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Unlocking the value of deep-sea fisheries in ABNJ
Insights from alfonsino and toothfish

Introduction

Deep-sea fisheries (DSF) in areas beyond national jurisdiction (ABNJ) represent a globally significant source of high-value seafood, livelihoods and trade. Over the past decade, the management of DSF has undergone important changes aimed at ensuring the sustainable use of resources and the protection of vulnerable marine ecosystems (VMEs). However, despite international instruments calling for the socioeconomic monitoring of fisheries (e.g. Code of Conduct for Responsible Fisheries, Articles 7.4.2 and 7.4.5), and particularly the International Guidelines for the Management of Deep-sea Fisheries in the High Sea (FAO, 2008), important knowledge gaps remain regarding the socioeconomic significance of DSF in ABNJ.

This technical brief provides key findings from a study conducted by the Common Oceans Deep-Sea Fisheries project, focusing on two DSF value chains, alfonsino (*Beryx* spp.) in the Indian Ocean and Patagonian and Antarctic toothfish (*Dissostichus* spp.) in the sub-Antarctic and Antarctic regions. The aim of the study was to better understand the socioeconomic characteristics of these two value chains, including how they function, the employment they generate, the working conditions on board vessels, gender equity and environmental sustainability practices.

The two fisheries were selected as they combine high economic value and good examples of sustainable and responsible practices. They also hold cultural significance in key markets and provide nutritional value appreciated by consumers.

gef global environment facility INVESTING IN OUR PLANET

Methodology

Official global capture, landing, production and trade data reported by countries to FAO (FAO, 2025) were used to demonstrate the global significance of the two value chains. This data combines data from exclusive economic zones (EEZs) and ABNJ globally.

To offer an understanding of the environmental, social and economic aspects of the two value chains, more specific data were collected from operators through a structured questionnaire. The questionnaire drew on selected elements of the Fish4ACP value chain analysis methodology (Neven *et al.*, 2024), adapted for an exploratory assessment of DSF operators.

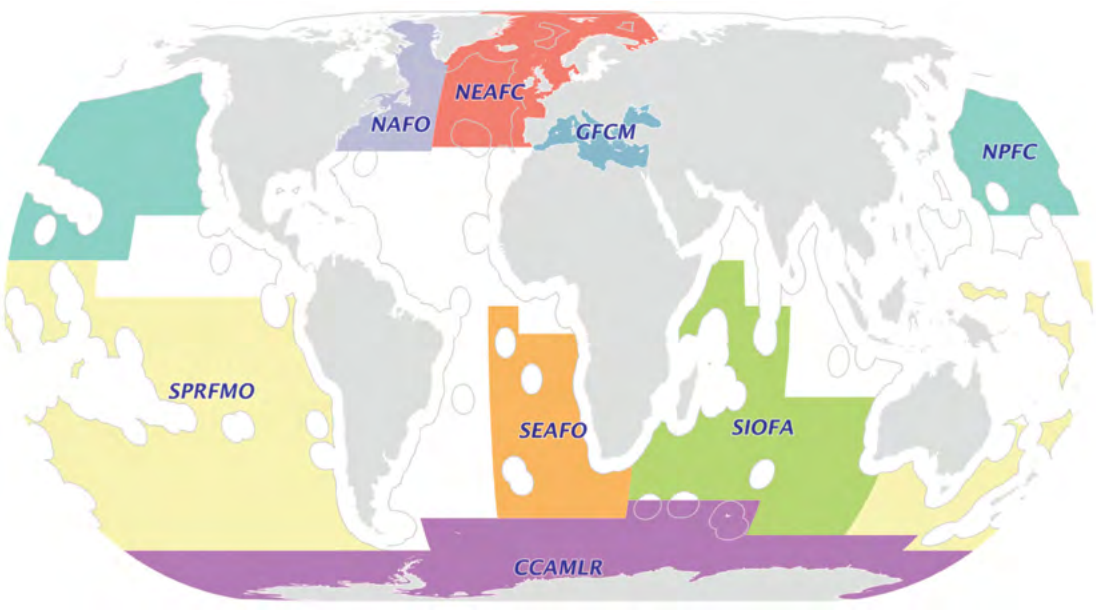
The findings presented in this technical brief draw on aggregated responses from participating operators active in the harvest sector of the alfonsino fishery (2 operators) and the toothfish fishery (8 operators). Where complete financial data were not available, estimates and approximations were made to assess profitability and economic performance. The analysis was complemented by a desktop review of available information on these fisheries, including from relevant regional fisheries management organizations (RFMOs), and the Marine Stewardship Council (MSC).

The information was reviewed by participating operators, who validated data relevant to their operations and provided additional insights based on their respective roles in the value chains.

It is important to note the limitations of this analysis. Due to the scarcity of publicly available data and the limited number of operators' responses, the study provides greater coverage of the harvesting and processing stages than of other parts of the value chain. Further research is required to obtain more extensive information on downstream segments, including distribution, retail and consumption, and from workers, regulators and other stakeholders.

Please note that the FAO FishStat website may have more recent data, particularly for production and trade, because the continuous nature of data collection and processing results in updates and new reference periods being added throughout the year.

