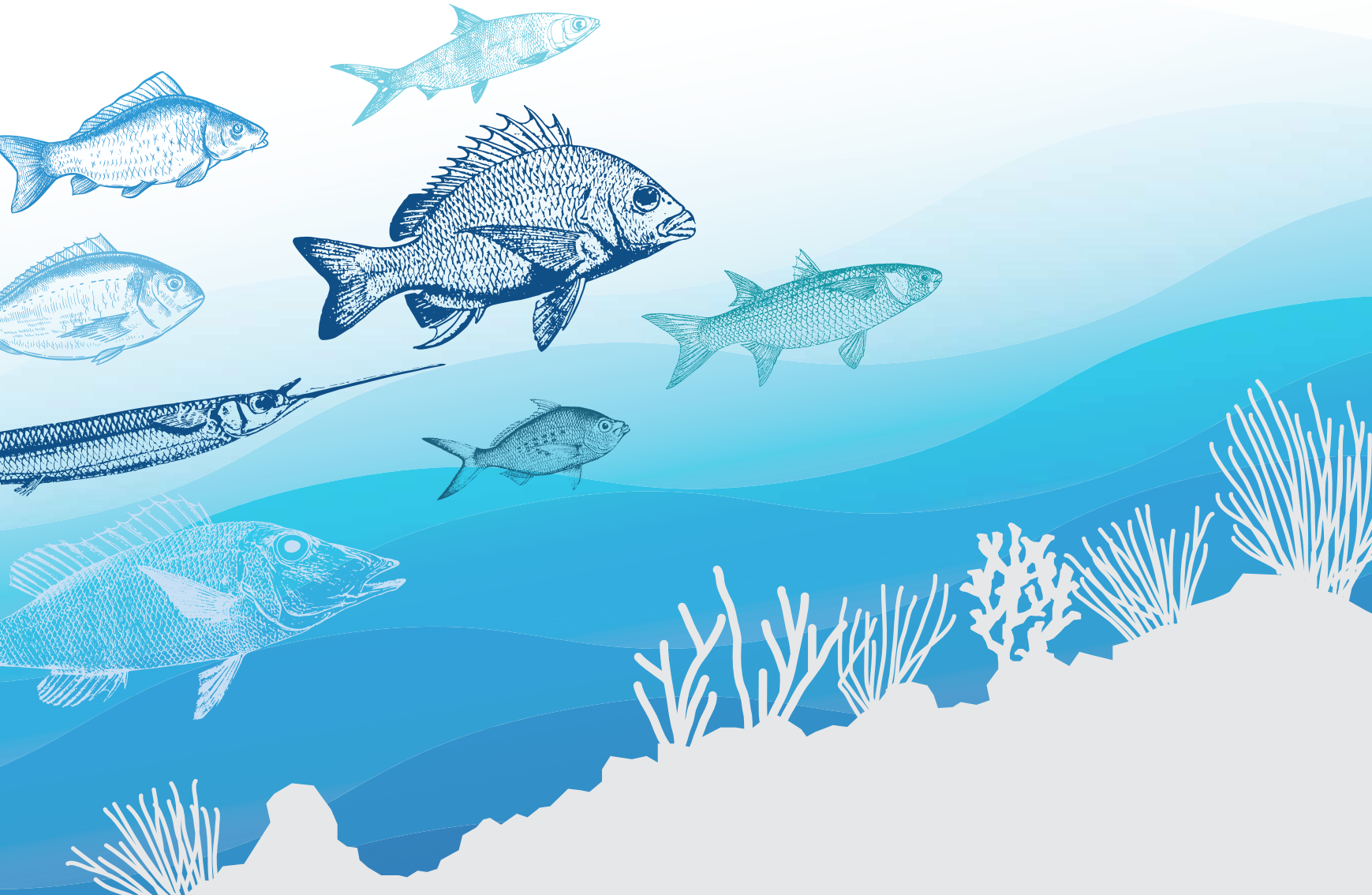
هـيـئـة الـبـيـئـة - أبـوظـبـي
Environment Agency - ABU DHABI

FISHERIES & AQUACULTURE BULLETIN 2021



The Environment Agency - Abu Dhabi (EAD) was established in 1996 to preserve Abu Dhabi's natural heritage, protect our future and raise awareness about environmental issues.

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FISHERIES & AQUACULTURE BULLETIN 2021

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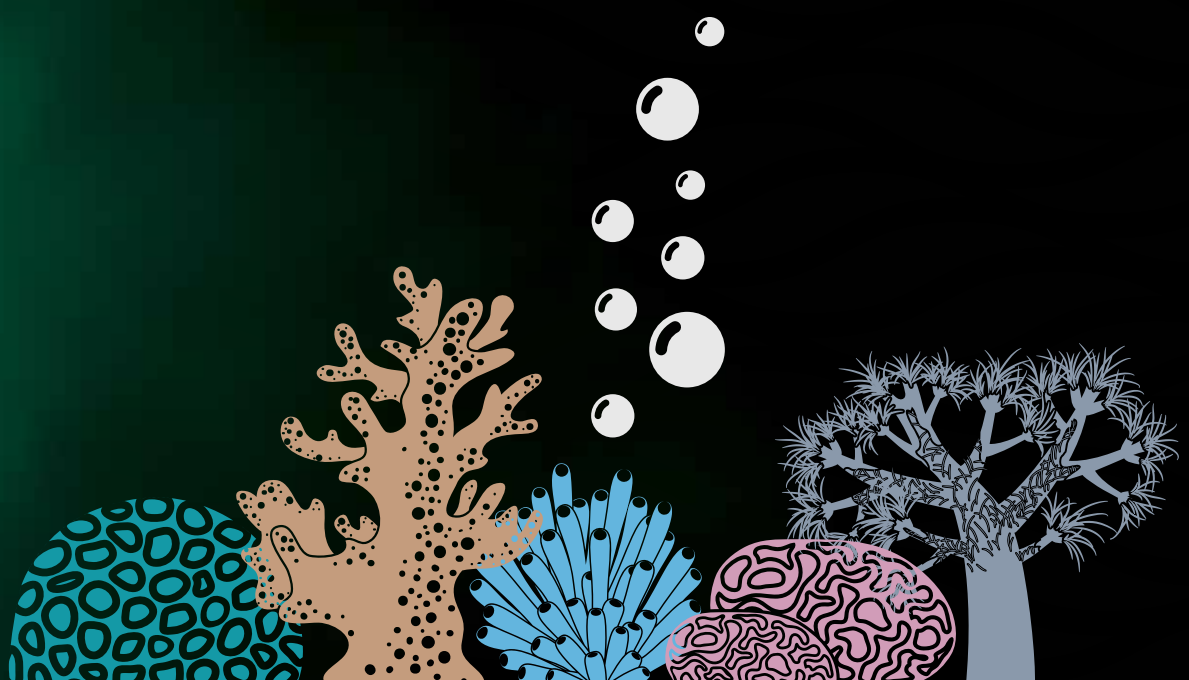
ABOUT EAD

Established in 1996, the Environment Agency – Abu Dhabi (EAD) is committed to protecting and enhancing air quality, groundwater as well as the biodiversity of our terrestrial and marine ecosystem. By partnering with other government entities, the private sector, NGOs and global environmental agencies, we embrace international best practice, innovation and hard work to institute effective policy measures. We seek to raise environmental awareness, facilitate sustainable development and ensure environmental issues remain one of the top priorities of our national agenda.



ACKNOWLEDGEMENTS

This bulletin provides information on commercial fisheries and aquaculture activities in the Emirate of Abu Dhabi. It is a direct result of enhanced cooperation and information sharing between several government entities, without which the publication of this bulletin would not have been possible.

Gratitude goes out to the Ministry of Climate Change and Environment (MOCCAE), which leads, in partnership with the Environment Agency – Abu Dhabi (EAD), the *'UAE National Framework for Sustainable Fisheries (2019–2030)'*, as well as initiatives on developing the aquaculture industry for the UAE. EAD is thankful to the Critical Infrastructure & Coastal Protection Authority (CICPA) and the Fishermen's Cooperative Societies in Abu Dhabi and Delma Island for the provision of data critical to the compilation of fisheries statistics, and to the Statistics Centre - Abu Dhabi (SCAD). Finally, we express our appreciation to all fishermen and aquaculture workers who volunteered their time and dedication to provide us with valuable information on the operations of commercial fisheries and fish production in the Emirate of Abu Dhabi. Special thanks to the EAD management and the team from the Fisheries Management section and Aquaculture section for their contribution to the preparation and completion of this report.

ACRONYMS

ADAFSA	:	Abu Dhabi Agriculture and Food Safety Authority
CICPA	:	Critical Infrastructure & Coastal Protection Authority
CMSY	:	Catch-Maximum Sustainable Yield method
CV	:	Coefficient of Variation
EAD	:	Environment Agency – Abu Dhabi
FAO	:	Food and Agriculture Organization of the United Nations
LCCV	:	Length-Converted Catch Curve method
MOCCAE	:	Ministry of Climate Change and Environment
MSY	:	Maximum Sustainable Yield
NGO	:	Non-governmental Organisation
SCAD	:	Statistics Centre – Abu Dhabi
UAESFP	:	UAE Sustainable Fisheries Programme

APPROACH

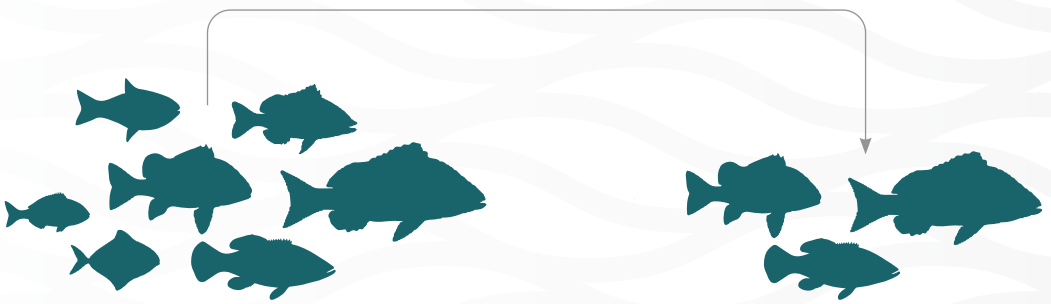
The data presented in this report are the result of the systematic monitoring of the commercial fishing activity occurring in Abu Dhabi waters, aquaculture production in the emirate, and the analysis of the status of commercially exploited fisheries resources. Data covers the totality of commercial fishing fleets and aquaculture facilities operating in Abu Dhabi Emirate (**Table 1**).

Fisheries data utilised in this report were collected following a mixed strategy, which combines a census survey with a multivariate sample survey. Specifically, the total number of vessels and fishing trips per port were obtained on a census basis from the Critical Infrastructure & Coastal Protection Authority (CICPA) logbooks. These data were integrated with direct observations conducted in the field and formed the statistical population of the survey. Finally, the population was stratified into homogenous segments comprising port and boat/gear combinations.

Detailed data on trip duration, total catch, catch by species, prices, average weight of individuals and gear utilised were collected from samples extracted from the segments. This statistical strategy comprised a multivariate sampling survey based on a statistical design where each sampling unit (fishing trip per boat/gear combination) was selected randomly[1]. The selected units were surveyed by means of direct observations and interviews, the data collected were uploaded onto an online advanced database application, which also generates monthly datasets of primary landings data that contain trip duration, total catch, catch by species, prices, and the average weight of individuals. The quality of the data was assessed using the coefficient of variation, modified for small populations, and the calculation of a non-probabilistic accuracy for small populations[2]. The sampling protocol was set upon a desired accuracy level of 90 %, which was mostly achieved for the year 2021.

The population was stratified based upon the following geographical and technical criteria. From a geographical perspective, Abu Dhabi was stratified into five segments, as there are five main ports operating across the emirate: Al Silaa, Delma, Al Marfa, Free port in Abu Dhabi city and Al Sadar (**see Map 1**). The fishing vessels were stratified based upon specific boat-gear combinations: Tarad-Hadaq, Tarad-Defara, Tarad-Sakkar, Tarad-Al hadhra and Lansh boats.

Over 100 species from more than 35 families are caught by the gears operated in the different fisheries of the emirate. Catch records and samples were classified by species for key stock assessment species where possible, otherwise family categories or guilds were used. In this report the species are grouped into eight families and one category of 'others'. The clustering of species and families is necessary especially where local generic names may refer to more than one species.



100 +

Species' were caught by commercial fishers

35 +

From more than 35 families

[1] Stamatopoulos, C. 2002. Sample-based fisheries surveys – a technical handbook. FAO Fisheries and Aquaculture Technical Paper No. 425. Rome, FAO.

[2] Scombridae (mackerels and tunas), Epinephelinae (groupers), Lutjanidae (snappers), Carangidae (jack mackerels), Haemulidae (grunts), Portunidae (crabs), Sparidae (seabreams) and Lethrinidae (emperors).

EXECUTIVE SUMMARY

Abu Dhabi hosts a unique and rich variety of marine habitats and biodiversity, where fisheries and aquaculture activities are adequately integrated, with fisheries in the emirate operating in a small-scale artisanal nature. In its effort to protect and preserve the emirate's biodiversity, the Environment Agency – Abu Dhabi (EAD) largely focuses on scientific data and knowledge collection, for the achievement of sustainable fisheries.

Through continuous data collection and analysis undertaken by EAD, the production of fisheries and aquaculture activities, as well as status of the stock of the emirate's fisheries are made available annually. This dataset spans over more than 20 years, covering the results from systematic monitoring of commercial fisheries and aquaculture activities occurring in the Emirate of Abu Dhabi (**Table 1**). This body of knowledge, supported by this data collection and analysis, is fundamental for assisting decision makers and higher management in the development of policies and managerial decisions. The *Fisheries & Aquaculture bulletin* is the annual publication where all data of commercial fishing activity, aquaculture production and analysis of the status of commercially exploited fisheries resources are presented.

The bulletin consists of six chapters, beginning with an overview of fisheries and aquaculture production in the emirate (Chapter 1), commercial fisheries production with insights into fishing seasons, areas, boat-gears and species composition as well as the description of fishing fleet and effort (Chapter 2), aquaculture production (Chapter 3), analysis of the status of fisheries resources (Chapter 4) and a description of fisheries governance and policy (Chapter 6).

The main highlights of the 2021 bulletin are summarized below:

COMMERCIAL FISHERIES AND AQUACULTURE PRODUCTION

Over the years, the total production of seafood in the Emirate of Abu Dhabi has been characterised by an overall decreasing trend, partly compensated by the production of aquaculture during the last seven years.

In 2021, the fisheries and aquaculture sector in the emirate generated 1 726 tonnes of seafood, valued at AED 35.2 million, and provided direct employment to a total of 2 452 people. Respectively, fisheries alone, with a total operating fleet of 574 boats, landed a total of 1 318 tonnes, with a total value of AED 22.1 million. On the other hand, the aquaculture sector, with five operating facilities, produced 408 tonnes worth a total value of AED 13.1 million accounting for 24 % of seafood production in the emirate. More than 2/3 of fishing production came from Abu Dhabi and Al Sadar regions, with Abu Dhabi alone accounting for more than half of the production.

Of note, the Ghazal nets and Gargours – two highly productive gears – were banned in recent years (**Table 2**). Resultantly, in 2020 and subsequently in 2021, Hadaq became the most important gear as it contributed to more than half of the production in volume of the emirate. Furthermore, as the gear targets high value species, it accounted for 77 % of the total production in terms of value (**Figure 9**).

In 2021, commercial fisheries landings comprised of thirty-five species from a total of eight different families and sub-families, in addition to one mixed category. The top four species of importance for both volume and value were the Kanaad *(Scomberomorus commerson)*, Hamour *(Epinephelus coioides)*, Naiser *(Lutjanus ehrenbergii)* and Jesh Um Al Hala *(Carangoides bajad)*, they represented 62 % of the total volume and 74 % of the total value of production. Aquaculture production was based on seven species with the Indian white prawn *(Penaeus indicus)* being the lead species in terms of production, contributing to 41 % of the total production.

STATUS OF RESOURCES

After observing a decline in the status of many key commercial fish stocks, a series of firm managerial decisions have been implemented over the years within the frame of a long-term strategy aimed at achieving sustainable fish stocks. Accordingly, some of the most productive fishing gears targeting overexploited species have been carefully regulated or banned, resulting in an overall decreasing trend in the pressure on the fishery, whereby the pressure on Abu Dhabi's fisheries decreased through the drop in production by 80% when compared to 2005. However, in comparison to the previous year, fisheries production increased slightly by 4%. Consequently, due to the decreasing fishing pressure on the fishery, the overall status of fish stocks increased, with an observed increase in the level of biomass, and a simultaneous decrease of fishing pressure, which was reflected through a marked improving trend of the strategic fisheries key performance indicators.

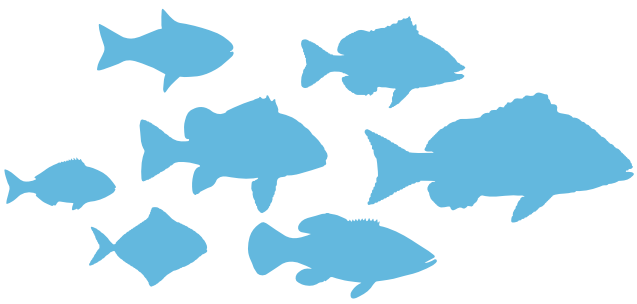
In particular, the Sustainable Exploitation Index (SEI), which provides a rapid insight on the level of sustainability of the landings, increased from 5.7 % in 2018, to 62.3 % in 2021. Moreover, the Spawning Biomass per Recruit (SBR), which is a proxy of the portion of the fish population that is able to spawn, had increased from 7.6 % in 2018, to 34.0 % in 2021. The results attained through data collection in 2021 indicate that fisheries management in the emirate is on track to achieve the set targets of sustainable fisheries resources.

GOVERNANCE AND POLICY

For over 20 years, EAD has been pursuing best practice fisheries management following a suite of benchmarked international management measures. In 2019, in response to increasing pressures on the fishery and the fisheries stock status being defined as 'severely overexploited', EAD authored and launched with the Ministry of Climate Change and Environment (MOCCAE) the *UAE National Sustainable Fisheries Framework (2019–2030)*, a national recovery plan for our fisheries. At the emirate level and consistent with the Framework EAD issued two key regulations that have reduced pressure on the fishery to support in its recovery. These included Ministerial Decision 542 in the year 2018, declaring an immediate stop to fishing using the pelagic Ghazal net and Ministerial Decision 82 of the year 2019, concerning the ban of Gargour fishing operations inside the waters of the emirate. These two regulations are considered to be key regulations that will support the recovery of the Abu Dhabi's fisheries. Moreover, in 2019, EAD launched the Sustainable Aquaculture Policy for the Emirate of Abu Dhabi, geared towards promoting the growth of a competitive local aquaculture industry.

LOOKING AHEAD

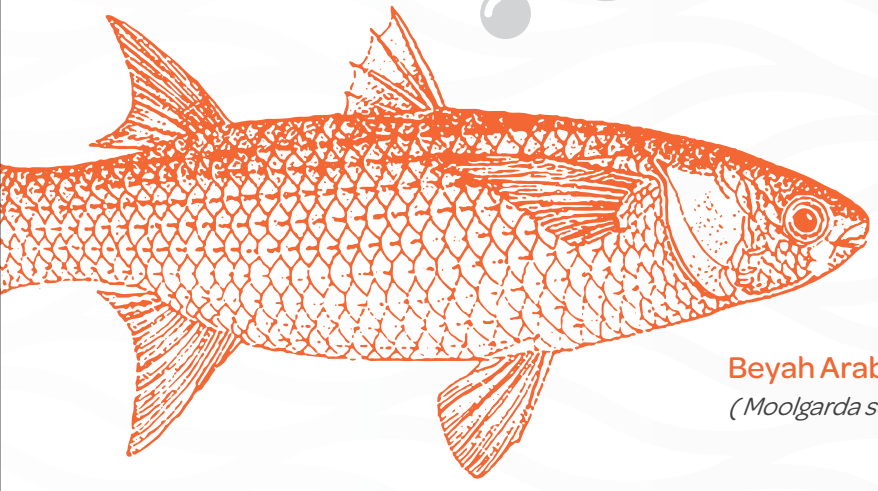
At the midpoint of the timeline set out in the UAE National Framework for Sustainable Fisheries (2019–2030) there has been strong progress made towards fully achieving the strategic objectives:



1. **Reduce Pressure on the Fishery**
2. **Develop Aquaculture Research and Programmes to support fish stock improvement**
3. **Enhance Fish Stocks**

With the implementation of careful fisheries management and thorough data collection and analysis, the emirate has been able to strengthen its seafood production in a sustainable manner that continues to respect and enhance the traditional importance of fishing activities, and allow these to also become activities of the future. The small-scale nature of the fisheries allows for fisheries that are well integrated and in harmony with the natural environment. The very nature of the fisheries, making use of traditional knowledge combined with robust scientific studies allows for Abu Dhabi to be a leader in the fisheries industry.

1. INTRODUCTION



Beyah Arabi
(Moolgarda seheli)

1. INTRODUCTION

The Environment Agency – Abu Dhabi (EAD) is the competent authority managing fish stocks in the Emirate of Abu Dhabi, the agency plays a crucial role in implementing programmes and studies to assess the state of fish stocks in the emirate.

The Ministry of Climate Change and Environment (MOCCAE), in collaboration with EAD, implements the UAE National Framework for Sustainable Fisheries (2019–2030) with the following strategic objectives to achieve sustainable fisheries in 2030:

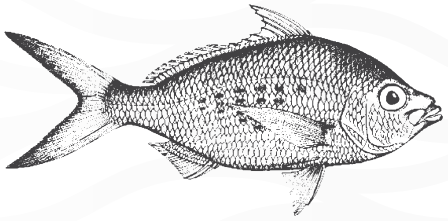
1. **Reduce Pressure on the Fishery**
2. **Develop Aquaculture Research and Programmes to support fish stock improvement**
3. **Enhance Fish Stocks**

The status of the UAE's fisheries resources, the socio-economic conditions, and the fact that sound fisheries management is a strategic priority for the government justified the establishment of the framework, which is a follow up of the UAE Sustainable Fisheries Programme that ran for four years between 2015 and 2018.

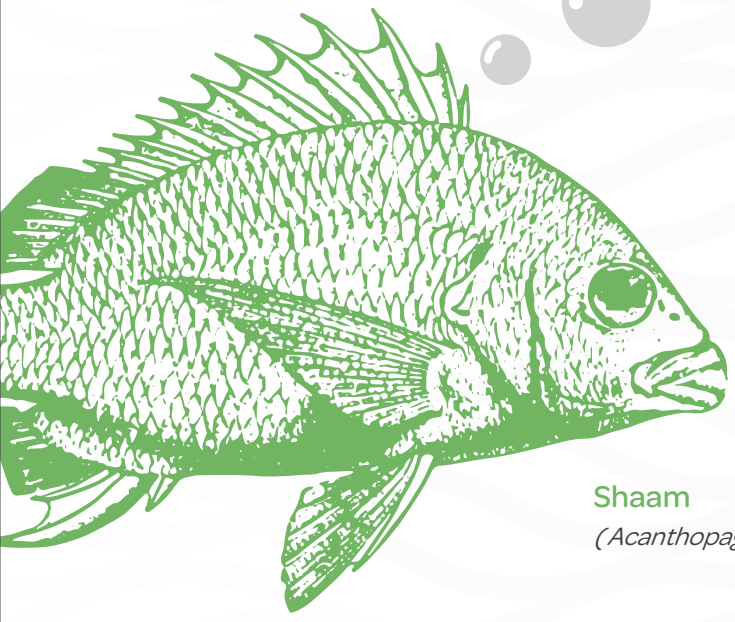
Abu Dhabi hosts a unique and rich variety of marine habitats and biodiversity, with its fisheries operating in a small-scale artisanal nature. In its effort to protect and preserve the emirate's biodiversity, EAD largely focuses on data and knowledge collection, as it is a strategical component for the protection and conservation of biodiversity and moreover, for the achievement of sustainable fisheries.

The status of the stock of the emirate's fisheries are made available by EAD on an annual basis through continuous data collection and analysis. The knowledge on the status of fish stocks is fundamental for assisting decision makers and higher management in the development of policies and managerial decisions.

This bulletin begins with an overview of the sector, examining its main characteristics and the dynamics of its production, as well as the sectors contribution economically and its contribution to employment. The bulletin also showcases details on the characteristics of fisheries and aquaculture production in the Emirate of Abu Dhabi and lastly, the bulletin concludes with details on the status of fisheries resources, and the manner in which fisheries and aquaculture are governed.



2. OVERVIEW



Shaam

(Acanthopagrus latus)

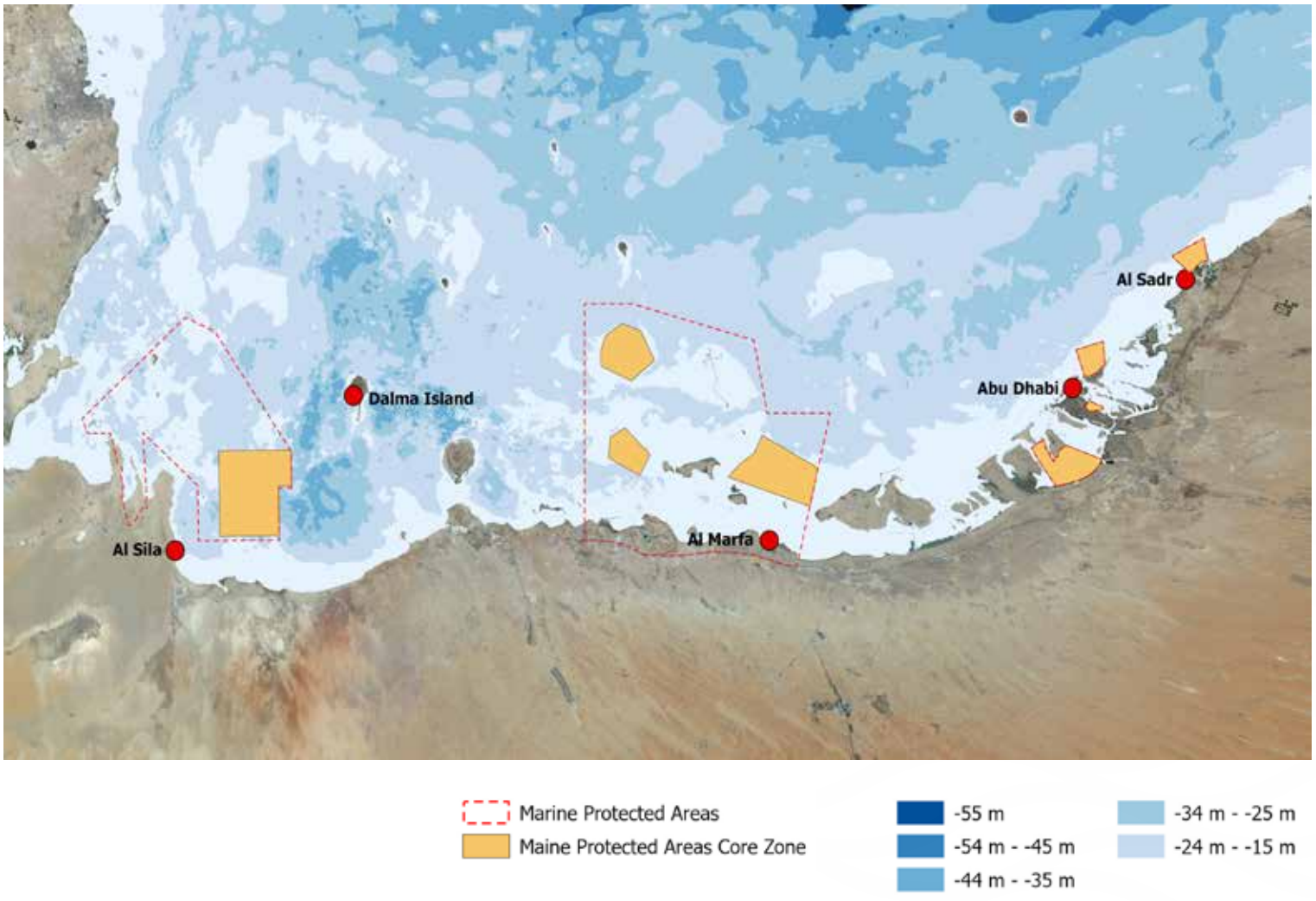
2. OVERVIEW

Fishing grounds in Abu Dhabi waters extend to approximately 48 000 km[3] , with the majority of the emirate's waters being categorised as shallow, with waters of less than 20 metres making up over 70 per cent of the area and the deepest depth recorded being approximately 50 metres **(see Map 1)**. Abu Dhabi hosts a unique and highly diverse marine biodiversity, with various critical marine habitats such as mangroves, coral reefs and seagrass beds spread across its coastline **(see Map 2).**

The bathymetry and habitat maps **(Maps 1 and 2)** give a detailed characterization of the aquatic habitats while also indicating the location of Marine Protected Areas and Marine Protected Area Core Zones. The Marine Protected Areas encompass areas where activities are regulated, whereas the Core Zones are defined as zones where no fishing activity is allowed.

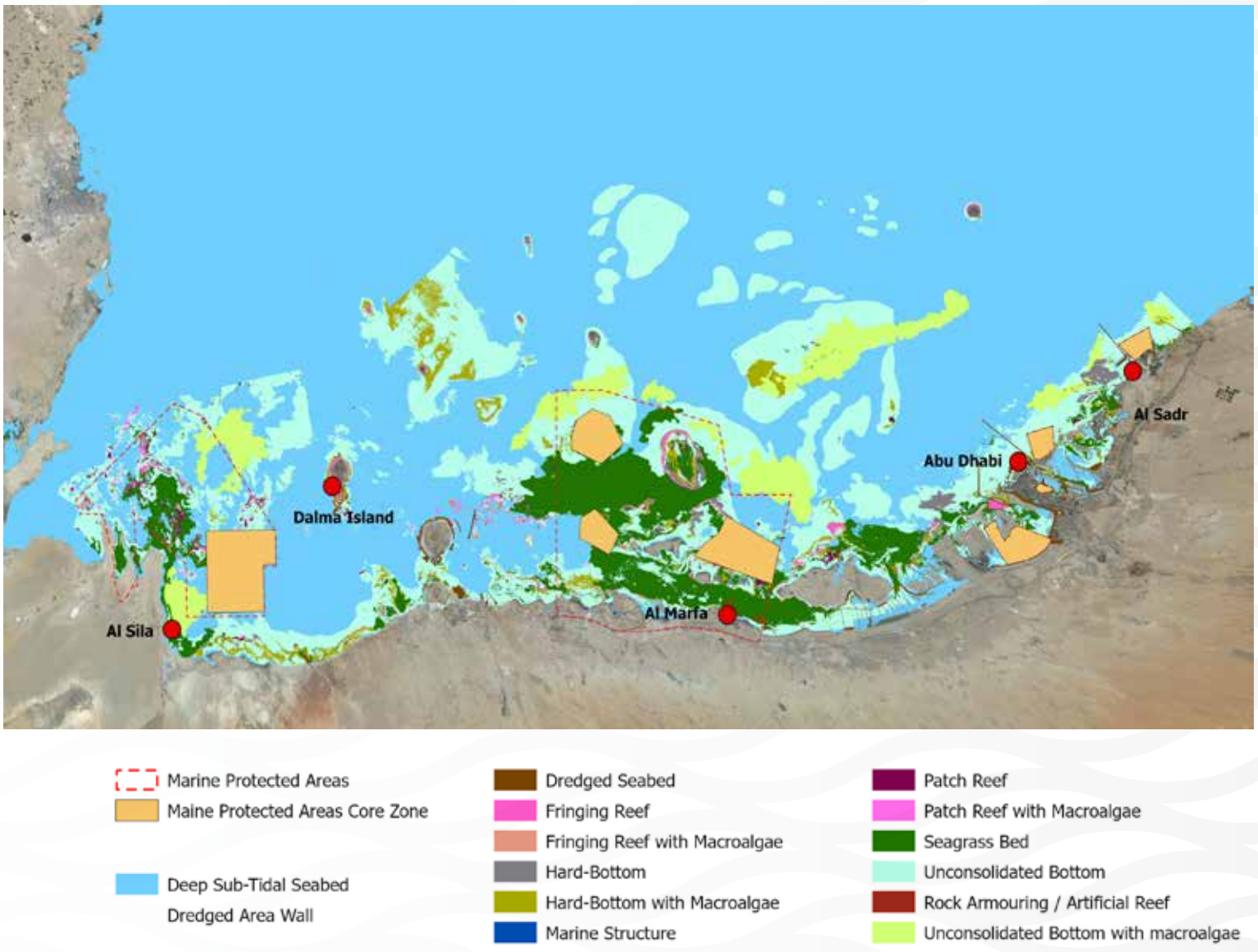
The protection and conservation of these habitats is crucial to maintaining sustainable fish stocks, as many of these habitats form nursery, breeding and foraging grounds for the emirate's fish species.

Map 1: Bathymetry of the study area



[3] Thabit Zahran Al Abdessalaam (2008). Marine Environment and Resources of Abu Dhabi

Map 2: Marine habitats of the study area



2.1 INTRODUCTION TO FISHERIES & AQUACULTURE

2.1.1 Fisheries – An integral part of the UAE's past, present and future

The marine and coastal environment of the Arabian Gulf and the Sea of Oman hold fundamental value in terms of their economic, social, and environmental benefits to the region. In the UAE, fishing practices are deeply embedded in the tradition and culture of the country; as people of the desert, the Emirati ancestors depended on the sea for survival, it was a source of income and a passage of connection to the rest of the world.

2.1.2 The Emirate of Abu Dhabi – An important fisheries and aquaculture stakeholder

Within the UAE, Abu Dhabi plays a crucial role in the management of fisheries as 72 % of the waters of the Arabian Gulf within the country fall within Abu Dhabi's borders. Fisheries in Abu Dhabi is unique in nature whereby it is highly interconnected with culture, tradition and nature. This is reflected through the traditional fishing techniques which have generated production for the Emirati ancestors in the past and continues to do so for current generations.

