Market Growth Potential

for Kazakhstan Fisheries and Aquaculture Products

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Cover photo: Common carp (*Cyprinus carpio)* can grow up to 15 kg. *Photo Credit:* G. Iskakov/H. Mikkola.

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Acknowledgments

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Abbreviations and Acronyms

CACFish	Central Asian and Caucasus Regional Fisheries and Aquaculture Commission
CIF	Cost, Insurance, and Freight
COVID-19	Coronavirus Disease 2019
CP	Crude Protein
EAEC/EurAsEC	Eurasian Economic Community
EBRD	European Bank for Reconstruction and Development
EU	European Union
FAO	Food and Agriculture Organization (of the UN)
FCR	Feed Conversion Ratio
GDP	Gross Domestic Product
HS	Harmonized Commodity Description and Coding System
IMF	International Monetary Fund
IRR	Internal Rate of Return
IUU	Illegal, Unregulated, or Unreported
KFDP	Kazakhstan Fisheries Development Programme by 2030
NACA	Network of Aquaculture Centres in Asia-Pacific
NFDP	National Fisheries and Aquaculture Development Programme
NPV	Net Present Value
RAS	Recirculating Aquaculture System
UN	United Nations
VASEP	Vietnam Association of Seafood Exporters and Producers
WAPI	World Aquaculture Performance Indicators
WCO	World Customs Organization
WEO	World Economic Outlook

Units

g	Gram
kg	Kilogram
km	Kilometer
KZT	Kazakhstan tenge
$	United States dollar

Abstract

Kazakhstan is home to a variety of commercially viable fish species, a large domestic market (1.83 million consumers in 2020), proximity to potentially lucrative export markets, and the resources necessary to expand the sector. The country has adopted a strategy to increase fish production by boosting fish farming and setting ambitious targets for aquaculture development by 2030. Domestic fish demand is expected to increase by 27% between 2018 and 2030. Yet Kazakhstan's current policy framework, the National Fisheries and Aquaculture Development Programme (NFDP), is mostly supply driven, with inadequate consideration for whether or how the intended production expansion can be accommodated. To align the NFDP and related policies with Kazakhstan's market growth goals, this report's recommendations include: developing domestic markets; promoting export markets; strengthening the regulatory framework; pursuing a value-oriented production strategy; adopting environmental best practices; promoting a positive image of Kazakhstan's fish through external public relations campaigns; and integrating Kazakhstan's aquaculture into a larger system of sustainable landscape practices.

Executive Summary

Executive Summary

Background

At the request of the Government of Kazakhstan, the World Bank and the Food and Agriculture Organization (FAO) of the United Nations (UN) have conducted a series of reviews (2003, 2010, 2016, and 2018) of the potential for growth in Kazakhstan's fisheries economy. The main conclusions of these studies include the following:

- Fish production has declined to about half of what it was under the USSR's subsidies structure.
- The main causes of decline in capture fisheries are: unregulated access, decline of government stocking programs, and reduction of flows in rivers due to diversion for irrigation and blockage for hydropower.
- Unused government hatchery infrastructure is available for stocking valuable fish species for income and conservation.
- There are abundant natural aquatic resources that could be more intensively managed for the benefit of local communities and gross domestic product (GDP).
- A large majority of registered fishers are subsistence/recreational in purpose.
- The cost of modifying infrastructure to recover lost fisheries and aquatic biodiversity will be high compared to expected national returns on investment.

In December 2018, these findings informed a comprehensive National Fisheries and Aquaculture Development Programme (NFDP) that was sent to the World Bank for review and advice. A mission was conducted in spring 2019, during which a wide range of senior government specialists, local experts, and seafood industry stakeholders were consulted for their evaluation of the practicality and potential impact of the NFDP in Kazakhstan. It was agreed that more information about potential markets was needed to effectively prioritize the broad range of interventions envisioned under the NFDP.

This study was subsequently carried out on behalf of the Ministry of Ecology's Committee for Fisheries to explore national, regional, and more distant international market trends and opportunities for species and product forms currently being produced or contemplated under the NFDP.

Findings

The study's key findings are:

- Kazakhstan is endowed with a variety of fish species, a large domestic market (1.83 million consumers in 2020), proximity to potentially lucrative export markets, and abundant water resources. Relative to potential, Kazakhstan is underperforming in freshwater fish output, producing only 0.0032% of the world's inland aquaculture while having 5.14% of the total surface area of inland water bodies.
- Kazakhstan has adopted a strategy to increase fish production by boosting fish farming, setting ambitious targets for aquaculture development by 2030. Currently, aquaculture production represents 13% of Kazakhstan's total fish production. Most of the aquaculture production comes from extensive/pasture aquaculture that relies on natural productivity to grow hatchery-produced fry or fingerlings stocked into artificial and/or natural water bodies and harvested, either commercially or through fee-based recreational fishing.
- The Kazakhstan NFDP is mostly supply

driven, with inadequate consideration of whether or how the intended production expansion can be accommodated, either by domestic or international market capacity. This report seeks to inform the NFDP by examining fish production trends, trade, and consumption and estimating domestic and foreign market growth potential driven by income and population growth. The report also offers a series of recommendations to maximize the government's efforts to capitalize on the economic potential of the sector.

- In 2018, Kazakhstan had a slightly positive trade balance for seafood. According to UN Comtrade statistics, the country exported 108 different types[1] of fish and fishery products to 36 countries/territories in 2018, for a total value of $116 million. Europe was the largest market accounting for 85% of the total. The country imported 205 different types of fish and fishery products worth $96 million in 2018.
- Based on projected population growth and per capita income growth adjusted to the impact of the Coronavirus Disease 2019 (COVID-19), domestic fish demand is expected to increase by 27% between 2018 and 2030. Using the same approach, export market growth is expected to increase by 13%. The domestic and export market growth potential for carp is the largest (30,379 tons), followed by roach (6,422 tons) and perch/pike/pikeperch (6,267 tons). The relatively low export market growth potential reflects the lack of population growth and the relatively low income-driven growth in per capita demand in most export markets of fish and seafood products from Kazakhstan.

Recommendations

The following key recommendations for Kazakhstan's fisheries and aquaculture sector will help align the NFDP with market demand:

- Developing the domestic market. Increasing domestic consumption should be a priority for policy and planning. Even if the actual consumption is currently higher than what official statistics seem to indicate, fostering or strengthening the domestic fish market tends to be one of the most effective ways to facilitate aquaculture development in the long run.
- Promoting export markets. Improving the quality of fish production (in terms of freshness, cleanliness, and safety), identifying and exploring niche markets through proper marketing/branding strategies and innovation in value-added products could make Kazakhstan's seafood more attractive in foreign markets. These recommendations could be achieved through a combination of targeted support to the private sector through, for example, the creation of an incubator that could bring together the private sector, public agencies, and academia and linking them to a publicly financed capacity-building program and promotion campaign.
- Strengthening monitoring, policy, and regulations. There is an urgent need to strengthen data and statistics in aquaculture and fisheries. Evidence-based policy and planning are impossible without reliable data and information. An effective legal and regulatory framework is also needed to ensure food safety, environmental integrity, and social license to operate. Proper site selection and zoning for aquaculture are needed to protect cage aquaculture in the

[1] Measured by the number of different Harmonized Commodity Description and Coding System (HS) six-digit codes. The HS is administrated by the World Customs Organization (WCO) and is updated every five years. The system serves as the foundation for the import and export classification systems used by many trading partners. The HS assigns specific six-digit codes for varying classifications and commodities.

Caspian Sea from existing and potential impacts of industrial and agricultural development on water quality—for example, from oil exploration and production. Planning and monitoring are also needed to prevent self-pollution of aquaculture activities.

- Pursuing a value-oriented (as opposed to volume-oriented) aquaculture development strategy. At its current stage of development, it may be difficult for Kazakhstan to rapidly increase aquaculture production. Species with great market potential (for example, pikeperch) face technical constraints on production, while species with relatively mature farming technology (for example, carp, rainbow trout, and sturgeon) are subject to limited domestic demand, competitive international markets, or both. A volume-oriented development strategy may not yield desirable outcomes due to a highly competitive global market.
- Adopting a development strategy based on best environmental practices. Extensive/pasture aquaculture can be turned into a marketing advantage by selling fish grown as wild fish (or naturally farmed fish) for premium prices, as many consumers are willing to pay for such 'wildness.' Under this strategy, the focus of farming is on creating and adopting an environment- and fish-friendly farming practices to produce high-quality fish and turn this into economic value through proper marketing strategies.
- Promoting a positive national image for Kazakhstan's fish. The global drive to build a healthy and profitable seafood and fishing sector builds synergy between catch and conservation. From an analysis of markets and trade for Kazakhstan's seafood, pikeperch and indigenous salmonids seem to be the products that are most likely to succeed commercially in the short term. Both of these are indigenous species and thus can be produced in a wide variety of management systems. Pikeperch is established in existing marketing channels, minimizing the need to make adjustments in the value chain. Caspian salmon can be produced to have the same culinary characteristics as the widely-known Atlantic salmon and could move as a specialty product through similar value chains. Social media have provided a powerful platform to propagate attractive images of Kazakhstan fish to every corner of the world. Yet all sub-sectors (fishing, farming, recreational fisheries, processing, fish markets, food catering services, and so on) need to live up to Kazakhstan's new 'Very Nice' public relations campaign being promoted by the country's Ministry of Tourism. A long-term, systematic mechanism is needed to coordinate these efforts toward a campaign promoting and publicizing high-quality fish from Kazakhstan.
- Developing and implementing of a strong regulatory framework for aquaculture development that prepares the industry for expansion and increased levels of scrutiny in markets. Such a framework would include carrying-capacity modeling, zoning, surveillance, and biosecurity. Ongoing consultation with stakeholders would also be needed to ensure clear messaging about the importance of sustainability as a prerequisite to accessing seafood markets of the future.
- Fostering adoption of production systems and value chains that are demonstrably 'blue'—that is, environmentally sustainable. Aquaculture is highly innovative. Best practices are constantly evolving, including in Kazakhstan. Strong engagement with adaptive research, including hiring international experts to work with local scientists and industry operators, can rapidly bring Kazakhstan's fish farmers up to speed. Marketing information and support through awareness-raising could position

the country's seafood as a high-quality, environment-friendly product for European as well as high-end domestic and Asian markets.

- Integrating aquaculture into sustainable landscapes. Aquaculture should develop in the context of sustainable watershed management. It can take many forms and can be conducted in a wide range of natural and artificial ecosystems, including cages in reservoirs or natural water bodies, raceways along river courses, and indoor 'fish plants' as well as traditional ponds. Stocking programs can support capture, recreational fishing, or both. Each ecosystem has a different carrying capacity that determines how much of each kind of aquaculture it can support. The government can use new and existing technologies and natural resource management science to support aquaculture mechanisms that encourage integration into sustainable landscapes.

1. Introduction

1. Introduction

A large population and abundant land and water resources give Kazakhstan great potential for the development of aquaculture and fisheries. The recent Kazakhstan Fisheries Development Programme by 2030 (KFDP) calls for a strategy of shifting from fishing to fish farming and sets ambitious targets for aquaculture production.[2] The strategy is detailed and incorporates established best practices in fisheries and aquaculture consistent with the Food and Agriculture Organization (FAO) of the United Nations (UN) Code of Conduct for Responsible Fisheries, but is almost entirely supply side with inadequate consideration of whether or how the intended production expansion could be accommodated by existing and potential markets. To address this question, an assessment of current production and trade compared to the potential for expanded domestic and foreign marketing of fish and other seafood production in Kazakhstan was conducted in 2020 based on official statistics and the existing literature supplemented with the input of local expert knowledge of Kazakhstan's seafood industry.

The information, knowledge, and insights provided by this report are intended to help the Government of Kazakhstan and other investors/donors in the private and public sectors make informed decisions on potential investments and other support to the country's fisheries and aquaculture sector. The report focuses on market and other demand-side factors with only a limited discussion on production and other supply-side factors and a few highlights of governance and other institutional issues, which need further study.

Section II provides a brief overview of the socioeconomic and natural resource conditions under which Kazakhstan is seeking to grow the seafood sector. Section III reviews the status of aquaculture and fisheries development in Kazakhstan, examines existing markets and trends, and explores the importance of the fishing and aquaculture industry in the national food supply and economy. Section IV estimates the potential impact of income and population growth on domestic and international demand. Section V discusses ways to unlock the growth potential for major fish species in Kazakhstan. Section VI concludes the report by recommending a value-oriented strategy for fisheries and aquaculture development in Kazakhstan and exploring a potential way forward accordingly. Supporting data are recorded in the Annexes.

The original work plan envisioned extensive travel and consultation with the seafood industry but was constrained by the COVID-19 outbreak and therefore limited to available import/export trade and market data and statistics from the FAO and the UN Comtrade Databases and informed by virtual consultation with stakeholders, gray literature, and industry experts.

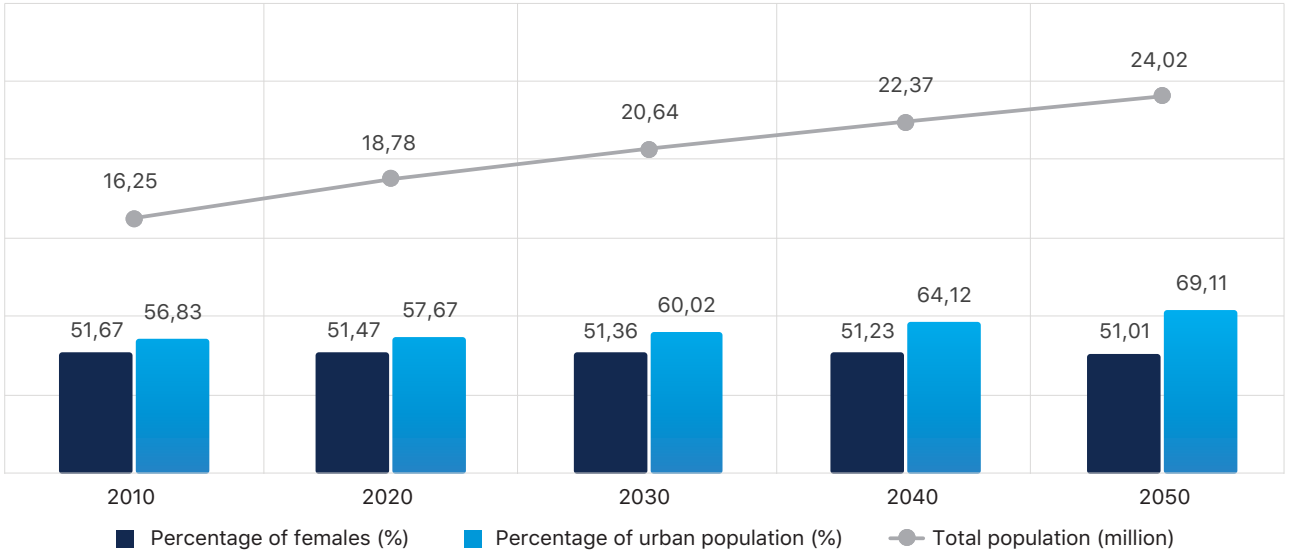
[2] https://primeminister.kz/ru/news/pravitelstvo-prinyalo-programmu-razvitiya-rybnoy-otrasli-do-2030-goda-2911034

2. Natural Resources and Socioeconomic Background

2. Natural Resources and Socioeconomic Background

Kazakhstan is the second most populated country in Central Asia (after Uzbekistan), and its 18.3 million population in 2018 was 0.24% of the world's total (Table A1, Annex A). Kazakhstan's population is expected to grow to 21 million by 2030 (24 million in 2050), with 60% (70% in 2050) of the people living in urban areas (Figure 2.1).

FIGURE 2.1: KAZAKHSTAN'S POPULATION PROSPECTS (2010–2050)



Data sources: UN World Population Prospects (2019 revision) and UN World Urbanization Prospects (2018 revision).

Kazakhstan is comparatively better endowed with inland water bodies. In comparison to its 0.24% of the world's population, Kazakhstan (Figure 2.2) is relatively rich in land and water resources. It is the largest landlocked country accounting for 2% of world total land area, 5.1% of world total surface area of inland water bodies, and 0.2% of global total renewable water resources (Table A1, Annex A).

Kazakhstan is an upper-middle-income country with $9,440 per capita gross domestic product (GDP) in 2018, higher than the Central Asian average yet only 84% of the world average (Table A1, Annex). Based on the pre-COVID-19 projection by the International Monetary Fund (IMF), the country's per capita GDP was expected to reach $13,186 in 2024 (Figure 2.3). The 5.7% annual national growth is higher than the world average (4.1%).

Like many higher-income countries, the prevalence of undernourishment in Kazakhstan (2015–2017) is less than 2.5% (compared to over 10% in the world), and it also has a low prevalence of severe food insecurity (1.4% compared to 8.2% in the world). But the country's 21.3% obesity rate in the adult population (2016) was much higher than subregional, regional, and world averages (Figure 2.4).

FIGURE 2.2: MAP OF KAZAKHSTAN WITH ITS INLAND WATER BODIES

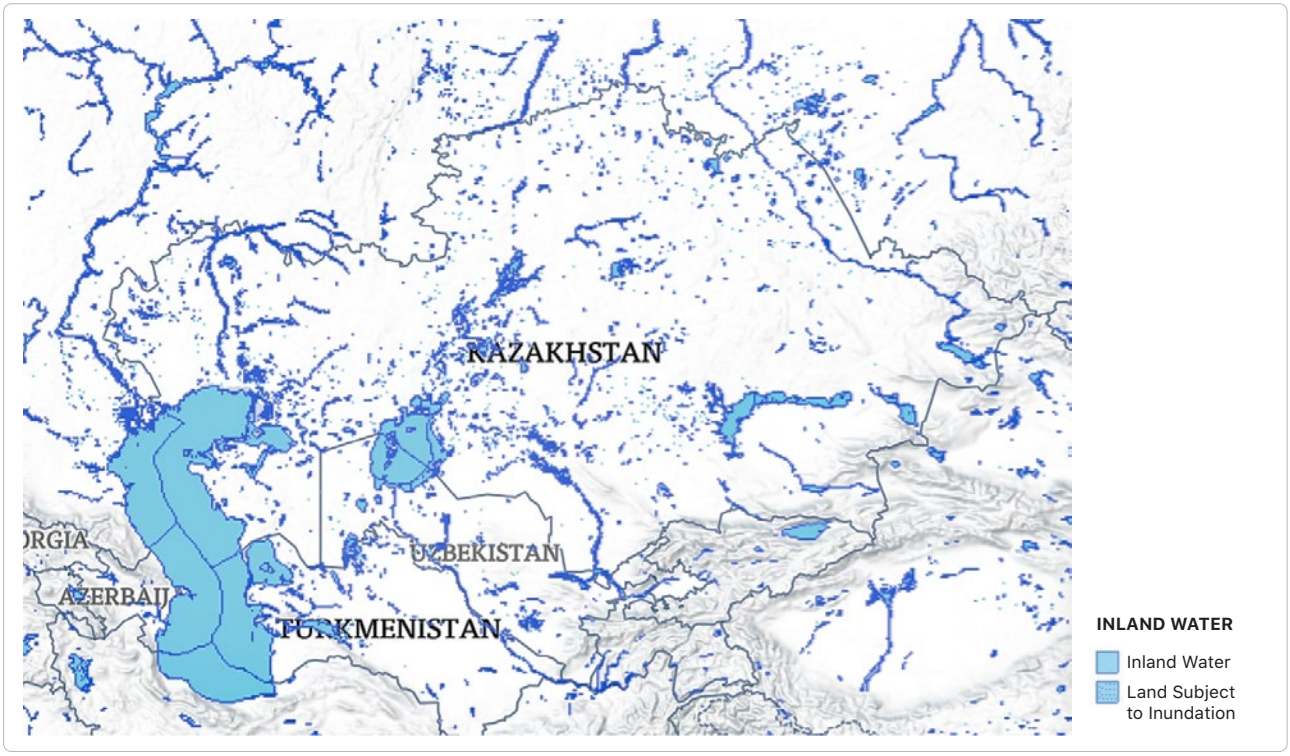
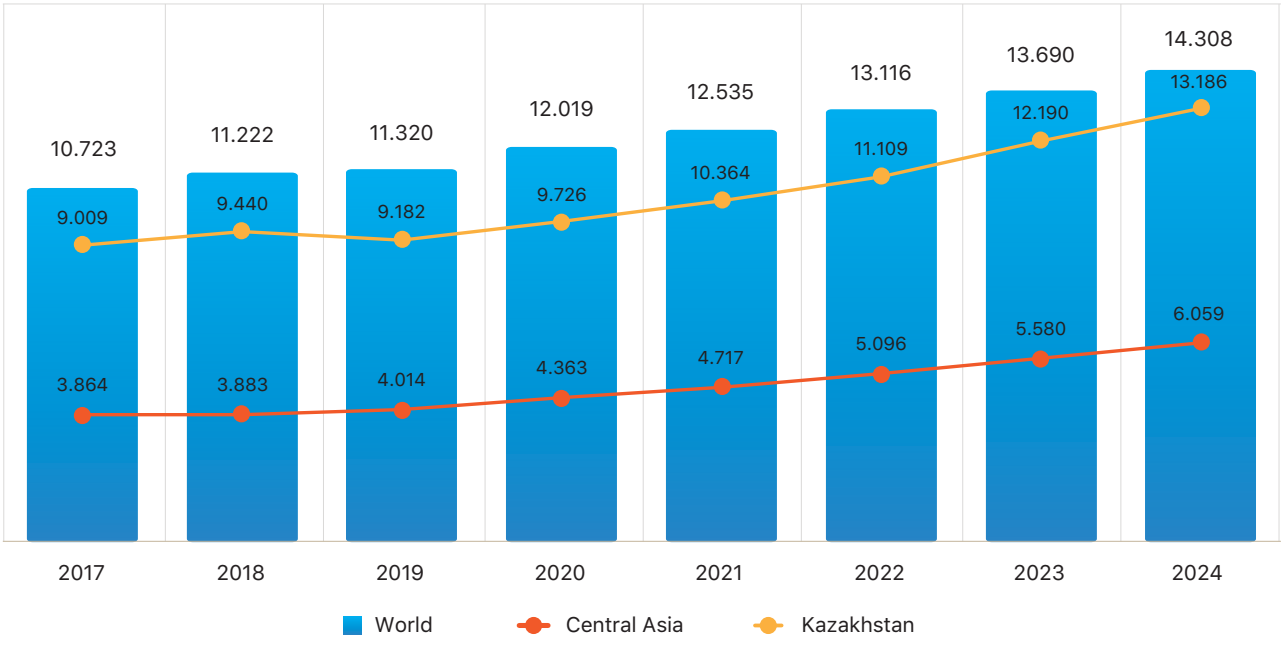
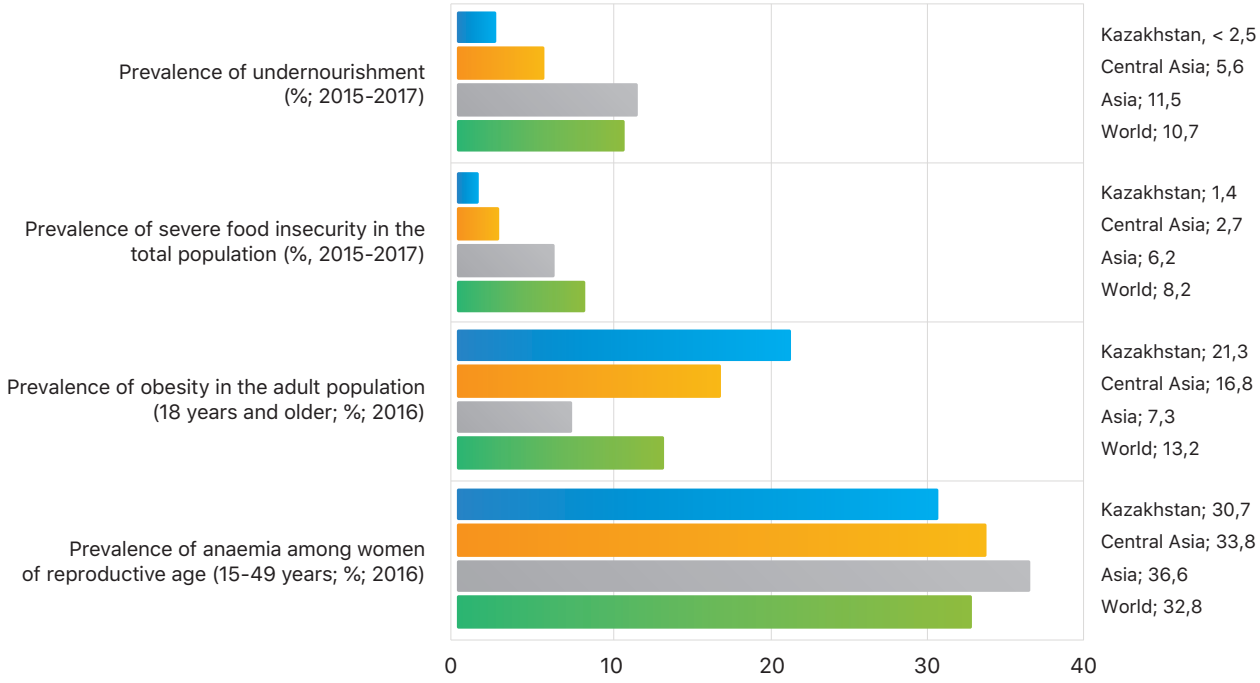


FIGURE 2.3: PRE-COVID 19 PROJECTION OF KAZAKHSTAN'S PER CAPITA GDP (CURRENT $, 2017–2024)



Data sources: IMF World Economic Outlook (WEO) database (October 2019).

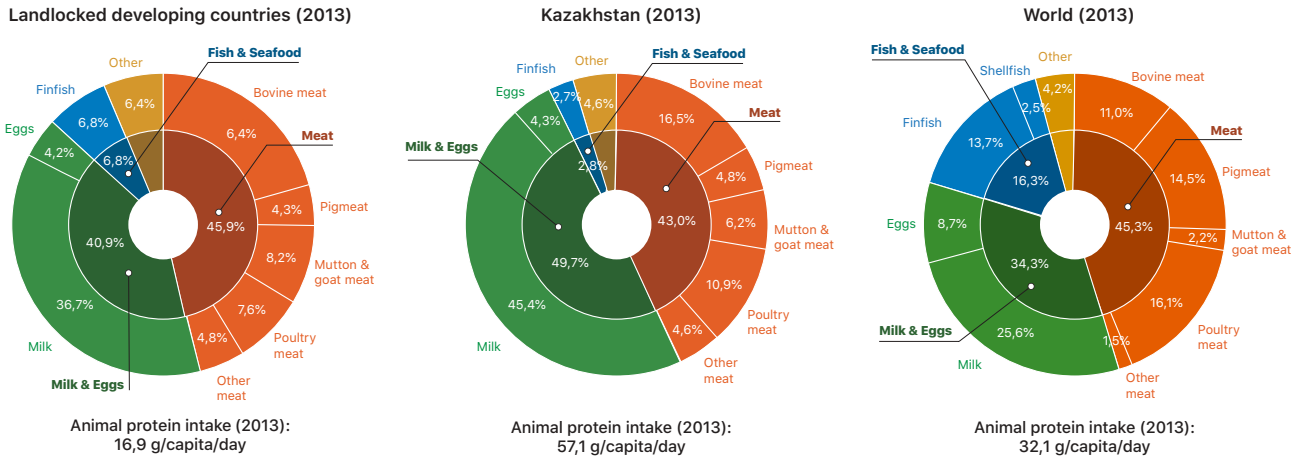
FIGURE 2.4: FOOD SECURITY AND NUTRITION STATUS IN KAZAKHSTAN



Data source: FAOSTAT – Suite of Food Security Indicators (updated on October 11, 2019).

Kazakhstan's 57.1 g/day per capita animal protein intake in 2013 was much higher than the landlocked developing countries average (16.9 g/day) and the world average (32.1 g/day). Yet the share of fish and seafood in its animal protein intake (2.8%) was much lower than the landlocked developing countries (6.8%) and the world (16.3%) in 2013 (Figure 2.5 and Table A2, Annex A).

FIGURE 2.5: ANIMAL PROTEIN INTAKE - KAZAKHSTAN VERSUS REGIONAL/WORLD PATTERNS, 2013



Data source: FAOSTAT Food Balance Sheets (accessed January 2018), www.fao.org/faostat/en/#data/FBSH.

The official statistics support the common perception that in Kazakhstan, people generally do not eat much fish. According to FAO,[3] fish and seafood contributed 2.3% of Kazakhstan's animal protein intake in 2017, much lower than the 17.1% of the world average. FAO statistics based on the food balance approach (that is, consumption = production + import – export)[4] indicate that per capita fish consumption in Kazakhstan declined from 3.81 kg in 2000 to 2.86 kg in 2017.[5] Using the food balance approach (Table A3, Annex A), Kazakhstan national production statistics and UN Comtrade import/export data are generally consistent, showing approximately 2.51 kg of per capita fish consumption in 2018 in line with FAO statistics.

However, the food balance approach may underestimate fish consumption in Kazakhstan because the official production statistics do not account for (a) fish production for fishers' own consumption; (b) fish harvested in recreational or amateur fishing; (c) undocumented import; and/or (d) production by illegal, unregulated, or unreported (IUU) fishing.

According to national household surveys (Table A4, Annex A), Kazakhstan's per capita fish consumption was 11.3 kg in 2015, 10.9 kg in 2016, 10.7 kg in 2017, 13.2 kg in 2018, and 14.6 kg in 2019. Fish consumption varied across regions, but consumption in urban and rural areas did not appear to differ significantly. Given the 13.2 kg per capita fish consumption based on the household survey and the 18.32 million population, Kazakhstan's total fish consumption in 2018 was 241,269 tons. An estimate of fish consumption by species is shown in Table 2.1. The total consumption of each species can be calculated by the food balance approach: production plus import minus export, and the corresponding per capita consumption is equal to the total consumption divided by Kazakhstan's 18 million population in 2018, resulting in an estimate of 5.71 kg of consumption of carps; 1.22 kg of consumption of roach; and 0.8 kg of consumption of perch, pike, or pikeperch (total 7.73 kg).

Low-income populations (that is, those with income below subsistence level) appeared to eat much less fish (Table A4, Annex A). This primarily reflects the dietary tradition in Kazakhstan that is based on meat and dough products. Compared to high-income populations, low-income populations tend to be less influenced by a modern dietary culture that includes healthy elements (for example, vegetables and fish), and they also tend to be more conservative in their dietary habits. In addition, fish is generally considered an expensive product, except in coastal villages where cheap fish are readily available.

Even with diverging figures, the trends in Kazakhstan's total fish and seafood consumption are likely indicative and declined by more than half between 1993 and 1998 due to the reduction in the food fish supply from domestic sources (Figure 2.6). Since the late 1990s, the country's total fish consumption reversed the downward trend primarily owing to a large increase in net import (that is, fish import minus export) from close to zero to nearly 50,000 tons between 1992 and 2013.

[3] FAOSTAT New Food Balances (accessed September 2020), http://www.fao.org/faostat/en/#data/FBS.

[4] FAO. 2020. "Fishery and Aquaculture Statistics. Food balance sheets of fish and fishery products 1961–2017 (FishStatJ)." www.fao.org/fishery/statistics/software/FishStatJ/en.

[5] The FAO statistics on fish consumption are only updated to 2017 at the time of writing this report.

TABLE 2.1: ESTIMATION OF FISH CONSUMPTION IN A NATIONAL HOUSEHOLD SURVEY, 2018

Species (ranked by consumption)	I	II	III	IV	V	VI	VII	VIII
	Production (live weight, tons)				Trade (live weight equivalent, tons)		Consumption (live weight equivalent)	
	Aquaculture	Capture fisheries		Total	Import	Export	Total (tons)	Per capita (kg)
		Official	Unreported					
All species	**5,653**	**37,283**	**174,307**	**217,243**	**73,171**	**49,145**	**241,269**	**13.17**
Carps	3,464	19,710	92,148	115,322	0	10,657	104,665	5.71
Roach	63	4,289	20,051	24,402	0	2,056	22,347	1.22
Perch/pike/pikeperch	49	6,647	31,074	37,770	0	23,086	14,684	0.80
Catfish	0	1,013	4,736	5,749	881	283	6,347	0.35
Salmon	0	0	0	0	6,144	0	6,144	0.34
Whitefish	254	104	487	846	0	0	846	0.05
Sturgeons	650	1	5	657	0	0	657	0.04
Rainbow trout	568	0	0	568	385	336	618	0.03
Others	603	5,520	25,806	31,929				

Note: HS = Harmonized Commodity Description and Coding System.

I: National official statistics on aquaculture production - see Table A1.

II: National official statistics on capture fisheries production statistics - see Table A1.

III: 174,307 tons of unreported capture fisheries production of all species equal to 217,243 tons of total production (IV) minus 5,653 tons of aquaculture production minus 37,283 tons of official statistics on capture fisheries production. The 174,307 tons of total unreported capture fisheries production attributed to individual species according to their shares in official capture fisheries production.

IV: 217,243 tons of total production of all species equal to 241,269 tons of consumption (VII) plus 49,145 tons of export (VI) minus 73,171 tons of import (V). The total production of each individual species equal to official aquaculture production statistics (I) plus official capture fisheries production (II) plus estimation of unreported capture fisheries production (III).

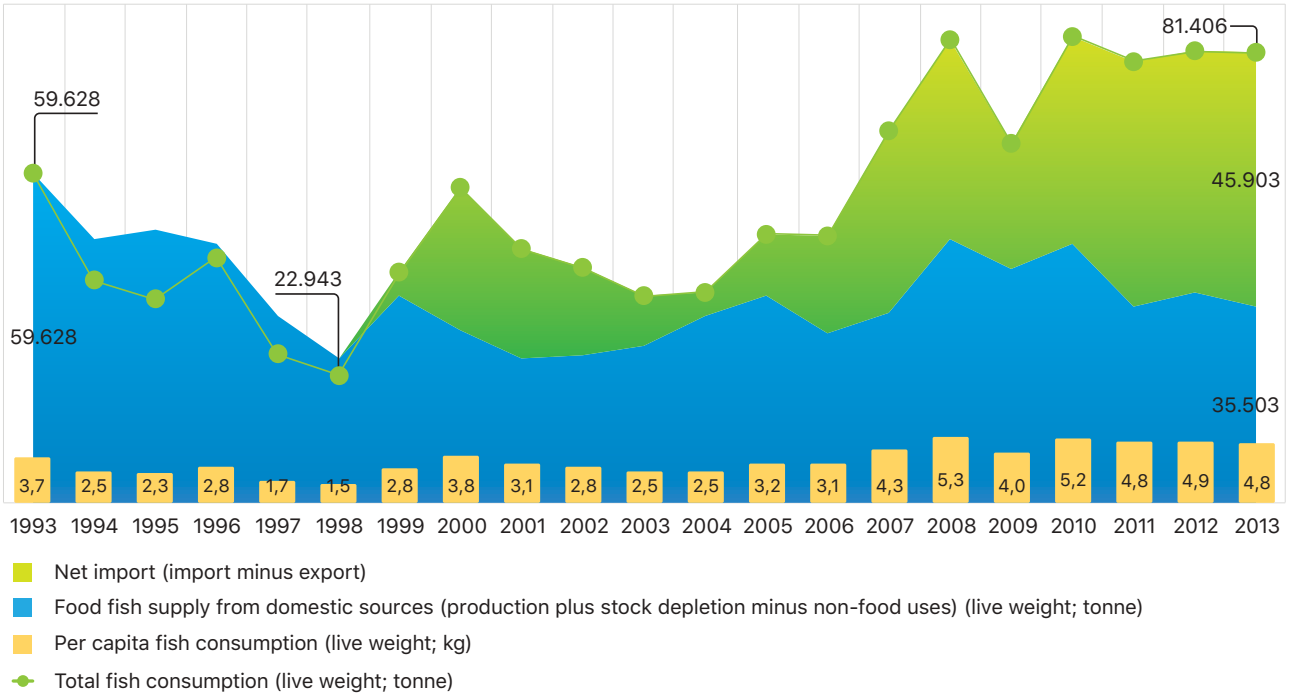
V: 73,171 tons of the import of all species equal to the live weight of official import statistics (52,150 tons) plus 21,021 tons of estimation of unreported import of herrings - see more detailed explanation in the text. Import of catfish equal to the live weight of 383 tons of import of frozen catfish fillet (HS030462). Import of salmon equal to the total live weight import of 4,686 tons of frozen Atlantic salmon (HS030313), 136 tons of fresh/chilled Atlantic salmon, and 440 tons of frozen Pacific salmon (HS030312).

VI: 49,145 tons of the export of all species equal to the live weight of official export statistics. Estimation of the live weight equivalent of export of individual species explained in detail in the text.

VII: 241,269 tons of the live weight consumption of all species equal to 13.17 kg per capita consumption multiplied by 18 million population. The live weight consumption of an individual species equal to production (IV) plus import (V) minus export (VI).

VIII: Equal to total consumption (V) divided by 18 million population.

FIGURE 2.6: TREND IN SEAFOOD SUPPLY AND UTILIZATION IN KAZAKHSTAN (1993–2013)



Data source: FAO Food Balance Sheets of fish and fishery products, 1961–2013, published through FishStatJ (accessed November 2017), www.fao.org/fishery/statistics/software/fishstatj/en.

In summary,

- Kazakhstan is comparatively better endowed with inland water bodies. It is the largest landlocked country accounting for 2% of the world's total land area and 5.1% of the world's total surface area of inland water bodies.
- Kazakhstan's total population is expected to grow from 18.3 million in 2018 to 21 million by 2030. In recent years, GDP in Kazakhstan has performed better than the world average.
- Food security has not been a major issue in the country, yet adult obesity appears to be more serious in Kazakhstan than the world average.
- Kazakhstan's per capita animal protein intake was nearly twice as high as the world average, yet the fish share in its animal protein intake appears to be three times lower than the world average. Low-income populations eat even less fish.
- Per capita fish consumption appears to be increasing since the late 1990s, supported by the increasing import volume of seafood. Estimates of per capita fish consumption show a wide variation depending on the statistical sources. Official FAO and national statistics could be underestimated due to illegal and unreported catches.
- According to the FAO statistics, imports accounted for nearly 70% of Kazakhstan's domestic food fish supply in 2013, whereas only 30% was from domestic production.

3. Status and Trends of Fisheries and Aquaculture Development

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3.1 Fish Production

Table 3.1 illustrates the main fish species found in Kazakhstan waters and markets. Common carp accounts for over half of the total production, followed by pikeperch/zander and roach.