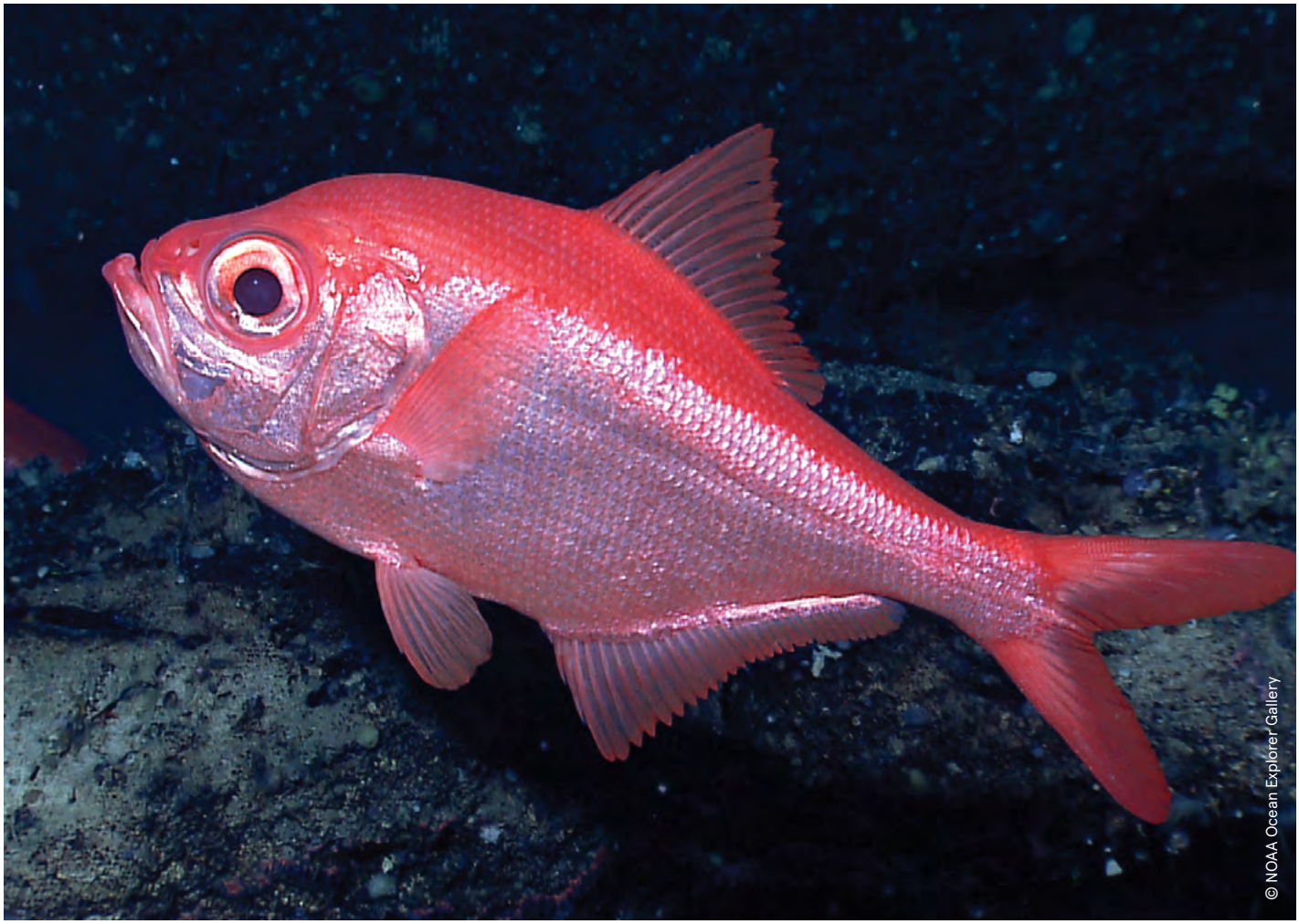
FIGURE 1. Regional Fisheries Bodies (RFBs) with the competence to manage small pelagic and deep-sea fisheries



- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- General Fisheries Commission for the Mediterranean (GFCM)
- Northwest Atlantic Fisheries Organisation (NAFO)
- North-East Atlantic Fisheries Commission (NEAFC)
- North Pacific Fisheries Commission (NPFC)
- South East Atlantic Fisheries Organisation (SEAFO)
- Southern Indian Ocean Fisheries Agreement (SIOFA)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Source: ©FAO/Statistics and Information Branch, FIAS.



Global overview of alfonsino

Alfonsino has been reported to the FAO under four distinct designations: Alfonsino (*Beryx decadactylus*), Alfonsinos NEI (*Beryx* spp.), Alfonsinos, etc. NEI (*Berycidae*) and Splendid Alfonsino (*Beryx splendens*). These species are commonly processed and traded interchangeably within the market. Alfonsinos are usually target species caught using midwater and benthopelagic trawls, with around 70 percent of the catch being from operations targeting alfonsino (SIOFA, 2025a)

The combined average annual landings of alfonsinos from 1969 to 2022 amounted to 5 940 tonnes. In 2022, the global landings of alfonsino came to 5 290 tonnes. From 1969 to 2022, 30 countries and territories reported alfonsino landings to FAO (Figure 2).

Historically, New Zealand has produced 30 percent of total cumulative alfonsino landings, followed by Japan with 18 percent (FAO, 2025).

According to Ottaviani (2020), about 65 percent of alfonsino landings in 2014 originated in ABNJ. In 2022, reports from regional fisheries management organizations (RFMOs) showed that most of these catches came from fisheries managed by the Southern Indian Ocean Fisheries Agreement (SIOFA), with smaller shares from fisheries managed by the North Pacific Fisheries Commission (NPFC) and the South Pacific Regional Fisheries Management Organisation (SPRFMO).

The Indian Ocean is therefore an important area for alfonsino catches, making it a relevant case study for understanding the alfonsino value chain in ABNJ.