On a global scale, according to the Food and Agriculture Organization of the United Nations (FAO), 34.2 % of the fish stocks of the world's marine fisheries are classified as overfished. Formerly, global fisheries production was higher than it has been reported in recent years. According to the FAO, global total marine catches dropped from 86.4 million tonnes in 1996 to 84.4 million tonnes in 2018[4].

The aquaculture sector utilises modern and innovative technology, and in the last decade its contribution to the emirate's seafood production has been relatively increasing.

According to the Food and Agriculture Organization of the United Nations (FAO), aquaculture production has accounted for 49 % of the global production of aquatic animals in 2020 reaching 88 million tonnes and a total sales value of USD 265 billion. It is expected that aquaculture production will reach 106 million tonnes in 2030, an overall increase of 22 % compared to 2020[5].

Similarly, in 2021 the aquaculture production in UAE was around 2 663 tonnes. Fish is considered as one of the 18 strategic food items listed in the UAE's National Food Security Strategy, making aquaculture a key component. Furthermore, aquaculture has been identified as an independent and new food-producing sector, that can contribute to reducing pressure on the fishery, whilst contributing towards economic growth, food security, and the social wellbeing of the emirate's citizens.

In the year 2021, the fisheries and aquaculture sector in the Emirate of Abu Dhabi generated 1 726 tonnes of seafood, worth a value of AED 35.2 million, and provided direct employment to a total of 2 452 people **(Table 1).** There was a total of 574 licensed commercial fishing boats operating in Abu Dhabi waters **(Table 1),** with the fishing fleet comprising mainly of Tarad boats and a few Lanshes operating. The fishing fleets generated a total number of 12767 fishing trips, employing a total of 2316 crew members, and generating a total production of 1 318 tonnes with a total value of AED 22.1 million **(Table 1).**

Furthermore, there were 5 operating aquaculture facilities in the Emirate of Abu Dhabi in the year 2021, employing a total of 138 workers, and producing 408 tonnes worth a total value of AED 13.1 million **(Table 1).**

Commercial fisheries		Aquaculture	
574	Number of fishing boats	Number of aquaculture facilities	5
16	Number of Bohoors	Employment (engaged crew onboard)	138
52	Number of Hadhra	Volume of production (tonnes)	408
2 314	Employment (engaged crew onboard)	Value of production (Million AED)	13.1
12 478	Fishing effort (fishing trips)		
12 767	Fishing effort (fishing days)		
1 318	Volume of production (tonnes)		
22.1	Value of production (Million AED)		

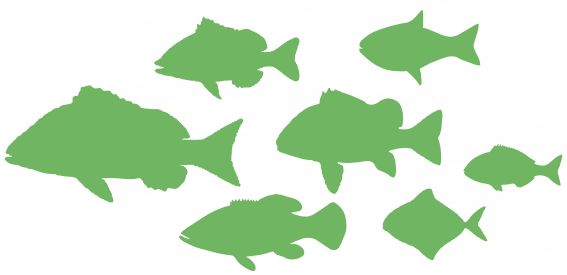


Table 1: Synoptic table (2021 Macro-data)

[4] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome.

[5] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. https://doi.org/10.4060/ca9229en

2.2 TIME SERIES OF TOTAL PRODUCTION

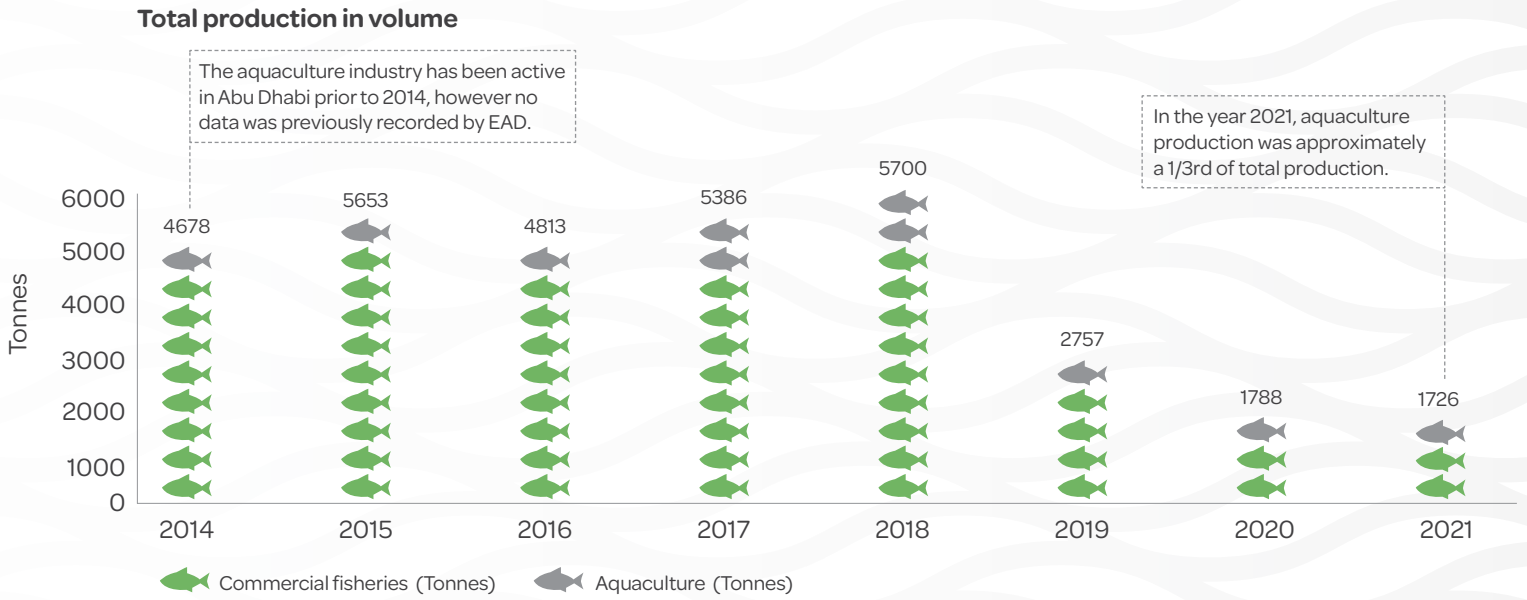


Figure 1: Time series of volume of commercial fisheries and aquaculture production

Over the years, the total production in seafood in the Emirate of Abu Dhabi has been characterised by an overall decreasing trend, partly compensated by the production of aquaculture during the last seven years **(Figure 1).** In the year 2021, the total production of seafood was 1 726 tonnes which is the lowest it has been since 2005, amounting to a decrease of 3 % in comparison to the previous year, and 73 % in comparison to 2005. However, fisheries production in specific showed a slight increase by 4 % in comparison to the previous year. The decrease in overall production in comparison to earlier years is largely attributed to the drop in fisheries production due to the implementation of strict policies and managerial decisions.

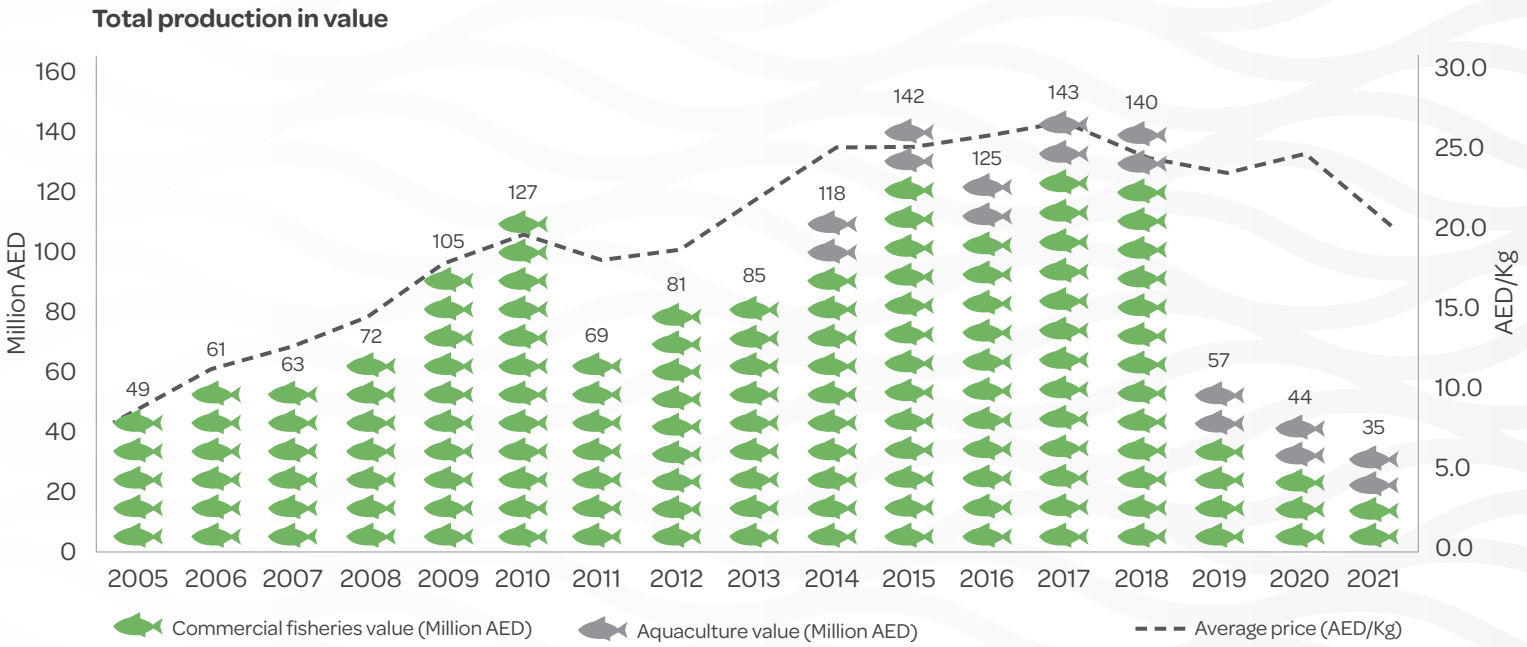


Figure 2: Time series of value of commercial fisheries and aquaculture production

3. COMMERCIAL FISHERIES PRODUCTION

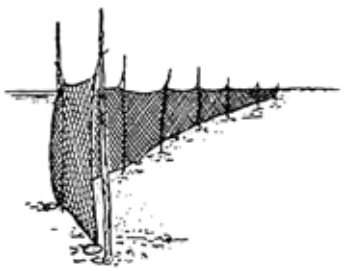
Aifah

(Chanos chanos)

3. COMMERCIAL FISHERIES PRODUCTION

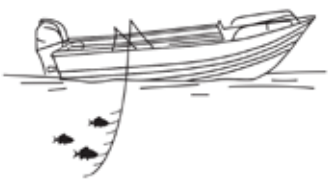
Fisheries in Abu Dhabi is artisanal in nature, with small-sized boats operating and utilising traditional fishing gears. Ordinarily, two types of fishing vessels operate within Abu Dhabi waters: tarads and lanshes. Tarads are open fibreglass boats, comparatively smaller in size than lanshes which are traditionally built wooden dhows. Tarads are equipped with one or two outboard engines, operating with 1–4 crew members onboard with trips typically being carried out at a maximum of one day. Lanshes on the other hand are fitted with diesel engines, and fishing trips range from 3–5 days in length. Currently, there are 574 licensed commercial fishing boats operating in Abu Dhabi waters **(Table 1),** as well as licensed boats from other emirates who comply with the fishing regulations and gear usage policies of the emirate.

Historically, a variety of fishing gears were utilised in the Emirate of Abu Dhabi, with specific gears targeting overexploited species. Accordingly, a number of the gears deployed in the past are now banned as shown in **Figure 3** limitations on the use of some fishing gears, ban of pelagic ghazal nets (2018), ban of gargour fishing traps (2019). Furthermore, usage of some of the gears is restricted to fisherman authorised to fish in privately leased areas of the sea, that are traditionally managed by local fisherman and are passed on passed on through generations (known as Buhoors). Buhoor areas are located in close proximity to shorelines **(Map 1).** In present day, the gears utilised by fishing fleets in Abu Dhabi waters are as follows:



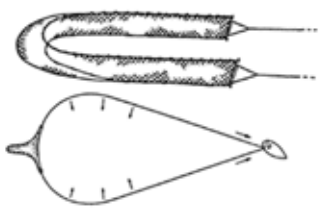
Al Sakkar

(an inter-tidal barrier net that is restricted for use in buhoors only)



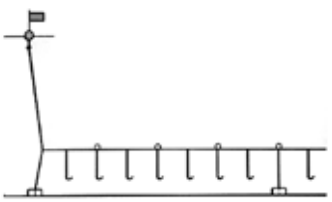
Hadaq

(handline)



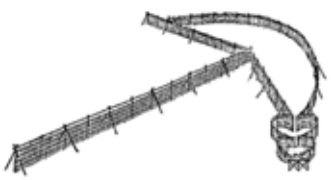
Al Defara

(an encircling net that is restricted for use in buhoors only)



Shark fishing gear

(a gear that targets sharks and is only authorised for use on lanshes)



Al Hadhra

(an inter-tidal enclosure trap)

The aforementioned gears target both demersal and pelagic species, with the species catch composition in Abu Dhabi comprising of over 100 species from more than 35 families. Some of the key families of fish making up the catch include, Epinephelinae *(Groupers)*, Lethrinidae *(Emperors)*, Lutjanidae *(Snappers)*, Haemulidae *(Sweetlips)*, Sparidae *(Seabreams)*, Carangidae *(Jacks)*, Mugilidae *(Mullets)*, Gerreidae (Silver-biddies) and Scombridae *(Mackerels)*.

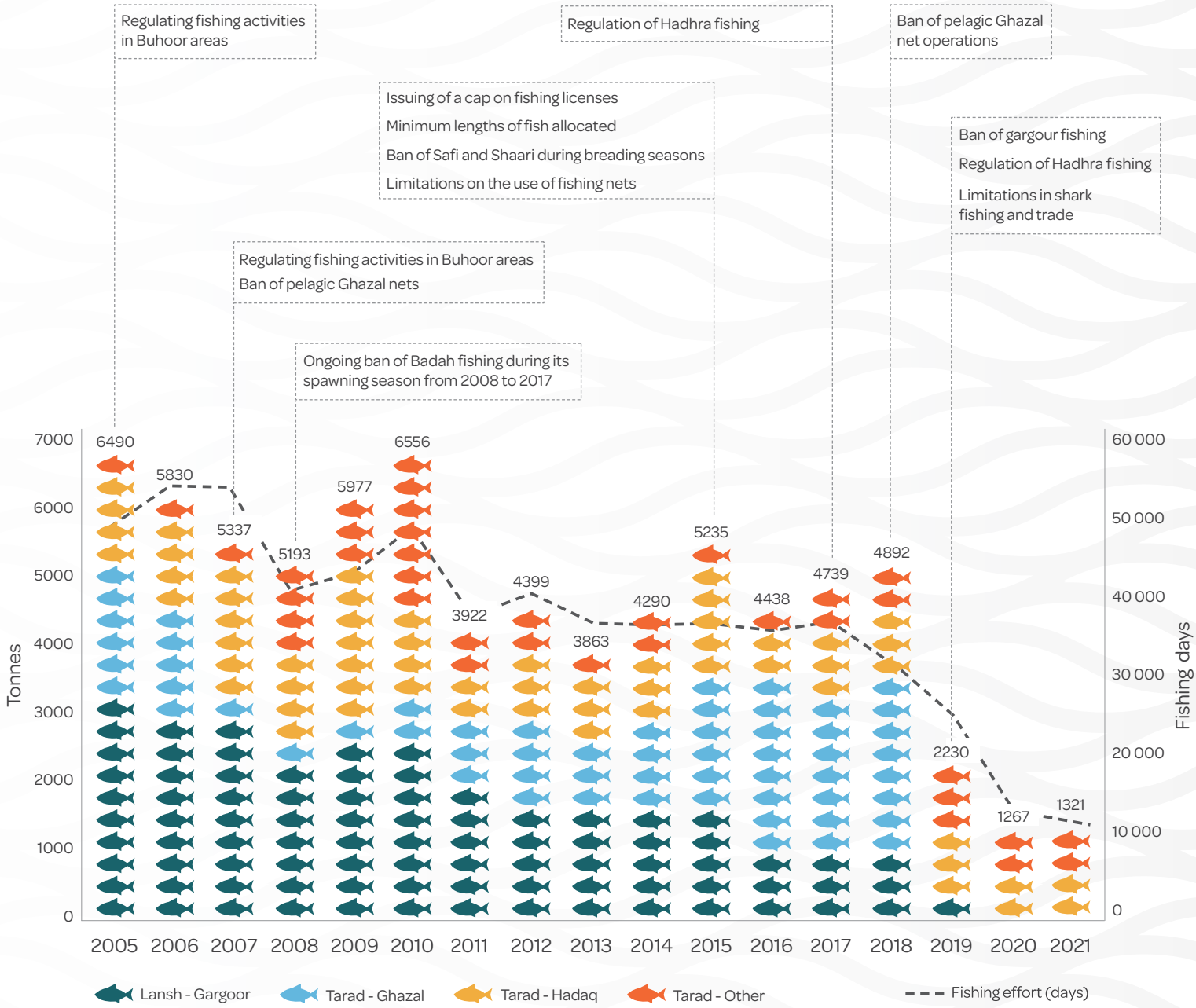


Figure 3: Timeline of fisheries production and effort

Figure 3 summarises the trends of production breakdown by fisheries and the total fishing effort over the years and the main managerial decisions undertaken. Both the production and fishing effort have shown a decreasing pattern across the time series, with the sharpest decrease occurring during the years 2019–2020. Production and fishing effort are two interlinked variables, and the fluctuation in the trend overtime coincides with the implementation of managerial decisions as outlined in **Figure 3.**

However, it is important to note that in 2021 an increase in production was recorded in comparison to 2020, coinciding with a decrease in fishing effort, which is an indication that the fish stock is increasing and recovering.

Furthermore, both the Lansh-Gargour and Tarad-Ghazal have continuously been the two dominant gears contributing to production, and the most gears with fluctuations in production over the years due to the implementation of several limitations and bans. Accordingly, the production of Tarad-Ghazal fisheries stopped at the end of 2018 due to the complete ban issued (Ministerial Decision No. 542), and likewise the Lansh-Gargour production stopped in May 2019 (Ministerial Decision No. 82).

3.1 PRODUCTION PER SEASON

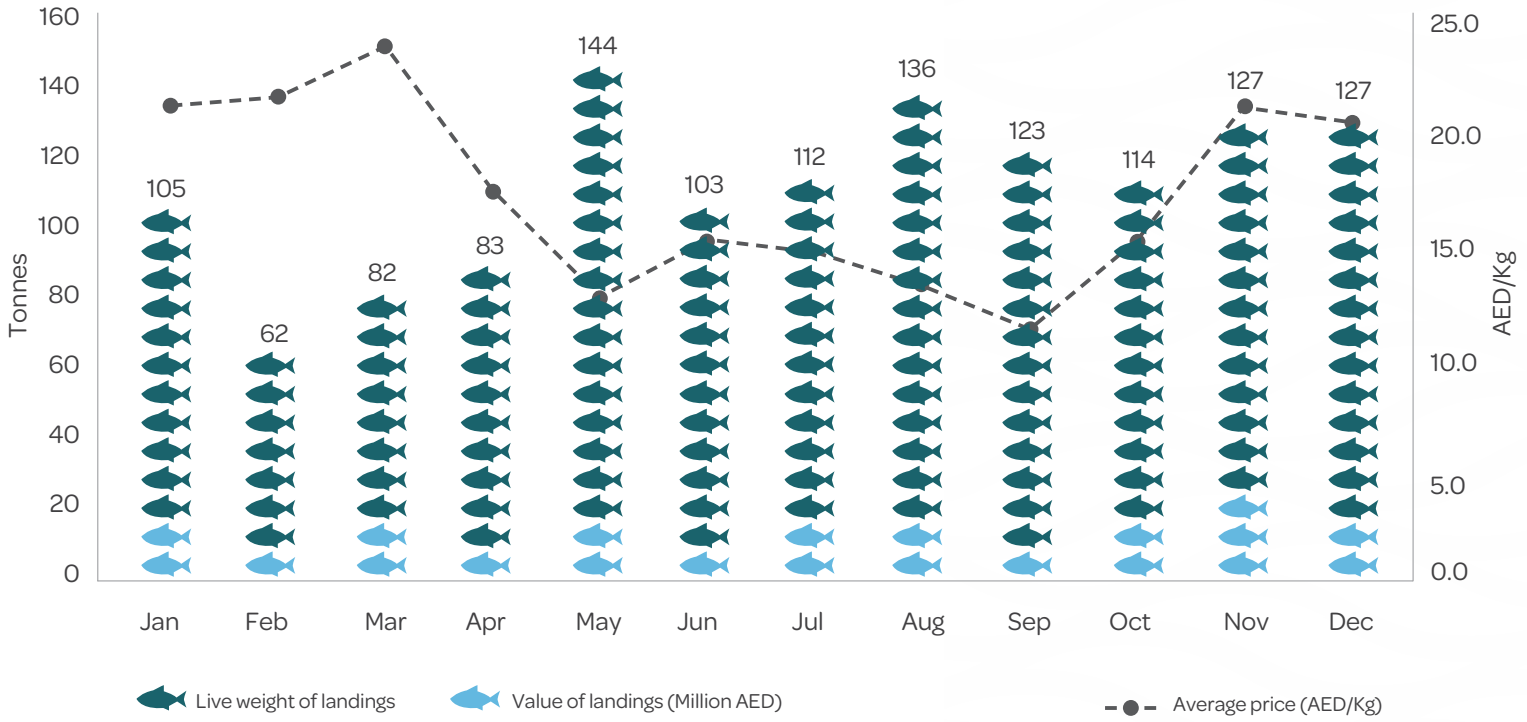
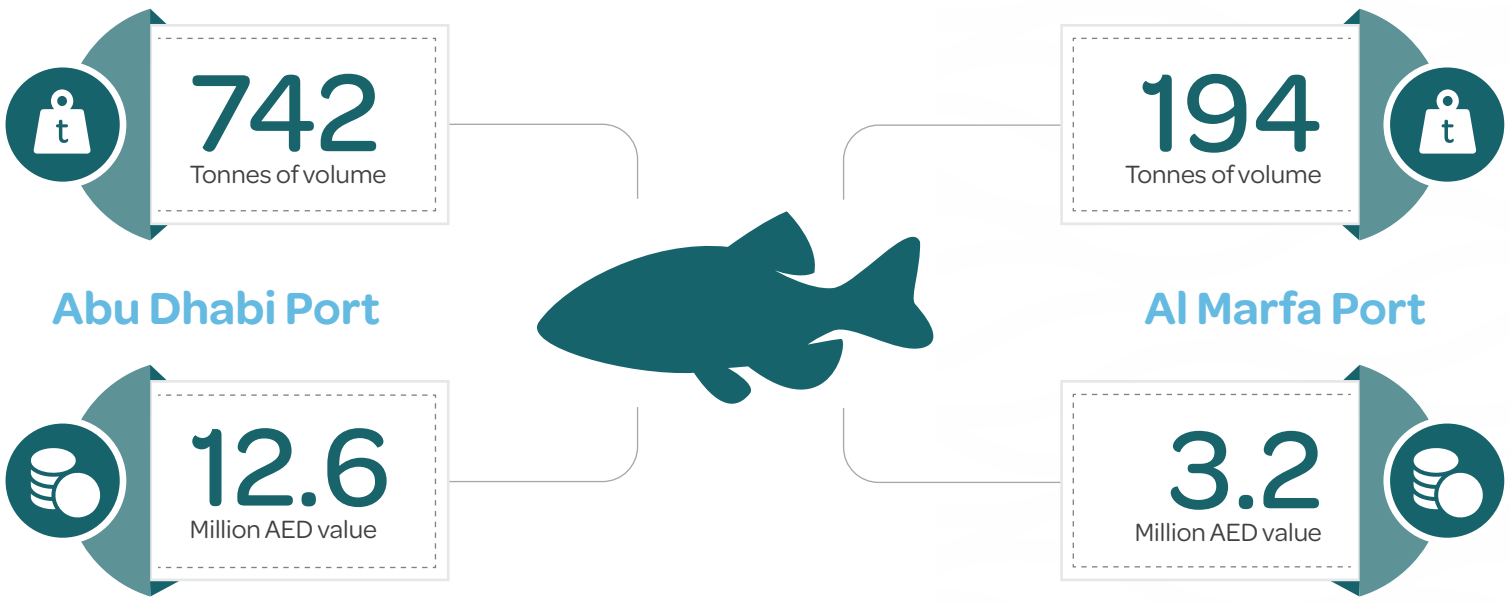


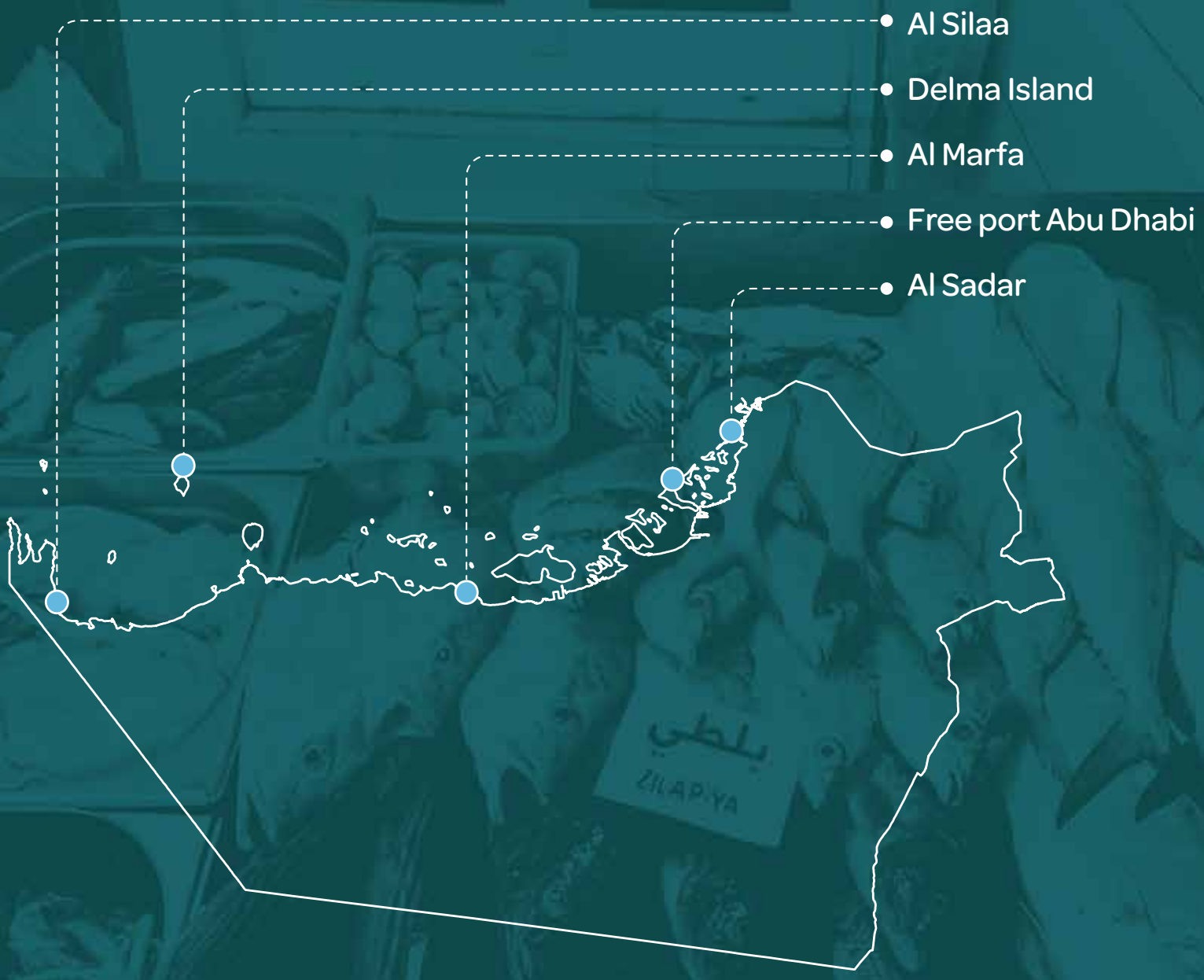
Figure 4: Production per month in volume and value for the year 2021

In the case of Abu Dhabi fisheries, seasonality plays a role in the volume of production. The highest volume of production in 2021 was recorded during the period between May–September, and the lowest during the first four months of the year. On the other hand, the average price of landings was not correlated with seasonality whereby it fluctuated and varied across the year, with the lowest values occurring during the months of May, August and September, and the peaks occurring during the months of January, February, April and November. Accordingly, the value of landings reached its peak during the month of March.



3.2 PRODUCTION PER AREA

Map 2: Commercial fishing landing sites in the Emirate of Abu Dhabi



Both the volume and value of production in the Emirate of Abu Dhabi are variable in terms of geographic location **(see Map 2),** with Abu Dhabi and Al Sadar's ports landing more than 2/3 of the production of the entire emirate in both volume and value (969 tonnes and AED 16.1 million) **(Figure 5)**. Abu Dhabi alone accounts for more than half of the production of the entire emirate (742 tonnes and AED 12.6 million). On the other hand, in the Al Dhafra region, Al Marfa was found to have the third largest volume of production with a total of 194 tonnes landed, and the third highest value of AED 3.2 million. Delma island ranked fourth in terms of production in volume and value (128 tonnes and AED 2.2 million) in comparison to the other five ports, and Al Silaa was the fifth and held the least production in both volume and value (27 tonnes and 570 000 AED) as shown in **Figure 5**.

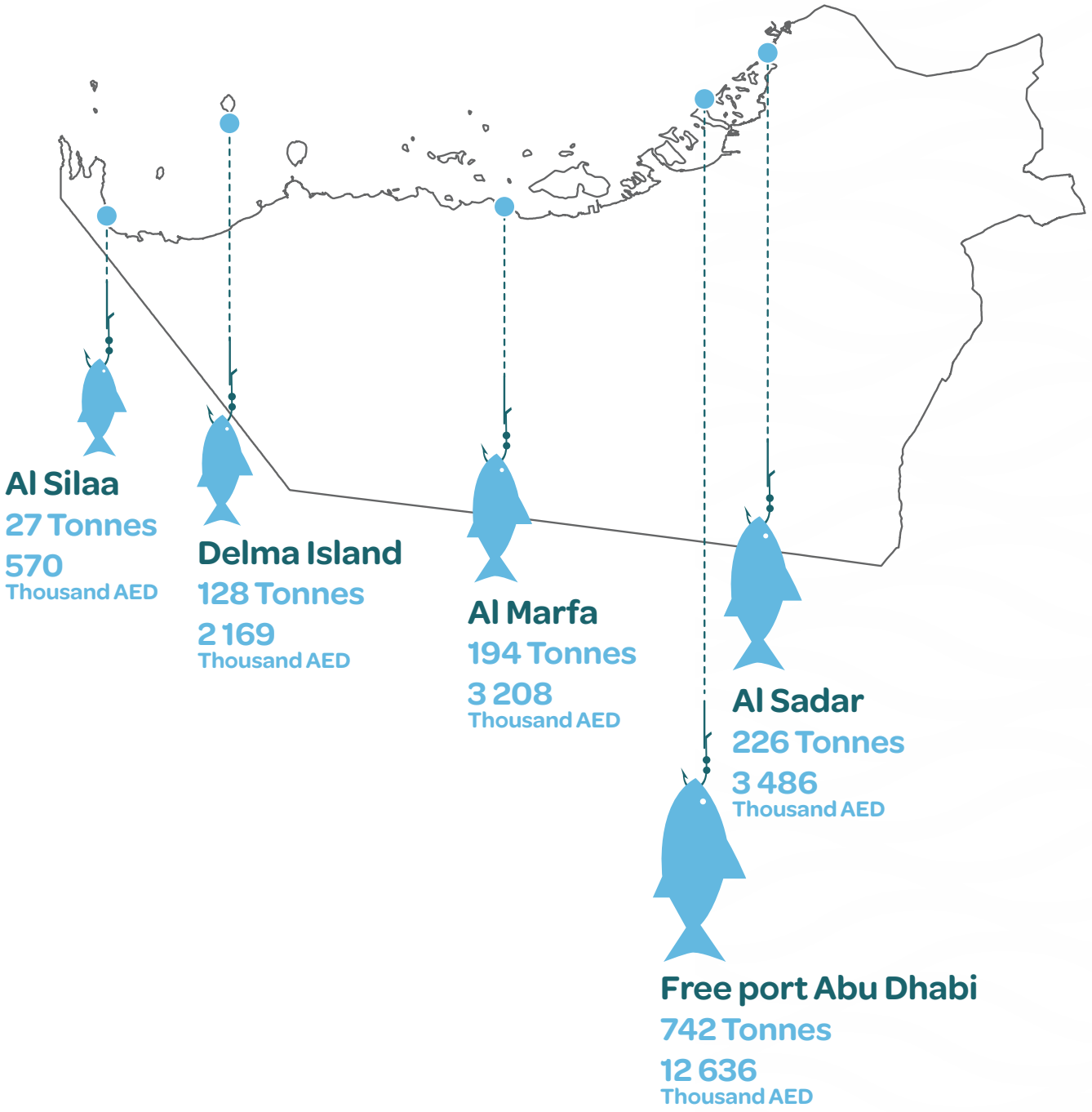


Figure 5: Production per port in volume and value

3.2.1 Historical trends

The main landing sites of the emirate were characterised by a general decline in landings when compared to landings prior to 2019, which followed the general decline in production of the sector as a response to the policies and management decisions on gear limitations a shown in **Figure 6**. In general, the ports of Al Dhafra region, Delma and Al Silaa in particular, showed a relatively higher decreasing trend from 2019 to 2020. This sharp decline in both volume and value coincides with the banning of both the Ghazal nets and the Gargour gears, as those were the two main methods utilised by vessels landing in those ports. Conversely, from 2020 to 2021 all ports with exception to Al Silaa showed an increase in their production, whereas Al Silaa's production remained stable. In 2021, a significant portion of production was generated through Al Hadhra fish traps, and fishing in Buhoor areas, both of which are highly operational in Abu Dhabi and Al Sadar, in comparison to Al Dhafra region (Hadhra and Buhoor numbers are higher in Abu Dhabi and Al Sadar when compared to Al Dhafra region).