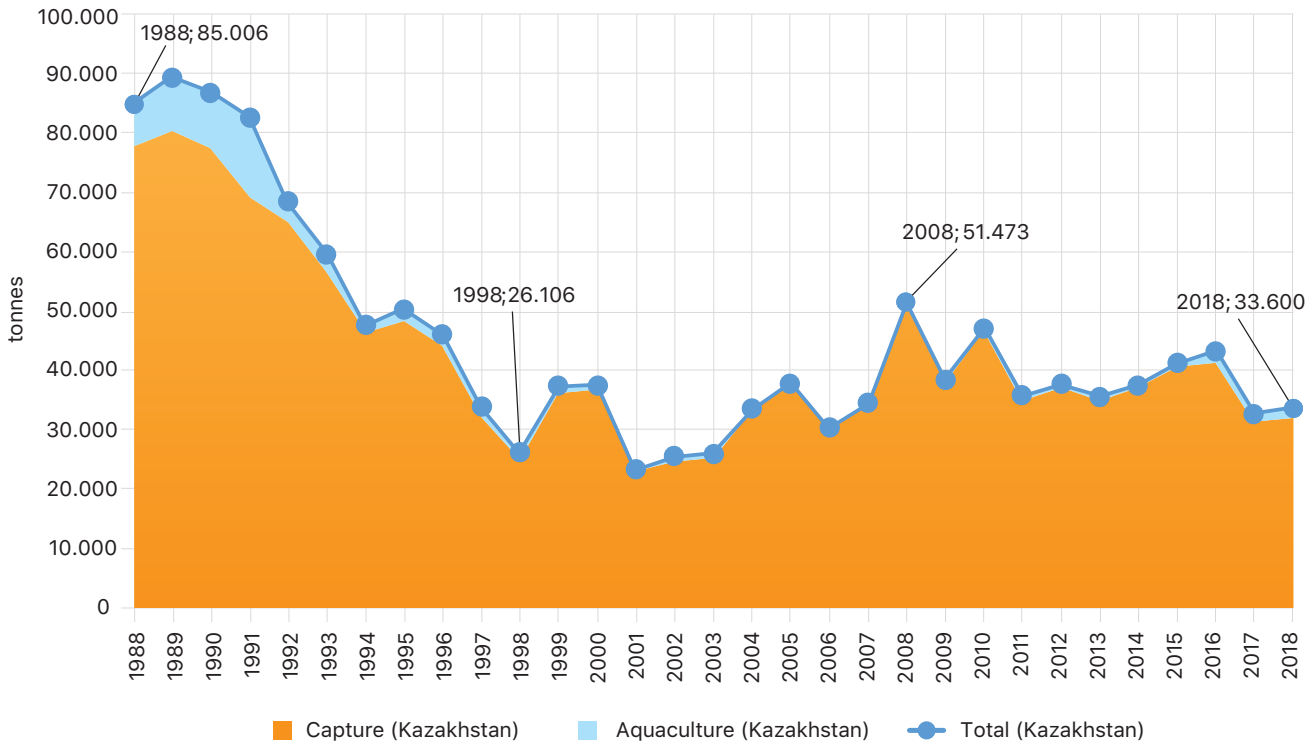
TABLE 3.1: FISH CURRENTLY DOMINATING WATERS AND LOCAL FRESH MARKETS IN KAZAKHSTAN (NOT TO SCALE)

Pike (Esox lucius)		**Snakehead** (Channa argus)	
Pikeperch or Zander (Sander lucioperca)		**Tench** (Tinca tinca)	
Perch (Perca fluviatilis)		**Rainbow Trout** (Oncorhynchus mykiss)	
Wels or Sommes (Silurus glanis)		**Whitefish** (Coregonus lavaretus)	
Asp (Leuciscus aspius)		**Common Carp** (Cyprinus carpio)	
Caras or Gibel Carp (Carassius spp.)		**Freshwater Bream** (Abramis brama)	
Roach (Rutilus rutilus)		**Sturgeon** (Huso and Acipenser spp.)	

According to FAO statistics, Kazakhstan's total seafood production (including aquaculture and capture fisheries) declined significantly from 85,000 tons to 26,106 tons between 1988 and 1998, the decline occurring in both aquaculture and capture fisheries (Figure 3.1). Total fishery production rebounded to 51,473 tons in 2002 but declined again to 33,600 tons in 2018, which reflected mostly the downward trend of capture fisheries production while the change in production from aquaculture remained marginal. The FAO numbers mirror more recent national statistics, showing that Kazakhstan's total fishery production increased from 43,213 tons in 2016 to 52,572 tons in 2019. Growth was attributed to an increase in capture production from 41,335 tons to 45,645 tons and aquaculture production expansion from 1,878 tons to 6,933 tons. As the country's aquaculture production doubled from 810 tons in 2000 to 1,600 tons in 2018, the share of aquaculture in total fishery production increased from 2.2% to 4.8%. Table 3.2 shows the production by species groups and their attribution according to capture or culture.

Total fishery production in 2019 was unevenly distributed among Kazakhstan's 14 regions (Table B1, Annex B), dominated by relatively large fisheries in Turkistan (19.9% of total production) and Kyzylorda (14% of total production) in the south, East Kazakhstan (16.1% of total production) and Almaty (11.5% of total production) in the east, and Atyrau (24.8% of total production) in the west.

FIGURE 3.1: TRENDS IN AQUACULTURE AND FISHERIES PRODUCTION IN KAZAKHSTAN (1988–2018)



Data source: Bureau of National Statistics, Kazakhstan.

TABLE 3.2: LATEST AVAILABLE FISHERIES AND AQUACULTURE PRODUCTION STATISTICS IN KAZAKHSTAN

Species group	Year 2018					Year 2019				
	Capture	Culture	Total fishery			Capture	Culture	Total fishery		
	tons	tons	tons	Share of all species (%)	Aqua-culture share (%)	tons	tons	tons	Share of all species (%)	Aqua-culture share (%)
All species	**37,283**	**5,653**	**42,936**	**100.0**	**13.2**	**45,645**	**6,933**	**52,578**	**100.0**	**13.2**
Carps (*cyprinids*)	19,710	3,464	23,174	54.0	14.9	24,291	4,001	22,292	55.0	13.8
Perch/pike/ pikeperch	6,647	49	6,696	15.6	0.7	7924	1,542	9,472	18.0	16.3
Roach	4,229	63	4,351	10.1	1.4	5,744	62	5,805	11.0	1.1
Salmonids	104	823	927	2.2	88.8	95	1,007	1,102	2.1	91.4
Trout/salmon		568	568	1.3	100.0		786	786	1.5	100.0
Whitefish	104	254	358	0.8	70.9	95	221	316	0.6	70.0
Sturgeons	1	650	652	1.5	99.8	1	179	180	0.3	99.4
Others	6,533	603	7,136	16.6	8.4	6,989	137	7,126	13.6	1.9

Data source: Bureau of National Statistics, Kazakhstan.

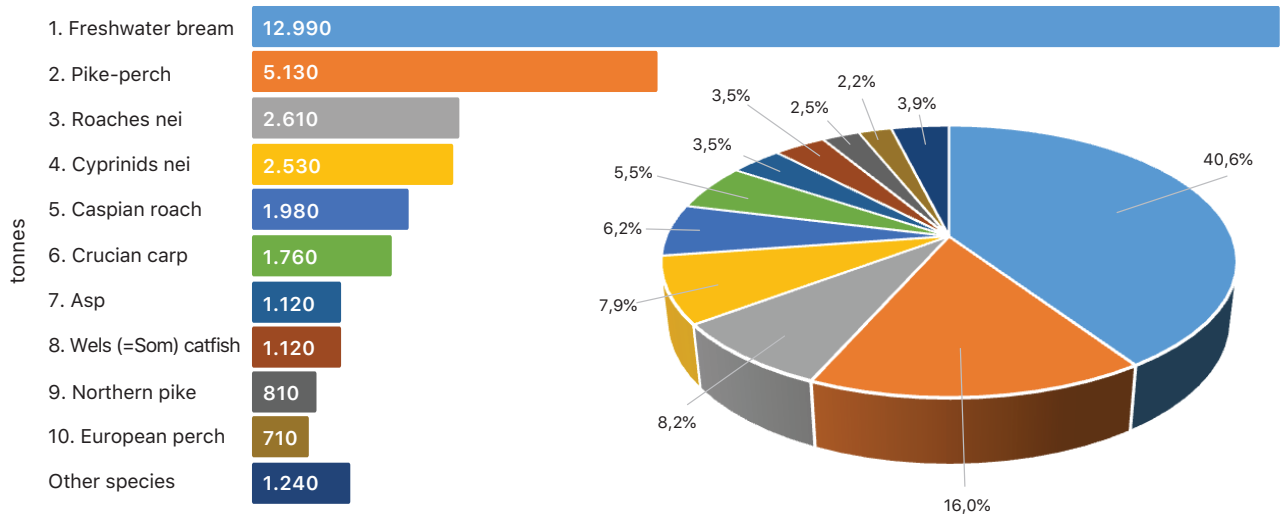
Capture fisheries

Kazakhstan is the second largest fishing country in Central Asia (Table B2, Annex B). Kazakhstan's capture fisheries production declined from 36,620 tons in 2000 to 32,000 tons in 2018 (Figure 3.2). In 2018, carp species, including freshwater bream (*Abramis brama*), roaches (*Rutilus spp.*) and crucian carp (*Carassius carassius*), accounted for 73% of captures (Figure 3.3). Other major species include pikeperch (*Sander lucioperca*; 16%), Northern pike (*Esox lucius*; 2.5%), and European perch (*Perca fluviatilis*; 2.2%).

FIGURE 3.2: KAZAKHSTAN CAPTURE FISHERIES PRODUCTION GROWTH FROM A GLOBAL PERSPECTIVE, 2008–2018

Data source: FAO Fishery and Aquaculture Statistics. Global capture fisheries production 1950–2018 (FishStatJ). March 2020.

FIGURE 3.3: TOP 10 SPECIES ITEMS IN CAPTURE FISHERIES PRODUCTION IN KAZAKHSTAN, 2018 BY VOLUME

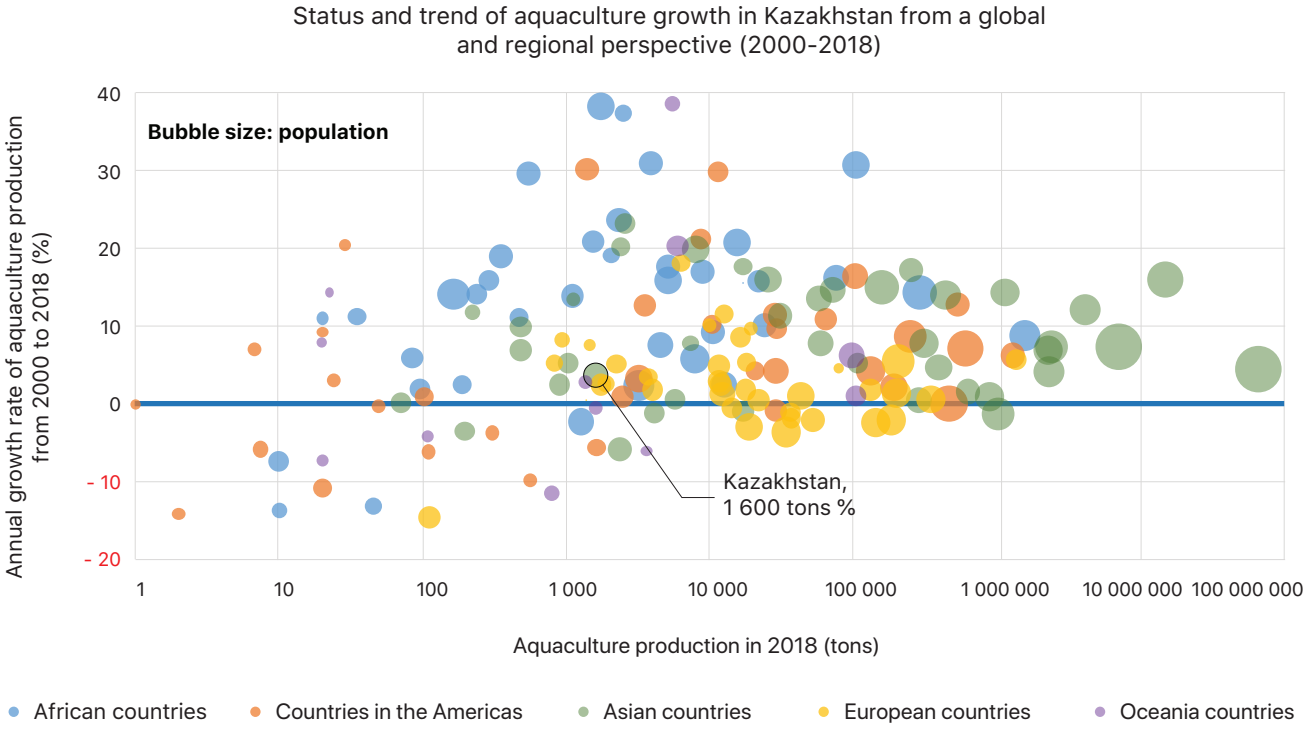


Data source: FAO Fishery and Aquaculture Statistics. Global capture fisheries production 1950–2018 (FishStatJ). March 2020.

Aquaculture

In 2018, Kazakhstan was the third largest aquaculture country in Central Asia, but its aquaculture production was much lower than the first two (that is, Uzbekistan and the Kyrgyz Republic) in terms of both tons (Table B3, Annex B) and growth rate between 2000 and 2018 (Figure 3.4). Even with much more abundant land and water resources, Kazakhstan's aquaculture production in 2018 (1,600 tons) was only 3% of Uzbekistan's (57,384 tons). Kazakhstan produces only 0.0032% of the world's inland aquaculture while controlling 2.03% of the world's total land area, 5.14% of the total surface area of inland water bodies, and 0.2% of the total renewable water resources.

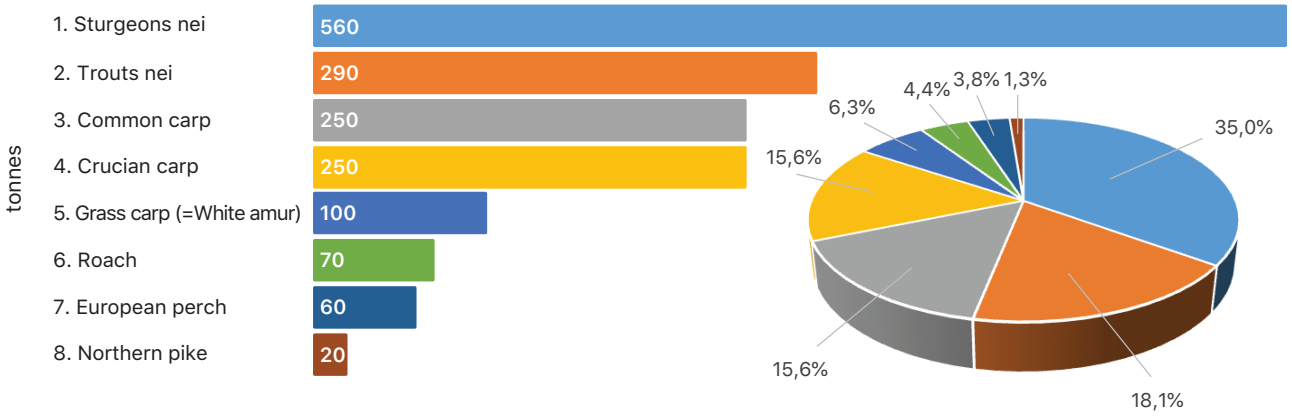
FIGURE 3.4: AQUACULTURE PRODUCTION GROWTH RATE IN KAZAKHSTAN FROM A GLOBAL PERSPECTIVE, 2000–2018



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

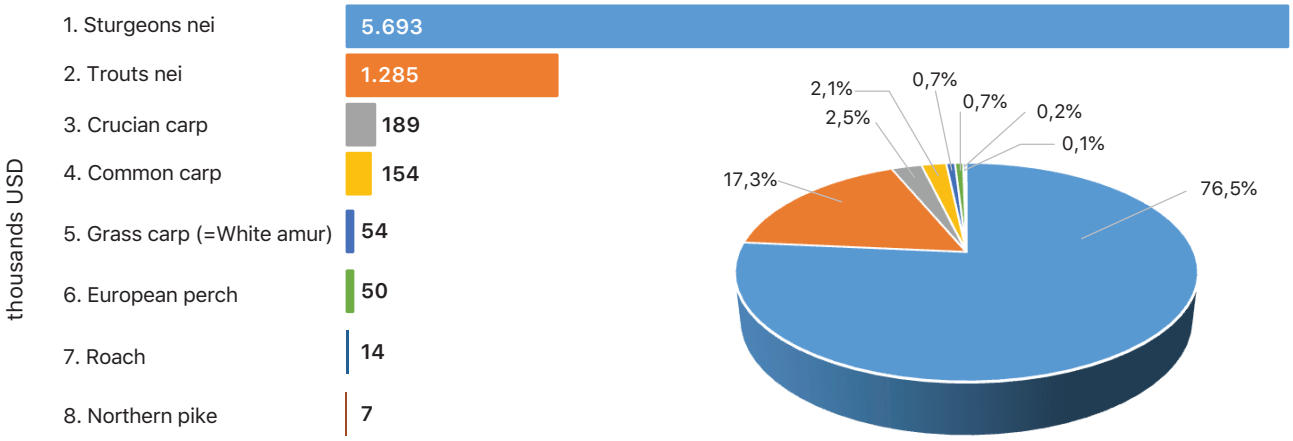
Kazakhstan's 1,600-ton aquaculture production in 2018 ($7.4 million farm gate value) was contributed by seven species (Figure 3.5 and Figure 3.6). Carps were the largest species group by volume accounting for 42% of the total production tonnage, including four carp species: common carp (*Cyprinus carpio*), crucian carp (*Carassius carassius*), grass carp (*Ctenopharyngodon idellus*), and roach (*Rutilus rutilus*). Trout (primarily rainbow trout) were the second largest species group in terms of both volume (290 tons) and value ($1.3 million). The other two minority species were European perch (60 tons; $50,000) and Northern pike (20 tons; $14,000). The $5.7 million of sturgeon production makes it the largest species group by value, accounting for 76% of the total production value.

FIGURE 3.5: AQUACULTURE PRODUCTION IN KAZAKHSTAN, 2018 BY VOLUME



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

FIGURE 3.6: AQUACULTURE PRODUCTION IN KAZAKHSTAN, 2018 BY VALUE



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

Aquaculture feed and seed

Feed

Kazakhstan's demand for formulated aquafeed is primarily for trout and sturgeon farming. Aquaculture in Kazakhstan used to rely on imported feed, but local feed producers have gradually increased their market share. In 2018, five feed manufacturers in Kazakhstan had 30,000 tons of design capacity for aquafeed production, whereas the actual production was only 2,000 tons.

The current prices of local trout feed are KZT 399/kg ($0.95/kg) for 40% crude protein (CP) feed, KZT 437/kg ($1.04/kg) for 45% CP feed, and KZT 500/kg ($1.19/kg) for 50% CP feed. The prices of sturgeon feed are similar. The government currently provides subsidies up to 30% of feed cost for sturgeons, salmonids, and carps (including respective hybrids) and plans to extend them to other species. For each kilogram of fish feed, the subsidy amounts would not exceed (a) KZT 285 for sturgeons

and Arapaima gigas (an Amazon species that some fish farmers in Kazakhstan are interested in introducing in Kazakhstan); (b) KZT 270 for salmonids; (c) KZT 228 for crustaceans (for example, shrimps); (d) KZT 210 for several introduced species including catfishes, tilapias, and barramundi (*Lates calcarifer*); and (e) KZT 105 for carp species.

While the aquafeed manufacturing capacity may not be a constraint in the near future, there has been a concern over the quality of locally manufactured feed. In addition, as major aquafeed manufacturers are located in Almaty, feed supply may become a bottleneck for aquaculture expansion in other regions.

Seed

Most of the 21 hatcheries in Kazakhstan produce larvae or fingerlings of carps, whitefish, or sturgeons for restocking. Trout farms usually use imported eyed eggs to produce fingerlings for their own use. According to the official statistics, the following are some examples of hatchery production: (a) an African catfish hatchery in Aktobe with a design capacity of producing 7.5 million fingerlings a year, (b) a crawfish hatchery in Almaty with a design capacity of producing 3.5 million larvae a year, and (c) a whitefish hatchery in North Kazakhstan with a design capacity of producing 20 million larvae a year.

3.2. Contribution of Fish to the Kazakhstan Economy

According to the national statistics from the Agency of the Republic of Kazakhstan on Statistics, the value of the fisheries and aquaculture sector (including capture production, aquaculture production, and service) was:

- $21 million in 2017 ($15 million capture and $5.7 million aquaculture)
- $23 million in 2018 ($14 million capture and $7.9 million aquaculture)
- $28 million in 2019 ($18 million capture and $9.2 million aquaculture).

Employment

Timirkhanov et al. (2010)[6] reported the Fisheries Committee of Kazakhstan statistics showing that the number of people employed in Kazakhstan's fisheries sector declined from around 60,000 in the 1980s (before independence) to 13,200 in 2002 and rebounded back to 17,300 in 2006. These numbers are high compared to the estimation by the Agency of the Republic of Kazakhstan on Statistics, in which fisheries and aquaculture in Kazakhstan employed only 2,349 people in 2002, with an average monthly wage of KZT 50,233 (around $418). More recent data from the Statistics Agency indicate that employment in Kazakhstan's fisheries and aquaculture sectors was:

- 7,200 people in 2017 (6.12 persons/ton; average $1,391 annual wage)
- 6,000 people in 2018 (7.16 persons/ton; average $1,736 annual wage)
- 5,500 people in 2019 (9.56 persons/ton; average $2,954 annual wage).

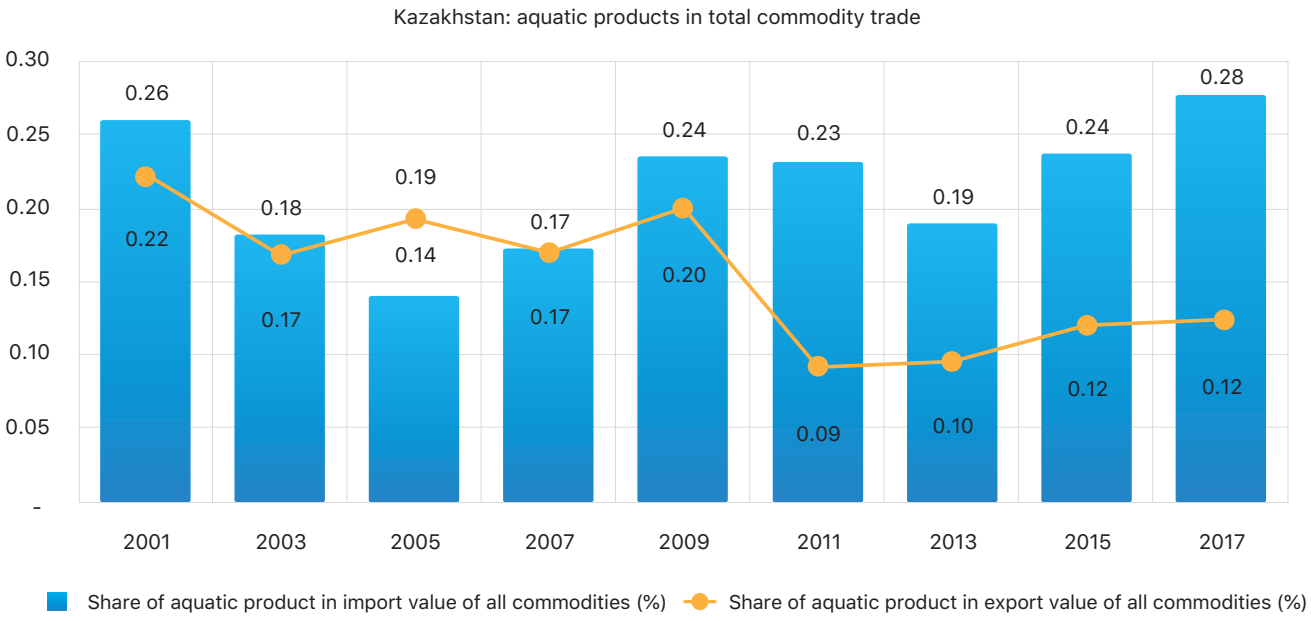
Fish processing is usually the largest job generator along the fish value chain. Unfortunately, quantitative information on employment in fish processing and other auxiliary industries on the fish value chain in Kazakhstan is not readily available.

Trade

While the share of aquatic products in Kazakhstan's total commodity import value nearly doubled from 0.14% to 0.22% between 2005 and 2017, the share of fish and seafood in its total commodity export value declined from 0.19% to 0.12% (Figure 3.7).

[6] Timirkhanov S. et al. 2010. "Fisheries and aquaculture in the Republic of Kazakhstan: a Review." FAO Fisheries and Aquaculture Circular, Series number: 2070-6065 (https://www.fao.org/publications/card/en/c/78cf6e7f-b63f-5473-bee7-35f19f7f516a/).

FIGURE 3.7: CONTRIBUTION OF AQUATIC PRODUCTS TO KAZAKHSTAN'S INTERNATIONAL COMMODITY TRADE



Data source: UN Comtrade (2020).

International trade statistics from the UN Comtrade Database were used to examine Kazakhstan's international trade of fish and fishery products (Annex C). Data reported by Kazakhstan importers (that is, import data) are used as primary data and are supplemented with data reported by exporters to Kazakhstan (that is, export data). Data constructed as such may not be the same as those from different sources and/or based on import or export data only.[7]

Import

In 2018, Kazakhstan imported 45,055 tons of fish and fishery products from 42 countries/territories. The Russian Federation and Norway were the largest suppliers accounting for over three-fourths of imports (Table C1, Annex C).

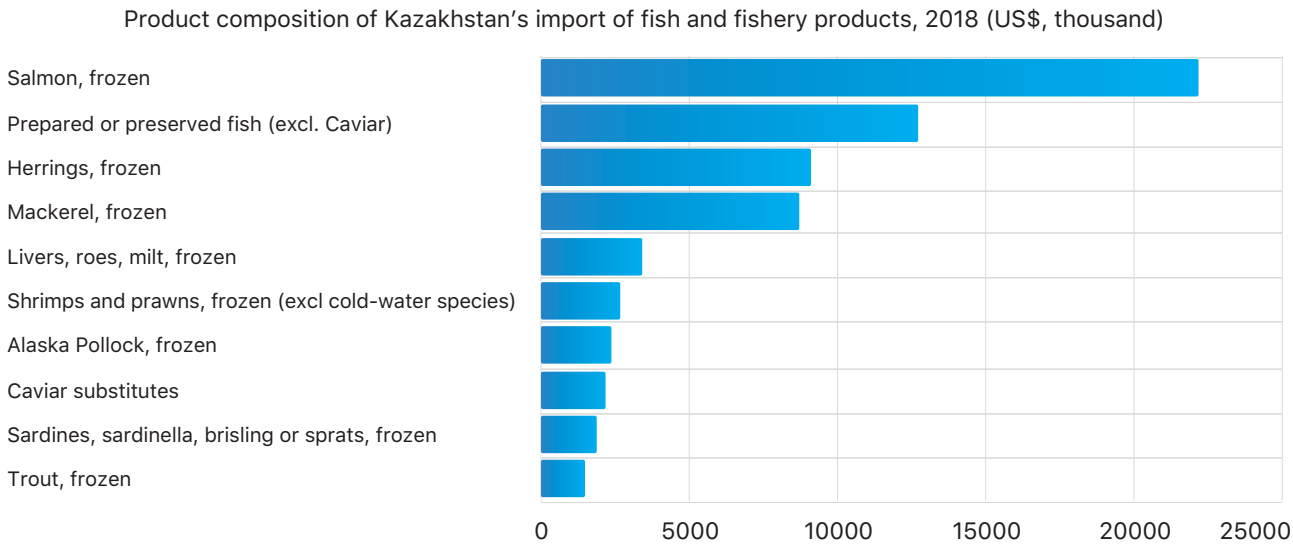
The import totaled $96.307 million (Figure 3.8 and Table C1, Annex C). Finfish[8] products accounted for 87.77% of the total import value, followed by shellfish products (8.39%), seaweed products (2.68%), and non-food products (1.16%).

Frozen Atlantic salmon was the largest item in terms of value (Figure 3.8) representing $22 million accounting for nearly one-fourth of the total import value, whereas frozen herring was the largest item in terms of volume (Figure 3.9) representing nearly 11,000 tons, accounting for one-fourth of the import volume. Other marine pelagic fishes (such as sardines and mackerels) are also major fish imports in Kazakhstan.

[7] For example, in UN Comtrade, the export data reported by Kazakhstan indicate that Kazakhstan exported 7,406 tons of frozen fish fillets nei (HS030489 containing mostly pikeperch fillets) in 2018, whereas the import data reported by its trade partners indicate that other countries imported 10,399 tons of HS030489 from Kazakhstan. These import data are used in the analysis.

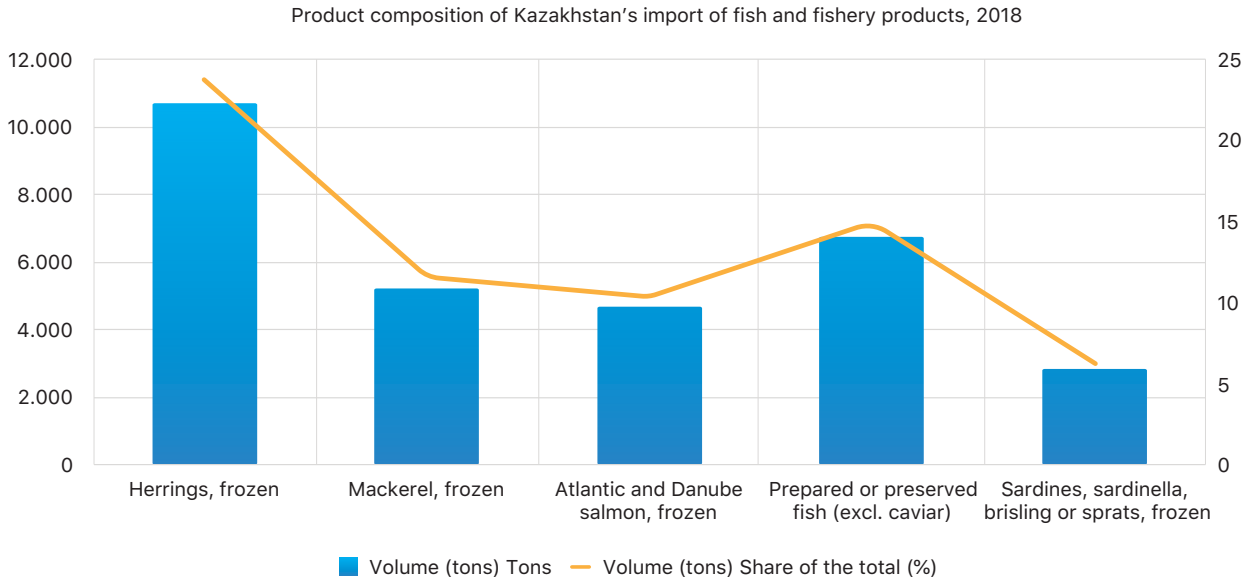
[8] A finfish is a fish with fins, as opposed to shellfish.

FIGURE 3.8: TOP 10 IMPORTS OF FISH AND FISHERY PRODUCTS, 2018 BY VALUE



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

FIGURE 3.9: TOP FIVE IMPORTS OF FISH AND FISHERY PRODUCTS, 2018 BY VOLUME



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

The $54.987 million (30,962 tons) of frozen (whole) fish products accounted for 57.1% of the total import value. Around half of this commodity group were relatively high-value products, such as frozen Atlantic/Danube salmon, Pacific salmon, and trout. The other half was contributed by relatively low-value products, such as herrings, mackerel, sardines, and Alaska Pollock. The $16.839 million (7,749 tons) prepared/preserved fish products accounted for 19% of the total import value. Five products in this group are among the top

20 largest import products. Caviar substitutes are relatively high-value products, whereas the other four are generally low-value products.

Export

In 2018, Kazakhstan exported 35,087 tons of fish and fishery products for a value of $116 million (Table C15 and Table C16, Annex C). Europe was the largest market accounting for 75% of total export volume and 85% of the total value. Asia and Northern America accounted for, respectively, 23% and 1.3% of the total export volume (or 11% and 3.6% in terms of value, respectively). Kazakhstan had no export of fish and fishery products to Africa, Latin America, the Caribbean, or Oceania.

Russia and China were the largest markets in terms of volume, whereas Poland, Germany, Russia, and the Netherlands were the largest markets in terms of value. Exports to China and Russia were primarily low-value products (average prices of $1.67/kg and $1.36/kg, respectively), whereas the prices of export to the three European markets (Poland, Germany, and the Netherlands) were above $7/kg.

Kazakhstan's fish and seafood export in 2018 (Figure 3.10) comprised finfish products accounting for 95.23% of the total export value, followed by non-food products (3.84%), shellfish products (0.5%), and seaweed products (0.43%). Frozen fish fillets accounted for two-thirds of the export value and 30% of the volume. Frozen items comprised mostly frozen pikeperch fillets at an average price of $7.24/kg. The main destinations include Poland,[9] Germany, the Netherlands, and Lithuania (Table C15, Annex C).

Frozen whole fish accounted for 30% of the export volume and 8.4% of value. The average price of $0.89/kg indicates that the item is comprised mostly of low-value carp species. China and Russia were the main destinations (Table C16, Annex C).

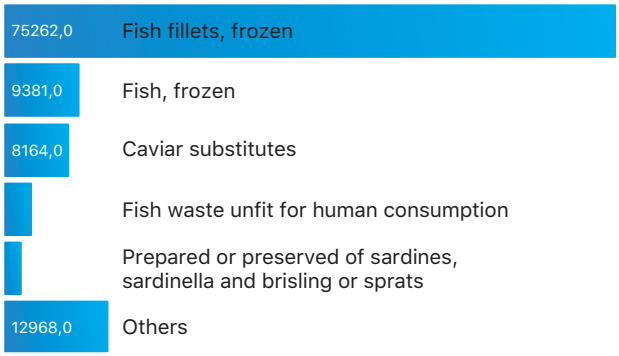
Caviar substitute was the third largest item accounting for 7% of export value, with Russia absorbing nearly the entire export of this item (Table C16, Annex C).

Kazakhstan exported $84,000 of live fish products in 2018, including (mostly carp) sent to Azerbaijan and Russia and ornamental freshwater fish exported to Russia.

Kazakhstan exported $12.428 million worth of frozen fish which accounted for 11.14% of its total fish and fishery products export value in 2018. Seven products in this group were among the top 20 fish export products, including $9.381 million of mixed frozen fish, primarily to China and Russia; $739,000 of carp, mostly to China, Uzbekistan, Russia, and Georgia; $553,000 of snakeheads to Russia and Turkey among others; $364,000 of Salmonidae (trout and salmon) to the Kyrgyz Republic, China, and Georgia; and $261,000 of frozen livers/roes/milt to Romania and Russia.

FIGURE 3.10: TOP FIVE EXPORTS OF FISH AND FISHERY PRODUCTS, 2018 BY VALUE

Product composition of Kazakhstan's export of fish and fishery products, 2018 (US$, thousands)



Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950–2018 (FishStatJ). March 2020.

[9] In Table 3.3, Poland's import of HS030489 is measured by UN Comtrade import data reported by Poland, whereas the UN Comtrade export data reported by Kazakhstan indicate only 757 tons ($5.3 million) of HS030489 exported to Poland.

Trade balance

Kazakhstan experienced a positive $15 million trade balance in 2018 due to the export of higher-value products such as frozen pikeperch fillets and relatively lower-value imports (Table 3.3.)

TABLE 3.3: KAZAKHSTAN TRADE BALANCE OF FISH AND FISHERY PRODUCTS, 2018

	Product Categories	Value ($, thousands)	Volume (tons)	Price ($/kg)
Import	205 products	96,307	45,055	2.14
Export	108 products	111,585	35,087	3.18
Balance		15,278	–9,968	

4. Assessment of Market Growth Potential

4. Assessment of Market Growth Potential

4.1 Methodology and Data

Population and income are the two main factors affecting fish demand. Based on the methodology established in the FAO Fisheries and Aquaculture Technical Papers 607 — Short-term projection of global fish demand and supply gaps,[10] the impacts of population and income growth on fish demand are estimated, and the international market potential for Kazakhstan's fisheries export is assessed accordingly. The projections of population prospects in countries or territories are from the UN World Population Prospects 2019 Revision,[11] whereas income projections are based on the GDP data from the WEO Database of the International Monetary Fund (IMF).[12]

Market demand in 2018 is treated as the baseline to estimate the potential market growth from 2018 to 2030 driven by population and income growth. The total market growth potential is composed of two components: one is growth potential in per capita fish demand driven by income growth and the other is market demand growth driven by population growth. Under the assumption of constant fish prices, the estimated demand growth driven by income and population growth in a country/territory is used to measure the market potential in the country/territory. The potential of Kazakhstan's fisheries export to the market is estimated accordingly based on the assumption that its market share remains unchanged.

The estimated market potential does not account for potential market growth driven by other factors like increased consumer preference for fish. It also does not account for potential market expansion of Kazakhstan's export products through more competitive pricing or more efficient marketing strategies.

Kazakhstan's national fishery production statistics in 2018 (that is, 37,283 tons of capture production + 5,652 aquaculture production = 42,935 tons of total fishery production) have been used in the following analysis.

Baseline supply and demand

In 2018, Kazakhstan's total finfish supply was 92,944 tons, including 50,009 tons of finfish supply from import (54%), 37,283 tons from capture fisheries production (40%), and 5,652 tons from aquaculture production (6%). About half of the total finfish supply (44,328 tons; 48%) went to domestic consumption, whereas the other half (48,617 tons; 52%) was exported to foreign markets.

In 2018, Kazakhstan's total shellfish supply was 2,141 tons, which came entirely from imports with no domestic shellfish production from capture fisheries or aquaculture. Three-quarters of the supply went to domestic consumption (1,613 tons) and the rest, 25% (528 tons) was exported.

In aggregate, Kazakhstan's total finfish and shellfish supply (95,085 tons) comprised 52,150 tons of import (55%), 37,283 tons of capture fisheries production (39%), and 5,652 tons of aquaculture production (6%). Around half of the total finfish and shellfish supply went to domestic consumption (45,941 tons; 48%), whereas the other half (49,145 tons; 52%) was exported.

[10] Cai, J., and P. S. Leung. 2017. "Short-Term Projection of Global Fish Demand and Supply Gaps." FAO Fisheries and Aquaculture Technical Paper No. 607. Rome, FAO. www.fao.org/3/a-i7623e.pdf.

[11] United Nations. 2019. *The 2019 Revision of World Population Prospects*. The Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. https://population.un.org/wpp/.

[12] IMF. 2019. "World Economic Outlook Database." IMF.

Note on data variability

Inconsistencies among these data have posed a challenge to the assessment (Table 4.1). Where relevant, the report has focused on trends rather than value. This report clearly indicates which sources were used and highlights any major discrepancies.

- Kazakhstan's national production statistics on aquaculture and fisheries are significantly higher than the values reported by the government to the FAO statistical database in recent years.
- Kazakhstan's national fish trade statistics are significantly lower than the trade statistics from FAO and UN Comtrade. The report has highlighted several issues on UN Comtrade data that need further investigation; for example, extremely low export prices of several products to Russia and Poland's import of frozen fish fillets nei (HS030489) from Kazakhstan (reported by Poland's customs) that were much greater than Kazakhstan's export of the product to Poland (reported by Kazakhstan's customs office).
- According to the FAO statistics, Kazakhstan's per capita fish consumption in 2013 was 4.8 kg. According to the estimation in this report, Kazakhstan's per capita fish consumption in 2018 was only 2.51 kg. According to the national statistics, Kazakhstan's per capita fish consumption in 2019 was 14.6 kg. Further investigation is needed to understand the extremely high per capita fish consumption reported in the national statistics.

TABLE 4.1: COMPARISON OF KAZAKHSTAN'S FISHERIES STATISTICS FROM DIFFERENT SOURCES

Data and statistics	FAO	National	UN Comtrade (mirror data) estimated in the report	Estimated in the report
Production (tons, live weight)				
Capture fisheries production 2017	31,157	41,320		
Aquaculture production 2017	1,563	2,776		
Capture fisheries production 2018	32,000	37,283		
Aquaculture production 2018	1,600	5,652		
Trade (tons, product weight)				
Import 2017	43,641	27,200		
Export 2017	25,175	26,900		
Import 2018		34,300	45,055	
Export 2018		24,500	35,087	
Per capita fish consumption (kg/year)				
2019		14.6		
2018				2.51
2013	4.8			

The FAO statistics may underestimate Kazakhstan's actual total fishery production. According to national statistics, Kazakhstan exported 10,399 tons of frozen fish fillets (mostly miscellaneous freshwater fishes) the live weight equivalent of which tends to be greater than 20,000 tons. In contrast, according to the FAO statistics, Kazakhstan's production of miscellaneous freshwater fishes in 2018 was only 7,850 tons. Indeed, according to Kazakhstan's national statistics, Kazakhstan's capture fisheries and aquaculture production in 2018 was, respectively, 37,283 tons and 5,652 tons, and the 42,935 tons of total fishery production was around 9,000 tons higher than the FAO statistics (33,600 tons).

