

# Revitalizing Pakistan's Fisheries

Options for Sustainable Development

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## Options for Sustainable Development

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# Executive Summary

## The Status of Pakistan's Fisheries

**Pakistan is the world's sixth-most populous country, with a population in 2017 of approximately 193 million people and a per-capita income of US\$1,629.** The poverty rate (US\$1.90 per day or less) has decreased from 13.2 percent of the population in 2007 to an estimated 4.9 percent in 2017-18. However, Pakistan's human development indicators—education, nutrition, and gender equity, among others—remain low compared to countries globally and to other South Asian nations. This is particularly true in rural areas, home to two thirds of the population, where a large proportion of households are highly dependent on agriculture, fishing, and other natural resources.

**Pakistan's fisheries contribute modestly to economic growth and social development.** Fisheries account for less than 0.4 percent of GDP. In 2015, marine capture fisheries produced almost 360,000 tons of fish, while inland capture fisheries and aquaculture operations produced a further 132,500 tons and 151,000 tons, respectively. The marine sector is a significant economic pursuit for people along the coasts of Sindh and Balochistan, while small-scale aquaculture and inland capture fisheries are found across the country. Fisheries employ a reported 390,000 people directly, and when secondary jobs such as processing, transporting, and retailing are considered, the number rises to between 900,000 and 1,800,000 jobs in total.

**Yet Pakistan's fisheries face challenges and are not achieving their economic potential.** The marine capture fishery has experienced a decrease in overall production since the 1990s, and a decrease in per-unit value. A recent stock assessment by the Government of Pakistan and the United Nations Food and Agriculture Organization found that Pakistan's marine fisheries are depleted and overfished, and that a continuation of current levels of fishing will seriously undermine production further. The decrease in production has occurred even while total fishing effort (the harvest capacity of the fishing fleet and the time spent fishing) has increased. In addition, costs are high, undermining the sector's profitability, while the shrinking resource base beneath the water undermines livelihoods in vulnerable, small-scale fishing communities.

**Aquaculture is also failing to fulfill its potential, despite favorable agro-climatic conditions.** While the country has extensive resources of fresh and brackish water, aquaculture in Pakistan is limited in its variety and extent. The industry is dominated by carp, with small quantities of tilapia and trout. Marine and coastal aquaculture, such as shrimp farming, are almost non-existent. Despite good agro-climatic conditions, Pakistan lags its neighbors in aquaculture production: Bangladesh and India are among the world's top-five aquaculture-producing countries, while Pakistan ranks 28th. Its aquaculture growth rate of approximately 1.5 percent per year over the past five years is considerably slower than rates in India and Bangladesh. Furthermore, Pakistan's aquaculture growth is well behind these countries' growth during equivalent periods of their aquaculture industry's development, despite continued strong global demand.

**Post-harvest processing is under-developed, contributing to relatively low value addition in the sector.** Post-harvest processing in Pakistan is characterized by poor quality control and outdated processing technologies. Much of the sector's capacity is focused on lower-grade products such as fishmeal. Limited capacity for high-quality and certified processing inhibits access to lucrative export markets. Poor sanitary and phytosanitary (SPS) conditions

led the EU to impose an import ban for several years, and continue to partially restrict access in a range of markets. Exports, which have averaged about US\$350 million annually in recent years, appear to have plateaued.

## The Opportunities for Pakistan's Fisheries

**Fisheries have an opportunity to become a much stronger engine of economic growth and social development.** The underlying potential of Pakistan's fisheries and aquatic resources is not reflected in current production, growth, and value. The sector has much more to offer in terms of boosting export revenues, creating decent jobs, supporting livelihoods in coastal communities, improving domestic nutrition and food security, and closing Pakistan's significant economic gender inequality. The Government of Pakistan recognizes these opportunities, and has signaled its desire to increase the contribution of the fishery sector towards these goals.

**Global demand for protein-rich fisheries products is rising, providing opportunities for ocean-facing countries such as Pakistan.** Fish is the world's most traded food commodity. Global capture fisheries production increased from about 70 million tons in 1970 to 93 million tons in 1990, and has stayed roughly constant since. Global aquaculture has grown from less than 5 million tons in 1970 to 73 million tons in 2014 (FAO 2016a), meeting the continued growth in demand. With world population expected to reach nine billion, and increasing incomes shifting consumption habits towards fish, demand will continue to expand. With this, opportunities for ocean-facing and aquaculture-proficient nations will increase.

**Improved management of marine resources can help prevent large declines in production.** If current trends continue, Pakistan's major commercial species groups, including demersal and pelagic fish, and shrimps, are projected to decline substantially in total stock size, undermining the valuable harvests that they currently support. An increasing proportion of these harvests will consist of smaller and lower-value individuals. A program to reduce the current levels of overfishing could help reverse these trends, helping to maintain current production quantities, and increasing the value of that production. Too many boats chasing too few fish also leads to high costs, and thus reducing overfishing will also increase profits. Combined gains from increased marine fish production and reduced costs are conservatively estimated to be worth between US\$400 million and US\$1,200 million over 30 years.

**Aquaculture presents opportunities to diversify exports away from marine fisheries.** Aquaculture is one of the fastest-growing food sectors globally. The experience of neighboring countries shows the potential for Pakistan to contribute to and benefit from this growth. Putting aquaculture on a growth trajectory that matches those of India and Bangladesh would expand the industry to annual production of over 560,000 tons after 10 years, up from the current 151,000 tons. By comparison, current growth rates lead to an only slightly enlarged sector with 183,000 tons of production annually in that time frame.

**Improving value added in post-harvest value chains is one of the most feasible ways to improve fisheries' economic contribution.** Pakistani fish exporters receive relatively low prices because the majority of their product is unprocessed or targeted towards low-value market segments. High-value markets such as the EU, Japan, and the United States are the world's biggest markets for seafood, yet at present, they account for less than 3 percent of Pakistan's export earnings from fisheries. With improvements in quality, recognized through international certification, Pakistan's fisheries could capture a bigger percentage of these markets.

**In addition to economic benefits, fisheries offer important benefits for food security and nutrition.** Pakistan urgently needs improved sources of nutrition: currently 50 percent of women and children (under five years old) are malnourished, and 44 percent of children are stunted physically and cognitively (ILO, 2016). Greater fish consumption, particularly among the poor, could help. Fish is a good source of proteins, healthy fats, and essential nutrients, and is highly beneficial for child development and cognition. Evidence from Bangladesh shows that increased fish production can increase domestic fish consumption among the poor, via greater availability in local markets, lower prices, and increased incomes.

**Increasing the production of nutrient-rich small fish, indigenous to Pakistan, could further improve nutrition outcomes.** International experience shows that small fish can be cultivated in homestead ponds, improving

family nutrition as well as household incomes. Small fish do not compete directly with larger cultured fish species, enabling farmers to add value to existing ponds. Rates of return on investment in women-led, nutrient-rich small fish farming range from 1:4 for livelihoods to 1:30 or more when health benefits are considered.

## The Challenges Facing Pakistan's Fisheries

**To derive greater, more sustainable economic value from fisheries, serious challenges must be overcome.** A leading challenge is the serious over-exploitation of marine fisheries stocks due to overcapacity in fishing fleets, illegal fishing methods, and lack of surveillance and licensing. A challenge to aquaculture is the systematic deficiencies that currently exist in biosecurity: surveillance, quarantine facilities, and animal health diagnostic capacity are all limited. Pakistan is currently not able to safeguard its own industry or to fulfill international obligations regarding fish diseases, making private investors wary of placing funds in the industry. In post-harvest activities, poor sanitary conditions are common in the supply chain, from landing facilities to processing facilities. Across the industry there is a need for capital investment both for both productive capacity, particularly in aquaculture, and value addition.

**These and many other problems can be traced to deficiencies in the governance framework.** The sector is hampered by institutional rivalries, low budgets, and weak enforcement of what legal and regulatory provisions do exist. Among the varied bodies that provide fisheries management and strategic planning, capacity is limited. The devolution of responsibilities from the Federal to the Provincial and Territorial level—part of wider changes under the constitutional reform process in Pakistan—has made coordination of policies and management more difficult.

**Management of natural resources needs a more integrated approach.** Excessive exploitation, mismanagement, and pollution have degraded ecosystems in Pakistan waters, reducing their productivity and endangering resource-dependent livelihoods. One reason is that fisheries management has developed in isolation from other activities: the value of fisheries is recognized, but policy linkages with other sectors, including water management and agriculture, are under-developed. Integration is key to maximizing overall economic benefits while minimizing damage to the environment. There is serious risk to these goals if fishing continues to be managed in isolation.

**A national policy framework should ensure coordination across the entire fisheries sector.** Pakistan can take advantage of earlier policy and strategy development efforts. The 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan remains largely relevant, though it was not adopted at the time due to political transition. If updated and adopted, such a policy strategy could help ensure that activities in different fisheries work in tandem. For example, aquaculture has strong growth potential in the short to medium term, which could provide income for rural households, as well as food security and nutrition benefits. In the longer term, improved management of marine fisheries could prevent diminishing harvests and ensure sustainable growth in value and jobs. Impacts from one part of the sector – for instance, aquaculture's demand for fishmeal, and pressure on coastal habitats – much be managed with the other parts of the sector in mind. A national policy framework is needed to manage such tradeoffs and realize complementarities.

## The Sustainable Way Forward

**This report presents a detailed set of actions for addressing the identified challenges and charting a sustainable course forward.** These are arranged around six key themes: (1) creating an enabling environment for growth, (2) managing marine capture fisheries for long-term sustainability, (3) ensuring sustainable inland capture fisheries, (4) supporting the development of an environmentally sensitive aquaculture industry, (5) improving value chain performance, and (6) optimizing the benefits of a productive fisheries sector for social goals.

### 1. Creating an enabling environment for growth

- The current governance structure is fragmented. Better-defined roles for existing institutions could improve management outcomes and investor confidence. As mentioned above, an important measure is to update and adopt the National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan, prepared in 2007 but not adopted. While Provinces and Territories would still need to develop their own, locally appropriate regulations, this

document would guide overall sector development in a nationally cohesive way and help manage tradeoffs and synergies between interlinked components of the fisheries sector.

- Revitalization of the sector will require substantial financial investment for new production, structural adjustment, and value-added activities. Strategic financial support in the form of grants, loans, and guarantees is required, along with systems for efficient and transparent delivery. A system of Fisheries Development Funds (FDFs) could make strategic public investments in infrastructure required to modernize the sector, while crowding-in private-sector financing for investments along the value chain. Investments would be market-driven, yet eligibility criteria would help ensure that social goals are promoted.
- The sector needs investment in skills and training. This could be achieved through increased funding for existing Provincial- and Territorial-level educational institutions, coupled with funding through the FDFs to support new partnerships with the private sector to ensure vocational readiness. This could also be pursued through technology-driven edu-tech solutions that promote disruptive and scalable skills development in countries that find it hard to mobilize global expertise due to conflict and safety concerns.
- With fish as an important local and global food, there is a need to strengthen food safety and sanitary and phytosanitary (SPS) systems, and ensure compliance, to build Pakistan's access to high-value markets, and reduce the risks that currently discourages private-sector investment. Stronger Federal oversight, and increased capacity in inspections, diagnostic laboratories, border-quarantine facilities, and industry protocols, are necessary.

## **2. Ensuring the productive and sustainable management of marine fisheries**

- As in many other ocean-facing countries, improvements to productivity and sustainability of marine capture fisheries will require an urgent reduction of overfishing. An effort reduction program and enforced licensing could cut fleet capacity and fishing effort and phase out certain types of vessels. Restrictions on timing and areas of fishing could further protect key habitats and ensure stock recovery. There are various technical approaches to designing such a program, which would be detailed in Fisheries Management Plans (FMPs), informed by a new research framework. The reduction in overfishing could proceed in parallel with compensation for affected operators, or by alternative livelihood programs to ameliorate the costs of adjustment.
- To better nurture fisheries revitalization, improved monitoring, control, and surveillance is essential, so as to protect Pakistan's fisheries both from unauthorized international and local fishing activities. Better enforcement of existing regulations is as important as introducing new ones. Monitoring, control, and surveillance in fisheries are a multi-jurisdictional affair in Pakistan, and thus a unified cross-government plan of action that clarifies responsibilities is an important step.

## **3. Ensuring the productive and sustainable management of inland capture fisheries**

- A review of the incentives created by existing management schemes for inland capture fisheries is needed. Many inland fisheries have low productivity and poor social and livelihood outcomes, partially due to contracting arrangements between managers and resource users. Policy options for management systems could be developed on a consultative basis as part of such a review.
- Improved ecosystem management would prevent further degradation of important freshwater resources. Fish yields at Pakistan's two largest lakes, for instance, have been diminishing, due to pollution and resource mismanagement. Improving yields and livelihoods will require better data collection and research to inform management of ecosystem tradeoffs, and to identify and reduce sources of water pollution.

## **4. Supporting the development of an environmentally sensitive aquaculture industry**

- Aquaculture faces risks that must be averted to encourage private sector investment and ensure that inadvertent costs do not outweigh benefits of growth. A system of spatial planning could reduce risks. Detailed mapping of where aquaculture development should be permitted would avoid environmentally costly impacts on mangroves and water supplies, and ensure optimal use of existing infrastructure such as roads and export facilities.

- The quarantine and certification system also need strengthening to reduce biosecurity hazards. This would require upgrades to aquatic animal health laboratories, stronger certification measures, and better inspection facilities at ports of entry. Institutional changes, such as nominating and empowering a focal-point biosecurity institution at the Federal level, might also help. Greater engagement with international organizations that deal with aquaculture biosecurity and food safety risks is also recommended.
- Deeper extension service would foster development of the industry. Aquaculture extension in Pakistan primarily takes place at the Provincial and Territorial level, through largely unlinked institutions. Institutional coordination, upgraded curricula, and learning from other countries' successes could increase productivity. This should be supported through increased research, undertaken jointly by the public and private sectors.

## **5. Improving value chain performance**

- Investment in infrastructure and services is needed to support firms' efforts to increase the value of their product, deliver quality to consumers, and compete internationally. Investments should focus on infrastructure and services that supports a wide range of fishing enterprises along the value chain. Investments could be used to create "competitiveness clusters", sites of co-located fisheries-related firms. Over time, the co-location of businesses drives productivity through the sharing of facilities and export services, and through peer-learning. Similarly, investments in fish markets can improve SPS conditions and help bring buyers and sellers together in ways that improves value.
- Productivity and competitiveness should also be improved through investments in training, benchmarking, certification schemes, and codes of practice (COPs). New markets should be developed through outreach, promotion and market-analysis to increase demand for Pakistan's improved fish products.

## **6. Optimizing the benefits of a productive fisheries sector to advance social goals**

- Investments and improvements in fisheries should benefit both large export-oriented firms and small-scale operators. There is also a need to ensure that policies disproportionately benefit poorer households and women. This could be achieved by encouraging FDF investments towards activities that employ or are led by women, which tend to be in post-harvest phase. Extension activities and financial support oriented towards small-scale home-stead aquaculture could also help.

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# Acronyms Used

<b>AAH</b>	Aquatic Animal Health
<b>AFD</b>	L'Agence Française de Développement
<b>AQD</b>	Animal Quarantine Department
<b>CCRF</b>	Code of Conduct for Responsible Fisheries
<b>CDFD</b>	Coastal Development and Fisheries Department
<b>CPUE</b>	Catch per Unit of Effort
<b>DoF</b>	Department of Fisheries
<b>EAF</b>	Ecosystem Approach to Fisheries
<b>EEZ</b>	Exclusive Economic Zone
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FDB</b>	Fisheries Development Board
<b>FDC</b>	Fisheries Development Commissioner
<b>FMP</b>	Fisheries Management Plan
<b>FRAPP</b>	Fisheries Resource Appraisal in Pakistan Project
<b>GDP</b>	Gross Domestic Product
<b>HACCP</b>	Hazard Analysis and Critical Control Point
<b>ICT</b>	Information and Communications Technology
<b>ILO</b>	International Labour Organization
<b>IOTC</b>	Indian Ocean Tuna Commission
<b>IUCN</b>	International Union for the Conservation of Nature
<b>IUU</b>	Illegal, unreported, and unregulated (fishing)
<b>MCS</b>	Monitoring, Control, and Surveillance
<b>MFD</b>	Marine Fisheries Department
<b>MINFAL</b>	Ministry of Fisheries, Agriculture and Livestock (disbanded in 2010)
<b>MNFSR</b>	Ministry of National Food Security and Research
<b>MPA</b>	Marine Protected Area
<b>MSY</b>	Maximum Sustainable Yield
<b>NGO</b>	Non-Governmental Organization
<b>NIO</b>	National Institute of Oceanography
<b>NPOA</b>	National Plan of Action
<b>OIE</b>	Office International des Epizooties
<b>PBS</b>	Pakistan Bureau of Statistics
<b>PMSA</b>	Pakistan Maritime Security Authority
<b>PNAC</b>	Pakistan National Accreditation Council
<b>RECOFI</b>	Regional Commission for Fisheries
<b>Rs.</b>	Pakistan Rupee (€1 = c. 123 Rs.; US\$1 = c. 115 Rs.)
<b>SME</b>	Small and Medium Enterprises
<b>SPS</b>	Sanitary and phytosanitary
<b>TBT</b>	Technical Barriers to Trade
<b>TED</b>	Turtle Excluder Device
<b>TRTA</b>	Trade-Related Technical Assistance
<b>UNIDO</b>	United Nations Industrial Development Organization
<b>VMS</b>	Vessel Monitoring System



**CHAPTER 1**

# Introduction and purpose of report

## 1.1. Background

**Pakistan is the world's sixth-most populous country, with approximately 193 million people in 2017 and a per-capita income of US\$1,629.** The poverty rate (US\$1.90 per day or less) has decreased from 13.2 percent of the population in 2007 to an estimated 4.9 percent in 2017-18. However, Pakistan's human development indicators—education, nutrition, and gender equity, among others—remain low compared to countries globally and to other South Asian nations. This is particularly true in rural areas, home to two thirds of the population, where a large proportion of households are highly dependent on agriculture, fishing, and other natural resources.

**Pakistan is endowed with fishery resources that have significant potential to make a bigger contribution to economic growth and social development.** The Arabian Sea is one of the most biologically productive areas in the world, and the country's exclusive economic zone (EEZ) in these waters has recently been extended. Inland are numerous productive waterways, and substantial area and suitable agro-climatic conditions for aquaculture. Globally, demand for protein-rich fisheries products continues to rise, providing opportunities for ocean-facing countries such as Pakistan. With the world population continuing to climb, and increasing incomes shifting fish consumption habits, demand for fish will continue to grow. With it, opportunities for ocean-facing and aquaculture-proficient nations will increase.

**Pakistan's fisheries contribute to economic growth and social development, but their full potential is not being realized.** The sector currently produces an estimated US\$650 million of fish annually, equivalent to about 0.4 percent of GDP, and employs a reported 390,000 people directly. Yet parts of the sector are struggling: the marine capture fishery has suffered a decrease in production and per-unit value due to overfishing over the past two decades (Fanning et al. 2016). The aquaculture industry is growing only slowly, and lacks crucial planning and governance arrangements. Post-harvest processing of fish is hampered by poor quality control and outdated technologies, and much processing capacity is focused on lower-grade products such as fishmeal.

**The right reforms could unlock far greater benefits.** Strategic investments and improved governance could put the sector on a sustainable and value-adding trajectory. Urgent action to prevent the present damaging

levels of overfishing could preserve the productivity of the marine resource for future generations. Adoption of a national policy framework could help coordinate development, ensuring that tradeoffs are minimized and complementarities are realized among interlinked sector components. Improvements to biosecurity and food safety systems could help Pakistan gain access to lucrative international markets, and reduce risks that hold back private investment. Fisheries could also bring considerable benefits for human health and nutrition. Fish is a source of proteins, healthy fats, and essential nutrients—all extremely valuable in the context of Pakistan's high level of malnutrition and childhood stunting (World Bank 2015).

**The time is right for Pakistan to launch a "Blue Revolution" where increased fisheries production, both captured and cultured, and improved value-addition drive both domestic and export-oriented growth.** Such "blue growth" prioritizes the sustainable management of natural aquatic resources in the delivery of economic and social benefits. It minimizes environmental degradation, biodiversity loss, and the unsustainable use of resources, while maximizing the economic and social benefits that build strong communities. The approach also aims to help workers in fisheries, aquaculture, and along the seafood value chain to act not only as resources users but to play an active role in managing natural resources for the benefit of future generations (FAO 2015a).

## 1.2. Purpose and Scope of this Report

**The World Bank, with partner organizations L'Agence Française De Développement (AFD) and the United Nations Industrial Development Organization (UNIDO), is supporting Pakistan's aspirations to achieve blue growth.** This report underpins this support. It provides an overview of current context and opportunities, a technical analysis of impediments, and recommendations for ways forward. The report covers the entire fisheries sector in Pakistan, including marine and inland capture fisheries, aquaculture, and the post-harvest value chain.

**The focus of the report is primarily technical, yet it recognizes that fisheries issues have important political implications.** Some of these arise from the structural reforms and devolution of power undertaken as part of the 2010 Eighteenth Amendment to the Constitution of Pakistan. Others political issues grow

from the fact that fisheries reforms can change access to natural resources, and thus impact livelihoods and asset values. There are thus winners and losers. The political implications of reforms will need to be considered by Pakistan's decision makers, who should ensure that changes lead to an equitable distribution of the gains of sector growth, as well as the costs of that growth. To maintain a focus on technical issues, this report does not address issues of politics directly.

**The report is the result of detailed research and consultation, which included review of literature, original analysis of fisheries data, and extensive meetings with people from the Federal Government, Provincial Governments, the private sector, and non-government and international organizations.** Consultations were roughly evenly divided across capture fisheries, culture fisheries, and cross-cutting issues. The findings are organized in four remaining sections:

- **Part Two** provides an overview of the current state of fisheries in Pakistan. Information on fisheries' contribution to the economy, production trends, and fishing practices for marine, inland, and aquaculture is presented. Part two also provides an overview of

the existing fisheries governance arrangements including current policy and legal framework and institutional arrangements.

- **Part Three** provides an analysis of the potential benefits that could be realized through a revitalization of Pakistan's fishery sector.
- **Part Four** gives an analysis of the challenges to realizing these benefits.
- **Part Five** describes specific activities necessary to overcome the challenges identified in Part Four. It provides recommendations within six themes: (1) creating an enabling environment for growth, (2) managing marine capture fisheries for long-term sustainability, (3) ensuring sustainable inland capture fisheries, (4) supporting the development of an environmentally sensitive aquaculture industry, (5) improving value chain performance, and (6) optimizing the benefits of a productive fisheries sector for social goals

**The result is an in-depth examination of the constraints that Pakistan's fisheries sector faces, and a set of policy actions that provides a road map for its revitalization.**





**CHAPTER 2**

# The status of the fisheries sector

## 2.1. Overview

**Marine fisheries are a significant economic activity off the coasts of Sindh and Balochistan, while aquaculture and inland capture fisheries are found in all provinces of Pakistan.** Fisheries production totals about 620,000 tons annually (FAO 2016b) has an estimated market value of US\$650 million, but a considerable proportion, particularly from inland subsectors, is not commercially traded. Approximately 17 percent of total production is sold to foreign markets, generating US\$350 million annually in export earnings.

**Pakistan's fisheries are characterized by a wide variety of species, vessel and equipment types, and approaches to management.** The industry consists of the following three sub-sectors (Figure 1):

1. A marine capture fishery comprising a fleet of around 3,600 bottom trawlers from Sindh, 5,550 gillnetters working both the Sindh and Balochistan waters, and a further 20,000 smaller vessels fishing coastal waters, especially the rich Indus Delta and creek area. In 2015, marine capture fisheries landed about 360,000 tons of fish (about 73 percent of capture production and 56 percent of total fish production) into the main ports of Karachi, Gwadar, and Pasni, and employed about 204,000 people.
2. An inland fresh water capture fishery in reservoirs, lakes, canals, and the Indus River that involves about 56,000 people, much of it carried out in leased wa-

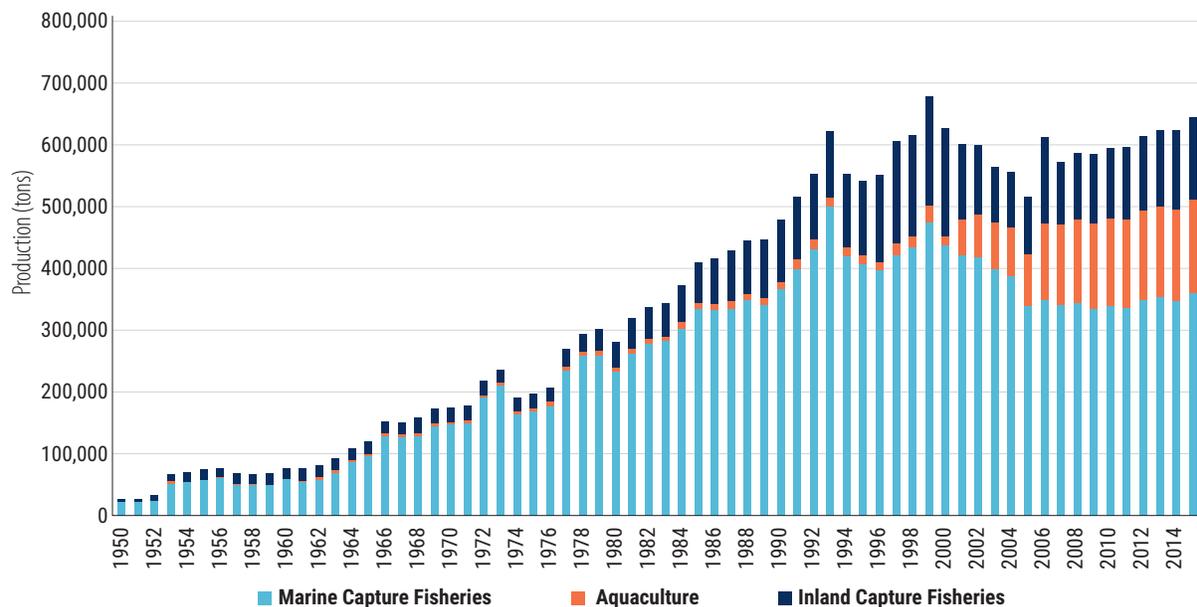
ter bodies. It produced about 132,500 tons of fish in 2015.