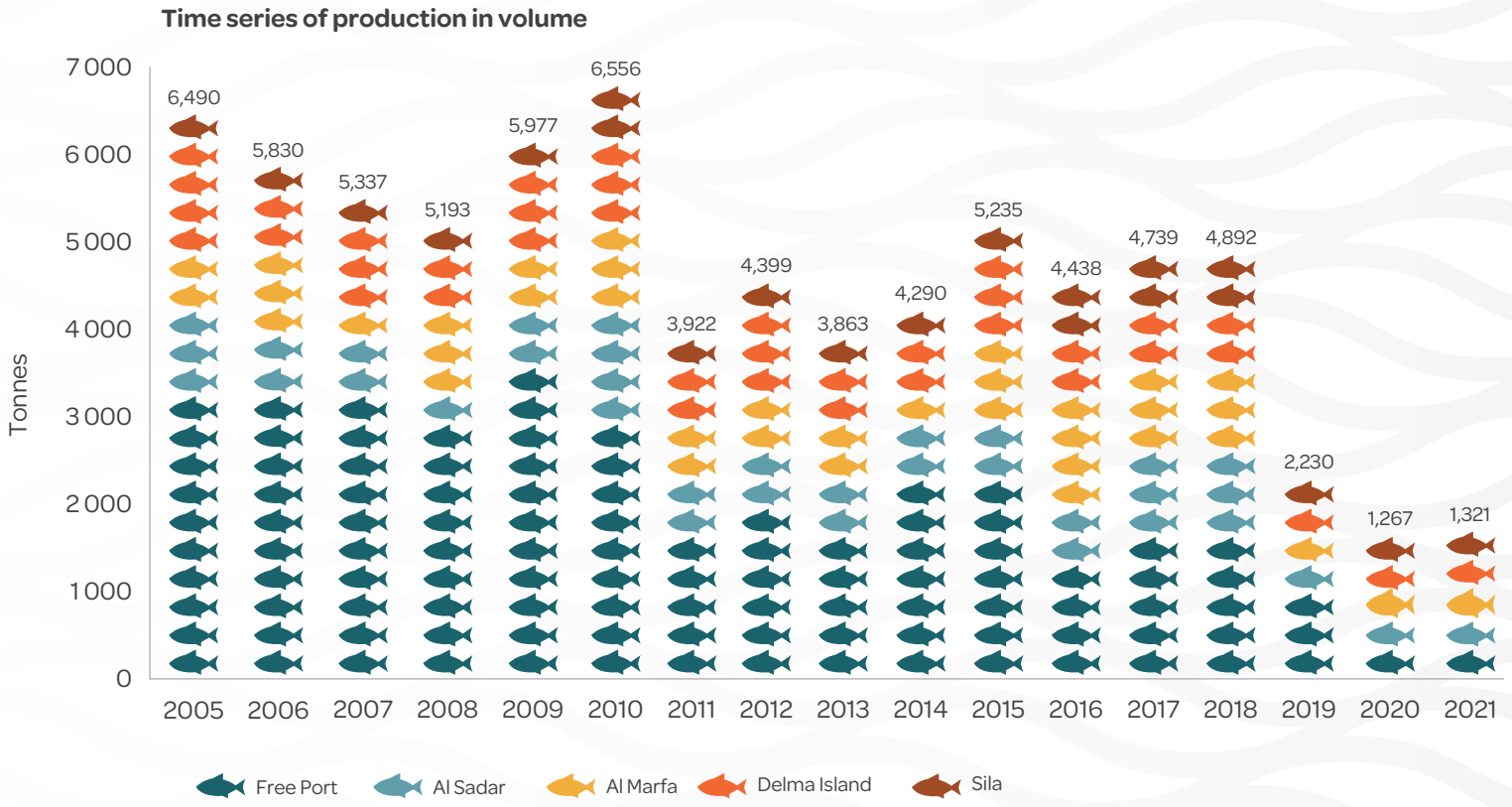


Figure 6: Time series of production in volume of the Emirate of Abu Dhabi

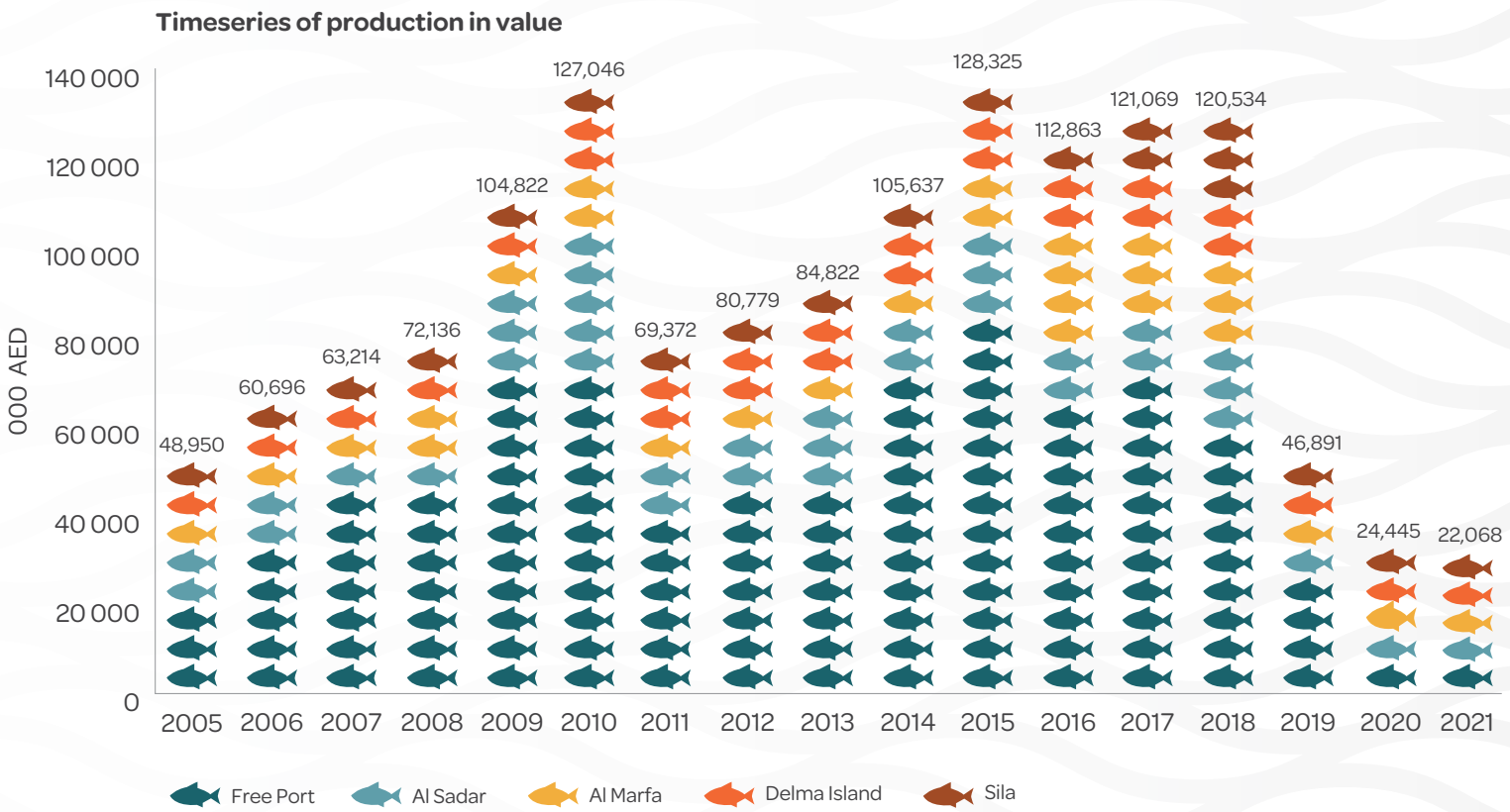


Figure 7: Time series of production in value of the Emirate of Abu Dhabi

3.2.2 Seasonal changes

Figure 8 outlines the seasonal trend in the relative percentage contribution to total production per port for the year 2021, with the main factor affecting the contribution being the seasonality of gear usage. In specific, the usage of Al Hadhra and Buhoor related gears are highly variable throughout the year, whereas the usage of the Hadaq gear is relatively constant. During the months of April to October of 2021, the contribution of Abu Dhabi and Al Sadar increased, while the relative contribution of other ports decreased due to the operation of Al Hadhra fisheries, whereby a high proportion of the fisheries operate within Abu Dhabi and Al Sadar's waters. Respectively, a decrease in Buhoor related gears (Deffara and Sakkar) is observed in the months of April–October. This decrease combined with the increase in Al Hadhra usage during those months results in the increase in relative percentage contribution of Abu Dhabi and Al Sadar regions ports.

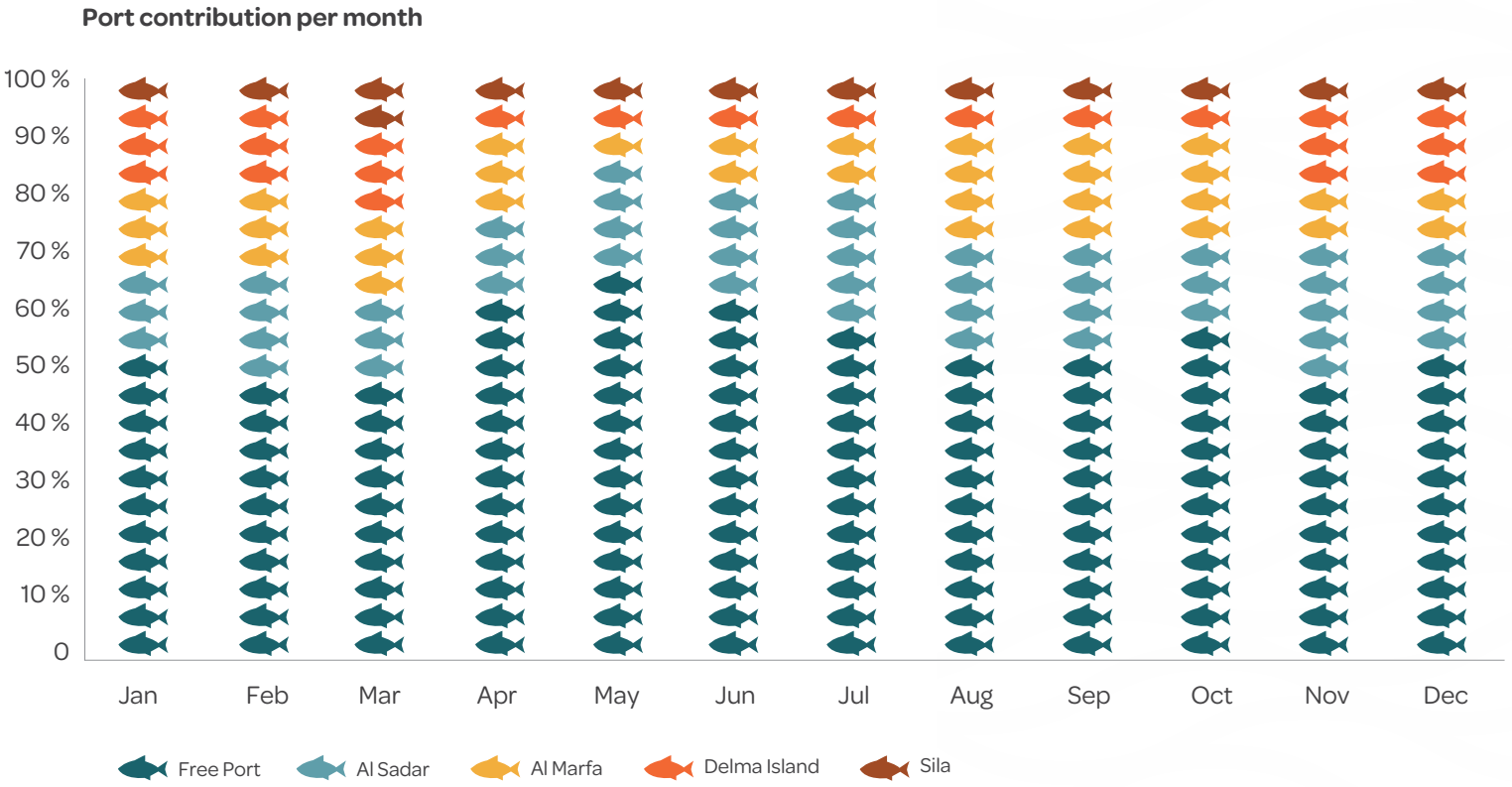


Figure 8: Port relative percentage contribution per month for the year 2021

3.3 PRODUCTION PER BOAT-GEAR CATEGORY

In the year 2021, the Tarad-Hadaq contributed to above half of the production in volume of the emirate, targeting high value species, it accounted for 77 % of the total production in value **(Figure 9)**. On the other hand, the Tarad-Al Hadhra was the second highest contributor in terms of volume (38 %), however the gear targeted species of lower value in comparison to the Tarad-Al Hadhra and so its contribution to production in value was only 16%. The Tarad-Al Defarra ranked third in terms of its contribution to both volume and value, while the Tarad-Al Sakkar ranked fourth and only contributed 1% to both volume and value. Exceptionally, the production in both volume and value of Lansh fisheries was less than 1 % in the year 2021, due to the limitations in operating the fleets.

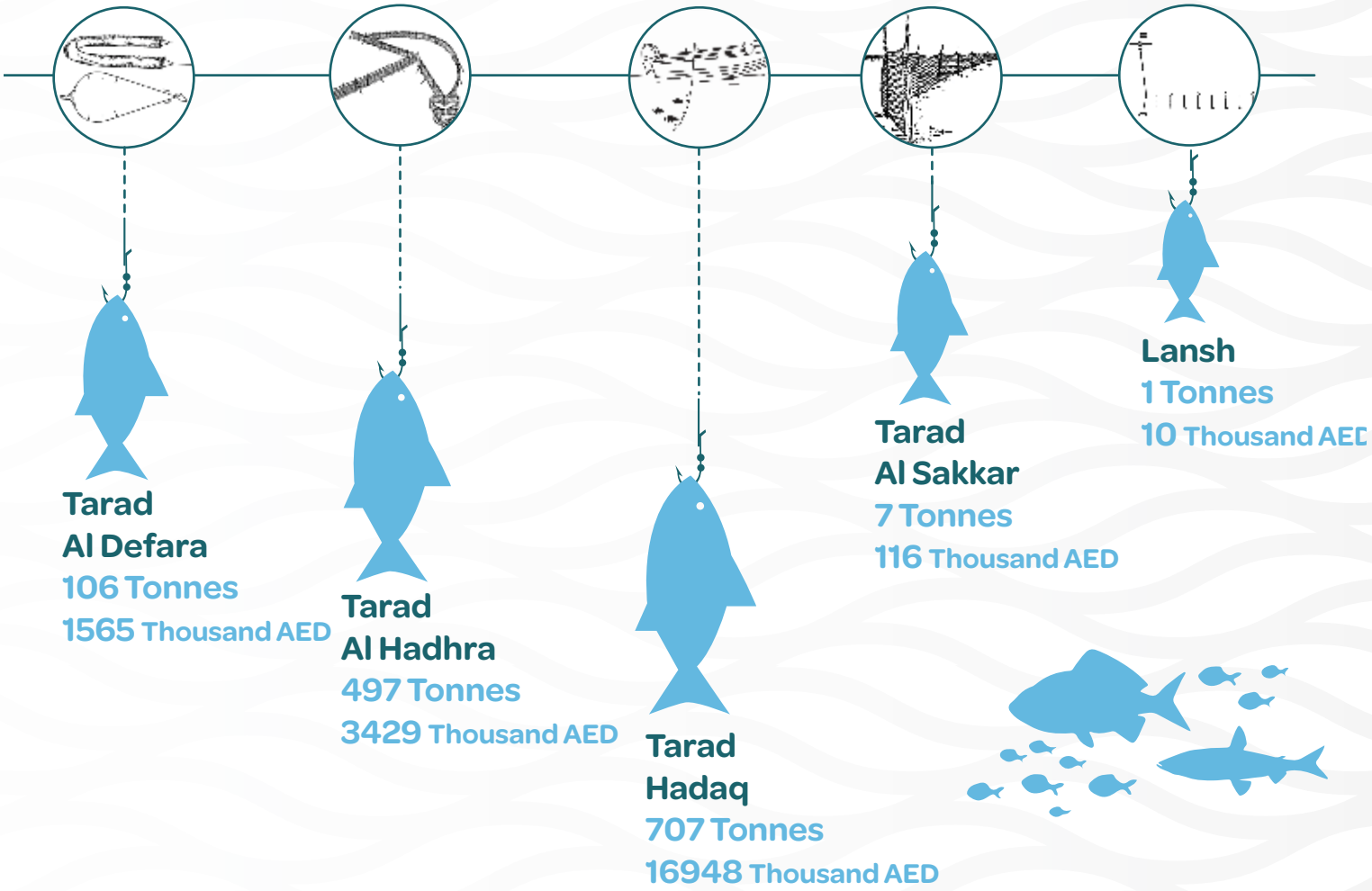


Figure 9: Boat-gear production in volume and value

3.3.1 Historical trends

Figure 10 & **Figure 11** outline the time series of production per boat-gear in volume and value, both are characterised by an overall decreasing trend in comparison to production prior to 2019, which followed the general decline in production of the sector as a response to the policies and management decisions on gear limitations. It is important to note that although there was an increase in production in comparison to the previous year, a 9.8 % decrease in value was recorded. This decrease is attributed to the Tarad-Al Hadhrah fisheries, which was had the highest increase in production when compared to the previous year, this fishery contributed 38 % to total production in volume and only 16 % in value as it targets low value species. Over the time series, the Tarad-Hadaq remains the most constant boat-gear contributing to both volume and value in absolute terms, whereas in relative terms the Tarad-Hadaq has become increasingly important, becoming the highest boat-gear contributor to both volume and value in the last three years. On the other hand, the Lansh has been continuously decreasing in its contribution to both volume and value, where previously its contribution in some years was over 50 % to both volume and value, whereas in 2021 its production in both volume and value was almost negligible. Furthermore, another main contributor to volume and value over the years was the Tarad-Ghazal fisheries. However, the Tarad–Ghazal fisheries fluctuated highly over time in terms of its contribution, the fisheries reached its peak contribution during the years 2016-2018, contributing approximately 50 % to both volume and value. Similarly, the Tarad-Al Defarra also had a peak in contribution to volume and value during 2008–2010 contributing 24 % to volume and 18 % to value, this peak coincides with the decrease in Tarad-Ghazal fisheries during that time period. Respectively, the importance of the Tarad-Al Defarra decreased after 2010, reaching less than 3 % contribution to volume per year for a period of time. However, its importance began to yet again increase during the last three years, once again coinciding with the decrease in Tarad-Ghazal fisheries. In the last four years, the Tarad-Al Hadhra's contribution to both volume and value increased from about 1 % to 38 % in volume, as well as from 1 % to 16 % in value. The fluctuations in boat-gear usage and contribution over time directly reflect the adaptation of the sector to managerial decisions and policies.

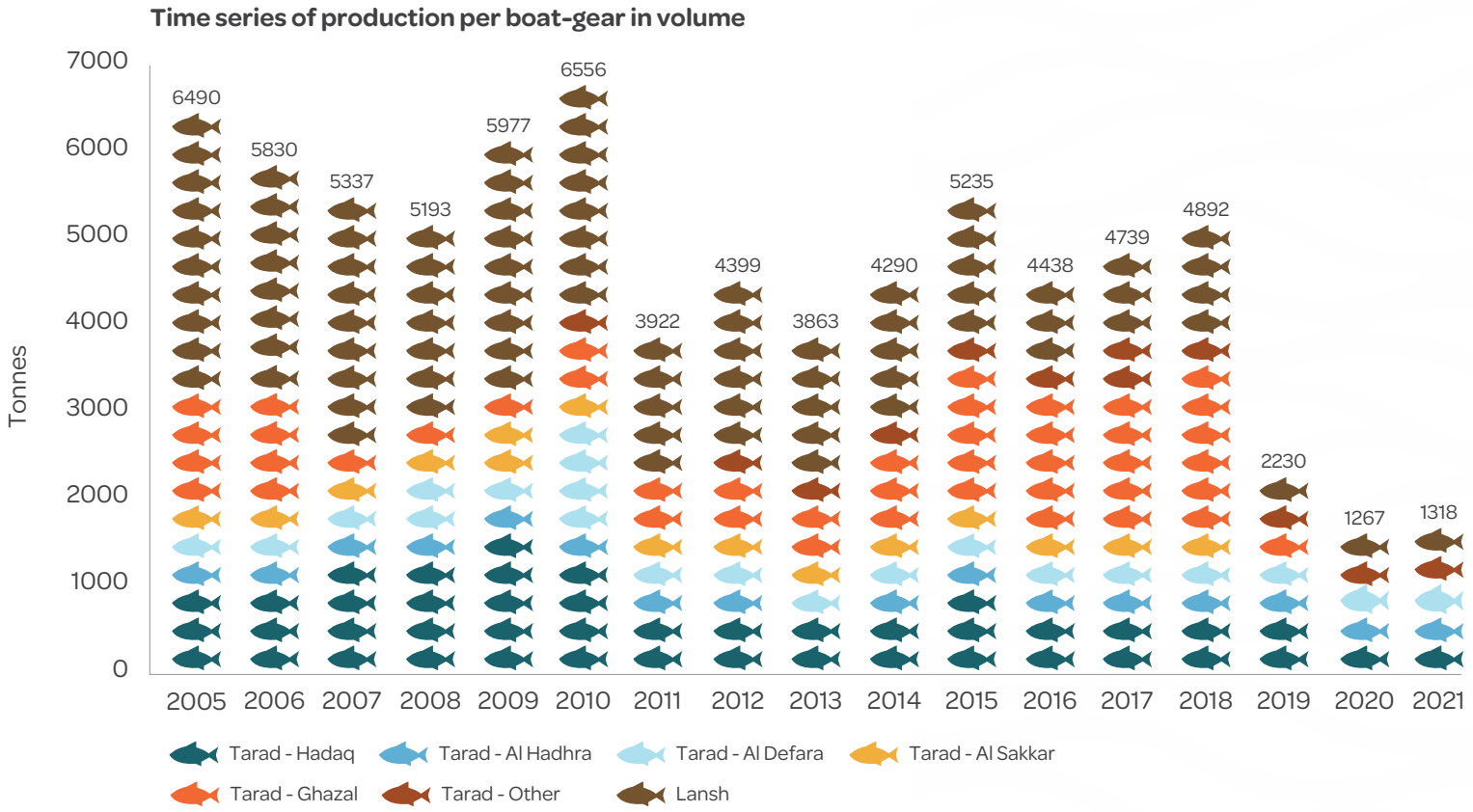


Figure 10: Time series per fishery (volume)

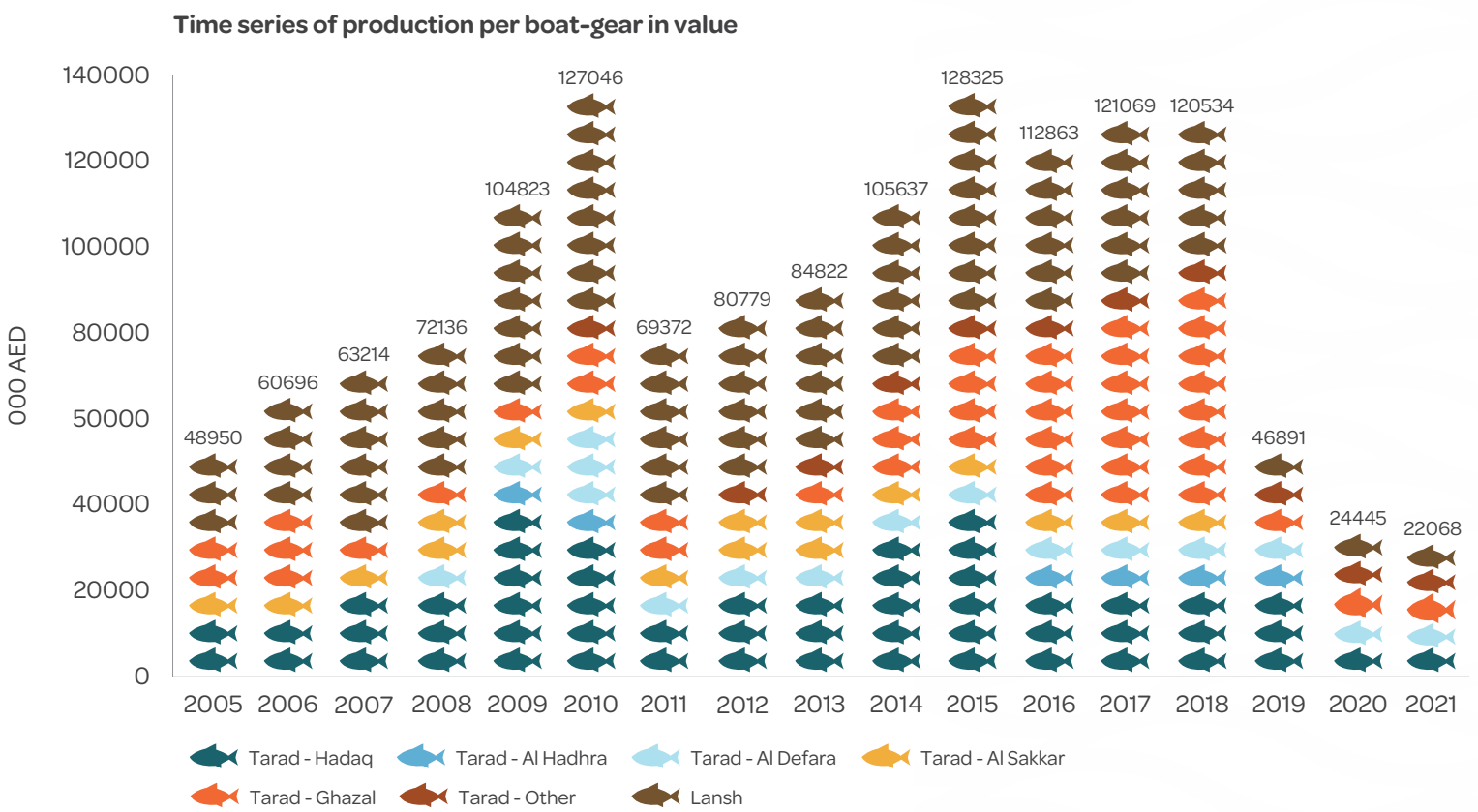


Figure 11: Time series per fishery (value)

3.3.2 Seasonal changes

Figure 12 outlines the gear contributions per month for the year 2021. During the months April to October, the Tarad-Al Hadhra season was open making it a large contributor to production during those months. Moreover, the Tarad-Al Hadhra was the main factor leading to relative fluctuation and changes in the contribution of other gears during those months. The Tarad-Hadaq was consistently the highest contributor during the rest of the year, being the most relatively constant gear in terms of its contribution, whereas relative seasonal fluctuation is noted for both the Tarad-Al Sakkar and Tarad-Al Defarra.

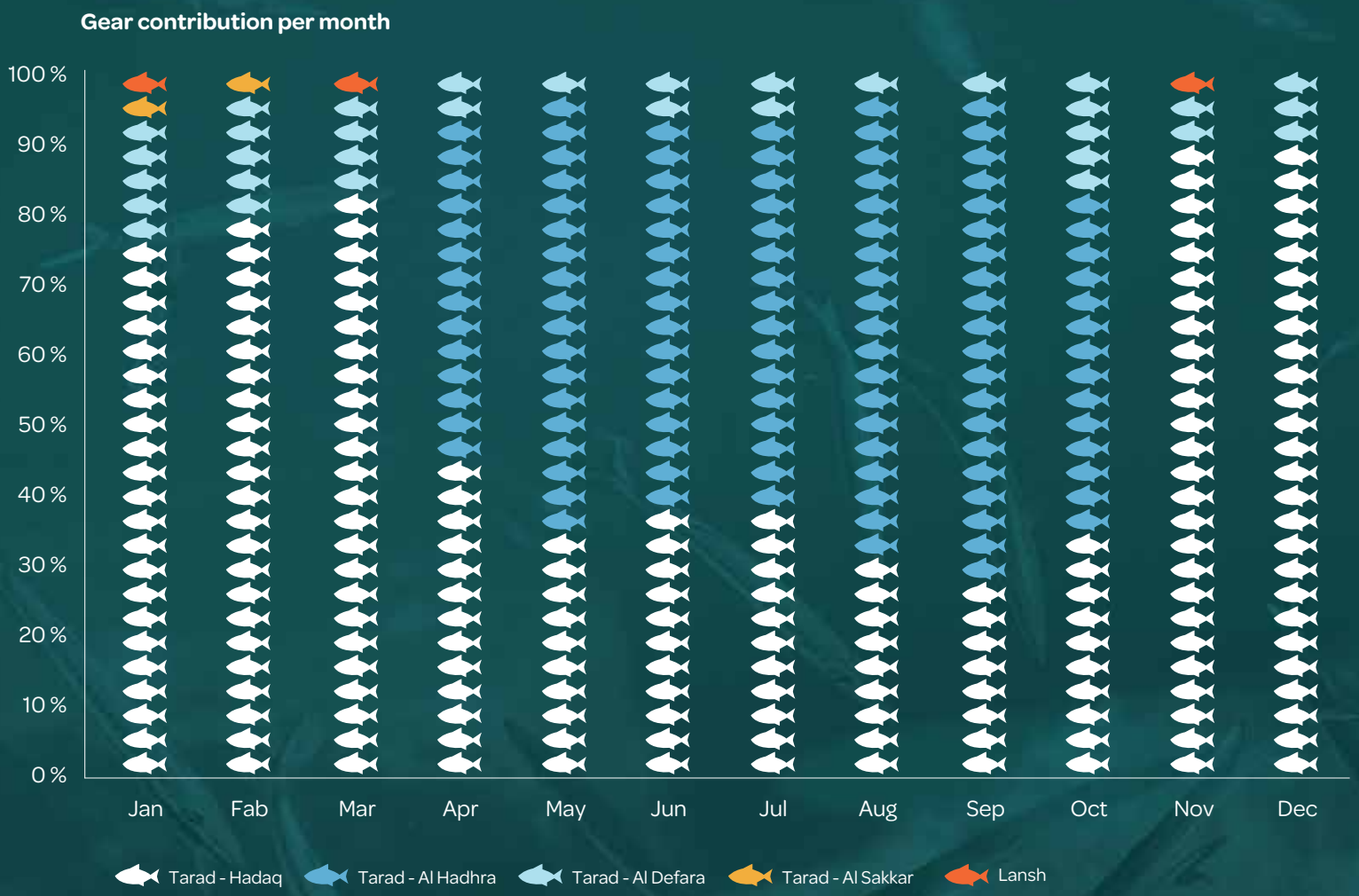


Figure 12: Gear contribution per month for the year 2021

3.4 PRODUCTION PER SPECIES

For the year 2021, Abu Dhabi's commercial fisheries comprised of thirty-five species, which were grouped into a total of eight families and sub-families, as well as one mixed category titled "others" as outlined in **Table 3.** The eight key families and subfamilies consist of: Scombridae (mackerels and tunas), Epinephelinae (groupers), Lutjanidae (snappers), Carangidae (jack mackerels), Haemulidae (grunts), Portunidae (crabs), Sparidae (seabreams) and Lethrinidae (emperors).