4.2 Domestic Markets

In 2018, Kazakhstan imported 43,231 tons of food finfish and shellfish products,the estimated live weight equivalent of which is 52,152 tons (Table 4.2). In 2018, Kazakhstan exported 31,860 tons of food finfish and shellfish products, the estimated live weight equivalent of which is 49,145 tons. In 2018, the estimated apparent finfish and shellfish consumption (live weight) in Kazakhstan was 45,941 tons, equal to its total fishery production of 42,935 tons plus the 52,152 tons of import (live weight) minus the 49,145 tons of export (live weight). As shown in Table 4.2, the estimated per capita apparent finfish and shellfish consumption (live weight) is 2.51 kg, equal to 45,941 total fish consumption divided by its population in 2018 (18.32 million).

TABLE 4.2: ESTIMATION OF KAZAKHSTAN'S APPARENT FISH CONSUMPTION, 2018

Product	Domestic production	Import			Export			Total consumption (live weight)	
	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Total (tons)	Per capita (kg)
Finfish and shellfish	**42,935**	**43,231**	**1.21**	**52,150**	**31,860**	**1.54**	**49,145**	**45,941**	**2.51**
Finfish	**42,935**	**41,843**	**1.20**	**50,009**	**31,604**	**1.54**	**48,617**	**44,328**	**2.42**
Fish, live (HS0301)		20	1.00	20	30	1.00	30		
Fish, fresh/chilled (HS0302)		460	1.05	484	1,025	1.00	1,025		
Fish, frozen whole (HS0303)		30,962	1.03	31,884	13,945	1.11	15,469		
Fish, fillet and other meat (HS0304)		1,682	2.10	3,528	11,427	2.21	25,221		
Fish, dried/salted/ smoked (HS0305)		971	1.82	1,770	2,050	2.40	4,920		
Fish, prepared/ preserved (HS1604)		7,749	1.59	12,324	3,128	0.62	1,952		

[13] Fish and fishery products minus ornamental fishes, live fishes used as seed, fish oils, seaweed products, and non-food products.

TABLE 4.2

Product	Domestic production	Import			Export			Total consumption (live weight)	
	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Total (tons)	Per capita (kg)
Shellfish	**0**	**1,387**	**1.54**	**2,141**	**256**	**2.06**	**528**	**1,613**	**0.09**
Crustaceans (HS0306)		5,66	1.26	713	32	1.73	55		
Mollusks (HS0307)		363	1.72	625	3	1.36	5		
Aquatic invertebrates nei (HS0308)		4	1.00	4	60	1.00	60		
Prepared/ preserved shellfish (HS1605)		454	1.76	798	161	2.53	408		

Note: The following items were excluded in the calculation of live weight: ornamental fishes, live trout used as seed, and fish oils. The conversion factor of each HS level 4 product group is the average of the top five HS level 6 products in this group with the largest export or import volume[14]. The results of fish, shellfish, and fish and seafood are from aggregation. Live weight = product weight × conversion factor.

Population

According to the UN World Population Prospects (United Nations 2019), the population in Kazakhstan is expected to increase from 18.32 million to 20.64 million between 2018 and 2030 (a total increase of 2.32 million or 12.7%).

Income

According to the IMF WEO projection published in October 2019 (IMF 2019), per capita GDP in Kazakhstan is expected to increase from $9,440 to $13,186 between 2018 and 2024 with a total increase of $3,746 or 39.7%.

The current Coronavirus Disease 2019 (COVID-19) pandemic and oil crises would tend to slow down Kazakhstan's economy significantly. Yet, with post-pandemic recovery, it is not unlikely that Kazakhstan's per capita GDP would reach $13,186 (the 2024 level according to the IMF's pre-pandemic projection[15]) in 2030.

Central Asia's income elasticity of demand for freshwater and diadromous fish is 0.3399,[16] which means that given other factors remaining unchanged (for example, constant fish prices), a 1% increase in per capita GDP would tend to drive up the demand for freshwater and diadromous fishes by 0.3399%. Central Asia's income elasticity of crustacean demand (0.8236) will be used as a proxy of that for shellfish demand.

Central Asia has a relatively low-income elasticity of fish and seafood demand than neighboring regions, such as Eastern Europe (0.4755 for freshwater and diadromous fishes and 1.0562 for crustaceans).[17]

[14] European Market Observatory for Fisheries and Aquaculture Products. 2019.

[15] IMF World Economic Outlook (WEO) Database (October 2019).

[16] Cai, J., and P. S. Leung. 2017. "Short-Term Projection of Global Fish Demand and Supply Gaps." FAO Fisheries and Aquaculture Technical Paper No. 607. Rome, FAO. www.fao.org/3/a-i7623e.pdf.

[17] See Table 3 in Cai, J., and P. S. Leung. 2017. "Short-Term Projection of Global Fish Demand and Supply Gaps." FAO Fisheries and Aquaculture Technical Paper No. 607. Rome, FAO. www.fao.org/3/a-i7623e.pdf.

Other demand-side factors

In addition to population and income, other factors (for example, urbanization and increased consumer preference for healthy food) could drive up fish demand in the long run. This report does not model the specific impacts of these factors but uses the average per capita fish/seafood consumption of the neighboring and related regions of Kazakhstan in 2013, that is, 7.246 kg of finfish and 0.483 kg of shellfish (Table 4.3) as a higher benchmark to examine the domestic market potential should Kazakhstan's per capita fish/seafood demand increase beyond its normal trajectory driven by income growth.

TABLE 4.3: PER CAPITA FISH CONSUMPTION IN REGIONS SIMILAR TO KAZAKHSTAN, 2013

Regions	Finfish (kg)	Shellfish (kg)
Central Asia	2.095	0.039
Southern Asia	6.837	0.388
Western Asia	7.415	0.558
Eastern Europe	15.611	1.404
Landlocked developing countries	4.270	0.024
Average	**7.246**	**0.483**

Data source: FAO (www.fao.org/fishery/statistics/software/fishstatj/en).

To estimate the midterm growth of domestic market demand, three scenarios are presented (Table 4.4):

- **Scenario I: Population growth only**

Given its per capita consumption in 2018 (2.51 kg), the increase of Kazakhstan's total population from 18.32 million in 2018 to 20.64 million in 2030 would tend to drive up its total finfish and shellfish demand by 5,816 tons (13% growth), including 5,612 tons of finfish and 204 tons of shellfish.

- **Scenario II: Population growth + income growth**

The increase of its per capita GDP from $9,440 (the 2018 baseline) to $13,186 (the IMF's pre-COVID-19 projection for 2024) would tend to drive up Kazakhstan's per capita finfish demand from 2.42 kg to 2.71 kg, shellfish demand from 0.09 kg to 0.12 kg, and finfish and shellfish demand from 2.51 kg to 2.83 kg. Together with the expected population growth, the total demand would tend to increase by 11,605 tons (26%) for finfish, 780 tons (48%) for shellfish, and 12,385 tons (27%) for finfish and shellfish as a whole.

- **Scenario III: Population growth + higher benchmark per capita demand**

If Kazakhstan's per capita finfish and shellfish demand in 2030 can be increased to 7.25 kg and 0.48 kg, respectively (the average of Central Asia, Southern Asia, Western Asia, Eastern Europe, and landlocked developing countries in 2013), then its domestic demand for finfish and shellfish would tend to increase to 113,562 tons in 2030 (247% higher than the 2018 baseline), including 105,215 tons of finfish (237% higher than the 2018 baseline) and 8,347 tons of shellfish (517% higher than the baseline).

TABLE 4.4: MIDTERM PROJECTION OF THE DOMESTIC MARKET POTENTIAL FOR FINFISH AND SHELLFISH, 2018–2030

	Projection of domestic fish and shellfish demand	Finfish	Shellfish	Finfish and shellfish
Baseline (2018)				
#1	Per capita fish consumption (kg)	2.42	0.09	2.51
#2	Population (UN data in 2018, thousands)	18,320	18,320	18,320
#3	Total demand (equal to #1 × #2, tons)	44,328	1613	45,941
Scenario I (2030): Impact of population growth				
#4	Per capita fish consumption (baseline in 2018, kg)	2.42	0.09	2.51
#5	Population (UN projection in 2030, thousands)	20,639	20,639	20,639
#6	Total demand (equal to #4 × #5, tons)	49,940	1,817	51,757
#7	**Total demand growth from 2018 to 2030 (equal to #6 – #3, tons)**	**5,612**	**204**	**5,816**
#8	**%age demand growth from 2018 to 2030 (equal to #7 / #3×100, %)**	**13**	**13**	**13**
Scenario II (2030): Impact of both population and income growth				
#9	Per capita fish consumption (driven by per capita GDP growth, kg)	2.71	0.12	2.83
#10	Population (UN projection in 2030, thousands)	20,639	20,639	20,639
#11	Total demand (equal to #9 × #10, tons)	55,933	2,393	58,326
#12	Total demand growth from 2018 to 2030 (equal to #11 – #3, tons)	11,605	780	12,385
#13	% demand growth from 2018 to 2030 (equal to #12 / #3 × 100, %)	26	48	27
Scenario III (2030): Impact of population growth and higher benchmark per capita fish consumption				
#14	Per capita fish consumption (kg)	7.25	0.48	7.73
#15	Population (UN projection in 2030, thousands)	20,639	20,639	20,639
#16	Total demand (equal to #14 × #15, tons)	149,542	9,960	159,502
#17	Total demand growth from 2018 to 2030 (equal to #16 – #3, tons)	105,215	8,347	113,562
#18	% demand growth from 2018 to 2030 (equal to #17 / #3 × 100, %)	237	517	247

4.3 Export Markets

The estimation of export market potential is based on the UN population projections from 2018 to 2030 (United Nations 2019) and the IMF WEO GDP projection from 2018 to 2024.[18]. The validity of the estimation of market potential driven by income growth depends on whether the 2024 level previously projected by the IMF is a realistic value for the 2030 per capita GDP. A detailed review of export markets by segment is available in Annex D. Table 4.5 and this section summarize the analysis.

Kazakhstan exported 108 fish and fishery products to 36 countries or territories in 2018 with $111.585 million total export value and 35,087 tons total volume (Table C15 and Table C16, Annex C). The estimated overall market growth potential due to population growth between 2018 and 2030 in the 36 export markets is negative ($628,000 decline in value and 130 tons decline in volume), which primarily reflects negative population growth prospects in the country's major fisheries export markets (for example, Poland, Russia, and Lithuania). The estimated overall market growth potential due to both the population and income growth is $12.861 million increase in value (12% growth compared to the baseline in 2018) and 4,553 tons in volume (13% growth).

Kazakhstan exported 84 different categories of finfish products to 36 countries or territories in 2018 with $106.266 million total export value and 31,864 tons total volume (Tables D1–D6, Annex D). The estimated overall market growth potential due to the population growth is negative ($647,000 decline in value and 143 tons decline in volume), which primarily reflects negative population growth prospects in the country's major fisheries export markets (for example, Poland, Russia, and Lithuania). The estimated overall market growth potential due to both the population and income growth is $12.631 million increase in value (12% growth compared to the baseline in 2018) and 4,466 tons in volume (13% growth).

Kazakhstan exported four live fish products to three countries in 2018 with $287,000 total export value (Table D7, Annex D). The estimated overall market growth potential due to the population growth is $2,000 (2.4% growth compared to the 2018 baseline), whereas the estimated overall market growth potential due to both the population and income growth is $9,000 (10.5% growth).

Kazakhstan exported 13 fresh/chilled fish products to eight countries in 2018 with $571,000 total export value and 1,025 tons total export volume (Table D8, Annex D). The estimated overall market growth potential due to the population growth is close to zero, whereas the estimated overall market growth potential due to both the population and income growth is $68,000 (11.8% growth) and 109 tons (10.7%).

Kazakhstan exported 22 frozen fish products to 23 countries or territories in 2018 with $12.428 million total export value and 13,945 tons total export volume (Table D9, Annex D). The estimated overall market growth potential due to the population growth is positive 1.1% in value ($137,000 increase) and negative 0.2% in volume (27 tons decline), whereas the estimated overall market growth potential due to both the population and income growth is around positive 20% ($3.004 million in value and 2,575 tons in volume) (Table 4.6).

Kazakhstan exported 25 different fillet and other fish meat products to 28 countries or territories in 2018 with $78.34 million total export value and 11,427 tons total export volume (Table D10, Annex D). The estimated overall market growth potential due to the population growth is around negative 1% ($752,000 decline in value and 126 tons decline in volume), whereas the estimated overall market growth potential due to both

[18] IMF World Economic Outlook (WEO) Database (October 2019).

the population and income growth is around positive 10% ($8.169 million in value and 1,198 tons in volume).

Kazakhstan exported 12 dried/salted/smoked/offal fish products to 10 countries or territories in 2018 with $3.011 million total export value and 2,050 tons total export volume (Table D11, Annex D). The estimated overall market growth potential due to the population growth is around negative 3% ($75,000 decline in value and 63 tons decline in volume), whereas the estimated overall market growth potential due to both the population and income growth is around positive 9% ($262,000 in value and 194 tons in volume).

Kazakhstan exported eight prepared/preserved fish products to eight countries or territories in 2018 with $11.805 million total export value and 3,128 tons total export volume (Table D12, Annex D). The estimated overall market growth potential due to the population growth is around positive 1% ($33,000 increase in value and 40 tons increase in volume), whereas the estimated overall market growth potential due to both the population and income growth is around positive 10% ($1.109 million in value and 329 tons in volume) (Table 4.5).

Kazakhstan exported 17 shellfish products (including crustacean products, mollusks products, other aquatic invertebrate products, and prepared/preserved crustaceans/mollusks/other aquatic invertebrate products) to six countries or territories in 2018 with $554,000 total export value and 256 tons total export volume (Table D13, Annex D). The estimated overall market growth potential due to the population growth is around positive 5% ($26,000 increase in value and 15 tons increase in volume), whereas the estimated overall market growth potential due to both the population and income growth is around positive 25% ($141,000 in value and 68 tons in volume).

Kazakhstan exported two seaweed products to two countries or territories in 2018 with $478,000 total export value and 92 tons total export volume (Table D14, Annex D). The estimated overall market growth potential due to the population growth is around negative 1.5% ($7,000 decline in value and 1 ton decline in volume), whereas the estimated overall market growth potential due to both the population and income growth is around positive 20% ($90,000 in value and 19 tons in volume).

Kazakhstan exported three non-food fisheries products to five countries or territories in 2018 with $4.288 million total export value and 2,875 tons total export volume (Table D15, Annex D). Most of the export could be fish waste from fish processing plants; the demand for which tends to be affected primarily by factors other than population and income. Thus, the market potential of this product group is not estimated here and is assumed to be zero when calculating the aggregate market potential for all fish and fishery products.

4.4 Summary

According to the IMF's pre-COVID-19 projection published in October 2019,[19] Kazakhstan's per capita GDP is expected to grow 40% between 2018 and 2024. In light of the negative impact of the current COVID-19 pandemic on economic growth, the 40% growth may not be realized in the original time frame but could occur in a longer horizon (that is, between 2018 and 2030). Given the 40% income growth, per capita fish demand tends to increase by 12% between 2018 and 2030, which, together with the 13% growth in Kazakhstan's population, would lead to 27% of overall growth in domestic fish demand driven by population and income growth. The growth potential in export markets driven by income and population growth can be estimated based on the same methodology.

[19] IMF World Economic Outlook (WEO) Database (October 2019).

The results are summarized as follows:

- The overall domestic and export market growth potential is 71,849 tons, including 65,043 tons of domestic market growth potential and 6,446 tons of export market growth potential (Table 4.6).
- The domestic and export market growth potential for carps is the largest (30,379 tons), followed by roach (6,422 tons) and perch/pike/pikeperch (6,267 tons), among others (Table 4.6).
- The 13% overall export market growth is only half of the 27% growth in the domestic market. The relatively low export market growth potential reflects the lack of population growth and the relatively low income-driven growth in per capita demand in most export markets of fish and seafood products from Kazakhstan (Table 4.7).

TABLE 4.5: EXPORT MARKET STATUS AND POTENTIAL FOR FISH AND FISHERY PRODUCTS FROM KAZAKHSTAN, 2018–2030

Fish and fishery products	Kazakhstan's export to the world market									
	Baseline in 2018						Growth potential between 2018 and 2030			
	Number of products		Value		Volume (tons)	Price ($/kg)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of total (%)			Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
Fish and fishery products	**108**	**4.42**	**111,585**	**100.00**	**35,087**	**3.18**	**–628**	**–130**	**12,861**	**4,553**
Finfish products	**84**	**3.68**	**106,266**	**95.23**	**31,864**	**3.33**	**–647**	**–143**	**12,631**	**4,466**
Fish, live	4	3.32	84	0.07	287	0.29	2	36	9	60
Fish, fresh/chilled	13	6.64	571	0.51	1,025	0.56	3	–3	68	109
Fish, frozen whole	22	3.03	12,428	11.14	13,945	0.89	137	–27	3,004	2,575
Fish, fillet and other meat	25	1.25	78,340	70.21	11,427	6.86	–752	–126	8,169	1,198
Fish, dried/salted/smoked/offal	12	3.38	3,011	2.70	2,050	1.47	–75	–63	262	194
Fish, prepared/preserved, including caviar and caviar substitutes from fish eggs	8	2.63	11,805	10.58	3,128	3.77	33	40	1,109	329
Fish oils (HS1504)	2	1.38	26	0.02	3	9.76	5	0.490	11	1
Shellfish products	**17**	**2.73**	**554**	**0.50**	**256**	**2.16**	**26**	**15**	**141**	**68**
Seaweed and seaweed products	**2**	**1.01**	**478**	**0.43**	**92**	**5.18**	**- 7**	**- 1**	**90**	**19**
Non-food products	**3**	**1.57**	**4,288**	**3.84**	**2,875**	**1.49**	-	-	-	-

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE 4.6: DOMESTIC AND EXPORT MARKET GROWTH POTENTIAL DRIVEN BY INCOME AND POPULATION GROWTH BETWEEN 2018 AND 2030

Species (ranked by baseline consumption)	I	II	III	IV	V	VI	VII
	Domestic market (tons, live weight)			Export market (tons, live weight)			Total domestic and foreign market growth potential between 2018 and 2030 (tons, live weight)
	Baseline in 2018	Growth potential between 2018 and 2030		Baseline in 2018	Growth potential between 2018 and 2030		
		%	Tons		%	Tons	
All species	**241,269**	**27**	**65,043**	**49,145**	**13**	**6,446**	**71,489**
Carps	104,665	27	28,216	10,651	20	2,163	30,379
Roach	22,340	27	6,023	2,062	19	398	6,421
Perch/pike/pikeperch	14,684	27	3,959	23,086	10	2,309	6,267
Catfish	6,347	27	1,711	283	12	34	1,745
Salmon	6,144	27	1,656	0			1,656
Whitefish	846	27	228	0			228
Sturgeons	657	27	177	0			177
Rainbow trout	618	27	167	336	7	25	192

Data source: Estimate based on research for this report.

TABLE 4.7: GROWTH POTENTIAL IN INDIVIDUAL EXPORT MARKETS BETWEEN 2018 AND 2030 DRIVEN BY INCOME AND POPULATION GROWTH

Export market (ranked by market value)	I	II	III	IV	V	VI	VII	VIII
	Baseline in 2018					Growth potential between 2018 and 2030 (%)		
	Value		Volume (product weight)		Price ($/kg)	Per capita demand growth	Popu-lation growth	Total demand growth
	$, thou-sands	Share of total (%)	Tons	Share of total (%)				
1. Poland	21,132	18.94	2,737	7.80	7.72	14.86	–2.58	11.90
2. Germany	17,516	15.70	2,383	6.79	7.35	8.16	0.01	8.17
3. Russian Federation	17,268	15.48	12,656	36.07	1.36	9.27	–1.64	7.48
4. Netherlands	14,673	13.15	2,086	5.95	7.03	8.46	2.29	10.95
5. Lithuania	10,197	9.14	1,532	4.36	6.66	17.22	–11.30	3.97
6. China	9,157	8.21	5,498	15.67	1.67	34.60	2.57	38.06

TABLE 4.7

Export market (ranked by market value)	I	II	III	IV	V	VI	VII	VIII
	Baseline in 2018					Growth potential between 2018 and 2030 (%)		
	Value		Volume (product weight)		Price ($/kg)	Per capita demand growth	Popu-lation growth	Total demand growth
	$, thou-sands	Share of total (%)	Tons	Share of total (%)				
7. Austria	6,299	5.65	709	2.02	8.88	8.13	3.20	11.58
8. United States of America	3,018	2.70	335	0.95	9.02	9.69	6.89	17.25
9. Czechia	2,788	2.50	385	1.10	7.24	13.33	0.74	14.17
10. Kyrgyz Republic	1,516	1.36	879	2.50	1.73	7.19	18.12	26.61
11. Switzerland	1,295	1.16	163	0.46	7.94	9.76	7.74	18.25
12. Ukraine	1,225	1.10	1,893	5.39	0.65	25.86	–7.60	16.29
13. Canada	994	0.89	120	0.34	8.26	10.88	10.14	22.12
14. Belarus	807	0.72	1,248	3.56	0.65	6.21	–1.99	4.10
15. Georgia	775	0.69	700	1.99	1.11	15.19	–3.74	10.89
16. Azerbaijan	467	0.42	436	1.24	1.07	5.39	7.94	13.76
17. France	436	0.39	78	0.22	5.58	6.61	2.62	9.41
18. Uzbekistan	418	0.37	608	1.73	0.69	28.06	15.22	47.55
19. North Macedonia	397	0.36	335	0.95	1.19	14.11	–1.55	12.35
20. Romania	256	0.23	57	0.16	4.50	20.89	–6.15	13.45

Data source: Columns I–V from UN Comtrade. Columns VI–VIII estimated based on research for this report.

5. Increasing Supply and Demand

5. Increasing Supply and Demand

Capture fisheries in Kazakhstan are stagnating mostly due to the prevalence of illegal fishing and inadequate management of fisheries and fishing fleets. The KFDP is consequently focusing on growing the sector through aquaculture, expecting to increase Kazakhstan's aquaculture production to 270,000 tons by 2030. A complete breakdown of the 270,000-ton overall target by species is not available. Thus, the analyses will be based on estimated production targets that are proportional to current farming and fishing system output (informed by local industry experts), disaggregated by species, and that add up to 235,000 tons (Table 5.1). Note that the official statistics presented in Table 5.1 do not account for unreported production which could be many times that of the official statistics. The discrepancy does not qualitatively affect the analysis and conclusions.

TABLE 5.1: TARGETED PRODUCTION IN THE KFDP

Species	Target aquaculture production (tons)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Caspian salmon (*Salmo trutta caspius*)	0	0	500	500	1,550	12,600	19,700	26,901	54,101	102,919
Carps (cyprinids)	12,326	16,023	22,372	28,025	35,043	41,941	48,860	55,907	67,637	79,706
Clarias catfish	2,500	6,197	6,697	7,697	11,197	12,197	13,197	13,864	13,864	18,864
Rainbow trout	922	2,124	2,881	3,303	4,969	9,406	11,599	13,081	13,952	16,629
Whitefish	2,968	3,058	3,467	3,607	3,749	3,901	5,678	7,565	9,012	10,470
Sturgeons (meat)	247	496	583	699	1,068	1,359	1,661	2,076	2,635	3,528
Pikeperch	0	0	0	1,000	1,000	1,000	1,000	1,500	1,500	1,500
Barramundi					1,000	1,000	1,000	1,333	1,333	1,333
Tilapia	50	50	50	50	50	50	50	50	50	50
Total	**19,012**	**27,949**	**36,550**	**44,881**	**59,626**	**83,455**	**102,746**	**122,277**	**164,085**	**235,000**

Data source: Preliminary data based on personal communication.

According to the analysis, most of the production growth between 2020 and 2030 would be contributed by Caspian salmon, carps, catfish (*Clarias* sp.), rainbow trout, and whitefish. The realization of the production target depends not only on the production capacity but also market potential to accommodate the production expansion.

Carps

Carps (*cyprinids*) are the largest species group with 28,892 tons of production in 2019, primarily consumed domestically. While the first-sale price of wild carp (*sazan*) is higher than that of pikeperch, most carp production in Kazakhstan is from less desirable species (for example, bream and crucian carp) sold at low prices in domestic and foreign markets. The government has set a target of approximately 80,000 tons of carp aquaculture production in 2030. Yet, the income and population growth in domestic and foreign markets could increase the total demand for carp species by approximately 30,000 tons between 2018 and 2030. There tends to be limited room to increase carp demand in an environment where carp price is already low. However, joint efforts from the public and private sectors could lead to an increase in carp demand through innovations in processing, as well as marketing strategies aimed at fostering carp cuisine culture and adding fish to Kazakhstan dietary habits. On the supply side, carp production can be increased by improving the productivity and profitability of the existing extensive farming systems. Semi-intensive or intensive carp farming systems could be established when efforts in carp market development become effective.

Pikeperch, pike, and perch

The export of pikeperch fillets to European countries has been the backbone of the fish industry in Kazakhstan. Contrary to the lack of demand for carp species, the main constraint for pikeperch, pike, and perch is insufficient and/or unstable supply. The government has set a target of 1,500 tons of pikeperch aquaculture production in 2030, but none for pike or perch. The planned expansion is insufficient to satisfy the approximately 6,000 tons of domestic and foreign market growth for pikeperch, pike, and perch between 2018 and 2030 driven by income and population growth. In the short term, the supply shortage could be partially addressed by better management of pikeperch/pike/perch fisheries.

Pikeperch farming in Kazakhstan has been hindered by multiple technical obstacles and uncertain market conditions caused by their large-scale production from capture fisheries. They may be farmed extensively as an additional species in carp aquaculture in earthen ponds. Investing in basic research and practical experiments of pikeperch aquaculture would lay a foundation for a potential leap forward in pikeperch farming. Kazakhstan may learn from the experiences of pikeperch farming and the farming of similar species in other countries, such as pikeperch stock enhancement in the Danube Delta of Romania, the farming of walleye, also known as yellow pike (*Sander vitreus*), in the United States of America, and the farming of mandarin fish, also known as Chinese perch (*Siniperca chuatsi*), in China. The first-sale price of pikeperch went down from KZT 481/kg in 2019 to KZT 175/kg in 2020 because of the impact of the COVID-19 pandemic on export. The incident, perhaps a transitory shock notwithstanding, indicates the importance of diversifying pikeperch export markets in the long run.

Sturgeons and caviar

To protect the endangered species, capturing wild sturgeons is forbidden. There are 30 sturgeon farms with a total design production capacity of 1,500 tons a year in Kazakhstan. However, in 2018, only 650 tons of sturgeon were produced and that declined to 179 tons in 2019, partially due to mass mortality caused by a water pollution incident. Sturgeon production in Kazakhstan is primarily for domestic consumption. The income and population growth in Kazakhstan could increase the domestic demand for sturgeon by approximately 180 tons per year by 2030, which means the export market must be expanded significantly to justify the 3,500 tons of sturgeon production targeted by the government. Sturgeons were the most expensive fish in Kazakhstan with KZT 4,067/kg ($9.68/kg) first-sale price in 2020. This reflects a high production cost in Recirculating Aquaculture System (RAS), which is the main

sturgeon farming system in Kazakhstan, and the situation has been exacerbated by inappropriate farm design, unreliable equipment, and/or inadequate expertise and experiences in running RASs. Lowering the production cost and thus the first-sale market price for sturgeon is crucial to increase their demand in both domestic and foreign markets.

Kazakhstan produced only 0.4 tons of caviar in 2017 despite its 17 tons overall design capacity for caviar production. While many sturgeon farms in Kazakhstan are interested in producing caviar, only three farms have current production, and one farm planned to start harvesting caviar in 2021. As the situation of sturgeon demand lower than supply in the global market tends to persist in the near future, sturgeon farming in Kazakhstan may need to go through a process of consolidation before it becomes a mature, robust industry. The public sector can help provide good market and sector information and set guidance and standards to facilitate the sustainable development of sturgeon and caviar production.

Trout and salmon

Trout/salmon production in Kazakhstan primarily came from aquaculture, and the production increased from 277 tons in 2016 to 786 tons in 2019. In 2019, 13 rainbow trout farms with nearly 3,000 tons of production capacity harvested only a little over 500 tons of fish. In 2020, the average farm gate price of rainbow trout in Kazakhstan was KZT 1,516/kg ($3.61/kg), which was higher than most species except for sturgeons. Kazakhstan imported a large amount of salmon/trout products, including 340 tons of frozen whole trout and 5,000 tons of frozen whole Atlantic salmon in 2018. According to both FAO statistics and UN Comtrade statistics, Kazakhstan exported over 300 tons of fresh/chilled trout to Russia in 2018. Even if Kazakhstan's domestic trout production can completely substitute its trout import and considering the domestic and export trout market growth potential driven by income and population growth, the estimated demand for trout production in Kazakhstan would be only 1,200 tons in 2030, which is less than half of the 3,000 tons of current trout production capacity and only a fraction of the 16,600 tons of trout production target in the government's plan for aquaculture in 2030. Using per capita trout consumption in Russia as a benchmark and considering the conditions in Kazakhstan's potential trout export markets (that is, the European Union [EU] and the Eurasian Economic Community [EAEC/EurAsEC] that includes Kazakhstan, the Kyrgyz Republic, Tajikistan, Belarus, and Russia), estimates indicate 12,300 tons of potential domestic and export market capacity for Kazakhstan's trout production in 2030. Yet, turning the potential into reality is not automatic and entails lowering the cost and improving the quality of trout production in Kazakhstan.

Additionally, a lead entity (for example, a large trout farm, processing plant, or a functional farmers/processors/traders association) would also be crucial to the development of an export-oriented trout industry in Kazakhstan. Substituting imported salmon products could create demand for domestic trout production, but there is another ambitious 100,000 tons of production target for Caspian salmon in 2030. Caspian salmon is not yet an established aquaculture species, and a marketing challenge is whether the fish (a subspecies of brown trout Salmo trutta) could be accepted by consumers (especially in export markets) as salmon. Therefore, it is a more realistic and viable strategy to first treat Caspian salmon as a niche species (that is, focusing on value) and refrain from pursuing it as a commodity species (that is, focusing on volume) before its technical and market prospects are firmly established. As a native niche species, Caspian salmon tends to have a competitive advantage in the local food catering industry and recreational fisheries, and it can be marketed to export markets as a novel salmon/trout product catering high-end

customers' love for varieties and novelties. With efforts in improving its aquaculture performance through tailor-made feed and genetics (for example, selective breeding), Caspian salmon could become a promising aquaculture species in Kazakhstan in the long run.

Whitefish

Despite a whitefish hatchery in North Kazakhstan with a design capacity of producing 20 million larvae a year for restocking, official statistics indicate only 358 tons of whitefish were harvested in 2018 and 316 tons in 2019. Most of the whitefish production in Kazakhstan is for domestic consumption. The first-sale price was KZT 421/kg ($1/kg) in 2020. The estimated domestic demand for whitefish in 2030 is only 600 tons, which is minuscule compared to the 10,000 tons of whitefish production target in the government's plan for aquaculture in 2030. The prospect in export market is unclear because of the lack of disaggregated trade statistics on whitefish products. According to FAO statistics, in 2018, only two countries (Saudi Arabia and the United States of America) imported a total of 8,000 tons of whitefish products and only one country (Canada) exported whitefish products in 2018. The world production of whitefish dropped by half from 56,905 tons in 1990 to 26,853 tons in 2018 because of the decline in capture fisheries production, whereas whitefish aquaculture production increased from 1,572 tons to 4,413 tons. In 2018, Canada had the largest whitefish capture fisheries production (7,706 tons), whereas Russia had the largest whitefish aquaculture production (3,558 tons). The global experiences indicate that Kazakhstan's target of 10,000 tons of whitefish production in 2030 tends to be challenging. Kazakhstan may be better off pursuing a niche species development strategy to focus on adding value to whitefish. The focus in the short term could be on improving the productivity of whitefish stock enhancement operations, the quality of whitefish products, and the efficiency of the whitefish value chain. There could be a genetic improvement program to develop better seed stock. A pilot test could be conducted to assess the technical and economic performance of whitefish farming. Only when there are clear, substantial market prospects should Kazakhstan pursue semi-intensive or intensive whitefish farming.

Nonnative warmwater species

The KFDP has set aquaculture production targets of approximately 19,000 tons of catfish (*Clarias sp.*); 1,300 tons of Barramundi, also known as Asian seabass (*Lates calcarifer*); and 50 tons of tilapia. *Clarias* catfish (primarily African catfish *C. gariepinus*) and tilapia are well-established aquaculture species cultivated in many countries worldwide, whereas Barramundi is a popular species in Southeastern Asia. These species may be attractive because of readily available seed stock and farming technology, but farming them tends to be expensive in Kazakhstan. RAS is normally needed to help these warm water species survive the cold weather in Kazakhstan, whereas special farming systems that utilize ad hoc hot water resources (such as wastewater from power plants or geothermal water) may only sustain small-scale operations. The high production cost would make it difficult for Kazakhstan to compete with other producers of these species in both domestic and foreign markets. These species may not even be able to outcompete pikeperch in the local commodity market, although they may serve some niche markets, such as specific ethnic groups that favor them or high-end restaurants that pursue variety in their menus. Wels catfish (*Silurus glanis*), a local catfish species, could be a potential aquaculture species in Kazakhstan in the long run.

Commercial fishing

In Kazakhstan, commercial fishing is mostly conducted in large inland water bodies (mostly reservoirs) that are divided into many fishing areas. Each area is leased to a specific tenant (which could be an individual or legal entity that

is a tax resident of Kazakhstan) for a period of 10–49 years.[20] The tenant is obliged to protect the reservoir from illegal fishing and carry out activities specified in the lease agreement, such as restocking, maintenance (cutting vegetation, dredging, rescuing juvenile fish from laced reservoirs, and so on), preventing mass fish mortality, aquaculture, fish processing, and/or sport fishing.

The tenant must catch fish within the annual limits set by the state based on annual scientific research on the level of fish resources in each reservoir. There are concerns that overly restrictive fishing quotas may not only constrain commercial fishing production but could also jeopardize the health of fish stock (that is, disease outbreaks in overpopulated fish stocks). The existence of a large amount of unreported fish production indicates that fishing quotas have not been effectively implemented. The fishing and fish processing industry is eager to cooperate with the research community to set the fishing quotas in scientific and practical ways to strike a balance between economic and ecological objectives.

While the KFDP has adopted the strategy of shifting toward fish farming, commercial fishing is expected to continue playing a crucial role in the country's fish production. Thus, improving the efficiency and effectiveness of commercial fishing management is important. The development of commercial fishing can also create opportunities, such as hatchery businesses in support of restocking of the North Aral Sea and the Syr Darya delta lakes with carps, pikeperch, and indigenous species for commercial fishing.[21]

Recreational fisheries

Being a country with relatively low fish consumption notwithstanding, it is said that (a) "every third Kazakhstani family has its own fisherman;" (b) there are many federations, clubs, and fishing communities actively engaging in sport/recreational fishing; and (c) the national fishing sports team of Kazakhstan has won the world championship twice in the team scoring events.[22]

According to a mission report prepared by Randall Brummett, "In 2017, Kazakhstan issued over 103 thousand licenses to fish, with total revenues accruing to government of KZT 102 million (approximately $300,000) from the sale of these licenses. The number of people who fish in support of household food security is unknown, but such 'subsistence' recreational fishing is conducted in all water bodies of Kazakhstan where fish exist."[23]

Recreational fishing (including amateur fishing and sport fishing) has been deemed a promising sub-section in the fisheries sector of Kazakhstan which is endowed with 85,000 rivers and more than 48,000 lakes. According to an FAO publication in 2010,[24] the main fish species targeted in recreational fishing are catfish, pikeperch, pike, asp, salmonids (rainbow trout, grayling, and lenok), sturgeons, and carps (crucian, silver, and grass) and scaleless and scaly osman in the mountain areas. The main areas for recreational fishing are near big settlements or industrial cities, including:

- Ural River (downstream)
- Syr Darya River (downstream and estuary lakes)

[20] EUROFISH article on "The fisheries and aquaculture sector in Kazakhstan." June 29, 2020. https://eurofish.dk/the-fisheries-and-aquaculture-sector-in-kazakhstan/

[21] van Anrooy, R. 2018. "Mission Report on an Assessment of the Fishery Situation in Kyzylorda Oblast in Kazakhstan." FAO/World Bank Cooperation Programme.

[22] Article on "The best fishing destinations in Kazakhstan." October 18, 2018. https://kazakhstan.travel/publications/en/22/the-best-fishing-destinations-in-kazakhstan.

[23] Brummett, R. 2019. "Market Opportunities in Recreational Fishing." Annex in the Back to Office Report of Randall Brummett.

[24] www.fao.org/3/i1596e/i1596e.pdf.

- Ili River (near the Kapshagay reservoir down to Balkhash Lake)
- Southwest part of Lake Balkhash
- Southwest part of Lake Alakol
- Irtysh River
- Shelek River (upstream)
- Tekes River (and its inlets)
- The western side of Djungar Alatau
- Various rivers that flow through the Kazakhstani part of the Altai mountain range.

According to personal communication with industry experts, the Federation of Sport Fishing of the Republic of Kazakhstan is eager to promote recreational fishing and would like to have a fishing quota in all water bodies and independently issue licenses against the quota. Yet, the current situation is that the tenants of reservoirs/sites sell sport fishing licenses by themselves to everyone, including members of the federation, at a too high price (for example, KZT 1,500 per voucher for one day of fishing up to 5 kg harvest). The tenants generally lack interest and/or financial resources to develop recreational fishing, and they are concerned with potential interference with their current business when large investors of recreational fisheries join the industry.

Cross-cutting constraints

Previous sections have highlighted the challenges of developing Kazakhstan's aquaculture production. The species that are better farmed in extensive systems (carp and pikeperch) would benefit from basic research and practical experiments. Other species such as trout and Caspian salmon may have potential in the local and export markets. Their production can be supported by improving productivity through innovation, improved feed, and genetics. Other constraints include an inadequate legal framework and lack of monitoring and control of food safety and environmental standards. These points are further developed in Box 5.1 and in the next section.

BOX 5.1. INTERVIEW WITH AN INDUSTRY EXPERT FROM RYBPROM

The export of pikeperch fillet (primarily to European countries) has played a vital role in the development of the fisheries industry in Kazakhstan. The expert attributed the success of pikeperch to "the national legislature, the system of state management of the fish industry, [and] the system of certification of entities and production control."[25] The expert highlighted the following issues and the way forward for fish processing and export:

- 'Chaotic development' of the market for raw fish materials and 'ill-conceived establishment' of processing facilities without 'clear production strategies' have resulted in overcapacity and consequently caused unstable supply and fluctuated prices that make trading partners in international markets reluctant to purchase products from Kazakhstan.
- Kazakhstan needs to 'reduce the volume of exports of raw materials in favor of increasing exports of finished products.

[25] "Fish processing and export - problems and solutions." https://rybprom.kz/en/news/pererabotka-i-eksport-ryibyi-problemyi-i-resheniya

- Kazakhstan should 'more actively use the export potential of popular species' and diversify its export toward 'fish species which are found in large quantities, such as bream, crucian carp, [and] roach'. Kazakhstan can process raw fish materials imported from neighboring countries.
- Kazakhstan should focus on 'scientific support' to address the issues of 'seeding, cultivation, replenishing, and regulating [fish] stocks', including the proper determination of fishing quotas based on scientific and accurate stock assessment.
- Research institutes should collaborate with the industry on practical issues and strike a balance between economic benefits and ecological integrity. The industry can provide support (facilities, materials, fishing sites, fishing fleets, statistics, and so on) to research activities and receive scientific recommendations to guide its development.

