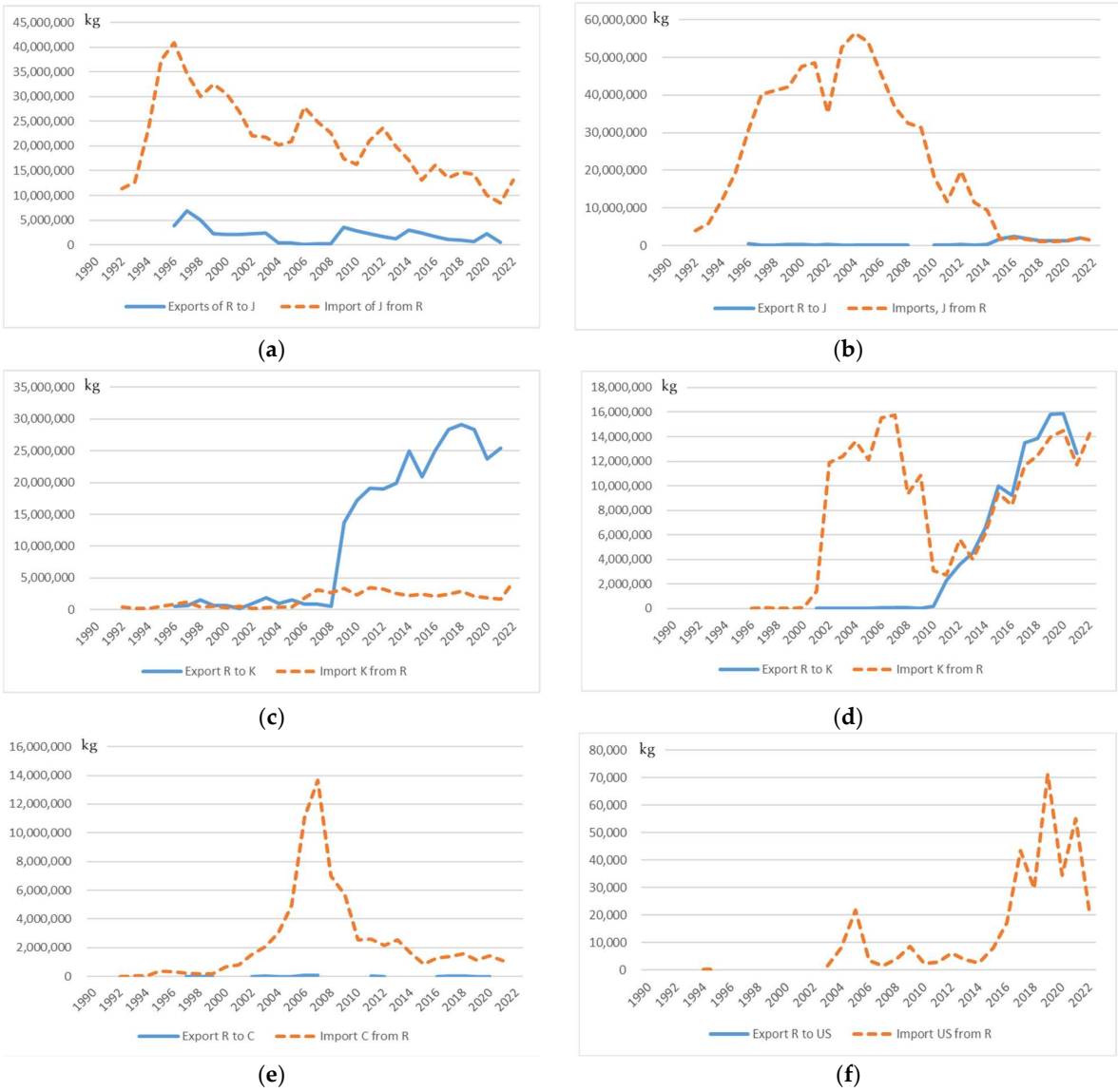


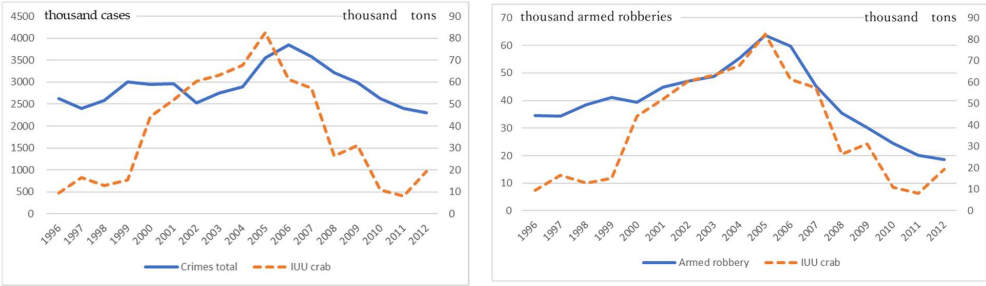
Figure 3. Mirror statistics of frozen and live crab exports by Russia and imports from Russia by the main trading partners (kg). (**a**) Japan, frozen crab. (**b**) Japan, live crab. (**c**) S. Korea, frozen crab. (**d**) S. Korea, live crab. (**e**) China, frozen crab. (**f**) US, live crab. Sources: the same as Figure 2.