Family	Scientific name	Arabic name	Production			% Variation	
			Average 2005-2018	2020	2021	2020 to average 2005-2018	2020 to 2021
Scombridae	*Scomberomorus commerson*	Kanaad	1 209.79	229.73	235.73	-81 %	3 %
Scombridae	*Euthynnus affinis*	Sadah	1.98	0.53	0.02	-73 %	-95 %
	***Scombridae Total***		**1 211.77**	**230.26**	**235.75**	**-81 %**	**2 %**
Lutjanidae	*Lutjanus ehrenbergii*	Naiser	68.67	202.85	279.06	195 %	38 %
Lutjanidae	*Lutjanus fulviflamma*	Aqalah	6.97	4.12	8.14	-41 %	98 %
	***Lutjanidae Total***		**75.64**	**206.97**	**287.19**	**174 %**	**39 %**
Epinephelinae	*Epinephelus coioides*	Hamour	854.19	157.11	160.93	-82 %	2 %
	***Epinephelinae Total***		**854.19**	**157.11**	**160.93**	**-82 %**	**2 %**
Carangidae	*Carangoides bajad*	Jesh Um Al Hala	157.36	135.29	148.07	-14 %	9 %
Carangidae	*Scomberoides commersonnianus*	Dhil'e	357.65	43.49	33.02	-88 %	-24 %
Carangidae	*Caranx ignobilis*	Jib	29.14	9.17	0.72	-69 %	-92 %
Carangidae	*Gnathanodon speciosus*	Zuraidi/Gufdar	131.54	7.83	12.81	-94 %	64 %
Carangidae	*Atule mate*	Durduman	93.55	3.80	2.80	-96 %	-26 %
Carangidae	*Carangoides fulvoguttatus*	Jesh Zeria	57.68	1.10	-	-98 %	-100 %
Carangidae	*Carangoides malabaricus*	Jesh Sal	14.78	0.72	0.07	-95 %	-90 %
Carangidae	*Decapterus russelli*	Sima	0.13	0.61	0.39	357 %	-36 %
	***Carangidae Total***		**841.84**	**202.00**	**197.88**	**-76 %**	**-2 %**
Haemulidae	*Diagramma pictum*	Farsh	368.42	0.03	0.03	-100 %	-17 %
Haemulidae	*Pomadasys argenteus*	Naqroor	15.54	2.07	3.92	-87 %	90 %
Haemulidae	*Plectorhinchus sordidus*	Yanam	29.21	1.03	10.12	-96 %	879 %
	***Haemulidae Total***		**413.16**	**3.13**	**14.07**	**-99 %**	**349 %**

Family	Scientific name	Arabic name	Production			% Variation	
			Average 2005-2018	2020	2021	2020 to average 2005-2018	2020 to 2021
Lethrinidae	*Lethrinus lentjan*	Shaari Eshkheli	94.24	0.12	0.06	-100 %	-52 %
Lethrinidae	*Lethrinus nebulosus*	Shaari	625.10	64.37	65.73	-90 %	2 %
Lethrinidae	*Lethrinus microdon*	Souli	39.87	4.30	5.61	-89 %	30 %
	***Lethrinidae Total***		**759.21**	**68.78**	**71.40**	**-91 %**	**4 %**
Portunidae	*Portunus pelagicus*	Qabqoob	168.87	27.81	24.07	-84 %	-13 %
	***Portunidae Total***		**168.87**	**27.81**	**24.07**	**-84 %**	**-13 %**
Sparidae	*Rhabdosargus sarba*	Qabit	41.76	18.26	14.21	-56 %	-22 %
Sparidae	*Acanthopagrus latus*	Shaam	13.85	5.06	2.67	-63 %	-47 %
	***Sparidae Total***		**55.62**	**23.33**	**16.89**	**-63 %**	**-47 %**
Others	*Chanos chanos*	Aifah	21.17	77.79	78.05	267 %	0 %
Others	*Gerres longirostris*	Badah	58.79	64.23	38.41	9 %	-40 %
Others	*Sphyraena jello*	Jedd	88.24	59.48	81.45	-33 %	37 %
Others	*Siganus canaliculatus*	Safi Arabi	23.02	46.12	72.19	100 %	57 %
Others	*Belonidae spp.*	Haqool	4.08	24.43	12.30	499 %	-50 %
Others	*Rhynchorhamphus georgii*	Sils	8.63	22.99	0.32	166 %	-99 %
Others	*Moolgarda seheli*	Beyah Arabi	54.32	17.33	10.08	-68 %	-42 %
Others	*Mixed species*	Mekhlot	6.18	6.37	8.09	3 %	27 %
Others	*Platax teira*	Imad	21.70	5.22	0.27	-76 %	-95 %
Others	*Rachycentron canadum*	Sikkil	30.32	2.99	1.76	-90 %	-41 %
Others	*Netuma thalassina*	Khan	23.36	2.85	3.08	-88 %	8 %
Others	*Carcharhinidae spp.*	Jarjoor	48.05	13.19	0.21	-73 %	-98 %
Others	*Sepia pharaonis*	Habbar	1.20	1.03	1.67	-14 %	63 %
Others	*Monodactylus argenteus*	Farzouk	1.51	0.76	0.37	-49 %	-52 %
	***Others Total***		**390.57**	**344.78**	**308.25**	**-49 %**	**-52 %**

Table 3: Production per family, sub-family, species and genera

Figure 13 & **Figure 14**, outline the production per family in terms of volume and value for the year 2021. Species categorised under the category "others" were the highest contributors to volume, contributing 23 % to total volume and 16 % to total value. Secondly, the Lutjanidae family was the second largest contributor to volume, contributing 22 % to total volume and 5 % to total value. The Epinephelinae family was the largest contributor to value in the year 2021, whereby the family contributed 28 % to total value and 12 % to total volume. Additionally, the Carangidae family contributed 15 % to total volume and 17 % to total value, the Scombridae family contributed 18 % to total volume and 27 % to total value, making it the second highest family group contributing to total value. The Lethrinidae family contributed 5 % to both total volume and value, the Portunidae family contributed 2 % to total volume and 1 % to total value and lastly, the Sparidae family contributed 1 % to both total volume and value.

Production per family in volume

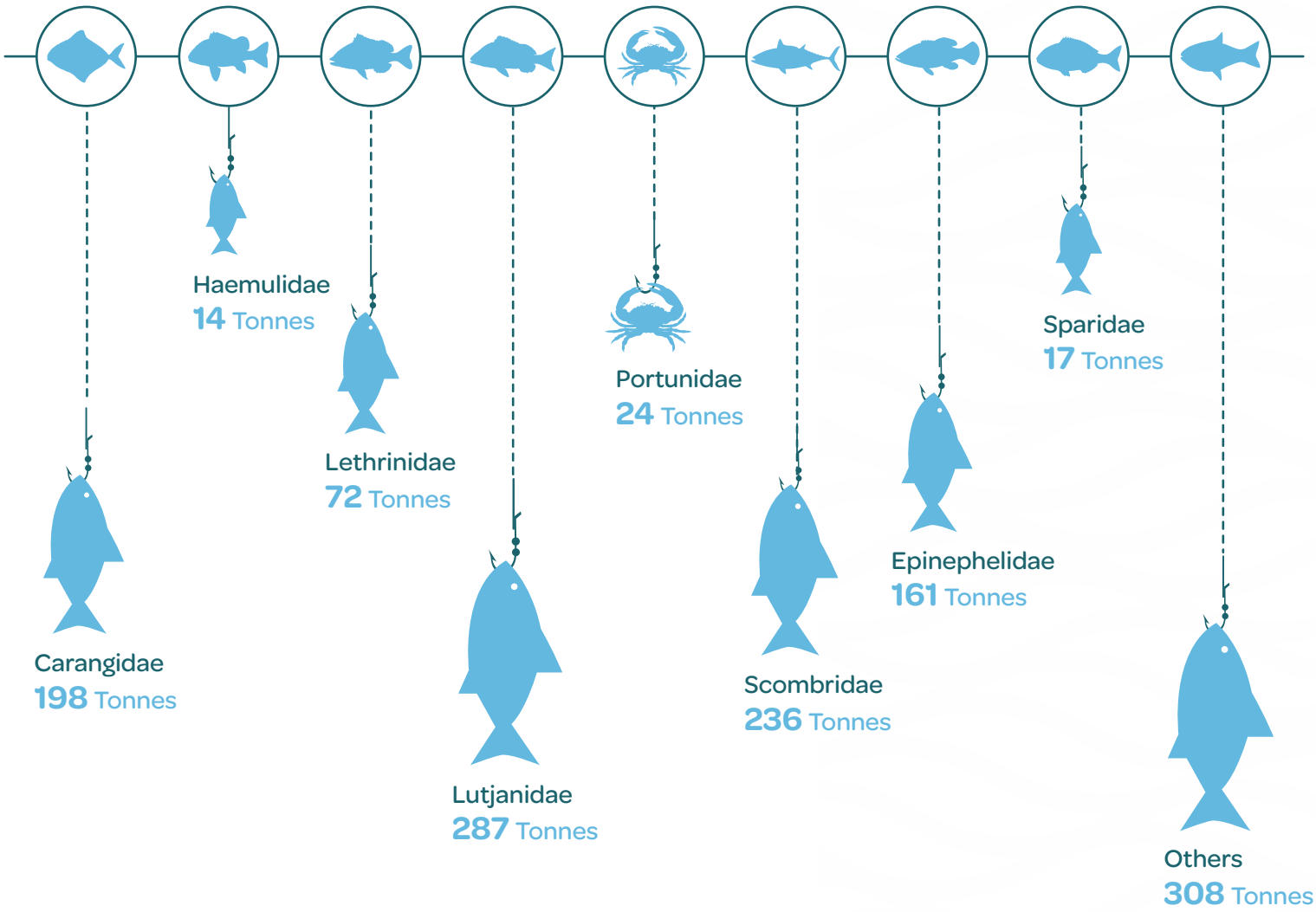
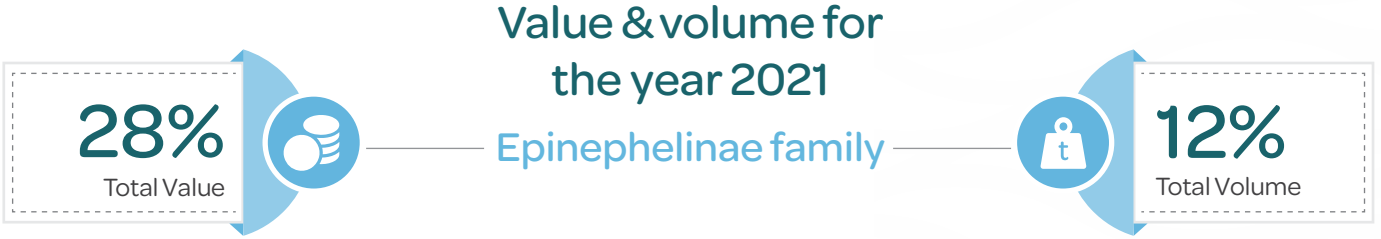


Figure 13: Volume of production per family in the year 2021



Production per family in value

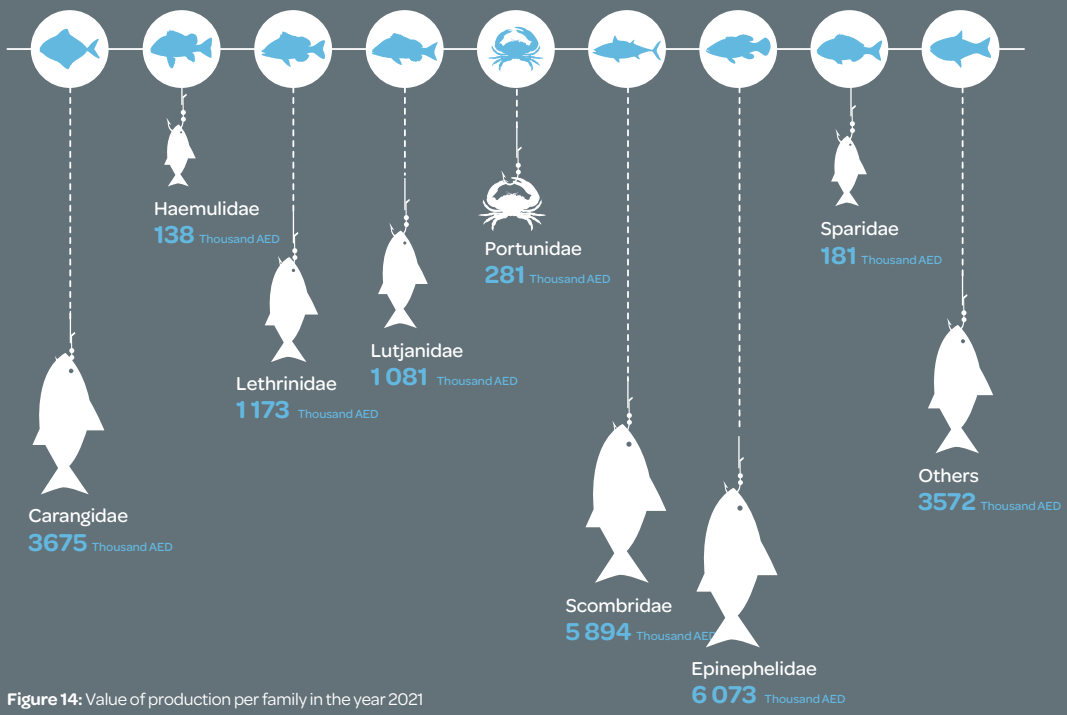


Figure 14: Value of production per family in the year 2021

3.4.1 Historical trends

Figure 15 & **Figure 16**, outline the time series of production per family in volume and value, whereby the volume has increased however value continues to show a decreasing trend. The overall fluctuations in production per family are distinctly due to the banning of two gears the Ghazal net and Gargour, which contributed highly to production in the past, and had a substantial impact on the production per family. In the case of Haemulidae which is largely represented by Farsh *(Diagramma pictum)* the species underwent a sharp decrease in production as it was exclusively targeted by the gargour, and in both 2020 and 2021 the family was almost negligible in landings. Similarly, Lethrinidae which are largely represented by Shaari *(Lethrinus nebulosus)* and Shaari Eshkheli *(Lethrinus lentjan)*, the production of this family decreased over recent years as they were species that were also primarily targeted by the gargour. Moreover, the Ghazal net and the Gargour also largely targeted Scombridae and Epinephelinae, whereby when those gears were operational the two families accounted for two-third of the value in production, in comparison to accounting for 54 % in 2021. Respectively, the two families accounted for more than 50 % of the volume of production in previous years, whereas in 2021 they accounted for 30 %. Regardless of their decrease in volume and value, Scombridae which is largely represented by Kanaad *(Scomberomorus commerson)* and Epinephelinae which is largely represented by Hamour *(Epinephelus coioides)* are continuously important families which have increased in production of volume and value in relative terms, with the Epinephelinae becoming the most important family in value in the years 2020 and 2021. On the other hand, as fisherman diverged onto the usage of other gears, several families showed an increase in relative production. In the year 2021 Carangidae which is highly represented by Jesh Um Al Hala *(Carangoides bajad)* and Dhil'e *(Scomberoides commersonnianus)* and the "others" category

which is represented mostly by Aifah *(Chanos chanos)*, Badah *(Gerres longirostris)* and Jedd *(Sphyraena jello)* showed a relative increase in production in comparison to previous years. Moreover, the species Naiser *(Lutjanus ehrenbergii)* hich is categorized under the Lutjanidae family showed the highest increment in absolute value of landings in comparison to the previous year.

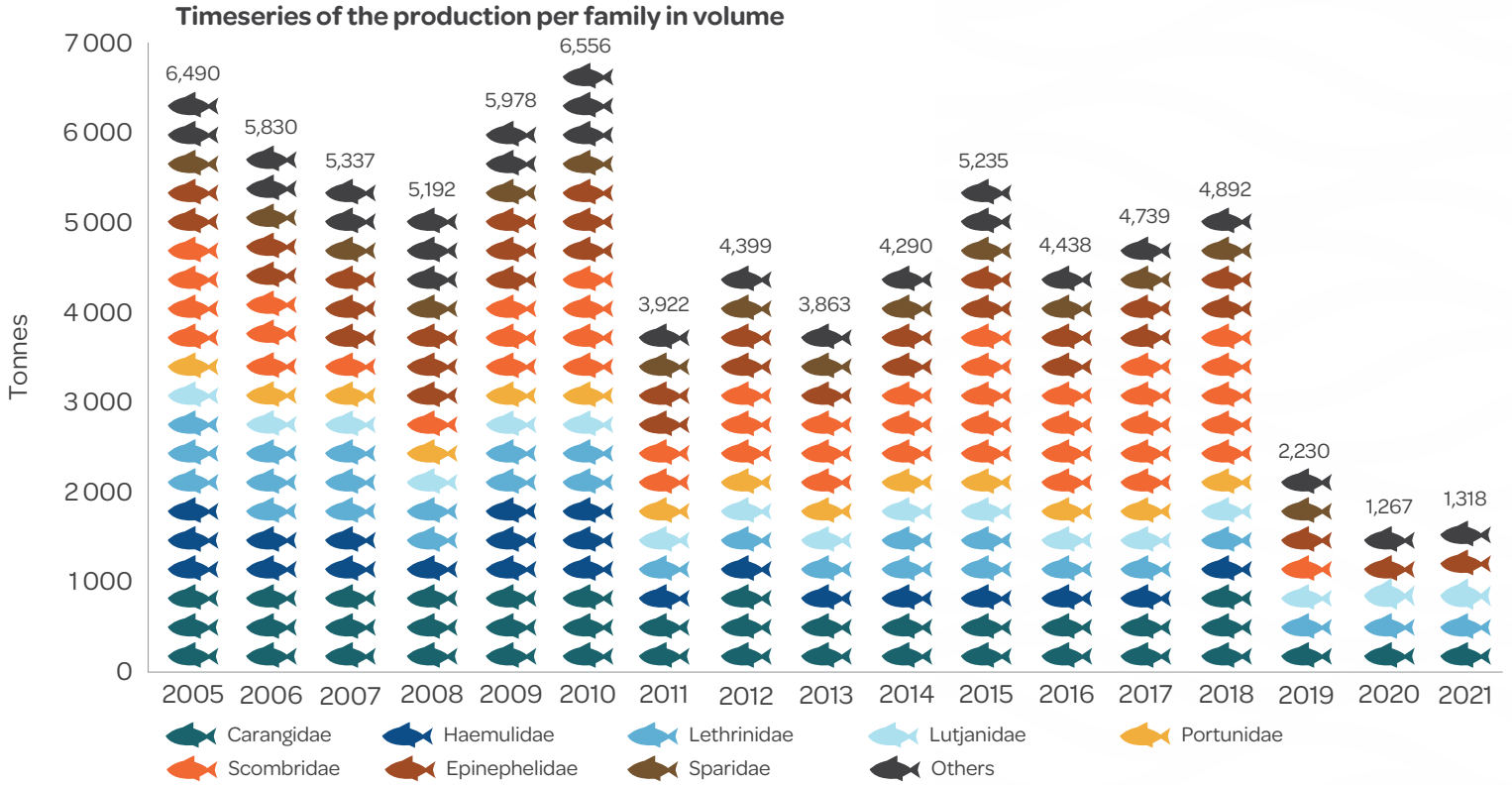


Figure 15: Time series of volume of production per family

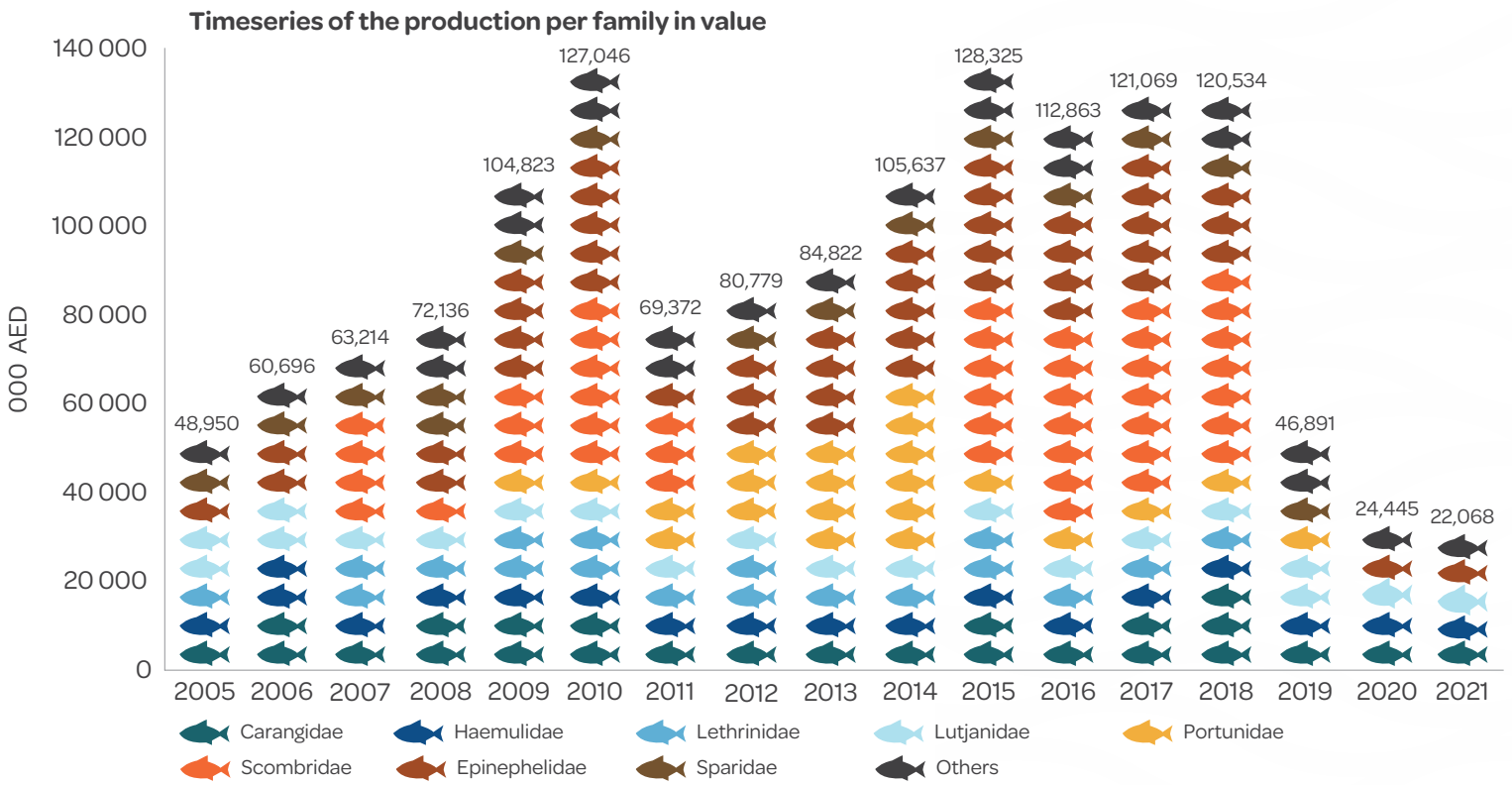


Figure 16: Time series of value of production per family

3.4.2 Seasonal changes

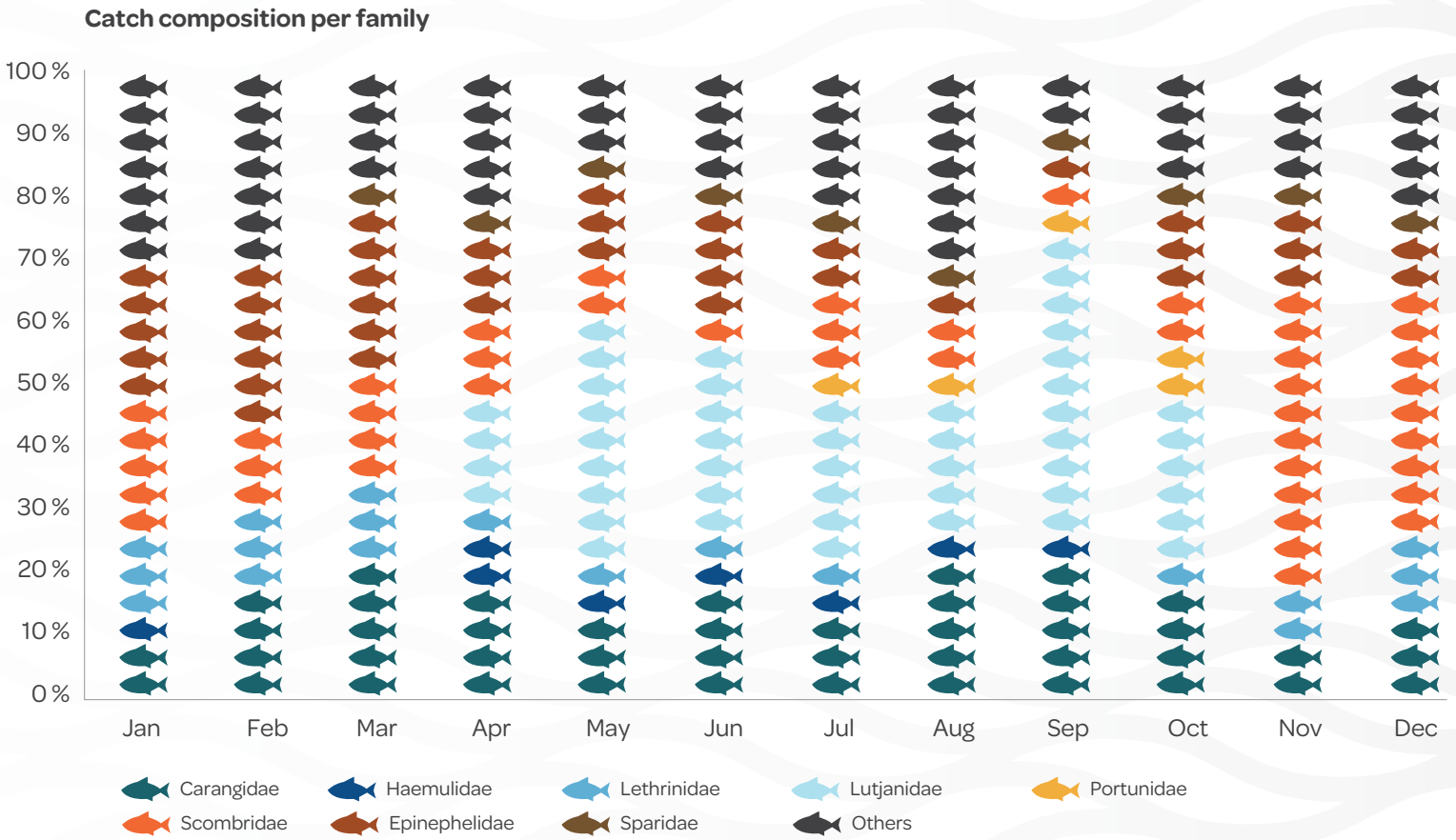
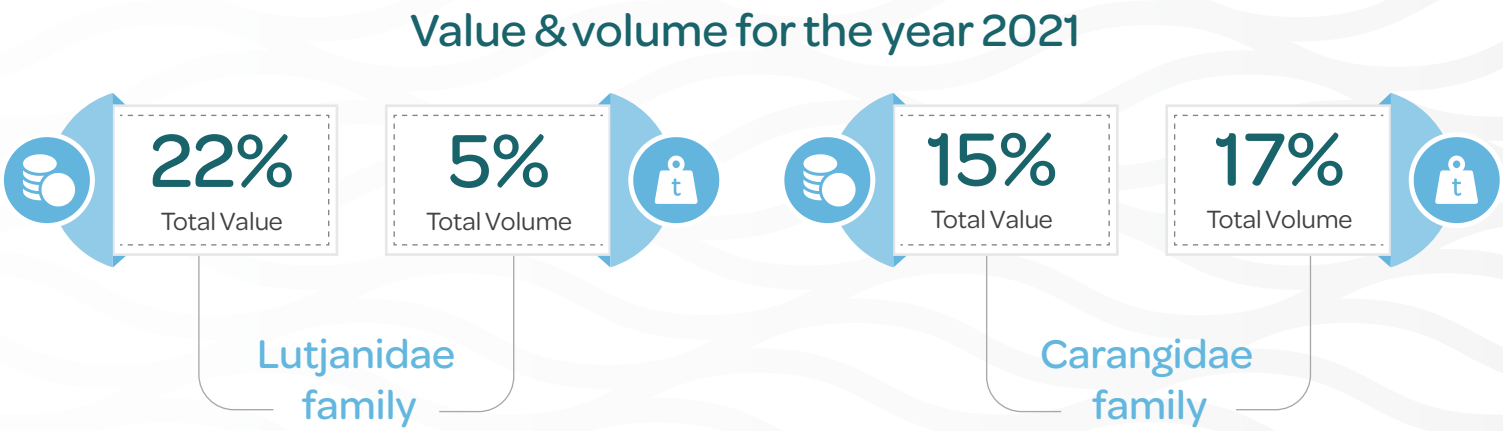


Figure 17: Percentage contribution of families per month for the year 2021

In the distinct case of Abu Dhabi's fisheries, seasonal changes in species occurrence are noted due to seasonality in gear operations. As seen in **Figure 17**, the production of Lutjanidae and Sparidae reach their peaks during the months April–October, during which Al Hadhra fisheries are operational. Moreover, Lutjanidae species are exclusively present during the months in which Al Hadhra fisheries operate and are negligible in production during the rest of the year. Similarly, although Hadaq fisheries are operational constantly throughout the year, the contribution of Hadaq fisheries is much higher during the winter months. Consequently, production of Scombridae and Lethrinidae are higher during winter months (November–April) as those families are mainly targeted by Hadaq fisheries.



3.4.3 Main species and groups

1. The most important 10 species in general

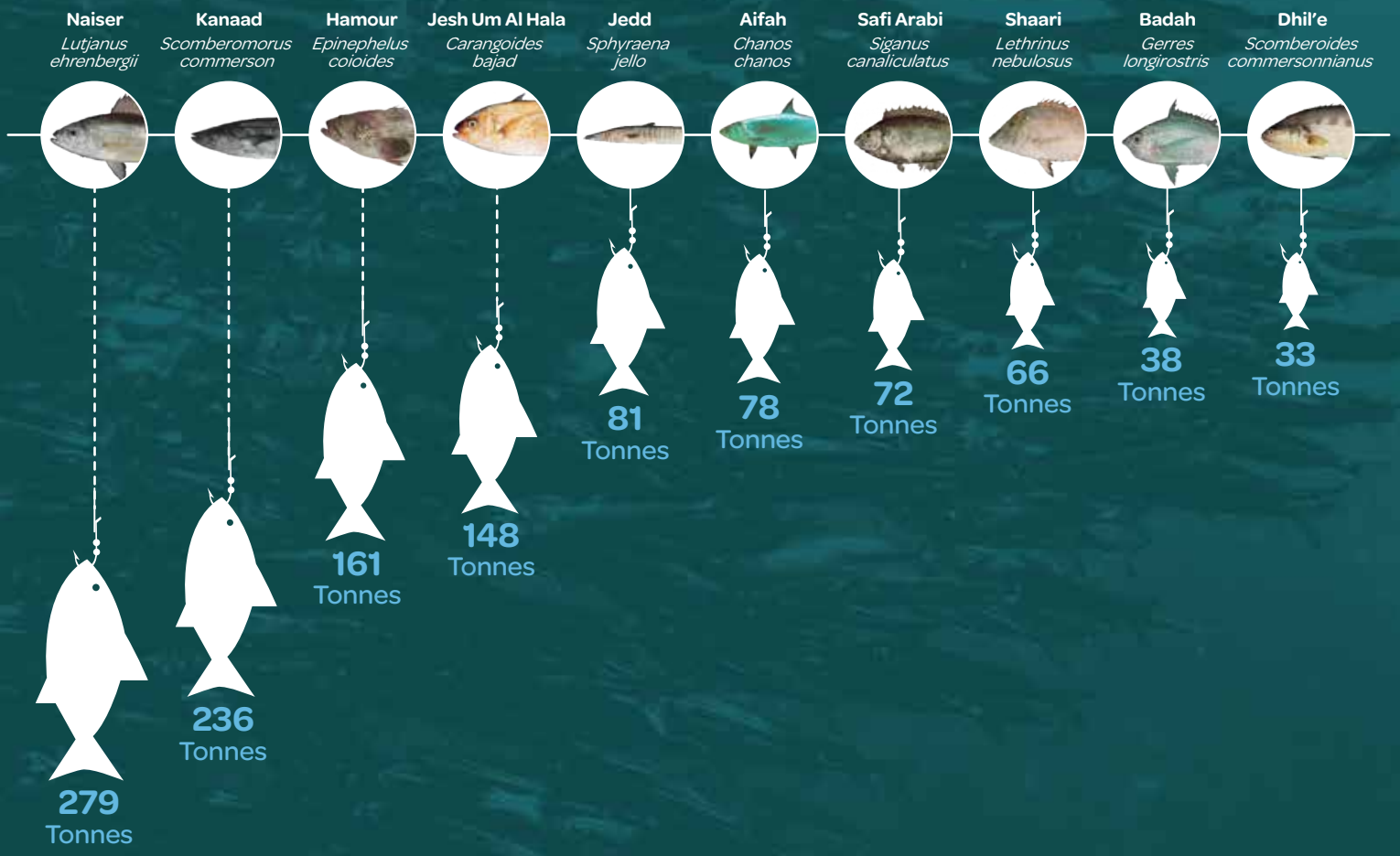


Figure 18: Ten most important species and their contribution to overall volume (tonnes) for the year 2021

The ten most important species in volume and value are outlined in **Figure 18** & **Figure 19**. The ten species represented 91 % of the total volume of landings, and 96 % of the total value of landings of the Emirate of Abu Dhabi in the year 2021. The top four species of importance for both volume and value were the Kanaad *(Scomberomorus commerson),* Hamour *(Epinephelus coioides),* Naiser *(Lutjanus ehrenbergii)* and Jesh Um Al Hala *(Carangoides bajad),* they represented 62 % of the total volume and 74 % of the total value of production. The occurrence of the same species as the top four in terms of volume and value indicates a polarisation in the fisheries of Abu Dhabi, meaning that the bulk of fisheries operate and are focused on a few species.