6. Conclusions and Recommendations

6. Conclusions and Recommendations

A recent EUROFISH article[26] points out the following constraints over aquaculture and fisheries development in Kazakhstan:

- The lack of a multiannual strategic plan prevents the systematic development of Kazakhstan's fisheries and aquaculture sector.
- The development of fisheries in Kazakhstan is hampered by a lack of investment and a lack of large companies. Small, fragmented fisheries are difficult to manage and control with a command-and-control approach.
- As in other countries, IUU fishing in Kazakhstan is one of the main challenges facing the industry, the resolution of which will require time and considerable efforts.
- There is no mechanism for the control and regulation of recreational fishing, an activity practiced on a significant scale.
- Obsolete technologies in aquaculture and fish processing, a lack of marketing and technological support for the industry, and outdated management systems are among other factors that hinder the industry's development.

The article also highlights Kazakhstan's advantages in fisheries and aquaculture development as follows:

- Abundant water resources
- A variety of species produced
- A large domestic market where current fish consumption is low
- Proximity to potential export markets.

The article suggests the following way forward:

- Cracking down on gray markets in production and processing
- Introducing a traceability system for fish products
- Investing in fish promotion and marketing efforts.

The above diagnosis and recommendations are sound. Based on the analysis in this report, further recommendations are made in the following paragraphs.

6.1 An Urgent Need to Strengthen Data and Statistics in Aquaculture and Fisheries

Evidence-based policy and planning are impossible without reliable data and information. A challenge encountered in the preparation of this report as well as the preliminary assessment report is to reconcile inconsistent data from different sources (national statistics, FAO statistics, UN Comtrade statistics, import data versus export data, and so on). Policy and planning priorities tend to differ for 2.51 kg per capita fish consumption according to the estimates based on the official production statistics than for 13.17 kg per capita fish consumption according to the household survey.

Key actions to improve data and information may include

- Conducting a census of fisheries and aquaculture operations in Kazakhstan.
- Conducting comprehensive surveys and in-depth analyses of the fish and seafood market and value chain in Kazakhstan,
- Facilitating registration/certification of fish farms, and
- Carrying out extension and capacity building on data collection and compilation.

[26] EUROFISH article on "The fisheries and aquaculture sector in Kazakhstan." June 29, 2020. https://eurofish.dk/the-fisheries-and-aquaculture-sector-in-kazakhstan

6.2 Pursuing a Value-Oriented (as Opposed to Volume-Oriented) Aquaculture Development Strategy

While production volume is a common policy target in policy and planning on fisheries and aquaculture development, more attention should be given to other performance metrics (for example, economic value, social responsibility, and environment/ecological integrity).

As Kazakhstan generally does not face food shortage, and fish is a minor source of animal protein for Kazakhstanis,[27] there may not be an urgent need to increase fish production in the country for food security purposes. In addition, at the current stage it may be difficult for Kazakhstan to rapidly increase aquaculture production. Species with a great market potential (for example, pikeperch) face technical constraints on production that entail a long-term effort to overcome, whereas species with relatively more mature farming technology (for example, carps, rainbow trout, and sturgeons) are nevertheless subject to limited domestic demand and/or competitive international markets.

A volume-oriented development strategy may not yield desirable outcomes. Take tilapia aquaculture in China as an example. Owing to the continuing effort of tilapia farmers and the research community in improving productivity, tilapia aquaculture production in China reached 1.6 million tons in 2018, accounting for one-fourth of the world production. China exported half of its tilapia produce and accounted for 70% of the $1.4 billion of international tilapia trade in 2018.[28] While the performance may seem impressive to outsiders, tilapia farmers in China know better. Rapid production expansion has made tilapia a low-value commodity with a thin profit margin that often renders tilapia farming a money-losing business under fluctuating foreign demand, or in farmers' words, a money-making business for upstream feed suppliers and/or downstream processing plants. Worse still, farmers' sacrifice was not appreciated by all stakeholders—many countries complained that cheap tilapia export from China destroyed their domestic tilapia industry. The situation has forced the tilapia industry in China to pay more attention to the domestic market and explore ways to add value to tilapia products. Indeed, the entire aquaculture sector in China has been gradually shifting toward a value-oriented development strategy, including paying increasing attention to the environmental sustainability and social responsibility of aquaculture. For example, many cage-farming operations have been removed from inland water bodies to preserve water quality for residential use.

Adopting the right development strategy and avoiding being locked in a wrong development path is vital to Kazakhstan's aquaculture in its infancy. It matters to policy and business decision-making in every aspect of aquaculture development. Kazakhstan is in the process of reorienting water bodies from 'fishing to fish farming'.[29] However, shifting toward farming does not simply mean to adopt intensive aquaculture systems or practices to pursue the highest production or productivity. Indeed, the disadvantage of extensive/pasture aquaculture in productivity can be turned into a marketing advantage by selling fish grown as wild fish (or naturally farmed fish) for a premium price—many consumers are willing to pay for such 'wildness'. Under this strategy, the focus of farming is not only on expanding production, increasing fish growth,

[27] FAO. 2020. "Aquaculture Growth Potential in Kazakhstan." World Aquaculture Performance Indicators (WAPI) factsheet. http://www.fao.org/3/ca8809en/ca8809en.pdf.

[28] FAO. 2020. "Tilapia Production and Trade with a Focus on India." WAPI factsheet. http://www.fao.org/3/ca9224en/ca9224en.pdf.

[29] News article on "Reorientation to fish farming, improvement of legislation and measures of state support - how fish industry developed in Kazakhstan" https://primeminister.kz/en/news/reviews/reorientation-to-fish-farming-improvement-of-legislation-and-measures-of-state-support-how-fish-industry-developed-in-kazakhstan

or reducing the feed conversion ratio (FCR), but also on creating/adopting an environment- and fish-friendly farming practices to produce high-quality fish and turn this into economic value through proper marketing strategies. An effective legal and regulatory framework is needed to ensure high standards on farming, food safety, environmental integrity, and social licensing. Proper policy and planning are crucial to guiding an orderly and sustainable sector development. For example, financial incentives can be used to support 'green aquaculture'.

6.3 Building a National Image for Kazakhstan Fish

"Very nice!" is the newly adopted slogan for Kazakhstan tourism. A one-minute short video for promoting Kazakhstan tourism[30] has no room to showcase the amazing fish in Kazakhstan, such as (a) a piece of delicious pikeperch fillet that would make the mouths of gastronomes water; (b) prehistoric looking sturgeon with exquisite beluga caviar; (c) exotic looking European carp (Box 6.1), unfamiliar yet appealing to Asian people who may be only accustomed to Asian carps; or (d) 2 m long catfish that would amaze sport fishers as a dream trophy.[31]

Social media have provided a powerful platform to pass on the images of the amazing fish in Kazakhstan to every corner of the world. Yet, all sub-sectors (fishing, farming, recreational fisheries, processing, fish markets, food catering services, and so on) need to live up to the 'Very nice' standard, and a long-term, systematic mechanism is needed to coordinate the efforts into a national image of the 'amazing fish' in Kazakhstan. The benefits of the image may not be immediate or directly visible; yet, it is essential for the pursuit of a value-oriented strategy, which is a promising way forward for fisheries and aquaculture development in Kazakhstan.

BOX 6.1: COMMON CARP CAUGHT IN KAZAKHSTAN

Data source: https://primeminister.kz/en/news/reviews/reorientation-to-fish-farming-improvement-of-legislation-and-measures-of-state-support-how-fish-industry-developed-in-kazakhstan.

6.4 Domestic Market Development

If per capita fish consumption in Kazakhstan is close to the 2.51 kg estimation based on official production statistics, increasing domestic consumption should be a priority in policy and planning. Even if the actual consumption is closer to the 13.17 kg estimation based on household surveys, fostering or strengthening the domestic fish market tends to be one of the most effective ways to facilitate aquaculture development in the long run. As suggested previously, a comprehensive investigation and in-depth study are needed to understand factors that facilitate or constrain fish consumption in Kazakhstan. Some suggestions based on global experiences are highlighted as follows:

- Public programs, such as nutrition education and fish menu in hospitals, schools, and other public institutions, have been a popular measure to promote fish consumption, which can not only increase fish consumption directly but also help foster future fish consumers.

[30] "Vice nice!" video on Kazakhstan tourism. https://www.youtube.com/watch?v=eRGXq4t9wY4.

[31] Article on "The best fishing destinations in Kazakhstan". October 18, 2018. https://kazakhstan.travel/publications/en/22/the-best-fishing-destinations-in-kazakhstan.

- In Kazakhstan, more and more consumers, especially the young generation that pursue a healthy lifestyle in the 'urban' culture (as opposed to the nomadic meat-eating tradition), choose to eat fish for health benefits. Such consumers may prefer imported fish (for example, salmon) whose health benefits are well advertised but pay inadequate attention to local fish that are also nutritious. Therefore, there should be a tailor-made nutrition education program to improve the public knowledge of the nutritional value and health benefits of local fish.
- For most people, food is not only a source of energy and nutrients but also a pleasure of the palate. An undesirable food to some people could be a delicacy to others. Cuisine culture and dietary habits matter.
    - Milkfish (Chanos chanos) is a good aquaculture species easy to cultivate, yet the thorny fish may not be desirable in many cuisine cultures. This nevertheless does not deter Southeastern Asian people from finding many ways (deboning, marinating, and so on) to make delicious dishes from the fish. The world aquaculture production of milkfish reached 1.3 million tons in 2018, and it has become the 'national fish' (albeit unofficially) of the Philippines.[32]
    - Crayfish, a star aquaculture species featured in a recent FAO factsheet on the top 10 species groups in global aquaculture,[33] is a hardy freshwater crustacean turning from a trash fish in swamps or a pest in paddy fields into a popular delicacy and another unofficial 'national fish'[34] that supports a multi-billion-dollar industry in China.[35]

The merit of these two success stories is that no fish is intrinsically undesirable. Processing, cooking, and marketing innovations could transform ordinary or less desirable local fish in Kazakhstan (for example, breams and crucian carp) into highly demanded products in domestic and/or foreign markets. Entrepreneurs in Kazakhstan have taken action in this direction.[36] For example, a fish processing company (Rybprom) once collaborated with the European Bank for Reconstruction and Development (EBRD) to implement a project to process breams into fish paste, sauces, and flavor enhancers.[37] However, sporadic efforts may not be sufficient or sustainable, and individual companies may not have the resources, patience, and/or incentives to devote long-term effort for product or market development since they cannot internalize all the benefits. Public support and coordination are needed.

- In addition to conventional promotion schemes (food tasting, cooking demonstrations, food shows, food fairs and so on), social media (YouTube, Facebook, and so on) can become an effective platform to foster fish dietary habit and cuisine culture through sharing recipes, cooking

[32] FAO. Cultured aquatic species fact sheets. Chanos chanos. https://www.fao.org/fishery/en/culturedspecies/chanos_chanos/en

[33] FAO. 2020. Top 10 species groups in global aquaculture 2018. http://www.fao.org/3/ca9383en/ca9383en.pdf

[34] Yi, Lia. 2019. China's Crayfish Craze - How Louisiana crayfish became China's national dish. Published on the Goldthread website. 21 August 2019. https://www.goldthread2.com/food/how-louisiana-crayfish-became-china-national-dish/article/3023711

[35] The Fish Site. 2016. "The Rise of China's Crayfish Capital." An editorial article published on the Fish Site. https://thefishsite.com/articles/the-rise-of-chinas-crayfish-capital; Ge, C. 2017. "China's craving for crayfish creates $2 billion business." *South China Morning Post*. July 26, 2017. https://www.scmp.com/business/companies/article/2100001/chinas-craving-crayfish-creates-us2-billion-business; Harkell, L. 2018. "China gov't says country's crayfish industry worth $42bn." *Undercurrent News*. June 19, 2018. https://www.undercurrentnews.com/2018/06/19/china-govt-says-crayfish-industry-worth-41bn/.

[36] Rybprom. "Consumption of fish is a key to health." https://rybprom.kz/en/news/potreblenie-ryibyi-put-k-zdorovyu.

[37] Rybprom. "Fish processing and export - problems and solutions." https://rybprom.kz/en/news/pererabotka-i-eksport-ryibyi-problemyi-i-resheniya.

styles, experiences, lessons learned, and so on among a large number of people. A new version of the traditional 'Fish Thursday' can be organized through social media and facilitated by public-private partnerships.

- The lack of skills, experience, interest, and/or facilities to prepare fish dishes tends to deter households from buying fish. To overcome the constraint, most fish stores in Albania have facilities to cook the fish they sell according to customers' preferences. Such a business model, which is not yet common in Kazakhstan, could help promote fish consumption in Kazakhstan, especially in urban areas.

These are only a few among many ways to promote fish consumption in Kazakhstan. The key is to establish a mechanism to coordinate them into a systematic, long-term effort in fostering a fish-eating culture in Kazakhstan.

6.5 Export Market Development

Fish fillets are the most lucrative fish export accounting for 70% of Kazakhstan's fish export value in 2018. A better solution is to increase the value of local fish through innovations in marketing and processing, including the following:

- **Improving the quality of fish production (in terms of freshness, cleanness, and safety).** This may require physical investments in laboratories for fish quality monitoring, production, and marketing infrastructure and facilities in the fish value chain as well as human resource development through training and extension.
- **Identifying and exploring niche markets through proper marketing/branding strategies.** The desirability of fish varies in different dietary and cuisine cultures. In Kazakhstan, the price of pikeperch is comparable to or could be even lower than common carp; yet it is an expensive delicacy in Finland. Crucian carp and bream are the cheapest, undesirable fish in Kazakhstan intended to be used as raw materials to produce fish sauce, whereas China cultivated 2.8 million tons of crucian carp and 0.8 million tons of Wuchang bream (*Megalobrama amblycephala*) for direct human consumption. Chinese consumers are generally more tolerant of thorny fish but more demanding of freshness. Marketing fish from Kazakhstan as wild or naturally produced fish may be able to overcome Chinese consumers' partiality for live seafood; yet the quality of the fish (for example, size, taste, and texture) must be satisfactory.
- **Innovations in value-added products.** In 2018, Kazakhstan exported 1,200 tons of dried fish at an average of $1.64/kg, primarily to Russia and Ukraine. Suppose 3 kg of raw fish materials are needed to produce 1 kg of dried fish, the price of the raw materials would be less than $0.55/kg, which indicates a limited value addition from the diversified product. The country also exported smoked fillet (primarily to Germany and Russia) at $9.2/kg; yet its quantity (46 tons) was rather limited. The main prepared/preserved product in Kazakhstan's fish export is caviar substitute prepared from fish eggs other than that of sturgeon. The country's exports of this caviar substitute representing 2,000 tons ($4/kg) in 2018 went entirely to Russia — a market with limited income and population growth potential. Canned products are less common for freshwater fishes than marine fishes (for example, tunas and sardines), and Kazakhstan has little export of canned fish that use local species. Much effort is needed for Kazakhstan to develop suitable value-added products that substantially utilize local fish species, especially those currently deemed undesirable. Global experiences could offer some guidance. For

example, a popular canned fish in China, 'fried dace with salted black beans'[38] is made of dace (*Cirrhinus molitorella*), a carp species normally undesirable because of its small size and thorniness.

These recommendations could be achieved through a combination of targeted support to the private sector, to innovation/incubator centers bringing together the private sector, public agency, and academia, as well as publicly financed capacity-building programs and promotion campaigns.

6.6 Supply-Side Interventions

While this report is focused on the demand-side analysis, some supply-side interventions by species have been suggested in Section III.

Carp

- Rehabilitation/restoration of existing earthen pond systems suitable for carp farming
- Genetic improvement programs to increase the growth performance of carp species
- Capacity building to increase the technical and economic performance of the cultivation of carp species.

Pikeperch

- Pikeperch may be farmed extensively as an additional species in carp culture in earthen ponds.
- There should be more efforts in basic research and practical experiments of pikeperch aquaculture to lay a foundation for a potential leap forward in pikeperch farming in the future.
- Kazakhstan may learn from the experiences in the farming of pikeperch or similar species in other countries.

Sturgeon

- As the situation of sturgeon demand being lower than supply in the global market tends to persist in the near future, sturgeon farming in Kazakhstan may need to go through a process of consolidation before it becomes a mature, robust industry.
- The public sector can help provide good market and sector information and set guidance and standards to facilitate the sustainable development of the sturgeon sub-sector.

Rainbow trout

- Cage culture tends to be the main contributor to export-oriented trout production in Kazakhstan because of its relatively low production cost and fewer constraints over production expansion. However, it is crucial to have proper planning and management to ensure the long-term sustainability of cage culture, especially in inland water bodies.
- One or a few leading entities (for example, large companies or a functional farmers/ processors/ traders association) are crucial to facilitate the development of an export-oriented trout industry in Kazakhstan. While such leading entities are usually molded by market forces, the public sector can adopt a policy to facilitate the process.

Caspian salmon

- It may be a more realistic and viable strategy to treat Caspian salmon as a niche species (that is, focusing on value) and refrain from pursuing it as a commodity species (that is, focusing on volume) before its technical and market prospects are firmly established.
- With efforts in improving its aquaculture performance through tailor-made feed and genetics (for example, selective breeding),

[38] "Fried dace with salted black beans." *Wikipedia* (accessed January 8, 2021), https://en.wikipedia.org/wiki/Fried_dace_with_salted_black_beans

Caspian salmon could become a promising aquaculture species in Kazakhstan in the long run.

6.7 Establishment of Genetic Resource Centers

Similar to the 'Genetic Selection Centers' proposed in an early version of the KFDP, genetic resource centers could be established to lay a solid foundation for aquaculture and fisheries development in Kazakhstan. The centers could cover carp, sturgeon, pikeperch, northern pike, European perch, Caspian salmon, and whitefish; yet the species need to be prioritized according to the country's aquaculture and fisheries development plan.

The key functions of a genetic resource center may include (a) collecting, managing, and preserving wild genetic resources; (b) producing broodstock (including breeders and broodfish fingerlings) for restocking or fish farming and improving broodstock quality via genetic improvement programs (for example, selective breeding); and (c) conducting research, training, and other scientific or extension activities.

A genetic resources center could be a state-owned enterprise or a joint venture under a public-private partnership. The center can be financially supported by the government although it should be run like a business.

6.8 Environmental, Social, and Institutional Dimensions

Aquaculture planning should consider existing and potential impacts of fish farming environments. For example, proper site selection and zoning are needed to protect cage aquaculture in the Caspian Sea from the existing and potential impacts of industrial and agricultural developments (for example, oil extraction and mining) on the water quality.

Proper planning and management are also needed to prevent self-pollution of aquaculture activities. In Ghana, disease outbreaks have recently caused large mortalities in cage tilapia farming in Lake Volta. In China, many cages have recently been removed from inland water bodies that are used as water sources for residential use. The global salmon farming industry has faced increasing resistance against cage salmon farming in marine areas because of concerns over its negative environmental impacts. Kazakhstan should learn from these experiences to plan the development of cage aquaculture (especially in inland water bodies) within the carrying capacity of the farming environment.

The concern of reservoir tenants over potential interference with their current business by large investments in recreational fisheries is an example of the importance of social acceptability of fisheries and aquaculture development. The potential impacts of rapid aquaculture expansion within a short time frame on the businesses and livelihoods of commercial fishers and other stakeholders on the fish value chain must be considered in the planning of aquaculture development.

The enforcement of environmental and social standards entails an effective and efficient legal and regulatory framework and other institutional arrangements. Imperfect legislation is one of the main barriers hindering the development of fisheries and aquaculture in Kazakhstan, and the government is currently focused on addressing the following issues in this regard:[39]

- Restrictions over the construction of fish farms and structures in the water protection zone

[39] News article on "Reorientation to fish farming, improvement of legislation and measures of state support - how fish industry developed in Kazakhstan." Friday, September 25, 2020. https://primeminister.kz/en/news/reviews/reorientation-to-fish-farming-improvement-of-legislation-and-measures-of-state-support-how-fish-industry-developed-in-kazakhstan

- Overpayment for the use of water in aquaculture
- Underutilization of local water bodies
- Cumbersome documentation requirements needed to establish pond and tank aquaculture systems
- Cost needed to change the purpose of agricultural land for aquaculture activities.

The government has amended legislations, such as the laws on the protection, reproduction, and use of animal species and those on architectural, urban planning, and construction activities, to facilitate aquaculture development and considers establishing specific laws on aquaculture. The recently established Fisheries Committee under the Ministry of Ecology, Geology and Natural Resources is another progress in strengthening the institutional arrangements in support of fisheries and aquaculture development in the country.

Internationally, Kazakhstan should try to facilitate regional cooperation through collaboration with regional fisheries/aquaculture organizations, such as Central Asian and Caucasus Regional Fisheries and Aquaculture Commission (CACFish) and Network of Aquaculture Centres in Asia-Pacific (NACA). The cost of membership is worthwhile considering the benefits in terms of knowledge exchange and potential joint projects. Strategic partnerships with key fish trade partners (for example, Russia and China) would also be useful.

6.9 Public Investments or Support

The lack of government support is deemed a constraint on aquaculture development in Kazakhstan. The existing support is mostly supply side, with a focus on subsidizing the purchase of aquafeed. The total amount of feed subsidies in 2019 was KZT 400 million ($1 million). The government plans to expand the scope of subsidies to hatchery operations and the establishment of cage farms and RAS farms.[40]

In addition to the supply-side support, public investments or support for market development are needed to enhance market capacity to accommodate production expansion on the supply side. One specific target is to increase per capita fish consumption, particularly for local species. Measures or activities for achieving the target may include investments or other financial instruments on

- Improvement of hygienic conditions along the fish value chain through the implementation of sanitary standards and regular quality control (testing of samples in a laboratory);
- Establishment or expansion of retail channels for fish products, such as specialized fish stores, fish counters in supermarkets, and fish vendors in bazaars, among others;
- Establishment of fish/seafood restaurants that target low- and mid-end customers;
- Innovations in cooked or uncooked products made of local fish species;
- Fish marketing activities, such as food fairs, food tasting, cooking shows, and cooking competitions, among others; and
- Fish menu in hospitals, schools, and other public institutions.

These are only a few measures or activities in a potential 'Fish Market Development Programme' that is much needed for unlocking the growth potential of fisheries and aquaculture in Kazakhstan. The formulation of the program entails a comprehensive survey and in-depth assessment of the fish market and value

[40] Ren, Yan, Mantang Xiong, Jixin Yu, Wei Li, Bo Li, Jiashou Liu, and Tanglin Zhang. 2019. "Effects of Artificial Submersed Vegetation on Consumption and Growth of Mandarin Fish *Siniperca chuatsi* (Basilewsky) Foraging on Live Prey." *Journal of Freshwater Ecology* 34 (1): 433–444. DOI: 10.1080/02705060.2018.1561530.

chain in the country as well as a wide range of stakeholder consultations.

6.10 Building a Blue Economy for Kazakhstan Fisheries

The global drive to build a healthy and profitable seafood/fishing sector captured in Sustainable Development Goal 14 points toward a strategy that builds synergy between catch and conservation. The blue economy focuses on economic growth, improved livelihoods, and a healthy ecosystem. Leveraging a healthy ecosystem by redirecting fishing from a 'tragedy of the commons', toward balanced exploitation depends in large part on being able to add value through markets for high-quality products produced in a demonstrably eco-friendly manner.

Kazakhstan's seafood production is currently dominated by low-value carps and whitefish, for which there is likely little scope for expansion in existing and near-term markets. To generate enough jobs and revenues to meet national targets for growth, both higher-value species and higher volumes of these species need to be moved.

From analysis of markets and trade for Kazakhstan seafood, pikeperch and indigenous salmonids seem to be the products that are most likely to succeed in markets in the short term. Both of these are indigenous species and so can be produced in a wide variety of management systems. Pikeperch is established in existing marketing channels, minimizing adaptation that might be needed in the value chain. Caspian salmon can be produced to have the same culinary characteristics as the widely known Atlantic salmon and could move as a specialty product through similar value chains.

The following three approaches to increasing volume without increasing negative environmental externalities have been shown to work elsewhere:

- **Increasing sales volume through stock enhancement of capture fisheries.** Natural productivity is regulated in part by heavy predation pressure and competition, leading to low survival of juveniles. By feeding and growing juveniles past the point where predation and competition are the highest, the proportion of preferred species in the catch can be increased. This is a long-standing practice in Kazakhstan that could be made more profitable by moving away from low-value (but easy to grow) whitefish and carps toward higher-value pikeperch and salmonids.
- **Cage aquaculture of salmonids.** Reproduction and culture technology for Caspian salmon is readily available for deployment in the many water bodies in Southern Kazakhstan, most particularly the Caspian Sea. Enterprise modeling (Table 6.1) demonstrates the considerable potential for this technology to be profitable. For these cages to avoid polluting the natural environments in which they are installed, and to ensure that product quality and production efficiency are maintained, scientifically sound regulations based on reliable models of the carrying capacity of the ecosystem to absorb nutrients from aquaculture are necessary. These are internationally available for adaptation to Kazakhstan's conditions.
- **High density closed aquaculture systems for high-value fish.** This is already being done for sturgeon to produce high-value caviar and trout for domestic markets. Recirculating aquaculture technology, hatchery systems, and specialized feeds for pikeperch farming have been successfully piloted in North America and elsewhere. Some work remains to be done to bring these to commercial scale, but enterprise modeling based on current practice and expertise (that is available for hire) indicates that they have considerable potential for profitability.

TABLE 6.1: FINANCIAL ANALYSIS FOR THE CULTURE OF CASPIAN SALMON IN CAGES IN KAZAKHSTAN

Technology	Semi-intensive finfish				
Investment	421,702	$			
Main output	89,063	kg of fish per year			
Markets	Domestic/pond bank				
Production parameters					
Production unit	5	cages	Target size (g)	3,000	
Production cycle	12	months	Mortality rate during grow out period	5%	
No. of cycles per year	1		No. of fingerlings	5.0	per m³
Cage volume	1,250	m³	Total no. of fingerlings required per cycle	31,250	
Total system volume	6,250	m³	Initial weight of one fingerling (g)	100	
Productivity	14.25	kg/m³	Feed conversion rate	1.25	

Per year	**89,063**	**kg/ha/ year**	**Per production cycle**				**Per year**		
			Unit	**No. of units**	**Unit costs ($)**	**Total amount ($)**	**No. of units**	**Unit costs ($)**	**Total amount ($)**
Output (revenue)	**Size (g)**	**Share**							
Whole finfish	3,000	100%	kg	89,063	4	356,250	89,063	4	356,250
Total output (revenue)		**100%**	kg	89,063	**4**	**356,250**	89,063	**4**	**356,250**
Intermediate inputs									
Fingerlings			No.	31,250	0.5	15,625	31,250	0.5	15,625
Feed			kg	18	1.50	27	18	28	499
Maintenance and repair of structures			lump sum	1	15,000	15,000	1	15,000	15,000
Maintenance and repair of equipment/ machinery			lump sum	1	1,250	1,250	1	1,250	1,250
Electricity/water/logistics/miscellaneous			lump sum	1	36,000	36,000	1	36,000	36,000
Marketing costs (including transport and commission)			kg	89,063	0.00	0	89,063	0.00	0.00
Total intermediate inputs						**67,902**			**68,374**
Value added						**288,348**			**287,876**
Value added per unit of primary output						**3.2**			**3.2**
Hired labor			person Months		1,200	28,800	24	1,200	28,800
Subtotal hired labor			person months	**24.0**		**28,800**	**24.0**		**28,800**
Gross margin						**259,548**			**259,076**

TABLE 6.1

Interest charges	3.0%					—			—
Taxes									
Gross profit						259,548			259,076
Depreciation						30,000			30,000
Net profit						229,548			229,076
Net profit per unit of primary output						2.6			2.6
Return to labor (per person month)						10,765			10,745

Investment costs, annual depreciation, maintenance, and repair

Item	Unit cost ($)	Useful life (years)	No. of units	Inv. cost ($)	Depre-ciation Per year ($)	Maintenance/ repair	
						% of inv. cost per year	$ per year
Buildings/structures							
Cages	10,000	10	5	50,000	5,000	5	2,500
Buildings, roads, docks, and boats	250,000	20	1	250,000	12,500	5	12,500
Equipment/machinery							
Equipment	25,000	2	1	25,000	12,500	5	1,250
Tube well	75,000	10	0	0	0	5	0
Aerators	12,000	5	0	0	0	5	0
Total assets				325,000			
Working capital per cycle				96,702			
Total				421,702	30,000		16,250

Net present value (NPV) at	**Internal rate of return (IRR)**	**59.1%**
	9%	**1,667,769**
	Benefit-cost ratio	**2.47**

6.11 Capturing the Potential

Aquaculture has taken over as the major supplier of seafood globally not just because capture fisheries are in general decline affecting supply. Importantly, unlike inherently unreliable capture fisheries, aquaculture is capable of delivering a product meeting the exact specification for weight, length, and culinary attributes on time in the amounts demanded by the market. Blind taste tests in New York, Washington DC, and Paris have repeatedly demonstrated the superiority of cultured salmon over wild caught. If price points can be achieved or even approached, cultured pikeperch and Caspian salmon can supplement and even replace the wild-caught product in the market. Since culture is not necessarily constrained by natural productivity, volumes can be increased well beyond whatever could be produced by capture.

To capture the opportunities for economic growth and increased food supply from aquaculture, Kazakhstan can invest in well-targeted public sector action, leverage better environmental management, and encourage private sector adoption of best aquaculture practices that reduce or reverse environmental impacts. Activities might include the following:

- **Develop and deploy a strong regulatory framework for aquaculture development that prepares the industry for expansion and increased levels of scrutiny in markets.** Carrying capacity modeling, zoning, surveillance, biosecurity, and ongoing consultation with stakeholders to ensure clear messaging about the importance of sustainability as a prerequisite to access seafood markets of the future would be key aspects.
- **Foster adoption of production systems and value chains that are demonstrably 'blue' (that is, environmentally sustainable).** Aquaculture is highly innovative and 'Best Practices' are constantly evolving, including in Kazakhstan. Strong engagement with adaptive research, including hiring international experts to work with local scientists and industry operators, can rapidly bring Kazakhstan's fish farmers up to speed. Marketing information and support through awareness raising could position Kazakhstan's seafood as a high-quality, environmentally friendly product for European and high-end domestic and Asian markets.
- **Integrate aquaculture into sustainable landscapes.** Aquaculture should develop in the context of sustainable watershed management. It can take many forms and can be conducted in a wide range of natural and manmade ecosystems including cages in small and large reservoirs or natural water bodies, raceways along river-courses, and indoor 'fish plants' as well as the traditional ponds. Stocking (that is, ranching) programs can support capture and/or recreational fishing. Each ecosystem has a different carrying capacity that determines how much of what kind of aquaculture it can support. The government can use new and existing technology and natural resource management science to support mechanisms to encourage integration.

Annexes

ANNEX A: Information on Resource and Socioeconomic Conditions

TABLE A1: KAZAKHSTAN'S POPULATION, GDP, AND NATURAL RESOURCES FROM A REGIONAL AND GLOBAL PERSPECTIVE

Country / area	Population (2018)[a]		GDP per capita (2018)[b]		Total country area (excluding coastal waters, 2013–2017)[c]		Surface area of inland water bodies (2015)[d]		Total renewable water resources (2013–2017)[c]	
	Mil-lions	Share of world total (%)	Current $	Ratio to world average (%)	km^2	Share of world total (%)	km^2	Share of world total (%)	Billion m^3/year	Share of world total (%)
World	**7,631**	**100.00**	**11,222**	**100.00**	**134,108,230**	**100.00**	**3,434,349**	**100.00**	**54,737**	**100.00**
Landlocked developing countries	509	6.67	1,549	13.81	16,946,350	12.64	504,329	14.69	2,746	5.02
Eastern Europe	294	3.85	11,105	98.96	18,826,260	14.04	628,791	18.31	5,232	9.56
Central Asia	72	0.94	3,883	34.61	4,001,730	2.98	284,073	8.27	228	0.42
Western Asia	271	3.55	13,013	115.96	4,829,698	3.60	106,238	3.09	439	0.80
Central Asia										
Kazakhstan	**18.3**	**0.24**	**9,440**	**84.12**	**2,724,900**	**2.03**	**176,442**	**5.14**	**108**	**0.20**
Kyrgyz Republic	6.3	0.08	1,283	11.44	199,950	0.15	7,190	0.21	24	0.04
Tajikistan	9.1	0.12	826	7.36	141,380	0.11	1,382	0.04	22	0.04
Turkmenistan	5.9	0.08	6,966	62.08	488,100	0.36	90,398	2.63	25	0.05
Uzbekistan	32.5	0.43	1,555	13.85	447,400	0.33	8,662	0.25	49	0.09
The Caucasus										
Armenia	3.0	0.04	4,211	37.53	29,740	0.02	1,332	0.04	8	0.01
Azerbaijan	9.9	0.13	4,718	42.04	86,600	0.06	79,865	2.33	35	0.06
Georgia	4.0	0.05	4,050	36.09	69,700	0.05	374	0.01	63	0.12

Data sources: a. UN World Population Prospects (2019 Revision); b. Total GDP from IMF WEO Database (April 2019) divided by population from UN World Population Prospects (2019 Revision); c. FAO. 2016. AQUASTAT Main Database – FAO. Website accessed on May 16, 2019; d. FAOSTAT Land Cover database (updated June 2019).

TABLE A2: STATUS AND TREND OF PER CAPITA FISH CONSUMPTION IN KAZAKHSTAN FROM A GLOBAL/ REGIONAL PERSPECTIVE, 1993 VERSUS 2013

Country/area	Per capita fish consumption (kg/year)		Annual growth (%)
	1993	2013	
World	**14.3**	**19.9**	**1.7**
Landlocked developing countries	3.0	4.3	1.8
Eastern Europe	10.1	17.0	2.7
Central Asia	2.0	2.1	0.5
Western Asia	7.8	8.0	0.1
Kazakhstan + selected countries in neighboring regions			
Kazakhstan	**3.7**	**4.8**	**1.3**
Kyrgyz Republic	0.1	2.5	19.0
Tajikistan	0.5	0.5	0.5
Turkmenistan	4.5	3.6	-1.1
Uzbekistan	1.0	0.7	-1.4
Armenia	1.2	4.5	6.8
Azerbaijan	3.0	2.8	-0.4
Georgia	3.8	8.6	4.1
Iran, Islamic Rep.	5.2	10.1	3.4
Russian Federation	14.3	22.7	2.3

TABLE A3: ESTIMATION OF KAZAKHSTAN'S APPARENT FISH CONSUMPTION BY PRODUCT FORM, 2018

Product	Do-mestic produc-tion	Import			Export			Total consumption (live weight)	
	Live weight (tons)	Product weight (tons)	Con-version factor	Live weight (tons)	Product weight (tons)	Con-version factor	Live weight (tons)	Total (tons)	Per capita (kg)
Finfish and shellfish	**42,935**	**43,231**	**1.21**	**52,150**	**31,860**	**1.54**	**49,145**	**45,941**	**2.51**
Finfish	**42,935**	**41,843**	**1.20**	**50,009**	**31,604**	**1.54**	**48,617**	**44,328**	**2.42**
Fish, live (HS0301)		20	1.00	20	30	1.00	30		
Fish, fresh/chilled (HS0302)		460	1.05	484	1,025	1.00	1,025		
Fish, frozen whole (HS0303)		30,962	1.03	31,884	13,945	1.11	15,469		

TABLE A.3

Product	Domestic production	Import			Export			Total consumption (live weight)	
	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Product weight (tons)	Conversion factor	Live weight (tons)	Total (tons)	Per capita (kg)
Fish, fillet and other meat (HS0304)		1,682	2.10	3,528	11,427	2.21	25,221		
Fish, dried/salted/ smoked (HS0305)		971	1.82	1,770	2,050	2.40	4,920		
Fish, prepared/ preserved (HS1604)		7,749	1.59	12,324	3,128	0.62	1,952		
Shellfish		**1,387**	**1.54**	**2,141**	**256**	**2.06**	**528**	**1,613**	**0.09**
Crustaceans (HS0306)		566	1.26	713	32	1.73	55		
Mollusks (HS0307)		363	1.72	625	3	1.36	5		
Aquatic invertebrates nei (HS0308)		4	1.00	4	60	1.00	60		
Prepare/preserved shellfish (HS1605)		454	1.76	798	161	2.53	408		

Note: The following items excluded in the calculation of live weight: ornamental fishes, live trout used as seed, and fish oils. The conversion factor of each Harmonized Commodity Description and Coding System (HS) level 4 product group is the average of the top five HS level 6 products in this group with the largest export or import volume (EUFOMA 2019). The results of fish, shellfish, and fish and seafood from aggregation. Live weight = product weight × conversion factor.

TABLE A4: FISH CONSUMPTION IN KAZAKHSTAN BY REGION, ESTIMATED FROM HOUSEHOLD SURVEY DATA

Region	Year 2018 (kg/capita)				Year 2019 (kg/capita)			
	All population	Urban population	Rural population	Low-income population	All population	Urban population	Rural population	Low-income population
Kazakhstan	**13.170**	**13.035**	**13.353**	**7.665**	**14.596**	**14.667**	**14.499**	**5.744**
Atyrau	19.029	17.525	20.648	11.119	18.984	17.722	20.303	19.977
North Kazakhstan	18.818	21.259	16.815	5.883	20.140	22.534	18.164	8.575
East Kazakhstan	15.381	16.360	13.86	6.263	19.093	21.348	15.430	4.647
Kyzylorda	14.953	15.143	14.818	10.103	16.031	15.013	16.782	6.666
Zhambyl	14.475	14.918	14.183	6.966	15.103	15.340	14.945	5.120
Kostanay	14.334	14.991	13.568	7.996	16.565	16.844	16.231	7.800
Karagandy	13.913	13.406	15.827	4.198	15.782	15.326	17.558	3.441
Pavlodar	13.896	13.718	14.315	3.758	13.872	13.835	13.958	3.451

TABLE A.4

Region	Year 2018 (kg/capita)				Year 2019 (kg/capita)			
	All population	Urban population	Rural population	Low-income population	All population	Urban population	Rural population	Low-income population
West Kazakhstan	13.705	14.404	12.936	4.324	14.819	15.333	14.244	6.343
Almaty	13.700	15.149	13.282	4.781	15.065	16.482	14.668	3.390
Akmola	12.718	15.037	10.62	6.492	16.336	18.216	14.616	6.737
Turkistan	12.012	11.406	18.61	15.152	12.616	13.203	12.474	8.161
Aktobe	11.533	11.618	11.382	5.580	11.566	12.317	9.724	4.399
Mangystau	9.066	10.056	8.421	0.465	10.227	10.268	10.199	0.489
Nur-Sultan city	8.650	8.650	—	1.093	11.562	11.562		5.347
Almaty city	12.563	12.563	—	3.882	15.938	15.938		1.940
Shymkent city	9.053	9.053	—	0.154	6.587	6.587		3.197

Data source: Bureau of National Statistics, Kazakhstan.

Note: Low-income population = population with income below subsistence level.

ANNEX B: Status and Trends of Fish Production in Kazakhstan

- According to the FAO statistics, Kazakhstan's total fishery production was 33,660 tons in 2018, including 32,000 tons of capture fisheries production and 1,600 tons of aquaculture production (4.8% of the total fishery production). The FAO production statistics were lower than the national statistics (37,283 tons of capture fisheries production and 5,652 tons of aquaculture production in 2018).
- Major wild production species include a variety of carp species (over 70% of the total wild production, primarily freshwater bream *bramis brama*), pikeperch (*Sander lucioperca*), northern pike (*Esox lucius*) and European perch (*Perca fluviatilis*). Major farmed species include carps, sturgeons, trout, northern pike, and European perch.
- Kazakhstan's share in world aquaculture production is much lower than its share in the world total land area, world total inland water surface area, and world total renewable water resources.