CASE STUDY OVERVIEW

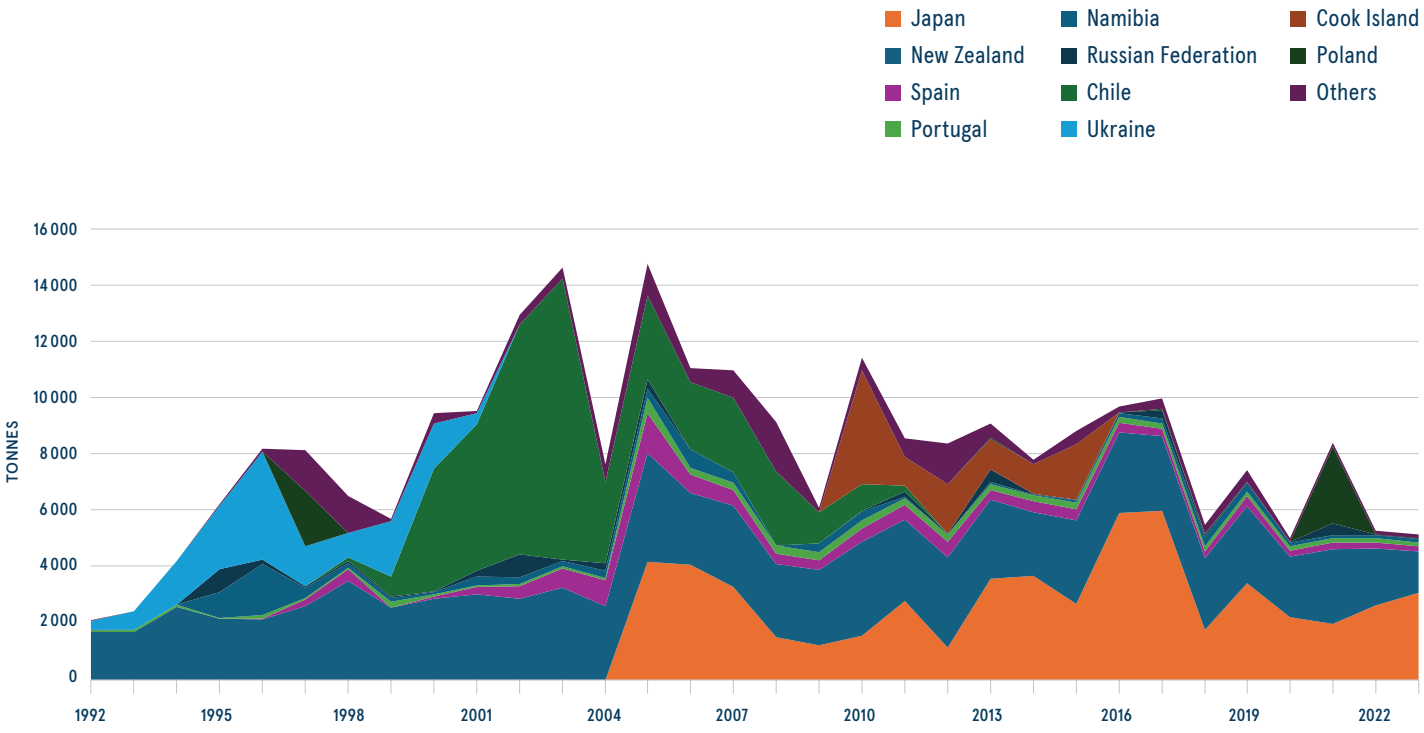
Alfonsino in the Indian Ocean

This case study is based on information provided by two of the three fishing operators active in the alfonsino fishery in the ABNJ of the Indian Ocean complemented by secondary sources where additional publicly available information is available to provide, as much as possible, a full overview of the alfonsino value chain in this area.

INDIAN OCEAN ALFONSINO VALUE CHAIN OVERVIEW

- Fishing operations by vessels flying flags from different States: The Cook Islands, Mauritius and Japan.
- Landing only in Port Louis, Mauritius.
- Main processing occurring on board (gutting, heading and freezing).
- Further processing operations (dressed, filleted, portioned, dried, retail packaged, and whole fish products) in different countries (New Zealand, China, Japan, Thailand, Vietnam and Indonesia).
- Sale of products in high-value end markets, mainly Japan and few portions going to China, the United States of America, the European Union, Singapore and Australia.

FIGURE 2. Alfonsinos landings by major producers



Source: FAO. 2025. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2025]. In: *FishStatJ*. Available at www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

Alfonsino in the Indian Ocean

FUNCTIONAL ANALYSIS

Harvesting

In 2024, three fishing vessels, flagged to Japan, Mauritius and the Cook Islands, were fishing in the Indian Ocean. Two vessels exclusively targeted alfonsino using pelagic trawl nets, while one vessel fished for other fishes during June and July, and targeted alfonsino with a benthopelagic trawl net for the rest of the year. Between 2018 and 2022 the average total annual catch volume of alfonsino in the Indian Ocean reached up to 3 700 tonnes for all three vessels (SIOFA, 2025a).

Landing

Port Louis (Mauritius) is the main landing site for alfonsino catches of two of the three vessels. It offers proximity to the main fishing areas, as well as availability of suppliers and port services related to vessel operations and onward export services such as ship agencies, cold storage facilities, provisioning, engineering services and the supply of consumables.

Processing

Alfonsino catch is primarily processed on board vessels (which are equipped with processing and freezing facilities) immediately after capture, including gutting, heading and freezing. This allows trips of up to 60 days at sea and ensures a high product quality.



▲ Alfonsino at the retail stage of the value chain, displayed on ice for sale.



▲ Alfonsino being processed.

The average conversion rate from raw fish to final product is around 70 percent, reflecting reduced waste due to onboard processing and immediate freezing. Secondary processing is vertically integrated into fisheries companies, which transport previously landed alfonsino raw material to their factories, particularly in Thailand.

Secondary processing results in dressed, filleted, portioned, dried and retail packaged fish products. Product format is mainly boneless skin-on fillets, and some boneless skin-on portion cut. These products are subsequently exported to Japan for sale.
A portion of catches goes to Japan for secondary processing, tailoring to a specific product demand.