3. A relatively small but expanding aquaculture industry, dominated by carp, but with growing tilapia production and supplemented by trout production in the hills. Aquaculture produced about 151,000 tons of fish in 2015, mostly through traditional semi-intensive polyculture methods, that is, the raising of multiple non-competing fish species in the same pond. Punjab and Sindh Provinces are the dominant aquaculture producers.

**Fisheries currently contribute only 0.4 percent of gross domestic product (GDP), and the sector's approximately US\$350 million of exports appears to have plateaued.** Comparisons to other countries in the region suggest that Pakistan is failing to fully realize the potential of its capture and culture fisheries sectors (Table 1), with much lower production in all fishery sectors in absolute terms, as well as in terms of proportion of GDP and maritime area.

**Sindh has Pakistan's most varied fishing activities, including coastal fishing, marine fishing, and inland fishing in the Indus River and associated streams, as well as in a large number of lakes.** Fishing in Balochistan is primarily marine, due to its long coastline and limited inland water bodies. In Punjab, fishing is concentrated around the abundance of rivers, canals, lakes, and dams. Fishing in Khyber Pakhtunkhwa and Gilgit Baltistan has lesser economic importance due

**Figure 1: Pakistan's Fisheries Production, 1950 to 2015**



Source: FAO 2016b.

**Table 1: Comparison of Fish Production of Pakistan, Bangladesh, India, and Myanmar in 2014**

Sector	Annual production (tons)			
	Pakistan	Bangladesh	India	Myanmar
Inland fisheries	276,501	2,821,266	6,181,000	2,462,750
Capture	128,235	961,458	1,300,000	1,463,120
Aquaculture	148,266	1,859,808	4,881,000	999,630
Marine fisheries	346,841	588,988	3,414,821	2,854,200
<b>Total</b>	<b>623,342</b>	<b>3,410,254</b>	<b>9,592,821</b>	<b>316,950</b>

Source: FAO 2016b.

to the colder climate and mountainous terrain. Fishing there is primarily for local consumption and recreation. Aquaculture, meanwhile, is largely concentrated in Punjab, Sindh, and to a lesser extent in Khyber Pakhtunkhwa.

**Fisheries have a strong linkage with, and dependence on, natural resources and their associated ecosystem services.** The following ecosystems play a critical role in supporting fisheries:

- 4. Coastal ecosystems** consist of mangroves, estuaries, salt marshes, seagrass beds, coral reefs, and mudflats, and serve as vital areas for fish spawning. For fisheries and the communities that depend on them, the most important components are mangroves and estuaries. In the Indus Delta, mangrove forests cover approximately 600,000 hectares and constitute a critical ecosystem. The forests provide important breeding habitat for commercially important marine fish, shrimps, lobsters, and crabs. They are almost entirely dependent upon freshwater discharges from the Indus River.
- 5. Freshwater wetland ecosystems** consist of lakes that have aquatic vegetation and large invertebrate and unicellular organisms that serve as food for many types of fish. Sindh has the largest freshwater lakes in the country, namely Manchar, Keenjhar, and Haleji (see Box 8). Wetland ecosystems depend on water quantity and quality to maintain their ecological functions. Lakes provide numerous benefits for communities, including food and income for fishers, nursery grounds for fish, maintenance of water quality and abatement of pollution, freshwater for rural and urban people, maintenance of ground water, flood abatement and erosion control, and recreation and tourism opportunities.
- 6. Riverine ecosystems** consist of river tracts and embankments. They contain sediment, riverine forests,

and unicellular organisms that together form a food chain for fish. The Indus River is the sixth largest river in the world and boasts one of the largest gravity-based canal irrigation systems. Of its total length of 2,800 km, 2,682 km lies in Pakistan. The river is critical for Pakistan's 193 million people, irrigating 80 percent of their 21.5 million hectares of agricultural land. The river watershed is an area of rich biodiversity, with the Indus River Delta being particularly productive for fish.

## 2.2. Status of Marine Capture Fisheries

**Pakistan's marine fisheries are diverse, with almost 250 demersal fish species, 50 small pelagic fish species, 15 medium-sized pelagic species, and 20 large pelagic fish species.** The main fisheries include shrimp trawl, tuna, industrial deep-sea, small-scale demersal, and small pelagics. Much of the fish landed is intended for domestic consumption, which is highest in coastal towns and cities that have landing sites. The Indus River Delta and its associated ecosystems make the coast of Sindh the most productive region of Pakistan's marine fisheries.

**Marine fish production peaked in the 1990s, declined in the early 2000s, and has been stable at about 350,000 tons per year since 2005 (Figure 1).** Particularly valuable target species include shrimps, of which about 22,000 tons are caught each year. Two other major catch groups, in terms of total biomass caught, are demersal fish and small pelagic fish (Table 2).

**Pakistan now has more than 29,000 marine fishing vessels in total (although not all are active), with about 130,000 full-time and 75,000 part-time employees.** The fleet is divided roughly two thirds in Sindh and one third in Balochistan. Almost 70 percent of it is

**Table 2: Major Species Groups in Marine Capture Production in 2015**

Species group	Production (tons)
Pelagic fish (e.g. mackerel, herrings, sardines, anchovy, and hilsa shad)	175,165
Demersal fish (e.g. groupers, snappers, pomfrets, bream, grunters, and croakers)	105,532
Other marine fish	38,595
Crustaceans (shrimp, prawns, crabs, and lobsters)	26,588
Cephalopods (octopus, squid, and cuttlefish)	10,080
Mollusks (excluding cephalopods)	3,048
<b>Total</b>	<b>359,008</b>

Source: FAO 2016b.

**Table 3: Fishing Gear Used in Pakistan's Marine Fisheries**

Gear type	Sindh	Balochistan	Total	
Industrial trawlers	3,612	-	3,612	12%
Gillnetters	3,458	2,103	5,561	19%
Handlines	7,395	74	7,469	26%
Encircling nets	5,268	7,197	12,465	43%
<b>Total</b>	<b>19,733 (88%)</b>	<b>9,374 (42%)</b>	<b>29,107 (100%)</b>	

Source: pers. comm. Marine Fisheries Department (MFD) 2017

small vessels with outboard motors (often assisted by sails), with the rest being larger gillnetters or trawlers. The smaller vessels use handlines and encircling nets, while trawlers use bottom otter trawls and gillnetters use larger mesh gillnets. Only Sindh has a trawl fleet, because trawling is banned in Balochistan Province (Table 3). The fishing fleet is concentrated in Karachi, Sindh, and Gwadar and Pasni, Balochistan.

**The marine fishery can be characterized as “open access”, with few mechanisms in place to control fishing.** While numbers are imprecise due to data limitations, available records suggest that between 2008 and 2016, marine fishing vessel numbers increased by around 3 percent per annum. Inshore mechanized and sail boat numbers rose by 4 percent per annum, gillnetters<sup>1</sup> by 3 percent, and trawlers<sup>2</sup> by 2.5 percent. These figures reflect numbers of vessels, rather than absolute fishing capacity, and given that new vessels are likely to be more powerful than those they replace, overall fishing effort<sup>3</sup> may have increased by 5 percent or more per year over the past decade (Figure 2). There is evidence the existing fleet is more active: both the numbers of trips per year and the duration

of the trips have increased since 2010 for the larger vessel classes.

**The biomass of virtually all the demersal stocks has fallen during the past 30 years.** The overall conclusion of the Fisheries Resource Appraisal in Pakistan Project (FRAPP), the first definitive stock assessment in Pakistan's EEZ in several decades, was that the majority of Pakistan's fish stocks are overfished. Nine of the fourteen major species groups are already depleted. Only two species groups show any indication that fishing mortality is at or below the limit required to maximize yields. This situation is directly linked to the steadily growing fishing capacity and effort.

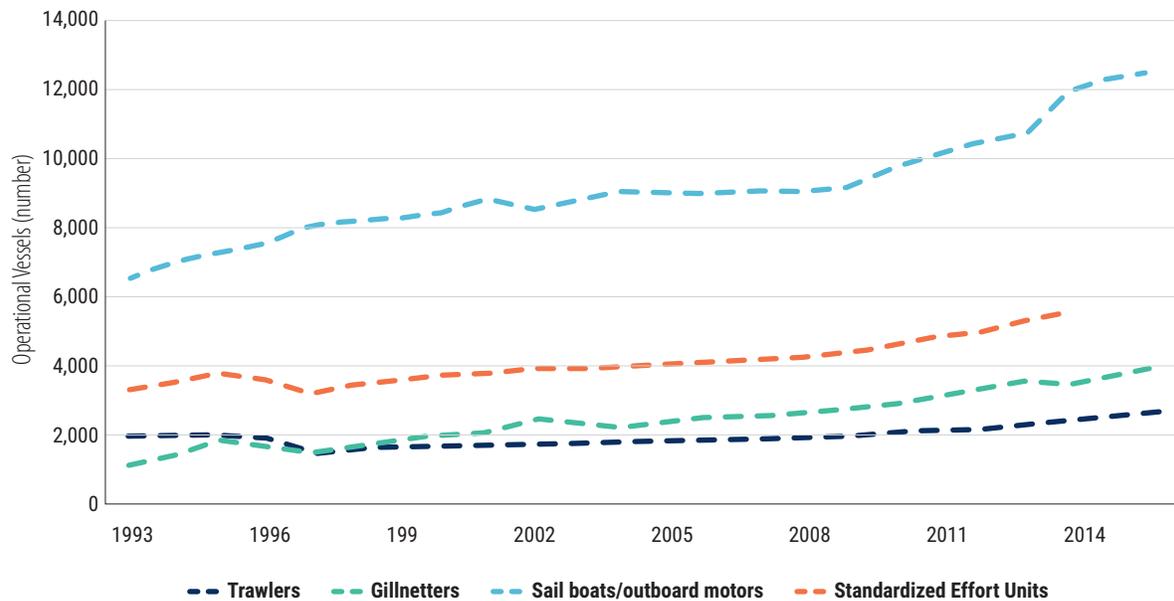
**In addition, FRAPP showed that:**

1. Composition of the catches in fish size has tended toward smaller species, and toward smaller individuals within species groups. Larger species of groupers, sharks, and croakers were not present in abundance, in contrast to earlier surveys. No large sharks, rays, and guitarfishes were seen, with very few smaller shark and ray species caught either. Larger specimens of some common species such as grouper, croakers,

1 A narrow mesh fishing net which is hung vertically so that fish are trapped by their gills.

2 A vessel that tows a fishing trawl net and hauls the catch up a stern ramp.

3 “Fishing effort” is a function of the numbers of vessels, the size and sophistication of the equipment aboard, the type and amount of fishing gear deployed, and the amount of time expended.

**Figure 2: Number of Marine Fishing Vessels by Type**

Source: Vessel numbers from pers. comm. MFD 2017 and standardized effort data from Fanning et al. 2016.

catfish, and ribbonfish were not encountered at all. This is concerning given that the economic value of fisheries is strongly linked to the size of individual fish, with the largest sizes being most valuable.

- Evidence is arising of ecological changes linked to excessive fishing pressure and environmental degradation. For example, opportunistic, fast-growing, and small species such as threadfin bream and lizardfish are growing in abundance, consistent with disturbed ecosystem structure due to the absence of larger species of top predators. Similarly, there are large catches of cephalopods (squids and cuttlefish), another fast-growing and opportunistic group, another indication of habitat and ecosystem disturbance. The abundant presence of jellyfish further likewise suggests a heavily disturbed resource system. These species are important predators of juvenile fish and shrimp and may interfere with rebuilding stocks of commercially valuable species.

#### These findings are consistent with earlier surveys.

Pakistan's most valuable demersal fisheries resources (snappers, groupers, grunters, croakers, soles, and shrimp) have been declining in overall abundance since at least 1984, in some cases by 90 percent or more. In addition, although landings of these species continue,

they are of relatively low value, with a very large portion suitable only for fishmeal production.

#### The FRAPP and other research notwithstanding, data on marine fisheries in Pakistan are generally limited.

The Marine Fisheries Department (MFD) undertakes research specifically on fisheries, while the National Institute of Oceanography (NIO) works on marine biology, oceanography, and geology. The department's activities include biological research on commercial fish species, length-frequency analysis of landings, and consultation with industry regarding fish mesh selectivity. However, considerable research and data gaps remain, such as on the number of active vessels. Data currently collected on landings are insufficiently detailed in terms of species, fleet, and spatial parameters to allow detailed stock assessment and scientific advice for fisheries management.<sup>4</sup>

### 2.3. Status of Inland Capture Fisheries

#### Inland capture fisheries produced about 130,000 tons in 2015, 21 percent of Pakistan's total.

Inland fishing, which in many regions is a traditional practice, is undertaken in rivers, irrigation canals, and reservoirs, and generally serves subsistence needs. About 30 spe-

<sup>4</sup> One exception is data collection for tuna, where a WWF crew-based observer program has reported length, catch, and effort data for tuna gillnetters (IOTC 2017). The data revealed that the catch of tuna was previously underreported.

cies<sup>5</sup> are commercially fished, including several exotic species of tilapia, carp, and trout. Unlike with marine fisheries, 90 percent of fish caught from inland waters are consumed locally. This trend is expected to continue, with the inland population likely to consume any increase in inland fish production in coming decades.

**An estimated 186,000 people take part in inland fishing in Pakistan, many of them very poor.** For example, more than 60 percent of fishing households in communities in the Indus Ecoregion are living below the poverty line (WWF 2015), equivalent to about US\$60 per month. For many fishers, loans (at high interest rates) are essential to smoothing out household consumption across the season.

**Inland fisheries are managed in different ways, by different organizations, depending on the types of aquatic resources and the Province or Territory.** Government bodies involved in inland fisheries management include the Punjab Forestry Wildlife and Fisheries Department (for rivers, lakes, and some reservoirs in Punjab), the Sindh Department of Fisheries (for inland lakes, ponds, depressions, and the Indus River in Sindh), the Mini Dams Department (for small dams on private land in rain-fed areas), the Small Dams Department (for small dams on public land), and the Water and Power Development Authority (for large dams such as the Mangla dam).

**Currently, most inland capture fisheries operate under a contract system by which rights to fish in public water bodies are auctioned off.** These leasing and licensing mechanisms aim to contribute to fisheries management as well as generate revenue. Incentivized by strict revenue targets, the Punjab Government auctions the rights to more than 400 water bodies. Flowing water systems are leased on an annual basis, and static systems on a three-year basis. In Sindh, the lease system for large water bodies has been replaced by a license system for individual fishers. However, this regime does not provide incentives for long-term management, including the restocking of water bodies with young fish.

**Sub-contracting of inland fisheries is not permitted, but is reported to happen nonetheless.** Bidding in the auctions requires substantial capital, restricting participation to the relatively well-off. Individual fishers may then go to work for a winning contractor, or receive

permission to fish in return for a proportion of their catch or earnings.

**To maintain inland fisheries, water bodies are restocked by fisheries departments or by fishing contractors.** There are 16 large and 30 small public-sector carp hatcheries, as well as eight seed nursing farms associated with restocking activities. Much of this infrastructure was developed by the Asian Development Bank (ADB) for aquaculture development programs during the 1980s.

## 2.4. Status of Aquaculture

**Aquaculture is an increasingly important component of Pakistan's fishing sector, producing approximately 150,000 tons of fish annually.** Most productive capacity has been developed only since 2000, and aquaculture remains a nascent industry in many parts of Pakistan, particularly compared to neighboring countries. For decades, semi-intensive composite carp culture, mainly undertaken in Punjab and Sindh, has been the slowly growing mainstay of the industry. Fish culture in earthen ponds, reservoirs, and community ponds was initiated in the late 1960s by the provincial fisheries departments. From the 1980s onwards, polyculture of Indian and Chinese carps was carried out in Punjab and Sindh and to a lesser extent in Khyber Pakhtunkhwa and Balochistan. More recently, carp farming has started to move beyond systems that use supplementary feeds to more intensive, economically efficient systems using floating pellets. There is some trout farming in hillier areas in the north. Commercial-scale marine and coastal aquaculture, such as shrimp farming, is non-existent.

**For now, Pakistan is producing only limited fish species in aquaculture, but is experimenting with broadening the selection (Table 4 and Figure 3).** In recent years, tilapia farming has developed, first with imported seed and now with domestically produced seed from public and private hatcheries. Small tonnages of shrimp and sea bass are being raised experimentally.

**Neighboring countries have much larger aquaculture sectors than Pakistan.** Bangladesh has similar fish fauna and level of economic development, but produces about ten times more fish from inland sources despite having fresh water resources that are around

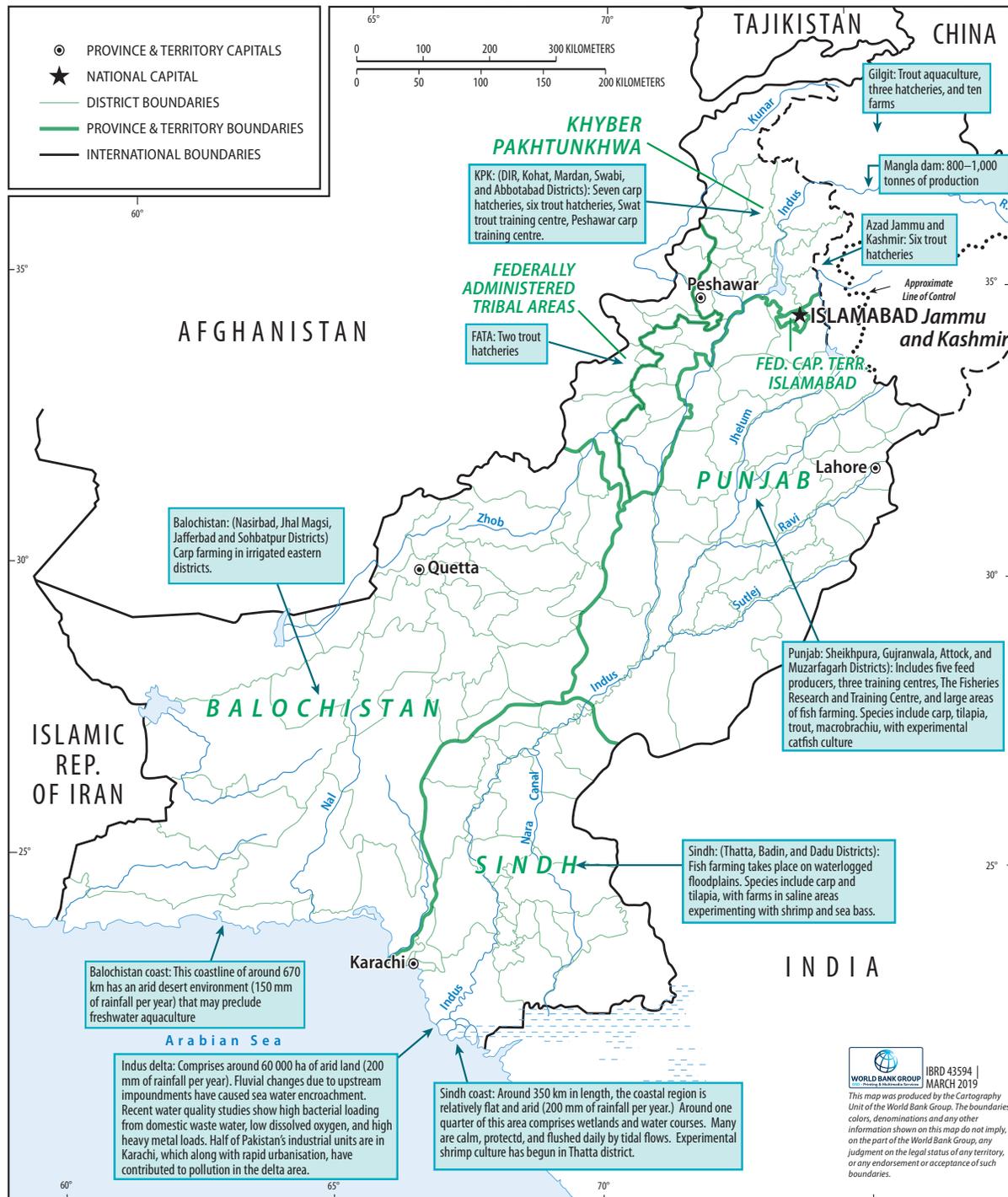
<sup>5</sup> These include *Labeo rohita*, *L. dyocheilus*, *Catla catla*, *Cirrhinus mrigala*, *C. reba*, *Channa striatus*, *C. marulius*, *Aorichthys (Mystus) seenghala*, *A. (M.) aor*, *Wallago attu*, *Rita rita*, *Bagarius bagarius*, *Tenualosa ilisha*, *Notopterus notopterus*, *Tor putitora*, *Schizothorax spp.*, and *Clupisoma nazirri* (Petr 1999).

Table 4: An Overview of Current Aquaculture Practices and Experimental Technologies

	Carp	Trout	Tilapia	Shrimp	Sea bass
Production	<ul style="list-style-type: none"> <li>The dominant aquaculture species across Pakistan</li> <li>Annual production of approximately 120,000 tons</li> <li>Mainly in Sindh, Punjab, and KP provinces</li> </ul>	<ul style="list-style-type: none"> <li>Both rainbow and brown trout are farmed in Pakistan.</li> <li>Annual production of approximately 300 tons</li> <li>Primarily in the northern areas</li> </ul>	<ul style="list-style-type: none"> <li>Farming of genetically improved Tilapia currently produces around 3,000 tons annually.</li> <li>Seed for the growing tilapia market is expanding in the public and private sector, with sex reversed, all-male seed as the key market.</li> </ul>	<ul style="list-style-type: none"> <li>There is currently no commercial shrimp production. Limited experimental production currently yields 50-80 tons annually.</li> <li>Initial production costs are high and will need to come down to make shrimp a viable farm crop.</li> </ul>	<ul style="list-style-type: none"> <li>There is currently no commercial sea bass production.</li> <li>Present activity is focused on experimental growing in cages and pens.</li> </ul>
Development stage	<ul style="list-style-type: none"> <li>Production is mainly traditional semi-intensive polyculture.</li> <li>No intensive culture currently exists in Pakistan and the productivity of carp farms shows marked differences across provinces.</li> </ul>	<ul style="list-style-type: none"> <li>A small amount of intensive rearing of trout is practiced in commercial raceways in mountain areas.</li> <li>Some live fish are transported to Punjab.</li> </ul>	<ul style="list-style-type: none"> <li>Small industry, a lot of interest in all male production</li> <li>Shorter growing season in Punjab (due to temperature)</li> <li>Fry available earlier in Sindh due to longer growing season</li> </ul>	<ul style="list-style-type: none"> <li>Currently experimental only</li> <li>A joint venture between the Fisheries Development Board (FDB) and the private sector using imported seed and feed</li> </ul>	<ul style="list-style-type: none"> <li>Currently highly experimental only</li> <li>Has potential for a high-value product but it is reliant on marine fishmeal as a feed source</li> </ul>
Current issues	<ul style="list-style-type: none"> <li>30% of producers have shifted to pelleted feed systems resulting in:</li> <li>Fewer fish kills</li> <li>Slightly higher cost efficiency</li> <li>Larger-size product which is valued by local consumers</li> <li>More intensive per unit area</li> </ul>	<ul style="list-style-type: none"> <li>Current trout feed market of several hundred tons is supplied by two Punjabi suppliers.</li> </ul>	<ul style="list-style-type: none"> <li>Tilapia culture is currently undertaken alongside carp polyculture.</li> <li>The growing season in Punjab is currently quite short due to lower temperature, allowing for only a single crop.</li> <li>In Sindh, two crops are possible.</li> </ul>	<ul style="list-style-type: none"> <li>Globally 60% of disease losses in shrimp culture are caused by viral pathogens.</li> <li>Pakistan has little capacity for viral diagnostics.</li> <li>Shrimp imports for aquaculture should follow a precautionary approach given environmental and disease risks.</li> </ul>	<ul style="list-style-type: none"> <li>FDB imported seed.</li> <li>Testing in Balochistan has sea bass reaching one kilogram in one year, grown in polyculture with carp, or in sea cages or pens.</li> </ul>
Market development	<ul style="list-style-type: none"> <li>The domestic market is saturated and there is currently no export market.</li> <li>Pakistan has previously supplied the local west Asian market but this is currently constrained by conflict.</li> </ul>	<ul style="list-style-type: none"> <li>There is currently no export market due to high production costs.</li> <li>Local target markets include retailers and restaurants in Abbottabad, Islamabad, Karachi, Lahore, and Peshawar.</li> <li>The currently small domestic market could be boosted by better cold chain facilities and expanded live fish transport.</li> </ul>	<ul style="list-style-type: none"> <li>The current domestic market targets 700-750 g fish (in Punjab) and 900 g fish (in Sindh)</li> <li>The export market is currently limited due to low prices on the Asian market resulting from high Chinese production.</li> </ul>	<ul style="list-style-type: none"> <li>Growth in the Chinese population, increasing due to the developing China-Pakistan Economic Corridor, may create a ready market for new aquaculture products.</li> </ul>	

Source: Compiled by authors.

**Figure 3: Areas of Current and Potential Aquaculture in Pakistan**



Source: Compiled by authors.

half the size of Pakistan's. Yields in Pakistan are typically 2,400 to 3,000 kg per hectare per year (Khan and Chatta 2015), while yields in Bangladesh averaged 4,600 kg across all pond-based systems in 2015–16 (Ministry of Fisheries and Livestock 2017) and were substantially higher in intensive-input systems. Factors lowering productivity in Pakistan include limited inputs required

for more intensive production, and insufficient quality of broodstock (breeding fish) and fish seed (young fish used to populate fish farms).

**Despite these lower yields, aquaculture in Pakistan has enjoyed some growth in the past decade and now accounts for about 23 percent of total fish**

### Box 1: Potential of Soybean Meal as a Protein Replacement in Fish Feeds

A significant barrier to the future growth of the global aquaculture sector remains the limited supply of fishmeal and fish oil as feedstock for aquaculture. New nutrient sources from non-fish sources are being explored, and breeding programs aiming to improve fish tolerance to new ingredients are underway.