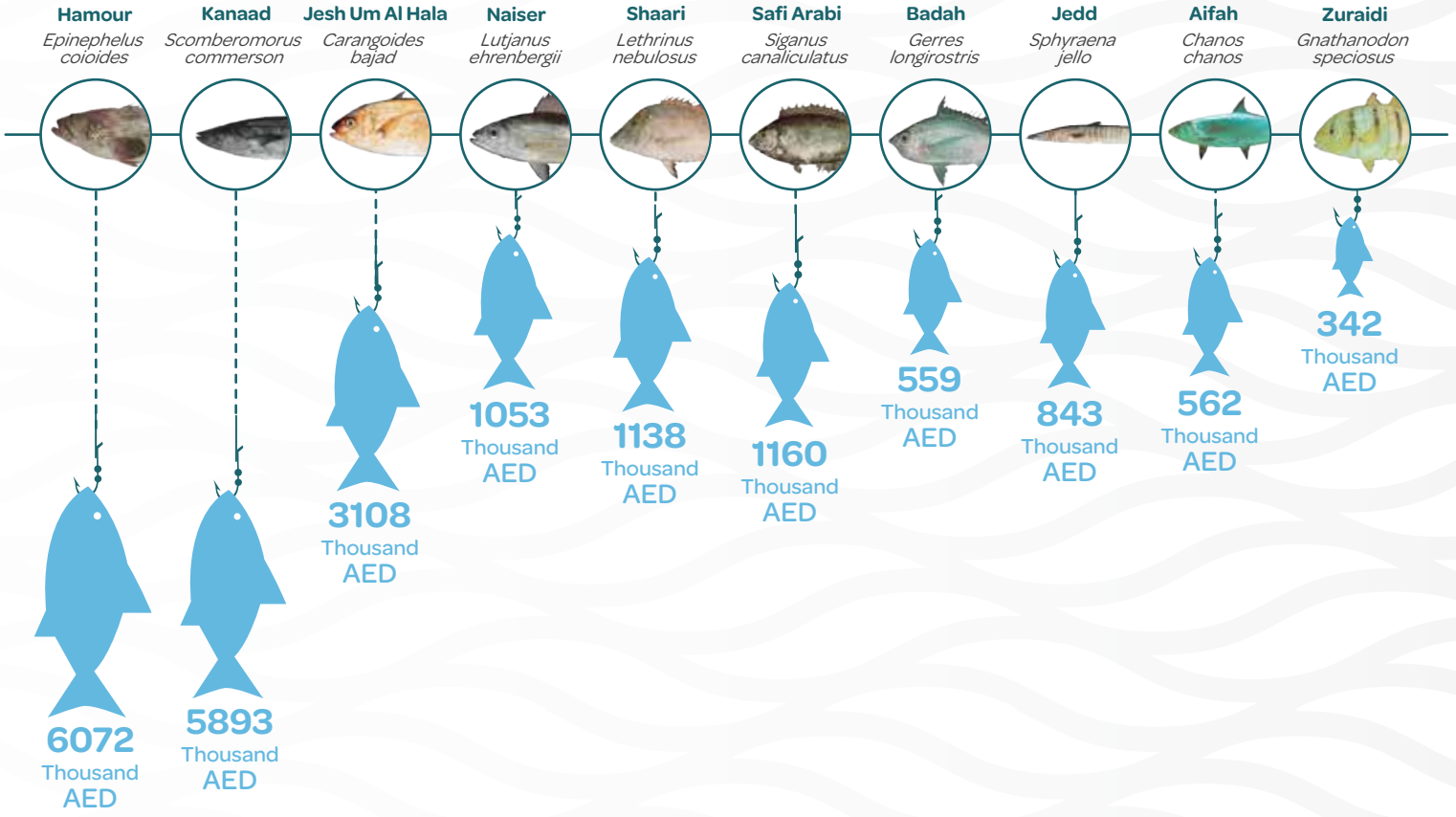


Figure 19: Ten most important species and their contribution to overall value for the year 2021

2. The ten most important per boat-gear category

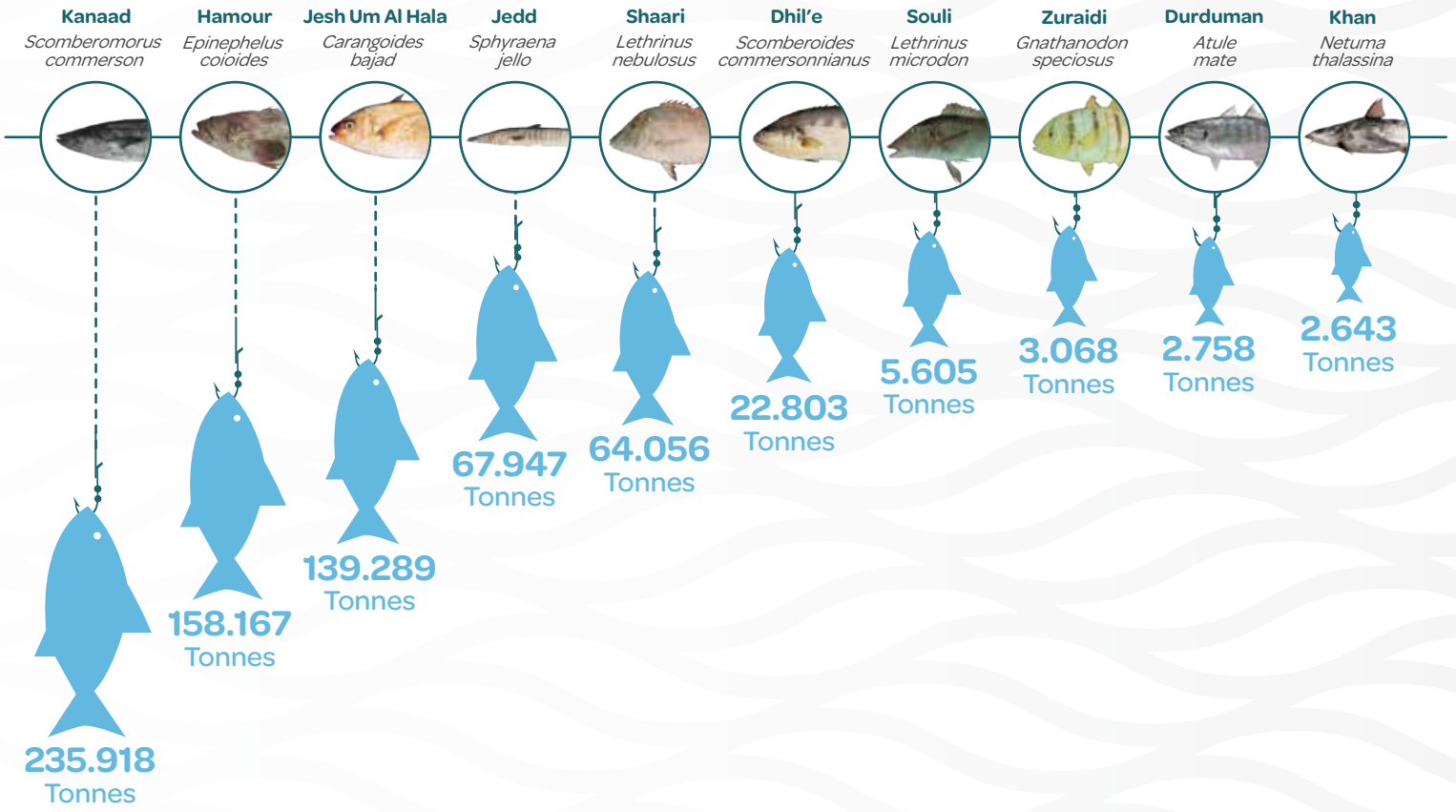


Figure 20: Ten most important species in volume for the Tarad-Hadaq gear

Tarad-Hadaq was the highest gear contributing to production in 2021, whereby it contributed 54 % to overall volume. Respectively, the ten most important species represented 99 % of the overall volume as shown in **Figure 20** and the five most important species accounted for 94 % in volume.

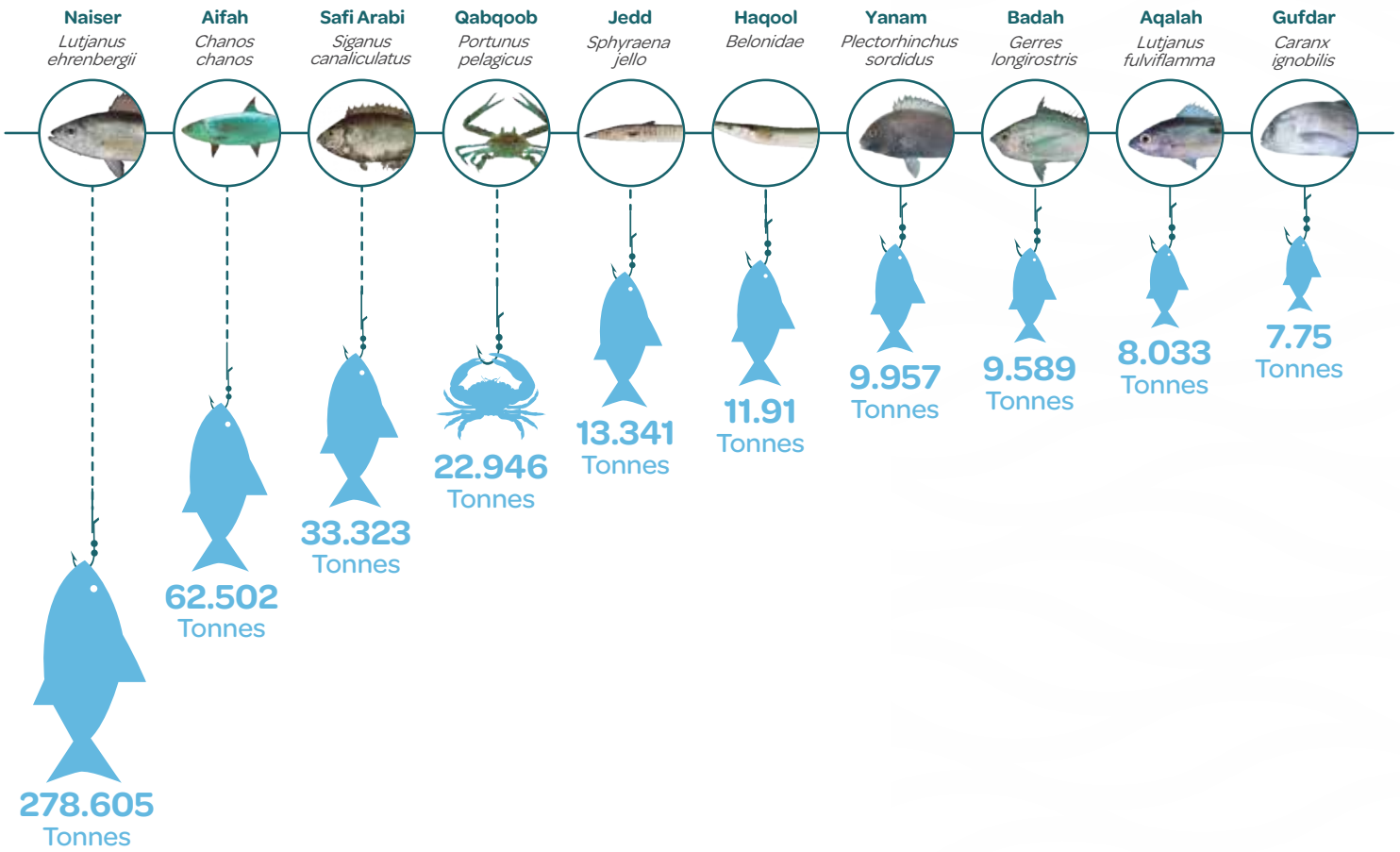
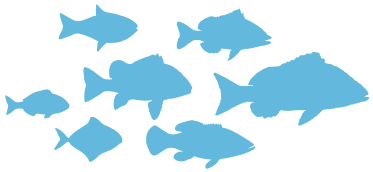


Figure 21: Ten most important species in volume for the Tarad-Hadhra gear

Al Hadhra was the second highest gear contributing to production in 2021, whereby it contributed 38 % to overall volume. The ten most important species represented 92 % of the overall volume as shown in **Figure 21** and the four most important species represented 80 % in volume, with Naiser *(Lutjanus ehrenbergii)* being the most dominant species representing 56 % in volume.

Tarad-Hadaq

Highest gear contributing to production in 2021



54 %
Overall volume

94 %
Volume accounted by five most important species

99 %
Overall volume by ten most important species

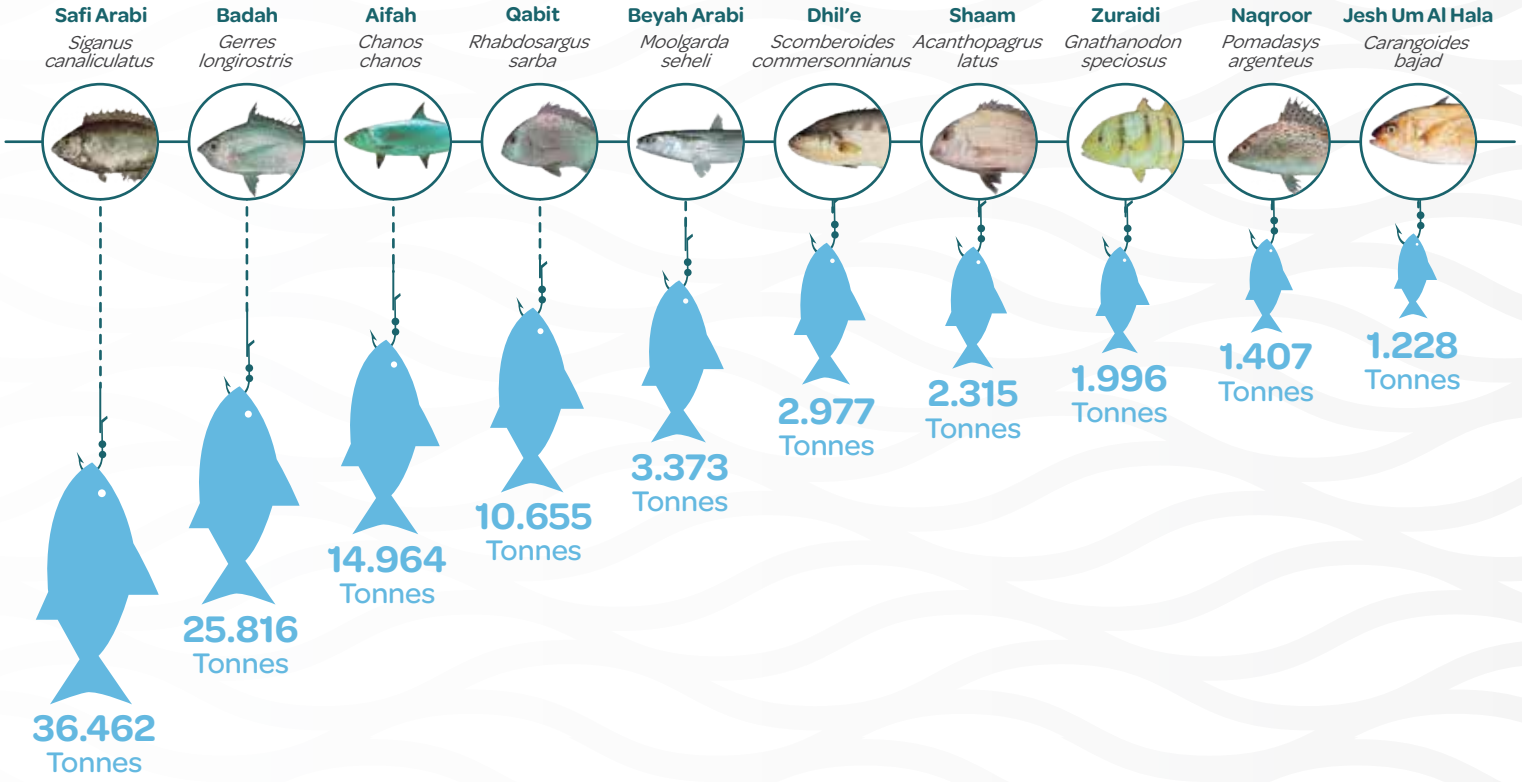


Figure 22: Ten most important species in volume for the Tarad-Defarra gear

Tarad-Defarra was the third highest gear contributing to production in 2021, whereby it contributed 8 % to overall volume. The ten most important species represented 95 % of the overall volume as shown in **Figure 22** and the four most important species represented 83 % in volume.

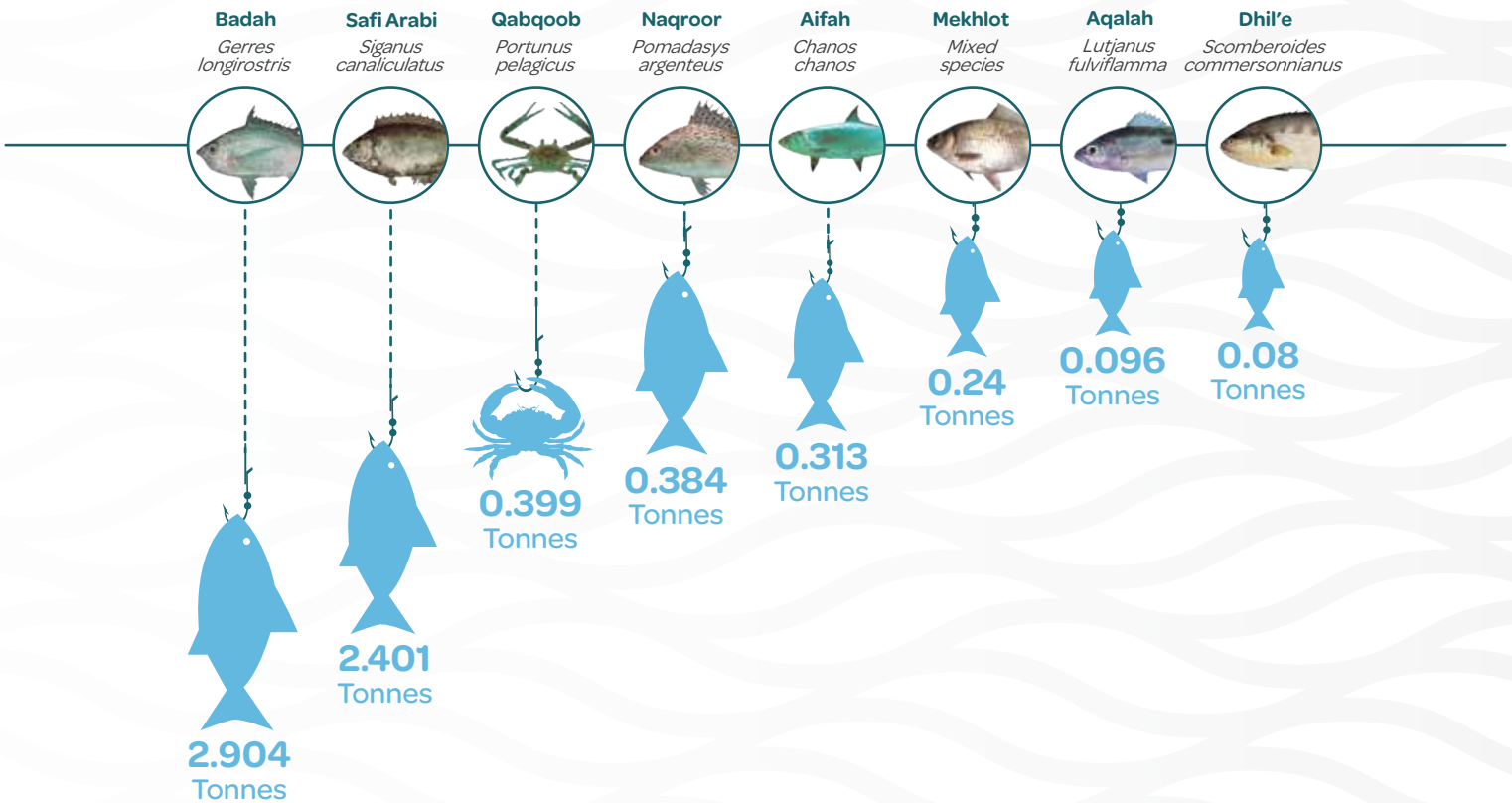


Figure 23: Ten most important species in volume for the Tarad-Sakkar gear

Tarad-Sakkar was the lowest gear contributing to production in 2021, whereby it contributed less than 1 % to overall volume. Only eight species were landed throughout 2021, and therefore those species represented 100 % of volume as shown in **Figure 23**, while the two most important species represented 78 % in volume.

3. The ten most important species per area

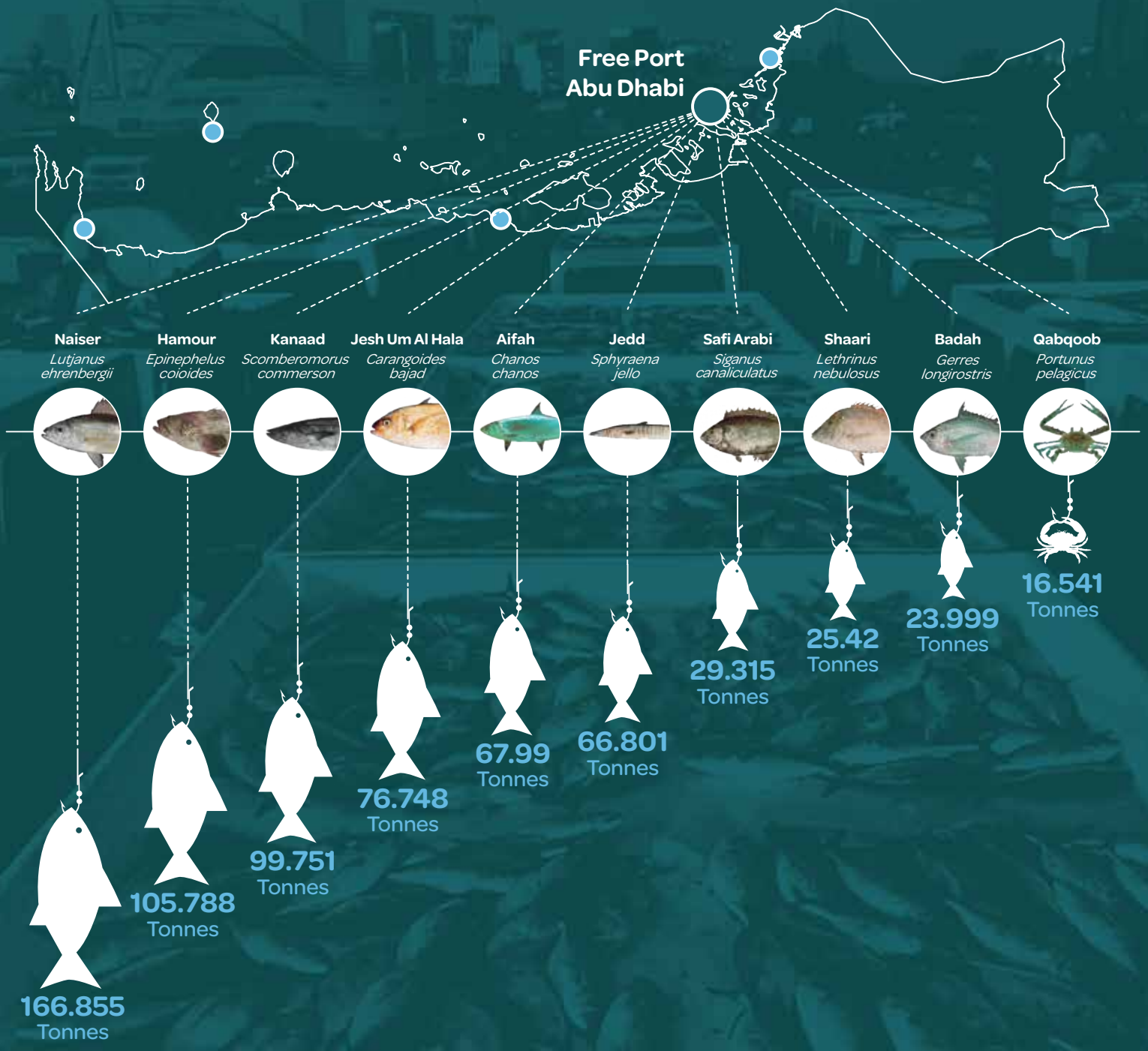


Figure 24: Ten most important species in volume for Free Port-Abu Dhabi

Free port-Abu Dhabi was largest port contributing to production in 2021, whereby it contributed 56 % to overall volume. The five most important species represented 70 % of volume as shown in **Figure 24**. Out of all five ports, production from Free port-Abu Dhabi was less polarised in volume in comparison to other ports with a variety of species of both low and high values, this is due to the fact a variety of gears are operational within the port, as well as it being the main area for Al Hadhra and Buhoor related gear usage.

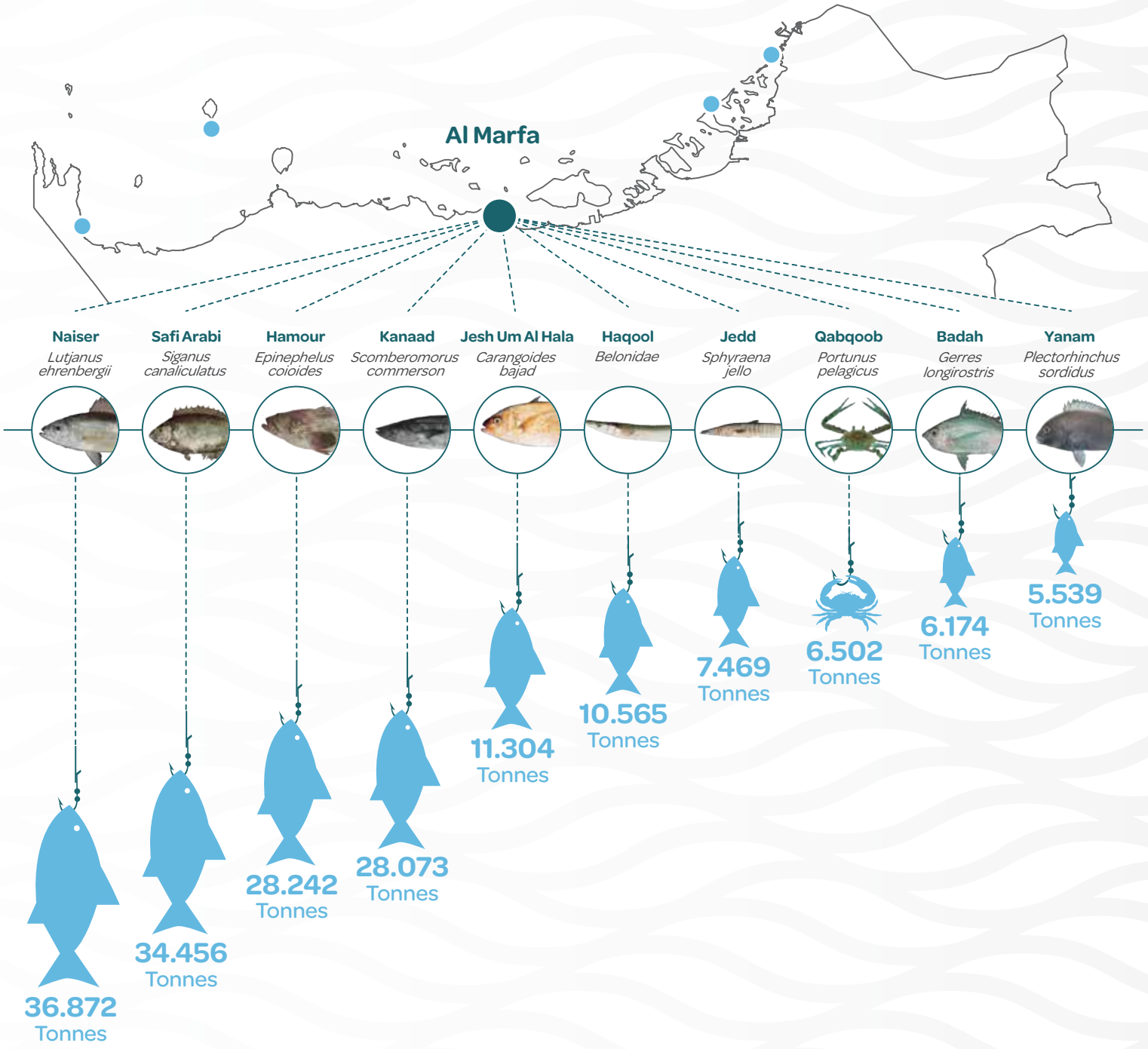


Figure 25: Ten most important species in volume for Al Marfa

Al Marfa was the third highest port contributing to volume, whereby it contributed 15 % to overall volume. The five most important species represented 71 % of volume as shown in **Figure 25**. The Hamour *(Epinephelus coioides)* and Kanaad *(Scomberomorus commerson)* were the two most important species, contributing to the majority of the value of the port. Correspondingly, Yanam *(Plectorhinchus sordidus)* and Haqool *(Tylosurus crocodilus)* were two key species that contributed to volume, however, not to value as they are considered low-value species.

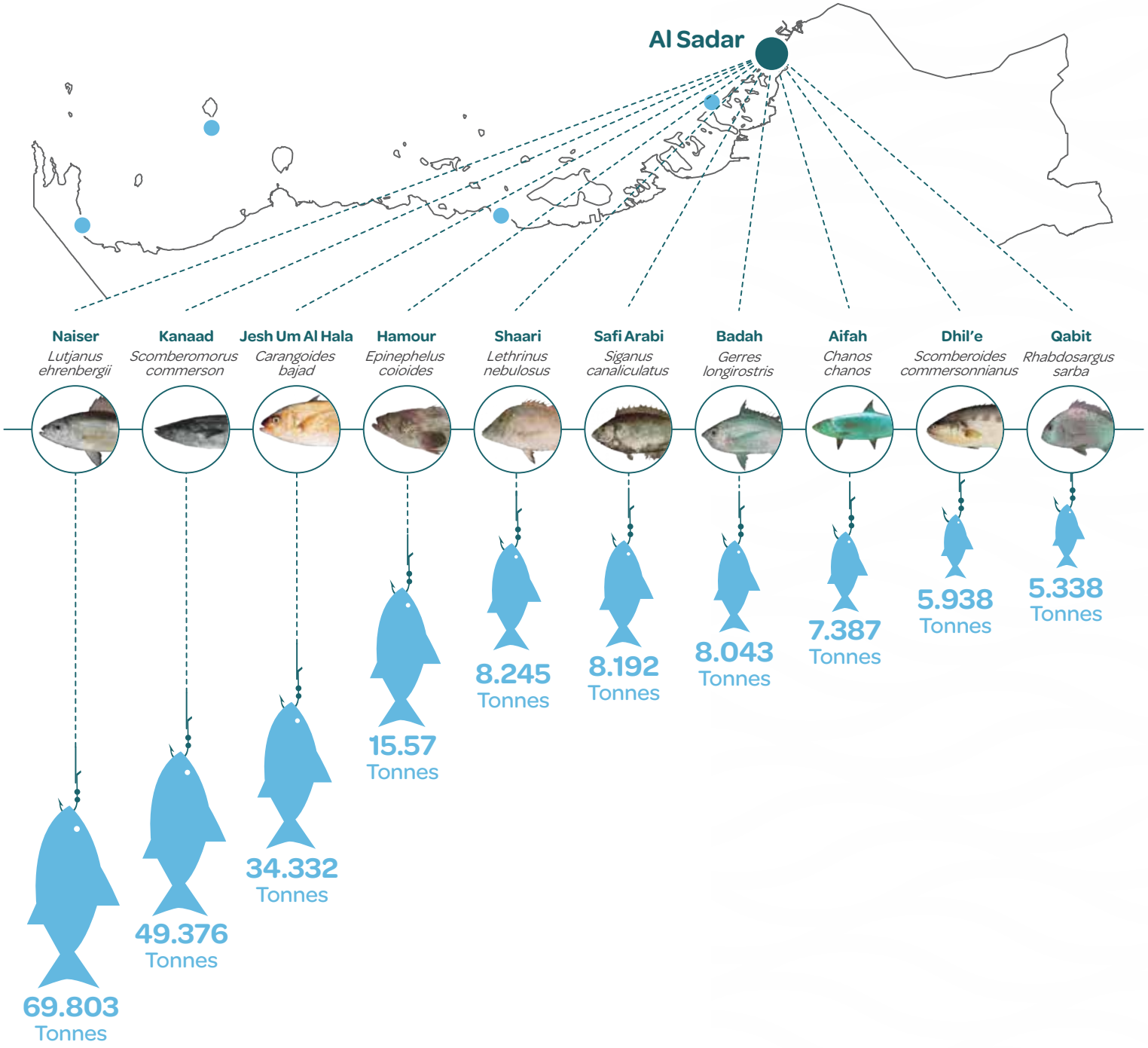


Figure 26: Ten most important species in volume for Al Sadar

Al Sadar was the second highest port contributing to volume in 2021, whereby it contributed 17 % to overall volume. The five most important species represented 78 % of volume as shown in **Figure 26**. The Naiser *(Lutjanus ehrenbergii)* was the most important in terms of volume contributing largely however, the species' contribution to value was not as significant as this species is classified as a low-value species. Furthermore, it is important to note that a proportion of the production landed in Al Sadar is sold at other ports, like Free port-Abu Dhabi.