Distribution, trade and market

Almost all the alfonsino, from the Indian Ocean and other parts of the globe, is consumed in Japan. A small volume is sold fresh in Australia, the United States and China, sourced mainly from New Zealand.

In Japan, the key market for the alfonsino coming from the Indian Ocean, the Izu (伊豆) and Odawara (小田原) areas, are well known for their locally caught alfonsino. However, demand has attracted imported alfonsino. Typically, locally sourced alfonsino is used for sashimi (served raw), while imported fish is prepared simmered or grilled. While Izu and Odawara are famous for alfonsino, the fish itself has gained popularity throughout Japan, resulting in strong demand nationwide.

Alfonsino in the Indian Ocean

ECONOMIC AND MARKET CONTRIBUTION

The alfonsino value chain generates high-value economic returns, driven by the demand of niche markets and product quality.

Participating operators involved in this study reported that in 2022, 3 500 tonnes of landed alfonsino came from ABNJ in the Indian Ocean. The landing value for this 3 500 tonnes is estimated to be USD 10.5 million and the total value added across the value chain is estimated at around USD 12 million or USD 3.4 per kg of live weight.

Economic value is created in different stages of the value chain. At the primary production level, the value is around USD 1.3 per kg, and the processing contributes to about USD 0.9 per kg for the final price. In addition, indirect value added from supporting services (logistics, cold storage and port services) represents approximately USD 1.3 per kg.

Estimates of indirect value added by service providers in Mauritius add up to approximately USD 2.2 million, ranging from provisions, cold storage, engineering services, ship agency, warehousing and accommodation.

The average export unit value is USD 6.0 per kg, varying by product types from USD 5.1 per kg for frozen whole alfonsino to USD 6.7 for headed and gutted frozen alfonsino.

Examples were reported of boneless, skin-on fillets sold in Japan at a price range of around USD 15 per kg, indicating value addition through processing and wholesale marketing. For alfonsino sold as sashimi or in premium dishes, based on 120-g portion sizes, the price for end consumers can vary from JPY 2 500 to JPY 6 666 per kg (USD 15.98 to USD 42.61) (SAKAMA, 2022), indicating value generation in the retail and hotel, restaurant and catering sectors.

KINMEDAI: A FISH ROOTED IN JAPANESE CULTURE

In Japan, alfonsino is known as kinmedai (金目鯛, meaning "golden eye sea bream") and has been part of traditional Japanese cuisine for centuries. This fish is highly appreciated for its bright red colour, fatty and sweet taste, and firm texture, making it ideal for refined dishes. Beyond its flavour, kinmedai is associated with spiritual power and is frequently served at celebratory occasions. These aspects make this fish highly valued by the Japanese people, and in later years its popularity has increased its consumption across the whole country.



▲ Alfonsino at the final consumption stage, prepared and served as sashimi.

SOCIAL CONTRIBUTIONS (GENDER AND DECENT WORK)

Employment generated by the alfonsino value chain may be limited, yet it holds significant importance for those engaged within this sector.

Vessels employ an average of 30 crew members, who are very specialized and responsible for harvesting and first processing. Taking into account crew rotation, the harvesting sector creates a total of around 135 jobs. They are predominantly men with the average age of 42 years old, coming from New Zealand, South Africa, the Philippines, Namibia and Japan.

Due to integration with other fisheries, total employment across the full value chain is difficult to estimate. Based on the average productivity of fish filleters, the 3 500 tonnes of alfonsino landed supports the approximate equivalent of 22 to 33 full-time jobs in the subsequent stages of the value chain.

Alfonsino in the Indian Ocean



Fish processing stage of the value chain in a seafood plant.

Participating operators reported established occupational safety procedures and respect for collective bargaining rights. Employment is formalized, with written contracts, training and clear remuneration structures.

Fishers are highly dependent on this economic activity. This economic dependency and vulnerability needs to be considered when evaluating fisheries management decisions and stresses the need to balance conservation measures with socioeconomic impacts on the workforce. One of the participating operators estimate that fishers' incomes support the livelihood of 215 dependants (roughly 3.5 dependants each for the 21 crew members on board each trip), including 85 direct dependants and 130 indirect dependants (SIODFA, 2008).

REMUNERATION SYSTEM

According to primary data provided by participating operators, crew members' remuneration is variable and follows Filipino minimum wage standards, with additional remuneration based on experience and a percentage of the catch for those involved in fishing. Salaries increase with rank, skill level and years of experience, reflecting a highly specialized workforce operating in distant-water fisheries. The vessel also employs different salaries for people on the deck and those working on the onboard processing.

DECENT WORK IN PRACTICE
FILIPINO CREW EMPLOYMENT

Based on information provided by participating operators, Filipino crew members are recruited through licensed maritime recruitment agencies, which offer a basic remuneration scale approved by the Philippine authorities, guaranteed overtime, catch bonuses and full coverage of employment-related costs (including travel, accommodation, food and medical care). Pre-departure briefings ensure that crews fully understand their contracts, rights, remunerations and job requirements. In addition, workers receive training both in the Philippines and abroad, with opportunities for career progression on board. These practices contribute to fair working conditions and a skilled, stable workforce within the fishery.