There is significant interest in soybean meal as an alternative source of protein for aquaculture feeds. The American Soybean Association recently supported a project that would increase demand for U.S. soy by speeding development of aquaculture and soy-based feed industries in Pakistan.

While it is widely accepted that soybean meal is a valuable protein source, it has limitations. It is deficient in some amino and fatty acids. While it is a good source of the Omega-3 precursor alpha-linolenic acid, it is poor in some Omega-3 long-chain polyunsaturated fatty acids, which are essential dietary nutrients for both fish and human health. A diet based predominantly on soybean meal in fish feed may also cause susceptibility to pathogens.

Despite these disadvantages, the global aquaculture and animal feed industries already utilize vast amounts of SBM successfully. The proportion of fishmeal in aquaculture feed is falling (Waite et al. 2014). In the short term, Pakistan may need to import soybean meal if it is to develop its fish feed sector without placing unacceptable pressure on fishmeal stocks that are already depleted.

**production.** Profitability of these systems is quite good, mainly because of low expenditure on inputs. Recent studies have examined private returns to fish farming in Pakistan, focusing on semi-intensive freshwater carp and tilapia operations in Punjab and brackish water carp culture in Sindh. They report cost benefit ratios at 1.17, 2.0, and 1.37-1.51 respectively (Fitzsimmons et al. 2015 and Chughtai and Mahmood 2012). In the 1990s, ADB financed a US\$15 million project that constructed demonstration fish farms and hatcheries, and improved extension, training, and data collection systems in three provinces. Upon completion of the project, the estimated value of fish production was US\$13 million annually, through more than 1,700 new small enterprises.

**Quality fish seed is a necessary input for an aquaculture industry.** As in other South Asian countries, feed is supplied by a mix of private and government hatcheries. In Punjab, the private sector operates 74 hatcheries while the public sector runs 14 hatcheries and nurseries. The Sindh Fisheries Centre has a hatchery complex for carp species, producing 10-20 million seed annually. Some government hatcheries supply seed both to stock in reservoirs and use in fish farms. Seed of carps is not currently a constraint on the sector's development.

**Complete feeds are one of the largest recurring costs to fish farmers in those systems that use them.**<sup>6</sup> Complete feeds (those that provide for fishes' full dietary needs) are used in the upland, cool-water trout industry in Pakistan, and are either locally pro-

duced or, more recently, sourced from Punjab feed suppliers. Indian major carps, which still dominate Pakistani aquaculture, have traditionally been reared semi-intensively in fertilized ponds with only supplementary feeds. With fish stocks declining, and fishmeal an expensive ingredient, interest is high in fishmeal alternatives for aquaculture feeds. One that has been tried in Pakistan is soybean meal (Box 1).

**A Fisheries Development Board (FDB) was recently established to trial new aquaculture approaches in Pakistan.** The board works in partnership with the private sector to support the development and expansion of aquaculture by determining locally-appropriate and cost-effective production methods. The current priorities are tilapia, shrimp, and sea bass farming. A shrimp demonstration farm was recently established as a FDB joint venture with the private sector, with experimental output of 50-70 tons per year. The board is also working to increase domestic private-sector production of fish seed (tilapia) and fish feeds (tilapia, carp, and trout). Box 2 provides more information on aquaculture development activities.

## 2.5. Status of Post-Harvest Processing

**While much of the inland capture fisheries' production is consumed locally at source, marine landings and most aquaculture production are sold via market channels.** In general, post-harvest

<sup>6</sup> Cultured fish require protein, lipids, energy, vitamins and minerals for growth. Nutrients for cultured fish may come from plankton, bacteria, insects and other fish from within the aquaculture ecosystem and/or from organic matter and processed feeds added to the ecosystem. For some species raised in semi-intensive pond systems, grains and food industry by-products serve as supplemental feeds (feeds that are rich in protein but nutritionally incomplete). Nutritionally complete feeds are required where natural foods sources are absent or only a minor source of nutrition, such as in intensive cages or tank systems.

## Box 2: Aquaculture Development Activities

In 2007, the Federal Government issued the National Policy and Strategy for Fisheries and Aquaculture Development. The document proposed Federal, and Provincial and Territorial roles in the development and implementation of aquaculture policy. Some of these have already begun. For example, a Fisheries Development Commissioner (FDC) position has been established, along with a Fisheries Development Board (FDB). Other actions taken to date include:

The introduction and development of tilapia farming using local hatcheries

- Research into farming of giant tiger prawns and white leg shrimp
- Research into Asian sea bass farming using trash fish in pens and cages
- At the Provincial level, the following actions have occurred:
  - Sindh Province developed a Fisheries and Aquaculture Strategy for 2010-13.
  - Khyber Pakhtunkhwa Province is working to establish a carp hatchery in Swabi district to stock the reservoirs of the Tarbela and Khanpur Dams.
  - Balochistan Province developed a strategy to promote shrimp farming in 2006, and has since focused on promoting carp farming in four of its most-irrigated districts.
  - Punjab Province created a five-year development framework for fisheries, which included research, training, and establishment of an aquaculture export processing zone and hatcheries for tilapia and shrimp.

processing in Pakistan is outdated and under-capitalized, which contributes to the relatively low value addition of the sector. As a highly perishable commodity, fish often needs rapid processing. The most valuable products are fresh, destined for direct human consumption (a share of 53 percent of global production), followed by frozen fish (26 percent), canned fish (11 percent), and cured fish (10 percent). Different levels of processing create different value multipliers (Table 5), with significant implications for the potential growth in fishery exports.

**The current underdeveloped state of processing helps bar the Pakistan fishery sector from many lucrative export markets.** At present, just two processing establishments have been approved for export to the EU. The Marine Fisheries Department has proposed five additional plants for listing, but the EU has declined to add them pending an inspection mission. Overall, lack of access to foreign markets is causing a significant loss of value for Pakistan (discussed further in section 4.5).

**The coast of Pakistan has four main harbors and nine primary landing sites.** The largest is Karachi fish harbor, which is severely overcrowded. By contrast, the other main harbors are underutilized due to a shortage of improved facilities and supporting infrastructure (Box 3). Infrastructure inadequacies at landing points further undermine product quality.

**The fish-processing sector of Pakistan is highly concentrated in Karachi.** Out of 183 registered ex-

**Table 5: Fishery Export Product Categories Scaled According to Their Value Addition Potentials**

Product category	Relative value addition
Live/assorted ready to eat	10
Fresh	8
Processed (simple ready to eat)	8
Processed (ready to cook)	7
Frozen (IQF)	5
Frozen (blast)	4
Dried/salted	3
Fishmeal	1

Source: SMEDA 2008.

porters and importers, 175 are registered in Karachi. About 104 are traders only, two are fishmeal operators, and 77 have a processing or packing facility (Sea-Ex 2017). Outside of Karachi, a number of processors have invested in establishments in Korangi, in anticipation of an increase in supplies of raw material landed at this location. Along the Balochistan coastal zone there are 29 establishments with freezing and cold storage, most of them aimed at small pelagic fish such as Indian mackerel for export. This coastal zone also has 30 ice plants.

**A major constraint in processing and marketing, including for export, is a shortage of landed catch.**

Operators report a capacity utilization of only 30-35 percent. Freezing plants in Balochistan are reported to

### Box 3: Fishing Harbor Infrastructure in Pakistan

There are two major harbors in Sindh Province—Karachi and Korangi—and two in Balochistan—Gwadar and Pasni.

The country's largest port, Karachi is used by 80-90 percent of the industrial fishing fleet, mostly shrimp trawlers and larger gillnetters. Overcrowding is a problem: the number of fishing boats operating here has increased from only 400 in 1966 to more than 13,000 in 2010. Facilities at the harbor include:

- 10 floating piers
- A slipway for maintenance and repair of large vessels
- Three 6,000-square meter fish auction halls with cold stores
- 25 processing factories of approximately 50,000 square meters
- A flake ice plant with capacity of 40 tons per day
- Crate-washing facilities

These facilities fall short of demand, and some are in poor condition. The resulting overcrowding increases unloading times. Overall, the loss of fish due to bad handling is estimated at 18 percent by weight.

Korangi fishing harbor was commissioned in 1996 and financed by the Asia Development Bank. It is now operated by the Korangi Fishing Harbor Authority. Designed for medium-sized vessels, the harbor is meant to lessen congestion at Karachi by taking on boats that are beyond that harbor's capacity. Due to weak supporting infrastructure, the Korangi harbor remains under-utilized and has not fulfilled its potential. However, since 2009, the harbor's operating income has increased and the authority is now reporting profits. Facilities include:

- Seven fish processing factories
- Two ice factories
- Four yards building fiberglass-reinforced plastic boats
- Mechanical workshops
- Two separate electric power supplies free from load-shedding
- Adequate water supply

Gwadar and Pasni fishing harbors, which were established by the Balochistan Coastal Development Authority, suffer from silting and require investment. The Pasni harbor is leased to private-sector operators who reportedly lack the resources to develop it further. Gwadar harbor is scheduled for redevelopment as a large commercial shipping port, with fishing vessels to move to new ports to be located at either Pishukan or Surbandar, some 46 and 30 km respectively from Gwadar.

have ceased operation due to the collapse of the Indian mackerel catch. This results in higher costs and undermines marketing due to low continuity of supply. Operators report no problems finding markets, even though entry to higher-value markets such as the EU and United States are constrained by Sanitary and Phytosanitary (SPS) measures<sup>7</sup> (discussed further in Section 0). Markets in the Persian Gulf countries and China continue to show high demand. Given the right conditions, and selection of the right species for culture, there is significant potential for the emerging aquaculture sector to provide a sustainable source of fish to the processing sector.

**Cold chain infrastructure is not a major constraint in the coastal regions—but sanitation conditions**

**could be better.** Ice for preserving fish is commonly available and affordable, but, there are reportedly poor sanitary conditions on board some vessels, as well as at landing sites. This could be corrected by improving facilities and skills training. For example, the Government of Balochistan through the UNIDO Trade Related Technical Assistance Program (TRTA II), successfully upgraded food safety conditions and quality of fish in participating fishing communities (Box 4).

**A large proportion of Pakistan's fish goes to relatively low-value fishmeal production (Box 5).** Almost 60 percent of Pakistan's marine capture production is considered "trash fish" and is used for fishmeal (Fanning et al. 2016), which has the lowest value of any processed fish product (Box 5). A number of companies

<sup>7</sup> SPS measures include tolerance limits for harmful residues, labelling requirements for food safety, and hygiene and quarantine requirements.

### Box 4: Improving Food Safety Conditions

In 2014 and 2015, the Government of Balochistan, with the support of the EU and the UNIDO Trade Related Technical Assistance (TRTA II) Program, trained 26 fisheries officers to be master trainers in fish quality control. The Government supplied 54,000 plastic crates, 12,000 ice boxes, 36,000 baskets, and other equipment to the fishery sector. It trained 2,000 fishers at the community level on good fish handling principals, food safety, post-harvest loss, and quality control (TRTA II 2016).

The project achieved an increase in the ex-vessel price from US\$0.25 to US\$2.0 per kg for some of the higher value species such as cuttlefish, because the product could now reach foreign markets via exporters in Karachi. This provided additional revenues for investment in the sector.

export fishmeal to China (Akhtar and Scheik 2014). Domestically, fishmeal is consumed by the poultry industry. However, development of the aquaculture industry and the introduction of fish feed into its production system will further expand the domestic market, potentially increasing pressure on the resource further (see Section 4.7).

**In line with the depleted resource base, production of fishmeal appears to be in decline, falling from 100,000 tons in fiscal year 2013-14 (60 percent from the industrial fishmeal subsector) to 40,000 tons in fiscal year 2015-16 (85 percent from the industrial subsector).** This is due to declining “trash fish” catches. The smaller-scale sun-dried producers in particular are finding it increasingly difficult to obtain consistent supplies of raw material.

## 2.6. Status of Markets and Trade

**Given low per capita consumption of fish at home, exports are an important component of Pakistan’s fisheries sector.** During the fiscal year 2015-16, Pakistan exported approximately 140,000 tons of fish products, worth more than US\$350 million. Export value has trended up over the past decade, in line with rising global fish prices, although earnings have plateaued in recent years (Figure 4). The most important export product categories are frozen fish (excluding fish fillets), which account for 58 percent of export value. Shrimp make up a further 23 percent. Fresh fish, fish fillets, salted fish, and fishmeal account for most of the balance, each within the range of 3-5 percent. Exports may increase in the next few years due to the establishment of a new land trading route from Gwadar to Guangdong, China. Imports are a relatively small but growing component of the Pakistan fisheries sector.

**SPS conditions and technical barriers to trade (TBT) have hurt Pakistan’s export opportunities in the past.** In 2007, the EU banned import of various Pakistani fisheries products for failure to meet the EU’s SPS conditions for trade. This led Pakistan to develop new markets, particularly in East Asia and Africa. Globally, the European Union, the United States, and Japan are the largest import markets for fish but also some of the stricter markets in terms of SPS controls. Their dependence on developing country imports is projected to increase in the future.

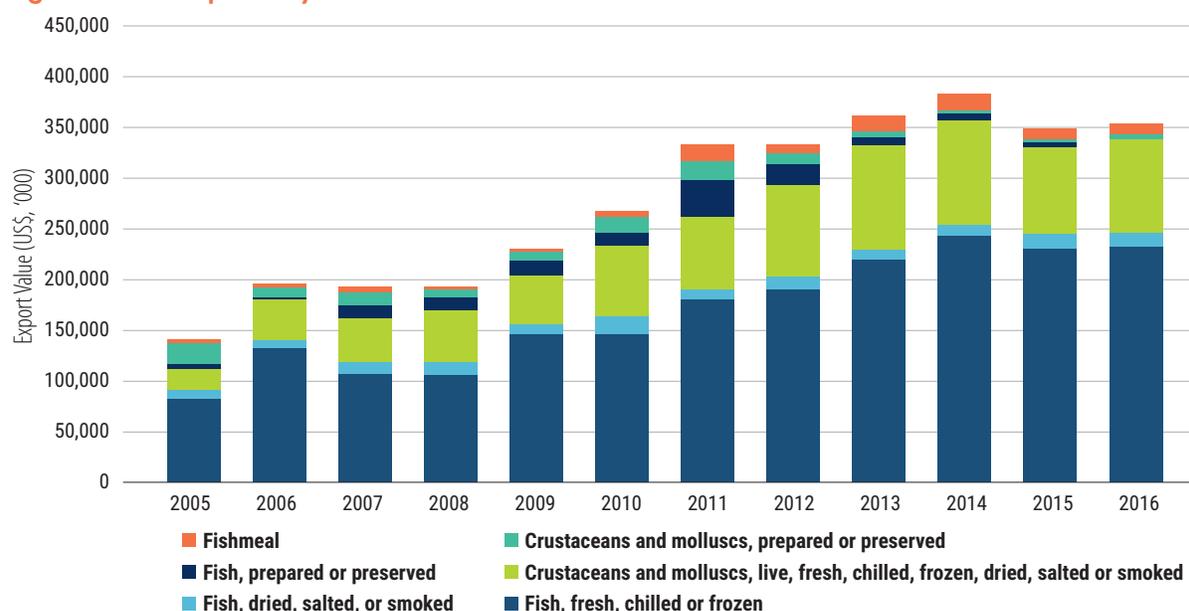
**Pakistan’s domestic market for fish and fishery products is small, relative to the size of the population.** Average per capita fish consumption is about 2 kg

### Box 5: Fishmeal Production and Impact on Fishing Sector Value Addition

In recent years, the catching of “trash fish” for fishmeal production in Pakistan has become a targeted fishery in and of itself. The fishmeal industry has three sources of fish (Van der Pijl et al. 2012):

1. Species of low value and small size for which fishmeal reduction is a reasonable use (for example, catches of some small pelagic species)
2. Spoilage of otherwise marketable catches due to factors such as poor handling and excessive trip length
3. Undersized and immature individuals of potentially valuable species caught in demersal and shrimp trawls

While some of the species within the trash catch have little alternative economic value (categories 1 and 2 above), a large fraction (category 3) is made up of juveniles of high-valued species. Some of these species are severely depleted. Even without directed fishing on these species groups, the trash fishery continues to deplete stocks and prevent rebuilding of the higher-value adult stocks. On this basis, a key conclusion of the FRAPP is that “alternative sources for fishmeal stock in mesopelagics, responsible harvest of small pelagics, and the unavoidable minimum of by-catch from other fisheries should be used” (Fanning et al. 2016).

**Figure 4: Fish Exports by Value from Pakistan**

Source: FAO 2016b.

per year (Table 6), only a tenth of the global average of 20 kg per capita in 2014 (FAO 2016a) and the lowest of any ocean-facing nation.

**Most domestic fish consumption takes place in the coastal zones, and it is probable that a significant proportion of the population never eats fish at all.** The highest fish consumption is in the two coastal provinces of Balochistan (2.4 kg per capita per year) and Sindh (1.6 kg), but levels drop to 0.2 kg in Punjab and just 0.05 kg in Khyber Pakhtunkhwa. There is no clear divide between rural and urban areas. The low rate of domestic fish consumption contributes to the poor nutritional status of a large segment of the population, which could potentially be improved if fish consumption increased. However, addressing this issue by extending fish consumption to people who never eat fish presents a different marketing challenge than increasing the frequency of consumption of those who do. In both groups, cultural barriers may exist.

**By contrast, the international market has provided Pakistan with export opportunities over the past two decades.** Pakistani fish products are exported to over 50 countries, including Vietnam, UAE, Thailand, Sri Lanka, Japan, China, Malaysia, South Korea, Egypt, and Saudi Arabia (Table 7). However, these opportunities have been limited by SPS and Technical Barriers to Trade.

**High demand for Pakistani exports in Southeast Asian markets ensures a reasonable price with-**

**Table 6: Supply Balance and Estimated Per Capita Fish Consumption**

Category	Volume (tons)	Units
Production (marine)	359,534	tons
Production (freshwater)	132,456	
Imports	7,089	
Exports	140,474	
Exports of fishmeal <sup>1</sup>	148,148	
Apparent consumption	352,331	
Pakistan population (2016)	193,200,000	
Per capita consumption	1.9	Kilograms per capita

<sup>1</sup> Estimate based on 40,000 tons of exports and a yield of 22 percent meal and 5 percent oil.

Source: pers. comm. MFD 2017 and ITC Trade Map 2017.

**out the specific requirements for complying with onerous SPS measures.** The Southeast Asian market prefers whole fish, which requires less processing and allows for larger volumes. This product may also undergo secondary processing in the importing country. These markets represent attractive alternatives to the EU, although the price obtained may not be as high. Pakistan recently entered negotiations with Hong Kong to export tuna.

**Pakistan's imports of fish have risen by a factor of three since 2012, from US\$5.4 million to US\$17.7 million, which is quite low relative to exports.** The current volume is about 7,000 tons, and almost all (92

**Table 7: Top 20 Export Markets for Pakistan Fishery Products**

	Exported value (US\$ thousands)				
	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Vietnam	76,196	86,517	87,841	82,411	92,520
Thailand	30,456	40,559	53,083	56,280	53,698
China	41,637	35,778	55,210	46,168	47,993
United Arab Emirates	28,745	50,805	46,614	35,756	41,475
South Korea	17,420	16,844	18,784	21,197	19,558
Kuwait	8,762	13,078	10,027	11,675	12,915
Malaysia	18,253	15,986	16,754	12,164	12,102
Saudi Arabia	22,704	18,924	9,267	8,387	10,814
Egypt	13,240	13,705	15,398	9,883	7,627
Indonesia	6,457	6,509	7,105	6,174	5,322
Sri Lanka	3,882	4,742	3,784	5,064	4,433
Qatar	1,654	2,584	2,083	2,705	3,408
Japan	2,414	5,594	5,073	8,154	2,871
Taiwan	1,635	3,829	3,571	2,605	2,713
Hong Kong, China	8,167	5,509	3,731	3,603	2,501
United Kingdom	3	277	2,331	2,600	2,472
Bahrain	2,515	1,058	2,712	2,656	2,293
United States	1,374	1,227	916	1,128	1,562
Singapore	665	1,180	1,105	927	1,160
Bangladesh	1,266	2,155	1,046	1,977	1,079
World	292,205	333,130	355,625	328,733	336,380

Source: ITC Trade Map 2017.

percent by value) is frozen farmed Pangasius fillets from Vietnam. This is used extensively in catering markets and is also sold in urban supermarkets. While the trade balance in fishery products is strongly positive (by a factor of about 20), imports have a higher unit value than exports: imports have an average price of US\$3.20 per kg compared to US\$2.62 for exports. The rapid growth in imports illustrates that there is an unfulfilled demand for low-cost fish fillets in Pakistan.

**The Federal Government is responsible for food safety where international trade and inter-provincial trade are involved.** Three separate federal authorities oversee safety of imported and exported fishery products. Safety of exported fishery products is controlled by certification at the point of export by MFD,

with authority granted by the Pakistan Fish Inspection and Quality Control Act 1997. The safety of imported, unprocessed fishery products is controlled by certification at the point of import by the Animal Quarantine Department (AQD) of the Ministry of National Food Security and Research. Imports of processed fishery products, such as canned goods, are controlled by the Pakistan Standards and Quality Control Authority.

**Provincial and Territorial governments are responsible for intra-provincial trade, and are at different stages of establishing food safety authorities.** The Punjab Food Authority has been operating since 2013 (under the Punjab Food Authority Act 2011 and the Pure Food Rules 2011). There is some overlap in functions with the Provincial Fisheries Department, which also have

control systems and the power to take samples, register, and certify fishery products. A new laboratory has been established at the Manawan Fisheries Research and Training Centre with the capacity for microbiological and chemical analysis.

## 2.7. Status of the Fisheries Governance Framework

**Pakistan's fisheries governance structure has changed substantially over the last decade.** For many years it was led by a Federal Ministry of Food, Agriculture and Livestock (MINFAL). In 2008, fisheries were transferred to the newly established Ministry of Livestock and Dairy Development. Following amendment to Pakistan's Constitution in 2010,<sup>8</sup> the development and management of food, agriculture, livestock, and fisheries were largely shifted to Provincial governments, although Federal bodies retained some responsibilities.

**Pakistan currently has no specific strategy or policy for capture fisheries or aquaculture.** In 2007, a National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan was developed for the then MINFAL with the support of FAO. This comprehensive document underwent considerable stakeholder review, and, while MINFAL signed off on it, it was never formally adopted due to a Federal political transition. At the Provincial level, Sindh developed its own fisheries plan, the Sindh Fisheries and Aquaculture Strategy 2010-2013 (Ministry of Finance 2009).

**The provinces have roughly similar distributions of responsibilities among their departments and other institutions (Figure 5), including:**

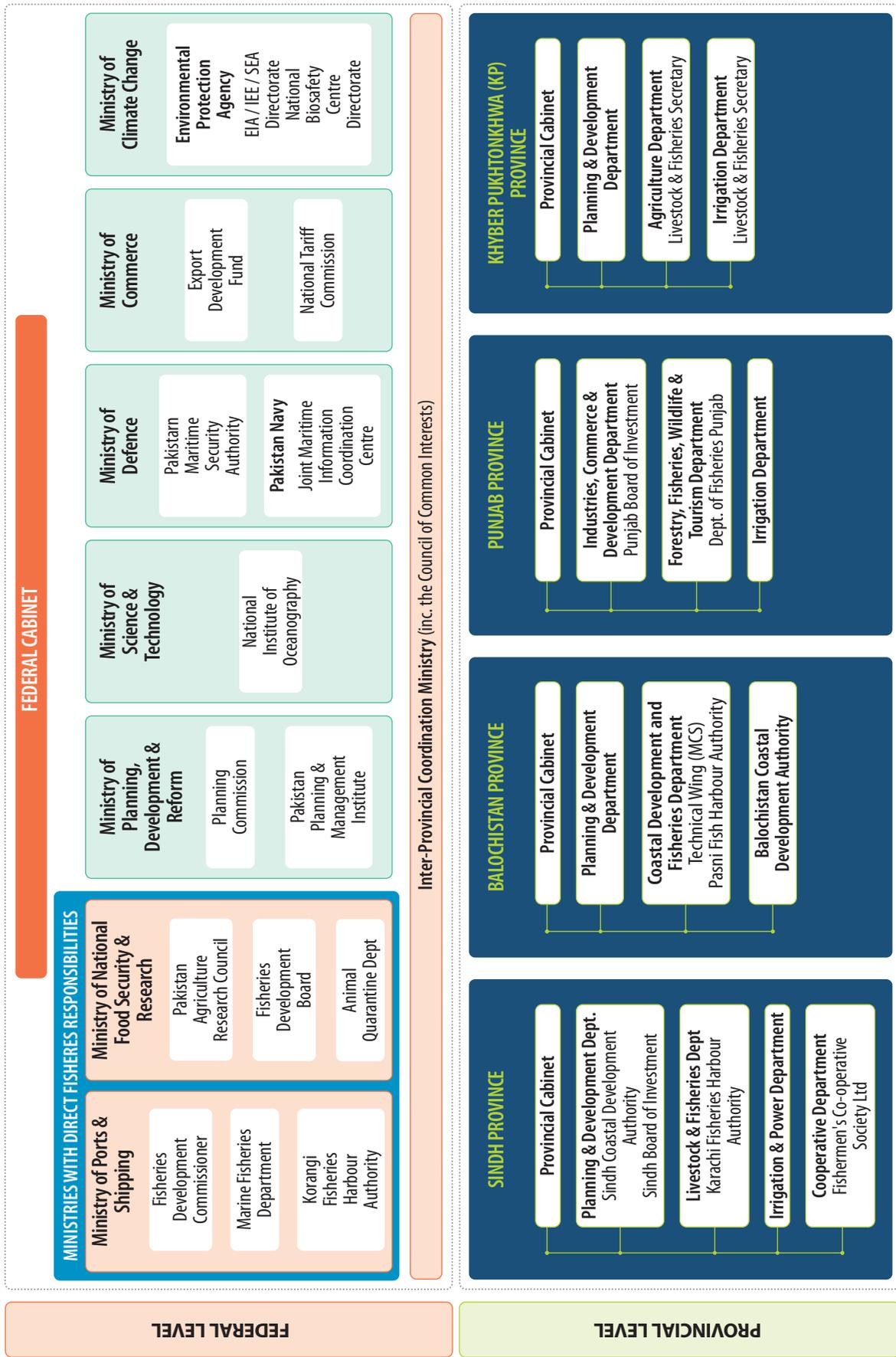
1. **Departments of Fisheries (DoF)** are responsible for licensing coastal fishing vessels and regulating fisheries under their jurisdiction (less than 12 nautical miles from the coast). They are also the permitting authority for aquaculture development and for leasing out government land or water bodies to private investors or communities. They own and operate fisheries training facilities. The Balochistan DoF also has the remit for monitoring, control, and surveillance (MCS) in the Province's marine waters, unlike Sindh where this function is mandated to the Pakistan Maritime Security Agency (PMSA).
2. **Fishing Harbor Authorities** operate the major fishing harbors of Karachi (Sindh) and Pasni (Balochistan) under the DoFs, while Korangi Harbor in Sindh is part of the Federal Ministry of Ports and Shipping. All of these ports are run on a corporate basis, with a board of directors and a managing director.
3. **Coastal Development Authorities** coordinate development in the coastal zone (from the coast to 30 km inland) in Sindh and Balochistan, including projects related to fisheries and aquaculture.
4. **Irrigation Departments** are responsible for supplying water to irrigation areas, and thus have an influence on inland aquaculture and fisheries development in Punjab and Sindh.
5. **Departments of Planning and Investment** scrutinize the development plans of sectoral departments, such as fisheries, at the provincial level. They have strong links with provincial boards of investment.