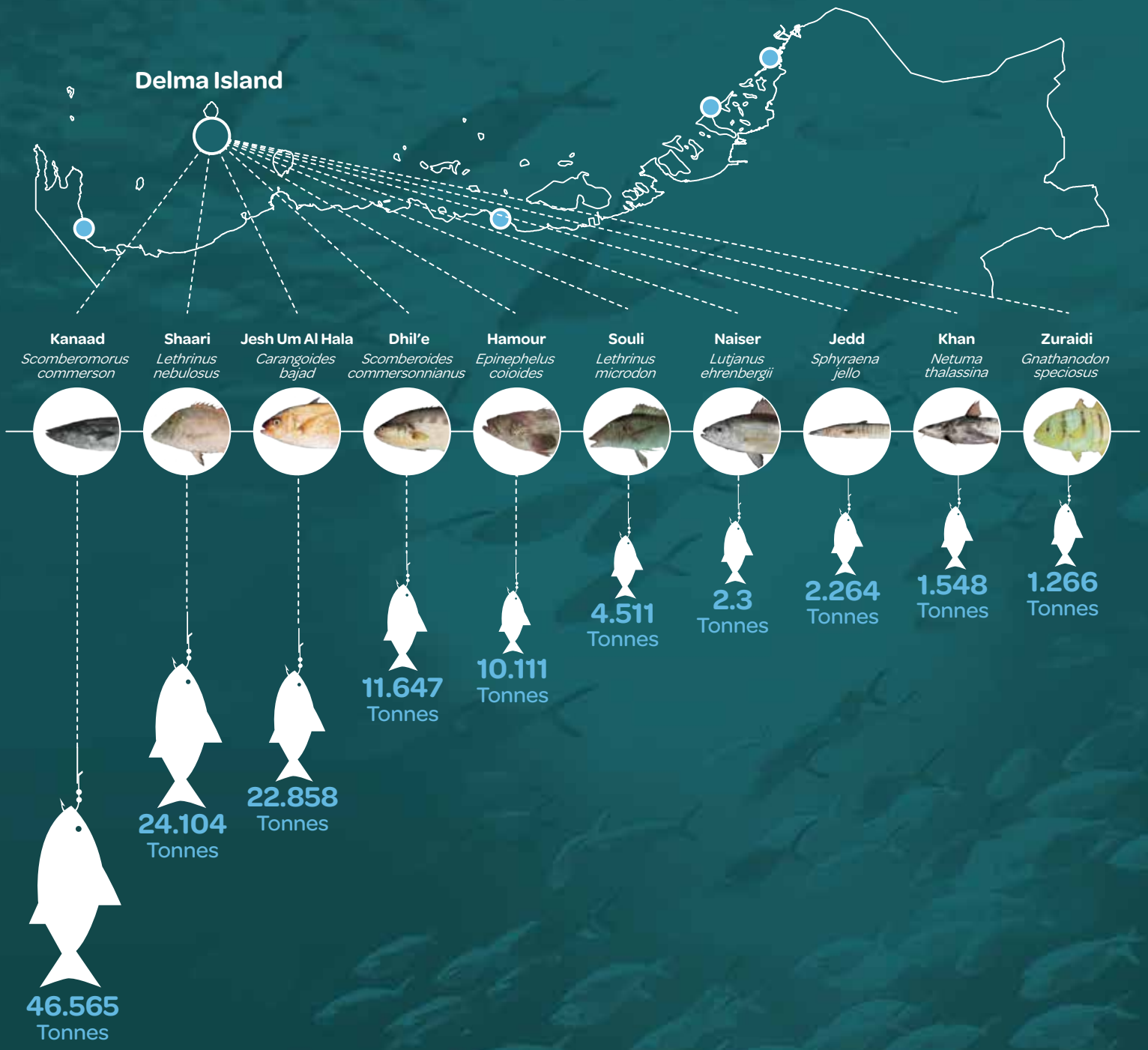


Figure 27: Ten most important species in volume for Delma Island

Delma was the fourth highest port contributing to volume and value of production in 2021, whereby it contributed 10 % to overall volume. The five most important species represented 90 % of volume as shown in **Figure 27**. Delma port had the highest polarity in species volume and value. This is partly due to the fact that the Tarad-Hadaq, which is a selective gear, is the main gear utilised and is a gear that mainly targets high value species.

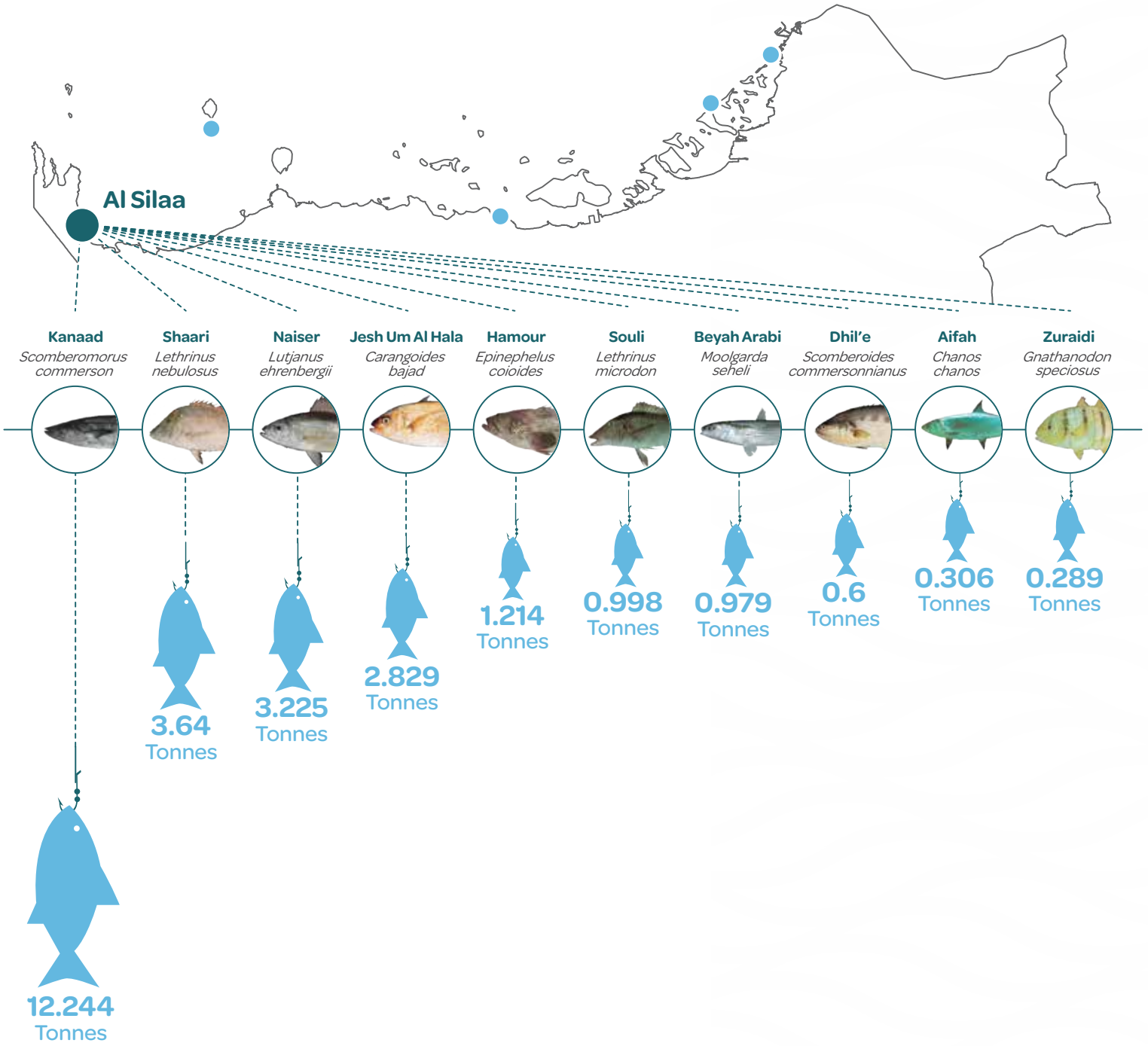


Figure 28: Ten most important species in volume for Al Silaa

Al Silaa was the lowest port in terms of its contribution to the volume of production in 2021, whereby it contributed 2 % to overall volume. The five most important species represented 87 % of volume as shown in **Figure 28**. The Kanaad *(Scomberomorus commerson)* was the most important species in terms of both volume and value, whereas the Hamour *(Epinephelus coioides)* was relatively lower in volume and value in comparison to other ports. Additionally, Naiser *(Lutjanus ehrenbergii)* is shown to be high in volume due to the large activity of hadhra fisheries in the area.

3.5 ENUMERATOR OBSERVATIONS

EAD has a number of field-based employees that operate at the major landing sites in the Emirate of Abu Dhabi, recording data and noting any significant observations in the markets. This sub chapter outlines some of the observations that have been noted by our enumerators, and have been corroborated with scientific data.

It was evident through enumerator observations at landing sites that average lengths of many species had increased in 2021, and that was the case in fact, whereby all the length-frequency assessments conducted by EAD in 2021 showed an increase in average length. Furthermore, in 2021 the team recorded the largest specimen amongst the EAD database for the species Kanaad *(Scomberomorus commerson),* whereby the sample was 175 cm in length and weighed 29.6 Kg.

Additionally, it was noted that in comparison to 2020 there was a significant increase in Safi Arabi *(Siganus canaliculatus)* landings throughout 2021, whereby its landing increased by 57 % from 46 tonnes in 2020 to 72.2 tonnes in 2021.

3.6 FLEET, EMPLOYMENT, AND EFFORT

This section of the bulletin focuses on fishing fleets, employment, and effort. In this context, licensed boats are the total number of boats authorised for commercial fishing, some of which may not be active, or constantly active throughout the year. Therefore, the figure utilised for licensed boats is considered as the potential maximum operating fleet capacity. Additionally, employment describes offshore employment onboard vessels and not the total employment of the fisheries sector. Employment directly refers to the number of jobs per vessel, and not the number of individuals as that may be rotational.

In 2021, 574 licensed boats were registered, with the majority being tarad boats. Offshore employment is directly proportional to fleet activity, and on average, four crew members work onboard tarad boats, whereas approximately six work onboard lansh boats. In the year 2021 offshore employment was almost exclusively from tarad boats.

Figure 29 shows a time series of the number of fishing trips throughout the years. On average, fishing trips on tarad boats are usually less than twenty-four hours, whereas lansh trips last approximately between three to four days. In general, an overall decrease is noted in the number of fishing trips over the time series. Previously, approximately 80 % of the fishing trips were conducted by tarad boats and 20 % by lansh boats, whereas in 2021 the number of fishing trips were almost exclusively conducted by tarad boats and fishing trips increased to 99 % and the number of lansh boat fishing trips decreased to under 1 %. The main driving factors behind the decreasing trend in the number of fishing trips in the time series are the managerial decisions on gear usage and limitations, a decrease in the number of boats and an increased number of limitations on gear use led to a drop in the number of fishing trips conducted.

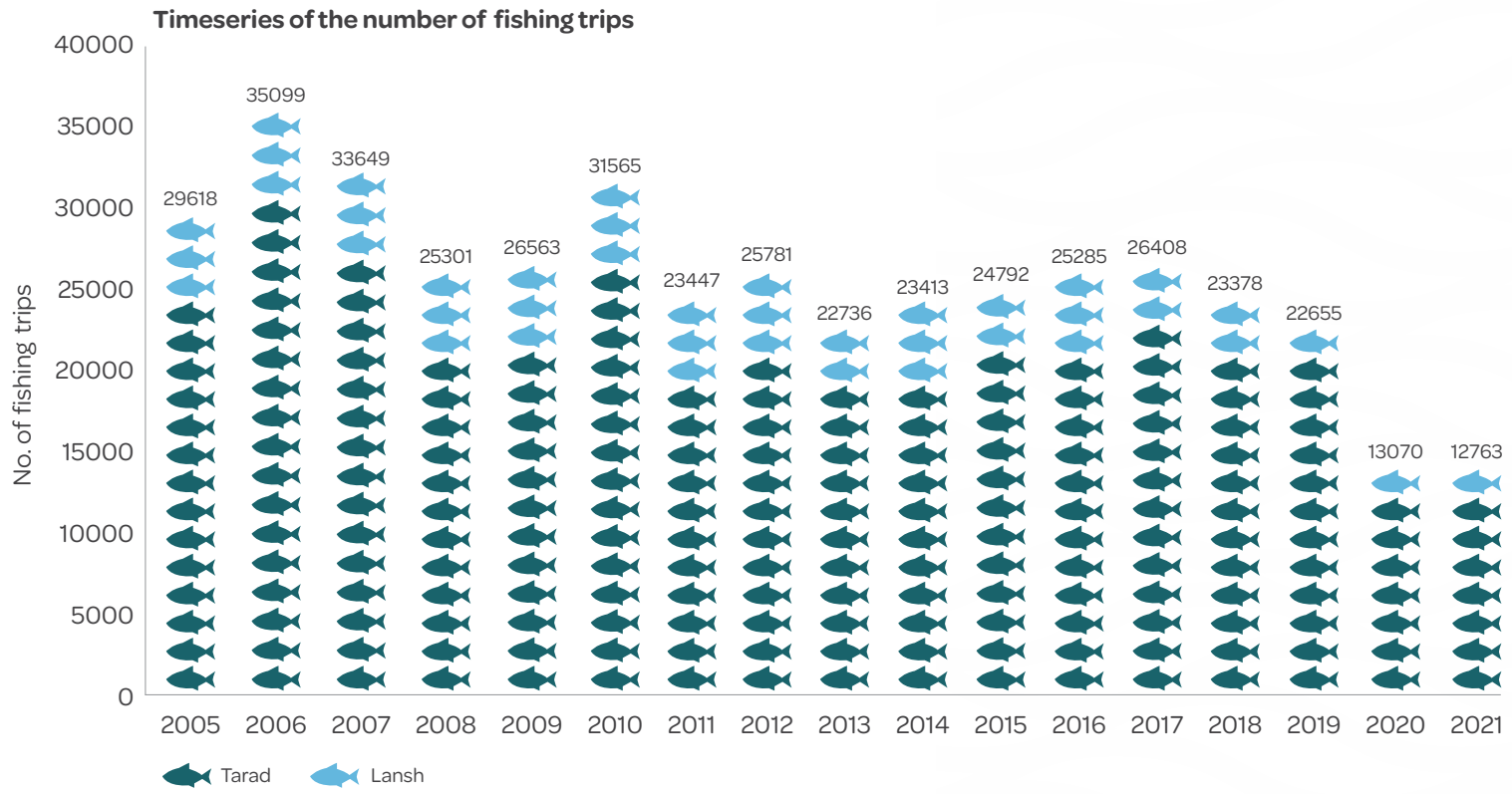
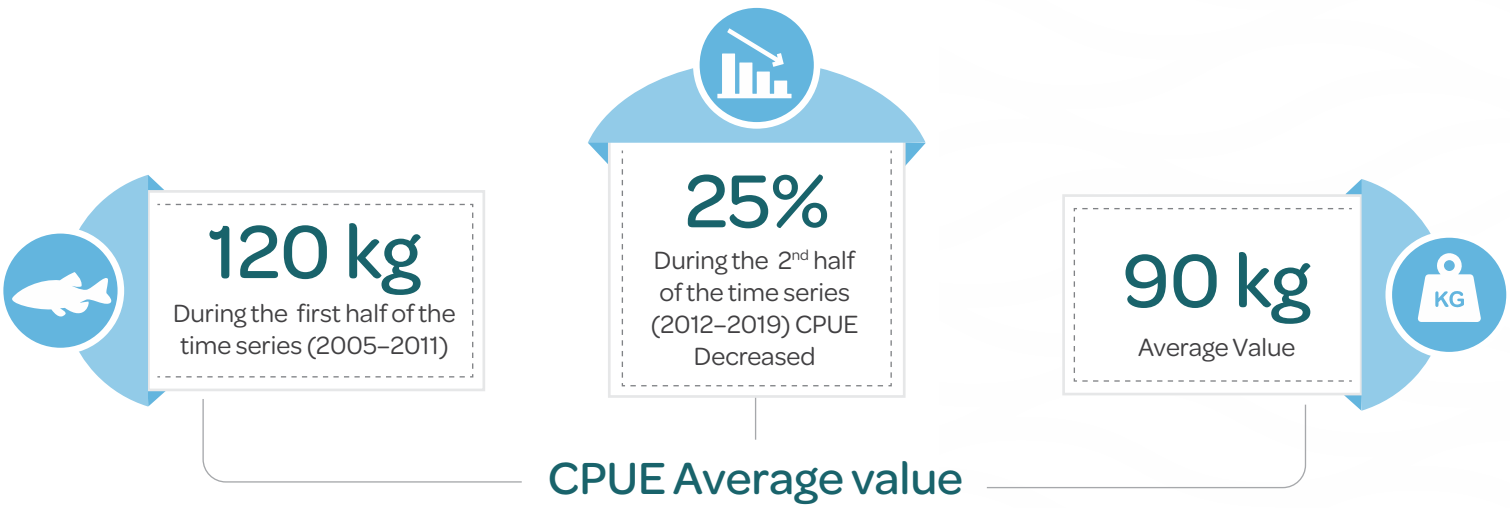


Figure 29: Time series of the number of fishing trips

The catch per unit of effort (CPUE) is defined as the catch per unit whereby effort is counted as the number of fishing days. **Figure 30** shows a time series of the CPUE for the two boat categories, the figure and data do not show an overall decreasing or increasing trend, rather fluctuation throughout the time series whereby the CPUE generally varies according to gear usage and limitations. Accordingly, the tarad boat CPUE is largely affected by the presence or absence of the ghazal gear however, in the last three years the CPUE has shown an increasing pattern. Similarly, the lansh boat CPUE is largely affected by the presence or absence of gargour fisheries. During the first half of the time series (2005–2011), the CPUE held an average value of 120 kg, whereas during the 2nd half of the time series (2012–2019) the CPUE decreased by 25 % to an average value of 90 kg. It is important to note that no limitations were set around the utilisation of the gargour gear between 2005 and early 2019, the decrease shown in the CPUE through the data was a direct reflection of the deterioration in the status of some of the demersal stock in Abu Dhabi waters. Furthermore, lansh boat CPUE for the year 2020 or 2021 is not reported as lansh boat operations were very minimal, with different gears being used aboard lansh vessels, therefore the CPUE was not consistent and comparable to the values reported in previous years.



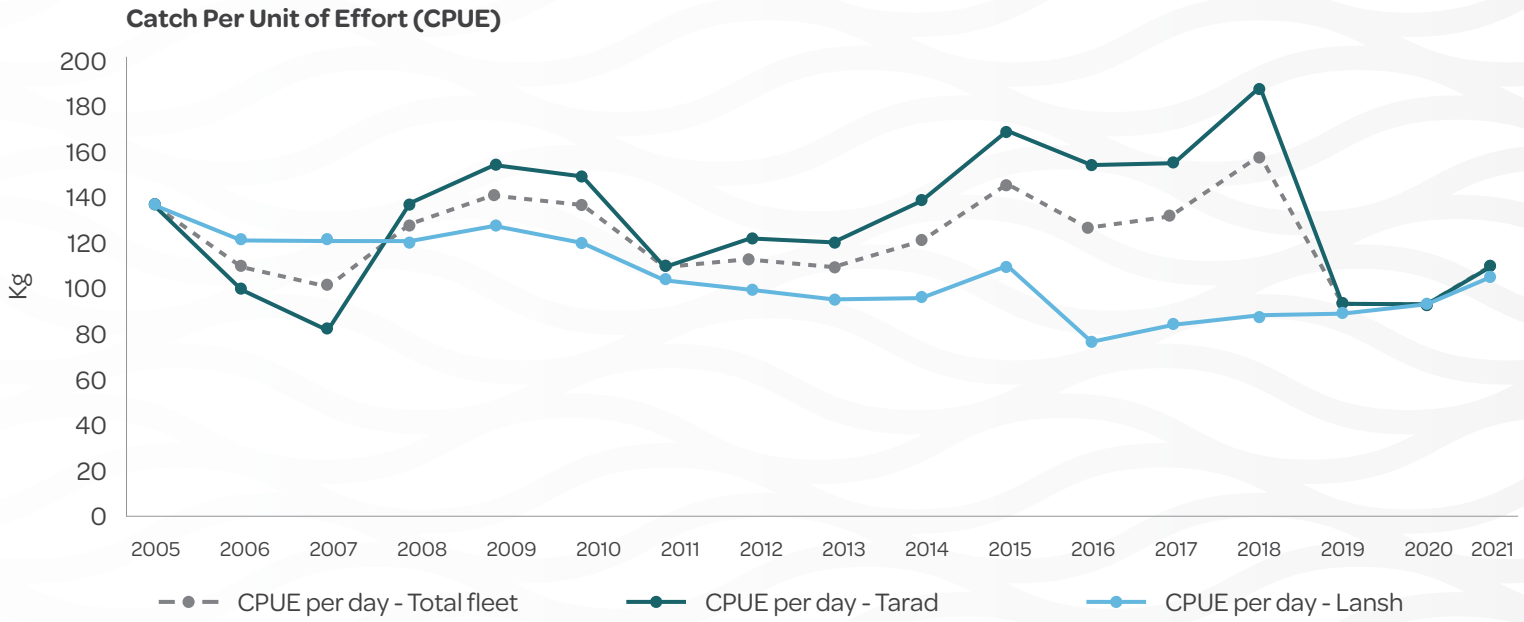


Figure 30: Time series of the Catch Per Unit of Effort (CPUE)

Figure 31 shows the time series of the CPUE of Tarad-Hadaq, which is currently the main gear in terms of production and effort, and which has been showing a constant increase across the previous four years. The increase in the CPUE of Tarad-Hadaq may be attributed to the increase in the density of target species, which has occurred as a result of the banning of some gears leading to a decrease in fishing pressures on the stocks.

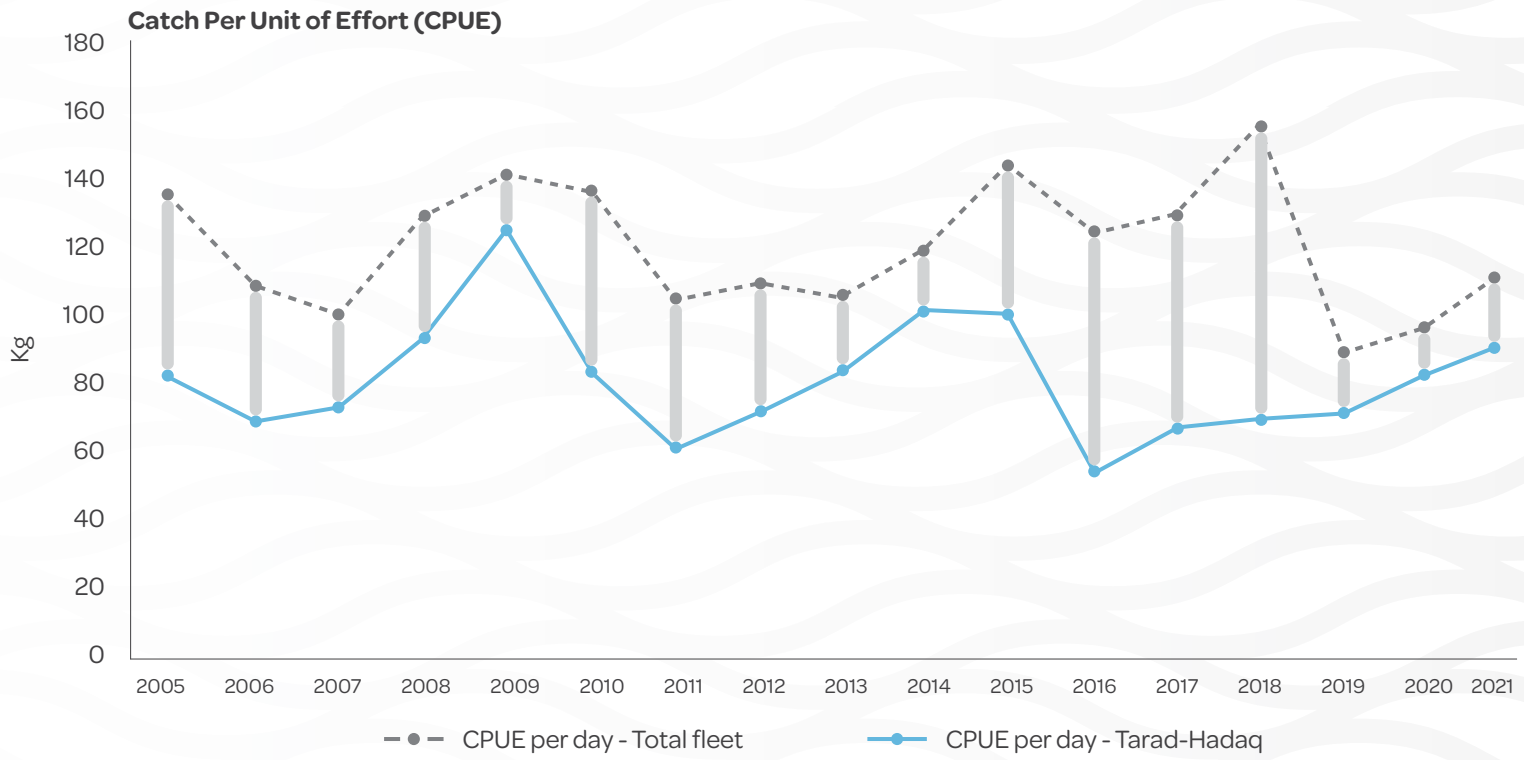
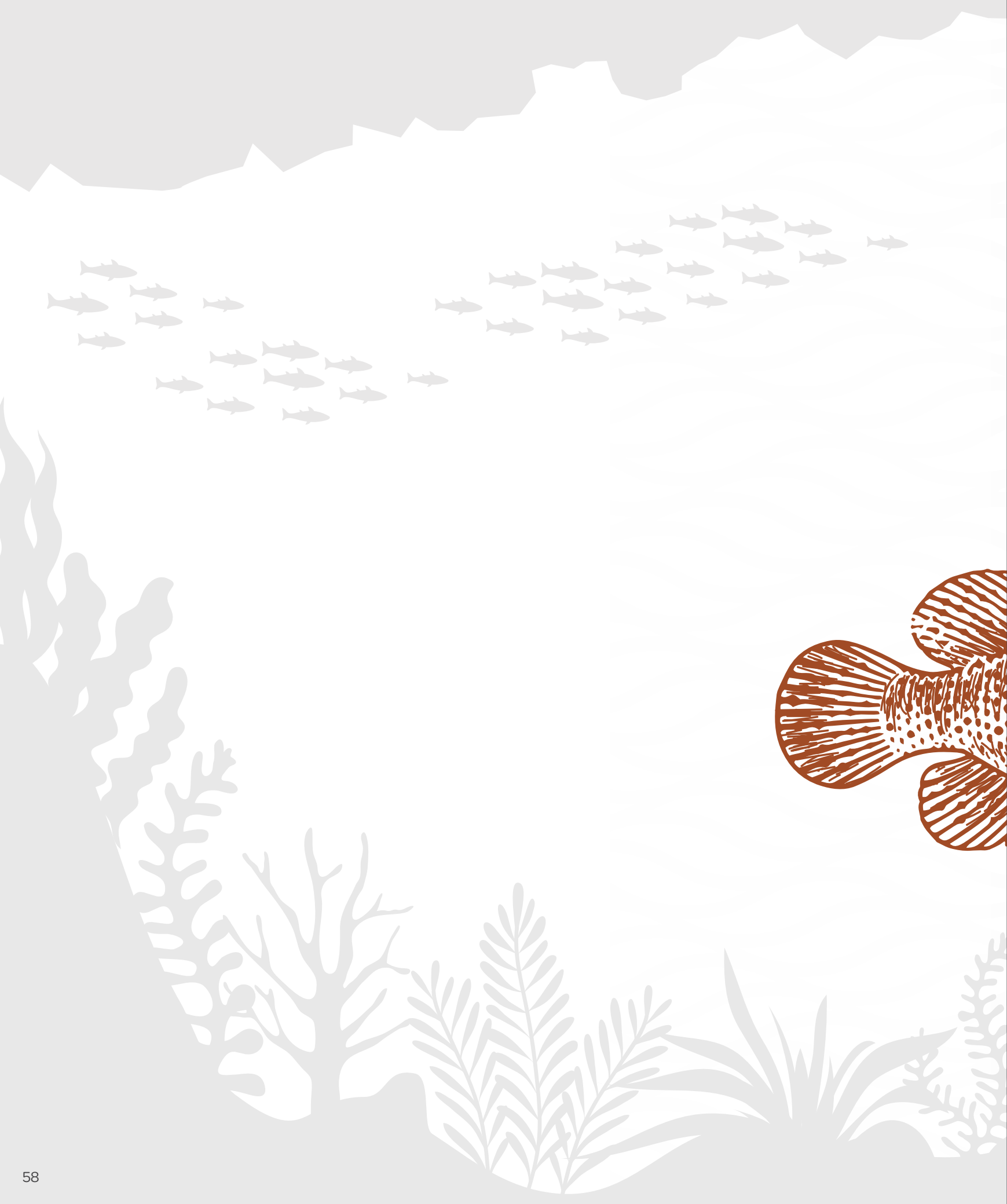
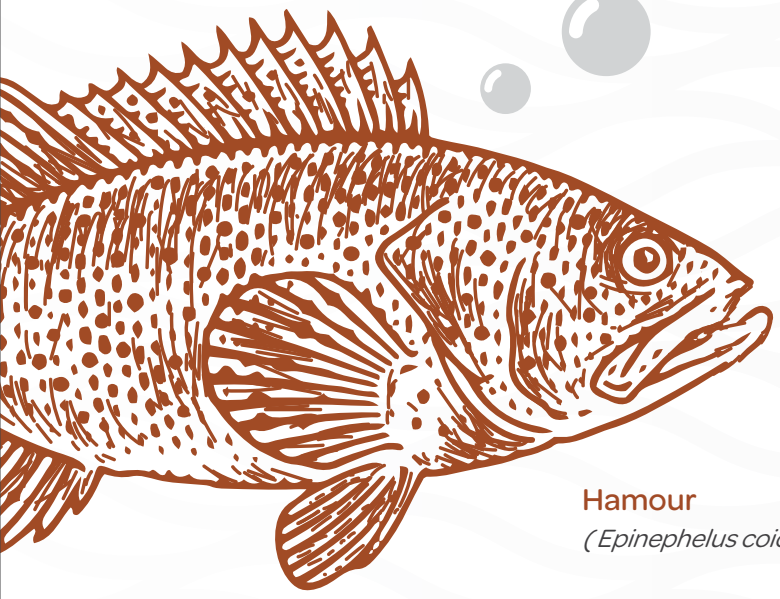


Figure 31: Time series of the Catch Per Unit of Effort of the Tarad-Hadaq gear



4. AQUACULTURE PRODUCTION



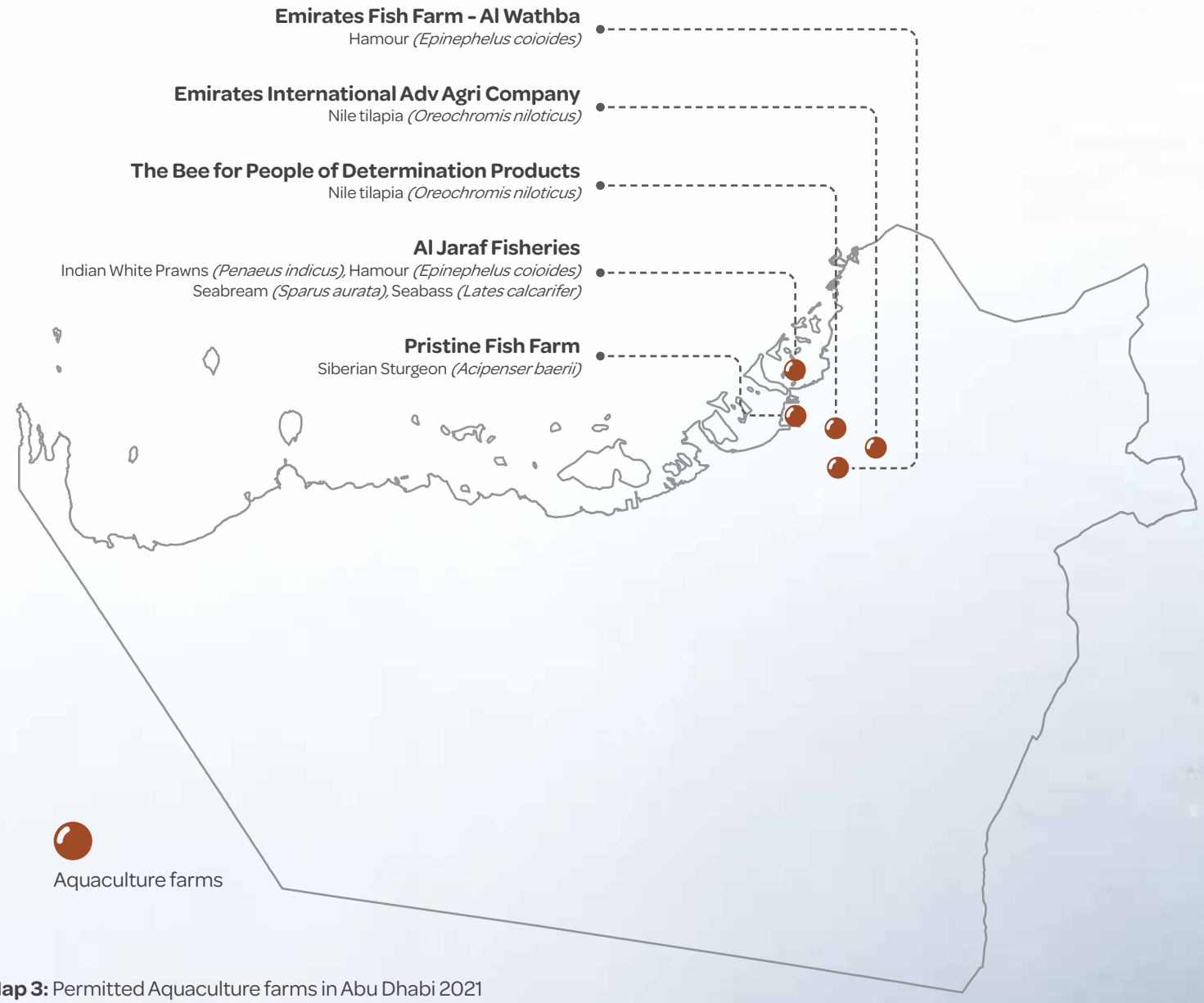
Hamour
(Epinephelus coioides)

4. AQUACULTURE PRODUCTION

4.1 OVERVIEW

According to the Food and Agriculture Organization of the United Nations (FAO), aquaculture production has accounted for 49 % of the global production of aquatic animals in 2020 reaching 88 million tonnes and a total sales value of USD 265 billion. It is expected that aquaculture production will reach 106 million tonnes in 2030, an overall increase of 22 % compared to 2020.

In 2021, there were five operational permitted aquaculture facilities in Abu Dhabi that accounted for a total output of 408 tonnes with an estimated farm gate value of AED 13.1 million. Which represented about 15% of the overall approximate 2,663 tonnes of seafood cultured in the UAE. Among these operations, there are three large-scale farms; one producing Indian White Prawns *(Penaeus indicus)* in ponds near Abu Dhabi city, one producing Hamour *(Epinephelus coioides)* in a high-tech re-circulating system at Al Wathba and the third is culturing non-native sturgeon *(Acipencer baerii)* in an intensive recirculating aquaculture system (RAS) at Mussafah. In Addition, there are two small-scale aquaponic farms producing Nile tilapia *(Oreochromis niloticus)* with vegetables in a symbiotic environment in Bani Yas and Al Faya. Production was dominated by Indian White Prawn then Hamour.