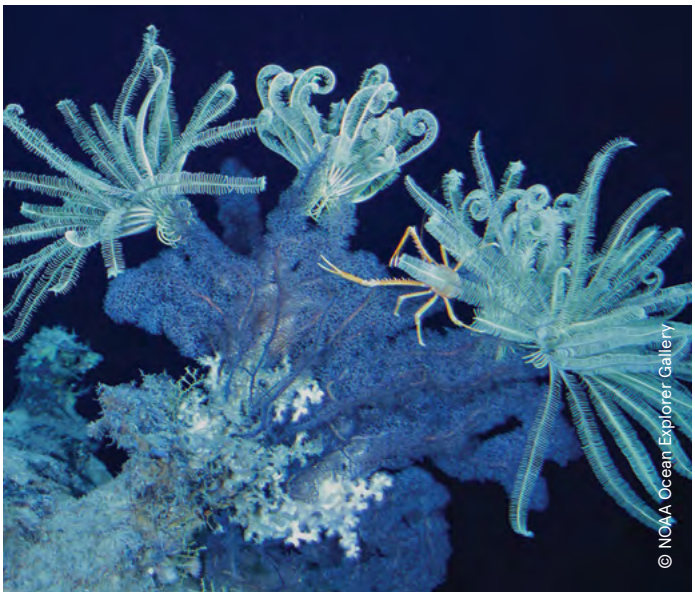
The employment of women remains below 10 percent of the total workforce, and their participation is limited to the post-harvest segments including processing, management, services and sales.

FISHERIES MANAGEMENT

Operators engaged in this study are involved in alfonsino fisheries in ABNJ of the Indian Ocean, which are managed by SIOFA through conservation and management measures (CMMs) (SIOFA, 2025b) aimed at ensuring the sustainable exploitation of stocks and the protection of vulnerable marine ecosystems. These measures include controlling the number of vessels taking part in the fishery, restricting the established bottom fishing footprint, VMEs encounter protocols with move-on rules, scientific observer coverage requirements, a vessel monitoring system and ongoing stock assessments to support management decisions.

Operators reported implementing a series of practices in alignment with these measures aimed at reducing fishing impact and the overall effects of their operations on the environment.

▶ Alfonsino in the Indian Ocean



▲ **Fishing activities follow strict conservation measures to protect vulnerable marine ecosystems.**

Fishing pressure

Alfonsino stocks in the Indian Ocean are considered to be maximally sustainably fished (Sharma *et al.*, 2025). According to most recent assessments by SIOFA, alfonsino stocks were neither overfished nor experiencing overfishing, with current biomass about 60 percent of virgin biomass (SIOFA, 2025a).

Bycatch and discards

Discard rates in midwater trawls are generally lower than in bottom trawl fisheries, with global average discard rates around 12 percent for midwater and otter trawls (Pérez Roda *et al.*, 2019). In alfonsino fisheries in the Indian Ocean, non-target species represent approximately less than 25 percent of total catches, with the violet warehou (SEY) as the most common bycatch species (SIOFA, 2025a).

Operators participating in this study reported that retained and processed bycatch can be up to 40 percent of each trawl (10 percent of total catch), with discards maintained below 10 percent. Retained bycatch are other benthopelagic teleost species including cardinal fishes (3 percent), boarfish (3 percent), butterfish (2 percent) and ruby fish (1 percent). Discarded teleosts are primarily spiky oreo dory (*Neocyttus rhomboidalis*) which have very low commercial value, but when there is space in the hold they are retained and donated to charity in Port Louis. Other discarded taxa are squids and some deepwater elasmobranchs (<1 percent).

Ecosystem protection

To minimize ecosystem impacts, vessels targeting alfonsino use midwater or pelagic trawls that minimize or eliminate contact with the ocean floor (SIOFA, 2025a), avoid vulnerable benthic fauna, and apply move-on rules when indicators of vulnerable marine ecosystems are encountered.

Waste and pollution management: Stakeholders reported different waste management actions in place, being aligned with the International Convention for the Prevention of Pollution from Ships (MARPOL) requirements. Plastic waste is compacted and landed for disposal, with no plastic discharge at sea reported. Biological waste, such as offal and fish remains, is discarded offshore in accordance with environmental protocols, while land-based residues are processed into fishmeal for use in feed industries.

Carbon emissions

Operators have adopted low sulphur fuels and work closely with fuel suppliers to explore and implement other fuel options that reduce carbon emissions on vessels and land-based operations, including opportunities such as renewable diesel. One of the companies involved in the VC reported innovative energy solutions based on using renewable compressed natural gas converted from a local landfill in an effort to reduce carbon emissions from their land-based boilers to zero.



▲ **Freshly caught alfonsino from the Indian Ocean.**



Global overview of toothfish

Toothfish has been reported to FAO under two different distinct designations in terms of primary production: Antarctic toothfish (*Dissostichus mawsoni*) and Patagonian toothfish (*Dissostichus eleginoides*). Initially, only Patagonian toothfish was reported, but from 1998, coinciding with the start of the Ross Sea fishery, Antarctic toothfish was reported as well (FAO, 2025). These species are processed and traded interchangeably in the marketplace, and both fall under the legal trade name of Chilean seabass in the USA.

Global toothfish captures exceeded 40 000 tonnes in 1995 and from 2000 to 2002, and have hovered around 27 000 tonnes from 2004 to 2022, with Patagonian toothfish contributing 85 percent on average and Antarctic toothfish 15 percent of catches (FAO, 2025). The Antarctic Ocean has been the primary source of toothfish capture production consecutively since 2002.

In 2022, France led the reported toothfish production with 5 582 tonnes (23 percent of the total), followed by Chile (16 percent), and Argentina and the Republic of Korea (14 percent each). Other significant producers include Australia, Uruguay, the United Kingdom of Great Britain and Northern Ireland and the Falkland Islands (Malvinas).

Toothfish fisheries in the Antarctic, Southeast Atlantic, Southern Indian and South Pacific Oceans are managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the South East Atlantic Fisheries Organization (SEAFO), the Southern Indian Ocean Fisheries Agreement (SIOFA) and the South Pacific Regional Fisheries Management Organization (SPRFMO), respectively. Additionally, fishing activities occur in domestic waters of coastal states.

This global overview provides the context for the value chain case study presented below, which focuses on selected toothfish operations in Antarctic and sub-Antarctic regions.