**Core functions are distributed throughout these institutions and their Federal counterparts.** These include:

6. **Fisheries Control**—This includes monitoring and, where deemed necessary, limiting fishing capacity, imposing technical standards on fishing techniques and gear, and controlling operations at sea, such as movements in and out of harbors. In Sindh, vessel registration is a Provincial matter for vessels under 30 tons and a Federal matter for larger vessels. In Balochistan, this is a Federal matter, but a lack of monitoring capacity on the ground means that it is undertaken by the Balochistan DoF. Fishing licenses in the EEZ beyond 20 nautical miles (Zone III) are issued by the Federal Government, and by the Provincial Governments in coastal waters (Zone I) and the buffer zone (Zone II) (Figure 6).
7. **Fisheries Research**—MFD has the recognized mandate for fisheries research, with the Karachi-based National Institute of Oceanography (NIO) working on wider marine biology, oceanography, and geology issues. A lack of national level marine research planning results in potential overlaps between the two organizations, and thus competition for funding. However, the two institutions work

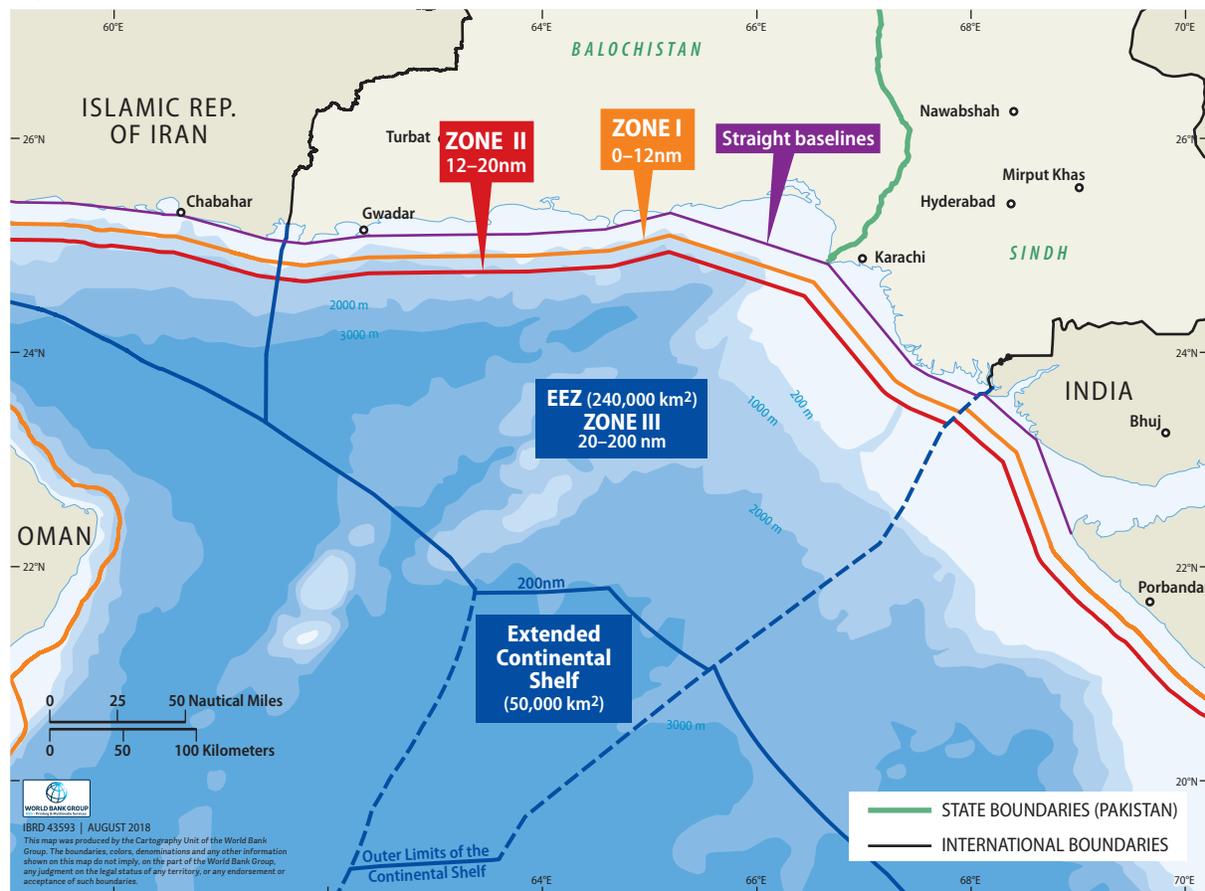
<sup>8</sup> The Eighteenth Amendment introduced changes to about 36 percent of the 1973 Constitution of Pakistan. The structure of the state shifted from heavily centralized to a more decentralized federation. The legislative and executive authorities of the governments were delimited by assigning the exclusivity of 53 subjects to the Federal government, 18 subjects to the Council of Common Interests (CCI), and all residual subjects to the Provincial Governments. The CCI is a permanent body to address inter-governmental disputes on issues of recurring contest between Provinces and the Federal Government.

Figure 5: Institutional Map of Fisheries-Related Governance in Pakistan



Source: Compiled by authors.

**Figure 6: The Three Marine Fisheries Zones of Pakistan**



Source: Compiled by authors.

together on some fisheries research. Pakistan does not own any fisheries research vessels, and therefore must depend upon foreign vessels, which are not always available.

**8. Statistics and Data Collection**—At the Federal level, the Pakistan Bureau of Statistics (PBS), under the Ministry of Economic Affairs and Statistics, is responsible for setting a national framework for statistics, including for the fisheries sector. At the Provincial level, each government has its own Bureau of Statistics. The responsibility for collecting fisheries statistics (for example, landings by location and species) lies with the fisheries department, which provides Provincial authorities with data, while MFD works with PBS to provide marine capture fisheries landings and exports. The Provinces also supply MFD with fisheries-related data (catches, employment, processing, commodities, exports, and prices).<sup>9</sup>

**9. Maritime Surveillance**—The limit of territorial waters is twelve nautical miles beyond land. The internal waters of Pakistan are measured from the baseline.<sup>10</sup> Fisheries outside of territorial waters are managed by the MFD, although responsibility for MCS is provided by the Pakistan Maritime Security Agency (PMSA). MCS functions within the territorial waters are more variable, with Sindh Province mandating the PMSA to undertake this function in coastal waters, while Balochistan—which does not allow trawling—has a Technical Wing in its Coastal Development and Fisheries Department (CDFD) that is responsible for MCS activities in territorial waters. Of the two provinces, Sindh faces the most challenges, with a convoluted coastline (especially the Indus Delta area to the southeast of Karachi) and a large, motorized bottom trawl fleet that operates throughout Pakistan's marine and coastal waters. The PMSA is better suited for monitoring and control in open waters.

<sup>9</sup> This is compiled into the 'Handbook of Fisheries Statistics of Pakistan' (MFD, 2012), however, the last year this document was produced was in 2012, with data up to 2009.

<sup>10</sup> Territorial Waters and Maritime Zones Act (see United Nations, 1976).



Wooden fishing boats under construction near Karachi (Naim Beg, Shutterstock)

**At present, there is no formal Fisheries Monitoring Centre at either the Federal or Provincial levels, nor are vessels fitted with satellite-based Vessel Monitoring Systems (VMS).**<sup>11</sup> That said, the Balochistan government recently directed that vessels greater than 15 meters in length must carry and operate VMS equipment, with data provided every four hours to the CDFD (Government of Balochistan 2016). It is likely the Sindh Government will follow suit, and it appears that the private sector is also encouraging the uptake of VMS monitoring.

**While there is no officially adopted national fisheries policy or strategy, other policies partially define the Federal Government’s vision for the sector.** The current supreme policy document in Pakistan is Pakistan 2025: One Nation, One Vision<sup>12</sup> (Planning Commission 2014). This affirms the Sustainable Development Goals (SDGs) and has pillars covering elements such as institutional reform, food security, the

private sector, and entrepreneurship-led growth and value addition. An important part of Pakistan Vision 2025 is a structural transformation towards production of high value-added products. The Ministry of National Food Security and Research, under which the Fisheries Development Board (FDB) operates, recently released a draft National Food Security Policy (MNFSR 2017) in which fisheries and aquaculture are considered “high value activities.”

**The Deep-Sea Fishing Policy, which guides access to the 20-200 nautical mile zone (Zone III) of the EEZ, was first developed in 1995, last updated in 2009, and is currently under revision (Ministry of Ports and Shipping 2016).** The policy intends to ban all bottom trawling and purse seining<sup>13</sup> in this zone, limiting the number of other gear-equipped vessels, and requiring use of VMS and Pakistani-only crews. A limited number of foreign joint ventures will be permitted for tuna, squid, and mesopelagic fishing, but

11 VMS is a general term describing satellite-based monitoring systems used in commercial fishing to allow regulatory organizations to keep track of vessel activities. VMS can monitor a vessel’s position, time at a position, course, and speed of commercial fishing, regularly transmitting data to fisheries authorities. VMS is a key part of MCS programs at national and international levels and helps improve maritime safety.

12 This document lays out a plan to build a connected society, with entrepreneurship-led growth, a modern public sector, and a knowledge economy, achieved by developing social and human capital and by empowering women. It sets out a path for Pakistan to be an energy-, water-, and food-secure nation that is taking steps towards meeting the SDGs. All policies, including aquaculture, must dovetail with this national strategic vision.

13 A purse seine is a large net that two boats set around a school of fish. After the ends have come together, the bottom is closed, capturing the school.

### Box 6: Multilateral Environmental Agreements Relating to the Marine Environment to Which Pakistan Is a Party

- Convention on the International Maritime Organization, 1948
- Agreement for the Establishment of the Indo-Pacific Fisheries Commission, 1948
- International Convention on Civil Liability for Oil Pollution Damage, 1969
- International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969; (INTERVENTION Convention 69)
- The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, 1971
- Convention on The Prevention of Marine Pollution By Dumping Of Wastes And Other Matter, 1972
- Convention concerning the Protection of the World Cultural and Natural Heritage, 1972
- Convention of International Trade in Endangered Species, 1972
- Protocol to the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1973 (INTERVENTION Protocol 73)
- International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 (MARPOL 73/78) including Annexes I-V
- Convention on the Conservation of Migratory Species of Wild Animals, 1979
- Articles of Association of the South Asia Cooperative Environment Program, 1981
- United Nations Convention on the Law of the Sea, 1982
- Protocol to Amend the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1982
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989
- Convention on Biological Diversity, 1992
- United Nations Framework Convention on Climate Change, 1992
- Protocol of 1992 to the International Convention for the Establishment of an International Fund for the Compensation of Oil Pollution, 1971
- Protocol of 1992 to Amend the International Convention on Civil Liability for Oil Pollution Damage, 1969 (CLC '92)
- Agreement for the Establishment of the Indian Ocean Tuna Commission, 1993
- Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, 2010

their vessels must have a minimum of 25 percent Pakistani crew.

**Pakistan is a signatory to international conventions covering basic UN agreements, regional fisheries management agreements, and several of the International Maritime Organization's conventions on marine pollution, safety at sea, and worker conditions (Box 6).** However, there are noticeable gaps.

Pakistan is not a signatory of the 1993 FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, and has not yet signed the Agreement on Port State Measures to Prevent, Deter, and Eliminate IUU Fishing (FAO 2001). In addition, it has yet to prepare and formalize National Plans of Action for subjects such as capacity limitation, illegal, unreported and unregulated (IUU) fishing, and conservation.





**CHAPTER 3**

# Opportunities for the fisheries sector

### 3.1. Overview

The Economic Survey of Pakistan 2015-16 provides a national vision for fisheries development: to “promote fisheries to ensure food security through availability of quality products at competitive prices” (Ministry of Finance 2016). The sector has much to offer in terms of boosting export revenues, creating decent jobs, supporting livelihoods in coastal communities, improving domestic nutrition and food security, and closing Pakistan’s significant economic gender inequality. Governments of Pakistan recognizes these opportunities, and have signaled their desire to increase the contribution of the fishery sector towards these goals.

**The sector has potential to be a much stronger engine of economic growth and social development.**

The marine capture fishery has suffered a decrease in production and per-unit value due to overfishing over the past two decades (Fanning et al. 2016). A program to reduce the current levels of overfishing could help reverse these trends, maintain current production quantities, and increase the value of that production. The aquaculture industry is for now growing only slowly. Improvements to biosecurity and food safety systems could help Pakistan gain access to international markets, and reduce risks that hold back private investment.

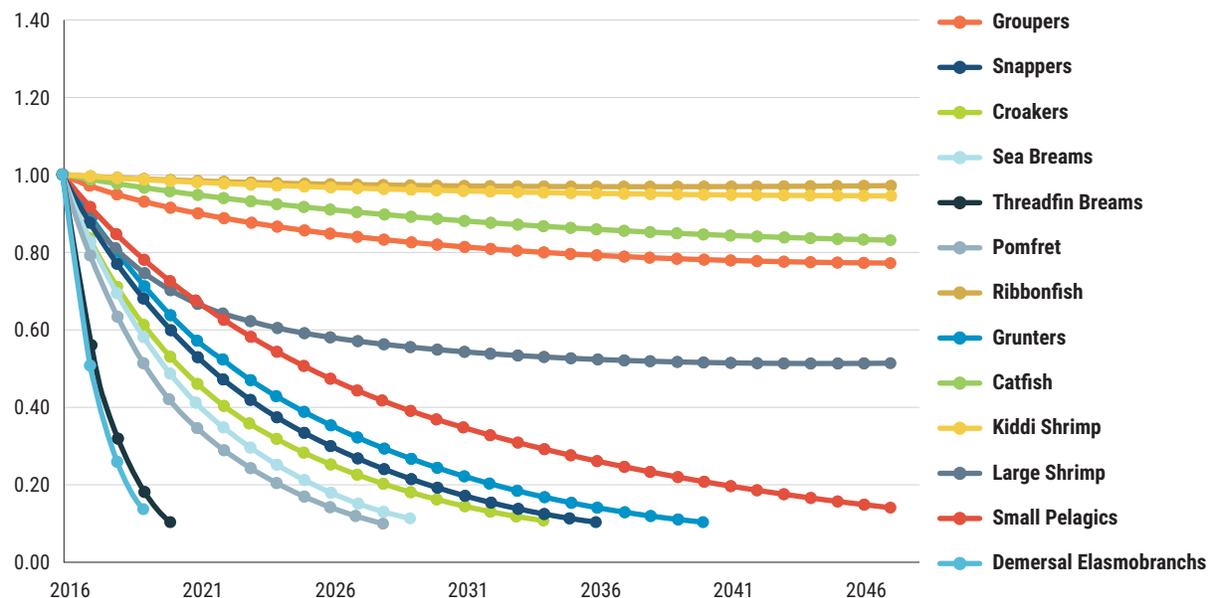
Fisheries could generate greater net benefits—this is widely accepted.<sup>14</sup>

**Pakistan would do well to make fisheries more sustainable and more attractive to investors, and to add value in both commercial and social terms.** The priority areas, explored throughout this section, are (1) ensuring sustainable conservation of marine resources, (2) further developing aquaculture, (3) enhancing fish processing and exports, and (4) improving food security and nutrition.

### 3.2. Opportunities from Sustainable Conservation of Marine Resources

**Improved management of marine resources could help prevent large declines in production.** If current levels of fishing effort continue, all major commercial species groups<sup>15</sup> are likely to decline substantially in total stock size (biomass) due to overfishing. Under status quo conditions, total marine fisheries biomass would stabilize at a long-term 40 percent of 2015 biomass levels. Within each species group, the remaining biomass would be concentrated in smaller, less valuable individuals, a trend evident already. A detailed description of

**Figure 7: Projected Biomass for Commercial Species Groups Relative to Current Size Under Status Quo (Constant 2014) Effort Levels, Using Median Stock Parameter Estimates**

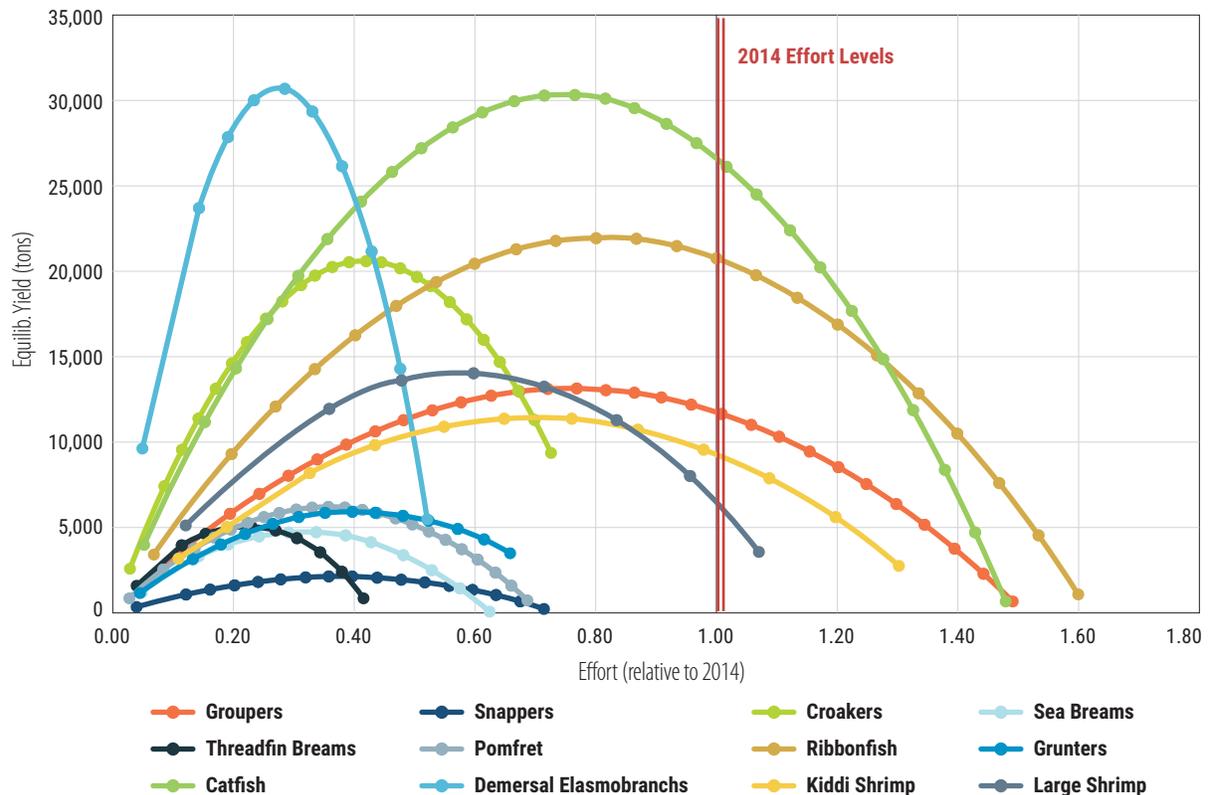


Source: Authors’ analysis (see Annex 1 for modelling approach).

<sup>14</sup> See for example: “Fisheries get attention; seafood exports rebound,” Dawn, February 2017, available online at <https://www.dawn.com/news/1317239>

<sup>15</sup> Analysis is based on a bioeconomic model (Schaefer-Gordon surplus production model) using parameters estimated by the FRAPP (Fanning et al. 2016), which assessed 13 of the most important commercial species groups, representing approximately 70 percent of total reported landings by volume.

**Figure 8: Fishing Yields, Concordant with Stable Stock Levels under Different Levels of Long-Term Effort**



Note: Effort is standardized relative to 2014 for each species group to allow for comparison between groups, which receive different levels of fishing effort due to gear choices and targeting.

Source: Authors' analysis (see Annex 1 for modelling approach).

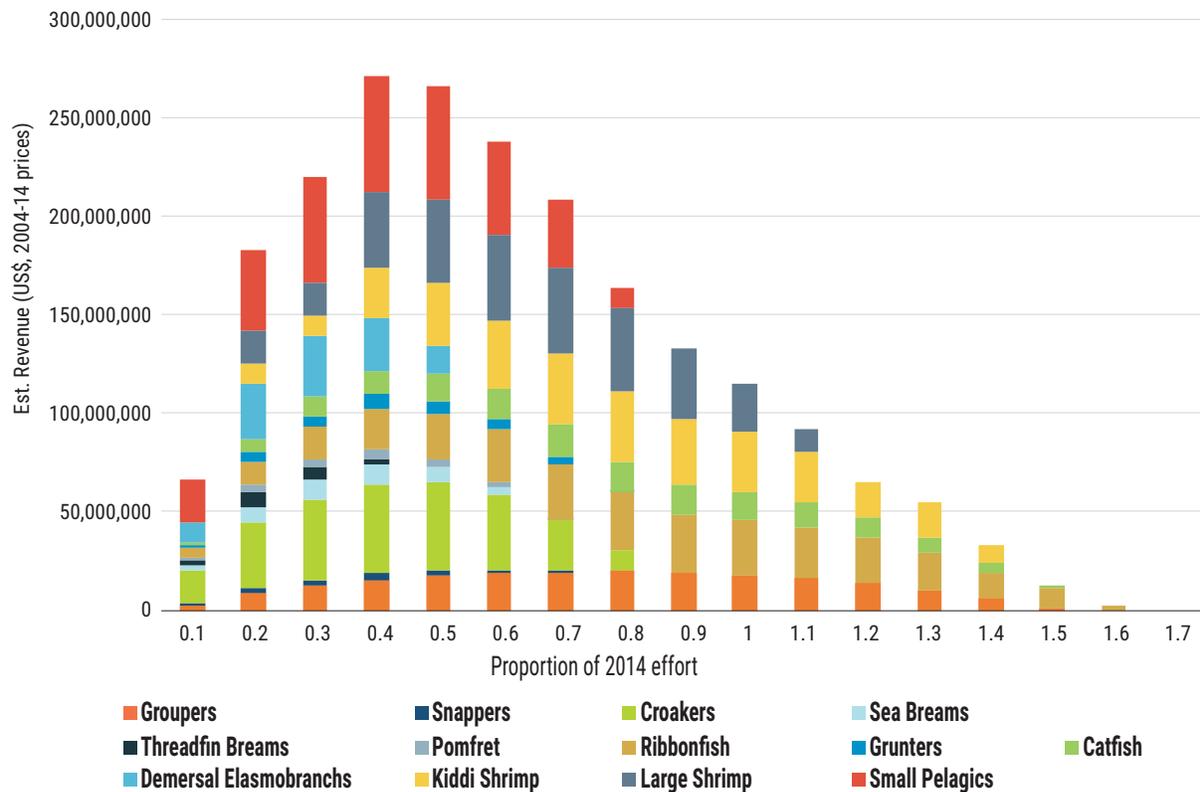
the modelling approach used for these projections and others in this chapter is provided in Annex 1.

**Improved management can take many forms, but a reduction in fishing overcapacity—the prevention of further overfishing—is key.** Capacity can be expressed as the effort<sup>16</sup> expended by all participants in a fishery, and is a function of the number of vessels, the type of gear used, the permitted fishing season length, and other factors. Effort can be controlled in various ways, including vessel licensing and buyback, season restrictions, and gear restrictions. The analysis presented here does not make recommendations concerning types of effort management—fishing managers can choose the means that are most locally appropriate. While there is some variation in projections, estimated annual harvests are found to be much higher under reduced effort levels, relative to status quo effort levels.

**Although each species group is slightly different, maximum sustainable yields (MSY) are achieved at approximately 40-60 percent of current effort.**

Figure 8 shows long-term sustainable yields that are projected under differing effort relative to 2014 effort. Very low effort naturally leads to low harvests, yet very high effort also leads to low harvest, by reducing the stock below its most productive size. The intermediate, optimum point varies by species. Ribbonfish and groupers show relatively flat responses with a maximum yield of about 70 percent of current fishing effort, while the more heavily depleted groups such as snapper, sea brems, and demersal elasmobranchs show much sharper responses but at significantly lower rates of fishing effort. Any species with a maximum that is lower than the current effort point can be expected to produce greater yields, in the long-term, from reduced fishing.

<sup>16</sup> Frequently some surrogate is used to measure effort relating to a given combination of inputs into fishing activity, such as the number of days spent fishing, the number of hooks used, and the size of boat capacity.

**Figure 9: Projected Annual Revenue under Different Levels of Long-Term Equilibrium Effort**

Source: Authors' analysis (see Annex 1 for modelling approach).