Map 3: Permitted Aquaculture farms in Abu Dhabi 2021

4.2 DATA DESCRIPTION

4.2.1 Production

The total aquaculture production in 2021 was 408 tonnes. The lead produced species was Indian white prawns, contributing around 41% (168 tonnes) of the total production (**Figure 32**). Followed by Hamour which accounted for 78 tonnes of the production and Sturgeon at 65 tonnes. Other species includes Seabream (52 tonnes), Nile Tilapia (43 tonnes), Seabass (2 tonnes) and Caviar (0.13 tonnes).

Figure 32: Aquaculture production volume by type for the year 2021

4.2.2 Value

In 2021, the aquaculture production total farm gate value was approximately AED 13.1 million. Indian white prawn comprised around 38% of the total farm gate value at AED 5 million whereas Hamour made up about 28% of the total value with AED 3.7 million. The farm gate value of the other species combined was around AED 4.4 million **(Figure 33)**.

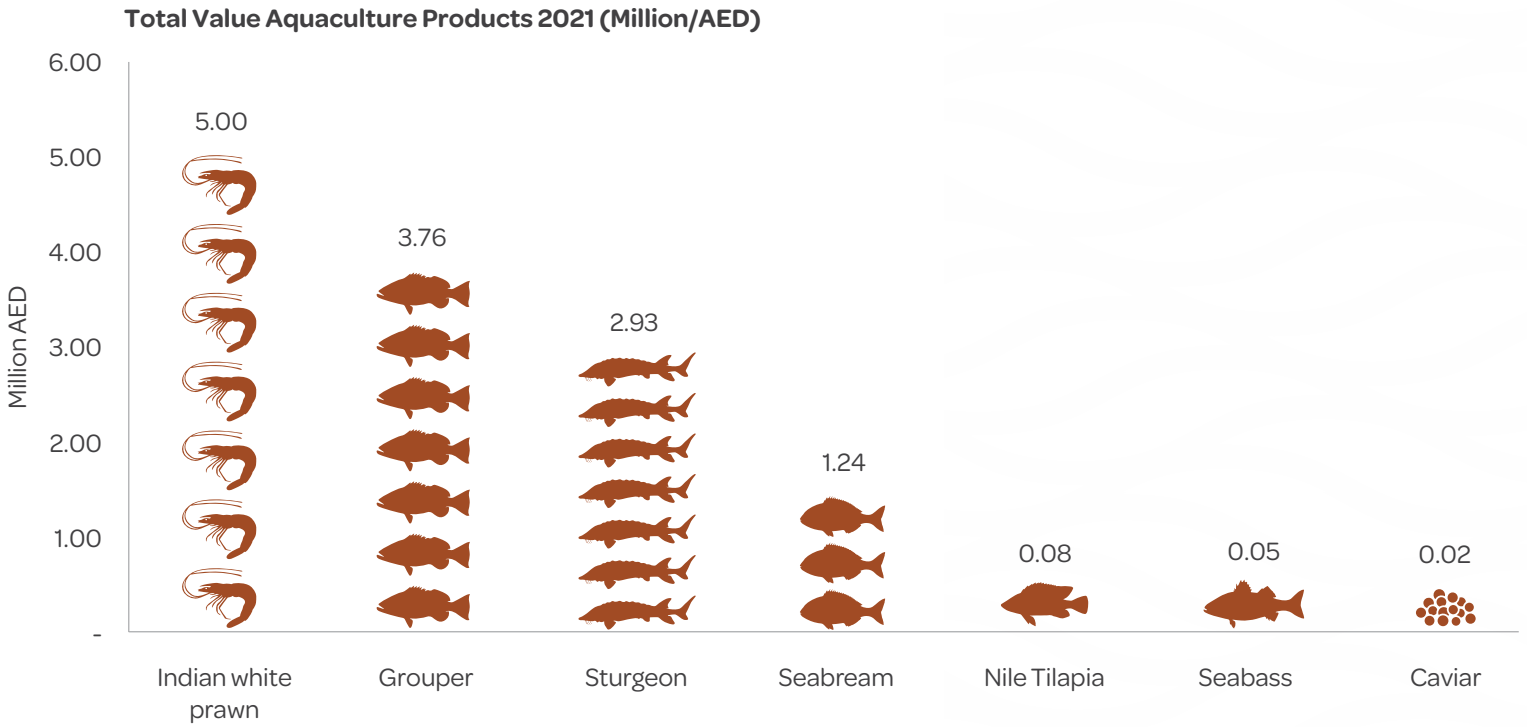


Figure 33: Value of aquaculture production

4.3 TIME SERIES

4.3.1 Production 2014–2021

Compared to 2020, the production of aquaculture farms in Abu Dhabi dropped to 408 in 2021. The aquaculture production reached the highest peak in 2018 (808 tonnes), almost double the production of what was produced in 2014, 2015 and 2016. Whereas in 2016 it was the lowest (375 tonnes).

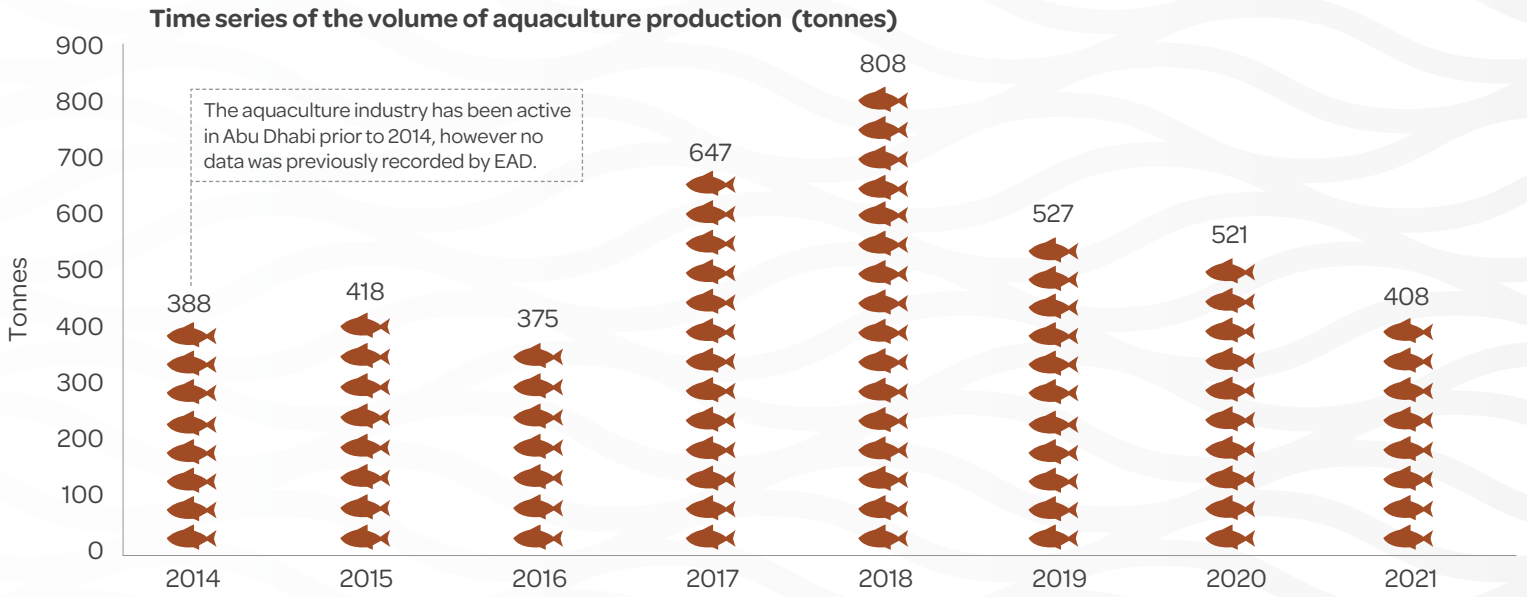


Figure 34: Time series of aquaculture production

4.3.2 Value 2014–2021

Figure 35 shows the time series of the total aquaculture value throughout the year 2014–2021. The total value of aquaculture products in 2021 declined to AED 13.1 million. The farm gate value of aquaculture products was highest in 2017 (AED 22 million) and lowest in 2014 and 2016 (AED 12 million).

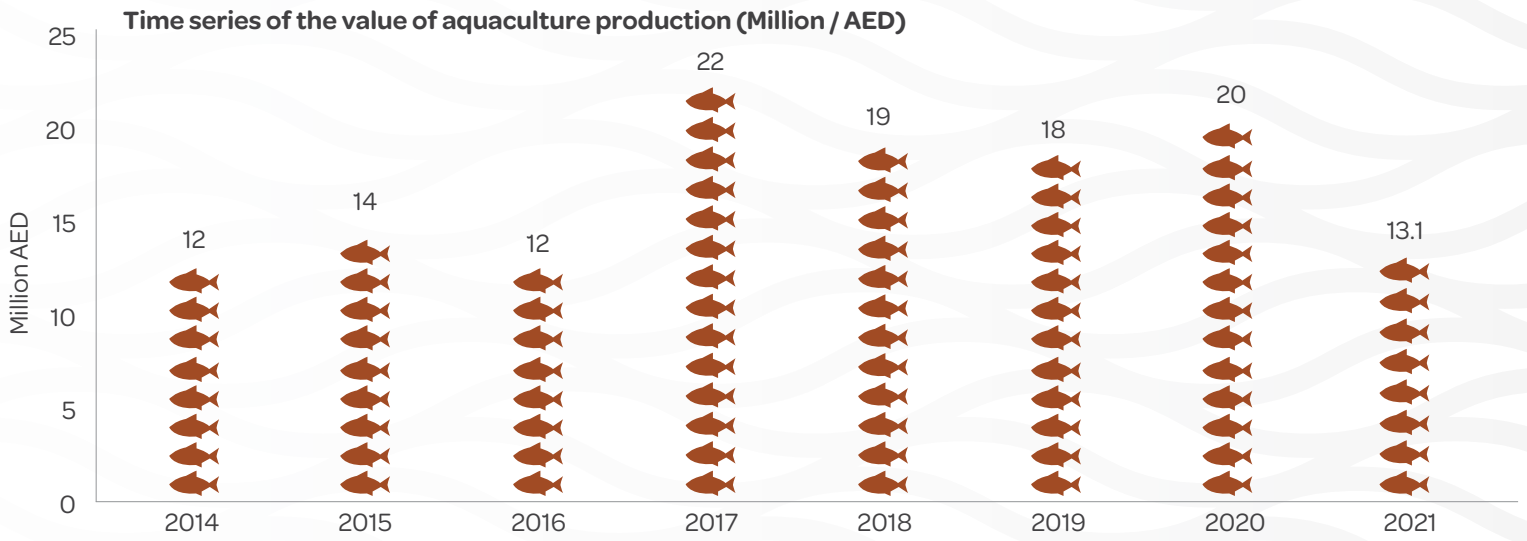


Figure 35: Time series of the value of aquaculture production

4.4 KEY PERFORMANCE INDICATORS FOR AQUACULTURE

Aquaculture has been recognized as a priority industry for development by the Abu Dhabi government due to its several potential environmental, economic and social benefits. Through producing safe, wholesome and high-quality seafood products, aquaculture can satisfy market demand through the use of sustainable technologies that preserve biodiversity and to ensure the protection of healthy, productive and resilient ecosystems.

EAD monitors the performance of the aquaculture sector and its benefits to the fisheries sector through the KPI that determines the percentage of aquaculture production of the total fisheries landings. In 2021, aquaculture sector in the Emirate produced 408 tonnes which is 31 % of the wild catch landed in Abu Dhabi. Even though there was a reduction in aquaculture production in 2021, it is still within the targets set by EAD which is 24 % and is predicted to continue to rise at a rate of 2 % per year. Equally important, this KPI highlights the aquaculture impact in alleviating pressres on local overexploited species as well as reducing relience on imports of non-native species.

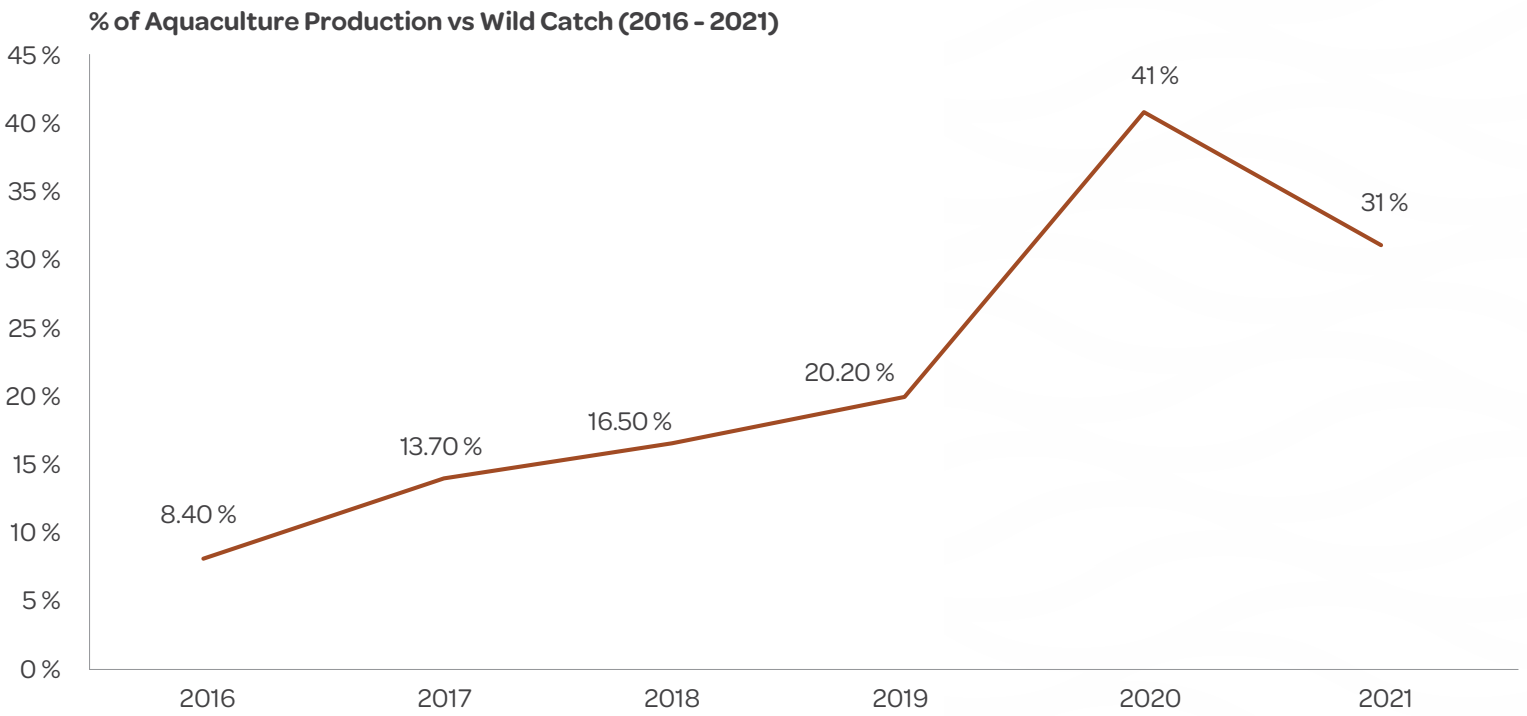


Figure 36: % of Aquaculture Production vs Wild Catch KPI (2016 – 2021)

4.5 AQUACULTURE LANDSCAPE OF ABU DHABI

4.5.1 Al Jaraf Fisheries

Established in 2004 and located at Bul Ruamid Island, the pond-based Al Jaraf Fisheries aquaculture farm is considered the only and largest shrimp farm in Abu Dhabi and the UAE, with the capacity of producing around 300 tonnes of Indian white shrimp *(Penaeus indicus)* annually in 53 open earthen ponds of various sizes ranging between 1.5 – 2 hectares. Although the farm focuses mainly on shrimp farming, other fish species are also being cultured at the facility including Hamour in open ponds, seabream and seabass in an indoor recirculating aquaculture system (RAS).

Overall, the farm is self-sufficient with a hatchery that ensures a constant and reliable supply of antibiotic-free and specific pathogen-free shrimp larvae that are cultivated for 5 to 6 months until they reach market size.

In order to achieve environmentally sustainable production, post-harvest effluent water from grow-out ponds is pumped to a sedimentation pond, where it is kept for a period of 10 days to allow suspended solids to settle down in the center of ponds.

Moreover, an integrated multi-trophic aquaculture system, where two or more species are cultured in the same pond, is adopted to further manage effluent water quality. In this regard, bivalves are used as biofilters due to their ability to remediate effluent waters prior to release. In addition, part of the effluent water is drained into another pond where it can be used for the next cycle of production, while the remaining accumulated waste is drained and converted to biofertilizers for agriculture.

Al Jaraf Fisheries

System

Open grow out ponds

Number of units

58 Ponds

Source of water

Seawater

Species

Indian White Prawns
(Penaeus indicus)
168 tonnes

Seabream
(Sparus aurata)
52 tonnes

Grouper Hamour
(Epinephelus coioides)
28 tonnes

Seabass
(Dicentrarchus labrax)
2 tonnes

Components

- Hatchery
- Live feed Unit
- Nursery

4.5.2 Emirates Fish Farm

The Emirates Fish Farm, that commenced operation in 2016, is considered the largest Hamour aquaculture venture in the UAE with a capacity of producing 120 tonnes of commercially important overexploited Hamour *(Epinephelus coioides)*.

In 2021, the facility achieved a production of 50 tonnes of Hamour, which is almost third of the wild caught Hamour landed in Abu Dhabi in that year. It is envisaged that at full production capacity the facility will be able to significantly exceed fisheries landing of Hamour. This will eventually play a role in relieving pressures on declining Hamour stocks as well and achieving sustainable fisheries by 2030.

The facility which is located in Al Wathba utilizes an advanced and environmentally sustainable indoor recirculating aquaculture system (RAS) that efficiently uses and reuses the same water over the full production cycle. Regardless of being in the desert, the facility is managed by an integrated system that controls key water quality parameters and ensures that the fish are cultured in an environment similar to their natural habitats.

Furthermore, solid wastes and dead fish are collected and composted to be utilized as fertilizers for vegetation. At the same time, low volumes of discharged water are taken advantage of by irrigating halophytes.

Additionally, a hatchery with its support units is currently under construction. Once completely developed, the facility will eliminate its reliance on external sources of juveniles and will also be able to supply Hamour fingerlings to emerging facilities across the country, which will further increase the sustainable production of this culturally and commercially important fish species.

4.5.3 Pristine Fish Farm

The world's largest indoor sturgeon and caviar aquaculture facility was established in 2011, using a state-of-art freshwater recirculating aquaculture system (RAS). The facility is based in a warehouse at Mussafah. Operating under full capacity, the facility is able to produce 35 tonnes of caviar and 400 tonnes of CITES-listed Siberian sturgeon *(Acipenser baerii)*. The species has also been classified as a critically endangered species on the International Union for Conservation of Nature (IUCN) Red List due to the extensive international trade in sturgeon products and actual and potential threats faced by this species all over the world. Therefore, through sustainable aquaculture the facility provides an alternative and sustainable source of one of the most endangered fish species in the world, which highlights the Emirate's efforts in regards to conservation of sturgeon populations.

The facility is divided into two wings each containing 80 grow-out tanks of various sizes that accommodate the fish throughout the different stages of the culture cycle. Furthermore, the facility is equipped with sophisticated detection and warning systems to warn against system failures in the tanks. This includes communicating with various lines of managers via smart applications and visual warning systems. Likewise, feeding is fully automated and monitored to ensure delivery of precise nutrition needs and to avoid the deterioration of excess feeds and the corresponding contamination of water. Moreover, effluent water goes through several physical and biological filtration systems to ensure it remains within the acceptable discharge limits.

Pristine Fish Farm

System

Recirculating
Aquaculture System

Number of units

160 tanks

Source of water

Municipal
Desalination Water

Species

Siberian Sturgeon
(Acipenser baerii)
65 tonnes

Caviar
0.13 tonnes

- Sterlet sturgeon
- Russian sturgeon
- Sterlet Albino sturgeon
- Beluga Sturgeon

Components

- Hatchery
- Nursery
- Process area

4.5.4 Integrated Aquaponics Facilities

The Bee for people of determination products farm in Bani Yas and Emirates International Agriculture Advanced farm in Al Faya utilize a small-scale production system known as Aquaponics, which is an intensive hybrid production system that combines the culture of fish with vegetables in an integrated recirculating system.

Each farm has two greenhouses - one for aquaculture and one for hydroponics connected through several different filters that break down the ammonia-rich fish waste into nitrates, which in turn is consumed by plants. This has the dual effect of providing nutrients to the plants and cleaning the water, which is then circulated back to the fish tanks where the cycle is constantly repeating.

Both facilities produce around 40 tonnes of Nile tilapia *(Oreochromis niloticus)* annually along with various vegetables including cherry tomato.

Aquaponics is an environmentally sustainable production method that utilizes less water to simultaneously cultivate two types of crops. In addition, the uptake of fish dissolved wastes by plants significantly reduces the water exchange rate and the minute volume of discharged effluent water is used for irrigation of different types of livestock plants.

Diagram of Aquaponics System

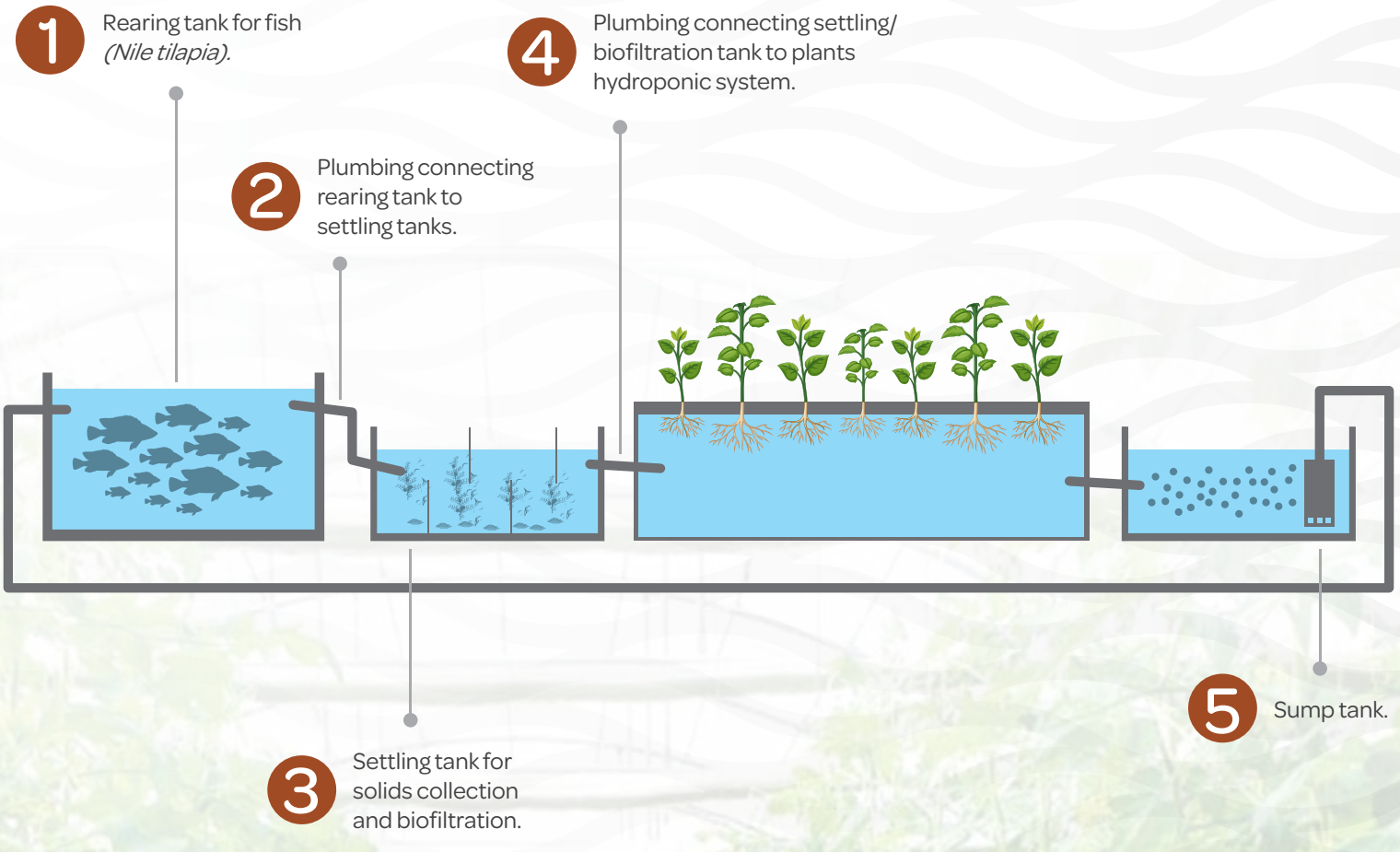
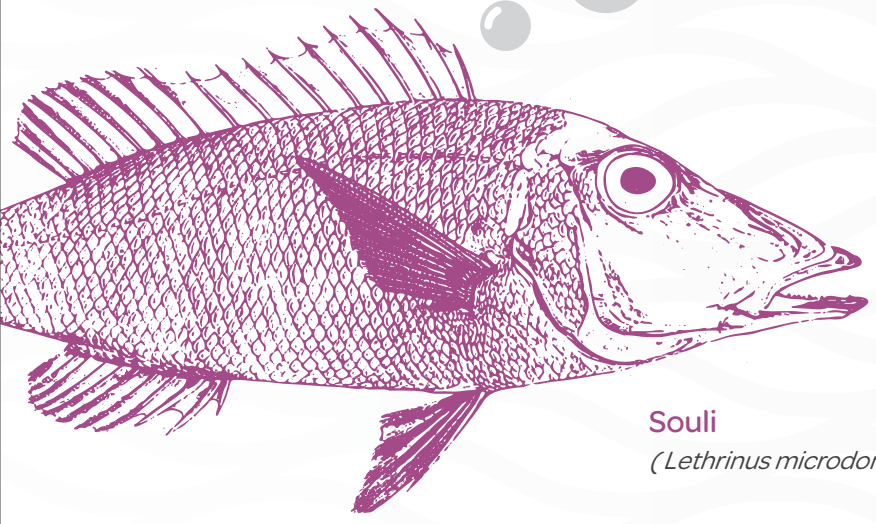


Figure 37: Illustration of the different components of a typical aquaponics system that is adopted by the integrated aquaponic facilities at Bani Yas and Al Faya.

5. THE STATUS OF FISHERIES RESOURCES



Souli
(Lethrinus microdon)

5. THE STATUS OF FISHERIES RESOURCES

The status of fisheries resources, precisely fish stocks are determined through the process of stock assessment. Stock assessment is the synthesis of information on life history parameters, fishery monitoring and resource surveys in order to estimate the stock size, reproduction rate and fishing pressure relative to sustainable reference points. The assessment of fisheries resources is essential as it allows for the forecasting of response of the resources to alternative managerial decisions.

5.1 METHOD

The assessment of the status of fisheries resources is based on a strategy which combines two different stock assessments methods: the length-converted catch curve **(LCCV)** method which allows for the estimation of the Spawning Biomass per Recruit **(SBR),** and the Catch-Maximum Sustainable Yield **(CMSY)** production model, which allows for the estimation of the level of biomass at sea **(B)** and fishing mortality **(F)** in reference to the Maximum Sustainable Yield **(MSY)** level.

The SBR is the ratio between the current spawning stock biomass and the spawning stock biomass without fishing, while B is the estimation of the total biomass at sea for that stock and F is the rate of the stock which is exploited by fisheries. Where MSY is the largest annual harvest that a fish stock can produce in the long term without the risking the depletion.

The LCCV method is based on the classical Beverton and Holt (1957)[6] model and requires regular collection of length frequency data from fishing landing sites and has been applied since 2001 to assess Abu Dhabi's fisheries resources.

The CMSY is a Bayesian method developed by Froese *et al.* (2017)[7], based on computational algorithms, it combines the time series of catch and CPUE data (if available) with information on the stock's productivity and exploitation history. The CMSY method has the big advantage with respect to other production models that catch data can account for gaps (or absence) in stock abundance information. In the case of Abu Dhabi fisheries, this novel method was applied for the first time in 2020, integrating and corroborating the existent knowledge on the status of the stocks estimated by the LCCV.

The two methods provide an estimation of the spawning biomass per recruit (SBR) biomass at sea (B), as well as the fishing mortality rate (F).

For the purpose of the overall diagnosis of the status of the resources, the three indicators were analysed in relation to precautionary reference points, all listed in **Table 4.**

Indicator	Precautionary reference point
SBR	30 %
B	Level of biomass at the MSY (B_{MSY})
F	Fishing mortality that produces MSY (F_{MSY})

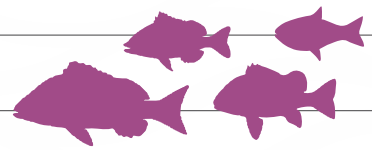


Table 4: Indicators and reference points

Subsequently, B/Bmsy is the ratio between the current biomass and the biomass at MSY, and F/Fmsy is the ratio between the current fishing mortality and the fishing mortality at MSY.

[6] Beverton, R.J.H., Holt, S.J., 1957. On the dynamics of exploited fish populations. Chapman and Hall, London.
[7] Froese, R., Demirel, N., Coro, G., Kleisner, K. M., and Winker, H. 2017. Estimating fisheries reference points from catch and resilience. Fish and Fisheries, 18: 506–526.

5.1.1 Temporal coverage of the assessments

Typically, the number of stocks assessed per year ranged between 3 and 9. In 2021 a total of 17 species stocks were assessed **(Figure 38)**. This peak in assessment numbers was made possible as a result of methodological improvements, and increased efforts on field surveys. The representation of the stocks assessed in terms of their contribution to total landings increased majorly throughout the past years, whereby the representation was 30 % in 2015 and 96 % in 2021 **(Figure 38)**. Although a decrease in the number of assessed species occurred between 2020 to 2021, an increase in the percentage of landings assessed was noted. Correspondingly, the novel methods and the increased presence in the field resulted in increases in both quantity and quality of the data provided.

In general, Hamour *(Epinephelus coioides)* Shaari *(Lethrinus nebulosus)* and Farsh *(Diagramma pictum)* have been sampled almost continuously over the entire period 2005–2021, while the other species have been sampled on average every three to five years depending on the species. In 2021, Aifah *(Chanos chanos)* and Haqool *(Tylosurus crocodilus)* were assessed for the first time through the SBR method.

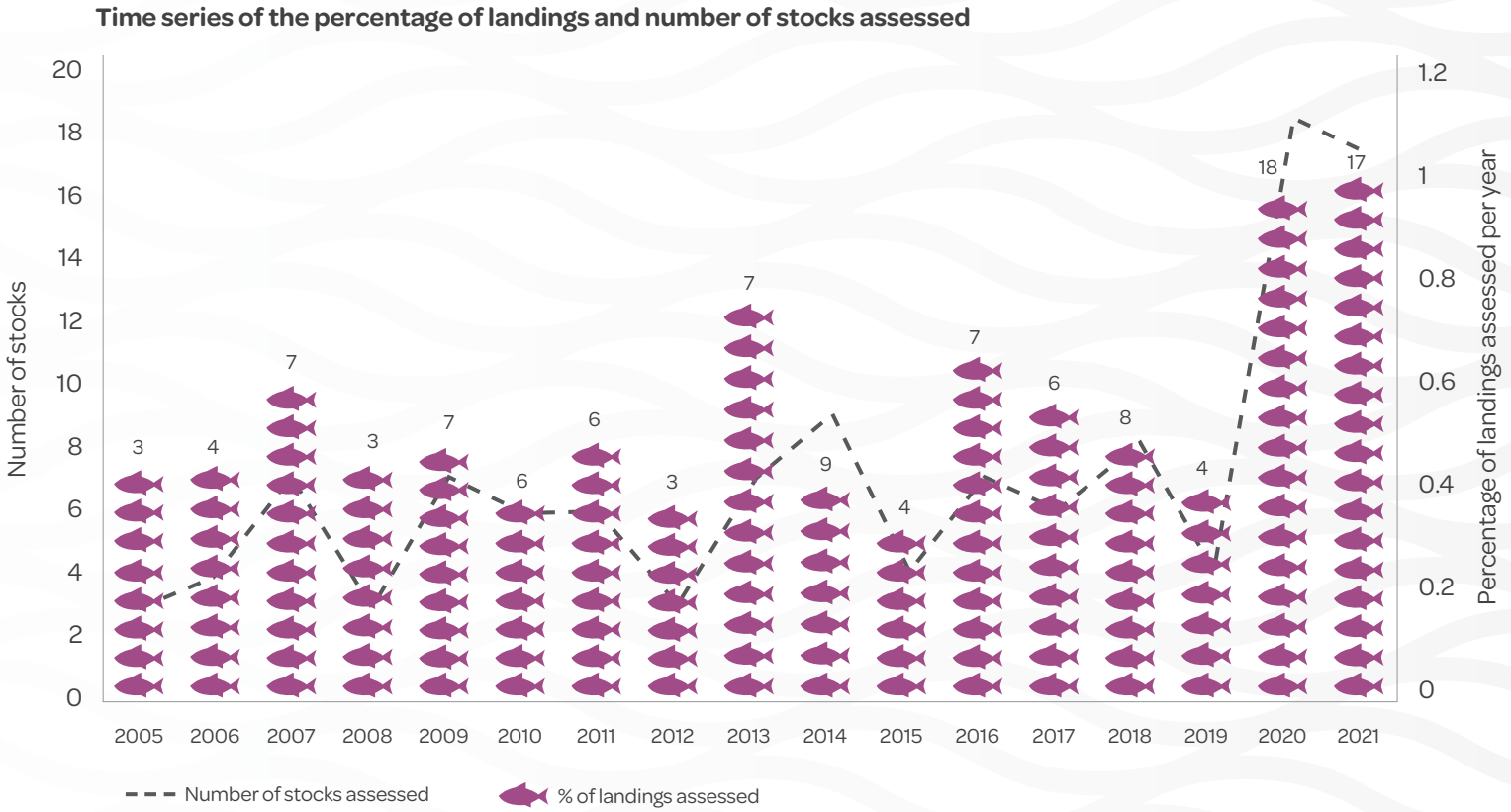


Figure 38: Number of stock units and percentage of landings assessed per year, 2005–2021

5.2 OVERALL STATUS OF MAIN SPECIES

The following table **(Table 5)** outlines the results of the stock assessment per indicator, the status per indicator is set based on a comparison between the current estimates and the relative reference points, as detailed in the legend of the table. Both the SBR and B/BMSY are correlated with the exploitation which occurred in previous years. On the other hand, the F/FMSY refers to the current exploitation which may affect the future status of the stock. The overall status was assigned with a precautionary approach, whereby the species are considered *sustainably exploited* only when both the SBR and the B/Bmsy show values above their respective reference points. The rate F/FMSY, which is not considered for the assessment of the current overall status of the stocks is labelled as overexploited (red) when the ratio is below its reference point.