CASE STUDY OVERVIEW

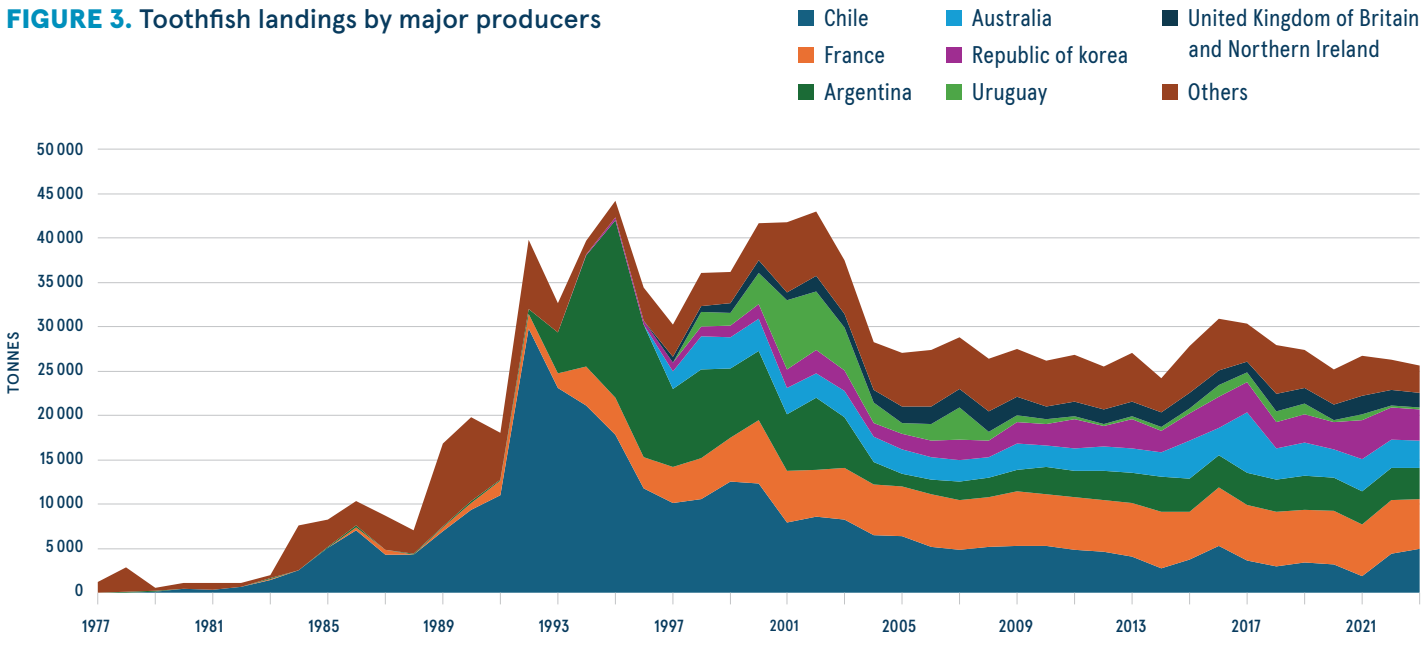
Toothfish in the sub-Antarctic and Antarctic regions

This case study is based on information provided by eight fishing operators active in the toothfish fisheries in the ABNJ of sub-Antarctic and Antarctic regions and complemented by secondary sources where additional publicly available information is available to provide, as much as possible, a full overview of the toothfish value chain in this area.

SUB-ANTARCTIC AND ANTARCTIC TOOTHFISH VALUE CHAIN OVERVIEW

- Operations are conducted by vessels from different flag states: Chile, France, Argentina, Australia, the Republic of Korea, Uruguay, the United Kingdom, Russian Federation, New Zealand, Spain, South Africa, Japan, Ukraine, Namibia and, from time to time, others. The survey covered operators from the Falkland Islands (Malvinas), Australia, the United Kingdom, Spain, Japan and New Zealand.
- The most common landing sites for interviewed operators include Stanley (the Falkland Islands [Malvinas]), Cape Town (South Africa), Punta Arenas (Chile) and Port Louis (Mauritius), with occasional landings reported in Vigo (Spain).
- Primary processing occurs on board (frozen, headed, gutted and tailed [HGT], and collars and cheeks).
- Any secondary processing operations (fillets, portions, skin-on steaks) take place mainly in the Falkland Islands (Malvinas) and the United States.
- Sale of products in high-value end markets: the United States, China, Chile, the Republic of Korea and the United Arab Emirates and China, Hong Kong SAR.

FIGURE 3. Toothfish landings by major producers



Source: FAO. 2025. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2025]. In: *FishStatJ*. Available at www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

Toothfish in the sub-Antarctic and Antarctic regions

FUNCTIONAL ANALYSIS

Harvesting

Apart from the artisanal fleet in northern Chile, toothfish is caught by around 35 longline vessels operating globally. From 2000 to 2021, toothfish catches in ABNJ[1] have amounted to an average of 23 percent of total toothfish captures reported to CCAMLR. The combined volume of toothfish products handled by the eight participating operators involved in this study, representing 10 vessels out of 35, were estimated at 4 025 tonnes of landed toothfish coming from ABNJ in the Antarctic.

Processing

Catches are HGT, and frozen on board, thereby maintaining product quality. Several operators indicated additional processing steps, including collar and cheek recovery, portioning and, in some cases, filleting at sea. Frozen toothfish dominates the processed production reported to FAO consisting of 97 percent of the cumulative total, followed by toothfish fillets, fresh or chilled.

In 2022, Chile, the Falkland Islands (Malvinas) and the United States were the biggest producers of processed toothfish (FAO, 2024a).