**Rebuilding fisheries by reducing effort will, in the long term, produce more fish than would otherwise be present.** However, the future level of production may not be much higher than present production in quantity terms, because current production is high only due to unsustainable overfishing. Current revenue levels (US\$288.6 million in 2014 for the equivalent group of fisheries) are being obtained at the expense of future revenues, which in the absence of policy change will be lower than both current revenues or the best future revenue scenario. Figure 9 shows the projected overall long-term annual revenue from the major commercial fisheries under different effort levels. Improved management will generate higher revenues (US\$200 million to US\$270 million in 2014 US\$) than status-quo effort levels at an equivalent point in time (approximately US\$115 million). Improved management will thus prevent a decrease or collapse in harvests, allowing for current levels of fishing to be maintained. It is important to note that these projections are conservative: they assume that fish prices remain the same, and that value-chain improvements that might otherwise allow for greater value add do not occur. Greater economic benefit, relative to both present value and future values, can be derived from increased value-added processing

and reduced economic inefficiencies, which are explored further below.

**Effort management has already proven successful in Pakistan on a small scale.** A partially closed season for the shrimp fishery, which limited fishing at certain points in the year, reportedly had positive impacts on productivity and landing volumes. Enforcement is required to ensure that closed seasons and gear restrictions are respected.

**There may be limited potential for future increases in marine fish production through more intense exploitation of offshore mesopelagic resources.** Some incremental potential exists in large pelagic species such as tuna and mackerel, species not affected by the overfishing analyzed above. These species can be used for canning and other forms of processing. Tuna and mackerel can also be processed raw (sashimi) or as loins (frozen). The largest incremental potential is for mesopelagic lantern fish. These small fish are well suited to making fishmeal as they do not currently serve higher-value markets. In this regard, the FRAPP notes that "the prospect of large yields of high quality fishmeal from mesopelagic sources should provide a suitable alternative to the present ecologically and economically

**Table 8: Total Net Present Value across 13 Species Groups, Over 30 Years (2014 US\$ Millions)**

Policy scenario	Status quo comparison	Median net present value (US\$ millions)	Confidence bounds (US\$ millions)	
			5th percentile	95th percentile
Discount rate: 0.05				
Reform policy: 10-year capacity-reduction period; effort levels reduced to approximate MSY		858.3	460.4	1,107.5
Temporary reform policy: 10-year capacity-reduction period; effort levels reduced to 0.75 of 2014 levels, then gradually return to status quo levels		447.5	290.4	608.7
Fast reform policy: 5-year capacity-reduction period; effort levels reduced to approximate MSY		1,026.1	586.2	1,416.6
Fast and temporary reform policy: 5-year capacity-reduction period; effort levels reduced to 0.75 of 2014 levels, then gradually return to status quo levels		508.3	309.5	645.1
Targeted reform policy: 10-year capacity-reduction period; effort levels reduced to MSY for each species group		1,007.7	592.5	1,184.3
Fast and targeted reform policy: 5-year rebuilding period; effort levels reduced to MSY for each species group		1,249.0	650.7	1,353.5

Note: Figures are net against a status quo scenario of constant 2014 levels of effort, at a 5 percent discount rate. Net present value is calculated as the sum of cost savings and revenue increases from increased production due to effort reductions. Cost savings exclude wage savings (i.e. employment is treated as a social good). Production is calculated using a Schaefer-Gordon logistic model (see Annex 1). No price increases are assumed. Confidence bounds are based on a Monte Carlo analysis over three biological fisheries parameters. Input parameters are provided by Fanning et al. 2016.

Source: Authors' analysis (see Annex 1 for modelling approach).

destructive 'trash' fishery to produce fishmeal" (Fanning et al. 2016).

**There is also interest in mesopelagic resources as a potential source of Omega 3 and higher-grade food products.** Mesopelagic organisms are a source of marine fat and protein, with the potential to contribute to both economic and nutritional outcomes. The Norwegian Institute of Marine Research is developing a research program to investigate the nutritional value of various mesopelagic organisms. This work will explore the suitability of these organisms as ingredients in both feed and food, including detailed analysis of chemical composition and potential environmental hazards (Norwegian Institute of Marine Research 2017).

**It is likely that fish harvests will increase in per-unit value as the harvest quantity increases.** Larger, healthier fish stocks produce larger, healthier, and more valuable fish. The per-unit value of the fishery is expected to increase under improved management.<sup>17</sup>

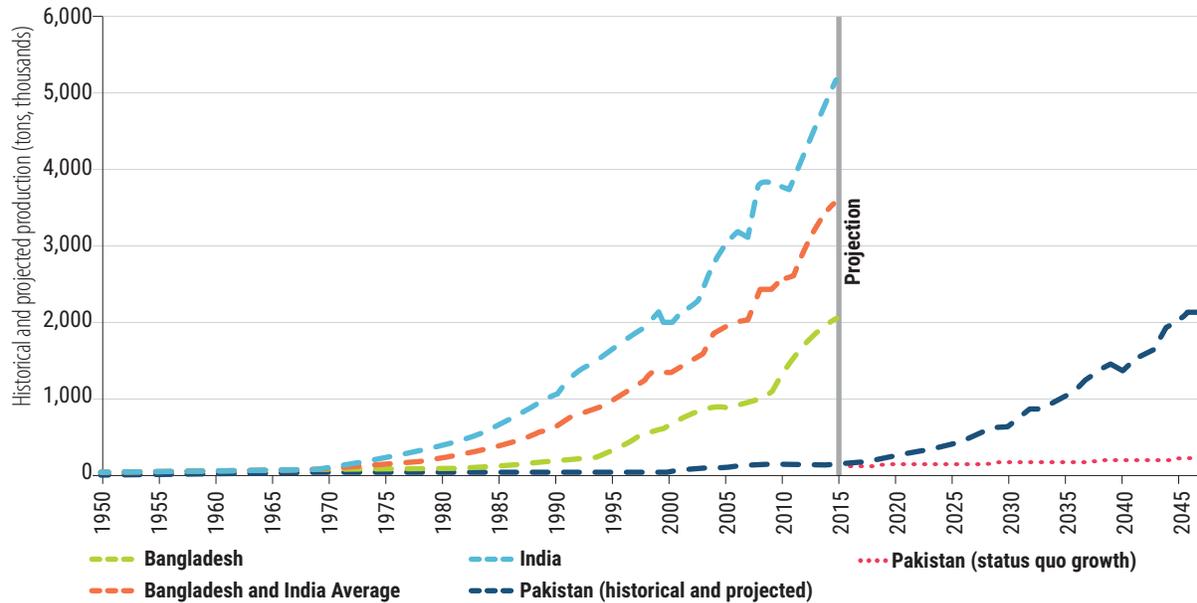
**However, the biggest economic benefits would come from reductions in uneconomic expenditure.** Under the current open-access conditions, fishing vessels compete for fish. This harms both fish stock and profits by incentivizing uneconomic competition. This

is the driver of the severe drops in productivity (catch per unit of effort) that has occurred over the past three decades. Reducing fishing effort helps to control uneconomic expenditure, making fishing more profitable. Marine fisheries' total profitability (revenues minus costs) is projected to be about US\$65 million greater per year in 2030 and US\$161 million greater in 2047 than under a no-change scenario. These benefits do not accrue evenly over time, however. In the very short term, a rebuilding period is required, which would impose costs on fishing operators in the form of restrictions. Only as fish stocks start to grow again are benefits realized. The speed at which the fisheries rebuild depends on the species, with fast-growing species like shrimp bouncing back most rapidly.

**The combined economic gains from increased marine fish production and reduced costs are conservatively estimated at US\$447-1,249 million over 30 years.** Table 8 presents expected net present values of different policy reform options. All are based on effort reduction and do not distinguish between how it is achieved (for example, by vessel buybacks, season restrictions, or other approaches). Policy variations modelled include a temporary reform policy (where effort is reduced but eventually increases again, perhaps due to a change in direction under future governments), a fast reform policy (where effort is reduced over an ambitious

<sup>17</sup> This benefit is not modelled by the analysis presented here, however, as it would require assumptions about fish prices that are difficult to make accurately with the available data.

**Figure 10: Projected Aquaculture Production Based on the Annual Average Growth Rate of Aquaculture in Bangladesh and India (at Equivalent Stages of Sector Development)**



Source: Authors' analysis.

five rather than ten years), and a targeted reform policy (where management plans specific to each species take effect). All show positive returns, which includes the cost of fishing restrictions in terms of temporarily reduced harvests during the rebuilding period, but not the cost of enforcement and governance reform. It should be noted that these estimates do not include potential substantial benefits from increased value-add in the processing sector, higher fish prices, or changes to other components of the fisheries sector, such as inland fisheries. Estimates also do not include substantial value paid out in wages.

### 3.3. Opportunities from Aquaculture Development

**Aquaculture presents opportunities to diversify production away from marine fisheries and fuel significant growth in overall fish production.** Aquaculture is among the fastest-growing food production sectors globally, substantially outpacing world population and economic growth, with an average growth rate of 5.8 percent in the decade from 2005 to 2014. In Pakistan, the growth of aquaculture over the same period was much lower, 2.3 percent, with production currently standing at about 150,000 tons per year.

**Pakistan's quantities are small relative to production in neighboring countries (Table 1).** Bangladesh

and India are among the world's five largest aquaculture-producing countries, while Pakistan ranks only 28th. In terms of growth, Pakistan's aquaculture considerably lags India's and Bangladesh's average rates over the past five years of 6.8 and 9.5 percent respectively. Furthermore, Pakistan's rate of growth is behind these countries' rates during similar periods of their aquaculture industry's development. When India's aquaculture production was about 150,000 tons per year, Pakistan's current size, it was growing at about 11 percent per year (averaged over the five years prior). Bangladesh's equivalent was above 10 percent. This compares to Pakistan's current growth (five-year average) of just 1.5 percent, despite continued strong demand for aquaculture products globally. Pakistan had a short period of fast growth about 15 years ago, but it has more recently tailed off. Putting aquaculture on a growth trajectory that matches its neighbors at their equivalent stages of aquaculture development would mean annual production of more than 2 million tons after 30 years (Figure 10). By comparison, current growth rates lead to a sector producing around 240 thousand tons after 30 years.

**Pakistan can already point to examples of high returns from private sector investment in aquaculture.** Recent studies have examined private returns to fish farming in Pakistan, focusing on semi-intensive freshwater carp and tilapia operations in Punjab and brackish water carp culture in Sindh that have cost-ben-



Fresh, raw shrimp at market (teang, iStockphoto)

**Table 9: Comparison of Shrimp Production and Exports—Pakistan, Bangladesh, Myanmar, and India**

	Pakistan (2014)	Bangladesh (2014)	Myanmar (2013)	India (2013)
Production (tons, live weight)	18,628	241,117	101,409	743,798
Proportion farmed (%)	0	61	32	45
Exports (tons)	13,211	109,000	22,000	426,000
Proportion exported (%)	71	45	35	57
Export value (US\$ millions)	75	500	335	3,100

Source: FAO 2016b.

efit ratios at 1.17:2.0 and 1.37:1.51, respectively. In the 1990s, ADB financed a US\$15 million project that constructed demonstration fish farms and hatcheries, and improved extension, training, and data collection systems in three provinces (ADB 1997). Upon completion of the project, the estimated annual value of fish production was US\$13 million. Within six years, the project directly helped expand the country's commercial aquaculture industry, adding more than 1,700 new, profitable small enterprises. Further programs that aim to realize the potential of aquaculture in Pakistan could harness a similar strategy of targeted public-private partnership investment in key parts of the aquaculture value chain.

**Pakistan also has potential for commercial aquaculture on its coastline.** Unlike other nations in the

region, Pakistan has not developed coastal aquaculture despite export opportunities and suitable environmental conditions (Table 9). Potential exists for shrimp farming. Globally, shrimp is one of the most important segments of the fisheries market, representing more than 16 percent of its global trade in value terms, of which aquaculture shrimp accounts for about 58 percent. Development of this industry in Pakistan could boost supplies for export while supporting the recovery of sustainable wild supplies.

**The Governments of Sindh and Balochistan have recognized the opportunities for shrimp farming within their provinces.** A recent pilot-scale operation, producing the introduced species white shrimp *P. vannamei*, has shown initial success and profitability.<sup>18</sup> The

<sup>18</sup> See, for example, "Pakistan Reliance Aquafarms," press release, January 2016, Shrimp News International, <http://www.shrimpnews.com/FreeReportsFolder/NewsReportsFolder/PakistanRelianceAquafarms.html>.

facility has now been functioning for five years. A native species, *Penaeus monodon*, has also been trialed. Balochistan has developed a Shrimp Farming Policy to drive the development of state and private land for shrimp farming. However, great care must be taken to avoid the environmental damage that shrimp farming has caused in other countries, such as loss of mangroves, which support wild fish breeding.

### 3.4. Opportunities from Enhanced Fish Processing and Exports

**Improving value-added production is one of the most feasible ways to improve the economic contribution of the fisheries sector.** Post-harvest processing in Pakistan is hampered by widespread poor-quality control and outdated technologies. Much of the sector's capacity is focused on lower-grade products such as fishmeal. Limited ability in high-quality and certified processing inhibits Pakistan's access to lucrative export markets. Through systematic improvements in handling and storage techniques, current high levels of spoilage could be reduced and fish quality increased, allowing reaping of higher value from the existing catch.

**Experience shows that incremental changes can make significant impacts on the competitiveness and value of Pakistan's fishery exports.** In response to the EU's export ban (see Box 10), more than 2,000 Pakistani fishing vessels were upgraded to comply with hygiene standards. The management of fish harbor facilities was improved, and traceability scanning systems were installed in processing plants, to conform to EU requirements. In parallel, the Government invested more than US\$800,000 in the renovation of fish auction halls and fishing vessels. Consequently, in March 2013 the EU lifted the six-year import ban on fishery products from Pakistan and, as an initial step, resumed imports from two seafood companies. Exports to non-EU international markets also increased. Three more processing plants are currently seeking EU approval.

**EU countries, Japan, and the United States are the world's biggest export markets for seafood, yet at present, they account for less than 3 percent of Pakistan's fisheries export earnings (about US\$9.3 million annually).** Pakistan's fisheries could capture a bigger percentage of these markets. However, to meet EU and U.S. quality standards, processing plants and supply chain management of Pakistan seafood will need to improve further. New industry standards—and compliance with those standards—will be crucial.

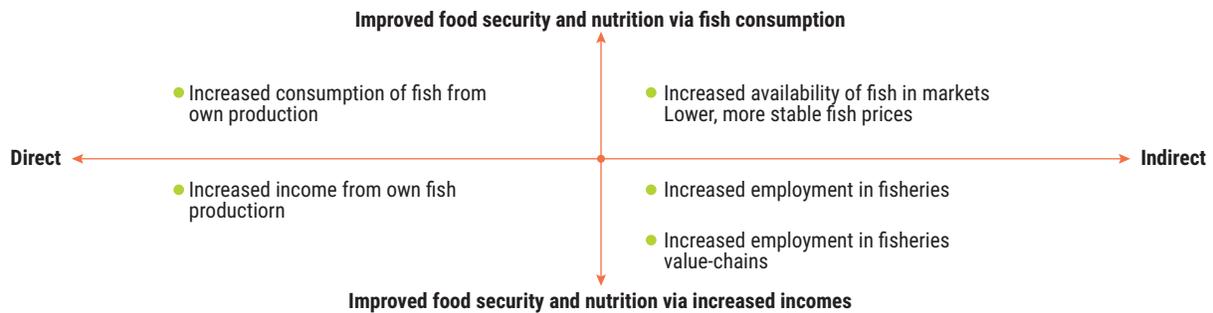
### 3.5. Opportunities to Improve Food Security and Nutrition

**Greater consumption of fish in Pakistan could support efforts to improve food insecurity and reduce malnutrition.** Pakistan greatly needs better sources of nutrition: 50 percent of women and children (under 5 years of age) are malnourished, and 44 percent of children are stunted physically and cognitively (ILO 2016). Increasing fish consumption, particularly among the poor, could help: Fish is a good source of proteins and healthy fats, and essential nutrients such as long-chain Omega-3 fatty acids, iodine, vitamin D, and calcium. Fish is also highly beneficial for child development and cognition (Lind et al. 2015 and Michaelsen et al. 2011). Fish consumption by mothers of young infants causes a better fatty acid profile in breastmilk, benefiting brain development (Lauritzen et al 2002). Studies from Bangladesh show that the risk of child mortality is lower for children born during peak fishing seasons to mothers who eat fish (Bennett et al. 2018).

**The fisheries sector can improve food security and nutrition both through direct and indirect pathways.** Greater fish production, particularly aquaculture, can mean that Pakistani families will eat more fish, either that they have produced themselves or bought from small fishing operations. Greater production can have positive indirect effects through stabilized prices and greater availability in local markets. Growth in the fisheries sector may also provide jobs and boost incomes, allowing for improved consumption of nutritious food in general (Figure 11). Experience suggests that development of the fisheries sector can be pro-poor in boosting their fish consumption. In Bangladesh, development of the sector raised fish consumption, and did so most among the poor and rural segments of the population. (relative to their initial consumption). The Bangladesh experience also suggests that market-mediated pathways to improved food security and nutrition are the most likely routes to change, including for the very poor. Low-income fish producers may prefer to sell their fish, given that they are a high value product, rather than consume them, but that could allow purchase of other high-nutrient foods (Toufique and Belton 2014).

**However, certain cultural preferences must be considered.** Improving nutrition and food security through increased fish consumption may face preference and cultural constraints. Fish consumption in Pakistan is amongst the lowest in the world, about 2 kg per year

**Figure 11: Pathways for the Impact of Fisheries on Food Security and Nutrition**



Source: Adapted from Toufique and Belton 2014.

per capita, compared to a global average of 17 kg. This is indicative of the minor role that fish play in Pakistan's traditional food culture. Developing a taste for fish may not occur rapidly or at all. However, large shifts in food preferences have occurred in Pakistan in the past: Chicken consumption and production grew rapidly through the 1970s and 80s with supportive government policies, and chicken is now a commonly consumed source of protein.

### **Greater Government promotion of new forms of polyculture could boost incomes and food security.**

The Government could signal increased recognition of fish for nutrition and income at a high level by explicitly including fish in the National Food Security Policy. Extension activities could promote alternative forms of polyculture focused on boosting nutrition and women-led enterprises, based on the successful adoption of these technologies in other countries in the region (see Box 7).

### **Box 7: The Potential for Improved Nutrition through Small-Fish Polyculture**

Certain culturable fish species, indigenous to South Asia, are particularly high in the micronutrients required to address hidden hunger and child stunting. Hidden hunger is a type of malnutrition that occurs when intake and absorption of important vitamins and minerals (including zinc, iodine, and iron) are too low to ensure good health and development. Hidden hunger affects about 2 billion people worldwide (IFPRI 2014).

Several indigenous small fish have the potential to address hidden hunger and child stunting in Pakistan (IUCN 2015). These fish are small-size species, rather than juveniles of larger species, and include *Amblypharyngodon mola*, found in the wild in Sindh Province. A growing body of evidence suggests that when consumed whole, with bones and head, these species provide concentrated and highly bioavailable minerals and vitamins, essential fatty acids, and animal protein.

Research has shown culture of *mola* to be cost-effective in Bangladesh. They reproduce quickly, and can be stocked in existing homestead aquaculture ponds that contain larger fish, such as carp, that do not prey on these small fish. While most larger cultured species fetch a higher market value and are thus typically sold for cash income, small fish are more likely to be consumed directly within the household, providing nutritional benefits.

Sale of a proportion of the small fish harvest can also provide a new source of income for households, particularly women. Field trials in Bangladesh suggests that small fish increase the overall productivity of a pond per hectare and therefore the economic value of each harvest (Castine et al. 2017). Transfer and adaptation of culturing methods could replicate Bangladesh's success in Pakistan.



An aerial satellite photograph showing the Indus River Delta and the city of Karachi, Pakistan. The river branches out into a complex network of channels and distributaries, creating a large, intricate delta system. The city of Karachi is visible as a dense urban area with a grid-like street pattern, situated along the western edge of the delta. The surrounding landscape is a mix of urban development, agricultural fields, and natural terrain. The water in the delta is a deep blue color, contrasting with the brown and green of the land.

**CHAPTER 4**

# **Critical challenges and needs in the fisheries sector**

*Karachi is located along the western edge of the Indus River Delta (Nasa, Earth Observatory)*

A decorative horizontal bar at the bottom of the page, consisting of a series of small, colorful squares in various colors including red, yellow, green, blue, and purple, arranged in a repeating pattern.

**To move toward sustainable management of Pakistan's fisheries, and to derive the greater socio-economic value described in the previous section, critical challenges must be addressed.** Overcapacity in fishing fleets, illegal fishing, and a lack of surveillance and licensing are causing overfishing and thus diminished quantity and quality of yields, both in marine and inland capture fisheries. Insufficient infrastructure and processing standards reduce quality, market access, and value add of fish products. Aquaculture is growing, but only slowly, and international experience suggests that with the right policy settings, it could contribute more to socio-economic development than it currently is. This section explores the changes required to achieve the sector's potential.

## 4.1. Challenges in Marine Capture Fisheries

### 4.1.1. Overfishing

**The message from the FRAPP is clear: Pakistan's major marine fisheries are either fully or over-exploited.** The major commercial fish stocks face considerable overfishing, and in some instances, are already depleted. Unless fishing effort is reduced, especially in the demersal finfish and shrimp trawl fisheries, stocks and harvests will continue to decline, with major ecological and socio-economic consequences.

**There is a need to reduce fishing effort to below scientifically-informed thresholds to maximize (or at least improve) yields.** Until FRAPP, robust, quantitative stock assessments had been lacking, preventing development of Fisheries Management Plans (FMPs). Such plans define a marine harvest strategy and aim to limit exploitation to agreed-on thresholds such as maximum sustainable yield (see Box 13). At present, Pakistan's marine fisheries are largely open access, with few effective mechanisms to limit fishing effort through input controls, such as the number of fishing licenses, or output controls, such as a quota system. Sustainability requires a long-term strategy on fleet capacity.

**The bottom trawl fleets are removing juvenile fish for use in fishmeal production, reducing later adult stocks that could be harvested for higher-value purposes.** This practice is a major contributor to stock diminishment. Pakistan needs a multi-faceted approach to reducing juvenile catch. This could include technical measures such as minimum mesh sizes and minimum landing sizes, and economic disincentives for non-human use of fish.

### 4.1.2. Legislative and Policy Gaps

**Fisheries legislation and regulations are fragmented across laws and institutions at both the Federal and Provincial levels.** The dissolution of the Ministry of Livestock and Dairy Development in 2010 and the transfer of different elements of fisheries governance and management to different line ministries have resulted in a highly fragmented governance system. This was exacerbated by changes under the Eighteenth Constitutional Amendment of 2010 which transferred executive powers to the Provinces, including control over Zones II and III of the EEZ. The original Fisheries Act (1897) now operates as a Provincial law under the residuary legislative and executive power of the Provinces, with Federal fisheries legislation mainly limited to the Exclusive Fishery Zone (Regulation of Fishing) Act (1975) and the Pakistan Fish Inspection and Quality Control Act (1997). This fragmented framework results in the following challenges:

1. While the country has legislation that covers most aspects of fisheries management and control, some of this legislation is dated, and does not fully reflect the increasingly devolved nature of marine fisheries in Pakistan.
2. Some international commitments have not yet been addressed.
3. Some modern aspects of fisheries legislation, such as the precautionary principle and the ecosystem approach, are yet to be integrated into the over-arching Fisheries Act and its subordinate legislation.
4. Authorities have limited control over fishing capacity, which holds back regulation of indiscriminate fishing practices that damage stocks and ecosystems.
5. Local governments need the power to establish additional management measures (such as spatial or temporal closures, or gear restrictions) if specific local requirements make such steps necessary and appropriate.

**Pakistan needs a review of fisheries legislation to inform the legislative and regulatory changes necessary to ensure sustainability.** There is also a need for formal definitions for small-scale or coastal fishing boats. Many currently-defined "coastal vessels" are in fact capable of fishing in deep waters, creating conflict or loopholes in terms of what regulations apply to whom. One bright spot is the new Deep-Sea Fishing Policy 2016 (Ministry of Ports and Shipping 2016), which

provides greater clarity over jurisdictional boundaries in marine waters.

**While fisheries administrations generally have adequate staffing in terms of numbers, public administrative capacity remains limited.** Greater investment in the Marine Fisheries Department, in terms of outlays for operational budgets, would allow an expansion of activities beyond simply maintaining its staff. Many senior staff positions are currently vacant. More broadly, responsibilities between fisheries administrations at Federal and Provincial levels would benefit from adjustments, such as a concentration of SPS authority in a new Federal SPS agency. Regulatory aspects of fisheries (such as licensing, inspection, and monitoring) should be separated from policy and strategy development functions to avoid conflicts of interest.

**Monitoring, control, and surveillance (MCS) is a multi-jurisdictional affair in Pakistan and is limited particularly in coastal zones.** The Pakistan Maritime Security Authority (PMSA) has a well-established role in fisheries enforcement and protection in Federal waters (those beyond 12 nautical miles), and benefits from its wide range of assets and military capabilities. However, it has less capacity to operate effectively in shallow, coastal waters. In waters off Balochistan, this role has been taken up by the Provincial fisheries department. There is a case for developing Sindh Province's capability to systematically police the Indus Delta creek network, utilizing local intelligence and fast, shallow-draft patrol vessels to respond to infringements. In waters beyond three nautical miles, a coordinated response between the Province and PMSA is more realistic. There is a need to develop a National Plan of Action (NPOA) for illegal, unreported and unregulated (IUU) fishing that confirms institutional responsibilities and sets out basic principles for combating this type of fishing in all of Pakistan.

#### 4.1.3. Data and Research Gaps

**At present, decision makers in Pakistan do not have access to quality science and information to facilitate sustainable use of marine resources.** Knowledge of the status of the marine environment and the social and economic processes that affect it is indispensable for effective decision-making.

**For example, current fisheries statistics do not include detailed information on the species being caught, just broad groups, do not track gear and effort, just the number of boats, and include no**

**seasonal information, just annual totals.** Collection of adequate data would add considerably to research and allow better management of the marine fisheries sector. It is difficult to develop effective FMPs without this information.