TABLE B1: SUBNATIONAL DISTRIBUTION OF TOTAL FISH PRODUCTION IN KAZAKHSTAN, 2019

	Tons	Share of total (%)	Number	Share of total (%)	
Kazakhstan	**52,578**	**100.0**	**18,395,660**	**100.0**	**2.86**
Almaty region (including Almaty city)	6,071	11.5	3,893,932	21.2	1.56
Turkistan region (including Shymkent city)	10,438	19.9	2,993,258	16.3	3.49
Akmola region (including Nur-Sultan city)	567	1.1	1,816,949	9.9	0.31
Karagandy region	927	1.8	1,378,554	7.5	0.67
East Kazakhstan region	8,463	16.1	1,378,504	7.5	6.14
Zhambyl region	1,005	1.9	1,125,297	6.1	0.89
Kostanay region	270	0.5	872,736	4.7	0.31
Aktobe region	280	0.5	869,603	4.7	0.32
Kyzylorda region	7,378	14.0	794,165	4.3	9.29
Pavlodar region	1,222	2.3	753,804	4.1	1.62
Mangystau region	1,575	3.0	678,224	3.7	2.32
West Kazakhstan region	274	0.5	652,314	3.5	0.42
Atyrau region	13,063	24.8	633,801	3.4	20.61
Nord Kazakhstan region	1,140	2.2	554,519	3.0	2.06

Data source: Production from Bureau of National Statistics, Kazakhstan. Total population from UN World Population Prospects (2019 revision), regional population: http://www.geo-ref.net/en/kaz.htm. Per capita production calculated by production divided by population.

TABLE B2: CAPTURE FISHERIES PRODUCTION IN KAZAKHSTAN VERSUS SELECTED COUNTRIES IN NEIGHBORING REGIONS, 2000–2018

Country/area	Capture fisheries production, 2000		Capture fisheries production, 2018		Annual growth between 2000 and 2018 (%)
	Tons	Share of world total (%)	Tons	Share of world total (%)	
World	**94,778,335**	**100.00**	**97,398,330**	**100.00**	**0.15**
Landlocked developing countries	775,998	0.82	1,346,977	1.38	3.11
Central Asia	52,373	0.06	81,719	0.08	2.50
Western Asia	1,048,957	1.11	1,439,935	1.48	1.78
Southern Asia	6,147,298	6.49	9,233,480	9.48	2.29
Eastern Europe	4,666,655	4.92	5,447,236	5.59	0.86
Top 20 capture fisheries countries / territories in Central Asia, Western Asia, Southern Asia, and Eastern Europe					
1. India	3,726,427	3.93	5,342,888	5.49	2.02
2. Russian Federation	4,027,370	4.25	5,116,900	5.25	1.34
3. Bangladesh	1,004,264	1.06	1,871,225	1.92	3.52
4. Iran, Islamic Republic	383,991	0.41	828,872	0.85	4.37
5. Oman	120,421	0.13	553,445	0.57	8.84
6. Sri Lanka	296,750	0.31	510,537	0.52	3.06
7. Pakistan	598,743	0.63	504,810	0.52	−0.94
8. Turkey	503,352	0.53	314,095	0.32	−2.59
9. Poland	217,682	0.23	222,704	0.23	0.13
10. Georgia	1,791	0.00	213,077	0.22	30.41
11. Maldives	119,373	0.13	151,013	0.16	1.31
12. Yemen, Republic	114,750	0.12	131,308	0.13	0.75
13. Ukraine	391,867	0.41	76,181	0.08	−8.70
14. United Arab Emirates	105,456	0.11	73,000	0.07	−2.02
15. Saudi Arabia	49,080	0.05	68,776	0.07	1.89
16. Iraq	20,767	0.02	36,936	0.04	3.25
17. Uzbekistan	3,306	0.00	33,600	0.03	13.75
18. Kazakhstan	**36,620**	**0.04**	**32,000**	**0.03**	**−0.75**
19. Nepal	16,700	0.02	22,070	0.02	1.56
20. Turkmenistan	12,228	0.01	15,000	0.02	1.14

TABLE B.2

Country/area	Capture fisheries production, 2000		Capture fisheries production, 2018		Annual growth between 2000 and 2018 (%)
	Tons	Share of world total (%)	Tons	Share of world total (%)	
Central Asia					
Uzbekistan	3,306	0.00	33,600	0.03	13.75
Kazakhstan	**36,620**	**0.04**	**32,000**	**0.03**	**–0.75**
Turkmenistan	12,228	0.01	15,000	0.02	1.14
Tajikistan	167	0.00	1,100	0.00	11.04
Kyrgyz Republic	52	0.00	19	0.00	–5.44
The Caucasus					
Georgia	1,791	0.00	213,077	0.22	30.41
Azerbaijan	18,797	0.02	1,601	0.00	–12.79
Armenia	1,133	0.00	369	0.00	–6.04

Data source: FAO Fishery and Aquaculture Statistics. Global capture fisheries production 1950–2018 (FishStatJ). March 2020.

TABLE B3: AQUACULTURE PRODUCTION IN KAZAKHSTAN FROM A REGIONAL PERSPECTIVE, 2000–2018

Country/area	2000		2018		Annual growth between 2000 and 2018 (%)
	Tons	Share of world total (%)	Tons	Share of world total (%)	
World	**43,014,088**	**100.00**	**114,508,042**	**100.00**	**5.59**
Landlocked developing countries	76,887	0.18	446,428	0.39	10.27
Central Asia	6,677	0.02	62,093	0.05	13.19
Western Asia	118,029	0.27	462,664	0.40	7.88
Southern Asia	2,672,459	6.21	10,173,614	8.88	7.71
Eastern Europe	198,951	0.46	360,568	0.31	3.36
Top 20 aquaculture countries/territories in Central Asia, Western Asia, Southern Asia, and Eastern Europe					
1. India	1,942,531	4.52	7,071,302	6.18	7.44
2. Bangladesh	657,120	1.53	2,405,416	2.10	7.48
3. Iran, Islamic Rep.	40,550	0.09	439,718	0.38	14.16

TABLE B.3

Country/area	2000		2018		Annual growth between 2000 and 2018 (%)
	Tons	Share of world total (%)	Tons	Share of world total (%)	
4. Turkey	79,031	0.18	311,681	0.27	7.92
5. Russian Federation	77,132	0.18	204,032	0.18	5.55
6. Pakistan	12,485	0.03	159,083	0.14	15.19
7. Saudi Arabia	6,004	0.01	72,000	0.06	14.80
8. Nepal	15,023	0.03	59,000	0.05	7.90
9. Uzbekistan	5,652	0.01	57,384	0.05	13.74
10. Poland	35,795	0.08	43,361	0.04	1.07
11. Sri Lanka	4,420	0.01	30,921	0.03	11.41
12. Iraq	1,745	0.00	25,737	0.02	16.13
13. Czechia	19,475	0.05	21,751	0.02	0.62
14. Ukraine	30,969	0.07	18,595	0.02	–2.79
15. Hungary	12,886	0.03	17,852	0.02	1.83
16. Armenia	893	0.00	17,000	0.01	17.78
17. Israel	20,098	0.05	17,000	0.01	–0.93
18. Bulgaria	3,654	0.01	16,342	0.01	8.68
19. Moldova	1,710	0.00	12,530	0.01	11.70
20. Romania	9,727	0.02	12,298	0.01	1.31
Central Asia					
Uzbekistan	5,652	0.01	57,384	0.05	13.74
Kyrgyz Republic	58	0.00	2,559	0.00	23.41
Kazakhstan	**813**	**0.00**	**1,600**	**0.00**	**3.83**
Tajikistan	86	0.00	480	0.00	10.02
Turkmenistan	68	0.00	70	0.00	0.16
The Caucasus					
Armenia	893	0.00	17,000	0.01	17.78
Georgia	86	0.00	2,382	0.00	20.26
Azerbaijan	140	0.00	478	0.00	7.06

Data source: FAO Fishery and Aquaculture Statistics. Global aquaculture production 1950-2018 (FishStatJ). March 2020.

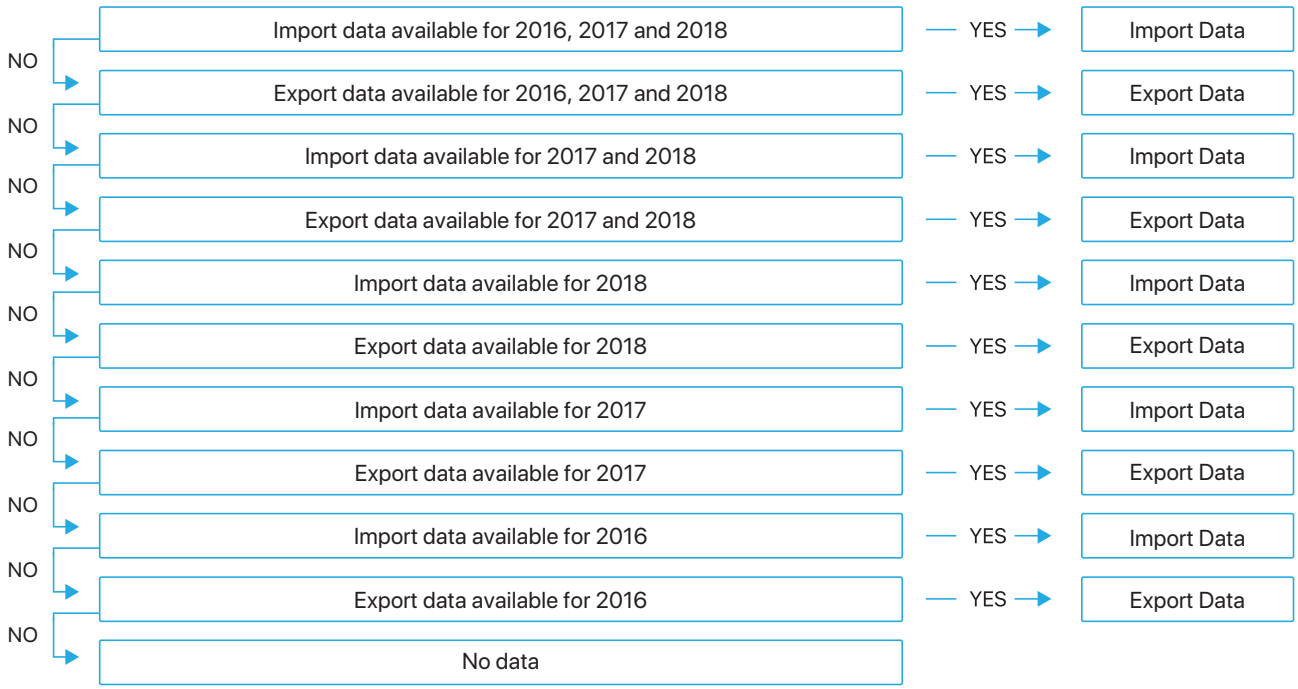
ANNEX C: Seafood Import and Export

Note on data and methods

The international market assessment uses annual data from the UN Comtrade Database, accessed on February 14, 2020 (UN Comtrade, 2020). Trade patterns for the recent three years (2016-2018) are examined, with the year 2018 being the focus.

International trade between two countries can be measured by trade volume or value reported by the importer (that is, import data) or that reported by the exporter (that is, export data). The assessment here uses import data as the primary data, whereas export data are used as supplementary data when the import data are not available or less complete—the procedure for determining whether to use import or export data is illustrated below.

FIGURE C1: PROCEDURE OF DETERMINING WHETHER TO USE IMPORT OR EXPORT DATA



The UN Comtrade data on export (or import) includes reexports (or reimports). To assess international trade patterns more accurately, reexports (or reimports) have been removed from the export (or import) data used in this exercise. Trade statistics constructed as such could differ from those directly using import or export data from Comtrade or those from different data sources (for example, FAO Global Fishery and Aquaculture Commodities Statistics).[41]

[41] The FAO Global Fishery and Aquaculture Statistics are not used because they only contain data on countries' trade with the world market but not individual markets at the national level, and the FAO fish trade data are only updated to 2017 at the time of this analysis.

The trade volume or value of HS level 4 or level 6 commodities at the country level are directly obtained from the UN Comtrade Database. These basic data are aggregated into high-level commodity groups and/or country groups (including the entire world).

Trade volume or value is used to measure the size of international markets for commodities or commodity groups at the country, regional, and global levels based on which the following derivative indicators are constructed:

- Market price, which is equal to trade value divided by trade volume. It should be noted that at an aggregate level, directly using trade value divided by trade volume may result in an inaccurate measure of trade price because some Comtrade data points report only trade value but not trade volume. While such data points are included in the calculation of trade volume or trade value, they have been excluded from the calculation of trade prices at the aggregate level.
- The number of suppliers in a market has two measures. One is the actual number of suppliers that measures how many countries or territories export to the market. The other is the effective number of suppliers that measures the diversity of suppliers (that is, the evenness of the market share distribution among suppliers).[42] For example, while 12 countries exported trout products to Belarus in 2018 (that is, the actual number of suppliers being 12), the corresponding effective number of suppliers is only 1.72, reflecting that Belarus' trout import market in 2018 was dominated by Norway (87% of the market value), Finland (7%), and Denmark (5%).
- The number of products in a country's export has two measures. One is the actual number of products that measures how many products a country's export comprises. The other is the effective number of products that measures the diversity of products (that is, the evenness of the distribution of the export among products).[43] For example, while Kazakhstan exported 21 fish and fishery products to Austria in 2018 (that is, the actual number of products being 21), the corresponding effective number of products is only 2.73, reflecting that Kazakhstan's export to Austria in 2018 was dominated by frozen fish fillets nei (HS030489, 71%), fresh/chilled fish fillets net (HS030449, 13%) and prepared/preserved fish (HS160420, 10%).
- Per capita import is calculated by dividing a country's import of a commodity by its total population—the population data are from the UN World Population Prospects 2019 (United Nations 2019). This indicator could give some indication of market potential, that is, a country that has a relatively small per capita import of a commodity may have relatively great potential in importing the commodity.

Import composition

Kazakhstan's import of live fish was primarily freshwater ornamental fish.

The 460 tons ($3,138 million) import of fresh/chilled (whole) fish primarily includes fresh/chilled salmons, seabass, seabream, and trout.

The 971 tons ($3.9 million) import of dried/salted/smoked/offal fish include primarily dried/salted/smoked fish livers/roes, smoked fillets nei, miscellaneous smoked freshwater fishes, dried fish nei, and dried fish fillets nei.

The $54.987 million (30,962 tons) frozen (whole) fish products accounted for 57.1% of the total import value. Around half of this commodity

[42] The effective number of suppliers in a market is calculated by $(-\sum_i s_i \ln s_i)$, where si denotes supplier i's share in the market (equal to its export to the market divided by the total export of all suppliers to the market).

[43] The effective number of products in a country's export is calculated by $(-\sum_i r_i \ln r_i)$, where ri denotes the share of product i in the total export (equal to the export value of product i divided by the total export value of all products).

group were relatively high-value products, such as frozen Atlantic/Danube salmon, Pacific salmon, and trout. The other half were contributed by relatively low-value products, such as herrings, mackerel, sardines, and Alaska Pollock. The $4.724 million (1,628 tons) of frozen fish fillets and other fish meat products accounted for 4.91% of the total import value. Among the species identified in the statistics were salmon and catfish. Relatively high-value products in this group include frozen skipjack tuna fillets and frozen cod fillets. Kazakhstan imported $3,447 million (566 tons) of shrimps/prawns and $1,885 million (363 tons) of frozen cuttlefish/squid, dried/salted/smoked cuttlefish/squid, dried/salted/smoked mollusks nei, and live/fresh/chilled oysters. Within the 4 tons ($21,000) import of other aquatic invertebrates was primarily dried/salted/smoked sea urchins. Within the 454 tons ($2.726 million) import of prepared or preserved shellfish products, shrimps/prawns, mussels, and cuttlefish/squid were identified in the statistics.

The 478 tons ($2.582 million) import of seaweed and seaweed products include primarily seaweed for human consumption and agar-agar used mostly in scientific research.

The 1,230 tons ($1.12 million) import of non-food products include fishmeal, dead fish/crustaceans/mollusks/other aquatic invertebrates unfit for human consumption, also known as 'fish waste', and raw coral and similar materials.

Russia (Table C5) and Norway (Table C6) are the two largest exporters of fish and fishery products to Kazakhstan, accounting for, respectively, 42.93% and 32.45% of the country's total fish and fishery products import value in 2018. Russia exported a variety of fish and fishery products to Kazakhstan, whereas Norway's export primarily focused on salmon products.

Other major fish and fishery products exporters to Kazakhstan include Iceland (Table C7), China (Table C8), Belarus (Table C9), Estonia (Table C10), United Kingdom (Table C11), India (Table C12), Lithuania (Table C13), and Chile (Table C14).

TABLE C1: KAZAKHSTAN'S IMPORT OF FISH AND FISHERY PRODUCTS, 2018

Kazakhstan's import of fish and fishery products from:	Value		Volume		Price ($/kg)
	$, thousands	Share of the total (%)	Tons	Share of the total (%)	
1. Russian Federation	41,345	42.93	18,979	42.12	2.18
2. Norway	31,248	32.45	14,029	31.14	2.23
3. Iceland	5849	6.07	3744	8.31	1.56
4. China	2994	3.11	1078	2.39	2.78
5. Belarus	2248	2.33	765	1.70	2.94
6. Estonia	1438	1.49	2551	5.66	0.56
7. United Kingdom	1277	1.33	494	1.10	2.59
8. India	1216	1.26	256	0.57	4.74
9. Lithuania	991	1.03	540	1.20	1.84
10. Chile	796	0.83	145	0.32	5.49
Rest of the world (32 countries)	6904	7.17	2474	5.49	2.79
World (42 countries)	**96,307**	**100.00**	**45,055**	**100.00**	**2.14**

Data source: UN Comtrade.

TABLE C2: PRODUCT COMPOSITION OF KAZAKHSTAN'S IMPORT OF FISH AND FISHERY PRODUCTS, 2018

	HS code	Value		Volume (tons)		Price ($/kg)
		$, thou-sands	Share of the total (%)	Tons	Share of the total (%)	
1. Atlantic and Danube salmon, frozen	HS030313	22,155	23.00	4,686	10.40	4.73
2. Herrings (*Clupea* spp.), frozen	HS030351	9,118	9.47	10,697	23.74	0.85
3. Mackerel, frozen	HS030354	8,691	9.02	5,226	11.60	1.66
4. Prepared or preserved fish (excluding whole or in pieces)	HS160420	6,320	6.56	3,583	7.95	1.76
5. Livers, roes, and milt, frozen	HS030391	3,414	3.55	1,384	3.07	2.47
6. Sardines, sardinella, and brisling or sprats, prepared or preserved	HS160413	2,979	3.09	1,569	3.48	1.90
7. Shrimps and prawns, frozen (excluding cold-water species)	HS030617	2,668	2.77	465	1.03	5.74
8. Herrings, prepared or preserved	HS160412	2,408	2.50	1,262	2.80	1.91
9. Alaska Pollock (*Theragra chalcogramma*), frozen	HS030367	2,382	2.47	1,719	3.82	1.39
10. Caviar substitutes	HS160432	2,162	2.24	454	1.01	4.76
11. Sardines, sardinella, brisling, or sprats, frozen	HS030353	1,870	1.94	2,825	6.27	0.66
12. Trout, frozen	HS030314	1,469	1.52	341	0.76	4.31
13. Atlantic and Danube salmon, fresh or chilled	HS030214	1,454	1.51	136	0.30	10.71
14. Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen	HS030359	1,452	1.51	1,734	3.85	0.84
15. Pacific salmon (excluding sockeye salmon), frozen	HS030312	1,413	1.47	440	0.98	3.21
16. Seaweeds and other algae, fit for human consumption	HS121221	1,342	1.39	413	0.92	3.25
17. Agar-agar, whether or not modified	HS130231	1,227	1.27	63	0.14	19.33
18. Other freshwater and saltwater fish, frozen	HS030389	1,104	1.15	621	1.38	1.78
19. Fish fillets, frozen, nei	HS030489	1,086	1.13	326	0.72	3.33
20. Prepared or preserved fish nei, whole or in pieces (excluding minced)	HS160419	1,018	1.06	333	0.74	3.05
Other products	*185 products*	*20,573*	*21.36*	*6,778*	*15.04*	*3.04*
All fish and fishery products	**205 products**	**96,307**	**100.00**	**45,055**	**100.00**	**2.14**

Data source: UN Comtrade.

TABLE C3: KAZAKHSTAN'S IMPORT OF FISH AND FISHERY PRODUCTS (HS LEVEL 4 OR 6), 2018

Commodity group		Kazakhstan's import from the world, 2018			
Name	HS code	Value		Volume (tons)	Price[a] ($/kg)
		$, thousands	Share of the total (%)		
Fish and fishery products		**96,307**	**100.00**	**45,055**	**2.14**
Finfish products		**84,527**	**87.77**	**41,960**	**2.01**
Fish, live	Products under HS0301	431	0.45	78	5.55
Fish, fresh/chilled	Products under HS0302	3,138	3.26	460	6.83
Fish, frozen whole	Products under HS0303	54,987	57.10	30,962	1.78
Fish, fillet and other meat	Products under HS0304	4,724	4.91	1,682	2.81
Fish, dried/salted/smoked/offals	Products under HS0305	3,900	4.05	971	4.02
Fish, prepared/preserved, including caviar and caviar substitutes from fish eggs	Products under HS1604	16,839	17.48	7,749	2.17
Fish oils	Products under HS1504	509	0.53	59	8.61
Shellfish products		**8,078**	**8.39**	**1,387**	**5.82**
Crustaceans, excluding prepared/ preserved products	Products under HS0306	3,447	3.58	566	6.09
Mollusks, excluding prepared/ preserved products	Products under HS0307	1,885	1.96	363	5.19
Aquatic invertebrates nei, excluding prepared/preserved products	Products under HS0308	21	0.02	4	4.88
Crustaceans/mollusks/other aquatic invertebrates, prepared or preserved	Products under HS1605	2,726	2.83	454	6.01
Seaweed and seaweed products	**HS121221 + HS121229 + HS130231**	**2,582**	**2.68**	**478**	**5.41**
Non-food products	**HS050800 + HS051191 + HS230120**	**1,120**	**1.16**	**1,230**	**0.91**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: a. For an aggregate commodity item, directly using trade value divided by trade volume may result in an inaccurate measure of trade price because some UN Comtrade data points report only trade value but not trade volume. While such data points are included in the calculation of trade volume or trade value, they have been excluded from the calculation of trade prices at the aggregate level.

TABLE C4: KAZAKHSTAN'S IMPORT OF FISH AND FISHERY PRODUCTS (HS LEVEL 6), 2018

Top 20 products in Kazakhstan's fish and fishery import, 2018			Kazakhstan's import from the world, 2018			
Ranking	Commodity name	HS code	Value		Volume (tons)	Price ($/kg)
			$, thousands	Share of the total (%)		
1	Atlantic and Danube salmon, frozen	HS030313	22,155	23.00	4,686	4.73
2	Herrings (*Clupea* spp.), frozen	HS030351	9,118	9.47	10,697	0.85
3	Mackerel, frozen	HS030354	8,691	9.02	5,226	1.66
4	Prepared or preserved fish (excluding whole or in pieces)	HS160420	6,320	6.56	3,583	1.76
5	Livers, roes, and milt, frozen	HS030391	3,414	3.55	1,384	2.47
6	Sardines, sardinella, and brisling or sprats, prepared or preserved	HS160413	2,979	3.09	1,569	1.90
7	Shrimps and prawns, frozen (excluding cold-water species)	HS030617	2,668	2.77	4,65	5.74
8	Herrings, prepared or preserved	HS160412	2,408	2.50	1,262	1.91
9	Alaska Pollock (*Theragra chalcogramma*), frozen	HS030367	2,382	2.47	1,719	1.39
10	Caviar substitutes	HS160432	2,162	2.24	454	4.76
11	Sardines, sardinella, brisling, or sprats, frozen	HS030353	1,870	1.94	2,825	0.66
12	Trout, frozen	HS030314	1,469	1.52	341	4.31
13	Atlantic and Danube salmon, fresh or chilled	HS030214	1,454	1.51	136	10.71
14	Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen	HS030359	1,452	1.51	1,734	0.84
15	Pacific salmon (excluding sockeye salmon), frozen	HS030312	1,413	1.47	440	3.21
16	Seaweeds and other algae, fit for human consumption	HS121221	1,342	1.39	413	3.25
17	Agar-agar, whether or not modified	HS130231	1,227	1.27	63	19.33
18	Other freshwater and saltwater fish, frozen	HS030389	1,104	1.15	621	1.78

TABLE C.4

Top 20 products in Kazakhstan's fish and fishery import, 2018			Kazakhstan's import from the world, 2018			
Ranking	Commodity name	HS code	Value		Volume (tons)	Price ($/kg)
			$, thousands	Share of the total (%)		
19	Fish fillets, frozen, nei	HS030489	1,086	1.13	326	3.33
20	Prepared or preserved fish nei, whole or in pieces (excluding minced)	HS160419	1,018	1.06	333	3.05
Other products		**185 products**	**20,573**	**21.36**	**6,778**	**3.04**
All fish and fishery products		**205 products**	**96,307**	**100.00**	**45,055**	**2.14**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: As the trade data used are primarily import data supplemented with export data, the trade value reflects mostly cost, insurance, and freight (CIF) value.

TABLE C5: RUSSIAN FEDERATION'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Russian Federation, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Prepared or preserved fish, excluding whole or in pieces (HS160420)	5,742	13.89	3,335	1.72
2. Atlantic and Danube salmon, frozen (HS030313)	3,314	8.02	557	5.95
3. Herrings (*Clupea* spp.), frozen (HS030351)	3,148	7.61	3,658	0.86
4. Sardines, sardinella, and brisling or sprats, prepared or preserved (HS160413)	2,592	6.27	1,209	2.14
5. Alaska Pollock (*Theragra chalcogramma*), frozen (HS030367)	2,382	5.76	1,719	1.39
6. Herrings, prepared or preserved (HS160412)	2,153	5.21	1,194	1.80
7. Mackerel, frozen (HS030354)	1,874	4.53	985	1.90
8. Caviar substitutes (HS160432)	1,401	3.39	312	4.49
9. Other Pacific salmon, frozen (HS030312)	1,354	3.28	424	3.19
10. Other shrimps and prawns, whether in shell or not, frozen (HS030617)	1,205	2.91	162	7.45
Other products	16,180	39.13	5,423	2.98
All products	**41,345**	**100.00**	**18,979**	**2.18**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C6: NORWAY'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Norway, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Atlantic and Danube salmon, frozen (HS030313)	17,916	57.34	3,889	4.61
2. Herrings (*Clupea* spp.), frozen (HS030351)	5,448	17.44	6,204	0.88
3. Mackerel, frozen (HS030354)	2,538	8.12	1,706	1.49
4. Atlantic and Danube salmon, fresh or chilled (HS030214)	1,452	4.65	136	10.71
5. Livers, roes, and milt, frozen (HS030391)	1,075	3.44	514	2.09
6. Trout, frozen (HS030314)	915	2.93	210	4.37
7. Fish heads, tails, maws, and tongues, frozen (HS030399)	695	2.22	599	1.16
8. Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen (HS030359)	342	1.09	414	0.83
9. Fish meat, whether or not minced, frozen (HS030499)	328	1.05	178	1.85
10. Fish livers and roes, dried, salted, or in brine, smoked (HS030520)	278	0.89	152	1.83
Other products	261	0.83	29	8.87
All products	**31,248**	**100.00**	**14,029**	**2.23**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C7: ICELAND'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Iceland, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Mackerel, frozen (HS030354)	3,112	53.20	1,833	1.70
2. Livers, roes, and milt, frozen (HS030391)	1,424	24.35	585	2.43
3. Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen (HS030359)	959	16.39	1,163	0.82

TABLE C.7

Top 10 products (by value)	Kazakhstan's import from Iceland, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
4. Other freshwater and saltwater fish, frozen (HS030389)	183	3.13	64	2.85
5. Fish meat, whether or not minced, frozen (HS030499)	169	2.89	93	1.82
6. Herrings (*Clupea* spp.), frozen (HS030351)	3	0.06	5	0.65
All products	**5,849**	**100.00**	**3,744**	**1.56**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C8: CHINA'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Estonia, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Fish fillets, frozen, nei (HS030489)	511	17.07	180	2.84
2. Seaweeds and other algae, fit for human consumption (HS121221)	495	16.54	291	1.70
3. Eels (Anguilla spp.), prepared or preserved (HS160417)	408	13.61	176	2.31
4. Other shrimps and prawns, whether in shell or not, frozen (HS030617)	372	12.43	85	4.36
5. Tilapias, catfish, carp, eels, Nile perch, and snakeheads, including fillets, smoked (HS030544)	307	10.26	89	3.44
6. Cuttlefish and squid, prepared or preserved (HS160554)	143	4.79	26	5.52
7. Caviar (HS160431)	128	4.26	1	167.26
8. Tilapias (Oreochromis spp.), fillets, frozen (HS030461)	112	3.75	49	2.28
9. Other fish fillets, dried, salted, or in brine, not smoked (HS030539)	76	2.54	15	4.96
10. Shrimps and prawns, prepared or preserved, not in airtight containers (HS160521)	74	2.46	8	9.09
Other products	368	12.30	157	2.34
All products	**2,994**	**100.00**	**1,078**	**2.78**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C9: BELARUS'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Belarus, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Caviar substitutes (HS160432)	735	32.68	142	5.19
2. Prepared or preserved fish, excluding whole or in pieces (HS160420)	311	13.84	172	1.81
3. Herrings, prepared or preserved (HS160412)	256	11.38	67	3.80
4. Trout, including fillets, smoked (HS030543)	156	6.94	9	18.34
5. Salmons, including fillets, smoked (HS030541)	155	6.90	9	17.31
6. Other fish fillets, dried, salted, or in brine, not smoked (HS030539)	104	4.64	6	18.45
7. Cuttlefish and squid, prepared or preserved (HS160554)	100	4.43	16	6.05
8. Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen (HS030359)	58	2.57	60	0.96
9. Meals of fish or crustaceans, mollusks, or other aquatic invertebrates, unfit for human consumption (HS230120)	53	2.36	79	0.68
10. Sardines, sardinella, and brisling or sprats, prepared or preserved (HS160413)	50	2.20	55	0.90
Other products	271	12.05	151	1.80
All products	**2,248**	**100.00**	**765**	**2.94**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C10: ESTONIA'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Estonia, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Fish fillets, frozen, nei (HS030489)	511	17.07	180	2.84
2. Herrings (Clupea spp.), frozen (HS030351)	383	26.64	655	0.58
3. Tunas, skipjack, and Atlantic bonito, prepared or preserved (HS160414)	17	1.20	6	2.99

TABLE C.10

Top 10 products (by value)	Kazakhstan's import from Estonia, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
4. Other fish, whole or in pieces, prepared or preserved (HS160419)	14	0.96	9	1.57
5. Mackerel, prepared or preserved (HS160415)	2	0.17	1	2.86
All products	**1,438**	**100.00**	**2,551**	**0.56**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C11: UNITED KINGDOM'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from United Kingdom, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Mackerel, frozen (HS030354)	581	45.47	337	1.72
2. Fish oils, other than liver oils (HS150420)	411.00	32.15	16.00	26.44
3. Livers, roes, and milt, frozen (HS030391)	154.740	12.12	70.200	2.20
4. Fish livers and roes, dried, salted, or in brine, smoked (HS030520)	96.00	7.52	46.00	2.08
5. Fish heads, tails, maws, and tongues, frozen (HS030399)	20.00	1.55	18.00	1.10
6. Trout, fillets, frozen (HS030482)	14.00	1.13	7.00	2.13
7. Seaweeds and other algae, fit for human consumption (HS121221)	0.827	0.06	0.006	137.83
8. Seabream (Sparidae), fresh or chilled (HS030285)	0.064	0.01	0.005	12.80
All products	**1,277.00**	**100.00**	**494.00**	**2.59**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C12: INDIA'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from India, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Other shrimps and prawns, whether in shell or not, frozen (HS030617)	1,090.00	89.63	217.00	5.01
2. Cuttlefish and squid, frozen (HS030743)	124.00	10.21	38.00	3.23

TABLE C.12

Top 10 products (by value)	Kazakhstan's import from India, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
3. Coral and similar material, unworked or simply prepared (HS050800)	1.37	0.11	0.500	2.75
4. Agar-agar (HS130231)	0.57	0.05	0.002	284.50
All products	**1,216.00**	**100.00**	**256.00**	**4.74**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C13: LITHUANIA'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Lithuania, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Mackerel, frozen (HS030354)	547.0	55.21	337.00	1.62
2. Livers, roes, and milt, frozen (HS030391)	152.0	15.33	70.00	2.16
3. Atlantic and Danube salmon, frozen (HS030313)	147.0	14.83	80.00	1.85
4. Trout, frozen (HS030314)	90.0	9.11	17.00	5.26
5. Herrings (*Clupea* spp.), frozen (HS030351)	41.0	4.17	35.00	1.18
6. Anchovies, prepared or preserved (HS160416)	10.0	1.01	0.51	19.91
7. Fish oils, other than liver oils (HS150420)	2.2	0.22	0.03	83.15
8. Agar-agar (HS130231)	1.2	0.12	0.01	96.75
All products	**991.0**	**100.00**	**540.00**	**1.84**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C14: CHILE'S EXPORT OF FISH AND FISHERY PRODUCTS TO KAZAKHSTAN, 2018

Top 10 products (by value)	Kazakhstan's import from Chile, 2018			
	Value		Volume (tons)	Price ($/kg)
	$, thousands	Share of total (%)		
1. Atlantic and Danube salmon, frozen (HS030313)	755	94.78	141	5.34
2. Pacific, Atlantic, and Danube salmon, fillets, frozen (HS030481)	42	5.22	4	11.31
All products	**796**	**100.00**	**145**	**5.49**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Export composition

It should be noted that while both the UN Comtrade data and FAO data indicate over 2,000 tons of export of caviar substitute from Kazakhstan, the export is not reflected in the national statistics.

Most fresh/chilled exports are not identified by species, but $130,000 of fresh/chilled trout and $84,000 of (presumably reexported) fresh/chilled shark fins were sent to Russia.

Kazakhstan exported $12.428 million of frozen fish which accounted for 11.14% of its total fish and fishery products export value in 2018.

Kazakhstan exported $78.34 million of fish fillets, which accounted for 70.21% of its total fish products export value in 2018, most notably $75.262 million to Poland and Germany, and $1.561 million of fresh fish fillets sent primarily to Austria and elsewhere in Europe.

Kazakhstan exported $3.011 million dried/salted/smoked/offal fish products which accounted for 2.7% of its total fish and fishery products export value in 2018, in the form of $1.937 million of dried fish sent to Russia, Ukraine, and Latvia; $419,000 of smoked fish nei exported to Germany, Russia, and the Kyrgyz Republic; and $238,000 of fish flours/meals/pellets fit for human consumption exported to Belarus, Russia, and the Kyrgyz Republic.

Kazakhstan exported $11.805 million of prepared/preserved fish which accounted for 10.58% of its total fish export value in 2018, largely as caviar substitutes ($8.164 million) and prepared/preserved sardines ($2.226 million) to Russia.

Interestingly, there were also various amounts of miscellaneous marine fishes,[38] shrimps/prawns, corals, mollusks, sea cucumbers, seaweeds, and jellyfish (presumably) reexported mostly to China, Belarus, and Russia. Kazakhstan exported $49,000 of crustacean products.