[1] FAO subdivisions 48.1, 48.2, 48.5, 48.6, 58.4.1, 58.4.2. 58.4.3a, 58.4.3b, 58.4.4a, and 58.4.3



▲ Toothfish served as a high-value dish.

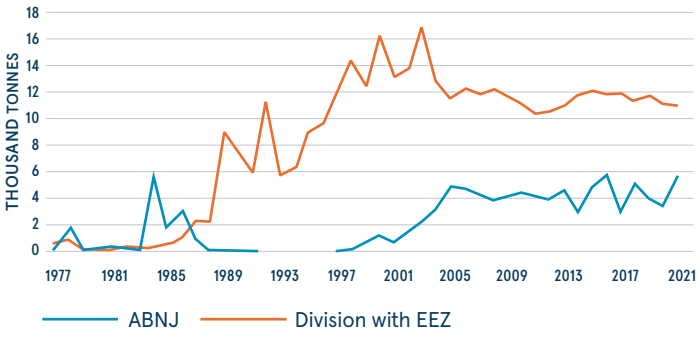


▲ Final product of the value chain: toothfish fillet prepared for consumption.

Landing

Catches are mostly landed in ports across the Southern Ocean, namely Stanley (the Falkland Islands [Malvinas]), Cape Town (South Africa), Punta Arenas (Chile) and Port Louis (Mauritius), because of their proximity to the main fishing areas and the availability of services and suppliers. Products are sold during the week preceding landing, allowing fish to be loaded directly from the dock into containers according to the finalized sales process. Containers are generally consigned directly to end buyers or importers without any intermediary steps, and no transshipment is involved. Vessels land in mid-season only for short periods to unload, resupply, change crew and undertake any urgent maintenance before heading back to sea. Frozen toothfish is the main traded commodity product (over 90 percent), followed by fresh or chilled toothfish fillets and frozen toothfish fillets.

FIGURE 4. Toothfish product landings reported to CCAMLR



Source: Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). 2023. Statistical Bulletin, Vol. 35. www.ccamlr.org © CCAMLR

Toothfish in the sub-Antarctic and Antarctic regions

Distribution, trade and market

The distribution and trade segment of toothfish is characterized by, and oriented towards, international high-value markets. Between 2019 and 2022, 117 countries and territories reported engaging in the trade of toothfish commodities, culminating in a total import value of over USD 630 million for toothfish products reported to FAO in 2022 (FAO, 2024b).

Chile, France and Argentina have been the largest exporters of toothfish with the Republic of Korea and Australia emerging as important exporters in recent years. The United States is the key market for toothfish, frequently accounting for the largest share of imports, followed by China, with both countries absorbing around 80 percent of total volumes. Other important markets include East and Southeast Asia (China, Hong Kong SAR, the Republic of Korea and Singapore), Europe, the Middle East (including the United Arab Emirates) and Chile.

The main traded product is HGT toothfish with an average price range provided by respondents of USD 25 to USD 30 per kg.


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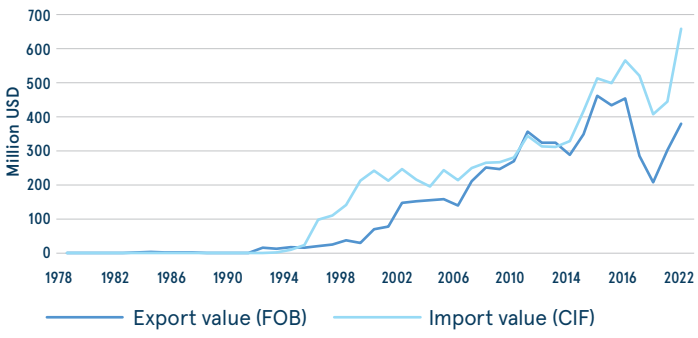
DECENT WORK IN PRACTICE

Crew recruitment follows formal procedures based on skills and experience, with multinational crews recruited through professional agencies and labour agreements. All crew members are employed under written contracts, which define remuneration structures, working conditions and repatriation rights, and are translated into native languages where necessary. Repatriation costs are covered by employers, and systems are in place to prevent debt bondage, with no recruitment or placement fees charged to workers (MSC, 2019, 2021).

ECONOMIC AND MARKET CONTRIBUTION

Toothfish is a premium, high-priced fish, with frozen or thawed fillets and portions available via supermarkets or specialist seafood retailers, generally ranging from USD 60 to over USD 100 per kg in some markets. Popular with chefs, it can also be found in restaurants in major markets, commonly ranging from USD 30 to USD 50 per serving. Prices reflect its delicate, buttery texture and difficult deep-sea harvesting in the remote Southern Ocean.

FIGURE 5. International trade with Toothfish



Source: FAO. 2024. FishStat: Global Aquatic Trade - All partners aggregated 1976-2024. [Accessed on 30 July 2024]. In: *FishStatj*. Available at https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

This value chain generates high-value economic returns, driven by the demand of niche markets and product quality. Based on estimations for the average 4 025 tonnes of landed toothfish coming from ABNJ in the Antarctic, reported by participating operators, the total value added across the value chain is estimated to be USD 70.4 million or USD 17.5 per kg of live weight.

Economic value is created at different stages of the value chain. At the primary production level, the direct value added is around USD 12 per kg, and indirect value added from supporting services (logistics, cold storage and port services) represents approximately USD 5.5 per kg.

Toothfish in the sub-Antarctic and Antarctic regions

SOCIAL CONTRIBUTIONS (GENDER AND DECENT WORK)

The toothfish fishery supports a highly regulated and professional workforce, with strong labour standards across operations (MSC, 2019, 2021, 2024, 2025, 2026). Participating operators reported that their workers are employed under formal written contracts, with occupational safety and health standards well established and implemented, with few incidents of injury occurring during fishing or processing activities.