The tables below **(Table 5 & Table 6)** describe the result of the stock assessment conducted on 32 species, 19 of which were undertaken in 2021 **(Table 5)** and 14 in previous years **(Table 6)**.

Arabic name	Scientific name	Landings 2021 (t)	SBR	B/Bmsy	F/Fmsy	Overall status
Naiser	*Lutjanus ehrenbergii*	279				Sustainably exploited
Kanaad	*Scomberomorus commerson*	236				Overexploited
Hamour	*Epinephelus coioides*	161				Overexploited
Jesh Um Al Hala	*Carangoides bajad*	148				Sustainably exploited
Aifah	*Chanos chanos*	78				Sustainably exploited
Badah	*Gerres longirostris*	38				Sustainably exploited
Shaari	*Lethrinus nebulosus*	66				Overexploited
Dhil'e/Bassar	*Scomberoides commersonnianus*	33				Sustainably exploited
Jedd	*Sphyraena jello*	81				Sustainably exploited
Qabqoob	*Portunus pelagicus*	24	NA			Sustainably exploited
Haqool	*Belonidae spp.*	12	NA			Sustainably exploited
Sils	*Rhynchorhamphus georgii*	0	NA			Sustainably exploited
Qabit	*Rhabdosargus sarba*	14				Overexploited
Safi Arabi	*Siganus canaliculatus*	72				Sustainably exploited
Beyah Arabi	*Moolgarda seheli*	10				Sustainably exploited
Durduman	*Atule mate*	3		NA	NA	Sustainably exploited
Khan	*Netuma thalassina*	3		NA	NA	Sustainably exploited
Farsh	*Diagramma pictum*	0				Overexploited
Aqalah	*Lutjanus fulviflamma*	8		NA	NA	Sustainably exploited
Total landings		1267.4				
Percentage on total landings 2021		97 %				

Table 5: Species assessed in 2021

- For the SBR, red indicates SBR <30 % while green indicates SBR> = 30 %, whereby 30 % is the reference point
- For the B/Bmsy, red indicates biomass < BMSY, while green indicates biomass > = Bmsy
- For F/Fmsy, red indicates fishing mortality > FMSY, while green indicates fishing mortality < = FMSY
- The overall status was decided based on a precautionary approach, with the green colour assigned only when both SBR and B/BMSY are above their respective reference points.

Arabic name	Scientific name	Landings 2021 (t)	SBR	B/Bmsy	F/Fmsy	Year of the assessment	Overall status
Shaam	*Acanthopagrus latus*	3		NA	NA	2018	Sustainably exploited
Zuraidi/Gufdar	*Gnathanodon speciosus*	13		NA	NA	2014	Overexploited
Souli	*Lethrinus microdon*	6		NA	NA	2016	Sustainably exploited
Aqalah	*Lutjanus fulviflamma*	8		NA	NA	2014	Sustainably exploited
Yanam	*Plectorhinchus sordidus*	10		NA	NA	2018	Sustainably exploited
Shaari Eshkheli	*Lethrinus lentjan*	0.1		NA	NA	2017	Sustainably exploited
Kofar	*Argyrops spinifer*	0		NA	NA	2014	Overexploited
Yemah	*Lethrinus borbonicus*	0.2		NA	NA	2016	Sustainably exploited
Marjaan	*Lutjanus argentimaculatus*	0		NA	NA	2013	Overexploited
Eshnenuh	*Cephalopholis hemistiktos*	0		NA	NA	2013	Overexploited
Anfooz	*Pomacanthus maculosus*	0		NA	NA	2017	Sustainably exploited
Hilali	*Plectorhinchus gaterinus*	0		NA	NA	2010	Sustainably exploited
Ebzimi	*Scolopsis taeniatus*	0		NA	NA	2016	Sustainably exploited
Total landings		40.3					
Percentage on total landings 2021		3 %					

Table 6: Species assessed in previous years

5.3 STOCKS STATUS TREND

In recent years, the conducted assessments have shown a decrease of overexploited stocks, and subsequently an increase in stocks that are sustainably exploited. In 2021, 23 out of 32 stocks were considered to be sustainably exploited, while 9 remain to be fished over biologically sustainable limits **(Figure 39)**.

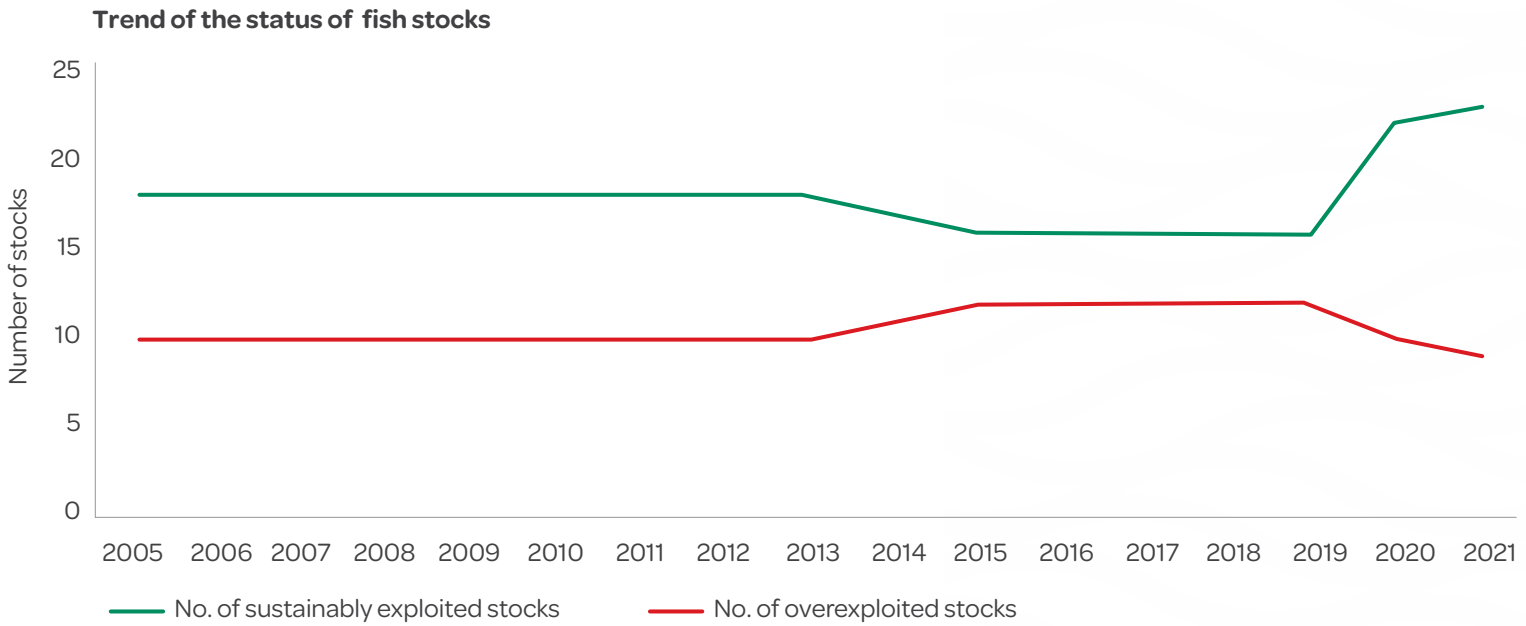
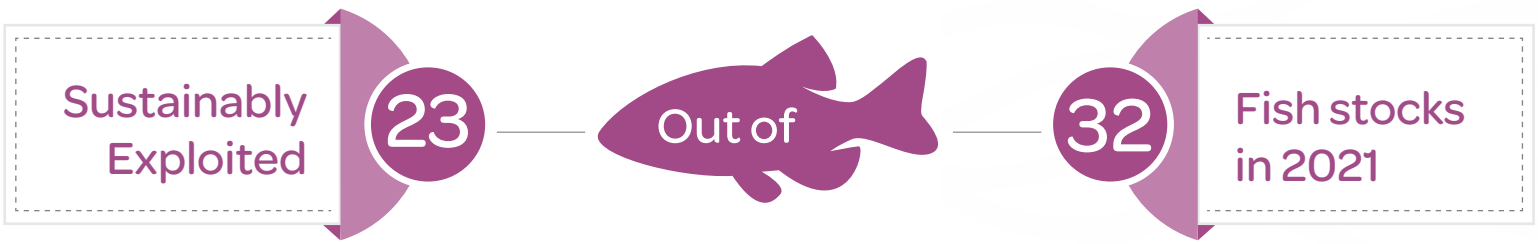


Figure 39: Trend of the number of stocks sustainably exploited (green) and in overexploitation (red)

5.3.1 Trend of the average biomass and fishing mortality for selected species

The trend of the average estimated biomass ratio (B/B_{MSY}) and fishing mortality ratio (F/F_{MSY}), which were calculated by applying the CMSY method throughout the period 2005-2021, the trend is portrayed in **Figure 42.** The calculation included 16 species, which accounted for 96 % of total landings[8].

The average biomass ratio of the group of species was found to have been below the reference point during the years 2010–2019. In 2019, the average biomass began showing a steady increase, reaching a value above the reference point in the year 2020 and subsequently increasing in 2021 (**Figure 40**, left). The average exploitation ratio, represented by the fishing mortality ratio, has been characterised by a fluctuating pattern, with the maximum values being registered in 2010 and 2015, with a decreasing trend characterised by the last few years where values had decreased below the reference point (**Figure 40**, right), corroborating the improvement in the fish stocks status shown by the increasing trend of biomass.



[8] Naiser *(Lutjanus ehrenbergii)*, Kanaad *(Scomberomorus commerson)*, Hamour *(Epinephelus coioides)*, Jesh Um Al Hala *(Carangoides bajad)*, Aifah *(Chanos chanos)*, Badah *(Gerres longirostris)*, Shaari *(Lethrinus nebulosus)*, Dhil'e/Bassar *(Scomberoides commersonnianus)*, Jedd *(Sphyraena jello)*, Qabqoob *(Portunus pelagicus)*, Haqool *(Tylosurus crocodilus)*, Sils *(Rhynchorhamphus georgii)*, Qabit *(Rhabdosargus sarba)*, Safi Arabi *(Siganus canaliculatus)*, Beyah Arabi *(Moolgarda seheli)*, Farsh *(Diagramma pictum)*

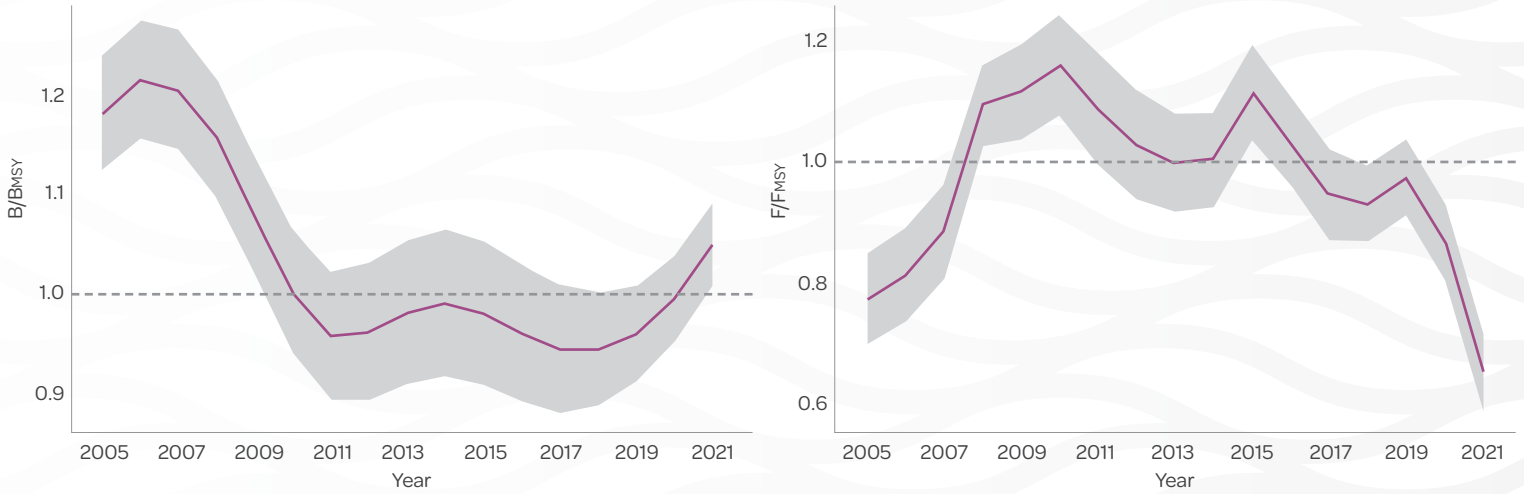


Figure 40: Trend of B/BMSY (Left) and F/FMSY (right) for 16 selected species

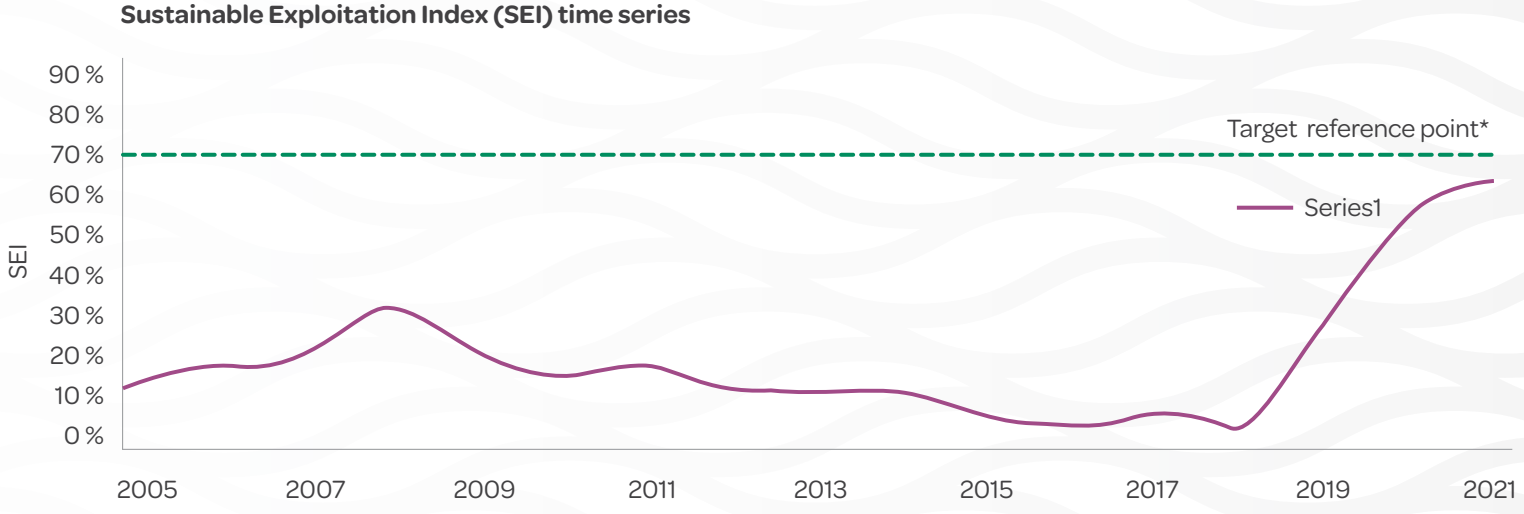
5.4 HISTORICAL TRENDS OF FISHERIES KEY PERFORMANCE INDICATORS (KPIS)

KPIs form the core of the fisheries management policy work, as they allow for evaluation and predictions to be made at multiple levels in fisheries management. The two KPIs utilised in the analysis combine both stock assessment data with fisheries production, resulting in the calculation of the following two indicators: The Sustainable Exploitation Index (SEI) and the Spawning Biomass per Recruit (SBR).

5.4.1 Sustainable Exploitation Index (SEI)

The SEI provides a rapid insight on the level of sustainability of the landings, through the calculation of the percentage of volume of landings which come from fish stocks assessed as *sustainably exploited,* over the total assessed landings. Technically, the KPI therefore represents the combination of landings data and stock status data, and it is calculated for the entire time series using data from all assessed species according to the following formula:

SEI = (Total sustainable catch/Total assessed catch) x 100



*Target reference point according to: UAE National Biodiversity Strategic Action Plan (2014-2021):
TARGET 4.1. By 2021, at least 70 % of important and vulnerable living marine resources are managed sustainably.
*The UAE National Framework Statement for Sustainable Fisheries (2019-2030)

Figure 41: Trend of Sustainable Exploitation Index (SEI), 2005–2021

The results of the SEI KPI outlined in **Figure 41** show a decreasing trend from 2008 to 2018, and a steep increase in during the last few years, whereby it increased from 5.7 % in 2018 to 62.3 % in 2021. The increase of the SEI is largely attributed to the improved conditions of exploited stocks, coupled with the changes in fishing patterns, which led to increased percentages of landings coming from fishing gears which target *sustainably exploited* stocks. In particular, the SEI was largely affected by the ban of Gargours and Ghazal nets, which were mainly targeting overexploited demersal and pelagic stocks respectively.

5.4.2 Spawning Biomass per Recruit (SBR)

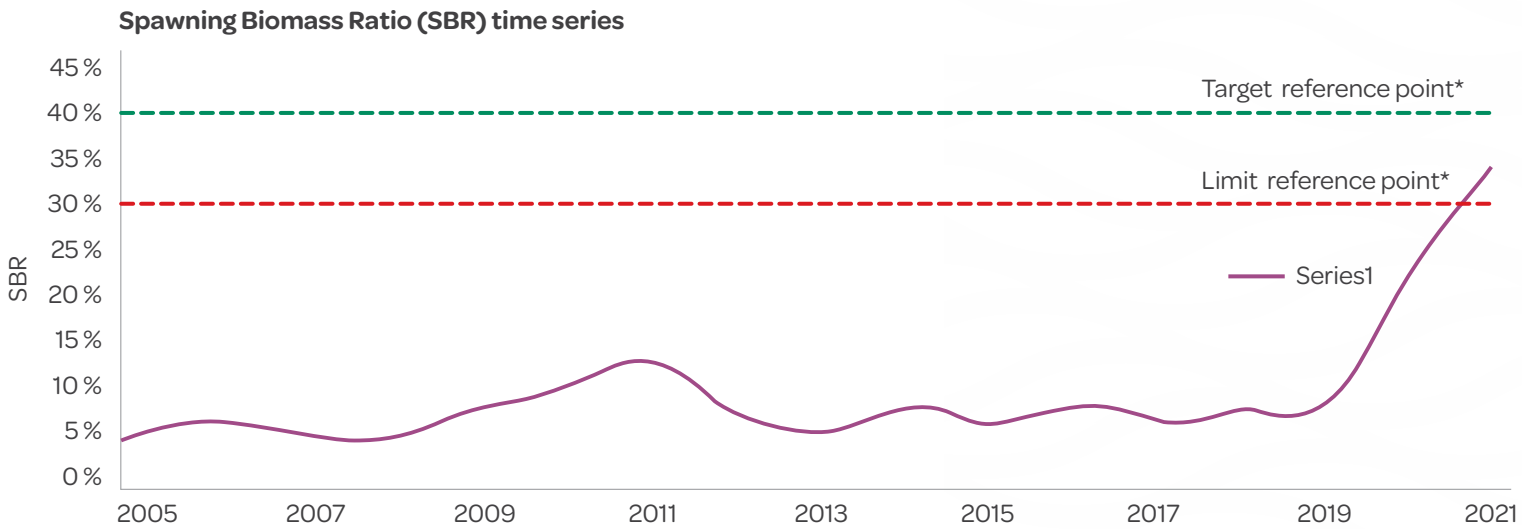
The SBR is the ratio of spawning biomass per recruit during a period of harvest to that which might accumulate in the absence of fishing, and is defined by the following equation:

$SBR = S/S_{F=0}$

where S is the estimated volume of spawning biomass per recruit and $S_F = 0$ is the estimated spawning biomass per recruit with the stock at its pristine level with no fishing activity.

Throughout the time period 2005–2019, the SBR was calculated using the results from three demersal species (Hamour, Shaari and Farsh). In 2021, the calculation method was altered, in order to provide a value which is representative of the overall status of fishing resources. The calculation of the SBR KPI now incorporates the values of all assessed species.

Although the SBR score is still below the limit reference point of 30 % (**Figure 42**), during the last three years the KPI had shown a dramatic increase, whereby it was raised from 7.6 % in 2018 to 34 % in 2021. This increase was largely due to the improved status of fish resources, as well as the method changes. Having higher relative spawning biomass forecasts a good potential for future improvements in fish stock conditions.



*Target reference point according to: UAE National Biodiversity Strategic Action Plan (2014-2021):
TARGET 4.1. By 2021, at least 70 % of important and vulnerable living marine resources are managed sustainably.
*The UAE National Framework Statement for Sustainable Fisheries (2019-2030)

Figure 42: Trend of Spawning Biomass per Recruit (SBR), 2005–2021

As outlined through the trends in the KPI's, and through fisheries dependent and independent surveys, Abu Dhabi's fisheries were previously in a severely overexploited state. The recovery and increase reflected in the two strategical KPI's through data collection in 2021 indicate that stocks are recovering and fisheries management in the emirate is on track to achieve the set targets.

6. GOVERNANCE AND POLICY

Shaari
(Lethrinus nebulosus)

6. GOVERNANCE AND POLICY

6.1 FISHERIES

6.1.1 Fisheries Law & Policy

EAD has been managing Abu Dhabi's fisheries and implementing best practice for over 20 years, our mandate for fisheries management in the emirate is codified in EAD's establishment law - Law No. (16) of 2005 pertaining to the Reorganisation of the Abu Dhabi Environment Agency and in federal legislation. This includes Federal Law No. 23 (1999), as amended by Federal Law No.7 (2016) and its bylaw and amendments (Ministerial Decision No. 302 (2001). At the national level, EAD works closely with MOCCAE, the federal fisheries management entity, in seeking to achieve the national vision of sustainable fisheries in the UAE.

EAD's fisheries management responses fall into three timeframes:

1. Pursuing Fisheries Management Best Practice (2002-2015)

Between 2002 and 2015, an internationally benchmarked suite of management measures was implemented in the UAE at both the federal and emirate level. These included:

- Introduction of a licensing system for commercial and recreational fisheries, including a commercial fishing capacity cap to prevent expansion and overexploitation of the fishery.
- Establishment of a representative network of marine protected areas with no take zones where fishing is prohibited.
- An update of Federal Law No. (23) of 1999 and its Executive Bylaw, in response to changes and new challenges such as the regulation of vice-captain eligibility.
- Regulation of gear use, including limitations on the number and design of fishing gear used. Specifically:
  - Unsustainable fishing techniques have been banned including trawling, drift netting, the use of monofilament in nets, and the use of nets by recreational fishers in the Emirate of Abu Dhabi.
  - On the federal level, gargour size was regulated to prevent fishers from using small gargours which target small fish;
  - EAD limited gargour to 125 traps per lansh and have banned gargour on tarad since 2003 in the Emirate of Abu Dhabi;
  - An escape panel was added to gargours to mitigate ghost fishing and juvenile fish retention;
- Establishment of seasonal bans to protect fish during their reproductive seasons (*e.g.* Safi, Shaari, Kanaad and Badah). This included fishing gear seasons for the Al Hadhra fishery (April–September) and Ghazal fishery (October–April), targeting Badah and Kanaad, respectively.
- Introduction of minimum catch size limits, gargour size and the strengthening of federal fisheries legislation.

2. UAE Sustainable Fisheries Programme (2015–2018)

In 2015, in recognition of the state of the UAE fishery, MOCCAE and EAD partnered to establish the strategic UAESFP (2015-2018), a comprehensive four-year plan with a Programme vision of 'Sustainable Fisheries for the UAE', and a desired national outcome of an environmentally sustainable, economically viable, and socially responsible fishing sector. The programme was a strategic priority and incorporated international (Convention on Biological Diversity, Aichi) and national targets-the primary environmental target of which is to have 70 % of fisheries resources sustainably harvested above the 30 % threshold. It was a nine-project programme with key activities and outcomes such as, spanning law and policy improvements; the most comprehensive fisheries resources assessment survey of the UAE's Arabian Gulf waters; integrated enforcement, socioeconomic and traditional knowledge surveys, and information management.

The UAESFP was a comprehensive fisheries sector review, gave the most up to date understanding of the fishery, and put in place the key building blocks to achieve a sustainable fishery by 2030.

The programme confirmed through landing-based stock assessment, an independent fisheries resources assessment survey, traditional knowledge, and socioeconomic surveys that the UAE fishery is severely overexploited and in need of recovery.

It enabled the launching of the National Framework for Sustainable Fisheries (2019-2030), which is the framework of the UAE national vision statement for fisheries, and associated regulations, the context of which is a recovering fishery.

3. National Framework for Sustainable Fisheries (2019–2030) and associated regulations

Following the completion of the UAESFP (2015–2018), the UAE National Framework for Sustainable Fisheries (2019–3020) was launched setting a clear policy direction for fisheries management in the UAE. The Framework Targets are:

Target 1

Environment

- **Target 1.1:** Mean relative adult stock size-Overexploited demersal fish stocks rebuilt to minimum sustainable thresholds. This will be measured as progress towards an increase in mean relative adult stock size for the three key demersal species (Hamour, Shaari and Farsh) based on annual landings' stock assessment, from 6.6 % average in 2017 to 30 % in 2030.
- **Target 1.2:** Sustainable Fisheries Catch Index—Achievement of 70 % in this index for all species. The term sustainable catch index is a measure for the UAE's fisheries resources that describes the proportion of the total assessed catch landed that consists of sustainably exploited species, estimated each year. This will be measured by progress towards an increase in the index 5.7 % for all species in 2018, toward a target of 70 % in 2030.

Target 2

Social and Economic

- **Target 2:** Stakeholder satisfaction—Stakeholder satisfaction with the ongoing fisheries management planning process is measured via surveys at regular intervals over the time horizon of the 2030 Framework. There are two key actions in the Framework to achieve its targets:

  ACTION 1: Implementation of management measures commensurate with the state of the fishery; and

  ACTION 2: Rehabilitation of fisheries habitats.

Consistent with the targets and actions of the National Framework and commensurate with the severely overexploited state of the UAE fishery, EAD commenced the implementation of the framework by issuing the following key regulations:

1. Ghazel Net and Gargour Ban

Due to a marked rise in net-related deaths of dugongs *(Dugong dugon)* in Al Dhafra region's waters in the Emirate of Abu Dhabi, EAD and MOCCAE issued Ministerial Decision 542 in the year 2018 declaring an immediate stop to fishing using the pelagic Ghazal net. This ban was in place throughout the years 2019 and 2020. A second Decree, Ministerial Decision 82 of the year 2019, concerned the ban of Gargour fishing operations inside the waters of Abu Dhabi Emirate, effective per 1st of May 2019. The Gargour is an unselective fishing gear catching a wide array of demersal, largely juvenile, fish species, including 10 of the overexploited species. These two regulations resulted in a decrease in local fish catch by 47% in 2019 in Abu Dhabi Emirate, in support of the national goal of reducing pressure on the fishery. They are considered to be key regulations that will support the recovery of the Abu Dhabi and UAE fishery by 2030.

In addition to these regulations, EAD at the local level and MOCCAE at the national level have issued a suite of management regulations across the commercial and recreational fisheries **(Table 7).**

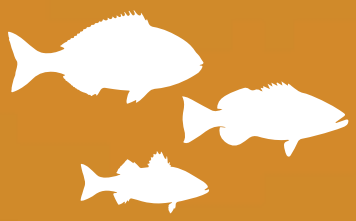
Fishery	Regulation
Commercial & recreational fisheries licensing and permitting	Please visit www.ead.gov.ae for permit applications. Law No. (16) of 2005 pertaining to the Reorganisation of the Abu Dhabi Environment Agency. Federal Law No. 23 (1999), as amended by Federal Law No.7 (2016) and its by law and amendments (Ministerial Decision No. 21 for the year (2018)). Ministerial Decree No. (261) of 2003 capping the number of licenses of tarad and lansh fishing boats.
Commercial fishery - gargour	Ministerial Decision 82 of the year 2019, concerned the ban of Gargour fishing operations inside the waters of Abu Dhabi Emirate.
Commercial fishery - hadhra	Ministerial Decree No.120 of 2019 amending, Ministerial Decree No. 115 of 2017 on Regulation of Fishing by Fixed Equipment (hadhra) in Abu Dhabi
Traditional fishery and co-management - buhoor	Executive Decree No. (44) of 2007 concerning termination of permits for fishing rights in the Buhoor fishing areas. Crown Prince Decree No. (3) of 2005 pertaining to regulating fishing activities in the area known as Buhoor.
Commercial fishery - ghazel nets	Ministerial Decision 542 in the year 2018 declared an immediate stop to fishing using the pelagic Ghazal net.
Federal Fisheries Size Limits	Minimum length of fish allowed to catch and market (PDF, 30.4 MB) according to Ministerial Decree No. 580 of 2015
Federal Spawning season ban – Shaari and Safi	Ministerial Decree No. 580 of 2015 on Prohibition of Catching and Selling Rabbitfish (Saffi) and Emperor Fish (Sheri) in Breeding Season
Shark fishery	Ministerial Resolution No. 43 of 2019 regulating shark fishing and trade.

Table 7: Key regulations for each fishery in Abu Dhabi

Looking ahead, a five-year fisheries recovery policy for Abu Dhabi Emirate is being developed in addition to an integrated regulation to manage the recreational fishery-Hadaq (hook and line), and spearfishing.

6.1.2 Fisheries Governance

Fisheries in the UAE are managed at the federal government level by MOCCAE, in cooperation with the seven emirate competent authorities for fisheries management. Under the Federal Law No. (23) of the year 1999 Concerning the Exploitation, Protection and Development of the Living Aquatic Resources in the State of the United Arab Emirates, which was recently amended by Federal Law No.7 of 2016, roles and responsibilities are shared between MOCCAE and the competent authorities, which is EAD in Abu Dhabi Emirate. The law requires coordination between emirate entities and MOCCAE for fisheries management components, such as determining the number of fishing boats permitted, licensing of fishermen and fishing methods and species permitted to be caught. Because in the past emirate fisheries management capacity has varied across the UAE the 2016 Federal Law 23 amendment gives provision for the formation of a federal committee, with a term of reference including: 'Taking the coordinating measures and actions that are necessary for the exploitation, protection and development of Living Aquatic Resources in UAE.' Entitled the 'Higher Committee for exploitation, protection and development of Living Aquatic Resources,' it is led by the Minister of Environment and Climate Change with members representing federal authorities as determined by him, and a representative for each emirate as per its nomination. Complimentary with the federal Higher Committee the existing formal and informal committees on which experienced fishers within each emirate can be engaged or be a member of a committee that discusses fisheries management issues, include:



1. 'Higher Committee for exploitation, protection and development of Living Aquatic Resources' under Federal Law 23 of 1999 as amended by Federal Law No.7 (2016);

2. Fisheries Cooperative Membership in each emirate (13 Cooperatives in seven emirates), mandated under UAE Federal Law No.13 on the management of Fisheries Cooperatives (1976);

3. Fishers Majlis (meeting places) in each emirate

6.2 AQUACULTURE

In 2019, EAD launched the Sustainable Aquaculture Policy for the Emirate of Abu Dhabi, geared towards promoting the growth of a competitive local aquaculture industry that will assist in the recovery of fish stocks.

The policy, the implementation of which is led by Abu Dhabi Agriculture and Food Safety Authority (ADAFSA), also contributes to food security and economic growth for the UAE by producing safe and high-quality seafood products through the use of sustainable technologies that preserve and protect marine biodiversity and ecosystems.

Developed in collaboration with federal and emirate-level partners, the policy identifies a series of common guiding principles in the development of a local aquaculture sector in balancing all pertinent environmental, societal, economic, and decision-making components that entail sustainability.

The policy includes six key initiatives: updating and streamlining the current permitting process; developing a strategy to identify farming systems and appropriate sites; promoting economic investment in the sector; developing legislation; policies and guidelines; promoting innovation and scientific research in aquaculture; as well as developing communication and marketing plans to attract investments to this sector.

Since the policy's launch EAD has worked on the components under its mandate. This has included developing a new aquaculture permitting form & a new risk-based inspection form which caters the need of all key entities. The aquaculture permitting process was also approved to be a part of the '12x12 Initiative' where clients can apply for such service online through TAMM platform.

In 2018, with the purpose of allocating suitable aquaculture development zones, EAD conducted a hydrodynamic modelling study in the sea of Delma island and its surrounding waters. The study aimed to determine the capacity of fish that can be cultured in marine cages sustainably for the selected areas, analyse the potential environmental impacts of aquaculture activities on the marine environment and determine how long the environment will take to recover to its normal form after cages are removed.

To verify the results of such a project and establish a business model that is both feasible and sustainable; EAD will establish a pilot-scale sea-cage aquaculture project in one of the selected areas in 2022.

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preserving our heritage · protecting our future

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