**Timely, publicly available data are particularly limited.** One important exception is the FRAPP, which provided valuable information on stock status. However, a one-off research effort is not sufficient for ongoing fisheries management. Research and data capacity must be strengthened long-term.

#### 4.1.4. Threats to Coastal and Marine Ecosystems

**Marine and coastal ecosystems face serious threats.** Excessive exploitation, mismanagement, and pollution have caused degradation of fisheries-centered ecosystems. This puts at risk fish resources that depend on these ecosystems.

**Threats to mangroves in the Indus Delta are a particular concern due to this ecosystem's role in providing habitat for breeding fish.** Mangroves cover an estimated 160,000 hectares of the Indus Delta and depend on fresh water flows from the Indus River. An estimated 80 percent of fish caught in coastal waters spend part of their life cycles in mangrove creeks, or depend on the food web within the mangrove ecosystem (Abbas et al. 2017). These mangroves have greatly declined in extent and variety. In the 1970s, the total area of the delta covered by mangroves was more than 30 percent larger than today (Amjad et al. 2016). Of eight species observed in surveys in the 1960s, only three remained in 1996 (Kidwai et al. 2016). These declines are due to human alterations of waterways such as the construction of barrages and dams on the Indus, coastal urbanization, and climate change. In addition to reducing area of mangrove coverage, these drivers are diminishing fresh-water flows and increasing storm surges (Panwhar et al. 2015), which in turn increase salinity to the detriment of mangroves.

**Industrial and domestic pollution is also a major hazard to aquatic ecosystems.** Karachi produces almost 500 million gallons of wastewater per day, one-fifth of which is industrial waste. This waste is discharged into coastal waters. As much as 87 percent of hazardous waste from industries flows into the Arabian Sea untreated. Karachi generates a further 12,000 tons of municipal solid waste daily, much of which ends up in coastal waters.



*Mangroves near Karachi, Sindh (Danishkhan, iStockphoto)*

**Given the dependence of coastal and offshore fisheries on mangroves, loss of these forests will result in reduced production of commercially important fish, harming commercial fishery and local communities that depend on fish as a primary source of sustenance (Amjad et al. 2016).** As such, investment to better manage and protect mangroves will have multiplier effects for livelihoods, improved environmental health, and storm-related disaster preparedness.

#### 4.1.5. Vulnerability of Small-Scale Fishers and Fisheries

**Coastal communities of small-scale fishers have been hit particularly hard by the decline in fish numbers.** For some communities, fishing is no longer a viable source of income. While the Food Security Policy encompasses a range of social protection measures for the wellbeing of fishers, the policy could use greater clarity as to who are the target groups for such measures. Provision of welfare support is enshrined in the mandate of the Ministry of Planning Development and

Reform, and the Provincial planning and development departments, but limited awareness among officers prevents adequate targeting to needy fishing communities in coastal and inland areas.

**In its current five-year development plan (2013-18), the Government of Pakistan has recognized that existing social welfare programs, services, and funding are insufficient, and has proposed a strategy to improve social welfare services (Ministry of Planning Development and Reform 2013).** The extent to which this will benefit fishing communities is, however, unclear. Some fishers have migrated out of economic necessity. There is a need for changes in welfare services for women left behind in communities that are both environmentally and socially constrained. In this context, the needs of small-scale fisheries and fishers could be better served by improving understanding of baseline conditions and implementing the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (Box 12) (FAO 2015b).<sup>19</sup>

<sup>19</sup> In 2014, the FAO's Committee on Fisheries adopted the Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication. The guidelines recognize the key role that small-scale fishing communities play in contributing to poverty alleviation and food security. The guidelines support investing in health, literacy, and education, eradicating forced labor, promoting social security protection, mandating gender mainstreaming, and building fisheries' resistance to climate change and extreme weather events.

**Fishers' associations exist, but these do not appear to have sufficient recognition or to be substantial enough to represent the interests of small-scale fishers in discussions with government.** Active representation is required if small fishing communities are to have meaningful input in the crafting of fisheries policy.

## 4.2. Challenges in Inland Fisheries

### 4.2.1. Inefficiencies and Inequities in Inland Fisheries Management

**The system of auctioning short-term fishing rights is not ideal for sustainability and equity because it does not encourage investment (including restocking) by rights-holders that would increase yields.** This system of contracts may also prevent people who lack access to credit, including indigenous fishers, from obtaining fishing rights. Bidding in auctions requires substantial capital, which restricts participation to the relatively well-off. Fishers may end up working for the winning contractor or being allowed to fish in return for a proportion of their catch or earnings.

**Sub-contracting is officially prohibited, but is reported to happen anyway.** This situation has forced some fishers to seek underpaid manual labor as a supplementary source of income, to migrate, or to take on high levels of debt.

**The economic contribution of inland fisheries is also hampered by limited supporting infrastructure.** While most production from inland fisheries is local, improvements to facilities such as landing sites, chilling units, and market facilities would increase value-add.

**There is no culture of stakeholder participation in decision-making on resource management.** A common conclusion from international experience is that bringing stakeholders together to address governance challenges is vital to sustainable management. Communities must be empowered to make decisions locally and to take actions that meet local opportunities and problems (Pomeroy and Rivera-Guieb 2006). A key enabler for improved inland capture fisheries could be a shift towards more inclusive co-management arrangements, where responsibility for making and enforcing management decisions is shared with local communities.

### 4.2.2. Threats to Fresh Water Ecosystems

**Pakistan's wetlands and lakes face environmental threats.** In Sindh, these include the reduction of fresh water flows due to diversion for irrigation, pollution runoff from agriculture and other land uses that result in eutrophication, the introduction of invasive species, and overfishing (Box 8).

**The Indus riverine ecosystem is also at risk.** Harmful trends include infrastructure development, depletion of riverine forests, land use change, industrial activities, dumping of municipal and industrial waste, and construction of upstream and riparian water diversions. Human alteration of the river and canals under the Indus Waters Treaty works have substantially impacted habitats needed to support productive fisheries. As a result, the potential to significantly increase fish production from the riverine and flood plain fishery remains limited. Further degradation should at least be avoided.

**Several inland aquatic species are threatened or endangered.** These include the Indus River Dolphin (*Platanista minor*), several of the larger species of Ma-sheer (*Tor*), and the Snow Trout (*Schizothorax richardsonii*).

## 4.3. Challenges in Aquaculture Development

### 4.3.1. Biosecurity and Environmental Health Risks

**Aquatic animal health (AAH) surveillance and control are limited.** This is despite the existence of an Animal Quarantine Ordinance, and a requirement for importers of live aquatic organisms for aquaculture to show health certification evidence on import. There are currently no requirement or facilities for quarantining. Pakistan has only limited diagnostic capacity concerning fish disease. In sum, the country is currently unable to effectively safeguard its own industry and faces challenges in fulfilling international obligations regarding fish diseases that require notification.

**For example, Pakistan's fisheries departments and universities currently have no capacity in shrimp viral diagnostics.** Globally, 60 percent of disease losses in shrimp culture are caused by viral pathogens. Pakistan is currently free of shrimp viruses, a major competitiveness advantage over other countries, and it should aim to maintain this status by developing capacity to spot

## Box 8: The Decline of the Manchar and Keenjhar Lakes

Manchar and Keenjhar Lakes are Pakistan's largest and second largest lakes respectively.

Manchar Lake, in Sindh, is also one of Asia's largest shallow lakes. Over the last three decades, its water quality has degraded to the point that it is now considered a "dead lake." Degradation occurred because of a loss of freshwater inflows due to diversion works and agricultural runoff. The worsening water quality and consequent loss of biodiversity have harmed the communities that for generations have depended on the lake.

The annual fish catch from the lake has dropped from 3,000 tons in 1950 to 300 tons in 1994 and to less than 100 today. The pollution and salinity of water in the lake has made it difficult for fish to survive—most commercially viable species have disappeared. Currently only 4,000 to 5,000 people live on the lake, compared to 20,000 in the 1980s. Many fishing families have moved to Balochistan to find alternative livelihoods. Remaining fishers mostly depend on fish called *dhayya*, which are sold at very low value for chicken feed.

A survey of communities living on the lake found that incomes had declined by 40 percent due to lower fishing profitability. Simultaneously, costs of living increased due to a need to buy clean water for domestic use (once provided by lake water) and a rise in illnesses due to water contamination (WWF 2012).

Keenjhar Lake, also in Sindh, is an important water source for Karachi and other cities. It is a wildlife sanctuary and a site for migratory birds, recognized under the Ramsar convention for wetlands. It has experienced a decline in fish resources over the years (Table 10) due largely to over-exploitation, fishing of juvenile stocks, and illegal fishing methods. In addition, the ecology has suffered from freshwater diversions, urban and agricultural water pollution, and the introduction of alien species. When fish were abundant, about 80-90 percent of local communities engaged in fishing. This has now fallen to about 40 percent (Table 11).

**Table 10: Decline in Commercial Fish Production from Keenjhar Lake**

Year	Total fish catch (kg)
2001-02	194,861
2002-03	178,839
2003-04	59,037
2004-05	27,351

Source: WWF 2007.

**Table 11: Decline in Number of Fishers and Boats on Keenjhar Lake**

Year	Number of fishers	Number of boats
1988-89	24,355	2,200
1998-99	11,900	1,710
2005-06	10,320	820

Source: WWF 2007.

and counter virus threats. Imported shrimp species such as *Litopenaeus vannamei* (exotic to Pakistan) should be handled using a precautionary approach.

**In addition to disease risks, new aquaculture operations must consider potential environmental health risks.** Currently, farmers in canal areas receive water in proportion to their land holding and make their own "crop" selections. Fish is considered to be a crop, like wheat or rice, for which land alteration without permitting can include creation of fish ponds. In Punjab, canal water is often supplemented from a freshwater aquifer. Tapping water from young sediments, however, risks arsenic contamination. There is also increasing concern

regarding heavy metal pollution from industrial and agricultural sources and the metals' accumulation in cultured fish (Chatta et al. 2016).

### 4.3.2. Insufficient Input Infrastructure

**There is a need for public and private sector investment in seed infrastructure that supports a growing aquaculture industry.** While seed for carp and tilapia is available domestically, seed for more nascent parts of the industry such as sea bass and shrimp is not. It is currently imported, mostly from Thailand at relatively high costs, by a small number of pilot projects. Domestic hatcheries could provide quality fish seed to

spur industry growth. High quality broodstock requires research and refined breeding techniques. Across South Asia, governments have promoted aquaculture through public provision of large, centralized hatcheries. In Pakistan, a public-private partnership model may also be suitable, where government facilities run genetic improvement programs to supply broodstock which private hatcheries then use to produce seed.

**The industry would benefit from development of local and cost-effective sources of feed.** Replacing fishmeal with other inputs (such as soy, see Box 1) is necessary to prevent additional pressure on depleted marine stocks. A quality fish feed industry is beginning to emerge in Punjab. Ultimately, cost of feed, quality, and supply are central determinants of the economic viability and environmental footprint of the country's aquaculture enterprises.

#### 4.3.3. Legislative and Policy Gaps

**An updated national policy framework, with delineated responsibilities between levels of government, would help end uncertainty for private-sector investment.** This could entail Federal responsibility over certification and quarantine, zoning, and management of international issues, and provincial and territorial responsibility over registration and monitoring of fish farms, abstraction and discharge consents, environmental impact assessments, notifiable disease monitoring, and food safety. Based on principles of central coordination and decentralized implementation, this could build upon the unimplemented National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan (Ministry of Food, Agriculture, and Livestock 2007), and might require an audit of current legislation.

**Governments need to identify sites suitable for aquaculture and establish zones for development to ensure that environmental and biosecurity risks are contained, and social conflicts minimized.** Once spatial zoning is complete, governments could implement a land lease policy enabling investors to purchase or rent land for aquaculture start-ups.

**There is currently no authorization process that directly regulates setting up a fish farm in Pakistan, and licensing is not required.** This may hinder efforts to prevent environmental harm and minimize social conflict over resources as aquaculture expands. It may also thwart efforts to enforce the spatial zoning described above. Moreover, the lack of an authorization process means that data collection is limited.

## 4.4. Challenges in Post-Harvest Activities

### 4.4.1. Low-Value Use of Fish Resources

**The catching of juveniles of premium species of demersal fish, such as threadfin beams, croakers, and small pelagic fish (which could be bulk frozen for human consumption), represents a major loss of nutrition and value added to the Pakistani fishery sector, estimated at US\$60 million per year.** Exporters of products for human consumption obtain average values of about US\$2,500 per ton, compared to US\$1,000 per ton for fishmeal.

**Too many fishmeal plants are currently operating, creating a demand for input material.** This demand drives overfishing by trawl vessels. As a result, Pakistan is the only country in the world that operates a trawl fishery targeted at demersal fish for fishmeal production. Improving the fish size selectivity of trawl vessels' gear would reduce the supply of under-size raw material. Policy options could include regulation and auctions for operating licenses, with the medium-term objective reducing the fishmeal sector to a size that is appropriate to the availability of fish which have no other use (see also Box 5).

### 4.4.2. Poor Post-Harvest Facilities and Handling

**While the waters of Pakistan produce fish of good innate quality, their value is undermined by poor handling and preservation of the catch.** Many fishing vessels stay out at sea for long periods, with poor storage facilities on board. Reported yield of export-quality catch from a 15-day trip is less than a fifth of that from a one-day trip.

**Substandard landing facilities contribute to further post-harvest losses.** Karachi Fishing Harbor is over-crowded with both active and inactive vessels, and working areas are heavily congested. A larger share of landing and processing operations could be moved to the underutilized Korangi Harbor, as was intended during the harbor's construction. This would require upgrades to power, water, and fish handling infrastructure.

**Most processors operate inefficiently, covering marginal costs only.** Fish processing is substantially undercapitalized and most of the factories are old. Modern management methods such as Hazard Anal-

ysis and Critical Control Point (HACCP), a food safety management system, are applied poorly or not at all. As a result, few establishments have achieved internationally recognized standards for food safety or quality. Export processors typically cannot source product of export grade from port auctions and are increasingly seeking to buy directly from fishers. Processors have also commenced import of fish from Southeast Asian suppliers, mostly low-value aquaculture products for the domestic market. For example, Pangasius fillets are imported from Vietnam and sold to supermarkets and caterers.

**An underlying reason for this inefficiency is underutilization of capacity.** Reductions in the supply of marine capture fisheries will worsen this problem, in the short term, at least, further discouraging investment in value-adding activities. The longer-term objective is to establish effective resource management to ensure sustainable supply and develop alternative sources of supply from aquaculture.

#### 4.4.3. Missed Opportunities for Value Addition

**Opportunities are lost through the practice of trans-shipping much of the skipjack and yellowfin tunas catch at sea to Iranian vessels for canning in Iran.** Pakistani vessel operators report they have no way to legally land product in Iranian ports, which would allow their product to be registered as an export. The tuna could alternatively be processed in Pakistan, either as fresh tuna for the EU market, or as cannery supply for Pakistan and other markets. One operator is reportedly seeking finance for such an operation, using Chinese-owned vessels operating under charter arrangements, but has been held up by difficulty in obtaining licenses.

**Other than for pilot-scale farming of shrimp in Sindh Province, there is very little processing of products of aquaculture.** Produced carp/rohu, tilapia, and trout are consigned from farms direct to markets via sales agents, who either place product with customers or sell by auction in larger population centers. Improved organization of producers and investment in packing plants could create higher return on investment for producers. This could serve the small but growing domestic market—there is no obvious potential for tilapia production for export given strong competition from other countries in Asia.

## 4.5. Challenges in Market Access and Trade Competitiveness

### 4.5.1. Insufficient Connections to Domestic Markets

**There is a need for information on habits of domestic fish consumption.** This information could guide decisions on how much the sector should focus on international markets versus domestic promotion. The recent increase in imports suggests that domestic consumption of fish can be increased; systematic information is needed to guide effective promotion to capture a larger share of this market segment.

**Purchasers could take advantage of domestic opportunities by coordinating among themselves more closely.** A buyers' network or other alliance could create codes of production practice, to ensure consistent quality and safety of fish products. At present, the seafood supply sector is not fully connected to the rapidly growing middle-income sector in Pakistan, which is instead being served by imports. Government purchasing departments could also play a role by ensuring, for example, safe and nutritional supply for hospitals, the armed forces, and nursing homes. The public-sector role is not necessarily to create new demand for product, but to create demand for the coordination required to improve quality and safety.

**Most broadly, the creation of greater value-added via improvements in post-harvesting processes will increase the competitiveness of Pakistan's fish sector both in high-value domestic markets and international markets.** This requires reforms to resource management to ensure sustainable and high-quality supply, as well as investment in processing methods and supporting infrastructure.

### 4.5.2. Tariff and Certification Barriers to Competitiveness

**Current tariff structures do not optimally promote sector development.** Some degree of tariff protection on consumer products may be necessary to protect the domestic sector from cheap imports and incentivize investment, at least while the sector makes the necessary efficiency gains to compete effectively. Simultaneously, tariffs that increase the cost of vital inputs (for example, inputs for aquaculture operations) should be reduced.

**Better compliance with SPS measures and technical barriers to trade would speed access to international markets.** The federal government needs more clearly defined institutional arrangements: at present, import and export SPS responsibilities are split between different ministries. The resulting SPS regulation is in general insufficient. There is a need for improved coordination between the Federal Government (responsible for trade policy and SPS oversight) and provincial governments (responsible for development of fishery regulations). Pakistan cannot afford to lose access to lucrative markets such as the EU and Saudi Arabia, as has occurred in the past due to compliance issues (see Box 6). These issues are explored in more depth in Section 0.

**A lack of certain technical measures that limit the ecosystem impacts of the fisheries can also hurt competitiveness.** Turtle Excluder Devices (TEDs), for instance, are required on vessels to ensure their catch can access certain international markets. A U.S. inspection team visited Pakistan in 2014, 2016, and 2017, observing vessels operating from Karachi Fish Harbor and Baba Bhit Island, and concluded that TED use was insufficient. As a result, Pakistan’s certification to export wild-caught shrimps to the United States was suspended in May 2017. The U.S. Department of State stated that it is willing to conduct a future inspection and consider re-certifying Pakistan when all shrimp trawlers supplying exports to the United States operate with TEDs.

**Certification to private standards contribute to competitiveness (Table 12).** In addition to official certification for compliance to SPS measures (see Section 4.6), a frequent de facto condition for access to certain markets is certification to private standards which buyers require as part of their contractual relationship with suppliers. Increasing public concern regarding environmental and social impacts of fish production is often expressed in buyer requirements for certification.

**Business operators in the supply chain need to put in place food safety systems and sustainability practices, including full chain traceability, to be able to meet customer demands for certification.** The establishment of accredited certifying bodies for these standards in Pakistan would almost certainly reduce the cost of certification and compliance. Meeting the terms of multiple certification systems for multiple international markets can present considerable challenges, both in terms of cost and complexity, especially for small- and medium-sized operators. Nonetheless, it can pay off in the long term.

**Table 12: Examples of Certification Types Typically Required of Shrimp Farmers and Exporters**

Sustainability	Food Safety
<ul style="list-style-type: none"> <li>• Aquaculture Stewardship Council</li> <li>• Best Aquaculture Practices</li> <li>• GLOBAL G.A.P. (aquaculture standard)</li> </ul>	<ul style="list-style-type: none"> <li>• British Retail Consortium</li> <li>• ISO 22000 Food Safety Standard</li> <li>• International Featured Standards (IFS)</li> <li>• Safe Quality Food (SQF) 2000 Standard</li> <li>• Hazard Analysis and Critical Control Points (HACCP)</li> </ul>

Source: Compiled by authors.

### 4.5.3. Congestion Barriers to Competitiveness

**As previously noted, the Karachi Fishing Harbor is over-crowded with both active and inactive vessels, and working areas are heavily congested.** The fishing harbors in Balochistan are less crowded, but are only lightly used due to undercapitalization. These facilities need new investment if they are to aid in future development of the industry. There is an opportunity to develop seafood clusters or business park initiatives that could drive added value, such as a proposed “blue growth cluster” at Korangi (Box 9).

### 4.5.4. The Need for a National Innovation Plan

**A national innovation policy was outlined in 2012, but not adopted.** In terms of innovation, Pakistan sits well below the majority of its competitor countries within the industry. Limited and uncoordinated investment in public research concerning commercial requirements has left gaps in knowledge and technology that are needed to advance processing in the sector.

**The National Science, Technology and Innovation Policy details improvements in research and development, including components that are directly relevant to the fisheries sector (Ministry of Science and Technology 2012).** However, this policy is not linked to the national FDB, which has its own planning, research and development committee, or to the provincial and territorial fisheries departments. Coordination would improve research and development outcomes.

### 4.5.5. Human Capital

**The International Labour Organization (ILO) states that “human capital is one of the principal enablers of trade growth and economic diversification” —**

### Box 9: Seafood Clusters to Improve Competitiveness

The concept of a seafood cluster or hub was proposed in the mid-2000s based on UNIDO's experience operating successful clusters and on the UK Seafood cluster. UNIDO and the Pakistan Government considered the creation of a cluster in 2013. Korangi Harbor was initially planned as the site due to its function as a higher value capture port.

The seafood hub would entail:

- Development of public infrastructure such as boat repair, fuel supply, roads, lighting, utilities, and security.
- Investment in a range of processing activities to utilize fish landed.
- Co-location of business services and input suppliers including co-packing, cold storage, packaging suppliers, staff catering, chemicals, sanitation services, technology and quality control laboratories, official certification, pre-shipment inspection, transport services, and freight forwarding agents. The goal is to reduce costs and promote innovation through proximity.

The feasibility study proposed charging a variety of tariffs and fees to businesses to cover the project's investments and operating costs. The proposal was not fully implemented, although some investment was undertaken.

A new comprehensive plan for revamping the Korangi Fisheries Harbor into a modern-day fishing port, again applying the cluster concept, was developed by the Korangi Fisheries Harbor Authority in June 2017 (KFA 2017). The first phase would require an estimated investment of US\$5 million. The plan includes the transfer of harbor ownership to the Sindh Government, to ensure that it will receive the required support (e.g. public infrastructure investment). Various institutional issues, however, remain to be solved, including the role of the Fishermen's Cooperative Society, sources of income for management, user fees, and whether the harbor would have auctions.

**however, the Pakistani fisheries sector has not yet made the investments needed to fully develop the skillset of its workers.**

As a result, too many fisheries workers lack the skills and education that drive increases in standards and productivity. Facilities for training in commercial operations in value chain productivity and quality are limited. Institutions that exist focus mainly on fishing skills. The Fisheries Research and Training Institute in Lahore runs training programs on fish farming techniques and fish farm management. Diplomas for fishers are offered through the Punjab Department of Fisheries. UNIDO, under the TRTA II project, and the Government of Balochistan have agreed there is a need to extend the scope of the fisheries training institute in Gwadar.

#### 4.5.6. Competitiveness Benchmarking

**A clear set of productivity indicators and benchmarking could encourage competitiveness.** These would let firms compare their operations to those of best-practice operators. Previous farm, industry, and vessel competitiveness programs have not focused on achieving the lower costs of production needed to compete with imports or alternative protein sources. There is a need for credible business plans that enable forecasting of the price point of production and the margins required for success. To drive competitive production, the National Productivity Organization, the Federal body responsible for national productivity under the Ministry of Industries and Production, should continue the sector improvement work it initiated in

TRTA II. Formation of a benchmarking "club" would provide additional impetus.

#### 4.5.7. A Stronger Private Sector

**Pakistan's fisheries sector currently lacks the demand-led approach required to drive growth.**

Industry competitiveness should be driven by market forces: buyers, suppliers, potential market entrants, potential product substitutes, and rivalry among existing industry competitors. At present, the fisheries industry is not itself the driving force within the fisheries value chain. Public-sector organizations need to move from being "doers" with a central role in the industry, to facilitators helping modernize a demand-led food system. To move to a competitive, demand-led sector, the needs of the market should be paramount, and consumer preferences will need to take a greater role (Table 13).

### 4.6. Sanitary and Health Barriers to Trade in the Fishery Sector

**Poor sanitary and aquatic animal health (AAH) conditions hurt Pakistan's ability to trade freely in fishery and aquaculture products.** SPS measures rely on an outdated legacy of institutional and legal structures. Exported products suffer rejections and market access restrictions, or trade at a discount due to the risk of non-compliance. This provides openings for compet-

**Table 13: Changes that Could Help Improve Market Access and Competitiveness**

Enhancer		Fisheries' future state
• Higher education and training	➔	<ul style="list-style-type: none"> <li>• Formal industry training program</li> <li>• Field-based training programs</li> <li>• Youth training programs</li> </ul>
• Goods market efficiency	➔	<ul style="list-style-type: none"> <li>• Industry-driven market orientated to customers</li> <li>• Incentives to foreign trade</li> <li>• Growth activities and innovation grants</li> </ul>
• Labor market efficiency	➔	<ul style="list-style-type: none"> <li>• Flexibility of labor so that workers are employed where they are most effective</li> <li>• Labor incentives</li> <li>• Reduced youth unemployment</li> <li>• Equality between men and women</li> </ul>
• Financial market development	➔	<ul style="list-style-type: none"> <li>• Sophisticated financial market</li> <li>• Capital for investment in private sector</li> <li>• Appropriate financial regulation and fair practice</li> </ul>
• Technological readiness	➔	<ul style="list-style-type: none"> <li>• Improved ICT usage</li> <li>• Enhanced fishing technology (but not overcapacity)</li> <li>• Increased adoption of new technology</li> </ul>
• Access to markets	➔	<ul style="list-style-type: none"> <li>• Export earnings</li> <li>• Opportunities for growth</li> </ul>

Source: Compiled by authors.

itors to obtain the value added lost by Pakistani operators. Unless shortcomings are fixed, Pakistan could lose access to the EU market again (Box 10).