The 35 toothfish vessels operating globally employ between 25 and 35 crew members per vessel per trip, plus one to two mandatory observers on board. Taking into account crew rotation[2], the fishery is estimated to support approximately 1 360 to 1 940 full-time jobs globally. In addition, it is estimated that the fishery from ABNJ supports the equivalent of around 40 to 60 full-time jobs in the processing stage of the value chain[3].

Remuneration systems for crew members vary across participating operators but commonly include daily rates combined with output-based remuneration linked to catch volumes or value, often supported by a minimum guaranteed salary. Processing and shore-based staff are more commonly paid hourly or through fixed salary arrangements. Crew members rely exclusively on the toothfish fishery for their income, meaning that changes in fishing opportunities, quota allocations or operational disruptions could have a significant impact on their livelihoods.

Women's participation is limited and concentrated in post-harvest segments including processing, management, services and sales. While some women are present in management roles, onboard employment remains predominantly male, reflecting broader patterns in distant-water fisheries and indicating that onshore processing facilities provide relatively more opportunities for female employment.



▲ Crew member preparing fishing gear on board a vessel targeting toothfish.

FISHERIES MANAGEMENT

Toothfish fisheries in the ABNJ are strictly managed by SIOFA, SEAFO, SPRFMO and CCAMLR, and each organization has measures in places, including catch and effort limits, catch reporting, observer coverage and other conservation measures, providing a robust framework for fisheries and environmental management.

Operators involved in this study are engaged mainly in toothfish fisheries in the CCAMLR regulatory area. The CCAMLR regulatory framework incorporates various measures to minimize environmental impacts and promote sustainable resource use. CCAMLR fully assesses and establishes annual catch limits for toothfish, enforces research obligations for authorized operators, and facilitates the advancement of scientific knowledge regarding Antarctic and sub-Antarctic fisheries. This fishery is the only deep-sea fishery in the ABNJ with a full catch documentation scheme in place.

Fishing pressure

In areas managed by CCAMLR, harvesting rate is regulated through precautionary total allowable catches (TACs) established on a seasonal basis.

[2] Employment of crew on board fishing vessels may be estimated by the number of crew positions on each vessel adjusted by a multiplier to consider the number of crew on paid leave after service periods at sea. The multiplier factor in personnel on paid leave is 1.5.

[3] Applying a conversion rate of 1.8, and considering an average filleting productive rate between 20 kg and 30 kg fillets extracted during one working hour.

Toothfish in the sub-Antarctic and Antarctic regions

These TACs are complemented by measures aimed to minimize the ecosystem impacts of fishing, including seabird bycatch regulation, spatial and temporal closures, among other measures adopted as part of an ecosystem-based approach to the management of Antarctic fisheries (Parkes, 2000). The majority of the assessed toothfish stocks (92 percent) are sustainably exploited (Sharma *et al.*, 2025). Around 50 percent of the global toothfish catch are MSC certified.

Bycatch and discards

Bycatch is low, usually less than 10 percent of catch, and it is generally retained and utilized, either for onboard consumption or processing into fishmeal. Otherwise, it is discarded in accordance with regulatory requirements in specific cases. Furthermore, fishers implement mitigation measures to reduce seabird bycatch, including the use of weighted mainlines, streamer lines, brickle curtains, seasonal closures and offal management.

Ecosystem protection

Fishing activities follow strict conservation measures, including move-on rules when bycatch thresholds are triggered or VMEs are encountered, plus mandatory reporting of VME interactions, and onboard observer coverage.

Waste and pollution management

Operations align with MARPOL and CCAMLR conservation measures, including maintaining vessels to high technical standards, for example engines and hulls, to fuel consumption and vessel speed. Measures to limit biological pollution include recycling fishing ropes, using biodegradable materials, where possible, and strict controls on the disposal of offal to reduce seabird attraction. Plastic waste is retained on board, with strong efforts made to minimize gear loss at sea and recover lost gear if feasible.

Carbon footprint

Approximately two-thirds of stakeholders reported that they do not currently quantify the carbon footprint of toothfish production. However, operators implement measures to address and reduce carbon emissions, including adhering to the ISO 50001 Energy Management Systems standard, monitoring CO_2 emissions, and minimizing fuel use and refrigerant gas loss. Some operators offset emissions through the purchase and retirement of carbon credits.

REDUCING ENVIRONMENTAL IMPACT

Environmental regulations and practices have reduced bycatch of seabirds such as albatrosses to near-zero levels, and the use of bottom-set longlines and spatial management measures have contributed to minimizing habitat impacts on vulnerable marine ecosystems (MSC, 2024, 2025).



▲ Albatross and white-chinned petrels flying over the high seas.

TOOTHFISH FISHERIES A RECOVERY STORY

In the past decades, toothfish fisheries have shifted from being overfished in some regions to achieving stock recovery. The CCAMLR regulatory framework, which incorporates various measures to minimize environmental impacts and promote sustainable resource use, including measures to eliminate illegal, unregulated and unreported (IUU) fishing, has helped restore stocks to sustainable levels. IUU fishing for toothfish has declined by more than 99 percent since the 1990s (Coalition of Legal Toothfish Operators, COLTO). The transformation of these fisheries can be attributed to legal operators collaborating closely with governments and science, through their industry association, COLTO, that has committed to sustainable fishing and environmental practices.

Conclusion

The two value chains analysed in this study demonstrate that deep-sea fisheries in ABNJ, although limited in volume, can generate significant economic value, specialized employment and high-value products for global markets. They also show how effective fisheries management, industry commitment and international cooperation can support both sustainable resource use and the protection of vulnerable marine ecosystems. Strengthening the socioeconomic understanding of these fisheries is essential to inform balanced management decisions that consider environmental, economic and social dimensions alike.

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