Starting in 2014, the quotas for harvesting crabs began to exceed the volume of its total imports from Russia. Consequently, the development of the crab industry has entered a new stage, where it is important to maintain the emerging positive trends, rebuild the aging fishing fleet, increase the value-added products for exports, and develop new markets. In the coming years, these types of activities should determine the areas of cooperation between Russia and the main importing countries in the fishing industry.

Another important event in the crab trade took place in the first half of 2022 when the European Union and the United States imposed bans on the import of Russian crustaceans in response to the situation in Ukraine. Some of the harvested crabs were swiftly redirected to South Korea, China, and Japan. However, the market for frozen products in Europe and the United States has been hard to replace. Moreover, Asian consumers have a deeply ingrained preference for live crustaceans. A complex process of restructuring has begun in Russia, which may be accompanied by a decrease in production and a weakening of

control over both domestic harvesting and foreign sales. All of these events underlie, once again, the importance of ongoing efforts to reduce the shadow elements of the lucrative crab-related business.

In addition to changes in international trade, certain significant trends have emerged within Russia. The relationship between IUU fishing and the characteristics of the social environment can be illustrated by comparing the dynamics of IUU crab harvesting with domestic crime rates during the period of most active illegal fishing from 1996 to 2013 (see Figure 4).



(**a**) (**b**)

Figure 4. IUU crab harvesting (thousand tons, right axe) and the number of crimes (thousand cases, left axe) in Russia in 1996–2013. (**a**) IUU crab harvesting and the total number of crimes. (**b**) IUU crab harvesting and the number of armed robberies. Sources: IUU crab harvesting is a difference between total crab imports by partner countries and TAC (see Figure 1 for details); the total number of crimes and the number of armed robberies are obtained from the Statistical Committee of Russia, https://rosstat.gov.ru/ (accessed on 16 April 2024).

It is evident from Figure 4 that estimates for IUU crab harvesting closely correlate with the total number of registered crimes in Russia (Figure 4a, correlation coefficient = 0.61) and even more strongly with particularly dangerous crimes such as armed robberies (Figure 4b, correlation coefficient = 0.86). According to the available literature, this correlation suggests that inadequate institutional capabilities of the state can lead to an increase in various types of crimes, including IUU harvesting [7,8]. Conversely, a surge in IUU fishing can exacerbate the crime situation, especially in regions where crab harvesting is prevalent.

Russian domestic statistics do not indicate an increase in criminal activity since 2019. However, certain international estimates do suggest a weakening of the institutional capacity and quality of the Russian state, which is widely recognized as an important component in deterring illicit activity [49], including IUU fishing. This decline is evidenced particularly by the dynamics of standard indicators commonly used to assess the quality of governance and the business environment [50] (refer to Table 2).

Table 2. Selected governance and business environment rankings for Russia (2019–2022).

Indicator	Rank/Number of Countries	Trends in 2019/2022
Rule of law index	168/193	↓
Government effectiveness index	141/193	↓
Control of corruption	153/193	↓
Regulatory quality index	167/193	↓
Voice and accountability index	164/193	↓
Political stability index	160/193	↓

Sources: author's compilation based on the World Bank data, https://www.worldbank.org/ (accessed on 16 April 2024).

For instance, the Government effectiveness index by the World Bank declined over three years following the onset of the COVID-19 pandemic in 2020, reaching its lowest point in 2022 (−0.11 in 2020, −0.21 in 2021, −0.69 in 2022) [51]. By comparison, a country with

high institutional capacity, such as Japan, recorded a reading of +1.6 for 2022. Very similar trends are also demonstrated by other indirect indicators of institutional quality, such as the Corruption perceptions index (by Transparency International), the Political rights index, and the Civil liberties index (by Freedom House), as well as a wide range of political system quality indexes from the Varieties of Democracy project (V-Dem). Given the established link between the shadow economy and the institutional capacity of the state, the possibility of a near-future increase in IUU fishing in Russia appears to be a well-founded hypothesis.