**There is a need to strengthen official SPS control systems.** Regulation of sanitary conditions on imports and exports is scattered across multiple federal ministries. Most fishery exports, in fact, are not subject to any sanitary controls. At the same time, the health conditions of live fish imports get few effective checks. Improvements are needed around food safety, covering animal feed inputs and monitoring and controls of veterinary medicine, environmental contaminants, and harvest and processing. Establishing an adequate AAH regime will be required to assure investors that their production will not be undermined by outbreaks of fish disease and will have access to markets which have their AAH controls in force. Several importing countries are considering requiring suppliers of aquaculture products to certify consignments as free of specific diseases. That would mean Pakistan would need not just testing capacity, but full AAH surveillance and monitoring ability.

#### 4.6.1. Challenges in Food Safety

**The food supply chain faces food-safety challenges due to deficiencies in infrastructure and processing.** These include insufficient washing of equipment, use of wooden fish boxes instead of plastic, use of unchlorinated water for washing and ice production, excessively long voyages in some of the larger vessels (three to four

weeks), and inadequate landing infrastructure. All of these conditions reduce fish quality and value-add. While ice is generally available (there are numerous ice plants located within reach of major landing sites), local ice storage and crushing conditions need improvement. Until these infrastructure challenges are resolved, most Pakistani exporters will continue focusing on lower-value markets, with little incentive to make investments to reach higher-value ones.

#### **The process of devolution following the Eighteenth Amendment of the constitution disrupted steps towards unification of federal food safety control under a proposed National Food Safety, Animal and Plant Health Regulatory Authority.**

The authority was intended to ensure a clear division of functions between Provincial and Federal Governments and to unify Federal food safety functions under a single risk management body. The EU-funded TRTA II project supported this approach, but due to the constitutional devolution, enabling legislation was not adopted. Consequently, there remains a need to improve coordination between Provincial and Federal bodies engaged in official control of safety of fish products. At present, Federal controls on international trade do not extend to the full value chain, and Provincial controls overlap.

**In addition to stronger control systems, there is a need to ensure compliance by fishery business operators.** A good example is set by a small number of export companies, mostly based at Karachi harbor, which have implemented HACCP (Hazard Analysis and Critical Control

### Box 10: EU Sanctions over Poor Sanitation Conditions

In 2007, an inspection mission by the Food and Veterinary Office of the EU's Directorate-General for Health and Consumer Protection identified deficiencies in Pakistani efforts to meet EU's sanitary conditions. The Government of Pakistan was not able to address the main issues raised, and so suspended exports in 2008. The EU-supported TRTA II project provided technical assistance and training to the MFD to solve these problems. FAO supported this effort by sending a mission on sanitation on fishing vessels. The Government of Sindh funded the upgrading of vessels, specifically fiberglass lining for fishing vessels and installation of onboard ice plants.

In 2015, the EU directorate-general approved a system in which a limited number of Pakistani vessels were permitted to supply four export operators via landings at a dedicated auction hall at Karachi Harbor (known as the "EU channel"). Exports to the EU resumed. However, the authorization covers only the one landing site and excludes tuna products due to lack of accredited testing for histamine. Furthermore, Pakistan cannot export aquaculture products to the EU due to lack of compliance with residue monitoring requirements.<sup>1</sup>

The system resulted in exports of fish, shrimp, and cuttlefish in 2016 totaling 1,234 tons worth €4.5 million. Since then, out of the 45 EU food safety alerts concerning products imported from Pakistan, two have been for fish products (in 2015, chilled fish with an incorrect temperature, and in 2017, squid with an abnormal smell). Within the constraints of limited number of species and the single landing hall, the control system appears to function effectively. However, these limitations have meant Pakistan has not obtained significant benefits from renewal of access on signment of vfe been with reforms were ng, ions and safety. logies es. That conditions can improve when these defciions oto the EU market.

Despite these improvements in conditions, problems remain. The control system at the MFD has lost key staff, and since January 2016 the MFD testing laboratory has faced suspension by the Pakistan National Accreditation Council (PNAC) of the lab's ISO 17025 accreditation. The MFD has since submitted a preliminary questionnaire describing the control system, and is awaiting an inspection mission from the European Commission.

Point, a food safety management system). Most of these companies control their own supply chains through contracts and purchase agents, work with vessels that take shorter trips, and operate their own distribution facilities.

**Aquaculture presents a set of additional hazards, given that production may take place in polluted waters, and that various permitted and non-permitted substances may be applied to cultured fish as prophylactic or therapeutic measures.** There is a need for routine monitoring of chemical hazards, including veterinary medicines, in freshwater fish and aquaculture products. In some regions where aquaculture is practiced, groundwater is contaminated with arsenic. The hazard is well recognized in drinking water and rice cultivation, but not in fish from aquaculture. There is also a need for a control regime of veterinary substances (including permitted and non-permitted lists for aquaculture) and residue monitoring.

#### 4.6.2. Challenges in Aquatic Animal Health (AAH)

**All aquaculture industries must manage the risk of fish diseases, which can undermine production and discourage investment.** The establishment of an

effective AAH surveillance and control system, including quarantine arrangements for international trade, is a pre-requisite for the development of a strong animal production industry.

**To date Pakistan has not faced outbreaks of fish diseases impacting aquaculture production, but the risks in terms of lost production and market access are clear from past experience.** In April 2016, the Saudi Arabia Food and Drug Authority (SFDA) reported it had identified white spot disease in shrimp exported from Pakistan. The product in question was wild-caught, not aquaculture-produced, and the viral nature of the problem was disputed. Nonetheless, SFDA enacted an across-the-board ban on the import of fresh, chilled, or frozen shrimp consignments from Pakistan until the country could prove the health status of its products.

**Pakistan does not have a designated authority responsible for fish disease surveillance or control.**

The Animal Quarantine Department (AQD), within the Ministry of National Food Security and Research,<sup>20</sup> has a mandate that technically includes fish. But the department does not have an AAH specialist, quarantine facilities for fish, or capacity to test for pathogens. Aquaculture disease control is generally assumed to be within

<sup>20</sup> The Animal Quarantine Department operates under the Pakistan Animal Quarantine (Import and Export of Animals and Animal Products) Ordinance (1979) and Rules, 1980. The department's functions are to prevent the introduction and spread of diseases through inspection and quarantine, to provide certification services, and to register processors of export-oriented animal products.

the mandate of the Provincial governments. Yet there is no Federal or Provincial legislation that specifies notifiable aquaculture diseases, reporting requirements, or provides authority to restrict transmission. Nor are structured disease surveillance programs in place. Although it has a nominated contact point in the quarantine department, Pakistan does not participate in the regional AAH network and has never made a fish disease notification.

**While Pakistan imports live fish, including juvenile tilapia, shrimp, and ornamental fish, it establishes no limits based on disease status or origin.** Controls, such as they exist at all, are simply visual health checks applied on live fish at the points of import and export. There are no quarantine facilities for live fish or capacity to test for pathogens.

**The lack of a Federal authority to develop and implement an AAH policy is a key problem to be solved.** This could be addressed by a National Food Safety and Animal and Plant Health Regulatory Authority, which would include AAH responsibilities. Once this body is in place, animal health legislation could be revised and modernized to provide a national framework for health of all animal species including aquatic animals. A food safety monitoring system would guarantee the safety of aquaculture products by guarding against environmental contaminants, especially arsenic, and use of unauthorized therapeutic substances. There is a need too to invest in key expertise in the animal health control system through recruitment and training of qualified veterinary staff. The National Veterinary Laboratory should also address the status of diagnostic capacity in relation to fish diseases.

#### 4.7. Managing Trade-Offs between Capture and Culture Fisheries

**At a global level, and often at a national level as well, capture fisheries and aquaculture are inextricably linked.** Policies directed at one fisheries subsector can have serious environmental and socio-economic consequences on the other. Awareness of these links can help policy makers choose and sequence policies that prevent harmful flow-on effects, and reinforce complementary positive outcomes across subsectors. There are challenges to be avoided and opportunities to be sought.

**Four particularly important links should be considered in the Pakistani context, drawing on lessons**

**from aquaculture development globally: (1) demand substitution, (2) demand from aquaculture for wild-caught fishmeal, (3) market interactions in the supply chain, and (4) spatial interactions in coastal areas.** These are discussed in turn below. In addition, a range of environmental spillovers between subsectors requires management, including invasive species and disease potential, the use of wild seed to supply aquaculture, and impacts on inland fisheries from aquaculture water discharge and modification of natural wetlands and river systems.

**Demand substitution for aquaculture products can reduce pressure on capture fisheries.** Global demand for fish products continues to grow, and now stands at more than 160 million tons. In 2014, aquaculture's contribution towards this demand exceeded 50 percent for the first time, while capture fisheries supply remained relatively static (FAO 2016a). Aquaculture is thus playing a vital role in providing fish that would otherwise come from capture fisheries, moderating pressure on wild stocks. These trends are projected to continue. Supply from aquaculture helps keep fish prices down, contributing to increased fish consumption in households both rich and poor (Toufique and Belton 2014 and HLPE 2014). In Pakistan, aquaculture has the potential to expand consumption even while it alleviates pressure on wild stocks. However, the precise size of this effect depends on the extent to which a particular fish product and its aquaculture substitute primarily serve domestic or export markets. More exports mean less local substitution.

**However, wild-caught fish are an input to aquaculture in the form of fishmeal, meaning that growth in aquaculture could heighten pressure on some marine resources.** Because fishmeal is currently being produced from juvenile fish, this activity reduces later adult stocks that could be harvested for higher-value purposes (see Box 5). At present, most fishmeal produced in Pakistan is either used for chicken feed or exported. For that reason, the magnitude of the link between the subsectors—and the direct effect of aquaculture on Pakistan's marine fisheries—is not clear. Nevertheless, there is at least the potential that additional demand for fishmeal from a growing aquaculture sector could further undermine the health of capture stocks. Policy actions are required to alleviate this risk. Management of marine stocks must be improved to prevent overfishing to supply new fishmeal demand. This would require a careful sequencing of fishery sector reforms: stock management should be improved before demand for aquaculture feed increases greatly. It may

also be possible to lessen this trade-off by regulating the post-harvest production of fishmeal.

**Alternative sources of aquaculture feed could also help reduce this tradeoff.** Many aquaculture species, both marine and freshwater, can consume at least some plant-based content as part of their diet. Major cultured species, such as carp and tilapia, are herbivorous. Globally, the proportion of fishmeal in farmed fish diets is falling across a range of species, as new soy-based and other vegetable-based feeds (see Box 1) are becoming increasingly cost-effective and appropriate for a range of species (Waite et al. 2014). Market-development activities would be needed to ensure that these modern, lower-impact approaches are adopted to their full potential in Pakistan. The type of aquaculture industry developed, along with the availability of feed substitutes, will influence the strength of the capture-culture linkage.

**From an economic standpoint, aquaculture and capture fisheries complement each other in important ways.** Both subsectors draw on common components of the supply chain, such as post-harvest processing, retailing, and exporting. Economies of scale and learning spillovers mean that growth of aquaculture can improve the value-added opportunities of the capture fishery. Larger volumes allow post-harvest processors to reduce costs, and incentivize investment in capacity that can raise the quality potential for both subsectors. There is also room for common governance in areas such as improved food-safety regulations, data collection, and management. Reforms that address one sector can thus benefit the other.

**Environmental tradeoffs must be managed through a planned approach to aquaculture development.** Coastal environment settings exemplify this. In many countries, extensive aquaculture development has occurred in important mangrove forests, which protect coastlines and provide habitat for wild fish stock breeding. Approximately one third of the world's mangrove area has been damaged due to human activity. The most common human cause of mangrove loss globally is aquaculture, responsible for approximately 11 percent of the loss between 1996 and 2010 (Thomas et al. 2017). Careful zoning that protects mangroves and other sensitive habitats is necessary to ensure that Pakistan does not lose these habitats and the important economic and environmental benefits they provide, including support for marine fisheries.

**Fisheries development also requires management of socioeconomic trade-offs, such as the tension**

**between food security and desire for higher export revenue.** If a larger aquaculture sector improves Pakistan's fish-processing capabilities, both aquaculture and fisheries products will be increasingly processed. This will decrease the supply of whole fish and thus the affordability and subsistence supply to local consumers. Similarly, the growth in pathways to export markets may increasingly price out local domestic consumption, even while delivering net benefits to Pakistan in terms of value addition. Given the current low per capita consumption of fish in Pakistan, and the potential benefits from increasing value added, these concerns are moderate, rather than severe. However, governments must consider these trade-offs as they chose goals and the policy pathways towards these goals.

## 4.8. Climate Change Impacts on the Fishing Sector

**Pakistan faces major climate-related risks, including glacial melt, variable monsoons, recurrent floods, sea water intrusion, higher average temperatures, sea level rise, and greater frequency of droughts.** In 2010, floods affected more than 18 million people in Pakistan and caused an estimated US\$10 billion in damage. Abnormally heavy rainfall in the 2011 monsoon affected 9.7 million people in Sindh and Balochistan. Sea level rise and saline intrusion are threatening infrastructure and agricultural land in the Indus Delta. Temperature rises in Pakistan from climate change are projected to exceed global averages, with water scarcity to become more severe (USAID 2017). These challenges threaten both modern economic sectors and traditional livelihoods, including fishing.

**Fisheries and aquaculture in Pakistan face specific impacts from climate change.** Increased intrusion of saline water in the Indus Delta is already harming fish breeding grounds. Higher temperatures are reducing river flows, further damaging habitat quality in the delta. Projected sea level rise and increased cyclonic activity due to higher sea surface temperatures threaten mangrove areas, which are crucial to wild shrimp breeding, one of Pakistan's largest export fisheries. The combination of climate change—particularly greater variation in weather conditions—and pressures on fishing stocks is increasing the vulnerability of rural communities dependent on this resource (Box 11).

**Changes in ocean temperature and acidity due to climate change are predicted to alter the distribution and abundance of marine fish.** The eco-

### Box 11: Vulnerability of Rural Fishing Communities to Climate Change

While many rural communities in Pakistan are vulnerable to climate change and climate-related disasters, fishing communities, particularly those in the lower Indus Basin, are especially vulnerable. This was confirmed by a recent study of 62 rural communities across four agro-ecological zones of Sindh (Ghauss et al. 2015).

Part of this vulnerability arises because climate stresses on fisheries are compounded by stresses from unsustainable fishing practices, both commercial and traditional. Reduced fish harvests, combined with more erratic agricultural yields, force households to undertake adaptation strategies such as migration. However, options are limited, especially in remote areas. Education levels in fishing communities are among the lowest in Sindh, reducing economic alternatives. The burden of adaptation is particularly high for women, who face traditional and educational barriers to employment and a higher burden of work at home following the temporary migration of men.

logical responses of fish species to climate change can be observed in the diversity, quality, and quantity of catches. The tropical zones of the world's oceans, which includes Pakistan's ocean territory, are expected to experience relatively high rates of extinction, decreases in catch, and decreases in the size of fish. Fisheries that are already under pressure from overfishing, as Pakistan's marine stocks are, already have compromised resilience and are thus particularly at risk from climate change.

**Pakistan's National Climate Change Policy (2012) attempts to provide a path forward to address these challenges through adaptation measures, but broader implementation is needed.** The goal of the policy regarding fisheries is to "maintain marine ecosystems and fish habitats for a healthy fisheries sector." The policy proposes increasing the resilience of fisheries through actions that maintain or improve the health of fisheries-related ecosystems. These include regenerating mangroves, ensuring water flow for healthy rivers, reducing water pollution, and promoting aquaculture (Ministry of Climate Change 2012). However, resource constraints have hampered implementation of many programs. There is a need to finance and implement the transformation of the governments' climate change commitments into tangible adaptation outcomes.

**While this section has focused on the consequences of climate change on fisheries and fishing communities, the relationship goes both ways—on a global level fisheries can have implications for the climate.** Under good conditions, aquaculture and capture fisheries can produce protein that has a smaller carbon footprint and a much lower terrestrial impact than other food systems (Nijdam et al. 2012). Increased reliance on fisheries (relative to farms producing red meat, for instance), particularly plant-fed aquaculture, offers a pathway towards lower-carbon food production. However, local environmental impacts must be carefully managed.

### 4.9. Gender Inequality within the Fishing Sector

**Women are important actors in fisheries and aquaculture, particularly in small-scale operations.** In the pre-harvest stages, women repair fishing gear and prepare aquaculture ponds, and to a lesser extent, take part in the fishing itself. Women's role in fisheries and aquaculture is often greatest in the post-harvest stages, such as in cleaning, processing, and distributing the catch. Women can suffer under many of the broader challenges that the fisheries sector faces. For example, pollution from canals flowing into Manchar Lake (see Box 8) reduced fishing by women, harming their economic participation and social status (Ghaus et al. 2015).

**Despite their contributions, women in fisheries and aquaculture face income inequality, workplace segregation, and health risks.** In Pakistan, women are employed in fisheries and aquaculture at some of the lowest pay levels (lower than in the manufacturing industry) with a large gender wage gap: women earned about one third of what men earned in skilled fishery work in 2014-15 (CPDI 2017). In addition, women undertaking fishing and aquaculture activities sometimes meet gender-related resistance, because access to fishing sites (i.e. tenure access rights), fishing quotas, and licenses are often traditionally reserved for men (World Bank 2018 and FAO 2017). In fish processing and retail, women face poor working conditions (more so than men, who are less involved in these activities), leading to fatigue, stress, and occupational injuries (FAO 2017). Official statistics on women's contribution to local economies and family nutrition are quite limited, making it difficult to formulate gender-inclusive policies and interventions (FAO 2017 and World Bank 2017).

**More broadly, gender inequalities pervade Pakistani society, but the government has shown willingness to take corrective actions.** Across the country, patriarchal traditions, male migration, purdah, honor and

### Box 12: Women and the FAO Small-Scale Fisheries Guidelines

The SSF Guidelines encourage a human rights-based approach to policy making. They are a means of addressing the root causes of poverty including discrimination, unjust distributions of power, marginalization, exploitation, and abuse, particularly of women and other vulnerable actors. FAO develops products to aid in the implementation of the guideline, including a Gender Handbook (FAO 2017) and companion baseline diagnosis/assessment tools. In the Pakistani context, the guidelines suggest key actions such as:

- Understand gender and the role of women in Pakistani fisheries and Aquaculture: Conduct a participatory diagnosis. It is important to grasp the baseline status of the situation including who are the actors, what are the specific vulnerabilities, and what are the institutional capacities moving forward.
- Strengthen the availability of reliable and time-sensitive gender-disaggregated data. Collect and publish official data that accurately depict the status of women. This may require modernizing data systems, strengthening analytical skills, and building strong collaborative relationships with communities based on trust and transparency.
- Mainstream gender across environmental, social, and economic policies. Policies and strategic planning should take into consideration the role of women not only as beneficiaries but as key contributors to the overall sustainable development goals of the country.
- Promote and support Community Driven Development (CDD). Community institutions, with the overall support of government administrations, should inculcate gender-responsive resource management and advocate for equitable access rights to resources and opportunities.
- Address gaps in employment quality and opportunities. Governments can work with employers to address unequal and unfair working terms and conditions, such as inequalities in pay and access to benefits such as health care and maternity leave.
- Prioritize secure access to nutrition. Conduct awareness-raising and behavioral change interventions to increase households' knowledge of nutritional needs and locally available nutrient-rich foods such as farmed small fish.

preference given to men limit women's access to basic services and opportunities. To combat gender-based inequalities, governments have created institutions and programs to promote women's access to economic opportunities, for example, the Benazir Income Support Program in Sindh. The Ministry of Human Rights, the main authority in charge of women's affairs and gender equality, provides support to women through bodies such as the National Commission on the Status of Women.

**There are policy frameworks and solutions that could enhance women's opportunities and con-**

**tribution to fisheries and aquaculture.** Having committed to implementation of the FAO's Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), Pakistan is encouraged to act to increase women's visibility and participation across the value chain (FAO 2015b). Developed in a participatory manner, the SSF Guidelines (Box 12) embody a global consensus on principles and guidance for small-scale fisheries governance and development applicable to all fisheries activities across the value chain.



## CHAPTER 5

# Summary and recommendations

**To increase the social and economic benefits derived from fisheries, there is a need to implement measures to both make Pakistan's fishery more sustainable and to 'add value'.** As detailed in the previous chapter, this requires conservation of marine resources to ensure that high-value, high-quality fish are available to produce high-value fish products such as table fish, and that stocks are not depleted by harvesting for low-value fishmeal. This goal further requires investments in aquaculture, as well as better facilities at fish markets, better fish processing, and better access to international markets.

**Although fish production has increased slightly in recent years, Pakistan is failing to realize the potential offered by its capture and farmed fishery sectors.** The marine capture fishery, for instance, has suffered a decrease in productivity and per-unit value due to overfishing (Fanning et al. 2016). Aquaculture could be far larger than today's level of development. Pakistan considerably lags its neighbors in aquaculture despite suitable conditions; growth in this sub-sector is relatively slow even in the face of continued strong global demand.

**This final section outlines key policy recommendations that could help Pakistan overcome these challenges and enjoy fisheries-driven growth.** These recommendations cover the fisheries sector broadly: from capture fisheries and aquaculture across the marine, coastal, and inland environments, to upstream and downstream value chains, research, and training. The timeframe for these recommendations is the next ten years, broadly aligned with the next two five-year planning periods of 2019-23 and 2024-28. The recommendations recognize the role of the Federal government in establishing the basic framework for sector management, as well as the role of Provincial and Territorial governments in managing fishery activities in their jurisdictions.

## 5.1. Structure and Approach

**Recommendations build upon the opportunities identified in the previous chapters.** There are six policy areas, mirroring the key themes presented throughout the report:

- 1. Enabling environment**—conditions and activities that support a well-functioning fisheries sector, including good governance, innovation, and capacity-building
- 2. Marine capture fisheries**—fishing activities in the marine exclusive economic zone (EEZ), as well as in the coastal and estuarine waters of Sindh and Balochistan Provinces
- 3. Inland capture fisheries**—fishing activities in the Indus Valley as well as the Himalayan foothills, including natural and stocked fisheries
- 4. Aquaculture**—marine, coastal, and inland aquaculture across Pakistan, varying from subsistence-level extensive farming to vertically-integrated intensive systems
- 5. Value chain performance**—activities that increase the sector's contribution to economic growth through enhanced productivity, value-addition, branding, and market access
- 6. Optimizing benefits**—activities that increase the sector's contribution to national development goals such as food security, social inclusion, and gender equality.

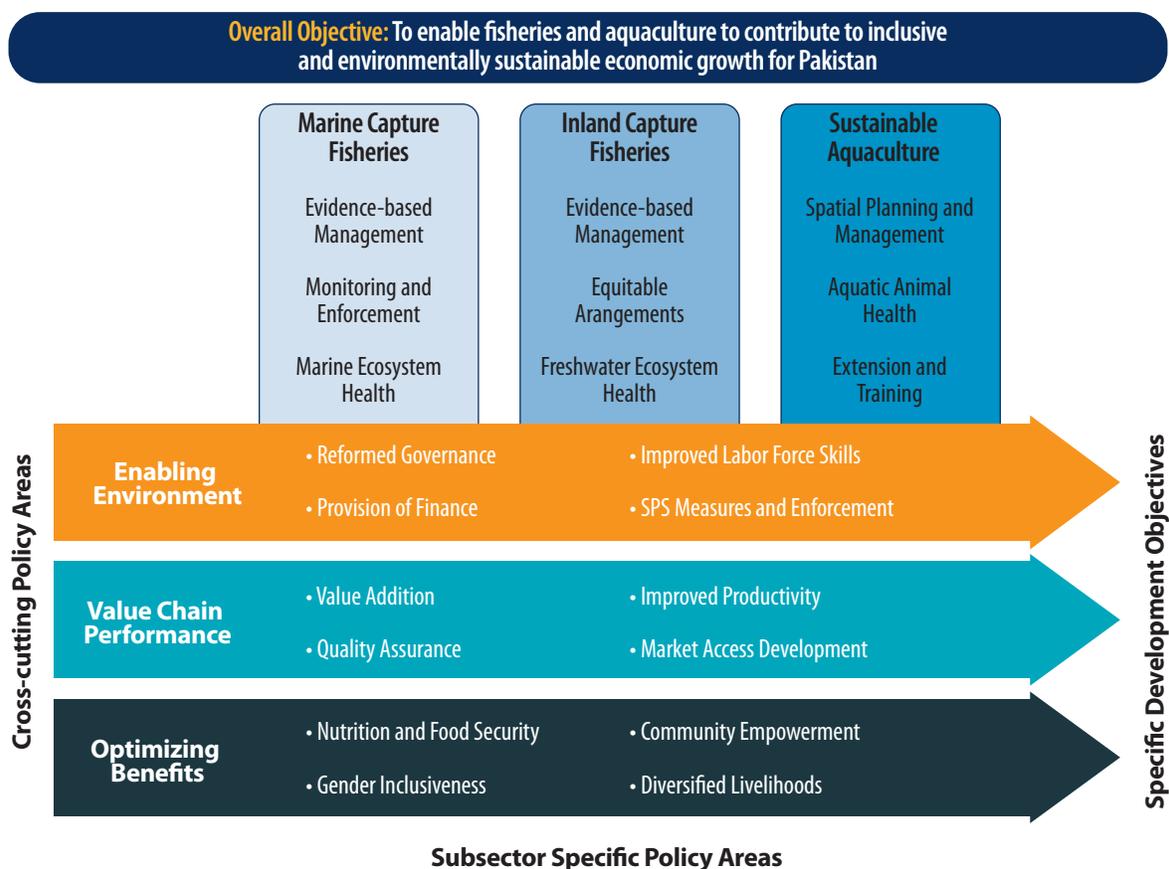
Three policy areas focus on fisheries subsectors, while another three, focused on the enabling environment, value chains, and optimizing benefits, are cross-cutting themes that apply to each subsector (Figure 12).

Each policy area has a Specific Development Objective (SDO). Each SDO has Results Areas that are addressed by specific activities. The SDOs and corresponding Results Areas are summarized in Table 14 and described in more detail below. The specific activities corresponding to each Result Area are further summarized in Annex 2.