TABLE C15: NATIONAL MARKETS OF KAZAKHSTAN'S FISH AND FISHERY EXPORT, 2018

Ranked by value	Country / territory	Kazakhstan's export of fish and fishery products, 2018						Population, 2018		Per capita GDP, 2018	
		Value		Volume (tons)	Price ($/kg)	Number of products		Thousands	Share of world total (%)	Current $	Ratio to world average (%)
		$, thousands	Share of world total (%)			Actual	Effective				
1	Poland	21,132.00	18.9400	2,737.00	7.72	5	1.16	37,922	0.50	15,448	138
2	Germany	17,516.00	15.7000	2,383.00	7.35	14	1.36	83,124	1.09	47,535	424
3	Russian Federation	17,268.00	15.4800	12,656.00	1.36	56	8.92	145,734	1.91	11,372	101
4	Netherlands	14,673.00	13.1500	2,086.00	7.03	7	1.11	17,060	0.22	53,607	478
5	Lithuania	10,197.00	9.1400	1,532.00	6.66	4	1.06	2,801	0.04	19,027	170
6	China	9,157.00	8.2100	5,498.00	1.67	12	2.50	1,427,648	18.71	9,364	83

[44] Including anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish

TABLE C.15

Ranked by value	Country / territory	Kazakhstan's export of fish and fishery products, 2018						Population, 2018		Per capita GDP, 2018	
		Value		Volume (tons)	Price ($/kg)	Number of products		Thousands	Share of world total (%)	Current $	Ratio to world average (%)
		$, thousands	Share of world total (%)			Actual	Effective				
7	Austria	6,299.00	5.6500	709.00	8.88	21	2.73	8,891	0.12	51,305	457
8	United States of America	3,018.00	2.7000	335.00	9.02	1	1.00	327,096	4.29	62,918	561
9	Czechia	2,788.00	2.5000	385.00	7.24	7	1.19	10,666	0.14	22,992	205
10	Kyrgyz Republic	1,516.00	1.3600	879.00	1.73	40	8.97	6,304	0.08	1,283	11
11	Switzerland	1,295.00	1.1600	163.00	7.94	2	1.04	8,526	0.11	82,757	737
12	Ukraine	1,225.00	1.1000	1,893.00	0.65	6	3.17	44,246	0.58	2958	26
13	Canada	994.00	0.8900	120.00	8.26	2	1.03	37,075	0.49	46,190	412
14	Belarus	807.00	0.7200	1,248.00	0.65	4	1.95	9,453	0.12	6,309	56
15	Georgia	775.00	0.6900	700.00	1.11	8	2.79	4,003	0.05	4,050	36
16	Azerbaijan	467.00	0.4200	436.00	1.07	3	1.42	9,950	0.13	4,718	42
17	France	436.00	0.3900	78.00	5.58	2	1.83	64,991	0.85	42,778	381
18	Uzbekistan	418.00	0.3700	608.00	0.69	12	5.16	32,476	0.43	1,555	14
19	North Macedonia	397.00	0.3600	335.00	1.19	1	1.00	2,083	0.03	6,083	54
20	Romania	256.00	0.2300	57.00	4.50	6	3.81	19,506	0.26	12,281	109
21	Estonia	181.00	0.1600	24.00	7.53	5	3.11	1,323	0.02	23,252	207
22	Latvia	154.00	0.1400	67.00	2.29	4	2.00	1,928	0.03	18,087	161
23	Turkey	142.00	0.1300	36.00	4.00	3	1.99	82,340	1.08	9,367	83
24	Slovakia	111.00	0.1000	13.00	8.35	5	3.83	5,453	0.07	19,543	174
25	Denmark	109.00	0.1000	15.00	7.22	1	1.00	5,752	0.08	61,205	545
26	Hungary	89.00	0.0800	52.00	1.70	1	1.00	9,707	0.13	16,604	148
27	Serbia	49.00	0.0400	5.00	9.76	2	1.47	8,803	0.12	5,738	51
28	Bulgaria	43.00	0.0400	11.00	4.05	1	1.00	7,052	0.09	9,246	82
29	Tajikistan	30.00	0.0300	17.00	1.74	9	6.07	9,101	0.12	826	7
30	Slovenia	15.00	0.0100	1.58	9.67	3	1.89	2,078	0.03	26,017	232
31	Moldova	13.00	0.0100	6.61	1.99	1	1.00	4,052	0.05	2,791	25

TABLE C.15

Ranked by value	Country / territory	Kazakhstan's export of fish and fishery products, 2018						Population, 2018		Per capita GDP, 2018	
		Value		Volume (tons)	Price ($/kg)	Number of products		Thousands	Share of world total (%)	Current $	Ratio to world average (%)
		$, thousands	Share of world total (%)			Actual	Effective				
32	Finland	11.00	0.0100	1.24	8.58	2	2.00	5,523	0.07	49,653	442
33	Norway	1.37	0.0012	0.14	10.07	1	1.00	5,338	0.07	81,336	725
34	Luxembourg	0.73	0.007	0.04	16.88	1	1.00	604	0.01	115,102	1,026
35	Mongolia	0.46	0.004	0.10	4.79	1	1.00	3,170	0.04	4,104	37
36	Kuwait	0.27	0.002	0.08	3.34	1	1.00	4,137	0.05	34,237	305

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

TABLE C16: PRODUCT COMPOSITION OF KAZAKHSTAN'S EXPORT OF FISH AND FISHERY PRODUCTS, 2018

Ranking	Commodity name (ranked by export value)	HS code	Value		Volume (tons)		Price ($/kg)
			$, thousands	Share of the total (%)	Tons	Share of the total (%)	
1	Fish fillets, frozen, nei	HS030489	75,262	67.45	10,399	29.64	7.24
2	Fish, frozen, nei	HS030389	9,381	8.41	10,509	29.95	0.89
3	Caviar substitutes	HS160432	8,164	7.32	2,052	5.85	3.98
4	Fish waste – dead fish, crustaceans, and other aquatic invertebrates, unfit for human consumption	HS051191	3,586	3.21	1,827	5.21	1.96
5	Sardines, sardinella, and brisling or sprats, prepared or preserved	HS160413	2,226	2.00	736	2.10	3.02
6	Other fish, dried, whether or not salted but not smoked	HS030559	1,937	1.74	1,181	3.37	1.64
7	Fish fillets, fresh or chilled, nei	HS030449	1,561	1.40	446	1.27	3.50
8	Fish meat, whether or not minced, frozen	HS030499	884	0.79	265	0.76	3.33
9	Prepared or preserved fish, excluding whole or in pieces	HS160420	823	0.74	188	0.53	4.38
10	Carp, frozen	HS030325	739	0.66	942	2.69	0.78
11	Meals of fish or crustaceans, mollusks, or other aquatic invertebrates, unfit for human consumption	HS230120	698	0.63	996	2.84	0.70

TABLE C.16

Ranking	Commodity name (ranked by export value)	HS code	Value		Volume (tons)		Price ($/kg)
			$, thousands	Share of the total (%)	Tons	Share of the total (%)	
12	Nile perch (*Lates niloticus*) and snakeheads (*Channa* spp.), frozen	HS030329	553	0.50	1,155	3.29	0.48
13	Seaweeds and other algae, fit for human consumption	HS121221	477	0.43	92	0.26	5.17
14	Mussels, prepared or preserved	HS160553	437	0.39	154	0.44	2.83
15	Other fish, including fillets, smoked	HS030549	419	0.38	46	0.13	9.19
16	Other salmonidae, frozen	HS030319	364	0.33	158	0.45	2.31
17	Livers, roes, and milt, frozen	HS030391	261	0.23	133	0.38	1.96
18	Catfish, frozen	HS030324	252	0.23	253	0.72	0.99
19	Anchovies, Indian mackerels, seerfishes, jacks, crevalles, silver pomfrets, Pacific saury, scads, capelin, Kawakawa, bonitos, marlins, sailfishes, and spearfish, frozen	HS030359	246	0.22	220	0.63	1.12
20	Fish flours fit for human consumption	HS030510	238	0.21	389	1.11	0.61
Other products		*88 products*	*3,079*	*2.76*	*2,945*	*8.39*	*1.05*
All fish and fishery products		**108 products**	**111,585**	**100.00**	**35,087**	**100.00**	**3.18**

Data source: UN Comtrade.

ANNEX D: Estimation of International Market Potential for Kazakhstan's Fish Exports

TABLE D1: INTERNATIONAL MARKET POTENTIAL FOR KAZAKHSTAN'S EXPORT OF FROZEN FISH FILLETS NEI (HS030489)

Top 10 markets	Kazakhstan's export of frozen fish fillets nei (HS030489) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018-2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
Poland	20,524	27.27	2,653	7.74	14.86	−2.58	11.90	−529	−68	2,442	316
Germany	16,566	22.01	2,230	7.43	8.16	0.01	8.17	2	0	1,354	182
Netherlands	14,407	19.14	2,009	7.17	8.46	2.29	10.95	330	46	1,577	220
Lithuania	10,102	13.42	1,435	7.04	17.22	−11.30	3.97	−1,141	−162	402	57
Austria	4,483	5.96	497	9.02	8.13	3.20	11.58	143	16	519	58
United States of America	3,018	4.01	335	9.02	9.69	6.89	17.25	208	23	521	58
Czechia	2,690	3.57	373	7.21	13.33	0.74	14.17	20	3	381	53
Switzerland	1,286	1.71	162	7.94	9.76	7.74	18.25	99	13	235	30
Canada	989	1.31	120	8.25	10.88	10.14	22.12	100	12	219	26
North Macedonia	397	0.53	335	1.19	14.11	−1.55	12.35	−6	−5	49	41
Rest of the world	802	1.06	250	3.20							
World	**75,262**	**100.00**	**10,399**	**7.24**			**10.12**	**−773**	**−123**	**7,698**	**1,040**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017. Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D2: INTERNATIONAL MARKET POTENTIAL FOR KAZAKHSTAN'S EXPORT OF FROZEN FISH NEI (HS030389)

Top 10 markets	Kazakhstan's export of frozen fish nei (HS030389) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018–2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
China	5,322	56.73	3,509	1.52	34.60	2.57	38.06	137	90	2,025	1,335
Russian Federation	1,640	17.48	4,446	0.37	9.27	−1.64	7.48	−27	−73	123	333
Ukraine	734	7.83	1,286	0.57	25.86	−7.60	16.29	−56	−98	120	209
Georgia	552	5.89	518	1.07	15.19	−3.74	10.89	−21	−19	60	56
Azerbaijan	427	4.56	396	1.08	5.39	7.94	13.76	34	31	59	54
Netherlands	207	2.21	61	3.38	8.46	2.29	10.95	5	1	23	7
Germany	179	1.91	31	5.75	8.16	0.01	8.17	0	0	15	3
Hungary	89	0.95	52	1.70	17.41	−3.80	12.94	−3	−2	12	7
Lithuania	78	0.83	92	0.84	17.22	−11.30	3.97	−9	−10	3	4
Uzbekistan	35	0.37	54	0.64	28.06	15.22	47.55	5	8	17	26
Rest of the world	118	1.25	64	1.83							
World	**9,381**	**100.00**	**10,509**	**0.89**			**22.76**	**65**	**−71**	**2,455**	**2,034**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D3: INTERNATIONAL MARKET POTENTIAL FOR KAZAKHSTAN'S EXPORT OF CAVIAR SUBSTITUTES FROM FISH EGGS (HS160432)

Top 10 markets	Kazakhstan's export of caviar substitutes from fish eggs (HS160432) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018-2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
Russian Federation	8,157.00	99.91	2,051.00	3.98	9.27	–1.64	7.48	–134.00	–34.00	610.00	153.00
Kyrgyz Republic	7.19	0.09	1.06	6.76	7.19	18.12	26.61	1.30	0.19	1.91	0.28
World	**8,164.00**	**100.00**	**2,052.00**	**3.98**			**7.50**	**–132.00**	**–33.00**	**612.00**	**154.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D4: INTERNATIONAL MARKET POTENTIAL FOR KAZAKHSTAN'S EXPORT OF FRESH / CHILLED FISH FILLETS NEI (HS030449)

Top 10 markets	Kazakhstan's export of fresh/ chilled fish fillets nei (HS030449) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018-2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
Austria	1,235	50.07	149	8.29	12.39	4.03	16.93	50.00	6.010	209.00	25.00
Germany	889	36.02	119	7.48	11.87	0.58	12.52	5.131	0.686	111.00	15.00
Russian Federation	300	12.16	51	5.93	12.15	–1.50	10.46	–4.498	–0.759	31.00	5.29
Estonia	37	1.49	5	7.99	23.97	–2.99	20.27	–1.102	–0.138	7.00	0.94
Poland	5	0.19	1	3.95	20.86	–2.66	17.65	–0.126	–0.032	0.840	0.21
Czechia	1	0.04	0	9.43	20.27	0.98	21.44	0.009	0.001	0.200	0.02

TABLE D.4

Top 10 markets	Kazakhstan's export of fresh/ chilled fish fillets nei (HS030449) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018-2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
Kuwait	1	0.02	0	13.85	7.83	17.04	26.20	0.092	0.007	0.141	0.01
World	**2,467**	**100.00**	**324**	**7.60**			**14.48**	**49.00**	**6.00**	**360.00**	**47.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D5: INTERNATIONAL MARKET POTENTIAL FOR KAZAKHSTAN'S EXPORT OF FROZEN CARP (HS030325)

Top 10 markets	Kazakhstan's export of frozen carp (HS030325) to each market, 2018				Growth potential for Kazakhstan's export to each market: increase or decrease during 2018–2030						
	Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	$, thousands	Share of the total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
China	235	31.78	161	1.45	44.01	3.05	48.40	7.00	5.00	114.00	78.00
Uzbekistan	214	28.91	360	0.59	21.40	17.08	42.13	36.00	62.00	90.00	152.00
Russian Federation	163	22.05	262	0.62	12.15	−1.50	10.46	−2.00	−4.00	17.00	27.00
Georgia	78	10.57	102	0.77	18.23	−3.88	13.65	−3.00	−4.00	11.00	14.00
Romania	23	3.14	15	1.55	28.75	−6.86	19.92	−2.00	−1.00	5.00	3.00
Azerbaijan	16	2.17	20	0.80	9.78	9.08	19.75	1.00	2.00	3.00	4.00
Ukraine	8	1.08	20	0.40	35.80	−8.10	24.80	−1.00	−2.00	2.00	5.00
Netherlands	2	0.30	2	1.23	13.31	2.52	16.17	0.06	0.05	0.36	0.29
World	**739**	**100.00**	**942**	**0.78**			**31.38**	**37.00**	**58.00**	**241.00**	**283.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D6: IMPORT OF ALL TROUT PRODUCTS IN THE TOP 20 MARKETS FOR KAZAKHSTAN'S FISHERIES EXPORT

Top 20 markets + selected trade unions	World export of all trout products to each market, 2018				Market growth potential from 2018 to 2030			
	Value		Volume (tons)	Price ($/kg)	Population growth only		Both population and income growth	
	$, thousands	Share of total world export (%)			Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Poland	69,273	3.36	13,321	5.20	–1,785	–343	8,241	1,585
2. Germany	320,456	15.54	38,234	8.38	43	5	26,197	3,126
3. Russian Federation	122,294	5.93	18,526	6.60	–2,003	–303	9,153	1,387
4. Netherlands	34,514	1.67	4,802	7.19	791	110	3,778	526
5. Lithuania	21,119	1.02	3,229	6.54	–2,386	–365	839	128
6. China	30,917	1.50	4,157	7.44	795	107	11,767	1,582
7. Austria	52,811	2.56	7,595	6.95	1,689	243	6,118	880
8. United States of America	186,886	9.06	16,483	11.34	12,881	1,136	32,241	2,844
9. Czech Republic	12,302	0.60	2,268	5.42	91	17	1,743	321
10. Kyrgyz Republic	72	0.00	210	0.34	13	38	19	56
11. Switzerland	27,543	1.34	2,258	12.20	2,131	175	5,028	412
12. Ukraine	25,479	1.24	4,564	5.58	–1,937	–347	4,151	743
13. Canada	60,028	2.91	5,298	11.14	6,087	537	13,278	1,172
14. Belarus	72,282	3.51	10,406	6.95	–1,436	–207	2,966	427
15. Georgia	*1027*	*0.05*	*279*	*3.68*	*–38*	*–10*	*112*	*30*
16. Azerbaijan	*768*	*0.04*	*236*	*3.25*	*61*	*19*	*106*	*32*
17. France	61,812	3.00	7,838	7.89	1,622	206	5,817	738
18. Uzbekistan	*40*	*0.00*	*5*	*7.49*	*6*	*1*	*19*	*3*
19. North Macedonia								
20. Romania	*19,605*	*0.95*	*4,786*	*4.10*	*–1,206*	*–294*	*2,637*	*644*
Top 20 total	**1,119,227**	**54.00**	**144,494**	**7.75**	**15,418**	**723**	**134,209**	**16,635**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices – see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). Population projections are from the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019). The income elasticity for freshwater and diadromous fishes is used as a proxy for income elasticity for this product.

TABLE D7: EXPORT MARKET STATUS AND POTENTIAL FOR LIVE FISH PRODUCTS (HS0301) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of live fish (HS0301) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	3	2.92	54	64.92	71	0.76	9.27	–1.64	7.48	–0.889	–1	4	5
2. Azerbaijan	1	1.00	24	28.69	20	1.20	5.39	7.94	13.76	2.00	2	3	3
3. Kyrgyz Republic	1	1.00	5	6.39	196	0.03	7.19	18.12	26.61	0.968	36	1	52
World	**4**	**3.32**	**84**	**100.00**	**287**	**0.29**			**15.74**	**2.00**	**36**	**9**	**60**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D8: EXPORT MARKET STATUS AND POTENTIAL FOR FRESH/CHILLED FISH PRODUCTS (HS0302) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of fresh/chilled fish (HS0302) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	11	5.93	435	76.11	936	0.46	9.27	–1.64	7.48	–7.00	–15.00	33.00	70.00
2. Uzbekistan	2	1.82	56	9.75	81	0.69	28.06	15.22	47.55	8.00	12.00	26.00	39.00
3. Austria	2	1.58	50	8.78	4	14.29	8.13	3.20	11.58	2.00	0.112	6.00	0.406

TABLE D.8

Market	Kazakhstan's export of fresh/chilled fish (HS0302) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
4. Germany	1	1.00	28	4.99	4	7.26	8.16	0.01	8.17	0.004	0.001	2.00	0.321
5. Slovenia	1	1.00	1	0.20	0	11.38	12.28	−1.04	11.11	−0.012	−0.001	0.126	0.011
6. China	1	1.00	1	0.09	0	2.22	34.60	2.57	38.06	0.014	0.006	0.203	0.091
7. Kuwait	1	1.00	0	0.05	0	3.34	2.27	14.74	17.34	0.040	0.012	0.048	0.014
8. Czechia	1	1.00	0	0.04	0	11.60	13.33	0.74	14.17	0.002	0.00	0.033	0.003
World	**13**	**6.64**	**571**	**100.00**	**1,025**	**0.56**			**11.25**	**3.00**	**−3.00**	**68.00**	**109.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D9: EXPORT MARKET STATUS AND POTENTIAL FOR FROZEN FISH PRODUCTS (HS0303) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of frozen fish (HS0303) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. China	4	1.25	5,604	45.09	3,707	1.51	34.60	2.57	38.06	144.00	95.00	2,133.00	1,411.00
2. Russian Federation	13	5.36	3,162	25.44	6,761	0.47	9.27	−1.64	7.48	−52.00	−111.00	237.00	506.00
3. Ukraine	3	1.48	832	6.69	1,371	0.61	25.86	−7.60	16.29	−63.00	−104.00	135.00	223.00
4. Georgia	5	2.20	723	5.82	679	1.07	15.19	−3.74	10.89	−27.00	−25.00	79.00	74.00

TABLE D.9

Market	Kazakhstan's export of frozen fish (HS0303) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
5. Azerbaijan	2	1.17	443	3.57	416	1.07	5.39	7.94	13.76	35.00	33.00	61.00	57.00
6. Kyrgyz Republic	8	1.60	359	2.89	147	2.44	7.19	18.12	26.61	65.00	27.00	96.00	39.00
7. Uzbekistan	5	2.78	316	2.54	474	0.67	28.06	15.22	47.55	48.00	72.00	150.00	225.00
8. Netherlands	3	1.11	211	1.70	63	3.33	8.46	2.29	10.95	5.00	1.00	23.00	7.00
9. Germany	4	1.37	194	1.56	34	5.75	8.16	0.01	8.17	0.026	0.005	16.00	3.00
10. Romania	3	2.12	181	1.45	43	4.17	20.89	−6.15	13.45	−11.00	−3.00	24.00	6.00
11. Lithuania	2	1.53	92	0.74	96	0.96	17.22	−11.30	3.97	−10.00	−11.00	4.00	4.00
12. Hungary	1	1.00	89	0.72	52	1.70	17.41	−3.80	12.94	−3.00	−2.00	12.00	7.00
13. Turkey	1	1.00	80	0.64	17	4.71	11.46	8.28	20.69	7.00	1.00	16.00	3.00
14. Slovakia	2	1.80	38	0.31	5	7.78	13.43	−0.91	12.40	−0.347	−0.045	5.00	0.608
15. Estonia	1	1.00	23	0.18	3	8.55	16.35	−3.25	12.57	−0.739	−0.086	3.00	0.334
16. Latvia	2	1.95	21	0.17	40	0.52	17.97	−10.80	5.22	−2.00	−4.00	1.00	2.00
17. Belarus	1	1.00	14	0.11	20	0.68	6.21	−1.99	4.10	−0.270	−0.397	0.557	0.821
18. Czechia	1	1.00	13	0.11	2	6.31	13.33	0.74	14.17	0.097	0.015	2.00	0.295
19. Tajikistan	2	1.86	13	0.10	13	0.98	8.28	26.99	37.50	3.00	3.00	5.00	5.00
20. Poland	1	1.00	8	0.07	2	4.09	14.86	−2.58	11.90	−0.215	−0.053	0.992	0.243
21. Finland	1	1.00	6	0.05	1	8.37	8.97	1.05	10.11	0.059	0.007	0.571	0.068
22. Canada	1	1.00	5	0.04	1	8.85	10.88	10.14	22.12	0.538	0.061	1.00	0.132
23. Austria	1	1.00	4	0.04	1	7.98	8.13	3.20	11.58	0.143	0.018	0.519	0.065
World	**22**	**3.03**	**12,428**	**100.00**	**13,945**	**0.89**			**21.32**	**137.00**	**−27.00**	**3,004.00**	**2,575.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D10: EXPORT MARKET STATUS AND POTENTIAL FOR FISH FILLETS AND OTHER FISH MEAT (HS0304) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of fish fillets and other fish meat (HS0304) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Poland	4	1.15	21,124	26.96	2,735	7.72	14.86	−2.58	11.90	−544.00	−70.00	2,513.00	325.00
2. Germany	5	1.10	16,857	21.52	2,270	7.42	8.16	0.01	8.17	2.00	0.00	1,378.0	186.00
3. Netherlands	1	1.00	14,407	18.39	2,009	7.17	8.46	2.29	10.95	330.00	46.00	1,577.00	220.00
4. Lithuania	1	1.00	10,102	12.90	1,435	7.04	17.22	−11.30	3.97	−1,141.00	−162.00	402.00	57.00
5. Austria	14	1.80	5,469	6.98	613	8.93	8.13	3.20	11.58	175.00	20.00	634.00	71.00
6. United States of America	1	1.00	3,018	3.85	335	9.02	9.69	6.89	17.25	208.00	23.00	521.00	58.00
7. Czechia	5	1.16	2,774	3.54	383	7.25	13.33	0.74	14.17	21.00	2.842	393.00	54.00
8. Switzerland	1	1.00	1,286	1.64	162	7.94	9.76	7.74	18.25	99.00	13.00	235.00	30.00
9. Canada	1	1.00	989	1.26	120	8.25	10.88	10.14	22.12	100.00	12.00	219.00	26.00
10. Russian Federation	9	4.99	695	0.89	710	0.98	9.27	−1.64	7.48	−11.00	−12.00	52.00	53.00
11. France	2	1.83	436	0.56	78	5.58	6.61	2.62	9.41	11.00	2.00	41.00	7.00
12. North Macedonia	1	1.00	397	0.51	335	1.19	14.11	−1.55	12.35	−6.00	−5.00	49.00	41.00
13. China	5	4.68	184	0.24	139	1.32	34.60	2.57	38.06	5.00	4.00	70.00	53.00
14. Estonia	3	2.28	157	0.20	21	7.39	16.35	−3.25	12.57	−5.00	−0.689	20.00	3.00
15. Denmark	1	1.00	109	0.14	15	7.22	9.13	4.34	13.87	5.00	0.658	15.00	2.00
16. Romania	3	1.99	75	0.10	13	5.58	20.89	−6.15	13.45	−5.00	−0.830	10.00	2.00
17. Slovakia	3	2.14	73	0.09	8	8.68	13.43	−0.91	12.40	−0.667	−0.077	9.095	1.00
18. Turkey	2	1.01	63	0.08	19	3.36	11.46	8.28	20.69	5.00	2.00	13.00	4.00
19. Serbia	2	1.47	49	0.06	5	9.76	20.82	−6.27	13.24	−3.00	−0.317	7.00	0.670
20. Slovenia	2	1.50	14	0.02	1	9.56	12.28	−1.04	11.11	−0.148	−0.015	2.00	0.165
21. Moldova	1	1.00	13	0.02	7	1.99	16.61	−4.10	11.83	−0.538	−0.271	2.00	0.782
22. Tajikistan	5	2.99	11	0.01	3	3.82	8.28	26.99	37.50	3.00	0.788	4.00	1.00

TABLE D.10

Market	Kazakhstan's export of fish fillets and other fish meat (HS0304) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
23. Kyrgyz Republic	4	1.99	11	0.01	3	3.30	7.19	18.12	26.61	2.00	0.605	3.00	0.889
24. Georgia	2	2.00	11	0.01	4	2.75	15.19	−3.74	10.89	−0.411	−0.150	1.00	0.436
25. Latvia	1	1.00	8	0.01	2	4.61	17.97	−10.80	5.22	−0.916	−0.199	0.443	0.096
26. Finland	1	1.00	5	0.01	1	8.83	8.97	1.05	10.11	0.052	0.006	0.500	0.057
27. Norway	1	1.00	1	0.00	0	10.07	1.37	10.08	11.58	0.138	0.014	0.159	0.016
28. Luxembourg	1	1.00	1	0.00	0	16.88	8.67	14.25	24.15	0.103	0.006	0.175	0.010
World	**25**	**1.25**	**78,340**	**100.00**	**11,427**	**6.86**			**10.45**	**−752.00**	**−126.00**	**8,169.00**	**1,198.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D11: EXPORT MARKET STATUS AND POTENTIAL FOR DRIED / SALTED / SMOKED / OFFAL PRODUCTS (HS0305) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of dried / salted / smoked / offal products (HS0305) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	7	2.36	1,778	59.04	1,068	1.66	9.27	−1.64	7.48	−29.00	−17.00	133.00	80.00
2. Ukraine	3	2.24	393	13.07	522	0.75	25.86	−7.60	16.29	−30.00	−40.00	64.00	85.00
3. Germany	3	2.03	345	11.47	47	7.41	8.16	0.01	8.17	0.047	0.006	28.00	4.00
4. Belarus	1	1.00	199	6.61	321	0.62	6.21	−1.99	4.10	−4.00	−6.00	8.00	13.00

TABLE D.11

Market	Kazakhstan's export of dried / salted / smoked / offal products (HS0305) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
5. Latvia	1	1.00	125	4.14	26	4.89	17.97	−10.80	5.22	−13.00	−3.00	7.00	1.00
6. Netherlands	2	1.46	52	1.74	14	3.87	8.46	2.29	10.95	1.00	0.311	6.00	1.00
7. Bulgaria	1	1.00	43	1.41	11	4.05	19.08	−9.00	8.36	−4.00	−0.945	4.00	0.877
8. Georgia	1	1.00	41	1.36	17	2.38	15.19	−3.74	10.89	−2.00	−0.643	4.00	2.00
9. Kyrgyz Republic	5	3.59	32	1.06	25	1.28	7.19	18.12	26.61	6.00	5.00	9.00	7.00
10. Lithuania	1	1.00	3	0.10	1	4.82	17.22	−11.30	3.97	−0.327	−0.068	0.115	0.024
World	**12**	**3.00**	**3,011**	**100.00**	**2,050**	**1.47**	**12.22**	**−2.79**	**9.10**	**−75.00**	**−63.00**	**262.00**	**194.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D12: EXPORT MARKET STATUS AND POTENTIAL FOR PREPARED/PRESERVED FISH, INCLUDING CAVIAR AND CAVIAR SUBSTITUTES FROM FISH EGGS (HS1604) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of prepared/preserved fish, including caviar and caviar substitutes from fish eggs (HS1604) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	4	1.75	10,068	85.29	2,593	3.88	9.27	−1.64	7.48	−165.00	−42.00	754.00	194.00
2. Kyrgyz Republic	7	3.47	905	7.67	409	2.21	7.19	18.12	26.61	164.00	74.00	241.00	109.00
3. Austria	2	1.62	769	6.52	91	8.43	8.13	3.20	11.58	25.00	3.00	89.00	11.00

TABLE D.12

Market	Kazakhstan's export of prepared/preserved fish, including caviar and caviar substitutes from fish eggs (HS1604) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
4. Uzbekistan	3	1.41	44	0.37	31	1.43	28.06	15.22	47.55	7.00	5.00	21.00	15.00
5. Switzerland	1	1.00	9	0.08	1	8.65	9.76	7.74	18.25	0.696	0.080	2.00	0.190
6. Tajikistan	1	1.00	6	0.05	2	3.58	8.28	26.99	37.50	2.00	0.446	2.00	0.620
7. Netherlands	1	1.00	3	0.03	1	5.13	8.46	2.29	10.95	0.071	0.014	0.337	0.066
8. Mongolia	1	1.00	0	0.00	0	4.79	14.31	17.22	33.99	0.079	0.017	0.156	0.033
World	**8**	**3.00**	**11,805**	**100.00**	**3,128**	**3.77**	**9.11**	**0.78**	**9.96**	**33.00**	**40.00**	**1,109.00**	**329.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices – see a detailed discussion of the §methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for freshwater and diadromous fishes is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D13: EXPORT MARKET STATUS AND POTENTIAL FOR SHELLFISH PRODUCTS (HS0306 + HS0307 + HS0308 + HS1605) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of shellfish products (HS0306 + HS0307 + HS0308 + HS1605) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	5	1.33	368	66.50	160	2.31	20.31	−1.64	18.34	−6.00	−3.00	68.00	29.00
2. Kyrgyz Republic	13	5.27	177	31.95	95	1.86	18.32	18.12	39.76	32.00	17.00	70.00	38.00
3. Austria	2	1.09	7	1.19	1	5.16	20.97	3.20	24.83	0.210	0.041	2.00	0.316
4. Estonia	1	1.00	1	0.22	0	10.03	48.97	−3.25	44.13	−0.040	−0.004	0.545	0.054

TABLE D.13

Market	Kazakhstan's export of shellfish products (HS0306 + HS0307 + HS0308 + HS1605) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
5. Tajikistan	1	1.00	1	0.14	0	8.43	21.25	26.99	53.98	0.209	0.025	0.419	0.050
6. China	1	1.00	0	0.00	0	2.56	86.68	2.57	91.48	0.001	0.00	0.021	0.008
World	**17**	**3.00**	**554**	**100.00**	**256**	**2.16**	**19.58**	**5.25**	**25.86**	**26.00**	**15.00**	**141.00**	**68.00**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for crustaceans is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D14: EXPORT MARKET STATUS AND POTENTIAL FOR SEAWEEDS AND SEAWEED PRODUCTS (HS121221 + HS121229 + HS130231) FROM KAZAKHSTAN, 2018–2030

Market	Kazakhstan's export of seaweed and seaweed products (HS121221 + HS121229 + HS130231) to each market												
	Baseline in 2018						Growth potential between 2018 and 2030						
	Number of products		Value		Volume (tons)	Price ($/kg)	Per capita demand growth driven by income growth (%)	Population growth (%)	Total demand growth (%)	Population only		Both population and income growth	
	Actual	Effective	$, thousands	Share of world total (%)						Value ($, thousands)	Volume (tons)	Value ($, thousands)	Volume (tons)
1. Russian Federation	2	1.01	476	99.53	90	5.30	20.31	–1.64	18.34	–8.00	–1.00	87	16
2. Uzbekistan	1	1.00	2	0.47	3	0.90	82.10	15.22	109.81	0.342	0.380	2	3
World	**2**	**1.01**	**478**	**100.00**	**92**	**5.18**	**21.46**	**–1.37**	**19.79**	**–7.00**	**–1.00**	**90**	**19**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices – see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for crustaceans is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

TABLE D15: EXPORT MARKET STATUS FOR NON-FOOD FISHERIES PRODUCTS (HS050800 + HS051191 + HS230120) FROM KAZAKHSTAN, 2018

Market	Kazakhstan's export of non-food fisheries products (HS050800 + HS051191 + HS230120) to each market, 2018					
	Number of products		Value		Volume (tons)	Price ($/kg)
	Actual	Effective	$, thousands	Share of world total (%)		
1. China	1	1.00	3,368	78.56	1,652	2.04
2. Belarus	2	1.04	595	13.87	907	0.66
3. Russian Federation	2	1.99	233	5.43	267	0.87
4. Germany	1	1.00	91	2.12	29	3.19
5. Uzbekistan	1	1.00	1	0.01	20	0.03
World	**3**	**1.57**	**4,288**	**100.00**	**2,875**	**1.49**

Data source: UN Comtrade (2020); see Section 4.1 for the data processing methodology.

Note: The growth potential of a country's demand for a seafood item is measured by the potential increase in the country's demand for the seafood item driven by its population and income growth, given constant seafood prices—see a detailed discussion of the methodology in Cai and Leung 2017 (http://www.fao.org/3/a-i7623e.pdf). The income elasticity for crustaceans is used for this group of products. Population projections from 2018 to 2030 are based on the UN World Population Prospects 2019. The projections of per capita GDP between 2018 and 2024 are from the IMF WEO database (October 2019).

ANNEX E: Production of Major Fish Species Groups

Carps (cyprinids)

Carps are the largest species group accounting for more than half of the total fishery production in Kazakhstan. Major carp producing regions include Atyrau, East Kazakhstan, Turkistan, Almaty, and Kyzylorda, and capture fisheries is the main source of carp production in nearly all of them except for Turkistan (Table E1).

Most of the production came from capture fisheries and extensive/pasture aquaculture (that is, relying on natural productivity instead of artificial feed to grow the fish) in large water bodies. Extensive/pasture aquaculture can also be categorized as culture-based fisheries. Kazakhstan farmers usually report relatively large-size European or Chinese carps from aquaculture production, whereas smaller and/or local carp species are recorded as capture fisheries production.

The prices of different carp species varied from KZT 46/kg for crucian carp (*Carassius* sp.) to KZT 380/kg for farmed common carp, and there appeared no significant seasonal variation in the prices (Table E1). However, the prices of carp species vary greatly across different regions. Carp price tends to be relatively low in places with ample supply (for example, main carp producing regions such as Atyrau and East Kazakhstan or a major market for carp products such as Almaty) and relatively high in regions with little carp production (for example, West Kazakhstan) (Table E2).

TABLE E1: FISHERIES AND AQUACULTURE PRODUCTION OF CARP SPECIES IN KAZAKHSTAN

Carp species	Production in 2018				Production in 2019			
	Capture fisheries (tons)	Aquaculture (tons)	Total		Capture fisheries (tons)	Aquaculture (tons)	Total	
			Tons	Share of total (%)			Tons	Share of total (%)
European minnows (Leuciscinae)	**15,573**		**15,573**	**67.2**	**19,617**		**19,617**	**67.9**
Freshwater bream (Abramis brama)	11,580		11,580	50.0	15,255		15,255	52.8
Bream nautical (Abramis brama)	2,489		2,489	10.7	2,619		2,619	9.1
Asp (Leuciscus aspius)	948		948	4.1	1,027		1,027	3.6
Sichel (Pelecus cultratus)	483		483	2.1	600		600	2.1
White bream (Blicca bjoerkna)	73		73	0.3	117		117	0.4
Common carp aka European carp	**1,870**	**2,784**	**4,653**	**20.1**	**1,990**	**3,480**	**5,470**	**18.9**
Cyprinus carpio	1,646	982	2,628	11.3	1,758	1,580	3,338	11.6

TABLE E.1

Carp species	Production in 2018				Production in 2019			
	Capture fisheries (tons)	Aquaculture (tons)	Total		Capture fisheries (tons)	Aquaculture (tons)	Total	
			Tons	Share of total (%)			Tons	Share of total (%)
Cyprinus carpio carpio	224	1,802	2,025	8.7	232	1,900	2,132	7.4
Asian carps	**2,267**	**681**	**2,948**	**12.7**	**3,284**	**521**	**3,805**	**13.2**
Crucian carp (Carassius sp.)	2,170	1	2,170	9.4	3,157	2	3,159	10.9
Silver carp (Hypophthal-michthys molitrix)	76	334	409	1.8	92	230	322	1.1
White amur (Ctenopha-ryngodon idella)	22	346	368	1.6	35	288	323	1.1
All carp species	**19,710**	**3464**	**23,174**	**100.0**	**24,891**	**4001**	**28,892**	**100.0**

Data source: Bureau of National Statistics, Kazakhstan.

For carp species, large-size fish tend to be more expensive. For example, large-size crucian carp (over 1 kg) in northern reservoirs (for example, North Kazakhstan, Akmola, Kostanay, or West Kazakhstan) is more expensive than small-size crucian carp in the south (for example, Almaty or Turkestan).

TABLE E2: FIRST-SALE PRICE OF CARP PRODUCTION IN KAZAKHSTAN, 2020

Carp species	First-sale price (KZT/kg)				
	1st Quarter	2nd Quarter	3rd Quarter	Average	
				KZT/kg	$/kg
Carp (aquaculture)	387	376	376	380	0.90
Carp (wild)	343	350	354	349	0.83
Silver carp	261	261	264	262	0.62
Sazan (wild carp)	136	134	133	134	0.32
Freshwater bream	118	117	115	117	0.28
Asp	84	84	86	85	0.20
Bream nautical	56	56	56	56	0.13
Carassius sp.	46	46	46	46	0.11

Data source: Bureau of National Statistics, Kazakhstan.

Note: $1 = KZT 420. Prices for products of fishing and aquaculture are prices of products of fishing and aquaculture excluding value-added tax and expenses on transportation and loading and unloading operations. 1. Fish caught in natural reservoirs with signs of cultivated carp. 2. Fish caught in natural reservoirs with 'wild' pheno-type, which do not show signs of cultivated carp. 3. Bream caught in brackish water (for example, Caspian Sea).

The prices of carp species may reflect local taste and/or perception. For example, common carp from the brackish water (8 ppm) in Lake Alakol is considered the most delicious. While sazan (wild carp) is generally more expensive than other carp species, the dark color and small form of sazan (wild carp) in some places leads to the perception of it being harvested from low-quality water. Most of the production of carp species in Kazakhstan is for domestic consumption. The average 5.71 kg consumption of carp species accounted for over 40% of Kazakhstan's fish consumption in 2018, and nearly all the carp consumption was supplied by domestic production with few imported products.

TABLE E3: SUBNATIONAL VARIATION OF THE FIRST-SALE PRICES OF CARP SPECIES IN KAZAKHSTAN, 2020

Sazan (wild carp) First-sale price (KZT/kg)		Freshwater bream (Abramis brama) First-sale price (KZT/kg)		Crucian carp (Carassius sp.) First-sale price (KZT/kg)	
West Kazakhstan	618	Zhambyl	251	West Kazakhstan	298
Zhambyl	511	West Kazakhstan	192	Akmola	281
Mangystau	499	Akmola	183	Zhambyl	230
Kostanay	337	Kostanay	132	Kostanay	199
Turkistan	294	Kyzylorda	110	North Kazakhstan	139
Kyzylorda	290	Turkistan	90	Kyzylorda	131
Karagandy	238	Almaty	61	East Kazakhstan	84
Almaty	228	Atyrau	58	Turkistan	81
East Kazakhstan	139	East Kazakhstan	42	Almaty	64
Atyrau	130	Karagandy	35	Karagandy	63
				Atyrau	44
Kazakhstan	**134**	**Kazakhstan**	**117**	**Kazakhstan**	**46**

Data source: Bureau of National Statistics, Kazakhstan.

According to the price list of several online fish stores, the retail prices of carp products are KZT 500–750/kg for whole carp, KZT 350–550/kg for whole crucian carp, KZT 1,000–1,700/kg for carp fillet, KZT 500/kg for crucian carp fillet, KZT 660–1,250/kg for dried crucian carp, and KZT 2,400–2900/kg for smoked silver carp (Table E4) The variations reflect differences in species, product form (whole, fillet, dried, smoked, and so on), and packaging (for example, vacuum packed or not). The prices are much higher than the first-sale prices. In Almaty, chilled whole carp was recently sold at KZT 1,200/kg ($2.86/kg) in bazaar and KZT 1,900/kg ($4.52/kg) in supermarket; the prices were at least three times of the first-sale carp prices. Further investigations are needed to understand factors (for example, logistic costs, market power, and so on) causing the high mark-up.

TABLE E4: RETAIL PRICES OF THE PRODUCTS OF CARP SPECIES IN KAZAKHSTAN, 2020

Product	Retail price from online store		Source
	KZT/kg	$/kg	
Fresh/chilled/frozen whole fish			
Carp, whole	500	1.19	Khamit
Carp, whole, vacuum packed	750	1.79	Khamit
Sazan (wild carp), gutted, head on	1,000	2.38	Fish House
Crucian carp, whole	350	0.83	Khamit
Crucian carp, whole, vacuum packed	550	1.31	Khamit
Crucian carp, gutted, head off	725	1.73	RYBPROM
Fillets			
Sazan (wild carp), fillet	1,350	3.21	Fish House
Carp, fillet	1,700	4.05	Radovnya (Kostanay city)
Carp, fillet	1,000	2.38	Khamit
Carp, fillet, vacuum packed	1,250	2.98	Khamit
Crucian carp, fillet	500	1.19	Khamit
Dried or smoked			
Common carp, air-dried, sliced	660	1.57	Radovnya (Kostanay city)
Crucian carp, air-dried, sliced	660	1.57	Radovnya (Kostanay city)
Crucian carp, air-dried, gutted	1,050	2.50	RYBPROM
Crucian carp, dried, sliced	1,250	2.98	Sapa-M
Crucian carp, cold-smoked, sliced	1,200	2.86	Sapa-M
Silver carp, smoked, whole or sliced	2,400	5.71	Khamit
Silver carp, smoked, whole or sliced, vacuum packed	2,900	6.90	Khamit

Data source: Various online sources.

In 2018, Kazakhstan exported 12,700 tons (product weight; $1.52/kg average price) of frozen whole carp and roach including 4,446 tons ($0.37/kg) to Russia and 3,509 tons ($1.52/kg) to China (see Chapter IV). Most of the products tend to be carp species. Kazakhstan also exported 942 tons ($0.89/kg) frozen whole carp to nearby countries (Table E5).

TABLE E5: KAZAKHSTAN'S EXPORT OF FROZEN WHOLE CARP (HS030325), 2018

Exporter: Kazakhstan	Volume		Value		Price ($/kg)
	Tons	Share (%)	Value ($, thousands)	Share (%)	
World	**942**	**100.00**	**739**	**100**	**0.78**
Uzbekistan	360	38.22	214	29	0.59
Russian Federation	262	27.83	163	22	0.62
China	161	17.13	235	32	1.45
Georgia	102	10.79	78	11	0.77
Azerbaijan	20	2.12	16	2	0.80
Ukraine	20	2.12	8	1	0.40
Romania	15	1.59	23	3	1.55
Netherlands	2	0.19	2	0	1.23

Data source: UN Comtrade.