Lastly, another intriguing domestic development in Russia pertains to the social perception of IUU fishing. Previous research has identified a positive correlation between IUU crab harvesting figures and the number of relevant mass media reports during the period of 2000–2013 [6]. However, such research is not available for periods after 2013, when large-scale IUU activities were halted. Nonetheless, rough estimates suggest that media coverage of illegal business activities may be resurging. For instance, a Google search for Russian equivalents of "IUU fishing" and "IUU crab" keywords («ННН промысел» and «ННН краб») returned 747 and 1460 hits for 2023, respectively, marking a 3.7-fold and 7.8-fold increase compared to the average numbers from 2014 to 2022 (201 and 188). These figures for 2023 also represent a 3.3-fold and 4.5-fold increase compared to the previous year, 2022 (229 and 323). The rapid rise in media coverage may suggest that something unusual is occurring in the realm of IUU fishing and crab harvesting.

All three groups of indicators discussed above indicate that the potential for the expansion of the illegal crab business remains in Russia. Discrepancies persist between Russian data on exports and international data on imports of crabs, the institutional capabilities of the state in combating the shadow sector are declining, and the number of Internet publications on the topic of illegal crab fishing is increasing. Therefore, this issue remains unresolved and demands ongoing attention.

6. Conclusions and Recommendations

A comparison of data on the TAC of crab in Russian waters and its importation from Russia, along with a narrative analysis of institutional dynamics, allows us to delineate the post-Soviet period into three distinct stages: (1) From 1990 to 1995, the TAC exceeded imports, yet the crab fishery suffered from a shortage of catching vessels and financial resources. (2) Between 1996 and 2013, actual production and imports significantly surpassed the TAC, leading to widespread IUU harvesting and the emergence of a large informal sector in the Russian crab trade. (3) Since 2014, the TAC has exceeded imports, with IUU fishing and shadow trade reduced to negligible levels. However, several indirect indicators, such as 'mirror' international crab trade statistics, the quality of the institutional environment and government, and coverage of IUU fishing in online media, suggest that some shadow activity persists and could rapidly escalate under worsening international conditions. This complexity derails efforts to address current issues in the Russian crab industry and underscores the importance of international cooperation in finding solutions.

A quarter of a century of combating IUU crab harvesting in Russia has made it possible to restore law and order, preserve resources, and improve international cooperation. In other words, conditions have appeared for the implementation of Russia's national interests related to sustainable development and the protection of valuable natural resources. The reverse side of the coin was the periodic revival and the emergence of new forms of shadow activity, as well as the reduction in employment, the monopolization of the industry, and the loss of the share in foreign markets. How might we consolidate the achievements and level out the failures? In other words, what measures can prevent the revival of the shadow sector but at the same time not suppress market competition and entrepreneurial initiative? The theory of the public sector rightly points to the improvement of the quality of state and public administration (governance). This recommendation, although general in nature, certainly makes sense, as it is precisely in the realm of governance that Russia currently faces challenges and yet possesses significant potential for the swift enhancement of the situation.

In our particular case, the analysis of the crab industry allows us to identify at least three practical recommendations aimed at improving protection and increasing the efficiency of resource utilization. First, it is necessary to make fuller use of the system of information interaction between the authorities and business and public circles. It is quite likely that in the conditions of weakness of business associations, NGOs, and other relevant institutions, which are typical for Russia, the established and informal media can play an important role in filling the lack of reliable information about shadow activity and formulating the demands of the society.

Secondly, from the point of view of resource protection, it makes sense to continue the concentration of economic activity in the hands of large and law-abiding companies since such enterprises have more opportunities and incentives to harvest and sell crab without resorting to shadow activities. This does not mean the need to oust small- and medium-sized enterprises from the crab business. We are talking about building cooperative interactions between enterprises of various sizes, as well as the formation of a business climate in the industry, more precisely focused on national economic interests, ranging from protection of resources to increase of employment.

Thirdly, the fight against IUU fishing requires continued and close coordination of international efforts, which must be ongoing and long-term. The curtailment of international cooperation is leading to the revival of shadow activities in new and even more sophisticated forms. A multilateral character, a long-term approach, and a gradual spread from the fight against IUU activities to interaction in the areas of technology exchange, investment coordination, and cooperation for the development of third-country markets are all important for the realization of Russia's national interests in trade with major international partners. Additionally, Russia's experience could prove insightful for numerous developing nations, particularly Chile and Argentina, as they aim to enhance their commercial harvesting of king and snow crab.

The thesis emphasizing the importance of international cooperation for Russia becomes particularly relevant in the context of sanctions imposed by several countries following the events in Ukraine. The United States' prohibition on the import of Russian marine products, Japan's heightened import duties, and Korea's expanded restrictive measures have already initiated shifts in the directions and mechanisms of international trade. A thorough analysis of these changes will be possible in 2–3 years. In the meantime, there is a hope that these developments will not jeopardize the previously established system of international crab trade.

Funding: The APC was funded by Fukui Prefectural University Research Support Fund, May 2024.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Supporting data for the reported results can be located in books, papers, and internet sources referenced within the text.

Conflicts of Interest: The author declares no conflicts of interest.

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