Significant increase in demand is expected for the carp species

The KFDP intends to increase the aquaculture production of carp species to 79,706 tons in 2030, which is 76,242 tons higher than the 3,464 tons production in 2018. According to the estimation (see Chapter IV), the income- and population-driven domestic and export market growth potential for carp species between 2018 and 2030 is 30,379 tons (live weight), including 28,216 tons of domestic growth potential and 2,163 tons of export market potential. The 30,379 tons growth potential is significantly lower compared to the 76,242 tons of production growth for carp species targeted in the KFDP. Even with substantial efforts to increase the demand for carp species in Kazakhstan, reaching the target is unlikely.

As carps are relatively low-value fish, there tends to be limited room for increasing the demand for carp species through lowering price. Yet, the demand for carp may be increased through value-added products. In addition to traditional dried/smoked carps, Kazakhstan may explore new product forms (surimi or canned products) for carp species. In the short term, the effort in developing new products for carp species may be focused on export markets where the products are well established. In the long run, the dietary habits of domestic consumers can be changed by new cooking styles or recipes.

In China, the fingerlings of low-value carp species (for example, silver carp or crucian carp) are used as live feed to culture high-value carnivore species such as mandarin fish, also known as Chinese perch (*Siniperca chuatsi*). Similarly, the fingerlings of low-value carp species can be used as feed to culture high-value species (for example, sturgeon and potentially pikeperch in the future).

Properly increasing carp production capacity

At present, most of the production of carp species in Kazakhstan are from wild harvest or extensive/pasture aquaculture. The productivity

of such extensive production systems can be improved through good fisheries management and more efficient stock enhancement operations. Yet, this may not be enough, and semi-intensive or intensive carp farming systems are needed to significantly increase production. However, any substantial investment in new carp farming systems should be based on a rigorous assessment of market potential and economic viability.

Actions to increase the technical and economic performance of the production of carp species in Kazakhstan may include (a) rehabilitation/restoration of existing pond aquaculture systems, (b) genetic improvement programs to increase the growth performance of carp species, and (c) capacity building to increase the technical and economic performance of the cultivation of carp species.

Perch, pike, and pikeperch

Kazakhstan produced 6,696 tons of pike, perch, and pikeperch in 2018, increasing to 9,472 tons in 2019, and the production primarily comprised pikeperch (*Sander lucioperca*), followed by Northern pike, also known as freshwater pike (*Esox lucius*), and European perch (*Perca fluviatilis*) with a trivial amount of Balkhash perch (*Perca schrenkii*) (Table E6). Virtually all the perch/pike/pikeperch production came from capture fisheries. While 1,500 tons of pikeperch aquaculture production appears for the first time in the national statistics, it is believed that the production may be actually from capture fisheries since there are no pikeperch farming operations in Kazakhstan.

Major producing regions of pike, perch, and pikeperch include (a) Turkistan that accounted for 71% of pikeperch production, (b) East Kazakhstan that accounted for 35% of northern pike production and 48.9% of European perch production, (c) Atyrau that accounted for 45.6% of European perch production; and (d) Kyzylorda that accounted for 15.7% of pikeperch production (Table E7).

TABLE E6: PRODUCTION OF PIKE, PERCH, AND PIKEPERCH IN KAZAKHSTAN

Species	Total fishery production in 2018 (tons)			Total fishery production in 2019 (tons)		
	Capture fisheries	Aquaculture	Total	Capture fisheries	Aquaculture	Total
Pike, perch, and pikeperch	**6,647**	**49**	**6,696**	**7,924**	**1,548**	**9,472**
Pikeperch (Sander lucioperca)	5,131		5,131	6,003	1,500	7,503
Northern pike (Esox lucius)	798		798	1,025		1,025
European perch (Perca fluviatilis)	717	49	767	890	48	938
Balkhash perch (Perca schrenkii)			0	5		5

Data source: Bureau of National Statistics, Kazakhstan.

TABLE E7: SUBNATIONAL DISTRIBUTION OF PIKE, PERCH, AND PIKEPERCH PRODUCTION IN KAZAKHSTAN, 2019

Region	Pikeperch		Pike		Perch		Balkhash perch		Pike, perch, and pikeperch	
	Tons	Share (%)	Tons	Share (%)	Tons	Share (%)	Tons	Share (%)	Tons	Share (%)
Kazakhstan	**6,003**	**100.0**	**1,025**	**100.0**	**890**	**100.0**	**5**	**100.0**	**7,924**	**100.0**
Turkistan	4,265	*71.0*	2	*0.1*	0	-		—	4,266	*53.8*
East Kazakhstan	772	*12.9*	359	*35.0*	525	*58.9*		—	1,656	*20.9*
Atyrau	628	*10.5*	468	*45.6*	36	*4.0*		—	1,132	*14.3*
Kyzylorda	944	*15.7*	45	*4.4*	43	*4.8*		—	1,032	*13.0*
Almaty	644	*10.7*	0	—	77	*8.7*		—	721	*9.1*
Zhambyl	126	*2.1*	1	*0.1*	0	*0.0*	5	*100.0*	132	*1.7*
Akmola	18	*0.3*	31	*3.0*	74	*8.3*		—	123	*1.6*
Nord Kazakhstan	12	*0.2*	32	*3.1*	74	*8.3*		—	118	*1.5*
Karagandy	41	*0.7*	33	*3.2*	36	*4.1*		—	110	*1.4*
Aktobe	2	*0.0*	21	*2.1*	37	*4.1*		—	61	*0.8*
Mangystau	45	*0.7*	0	—	0	—		—	45	*0.6*
West Kazakhstan	7	*0.1*	14	*1.4*	24	*2.7*		—	44	*0.6*
Kostanay	0	-	16	*1.5*	10	*1.2*		—	26	*0.3*
Pavlodar	1	*0.0*	4	*0.3*	3	*0.3*		—	7	*0.1*

Data source: Bureau of National Statistics, Kazakhstan.

In 2020, the average first-sale prices of pikeperch, northern pike, and European perch in Kazakhstan were, respectively, KZT 175/kg, KZT 335/kg, and KZT 191/kg (Table E8). The prices were much lower than the prices in 2019 (KZT 481/kg, KZT 507/kg, and KZT 270/kg, respectively), which may primarily reflect the impacts of the COVID-19 pandemic on fish export. Pikeperch (as the major export product) appeared to be affected the most. The incident, perhaps a transitory shock notwithstanding, indicates the need to diversify pikeperch export markets in the long run. China could be a potential market since perch-like fishes are generally favored by Chinese consumers. Similar to carp species, the prices of pikeperch, pike, and perch had not much seasonal variation but varied significantly across regions.

The retail prices of pike/perch/pikeperch products (Table E9) are much higher than the first-sale prices. The information indicates that, in the domestic market of Kazakhstan,

(a) The price of pikeperch fillets varied from KZT 1,000/kg ($2.38/kg) to KZT 2,400/kg ($5.71/kg). Large-size fillets are more expensive than smaller fillets. Vacuum-packed fillets are more expensive than those with no such packaging;

(b) Pikeperch fillets appeared to be more expensive than the fillets of northern pike (KZT 1,340–1,450/kg) or European perch (KZT 600–1,000/kg); and

(c) While pikeperch products comprised mostly fillets, perch and pike sold in the domestic market appear to be mostly dried or smoked products.

TABLE E8: FIRST-SALE PRICES OF PIKE, PERCH, AND PIKEPERCH IN KAZAKHSTAN, 2020

Region	1st Quarter (KZT/kg)	2nd Quarter (KZT/kg)	3rd Quarter (KZT/kg)	Annual average	
				KZT/kg	$/kg
Pikeperch					
Kazakhstan	**178**	**173**	**173**	**175**	**0.42**
Kyzylorda	658	665	672	665	1.58
Zhambyl	615	615	645	625	1.49
West Kazakhstan	590	590	590	590	1.40
Mangystau	576	577	595	582	1.39
Almaty	408	408	408	408	0.97
East Kazakhstan	397	397	412	402	0.96
Karagandy	377	377	377	377	0.90
Turkistan	268	268	287	274	0.65
Atyrau	171	166	166	168	0.40
Northern pike					
Kazakhstan	**320**	**343**	**343**	**335**	**0.80**
West Kazakhstan	445	482	482	470	1.12
Akmola	376	402	402	393	0.94
Kostanay	343	341	341	341	0.81
Karagandy	299	299	299	299	0.71
North Kazakhstan	241	241	241	241	0.57
East Kazakhstan	140	140	142	141	0.34
Kyzylorda	136	138	138	137	0.33
Atyrau	106	106	106	106	0.25
European perch					
Kazakhstan	**193**	**189**	**191**	**191**	**0.45**

TABLE E.8

Region	1st Quarter (KZT/kg)	2nd Quarter (KZT/kg)	3rd Quarter (KZT/kg)	Annual average	
				KZT/kg	$/kg
Akmola	213	215	215	214	0.51
West Kazakhstan	202	198	198	200	0.48
North Kazakhstan	145	146	145	146	0.35
East Kazakhstan	140	140	149	143	0.34
Kostanay	131	131	131	131	0.31
Almaty	100	100	100	100	0.24
Karagandy	82	82	82	82	0.20
Atyrau	68	68	68	68	0.16

Data source: Bureau of National Statistics, Kazakhstan.

TABLE E9: RETAIL PRICES OF PIKE / PERCH / PIKEPERCH PRODUCTS IN KAZAKHSTAN, 2020

Species	Retail price from online stores		Source
	KZT/kg	$/kg	
Pikeperch			
Whole fish			
Pikeperch, whole, gutted, head off	1,000	2.38	RYBPROM
Pikeperch, whole, gutted, head on	1,600	3.81	Fish house
Fillet			
Pikeperch, fillet, 120-250 g	1,880	4.48	Fish house
Pikeperch, fillet, extra-large standard	1,600	3.81	Fish house
Pikeperch, fillet, large standard	1,500	3.57	Fish house
Pikeperch, fillet, medium standard	1,350	3.21	Fish house
Pikeperch, fillet, small standard	1,000	2.38	Fish house
Pikeperch, fillet (large), vacuum packed	2,200	5.24	Khamit
Pikeperch, fillet (large)	1,600	3.81	Khamit
Pikeperch, fillet (small and medium), vacuum packed	1,900	4.52	Khamit
Pikeperch, fillet (small and medium)	1,400	3.33	Khamit
Pikeperch, fillet, > 230 g	2,400	5.71	RYBPROM
Pikeperch, fillet, 120 g/300 g	1,950	4.64	RYBPROM
Pikeperch, fillet, with skin, 40 g/120 g	1,700	4.05	RYBPROM
Pikeperch, fillet, with skin	1,200	2.86	RYBPROM

TABLE E.9

Species	Retail price from online stores		Source
	KZT/kg	$/kg	
Dried			
Pikeperch, air-dried, gutted	1,675	3.99	RYBPROM
Pikeperch, dried, sliced	1,400	3.33	Sapa-M
Pikeperch, dried, gutted	1,300	3.10	Sapa-M
Smoked			
Pikeperch, cold-smoked, sliced	1,350	3.21	Sapa-M
Northern pike			
Whole fish			
Pike, whole	640	1.52	Sapa-M
Fillet			
Pike, fillet	1,340	3.19	Radovnya (Kostanay city)
Pike, fillet, without skin	1,450	3.45	RYBPROM
Dried			
Pike, air-dried	1,200	2.86	Radovnya (Kostanay city)
Pike, air-dried, gutted	1,800	4.29	RYBPROM
Pike, dried, gutted	1,350	3.21	Sapa-M
Smoked			
Pike, cold-smoked, cut	1,400	3.33	Sapa-M
Pike, cold-smoked, sliced	1,300	3.10	Sapa-M
European perch			
Fillet			
Perch, fillet	600	1.43	Khamit
Perch, fillet, with skin	1,000	2.38	RYBPROM
Dried			
Perch, air-dried	650	1.55	Radovnya (Kostanay city)
Perch, air-dried, whole	1,200	2.86	RYBPROM
Perch, dried	720	1.71	Sapa-M
Perch, dried, sliced	1,400	3.33	Sapa-M
Smoked			
Perch, cold-smoked	680	1.62	Sapa-M
Perch, cold-smoked, sliced	**1,350**	**3.21**	**Sapa-M**

Data source: Estimates based on research for this report.

The retail prices of pike/perch/pikeperch products (Table E9) are much higher than the first-sale prices. The information indicates that, in the domestic market of Kazakhstan,

- The price of pikeperch fillets varied from KZT 1,000/kg ($2.38/kg) to KZT 2,400/kg ($5.71/kg). Large-size fillets are more expensive than smaller fillets. Vacuum-packed fillets are more expensive than those without such packaging;
- Pikeperch fillets appeared to be more expensive than the fillets of northern pike (KZT 1,340–1,450/kg) or European perch (KZT 600–1,000/kg); and
- While pikeperch products comprised mostly fillets, perch and pike sold in the domestic market appear to be mostly dried or smoked products.

In addition to the main products (that is, whole fish and fillets), side products, such as pikeperch cheeks, eggs, gullets, or fins, are also sold in the domestic market.

According to UN Comtrade statistics, Kazakhstan exported 10,399 tons (product weight) of frozen fish fillets nei in 2018, mostly to European countries. Most of the products were pikeperch fillets, and their $7.24/kg average price is higher than the prices of pikeperch fillets sold in the domestic market.

Insufficient supply of pike / perch / pikeperch

According to estimates, the income and population-driven domestic and export market growth potential for pike, perch, and pikeperch between 2018 and 2030 is 6,267 tons (live weight), including 3,959 tons of domestic growth potential and 2,309 tons of export market growth potential. The relatively low export market growth potential despite the 23,086 tons of baseline export reflects relative low population and/or income growth in the existing markets, mostly in Europe.

The KFDP set a target to increase the aquaculture production of pikeperch by 1,500 tons in 2030 with no target on the production of northern pike or European perch. The production expansion would be insufficient to satisfy the 6,267 tons of domestic and export market growth potential driven by income and population growth.

Indeed, the fish processing industry in Kazakhstan has been constrained by the lack of pikeperch and other raw materials to operate at full capacity. Pikeperch is a popular fish favored by European consumers. In countries with the tradition of consuming freshwater fishes (for example, Finland), pikeperch is deemed a high-value species sold at a high price. With relatively cheap first-sale prices of pikeperch (average KZT 481/kg or $1.14/kg of whole fish in 2019) compared to the export market price ($7.25/kg of fillet in 2018; 2.22 kg whole fish needed for 1 kg fillets), Kazakhstan tends to have little problem in the near future exporting any amount of pikeperch fillets allowed by the supply of raw fish materials. Therefore, the main constraint over pikeperch and other perch-like fishes is primarily on the supply side.

Increasing the production of pikeperch / pike / perch

According to FAO statistics, 29 countries had captured fisheries production of pikeperch in 2018, whereas the 21,234 tons of world production was primarily contributed by Russia (29.12%), Kazakhstan (24.16%), and Finland (22.7%) (Table E10). According to the FAO statistics, 18 countries had aquaculture production of pikeperch in 2018; yet, the 1,557 tons of world production was primarily contributed by Uzbekistan (28.12%), Denmark (21.57%), Russia (11.17%), and Tunisia (10.92%).

Pikeperch aquaculture is subject to multiple technical difficulties,[45] including (a) the lack

[45] Workshop on recent progress in pikeperch culture https://www.diversifyfish.eu/uploads/1/4/2/0/14206280/fontaine_et_al._nancy_juin_2018.pdf.

of knowledge of the genetic variability of broodstocks; (b) high sensitivity to stressors, handling, and husbandry practices that result in high and sudden mortalities; (c) low larval survival (typical 5–10%); and (d) high incidence of deformities.

Relatively high production cost is another constraining factor—$6.2–7/kg of cost of producing marketable pikeperch (1.5 kg body weight),[46] and the constraint is particularly difficult to overcome under the current situation in Kazakhstan with a large amount of much less expensive pikeperch supplied by capture fisheries.

However, pikeperch aquaculture production was only 0.2% of the 770,040 tons of global aquaculture production of freshwater perch-like fishes (including freshwater species in the superfamily *Percoidea*) in 2018 (Table E11). The rapid expansion of the global aquaculture production of this species group from less than 100,000 tons in 2000 to nearly 800,000 tons in 2018 is encouraging. Particularly, mandarin fish, also known as Chinese perch, which is still mostly relying on live fingerlings as its main feed stock, managed to increase its production to over 300,000 tons in 2018.

TABLE E10: GLOBAL FISHERIES AND AQUACULTURE PRODUCTION OF PIKEPERCH, 2018

Capture fisheries production of pikeperch			Aquaculture production of pikeperch		
Country or territory	Tons	Share of total (%)	Country or territory	Tons	Share of total (%)
1. Russian Federation	6,184	29.12	1. Uzbekistan	438	28.12
2. Kazakhstan	5,130	24.16	2. Denmark	336	21.57
3. Finland	4,820	22.70	3. Russian Federation	174	11.17
4. Ukraine	952	4.48	4. Tunisia	170	10.92
5. Sweden	944	4.45	5. Netherlands	100	6.42
6. Estonia	808	3.81	6. Romania	62	3.99
7. Turkey	422	1.99	7. Czechia	62	3.98
8. Poland	303	1.43	8. Bulgaria	58	3.70
9. Netherlands	273	1.29	9. Germany	54	3.47
10. Germany	261	1.23	10. Hungary	53	3.38
Others	1,137	5.35	Others	51	3.27
World	**21,234**	**100.00**	**World**	**1,557**	**100.00**

Data source: FAO.

[46] "How to Farm Pike-Perch." https://thefishsite.com/articles/cultured-aquatic-species-pikeperch.

TABLE E11: WORLD AQUACULTURE PRODUCTION OF FRESHWATER PERCH-LIKE FISHES, 2018

Common name	Scientific name	Production in 2000		Production in 2018	
		Tons	Share of total (%)	Tons	Share of total (%)
Largemouth black bass	*Micropterus salmoides*	178	0.19	434,148	56.38
Mandarin fish	*Siniperca chuatsi*	86,144	91.79	315,906	41.02
Nile perch	*Lates niloticus*	1,367	1.46	15,417	2.00
Striped bass, hybrid	*Morone chrysops x M. saxatilis*	5,394	5.75	1,619	0.21
Pikeperch	*Sander lucioperca*	363	0.39	1,557	0.20
European perch	*Perca fluviatilis*	126	0.13	670	0.09
Silver perch	*Bidyanus bidyanus*	271	0.29	365	0.05
Murray cod	*Maccullochella peelii*	8	0.01	266	0.03
Barcoo grunter	*Scortum barcoo*			64	0.01
American yellow perch	*Perca flavescens*			24	0.00
Golden perch	*Macquaria ambigua*	2	0.00	3	0.00
Freshwater perch-like fishes (Percoidea, freshwater)		**93,853**	**100.00**	**770,040**	**100.00**

Ways to increase pikeperch production in Kazakhstan include, among others, the following:

- Pikeperch may be farmed extensively as an additional species in carp culture in earthen ponds. Yet, it may not become a target farming species in Kazakhstan in the near future.
- There should be more efforts in basic research and practical experiments of pikeperch aquaculture to lay a foundation for a potential leap forward in pikeperch farming in the future.
- Kazakhstan may learn from pikeperch farming experiences in other countries. Pikeperch stock enhancement has for many years played an important role in maintaining fisheries in the Danube Delta of Romania.
- Kazakhstan may also learn from experiences of the aquaculture development of similar species. In North America, there has been substantial progress in the hatching, restocking, and farming of walleye, also known as yellow pike (*Sander vitreus*),[47] the North American cousin of pikeperch. Pikeperch has been marketed in the North America as walleye or walleye pike.[48] The farming of

[47] Summerfelt, R. C. 1996. *Walleye Culture Manual*. NCRAC Culture Series 101. North Central Regional Aquaculture Center (NCRAC). Iowa State University. www.ncrac.org/content/walleye-culture-manual; Davidson, J., R. Summerfelt, F. Barrows, B. Gottsacker, C. Good, G. Fischer, and S. Summerfelt. 2016. "Walleye Sander vitreus Performance, Water Quality, and Waste Production in Replicated Recirculation Aquaculture Systems When Feeding a Low Phosphorus Diet without Fishmeal versus a Traditional Fishmeal-Based Diet." *Aquacultural Engineering* 75: 1–13.

[48] Summerfelt, R. C., R. D. Clayton, J. A., Johnson, and R. E. Kinnunen. 2010. "Production of Walleye as Potential Food Fish." NCRAC Extension Fact Sheets (7-2010). North Central Regional Aquaculture Center (NCRAC). Iowa State University. https://www.ncrac.org/files/biblio/WFS116secure.pdf

mandarin fish, also known as Chinese perch (*Siniperca chuatsi*) in China, which started in the early 1970s and developed into a 300,000 tons industry in 2018, may also offer useful experiences and lessons.[49]

While the production of northern pike and European perch were much less than pikeperch in Kazakhstan, the world production of the two species were slightly greater than pikeperch (Table E12 and Table E13). Similar to pikeperch, there was only a small amount of aquaculture production of the two species: 1,324 tons for northern pike (Table E12) and 670 tons for European perch.

TABLE E12: GLOBAL FISHERIES AND AQUACULTURE PRODUCTION OF NORTHERN PIKE, 2018

Capture fisheries production of northern pike			Aquaculture production of northern pike		
Country or territory	Tons	Share of total (%)	Country or territory	Tons	Share of total (%)
1. Russian Federation	21,994	60.74	1. Russian Federation	772	58.33
2. Finland	7,200	19.88	2. Poland	150	11.33
3. Uzbekistan	1,940	5.36	3. Belarus	133	10.03
4. Canada	1,721	4.75	4. Czechia	87	6.57
5. Kazakhstan	810	2.24	5. Germany	44	3.32
6. Sweden	653	1.80	6. Lithuania	40	3.05
7. Poland	241	0.67	7. Hungary	23	1.77
8. Romania	221	0.61	8. Kazakhstan	20	1.51
9. Germany	209	0.58	9. Romania	17	1.27
10. Estonia	207	0.57	10. Bulgaria	12	0.92
Others	1,016	2.81	Others	25	1.89
World	**36,212**	**100.00**	**World**	**1,324**	**100.00**

Data source: FAO.

[49] Ren et al 2019;Li, W., B. J. Hicks, M. Lin, et al. 2018. « Impacts of Hatchery-Reared Mandarin Fish Siniperca chuatsi Stocking on Wild Fish Community and Water Quality in a Shallow Yangtze Lake." *Sci Rep* 8, 11481. https://doi.org/10.1038/s41598-018-29758-z; He, S., L. Li, L. Y. Lv, et al. 2020. "Mandarin Fish (Sinipercidae) Genomes Provide Insights into Innate Predatory Feeding." *Commun Biol* 3, 361. https://doi.org/10.1038/s42003-020-1094-y.

Kazakhstan may not have enough resources to pursue all three species (pikeperch, northern pike, and European perch) at the same time with equal force; prioritization is needed. Judging from market potential, pikeperch tends to be a more advantageous aquaculture species for Kazakhstan than the other two species, whereas a more comprehensive assessment is needed to consider their technical feasibility.

TABLE E13: GLOBAL FISHERIES AND AQUACULTURE PRODUCTION OF EUROPEAN PERCH, 2018

Capture fisheries production of European perch			Aquaculture production of European perch		
Country or territory	Tons	Share of total (%)	Country or territory	Tons	Share of total (%)
1. Russian Federation	14,338	49.76	1. Switzerland	305	45.51
2. Finland	8,457	29.35	2. Russian Federation	284	42.38
3. Estonia	1,737	6.03	3. Kazakhstan	60	8.95
4. Sweden	1,044	3.62	4. Czechia	14	2.09
5. Poland	798	2.77	5. Denmark	2	0.30
6. Kazakhstan	710	2.46	6. Italy	2	0.30
7. United Kingdom	400	1.39	7. Bulgaria	2	0.29
8. Germany	365	1.27	8. Romania	1	0.19
9. Switzerland	344	1.19			
10. Albania	162	0.56			
Others	459	1.59			
World	**28,814**	**100.00**	**World**	**670**	**100.00**

Data source: FAO.

Sturgeons and caviar

Sturgeons

Capture fisheries production of sturgeons is forbidden in Kazakhstan to protect the endangered species. According to the national statistics, Kazakhstan's sturgeon aquaculture production in 2019 was 179 tons, which was much lower than the 650 tons production in 2018. The decline, which may be overstated because of the unavailability of the production data in Atyrau,[50] occurred to all the three sturgeon species and in all regions (Table E14).

[50] In December 2018, mortalities occurred in sturgeon farms in Atyrau with 102 tons of female sturgeon with caviar dead because of water pollution caused by the combined heat and power plant located upstream of the Ural river.

TABLE E14: STURGEON AQUACULTURE PRODUCTION IN KAZAKHSTAN

Region	All sturgeon species		Siberian sturgeon (A. baerii)		Sterlet (A. ruthenus)		Beluga (Huso huso)	
	2018	2019	2018	2019	2018	2019	2018	2019
Kazakhstan	**650**	**179**	**555**	**141**	**73**	**36**	**23**	**2**
Atyrau region	318	—	286	n.a.	31	n.a.	—	—
Mangystau region	150	89	96	65	31	22	23	2
Turkistan region (including Shymkent city)	116	33	111	33	6	—	—	—
Almaty region	23	12	23	12	—	—	—	—
Karagandy region	13	2	13	2	—	—	—	—
West Kazakhstan region	4	—	n.a.	n.a.	4	n.a.	—	—
East Kazakhstan region	—	23	—	23	—	—	—	—

Data source: Bureau of National Statistics, Kazakhstan.

Sturgeon and caviar production tends to be a capital-intensive business suitable primarily for large enterprises with strong financial/technical capacity and good market channels. There has been much interest in sturgeon farming in Kazakhstan. According to the unofficial data based on field survey, as of 2017, there were 30 sturgeon farms in Kazakhstan with the total annual production capacity of 1,500 tons of sturgeon meat and 27 tons of caviar (Table E15). There are a variety of sturgeon farming systems in Kazakhstan with RAS being the main system, and nearly the entire caviar production capacity is from RAS (Table E16).

TABLE E15: OPERATIONAL STURGEON FARMS IN KAZAKHSTAN, 2017

Region (ranked by meat production capacity)	Number of farms	Designed capacity (tons)	
		meat	caviar
Almaty	11	561	5
Atyrau	3	304	6
Aktobe	1	150	-
Karagandy	4	101	1
Zhambyl	1	90	-
Mangistau	3	81	1
West Kazakhstan	2	71	9
Turkestan	1	60	1

TABLE E.15

Region (ranked by meat production capacity)	Number of farms	Designed capacity (tons)	
		meat	caviar
East Kazakhstan	3	51	4
Pavlodar	1	35	-
Total	**30**	**1,503**	**27**

Data source: Unofficial data based on field survey.

TABLE E16: STURGEON FARMING SYSTEMS IN KAZAKHSTAN, 2016

Farming system (ranked by meat production capacity)	Number of farms	Designed capacity (tons)	
		Meat	Caviar
All systems	**23**	**793**	**17**
RAS	13	566	16
Ponds	2	103	0
Cages	2	57	1
Basin	4	41	0
Mixed (tank + pond)	2	27	0

Data source: Unofficial data based on field survey.

Most of Kazakhstan's sturgeon production is for domestic consumption. In 2020, the first-sale price of farmed sturgeon in Kazakhstan was KZT 4,067/kg ($9.68/kg), which was much higher than that of other species. Few online fish stores offer sturgeon products; thus, only one sturgeon product was found, that is, smoked sturgeon fillet offered by Instashop (Almaty city) at KZT 32,480/kg ($77/kg).

Modest increase in demand for sturgeon

According to estimates, Kazakhstan's domestic market growth potential for sturgeons between 2018 and 2030 is only 177 tons, which, given the 657 tons baseline domestic demand, implies 834 tons of domestic demand for sturgeons in 2030. This is a little more than half of the 1,503 tons existing production capacity and much less than the 3,528 tons of sturgeon production target in the KFDP.

Way forward for sturgeon aquaculture in Kazakhstan

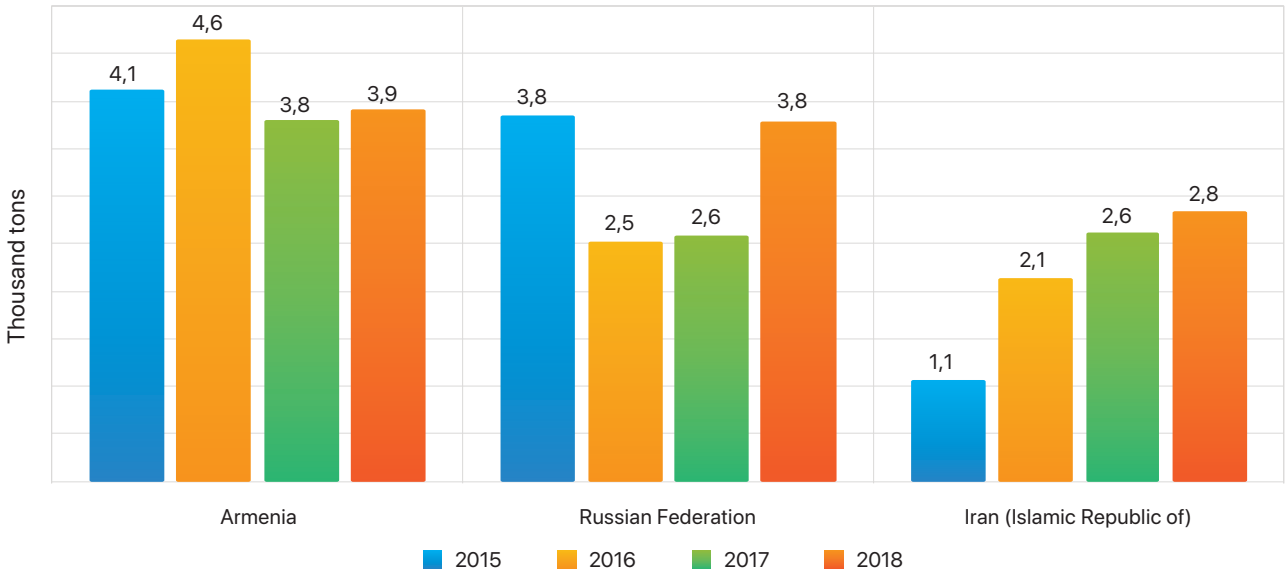
According to the latest FAO statistics, 35 countries/territories contributed to the 115,236 tons of global aquaculture production of sturgeons and paddlefishes in 2018, and the top four producing countries are neighbors of Kazakhstan (Table E17). China accounted for 84% of the production, and most of sturgeon/paddlefish aquaculture production in China occurred in warmer places (compared to Kazakhstan) that allow faster growth of sturgeons. Armenia, Russia, and the Islamic Republic of Iran also had substantial sturgeon aquaculture production; yet production in the former two has been stagnant in recent years (Figure E1).

TABLE E17: GLOBAL STURGEONS/PADDLEFISHES AQUACULTURE PRODUCTION, 2018

Country or territory	Aquaculture production of sturgeons and paddlefishes	
	Tons	Share of total (%)
1. China	96,914	84.10
2. Armenia	3,910	3.39
3. Russian Federation	3,791	3.29
4. Iran, Islamic Rep.	2,839	2.46
5. Vietnam	1,400	1.21
6. Italy	1,179	1.02
7. United States of America	1,166	1.01
8. Poland	784	0.68
9. Kazakhstan	560	0.49
10. Bulgaria	520	0.45
Others	*2,173*	*1.89*
World	**115,236**	**100.00**

Data source: FAO.

FIGURE E1: STURGEON / PADDLEFISH AQUACULTURE PRODUCTION IN THREE NEIGHBORING COUNTRIES OF KAZAKHSTAN, 2015–2018



Data source: FAO.

According to the national statistics, sturgeon aquaculture production faced a similar situation, declining from 650 tons in 2018 to 179 tons in 2019 (Table E14). While the magnitude of the decline may be overstated because of the missing of the production figure for Atyrau, the decline was generally in all regions. Multiple factors have contributed to the lack of growth in sturgeon aquaculture in Kazakhstan:

- The incorrect assessment of the sturgeon market capacity is a fundamental issue. Investors were attracted by the high price of caviar but paid inadequate attention to the change in market conditions when the supply surged, and the business plans were designed based on an overoptimistic assumption that all production could be sold.
- There is limited domestic demand in Kazakhstan for sturgeon meat and black caviar, and the competition in the international markets from other producing countries is harsh (for example, China and Russia).
- There are technical issues such as inappropriate farm design, unreliable equipment, and/or inadequate expertise and experiences in running RAS systems.

Lowering the cost of sturgeon aquaculture production is crucial to increasing its demand in both domestic and foreign markets. As the situation of sturgeon demand lower than supply tends to persist in the near future,[51] sturgeon farming in Kazakhstan may need to go through a process of consolidation before it becomes a mature, robust industry. The public sector can help provide good market and sector information and set guidance and standards to facilitate the sustainable development of the sturgeon sub-sector.

Caviar

There is no target of caviar production in the current version, but an earlier draft of the KFDP has set a target of 10 tons caviar production in 2030.

According to an industry report,[52] 45 countries worldwide legally produced around 360 tons of caviar in 2017. The large producers include China (100 tons, 27.5% of the total), Russia (49 tons, 13.5%), Italy (43 tons, 11.8%), France (37 tons, 10.2%), Poland (20.4 tons, 5.6%), Germany (16.1 tons, 4.4%), and the United States of America (15.9 tons, 4.37%).

According to the report, Kazakhstan's caviar production was 0.4 tons in 2017, lower than some neighboring countries such as Armenia (4 tons), Azerbaijan (3 tons), the Kyrgyz Republic (1 ton) and Uzbekistan (0.5 tons). While many sturgeon farms in Kazakhstan are interested in producing caviars, only three farms have current production, and one farm plans to start harvesting caviar in 2021.

Under this situation, the 10-ton caviar production target in 2030 set in the KFDP appears ambitious. However, Kazakhstan has ample caviar production capacity (17 tons according to Table E16), and the successful experience of China in producing high-quality caviar through farmed sturgeons is encouraging. As one of the Caspian countries, Kazakhstan may enjoy a branding advantage in Beluga caviar.

Trout and salmon

Similar to sturgeons, the production of trout and salmon in Kazakhstan primarily came from aquaculture. According to the national statistics, trout and salmon aquaculture production in Kazakhstan increased from 277 tons in 2016 to 786 tons in 2019, and the production comprised primarily rainbow trout and a small amount of unspecified salmon produced in Mangystau (Table E17). The rainbow trout aquaculture in 2019 was concentrated in East Kazakhstan and Almaty with a relatively small amount of

[51] Bronzi, P., M. Chebanov, J. T. Michaels, Q. Wei, H. Rosenthal, and J. Gessner. 2019. "Sturgeon Meat and Caviar Production: Global Update 2017." *J. Appl. Ichthyol*. 2019 (35): 257–266.

[52] Bronzi et al. 2019.

production in Turkistan and some sporadic production in Karagandy.

In 2019, 13 rainbow trout farming operations with nearly 3,000 tons of production capacity harvested only a little over 500 tons of fish. Most of the production capacity belongs to two cage farms in East Kazakhstan with over 1,000 tons production capacity each (Table E18). While the four cage farms (as well as the three pond farms to a less extent) operated well below their design capacities, two RAS farms (#3 and #5) and the tank farm operated at full capacity.

TABLE E18: TROUT AND SALMON AQUACULTURE PRODUCTION IN KAZAKHSTAN, 2016–2019

Region (farming species)	2016	2017	2018	2019	
	Tons	Tons	Tons	Tons	Share (%)
Kazakhstan	**277**	**502**	**568**	**786**	**100.00**
East Kazakhstan (rainbow trout)	1	n.a.	133	345	43.88
Almaty region (rainbow trout)	202	n.a.	289	322	41.01
Turkistan region (rainbow trout)	66	n.a.	115	91	11.64
Karagandy region (rainbow trout)	—	16	—	1	0.17
Mangystau region (unspecified salmon)	8	22	31	26	3.30

Data source: Bureau of National Statistics, Kazakhstan.

Some of the 13 farms have their own processing facilities, mostly gutting and chilling, and the RAS farm #4 in Turkistan (established in 2009) has a more complete set of processing facilities that also include salting, drying, smoking, and vacuum packing. Some of the farms have their own trading operations, including delicatessen shops (cage farm #4 in Karagandy), frying fish on-site or their own restaurant (pond farm #1 in Almaty and RAS farm #4 in Turkistan), and fish kiosk (RAS farm #1 in Almaty) (Table E19).

In 2020, the average farm gate price of rainbow trout in Kazakhstan was KZT 1,516/kg ($3.61/kg), which was higher than most other species except for sturgeons. A recent market survey shows that live trout was sold at KZT 2,100/kg ($5/kg) in a supermarket in Almaty.

According to the price lists from several online fish stores (Table E20),

- The retail prices of whole trout ranged from KZT 1,200/kg ($2.86/kg) for brook trout to KZT 5,050/kg ($12.02/kg) for large trout over 2 kg;
- The local whole rainbow trout offered by Rybprom at KZT 2,000/kg was much cheaper than imported whole trout from Turkey (KZT 3,630/kg) or from Norway (KZT 3,700/kg);
- There were large premiums for large-size trout—the price of large trout (1.2–1.8 kg, KZT 4,950/kg) was more than twice the price of 300–350 g gutted trout (tail off, head on) offered by Fish House; and
- The local rainbow trout fillet offered by Rybprom at KZT 2,800/kg was much cheaper than trout fillet imported from Norway (KZT 4,550/kg).

TABLE E19: RAINBOW TROUT AQUACULTURE PRODUCTION CAPACITY IN KAZAKHSTAN, 2019

Technology	Location	Water source	Project starting date	Design capacity (tons per year)	2019 production (tons)	Own processing facilities	Own trading capacity
Cage operations				2,320	174		
Cage farm 1	East Kazakhstan	Ust'-Kamenogorsk reservoir	2017	1,200	100	Unknown	Unknown
Cage farm 2	East Kazakhstan	Ust'-Kamenogorsk reservoir	2017	1,000	65	No. Fish transferred to the parent company for processing.	No
Cage farm 3	East Kazakhstan	Small reservoir at springs	2018	105	4	No	No
Cage farm 4	Karagandy	Topar reservoir	2010	15	5	Gutting, chilling	One delicatessen shop in Karagandy city
Pond operations							
Pond farm 1	Almaty	Turgen river	2014	100	50	Gutting, cleaning on-site	Frying fish on-site for tourists
Pond farm 2	Almaty	Well	2018	100	12	No	No
Pond farm 3	Turkistan	Unknown	2016	32	—	Unknown	No data
RAS operation							
RAS farm 1	Almaty	Well	2008	50	50	No	Fish kiosk in Almaty city
RAS farm 2	Almaty	Well	2015	50	23	No	No
RAS farm 3	Almaty	Well	2009	50	1.3	No	No
RAS farm 4	Turkistan	Well	2009	30	13	Gutting, chilling, salting, drying, smoking, and vacuum packing	On farm trade, frying on own restaurant
RAS farm 5	Turkistan	Well	2012	15	15	No data	No data
Tank operation							
Tank farm 1	Almaty	Issyk River	2015	198	166	Gutting and chilling	No. Chilled fish exported to Russian Federation. Caviar for processing is transferred to Rybprom LLP (Almaty). In 2020, the farm attempted to self-process the caviar.
All 13 farms				**2,945**	**504**		

Data source: Forest Committee and regional *Akimats* (regional executive bodies).

TABLE E20: RETAIL PRICES OF TROUT PRODUCTS IN KAZAKHSTAN, 2020

Species	Origin	Retail price from online stores		Source
		KZT/kg	$/kg	
Whole fish				
Trout, whole, > 2 kg	Kazakhstan	5,050	12.02	Fish house
Trout, whole, 1.2–1.8 kg	Kazakhstan	4,950	11.79	Fish house
Trout, whole, superior	Norway	3,700	8.81	Fish house
Trout, whole	Turkey	3,630	8.64	Instashop (Almaty city)
Rainbow trout, whole		2,000	4.76	RYBPROM
Char, whole		1,200	2.86	Sapa-M LLP (Kostanay)
Gutted				
Trout, gutted, head off		4,400	10.48	Sapa-M LLP (Kostanay)
Trout, gutted, tail off, head on, 300–350 g	Kazakhstan	2,000	4.76	Fish House
Fillet/steak				
Rainbow trout, fillet		2,800	6.67	RYBPROM
Trout, fillet, vacuum packed	Norway	4,550	10.83	Fish house
Trout, steak, vacuum packed	Norway	4,050	9.64	Fish house
Smoked				
Char, cold-smoked, gutted		2,200	5.24	Sapa-M LLP (Kostanay)

Data source: estimates based on research for this report.

Kazakhstan had little salmon production yet imported a large amount of Atlantic salmon and a variety of other salmon products. Indeed, the country's nearly 5,000 tons (product weight) import of frozen whole Atlantic salmon was worth $22 million and accounted for one-fourth of the total fish and seafood import value in 2018. Kazakhstan also imported 136 tons ($1.45 million) of fresh/chilled salmon (HS030214), the price of which ($10.71) was more than twice that of the frozen Atlantic salmon ($4.73/kg). The country also imported 440 tons ($1.41 million) of frozen Pacific salmon whose price ($3.21/kg) was lower than that of frozen Atlantic salmon.

Salmon appears to be the most popular fish product offered by many online fish stores with a variety of products — see Table E21 for a small sample. The KZT 3,700/kg ($8.81/kg) price of whole Atlantic salmon (6 – 7 kg) offered by Radovnya (Kostanay city) is similar to the prices of imported whole trout. This may indicate that Kazakhstani consumers may differentiate salmon according to their size and color instead of the exact species, yet more data and a rigorous investigation are needed to verify the conjecture. In addition to Atlantic salmon, Kazakhstan also imported a variety of Pacific salmon, including those cheaper

than Atlantic salmon (for example, coho/silver salmon, humpback/pink salmon, sockeye/red salmon, and chum/dog salmon) and king/chinook/quinnat salmon that appeared to be more expensive.

Both the international statistics (FAO and UN Comtrade) and national statistics indicate that in 2018, Kazakhstan exported 336 tons of fresh/chill trout (HS030211) with Russia being the sole destination.[53] According to a survey in March 2019, the wholesale prices in Moscow and St. Petersburg were $4.33/kg for standard size trout (0.8 kg) and $6.5/kg for large trout (1.5/kg).

Expected modest increase in demand for trout and salmon production from Kazakhstan

According to estimates, the baseline domestic consumption of rainbow trout in 2018 was 618 tons (live weight), the baseline export was 336 tons, and the domestic and foreign market growth potential driven by income and population growth between 2018 and 2030 is 192 tons. The sum of the three figures is equal to 1,146 tons, which is less than half of the existing 2,945 tons of the existing capacity of rainbow aquaculture in Kazakhstan (Table E18).

Kazakhstanis consumed 6,144 tons (live weight) of imported salmon products in 2018, and the demand could increase by 1,656 tons because of income and population growth in Kazakhstan, which could raise the demand to 7,800 tons in 2030. Substituting local rainbow trout products for the salmon import would help utilize the existing production capacity of rainbow trout. However, even if the local rainbow trout products were able to entirely substitute imported salmon products, the overall demand would still fall short of the country's 16,629 tons of target for rainbow trout production in 2030, not to mention the daunting target of over 100,000 tons of Caspian salmon production.

Therefore, substantial efforts are needed to increase domestic and export market potential to help realize the production targets set in the KFDP. Similar to the case of sturgeon, the demand increase would entail lowering the cost of trout and salmon production in Kazakhstan.

TABLE E21: RETAIL PRICES OF SALMON PRODUCTS IN KAZAKHSTAN, 2020

Species	Retail price from online stores		Source
	KZT/kg	$/kg	
Whole fish			
Atlantic salmon, whole (6–7 kg)	3,700	8.81	Radovnya (Kostanay city)
Coho/silver salmon, whole	2,750	6.55	Radovnya (Kostanay city)
Humpback/pink salmon, whole	1,950	4.64	Radovnya (Kostanay city)
King/Chinook/Quinnat salmon (Far East), whole (4–10 kg)	6,705	15.96	Instashop (Almaty city)
Fillet/steak			
Atlantic salmon, fillet	6,300	15.00	Radovnya (Kostanay city)
Atlantic salmon, steak (300 g)	5,800	13.81	Radovnya (Kostanay city)

[53] Yet the $130,000 value of the export implied an unrealistically low price (only $0.4/kg) for fresh/chilled trout.

TABLE E.21

Species	Retail price from online stores		Source
	KZT/kg	$/kg	
Sockeye/red salmon, steak	4,300	10.24	Sapa-M LLP (Kostanay)
Dried/salted/smoked			
Atlantic salmon, slightly air-dried fillet	6,500	15.48	Radovnya (Kostanay city)
Coho/silver salmon, air-dried	2,000	4.76	Radovnya (Kostanay city)
Chum/keta salmon, slightly air-dried	1,600	3.81	Radovnya (Kostanay city)
Atlantic salmon, slightly salted, fillet	6,700	15.95	Radovnya (Kostanay city)
Sockeye/red salmon (Far East), light salted	7,866	18.73	Instashop (Almaty city)
Atlantic salmon, cold-smoked fillet	6,150	14.64	Sapa-M LLP (Kostanay)
Chum/keta salmon, smoked	5,445	12.96	Instashop (Almaty city)
Humpback/pink, cold-smoked steak	2,800	6.67	Sapa-M LLP (Kostanay)

Data source: estimates based on research for this report.

Rainbow trout

International markets imported 263,000 tons (product weight) of trout products in 2018. EAEC/EurAsEC, including Kazakhstan, the Kyrgyz Republic, Tajikistan, Belarus, and Russia, is the most favorable trout export market for Kazakhstan in the near future. EAEC/EurAsEC imported 30,000 tons of trout products in 2018, which comprised primarily fresh and frozen whole trout.

EU28 imported 127,000 tons (product weight) of trout products in 2018 with a diversified production composition, including around 20,000 tons of frozen whole trout market that can be tapped by Kazakhstan's trout export.

The extent to which Kazakhstan can tap the 50,000 tons of the target export markets (that is, the 30,000 tons of trout import by EAEC/EurAsEC and the 20,000 tons frozen whole trout import by EU28) depends on the competitiveness of its trout products.

According to FAO statistics, the global aquaculture production of rainbow trout in 2018 was 848,051 tons with the Islamic Republic of Iran and Turkey accounting for, respectively, 21.19% and 13.26% of the production. Russia was the only EAEC/EurAsEC member among the top 10 trout farming countries (Table E22).

TABLE E22: TOP 10 RAINBOW TROUT FARMING COUNTRIES, 2018

Country or territory	Aquaculture production of rainbow trout, 2018	
	Tons	Share of total (%)
1. Iran, Islamic Rep.	179,684	21.19
2. Turkey	112,427	13.26
3. Chile	78,446	9.25

TABLE E.22

Country or territory	Aquaculture production of rainbow trout, 2018	
	Tons	Share of total (%)
4. Norway	68,216	8.04
5. Peru	55,030	6.49
6. China	38,606	4.55
7. Russian Federation	35,204	4.15
8. Italy	32,826	3.87
9. Denmark	29,737	3.51
10. France	26,100	3.08
Others	191,776	22.61
World	**848,051**	**100.00**

Data source: FAO.

In 2018, the EAEC/EurAsEC imported 11,796 tons of frozen whole trout (HS030314); 10,712 tons of which went to Russia. Chile was the largest exporter and Peru the third largest, despite their long distance to the market (Table E23). This indicates that for frozen trout export, geographic proximity may be less important than other factors, such as the quantity, quality, and stability of the supply. The Kyrgyz Republic was the only EAEC / EurAsEC member among the top 10 frozen trout exporters to EAEC / EurAsEC.

TABLE E23: IMPORT OF FROZEN WHOLE TROUT (HS030314) BY THE EAEC/EURASEC, 2018

Top 10 exporters	Frozen whole trout (HS030314) import by EAEC/EurAsEC, 2018			
	Tons	Market share (%)	Value ($, thousands)	Price ($/kg)
1. Chile	5,642	47.83	43,746	7.75
2. Turkey	3,057	25.91	14,922	4.88
3. Peru	1,237	10.48	7,336	5.93
4. Norway	573	4.86	3,460	6.04
5. China	381	3.23	2,915	7.65
6. Kyrgyz Republic	264	2.24	1,223	4.63
7. Iran, Islamic Rep.	145	1.23	916	6.32
8. Finland	136	1.15	210	1.55
9. Denmark	84	0.71	481	5.71
10. Estonia	78	0.66	125	1.60
Rest of the world	200	1.69	1,197	5.99
World	**11,796**	**100.00**	**76,533**	**6.49**

Data source: UN Comtrade.

Note: The members of the EAEC/EurAsEC include Kazakhstan, Kyrgyz Republic, Tajikistan, Belarus, and Russian Federation.

In 2018, the EAEC/EurAsEC imported 16,359 tons of fresh whole trout (HS030211); 9,563 tons went to Belarus and 6,743 went to Russia. Norway was the largest exporter, and all the top 10 exporters are in relatively close proximity to the market (Table E24). This reflects the importance of geographic proximity for fresh trout export. Three EAEC/EurAsEC members (Kazakhstan, Belarus, and Russia) were among the top 10 exporters to the market, and a Caucasus country, Armenia was the third largest exporter.

TABLE E24: IMPORT OF FRESH WHOLE TROUT (HS030211) BY EAEC/EURASEC, 2018

Top 10 exporters	Fresh whole trout (HS030211) import by EAEC/EurAsEC, 2018			
	Tons	Market share (%)	Value ($, thousands)	Price ($/kg)
1. Norway	8,119	49.63	60,710	7.48
2. Turkey	2,997	18.32	16,091	5.37
3. Armenia	2,985	18.25	17,736	5.94
4. Finland	884	5.40	4,438	5.02
5. Denmark	533	3.26	2,697	5.06
6. Kazakhstan	336	2.05	130	0.39
7. Belarus	225	1.37	1,087	4.83
8. Faeroe Islands	141	0.86	648	4.61
9. Iran, Islamic Rep.	60	0.36	327	5.48
10. Russian Federation	44	0.27	143	3.28
Rest of the world	38	0.23	277	7.25
World	**16,359**	**100.00**	**104,285**	**6.37**

Data source: UN Comtrade.
Note: The members of the EAEC/EurAsEC include Kazakhstan, Kyrgyz Republic, Tajikistan, Belarus, and Russian Federation.

In 2018, EU28 imported 19,401 tons of frozen whole trout (HS03014) with Turkey being the largest exporter accounting for one-third of the market. The $4.46/kg average price in the EU market for frozen trout import was much lower than that of the EAEC/EurAsEC market ($6.49/kg). No country in EAEC/EurAsEC or Central Asia and the Caucasus was among the top 10 exporters of frozen whole trout to the EU market (Table E25).

TABLE E25: EU28'S IMPORT OF FROZEN WHOLE TROUT (HS030314) IN 2018

Top 10 exporters	EU28's import of frozen whole trout (HS030314), 2018			
	Tons	Market share (%)	Value ($, thousands)	Price ($/kg)
1. Turkey	6,716	34.62	24,387	3.63
2. Denmark	2,982	15.37	16,309	5.47

TABLE E.25

Top 10 exporters	EU28's import of frozen whole trout (HS030314), 2018			
	Tons	Market share (%)	Value ($, thousands)	Price ($/kg)
3. Spain	2,362	12.17	9,968	4.22
4. United Kingdom	1,204	6.21	6,017	5.00
5. Norway	1,021	5.26	5,785	5.67
6. France	685	3.53	2,285	3.33
7. Netherlands	640	3.30	2,848	4.45
8. Poland	537	2.77	2,009	3.74
9. Sweden	443	2.29	4,696	10.59
10. Albania	442	2.28	1,418	3.21
Rest of the world	2,368	12.21	10,750	4.54
World	**19,401**	**100.00**	**86,472**	**4.46**

Data source: UN Comtrade.

Suppose that Kazakhstan can manage to increase its domestic trout consumption to 0.36 kg, which was Russia's per capita trout consumption in 2018;[54] then the total trout consumption of its 20.639 million population would be approximately 7,400 tons in 2030.

EAEC/EurAsEC has a limited market growth potential (for example, only 7.5% growth for Russia between 2018 and 2030) because of the relatively low population and income growth in the member countries. For simplicity, assuming a 10% market growth potential, the EAEC/EurAsEC import market for fresh whole trout could increase to 18,000 tons. It may be difficult for Kazakhstan to compete with Norway and Turkey in the fresh trout market, but it could take Armenia to become the third largest exporter holding 18% of the market. Under this situation, Kazakhstan could export 3,200 tons of fresh trout to EAEC-EurAsEC.

Similarly, suppose that the EAEC/EurAsEC and EU28 import of frozen whole trout increase 10% between 2018 and 2030 (reaching, respectively, 13,000 tons and 21,000 tons in 2030) and Kazakhstan manages to hold 5% of each market, then Kazakhstan's frozen trout export to the EAEC/EurAsEC and EU markets could reach 1,700 tons.

The 3,200 tons of fresh/chilled trout export to EAEC/EurAsEC plus the 1,700 tons of frozen trout export to EU28 and EAEC/EurAsEC equal to 4,900 tons of total trout export, which, together with the 7,400 tons of domestic consumption, gives 12,300 tons of total market capacity in 2030 for trout production in Kazakhstan.

As rainbow trout is a popular fish commodity, Kazakhstan may not need to spend much effort in marketing but could focus on improving the quality and lowering the cost of rainbow trout production and enhancing the efficiency of its fish value chain. The current $3.61/kg farm gate price of rainbow trout in Kazakhstan is lower than the average $6.37/kg price of EAEC/EurAsEC's fresh trout import. Yet, price is not

[54] In 2018, Russia had 35,204 tons of domestic aquaculture production of rainbow trout, imported 17,455 tons, and exported 396 tons, which gives the apparent trout consumption was 52,263 tons. Given the country's 146 million population in 2018, the estimated per capita trout consumption in 2018 was 0.36 kg.

the only factor that matters in international fish trade. Kazakhstan needs to maintain a stable supply of a substantial amount of high-quality products to outcompete other exporters.

In terms of farming systems, RAS is less constrained by terrain and soil conditions; yet it is difficult to become the main contributor to export-oriented rainbow trout production because of its relatively high production cost. Flowing through systems, such as raceway or tank, can produce high-quality rainbow trout at a relatively low cost; yet they tend to be constrained by the availability of suitable water source. Cage culture tends to be the main contributor to export-oriented trout production in Kazakhstan because of its relatively low production cost and less constraint over production expansion. However, it is crucial to have proper planning and management to ensure the long-term sustainability of cage culture, especially in inland water bodies.

In terms of industrial organization, it tends to be difficult for a trout farming industry composed of a number of small-scale operations to be competitive in the international markets because of the lack of economies of scale in not only production but also marketing. Experiences in other countries indicate that a leading entity, being a large company (for example, the Akvatekhavtomatika company in Armenia)[55] or a functional association (for example, the Vietnam Association of Seafood Exporters and Producers [VASEP]), is often crucial to an export-oriented aquaculture industry. While such leading entities are usually molded by market forces, the public sector can adopt a policy to facilitate the process.

Caspian salmon

Caspian salmon (*Salmo trutta caspius*) is a subspecies of *Salmo trutta* commonly known as brown trout. The KFDP sets an ambitious target of annual aquaculture production of 100,000 tons of Caspian salmon by 2030. This is a daunting task in terms of both production and marketing, especially since Caspian salmon is not an established aquaculture species. While some countries (for example, Azerbaijan[56]) culture Caspian salmon fingerlings for stock enhancement, there is little commercial aquaculture of the species.

With the lack of experience in Caspian salmon farming, global experiences in the aquaculture of other salmon species provides some guidance. According to FAO statistics,

- The world aquaculture production of Atlantic salmon (*Salmo salar*) increased from 294 tons in 1970 to 2.4 million tons in 2018 (Table E26). Totally 21 countries/territories have farmed the species during the period; yet only 13 countries (primarily Norway and Chile) contributed to the production in 2018;
- The world aquaculture production of coho/silver (*Oncorhynchus kisutch*) increased from 250 tons in 1970 to 166,521 tons in 2018. Totally 10 countries have farmed the species during the period; yet only two countries (primarily Chile with a small amount of production from Japan) contributed to the production in 2018;
- The world aquaculture production of chinook/king salmon (*Oncorhynchus tshawytscha*) increased from 234 tons in 1985 to 16,291 tons in 2018. Totally five countries have farmed the species during the period; yet the 2018 production was contributed solely by New Zealand; and
- Norway, Chile, United Kingdom, and Canada were the only countries with annual salmon aquaculture production exceeding 100,000

[55] World Bank. 2013. "Case Study: Akvatekhavtomatika CJSC – Fish-Breeding in a Landlocked Economy." In *Fostering Entrepreneurship in Armenia* (pp. 33–37). http://documents1.worldbank.org/curated/en/462221468008429321/pdf/Fostering-entrepreneurship-in-Armenia.pdf.

[56] In Azerbaijan, there have been state-funded operations to restock Caspian salmon with limited impact, and the stock of Caspian salmon has yet to recover to the level that can sustain commercial fisheries of the species.

tons. It took Norway 26 years (from 1964 to 1989) to increase salmon production from nil to over 100,000 tons, Chile 19 years (from 1978 to 1996), United Kingdom 29 years (from 1970 to 1998), and Canada 36 years (from 1979 to 2014).

TABLE E26: TRENDS OF WORLD SALMON AQUACULTURE PRODUCTION, 1970–2018

Year	World aquaculture production (tons)		
	Atlantic salmon (Salmo salar)	Coho/silver salmon (Oncorhynchus kisutch)	Chinook/king salmon (Oncorhynchus tshawytscha)
1970	294	250	
1975	1,258	420	
1980	5,288	2,560	
1985	38,797	9,361	234
1990	225,642	39,164	14,998
1995	465,245	58,360	13,444
2000	895,808	108,626	16,664
2005	1,267,297	115,223	10,404
2010	1,437,052	137,510	13,541
2015	2,381,579	140,957	12,474
2018	2,435,948	166,521	16,291

Data source: FAO.

Although the relatively slow production growth in these countries was partly due to stringent environmental regulations constraining the sector development, the historical experiences indicate that Kazakhstan's attempt to increase Caspian salmon aquaculture production from nil to 100,000 tons in a decade is challenging.

As Caspian salmon can be artificially bred and grown, production expansion is technically feasible. The difficulty lies in how to cultivate the species at a cost acceptable to the market, especially when facing strong competition from established species (for example, Atlantic salmon or rainbow trout) that have mature farming technologies and marketing mechanisms.

Caspian salmon also faces a less noticeable yet potentially significant hindrance in marketing as a salmon. While belonging to the same genus as Atlantic salmon (*Salmo salar*) and behaving like salmon in marine water, *Salmo trutta* is commonly deemed a trout species and treated so in trade statistics. Simply marketing Caspian salmon (*Salmo trutta caspius*) as a salmon is not guaranteed success. The controversy on whether steelhead salmon (that is, rainbow trout grown in marine water) is a salmon or a trout is a good lesson to learn.[57] The legitimacy of marketing rainbow trout as 'freshwater salmon' has recently

[57] News article on "Salmon or trout: What the heck is a steelhead, anyway?" https://www.cbc.ca/news/canada/british-columbia/salmon-or-trout-what-the-heck-is-a-steelhead-anyway-1.4461827.

been hotly debated in China, and researchers and industry experts' efforts in justifying the legitimacy from various perspectives (biological, nutritional, and taste) have apparently not been all successful in convincing consumers that rainbow trout is a salmon.

It is a more realistic and viable strategy to treat Caspian salmon as a niche species (that is, focusing on value) and refrain from pursuing it as a commodity species (that is, focusing on volume) before its technical and market prospects are firmly established. As a native, niche species, Caspian salmon tends to have a competitive advantage in local food catering industry and recreational fisheries, and it can be marketed to export markets as a novel salmon/trout product catering high-end customers' love for varieties and novelties. With efforts in improving its aquaculture performance through tailor-made feed and genetics (for example, selected breeding), Caspian salmon could become a promising aquaculture species in Kazakhstan in the long run.

Whitefish

The KFDP set a target of annual aquaculture production of 10,470 tons of whitefish in 2030. In 2018, Kazakhstan produced 358 tons of whitefish, including 104 tons of 'ripus' (small-size whitefish) from capture fisheries and 254 tons of 'peled' (large-size white fish) from aquaculture, and the total whitefish production declined slightly to 316 tons in 2019 (Table E27). North Kazakhstan and East Kazakhstan are the main whitefish producing regions, with a small amount of production in Akmola.

It is worth noting that the differentiation of species and production mode (culture versus capture) in the official whitefish production statistics is for statistical purpose. Both ripus and peled are harvested by Commercial Lake Fish Farms (CLFFs). Five to seven species from the *Coregonidae* family were stocked into the lakes in Kazakhstan. They formed interspecific hybrids over time, and there may be no pure whitefish species in the lakes for a long time. Larvae used to restock the lakes are often considered peled larvae because large-size fish are used as broodstock. Consequently, large-size whitefish are recorded as 'peled' from aquaculture, whereas small whitefish are recorded as 'ripus' from capture fisheries.

TABLE E27: WHITEFISH PRODUCTION IN KAZAKHSTAN, 2018 AND 2019

Region	Capture production (tons)		Aquaculture production (tons)		Total fishery production (tons)	
	Ripus (small-size whitefish)		Peled (large-size whitefish)			
	2018	2019	2018	2019	2018	2019
Kazakhstan	**104.0**	**95.0**	**254.0**	**221.0**	**358**	**316**
North Kazakhstan	1.5	1.5	254.0	213.0	255	215
East Kazakhstan	92.0	86.0	0.3	7.7	93	94
Akmola	10.0	7.0			10	7

Data source: Bureau of National Statistics, Kazakhstan.

Insufficient domestic demand for whitefish

Most of the whitefish production in Kazakhstan is for domestic consumption. In 2020, the average first-sale price was KZT 421/kg ($1/kg) (Table E28).

- The wholesale price of frozen whole whitefish varied from KZT 500/kg ($1.67/kg) to KZT 1,000/kg ($2.38/kg). The larger the fish, the higher the price.
- The retail price of frozen gutted peled was sold at KZT 1,400/kg ($3.33/kg).
- While the price of small dried/smoked whitefish was around KZT 1,600/kg ($3.81/kg), that of large smoked whitefish was around KZT 2,500/kg ($5.95/kg).

According to estimates, income and population growth in Kazakhstan could increase the domestic demand for whitefish by 228 tons between 2018 and 2030. Given 358 tons of baseline whitefish production in Kazakhstan, the domestic whitefish demand in 2030 tends to be around 600 tons, which is trivial compared to the 10,470 tons of production target in 2030.

TABLE E28: WHOLESALE OR RETAIL PRICE OF WHITEFISH PRODUCTS IN KAZAKHSTAN

Location	Type	Product	KZT/kg	$/kg	Date
Karagandy region	Wholesale	Ripus, frozen whole	500	1.19	16/12/2020
East Kazakhstan	Wholesale	Ripus, frozen whole (70–120 g)	580	1.38	30/11/2020
North Kazakhstan	Wholesale	Peled, fresh or frozen	700	1.67	01/09/2020
North Kazakhstan	Wholesale	Peled, frozen whole	900	2.14	03/01/2020
Kostanay	Wholesale	Peled, frozen whole (400 g–500 g)	1,000	2.38	03/01/2021
Akmola	Retail	Peled, frozen gutted	1,400	3.33	22/12/2020
East Kazakhstan		Ripus, dried whole	1,700	4.46	01/05/2019
East Kazakhstan		Ripus, smoked gutted	1,500	3.94	01/05/2019
East Kazakhstan	Wholesale	Ripus/peled/nelma, hot-smoked	1,600	3.81	04/01/2021
East Kazakhstan		Peled, cold-smoked, gutted (350 g–2 kg)	2,400–2,600	6.30–6.82	01/05/2019
Akmola	Retail	Peled, hot-smoked	2,400	5.71	03/01/2021
Shymkent city	Retail	Peled, hot-smoked, from Akmola	4,500	10.71	19/12/2020

Data source: Estimates based on research for this report.

Unclear export market prospect for whitefish

While FAO statistics record 14 countries/territories importing fresh and/or frozen whole whitefish during 1976–2018, only concrete data for two importing countries are recorded for 2018 (Table E29). One is the United States of America which imported 2,600 tons of fresh/chilled and frozen whitefish with $5.38/kg for fresh/chilled whitefish and $3.86/kg for frozen products. The other is Saudi Arabia that imported cheaper whitefish yet at higher volume.

While FAO statistics record 12 countries/territories exporting fresh and/or frozen whole whitefish during 1976–2017, Canada is the only country with concrete whitefish export data shown in the FAO statistics.

TABLE E29: INTERNATIONAL MARKETS OF FRESH OR FROZEN WHITEFISH, 2018

Importer	Product	Value ($, thousands)	Quantity (tons)	Price ($/kg)
United States of America	Fresh/chilled whole whitefish (HS030219)	10,183	1,893	5.38
	Frozen whole whitefish (HS030319)	2,758	714	3.86
Saudi Arabia	Fresh/chilled whole whitefish (HS030219)	6,442	4,743	1.36
	Frozen whole whitefish (HS030319)	1,204	595	2.02

Data source: FAO.

According to UN Comtrade, Kazakhstan exported 2.6 tons ($42,000; $15.97/kg) of fresh/chilled salmonids nei (HS030219) in 2018 to Austria, and it also exported 158 tons ($364,000; $2.31/kg) of frozen salmonids nei (HS030319) to three countries (Table E30). Part or most of the products could be whitefish.

As whitefish is not a major fish commodity with a specific 6-digit HS code, international trade statistics (for example, FAO or UN Comtrade) may not capture all the whitefish importing or exporting countries or all whitefish products (for example, smoked or dried whitefish).

However, judging from the information in Table E29 and Table E30, the export market capacity for whitefish products appears to be much less than for trout products, even though Kazakhstan has a similar production target for rainbow trout and whitefish.

Way forward for whitefish production in Kazakhstan

According to FAO statistics, world whitefish production dropped by half from 56,905 tons in 1990 to 26,853 tons in 2018 because of the decline in the capture fisheries production, whereas the aquaculture production increased from 1,572 tons to 4,413 tons (Table E31).

TABLE E30: KAZAKHSTAN'S EXPORT OF FRESH/CHILLED OR FROZEN SALMONIDS NEI, 2018

Kazakhstan's export	Tons	Value ($, thousands)	Price ($/kg)
Frozen salmonids nei (HS030319)			
World	**158.0**	**364.0**	**2.31**
Kyrgyz Republic	125.0	320.0	2.57
China	31.0	42.0	1.35
Georgia	2.0	2.6	1.30
Fresh salmonids nei (HS030219)			
World	**2.6**	**42.0**	**15.97**
Austria	2.6	42.0	15.97

Data source: UN Comtrade.

TABLE E31: WORLD PRODUCTION OF WHITEFISH (COREGONIDAE)

Year	Capture	Aquaculture	Total
1990	55,333	1,572	56,905
2000	39,243	2,346	41,589
2010	37,399	5,017	42,416
2015	21,840	4,957	26,797
2016	23,407	5,719	29,126
2017	22,401	5,310	27,711
2018	22,440	4,413	26,853

Data source: FAO.

In 2018, all major whitefish producing countries were in Europe or Northern America (Table E32). Canada was the largest capture fisheries whitefish producer with 7,706 tons of production, whereas Russia was the largest aquaculture whitefish producer with 3,558 tons of production. The global experience indicates that Kazakhstan's 10,000 tons target of whitefish production in 2030 tends to be challenging.

TABLE E32: MAJOR WHITEFISH PRODUCING COUNTRIES, 2018

Whitefish capture fisheries production (tons)		Whitefish aquaculture production (tons)	
Canada	7706	Russian Federation	3,558
Finland	4,694	Finland	840
United States of America	2,867	Switzerland	10
Russian Federation	2,096	Czechia	5
Finland	1,788		
Sweden	1,227		
Switzerland	673		
Germany	350		
Estonia	308		
Sweden	220		
Other	511		
World	**22,440**		**4,413**

Data source: FAO.

Under this situation, Kazakhstan may be better off pursuing a niche species development strategy to focus on adding value to whitefish. The focus in the short term could be on improving the productivity of whitefish stock enhancement operations, the quality of whitefish products, and the efficiency of whitefish value chain. There could be a genetic improvement program to develop better seed stock. A pilot test could be conducted to assess the technical and economic performance of whitefish farming. Only when there are clear, substantial market prospects should Kazakhstan pursue semi-intensive or intensive whitefish farming.

Nonnative warmwater species

In the KFDP, three nonnative, warmwater species (that is, catfish, tilapia, and barramundi) appear in the target production list. As these species cannot survive the cold winter in Kazakhstan, there is little chance that they become invasive species. However, their ill-adaptation to the climate conditions in Kazakhstan tends to increase production cost.

Catfish

Catfishes are the seventh largest species group accounting for 5% of global aquaculture production in 2018.[58] According to the national statistics, Kazakhstan captured 1,013 tons of wels catfish (*Silurus glanis*) in 2018 (primarily from Atyrau and Almaty), and the production could be much greater when unreported production is accounted for. Most of Kazakhstan's wels catfish production went to domestic consumption, and their average first-sale price in 2020 was only KZT 117/kg ($0.28/kg).

In 2018, Kazakhstan imported 383 tons of catfish fillets (product weight), including 246 tons of relatively cheap fillets from Vietnam (mostly Pangasius fillets) and 137 tons of more expensive fillets from Russia. The country also imported a small amount of fresh/chilled catfish fillets and frozen catfish from Russia (Table E33).

TABLE E33: KAZAKHSTAN'S IMPORT OF CATFISH PRODUCTS, 2018

Products	Tons	$, thousands	$/kg
Catfish, frozen fillet (HS030462)	**383.0**	**647.0**	**1.69**
Vietnam	246.0	264.0	1.07
Russian Federation	137.0	383.0	2.80
Catfish, fresh/chilled fillet (HS030432)	**2.0**	**6.5**	**3.25**
Russian Federation	2.0	6.5	3.23
Catfish, frozen (HS030324)	**0.8**	**2.3**	**3.07**
Russian Federation	0.8	2.3	3.07

Data source: UN Comtrade.

[58] FAO. 2020. "Top 10 Species Groups in Global Aquaculture 2018." WAPI factsheet. www.fao.org/3/ca9383en/ca9383en.pdf.

In 2018, Kazakhstan exported 253 tons of frozen whole catfish (HS030324), primarily to Russia and other neighboring countries, and the average price of the export was $0.99/kg. The country also exported a small amount of frozen catfish fillets (HS030462) and fresh/chilled catfish fillets (HS030432) with much higher prices (Table E34).

TABLE E34: KAZAKHSTAN'S EXPORT OF CATFISH PRODUCTS, 2018

Products	Tons	$, thousands	$/kg
Catfish, frozen whole (HS030324)	**253.1**	**251.7**	**0.99**
Russian Federation	129.7	78.0	0.60
Ukraine	65.3	89.4	1.37
Georgia	37.3	70.9	1.90
Uzbekistan	20.5	11.9	0.58
Netherlands	0.3	1.6	6.03
Catfish, frozen fillet (HS030462)	**21.9**	**71.8**	**3.29**
Russian Federation	10.1	15.3	1.52
Germany	5.4	27.1	5.00
Romania	3.4	19.4	5.71
Georgia	2.0	5.2	2.61
Czechia	0.6	1.6	2.72
Austria	0.3	3.1	9.23
Catfish, fresh/chilled fillet (HS030432)	**3.4**	**19.4**	**5.64**
Georgia	2.0	5.8	2.89
Austria	1.4	13.6	9.49

Data source: UN Comtrade.

With unreported catfish production accounted for, the estimated per capita catfish consumption in 2018 was 0.35 kg (live weight), which was lower than that of carps, roach, or perch/pike/pikeperch yet higher than salmon, whitefish, sturgeons, and rainbow trout.

In 2020, frozen catfish fillets were offered by online fish stores at KZT 1,100/kg ($2.62/kg) with skin or KZT 1,250/kg ($2.98/kg) with no skin. A variety of dried/smoked catfish products were also offered at various prices (Table E35). Notably, the expensive cured catfish branded 'Balkhash' (KZT 6,960/kg) is made of extraordinarily large catfish (sometime around 100 kg), and cured fillet of this fatty fish, which tastes like a piece of smoked fatty meat, is a delicacy loved by Kazakhstanis.

TABLE E35: RETAIL PRICE OF CATFISH PRODUCTS IN KAZAKHSTAN, 2020

Product	Retail price from online stores		Source
	KZT/kg	$/kg	
Fillet			
Catfish, fillet with skin	1,100	2.62	Rybprom
Catfish, fillet	1,250	2.98	Khamit
Dried/salted/smoked			
Catfish steak air-dried	1,450	3.45	Radovnya (Kostanay city)
Catfish, cold-smoked, sliced	2,600	6.19	Sapa-M LLP (Kostanay)
Catfish cured (Balkhash)	6,960	16.57	Instashop (Almaty city)
Catfish cold-smoked tail	630	1.50	Sapa-M LLP (Kostanay)
Catfish soup set	600	1.43	Sapa-M LLP (Kostanay)

Data source: Estimates based on research for this report.

The KFDP sets a target of 188.64 tons of aquaculture production of catfish (*Clarias sp.*) in 2030. The above analysis indicates that the existing domestic and export market potential apparently cannot accommodate the large production expansion.

More importantly, *Clarias sp.* (for example, African catfish *C. gariepinus*) are warmwater species that do not adapt well with cold weather conditions in Kazakhstan. Even the south of Kazakhstan may not have a long enough summer to complete a production cycle in open farming systems (for example, pond or cage). RAS can be used to farm the species. Yet, the cost tends to be expensive. The utilization of hot water resources, such as wastewater from power plants or geothermal water (for example, hot springs), may allow some small-scale African catfish farming operation in cold places; yet such farming systems are unlikely to sustain large-scale production.

The lack of interest in developing wels catfish as an aquaculture species is understandable because of its relatively abundant supply at present. However, it could be a better candidate for catfish farming in Kazakhstan in the long run.

Barramundi

The KFDP sets a target of 1,333 tons of barramundi aquaculture production in 2030. Barramundi (*Lates calcarifer*) is a warmwater aquaculture species popular in Southeastern Asia and Eastern Asia, which accounted for, respectively, 68% and 18% of the 81,000 tons of world barramundi aquaculture production in 2018.

Similar to the case of African catfish, farming barramundi (a warmwater species) tends to be expensive in Kazakhstan. Yet, the species may not command a price premium to compensate the disadvantage of the high production cost. Barramundi is a perch-like fish like pikeperch and European perch; hence, it may not bring a novel taste to Kazakhstani consumers. It is less known outside Asia and does not have the fame of salmon. Thus, the domestic market prospect for the species may not be promising. As to export, barramundi tends to be a more expensive raw material (compared to pikeperch from capture

fisheries) for the processing industry, and it does not seem to have advantages in taste, texture, nutrients, or popularity over pikeperch in the European market. In any case, it tends to be difficult for Kazakhstan to compete with Southeastern and Eastern Asian countries over barramundi export.

Therefore, although barramundi has relatively mature farming technology compared to pikeperch and European perch, its aquaculture prospect in Kazakhstan deserves further investigation.

Tilapia

The KFDP sets a target of 50 tons of annual tilapia aquaculture production in Kazakhstan from 2021 onward. Tilapia is the fourth largest aquaculture species group with 6 million tons of global production in 2018, and it is the most popular aquaculture species cultivated in over 120 countries.

In 2018, Kazakhstan imported 117 tons ($2.47/kg) of frozen tilapia fillets as well as a small amount of fresh/chilled tilapia fillets and frozen whole tilapia. Thus, the 50 tons of tilapia production could be absorbed by the domestic market through import substitution. However, farming tilapia (a warmwater species) in Kazakhstan entails a special farming system that gets access to warm water at an acceptable cost. In addition, as a low-value fish, a 50 ton operation may not have enough economies of scale to be profitable.

TABLE E36: SUBNATIONAL DISTRIBUTION OF THE PRODUCTION OF CARP SPECIES IN KAZAKHSTAN, 2019

Region (ranked by total carp production)	All carp species, including				European minnows		Common carp				Asian carps			
	Capture (tons)	Culture (tons)	Total		Capture = Total		Capture (tons)	Culture (tons)	Total		Capture (tons)	Culture (tons)	Total	
			Tons	Share (%)	Tons	Share (%)			Tons	Share (%)			Tons	Share (%)
Kazakhstan	**24,891**	**4,001**	**28,892**	**100.0**	**19,617**	**100.0**	**1,990**	**3,480**	**5,470**	**100.0**	**3,284**	**521**	**3,805**	**100.0**
Atyrau	6,943	—	*6,943*	*24.0*	*5,449*	*27.8*	654	—	*654*	*12.0*	840	—	840	*22.1*
East Kazakhstan	5,738	117	*5,855*	*20.3*	*5,647*	*28.8*	8	117	*125*	*2.3*	83	—	83	*2.2*
Turkistan	1,858	3,657	*5,515*	*19.1*	*651*	*3.3*	229	3,138	*3,367*	*61.6*	978	519	1,497	*39.3*
Almaty	3,984	42	*4,026*	*13.9*	*3,466*	*17.7*	328	42	*370*	*6.8*	190	—	190	*5.0*
Kyzylorda	3,615		*3,615*	*12.5*	*3,263*	*16.6*	209		*209*	*3.8*	143		143	*3.8*
Karagandy	600	90	*690*	*2.4*	*385*	*2.0*	64	90	*154*	*2.8*	150	—	150	*4.0*
Zhambyl	681	—	*681*	*2.4*	*532*	*2.7*	102	—	*102*	*1.9*	48	—	48	*1.3*
North Kazakhstan	470	58	*528*	*1.8*	*15*	*0.1*	41	56	*97*	*1.8*	414	2	416	*10.9*

TABLE E.36

Region (ranked by total carp production)	All carp species, including				European minnows		Common carp				Asian carps			
	Capture (tons)	Culture (tons)	Total		Capture = Total		Capture (tons)	Culture (tons)	Total		Capture (tons)	Culture (tons)	Total	
			Tons	Share (%)	Tons	Share (%)			Tons	Share (%)			Tons	Share (%)
Akmola	279	—	*279*	*1.0*	*59*	*0.3*	55	—	*55*	*1.0*	166	—	166	*4.4*
Mangystau	230	—	*230*	*0.8*	*73*	*0.4*	156	—	*156*	*2.9*	0	—	—	*0.0*
Kostanay	190	—	*190*	*0.7*	*2*	*0.0*	57	—	*57*	*1.0*	132	—	132	*3.5*
Aktobe	166	11	*177*	*0.6*	*30*	*0.2*	76	11	*87*	*1.6*	60	—	60	*1.6*
West Kazakhstan	90	—	*90*	*0.3*	*44*	*0.2*	8	—	*8*	*0.1*	38	—	38	*1.0*
Pavlodar	46	—	*46*	*0.2*	*3*	*0.0*	1	—	*1*	*0.0*	42	—	42	*1.1*

Data source: Bureau of National Statistics, Kazakhstan.

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