### 5.1.1. Overall Objective and Main Components

**The objective of this chapter is to provide a set of recommendations that, if enacted, would enable fisheries and aquaculture to contribute to inclusive and environmentally sustainable economic growth.** Specifically,

Figure 12: Policy areas addressed by the recommendations



Source: Compiled by authors.

the recommendations aim to create a revitalization process that results in healthy ecosystems being fished by a well-structured and profitable capture sector. Over time, capture fish production will be supplemented with marine and inland farming which is well-planned and respondent to existing and emerging threats. The revitalized sector will be supported by capable management institutions, focused on sustainable development, and enabled by an innovative and skilled private sector.

### 5.1.2. Consistency with Wider Policy Objectives and International Commitments

**This set of policy recommendations sits within the wider development agenda set out in the Government of Pakistan's Vision 2025 (Planning Commission 2014).** It will develop human and social capital (Vision 2025 Pillar 1) and contribute to maternal and child health and nutrition. It will support inclusive growth (Pillar 2). It will contribute to water and food security (Pillar 3) through actions to reduce food insecurity and improve efficiency of water use. It will contribute to private sector-led growth (Pillar 4) by enabling greater value-added seafood production. It will contribute to the Pakistani knowledge economy (Pillar 5) through actions to create innovation and value-added, and will increase regional connectivity and economic benefits (Pillar 6) through actions to increase value and volume of seafood exports.

**The recommendations will also help Pakistan achieve its objectives under the Sustainable Development Goals (SDGs).**<sup>21</sup> Goals addressed include alleviate poverty (SDG1), tackle hunger (SDG2), promote good health (SDG3), support gender equity (SDG5), provide decent work and economic growth (SDG8), enable responsible consumption and production (SDG12), support adaptation to climate change (SDG13), and revitalize and restore life below water (SDG14).

<sup>21</sup> The SDGs are a set of universal goals aimed at ending extreme poverty, fighting inequality and injustice, and fixing climate change (United Nations 2016).

Table 14: Summary of Specific Development Objectives (SDOs) and Results Areas

Policy Area	Specific Development Objectives (SDOs) and Results Areas
1. Enabling environment	SDO 1: Enact policies and programs that deliver structural funding, innovation, capacity building, and other changes to attract investment, support trade, and improve the management of fisheries resources.
	Results Areas:
	1.1 Reformed governance for greater oversight and coordination
	1.2 Provision of finance for structural investments
	1.3 Higher capacity of education institutions to improve labor force skills
2. Marine capture fisheries	SDO 2: Ensure that marine fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits.
	Result Areas:
	2.1 Effective management of sustainable marine fisheries
	2.2 A well-regulated and compliant fishing sector
	2.3 A healthy and productive marine ecosystem
3. Inland capture fisheries	SDO 3: Ensure that inland fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits
	Result Areas:
	3.1 Effective and equitable management of sustainable inland fisheries
	3.2 Effective freshwater ecosystem management
	4. Aquaculture
Result Areas:	
4.1 Effective planning and management of aquaculture	
4.2 Effective aquatic animal health planning and management	
4.3 Expanded and improved aquaculture extension and training	
5. Value chain performance	SDO 5: Ensure the contribution of the fisheries sector to economic development through enhanced productivity, value-addition, branding, and market access
	Results Areas:
	5.1 Investment in infrastructure and services that adds value and enhances quality
	5.2 Improved productivity, quality, and market access
	6. Optimizing benefits
Results Areas:	
6.1 Improved nutrition and food security for all	
6.2 Greater attention to gender issues and progress towards gender equality	
	6.3 Community empowerment and improved livelihood opportunities

The recommendations are also consistent with the objectives articulated in the **National Policy and Strategy for Fisheries and Aquaculture Development**. Developed in 2007, this document focused on national economic growth, poverty alleviation, and food security. It was not formally adopted at the time due to political transition, but it remains relevant and forms the basis for several recommendations. The recommendations are also consistent with Pakistan's international obligations.



Karachi coast (Dmitry Pichugin, Shutterstock)

## 5.2. Recommendations: Enabling Environment

**The lack of a coherent, holistic strategy for the development of fisheries and aquaculture is a fundamental constraint to the sector’s sustainable development, and manifests itself in many ways, including inadequate harvest controls and limited guidance of the development of aquaculture.** The transition to a more sustainable fisheries sector requires fulfilling a range of conditions, most obviously governance and policies that integrate environmental and economic considerations. The future enabling environment will be informed by existing governance structures but will also require new legislation, rules, strengthened institutions, and potentially entirely new institutions. Translating new opportunities into productive sectors will require investment in research and development and technical capacity and creation of the right environment to attract outside investment.

**Many of the sector-specific recommendations that follow will only be effective once the overarching enabling environment is in place.** For that reason, steps to create the enabling environment must begin as a matter of priority.

**This set of recommendations aims to achieve SDO 1: Policies and programs that deliver structural funding, innovation, capacity building, and other changes that attract investment and improve the management of fisheries resources.**

## Result Area 1.I: Reformed governance of the sector for greater oversight and coordination

**Current governance arrangements are fragmented and contain significant gaps.** The transfer of different elements of fisheries governance to both the Ministry of National Food Security and the Ministry of Ports and Shipping has resulted in a fragmented governance system. The consequent lack of unified national policy development means that Provincial and Territorial fisheries departments have received limited guidance over issues that are of common interest nationally. The MFD, which is the main technical body at the Federal level for planning and overseeing marine fisheries development, suffers from limited operational budget and staff capacity, as well as a mandate now at odds with the relatively new emphasis on Provincial- and Territorial-led fisheries management under the 18th Amendment to the Constitution. A more cohesive set of institutions and better-defined roles for those institutions across governance levels would improve management outcomes.

**Greater involvement of Provincial and Territorial Governments in planning fisheries and aquaculture would be beneficial, and requires Federal coordination.** This would be helped by development of a national policy and strategy that provides a coherent framework. Within this framework, Provincial and Territorial Governments could address in a coordinated way issues such as fleet capacity reduction, harvest control rules, aquaculture spatial planning, and value chain improvements, through their own locally-appropriate policies. The new national policy could build on the 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan.

### Activities proposed:

<b>1.1.1 Develop a national, unified policy for fisheries and aquaculture inclusive of Provincial and Territorial government roles in implementation (Federal Government to coordinate).</b>	
<b>Short-term priority<sup>22</sup></b>	This is necessary to ensure that the capture fishery and aquaculture activities at the subnational level are consistent with national strategic priorities. Such a policy framework should address national-level priorities, issues straddling different levels of government, and roles and responsibilities of Federal and Provincial and Territorial agencies. The 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan provides a good basis for this, and could be adopted following updates.
<b>1.1.2 Assess institutional capacity and options for institutional strengthening (Federal Government to coordinate).</b>	
<b>Medium-term Priority</b>	National policy must be supported by a Federal-level coordinating agency. There is a need to assess the current capacity and future governance requirements of the fishery sector and agree on options for institutional reforms. This should include the option of a single Federal agency to coordinate the development of the fishery sector in conjunction with Provincial and Territorial Governments.
<b>1.1.3 Achieve jurisdictional clarity in light of the autonomy law, and strengthen legislation at both Federal and Provincial and Territorial levels (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	The existing legal framework needs a critical review with a goal of updating existing instruments, where these are either outdated or inconsistent with the national policy framework to be adopted (Activity 1.1.1).
<b>1.1.4 Prioritize the needs of small-scale fishers and fish farmers (Provincial and Territorial Governments to lead with Federal Government support)</b>	
<b>Long-term Priority</b>	To address issues relating to social protection and gender equality within fishing communities, and to understand the implications of policy reforms for small-scale fishers, a baseline assessment of small-scale fishers' needs would be useful. This would follow the FAO's SSF Guidelines, including the human rights based approach for SSF (see Box 12). Findings should guide management choices. Updating the National Food Security Policy to better reflect the needs of small-scale fishers is also recommended.

### Anticipated outcomes of these activities include:

- An overarching national policy framework, agreed to by key stakeholders, that can provide the basis for establishment of detailed Provincial and Territorial policies, strategies, and action plans that are consistent across borders but tailored to fit local context
- The implementation of a robust framework of laws and regulations to guide the sustainable development of fisheries and aquaculture across Pakistan

<sup>22</sup> Short-term = 0-2 years; medium-term = 2-4 years; long-term = > 4 years

## Result Area 1.2: Greater finance for structural investments

**Few sources of finance currently exist for the private fisheries sector in Pakistan, whether for large commercial or microenterprises.** Investments will be required for new production, structural adjustment, infrastructure, and value-added activities. Existing financing mechanisms provided through commercial credit facilities and the FDB are good but insufficient tools for catalyzing these investments. New financial support is required, along with systems to efficiently and transparently deliver it to investors.

**Fisheries Development Funds (FDFs), at both the Federal and Provincial and Territorial levels, could finance fisheries and aquaculture development.** Investment priorities would be chosen to maximize public and private finance in strategic sector areas. These could include (1) grants to fund public goods such as training and capacity building, (2) funds to support public and private investments in infrastructure and systems to manage that infrastructure, and (3) funding guarantee facilities to support private sector investments and deepen their relationships with commercial banks (Table 15). Rather than relying solely on central planning of sector investments, this mix of grants, loans, and guarantees could help crowd in private-sector investment and innovation. Investments under this system would be market-driven, while the grants component would help ensure that social goals are promoted.

**Table 15: A Summary of Proposed Fisheries Development Fund Investments and Activities**

Investments	Public goods	Public private partnerships	Private
Funding structures	Grants and matching grants	Mix of public and private funding	Guarantee facilities
Types of activities	Capacity-building for fishers and communities, with an emphasis on small-scale fishers Small-scale infrastructure for vulnerable communities Technical training	Physical infrastructure, assets, and operations at key landing and market access points Comprehensive fisheries information	Support for commercial bank financing of value chain actors (fishers and producers, processors, cold-chain actors, and exporters)

**Such a program of public-private finance would require an institutional framework that could ensure integrity and transparency at all levels.** A mix of public and private stakeholders could oversee the funds' investments, with a technical team in charge of daily operations. An example is provided by Bloomberg Philanthropies, which has partnered with Encourage Capital and the Rockefeller Foundation to launch the Vibrant Oceans Initiative, a US\$53 million, five-year effort to boost fish stocks in Brazil, the Philippines, and Chile.

### Activities proposed:

<b>1.2.1 Study the design and feasibility of Fisheries Development Funds (Federal, and Provincial and Territorial Governments).</b>	
<b>Short-term priority</b>	There is a need to assess the options available for such mechanisms. The assessment should include legal measures, institutional framework, staffing, and operational procedures required to manage disbursement, monitor investments, and ensure transparency. The funds would be overseen by governance authorities with broad-based representation from public and private sectors.
<b>1.2.2 Plan an operational program, including procedures, eligibility, accountability, and monitoring and evaluation (Federal, and Provincial and Territorial Governments, based on activity and geographic jurisdiction).</b>	
<b>Short-term priority</b>	The program will need a strategy to determine the type and size of investments that the funds will support. Such a strategy should include procedural rules, transparency requirements, and monitoring and evaluation. Legislative amendments may be necessary. These will be updated over time.
<b>1.2.3 Establish FDFs (Federal, and Provincial and Territorial Governments, based on activity and geographic jurisdiction).</b>	
<b>Short-term priority</b>	FDFs will need dedicated governance and staffing. Set-up will require drafting of operating procedures and procurement of such systems as IT platforms.
<b>1.2.4 Implement FDFs, first as pilots with limited geographical area or investment scope, followed by full roll-out (Federal, and Provincial and Territorial Governments, based on activity and geographic jurisdiction).</b>	
<b>Medium-term priority</b>	Pilot implementation will allow testing of systems and training of staff and key stakeholders. Once the systems have been assessed as robust, and initial results appear promising, full scale roll-out can begin.

### Anticipated outcomes of these activities include:

- Federal, and Provincial and Territorial institutions that deliver targeted finance to support the investment needed to sustainably grow the sector and support enabling reforms
- Socially beneficial investment based on public anchor finance with private sector co-financing
- Support for fishers and their communities to allay disruptions they may suffer from fisheries management reforms. Associated investments may take the form of retraining, provision of investment capital, and business support services.

### Result Area 1.3: Build the capacity of education institutions to improve labor force skills

**Federal and Provincial and Territorial Governments have made investments in education and training for fisheries in recent years, but additional work is required.** Sindh has training centers at Chilya and Sukkarin. In Punjab, there is the Fisheries Research and Training Centre at Manawan. In Balochistan, the Marine Fisheries Centre in Gwadar was constructed but not commissioned. These centers could function as core institutions to provide the human resources required to revitalize fisheries and aquaculture. But they will need investment to upgrade and expand their activities.

**There is a need to establish clear connections between the content and level of training offered and the strategic needs of the sector.** This implies a stronger (but not exclusive) focus on aquaculture, value-added processing, and quality control. This may require restructuring and upgrading at the three main educational institutions to ensure they deliver relevant, private sector-linked training. The teaching material could be enhanced by forging new partnerships with foreign institutes and strengthening local institutions' delivery of extension services.

### Activities proposed:

<b>1.3.1 Assess the current capacity of, and development needs for, fisheries technical training (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	Conducting a comprehensive capacity needs assessment (CNA) for capture fisheries and aquaculture would greatly enhance understanding of current capacity needs and constraints. Training programs at the key training centers should then be reviewed to determine what gaps exist, relative to the CNA-identified needs, and assess the feasibility of technology-enabled extension services.
<b>1.3.2 Plan and make investments in fisheries training institutions, with a focus on aquaculture (Provincial and Territorial Governments to lead with Federal Government support).</b>	
<b>Long-term priority</b>	Primarily this work will focus on upgrades to existing educational facilities, including provision of practical learning-based facilities (for example, demonstration aquaculture ponds, laboratories, and feed mills). This would likely require investment in new technical staff. The establishment of a more formal curricula and qualifications, benchmarked against international best practice, would assure the quality of the revised education system.

### Anticipated outcomes of the identified activities include:

- The establishment, in each jurisdiction with fisheries and aquaculture potential, of a leading training institute, following curricula with strong links to the private sector, to train an appropriate number of skilled workers

## Result Area 1.4: Improved SPS measures and enforcement to protect consumers and align with international standards to facilitate trade

**Federal SPS controls on fishery products are divided between ministries.** Currently, export controls are limited to shipments to the EU, with poor compliance records for shipments to other destinations. The ability of some larger firms to meet stringent standards demonstrates that the sector can achieve the standards required by higher-value markets. However, investments and reforms are required if more companies are to follow suit.

**Provincial and Territorial Governments have limited capacity to manage SPS controls, and there is no integration with food safety functions.** The Government of Punjab has established its own Punjab Food Authority to manage food safety issues within its jurisdiction, but there are overlaps with Federal functions. This highlights the need to establish a clear division of labour across levels of government for food safety responsibilities and to establish rules of engagement for issues that require joint action.

**Detailed SPS recommendations were developed between 2011 and 2016 by the EU's TRTA II project, including a recommendation to establish a National Food Safety, Plant and Animal Health Regulatory Authority.** However, despite the substantial agreement of most stakeholders, the reforms were not adopted by the Federal Government. Some Provincial and Territorial Government actions in this area have partially filled the vacuum. However, these activities are not well-coordinated, and proceeded without recognition of Pakistan's international obligations.

### Activities proposed:

<b>1.4.1 Support the development and reform of Provincial and Territorial SPS policies for fisheries products (Provincial and Territorial Governments to lead with Federal Government support).</b>	
<b>Short-term priority</b>	Poor SPS conditions are common across the supply chain, from fishing vessels to processing plants. Reversing this trend will require new protocols, inspection guidelines, checklists, and compliance enforcement.
<b>1.4.2 Strengthen SPS controls and inspection capacity in fish production and distribution (Provincial and Territorial Governments to lead with Federal Government support).</b>	
<b>Short-term priority</b>	Improving sanitary controls in the value chain will require building the capacity of staff to implement, inspect, and enforce. Training could include study tours as well as university-based courses and higher education degrees in food safety.
<b>1.4.3 Strengthen the capacity of laboratories providing food safety testing to the fishery sector (Federal Government to lead with Provincial and Territorial Government support).</b>	
<b>Short-term priority</b>	Critical to meeting SPS requirements in external markets is having accredited, high-quality laboratories. Accreditation (ISO 17025) of the Marine Fisheries Department's testing laboratory was suspended by the Pakistan National Accreditation Council in January 2016. There is a need to invest in equipment and staff to raise capacity and regain accreditation.
<b>1.4.4 Establish a risk-based SPS border control system for exports and imports of fish products for human consumption (Federal Government to lead with Provincial and Territorial Government support) (see also Results Area 4.2 on related measures regarding fish disease control).</b>	
<b>Medium-term priority</b>	Border controls must ensure that food safety hazards are stopped, while allowing for an efficient cross-border trade of healthy products. This will require an assessment of the food safety and fish disease hazards related to trade in fish for human consumption, and investment in hazard detection and control capacity.
<b>1.4.5 Establish national data collection for SPS (Federal Government leads with Provincial and Territorial Government support).</b>	
<b>Long-term priority</b>	Data collection is vital to making real-time decisions on emerging risks, as well as long-term planning. An SPS data system should be installed with agreed on, standardized data inputs from Provincial and Territorial Governments, to be collected and published (where appropriate) by a centralized Federal agency.

### Anticipated outcomes of these activities include:

- Effective risk-based SPS measures on fish products for human consumption, in line with OIE and Codex Alimentarius standards
- Effective risk-based controls at border inspection posts, adequately equipped with quarantine and testing facilities to protect against the import and export of non-compliant products
- Scientifically-accredited testing services for food safety

### 5.3. Recommendations: Marine Capture Fisheries

**Marine capture fisheries remain the mainstay of fisheries production and export in Pakistan.** However, the recent stock assessment under FRAPP showed that marine fish stocks are heavily depleted and continue to be over-fished, especially by the Sindh-based bottom-trawler fleet that supports a fishmeal industry based on juvenile fish by-catch.

**This set of recommendations aims to deliver SDO 1: Ensure that marine fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits.**

#### Result Area 2.1: Effective management of sustainable marine fisheries

**The FRAPP concluded that a long-term reduction in fishing capacity is required to prevent declines in the yield and productivity of Pakistan's marine fisheries, in almost all species groups.** A long-term reduction of fishing effort by about 50 percent would have the highest expected benefits in terms of yield, approximating the maximum sustainable yield, MSY. This would also bring large efficiency gains by reducing uneconomic expenditure. However, more modest reductions in effort would achieve positive (albeit smaller) gains in long-term yield and efficiency. Pakistan therefore needs a fleet capacity reduction program that would (1) limit growth in vessel numbers and effort via licensing, with associated enforcement, (2) phase out certain vessel types, and (3) introduce spatial and temporal restrictions of fishing activity.

**Numerous policy options exist to achieve the required reduction in fishing and manage the renewal of capacity.** Policy makers will need to consider the scope for indirect management (e.g. by excluding the use of under-size fish for fishmeal production) versus direct capacity management (e.g. vessel withdrawals). Fishery business operators whose operations or previous investments are harmed by regulation changes may require compensation. The extent of that compensation may be based on equity, past compliance with regulation, and the need to maintain investor confidence in the regulatory framework going forward. Potentially, compensation for the effects of new marine regulation could be linked to opportunities to have shares or involvement in emerging fish farm operations.

**Pakistan would benefit from implementation of Fisheries Management Plans (FMPs), detailed frameworks that align fishing effort and specific regulations with economic objectives and scientific guidance on health of the stock.** The plans should aim to reduce effort in the most flexible and least onerous ways possible (Box 13). They should be drafted with the input of commercial and small-scale fishers, and implemented for key commercial species groups. Plans should include harvest strategies that detail technical measures to increase the selectivity and reduce the ecological impact of these fisheries. The plans need frameworks for stock rebuilding as well (FAO 2003).

#### Box 13: Main Components of a Fisheries Management Plan (FMP)

FMPs govern many fisheries worldwide. Based on the precautionary principle, they typically include the following elements:

- An overview of the fishery—participants, location, landings, and international considerations
- Stock status—biology, environment, habitat, species interactions, stock assessment, and prospects
- Management objectives—desired outcomes, and reference points (targets and limits) for key measurable indicators such as spawning stock biomass, spatial distribution, age structure, recruitment, and by-catch levels
- Decision rules—a series of rules based upon the management objectives and the pre-established reference points. These allow fisheries managers to announce what action should be taken on reaching a certain indicator level. For example, when the number of boats in the fishery reaches “a,” no further licenses will be issued for a period of “b” months, or when the spawning stock biomass reaches the limit “c,” the fishery will be closed for “d” months.
- Current management measures—measures that are established for the short term and reviewed periodically. These could include fishing seasons, closed areas, quota allocations, licensing restrictions, gear restrictions, and by-catch reduction methods.
- Enforcement strategies—the monitoring of fisheries activities by sea, land, and air, with enforcement of technical management measures, complemented by awareness building and education
- Species recovery plans for depleted stocks—temporary capacity limits or enhanced restrictions on gear, fishing areas, or season length, implemented according to specific decision rules, and revised according to stock status over time. The plan should have specific recovery targets. Where scientific information is lacking or uncertain, the recovery plan should be precautionary in its outlook.

More broadly, there is an opportunity to align future development of the fisheries sector with the ecosystem approach to fisheries (EAF).<sup>23</sup> EAF aims to manage fisheries with respect to impacts on all species, including non-commercial ones, in contrast to traditional single-species management, which may ignore interaction effects between different species of fish. This requires managing by-catch and pollution. It widens the definition of users of marine ecosystems to include both extractive and non-extractive users, and aims to improve their participation in decision-making.

### Activities proposed:

<b>2.1.1 Impose a temporary freeze on the entry of new vessels into the fishery (Federal and Provincial Governments).</b>	
<b>Short-term priority</b>	As an urgent measure, Governments should impose a temporary freeze on the entry of any new vessels into the marine capture fishery until implementation of the more robust access control measures outlined in Activities 2.1.3 and 2.1.4. This would require enforcement of existing licensing systems.
<b>2.1.2 Impose restrictions on fishing access to the most depleted fish stocks, and in conjunction implement alternative livelihood measures (Federal and Provincial Governments).</b>	
<b>Short-term priority</b>	As a further urgent measure, Governments should impose temporary restrictions on fishing of the most depleted fish stocks, including certain demersal fish and shrimps. These steps could include temporal and spatial limits, and bar use of the most harmful types of fishing gear. Where these restrictions place a high burden on resource-constrained communities, Governments should provide alternative livelihood opportunities and other forms of assistance.
<b>2.1.3 Agree to ecosystem-based principles and objectives for marine fisheries (Federal and Provincial Governments).</b>	
<b>Medium-term priority</b>	The ecosystem approach to fisheries includes principles such as (1) fisheries must be conducted in a manner that does not lead to over-fishing, (2) harvesting and processing capacity should be commensurate with estimated resource levels, (3) fishing operations should minimize their impact on the structure, function, and biological diversity of the system, and (4) the precautionary principle should be the basis for management decisions. Much of this approach is embedded in the 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan, which is recommended for adoption under Activity 1.1.1.
<b>2.1.4 Develop an NPOA for fishing capacity (Federal Government to lead with Provincial government input to implement).</b>	
<b>Medium-term priority</b>	Beyond the prevention of further growth in the capacity of the marine capture fishing fleet (Activities 2.1.1. and 2.1.2), there is a need to systematically reduce the current overcapacity. This will require a comprehensive survey of the fishing fleet and its contribution to the mortality of key stocks, and a determination of the acceptable level of mortality (see also Activities 2.1.3 and 2.1.5). Implementation of options for reducing capacity must include monitoring to assess efficacy. These options will also need to include restrictions on the near open-access nature of the marine fisheries, to prevent new entrants from offsetting the steps taken to reduce fishing.
<b>2.1.5 Develop FMPs for key commercial species (Federal Government to lead with Provincial government input to implement).</b>	
<b>Medium-term priority</b>	Revision of the current near open-access system of fishing should occur through the development of FMPs for key commercial stocks (Box 13). FMPs should operate over a period of three-to-five years with a shorter cycle for management implementation and review at the operational level. Given that many of these stocks are already critically depleted, plans should also incorporate a recovery or rebuilding process where required.

### Anticipated outcomes of these activities include:

- A strategy for fleet-capacity reduction that includes a range of management measures, including enforced licensing and spatial and temporal restrictions based on stocks' habitats and seasonal vulnerabilities. These measures should result in fishing capacity and effort that are commensurate with the reproductive capacity of available stocks.
- Harvest strategies, in the form of FMPs, for key commercial stocks, based on scientific advice and the ecosystem approach to fisheries management
- Sustained increase in the productivity of marine fish stocks over the long term (30 years).

<sup>23</sup> The ecosystem approach to fisheries (EAF) was formally included as a supplement to the FAO Code of Conduct for Responsible Fisheries (CCRF) in 2003 (FAO 2003).

## Result Area 2.2: A well-regulated and compliant fishing sector

**The updated national framework (Activity 1.1.1) for fisheries management needs to mesh with the regulatory framework.** This would ensure that harvest strategy elements such as minimum landing sizes and gear restrictions are harmonized across jurisdictions, ideally through the proposed FMPs (Activity 2.1.5). In addition, Provinces and local governments may want to develop additional fisheries-specific bylaws in response to local issues. As a starting point, a holistic review of regulations would determine what changes are needed to comply with the updated national framework.

**Enforcement of existing MSC regulations should be made a priority, supplemented with new regulations where required.** MCS in fisheries is a multi-jurisdictional affair in Pakistan. The role of the Pakistan Maritime Security Authority is well established in Federal waters (those beyond 12 nautical miles). However, the authority has less capacity and mandate to operate in shallow, coastal waters. In Balochistan, the provincial fisheries department has taken over this role. There is a case for developing Sindh Province's own capability to systematically police the Indus Delta creek network, utilizing local intelligence and fast, shallow-draft patrol vessels to respond to infringements. In waters beyond three nautical miles, a coordinated response between the Province and security authority is more realistic. This could be agreed to in a National Plan of Action (NPOA) for illegal, unreported and unregulated (IUU) fishing that confirms institutional responsibilities and sets out principles for combating these practices. Once this NPOA is established, the Provinces will be able to develop their own MCS strategies within the nationally agreed framework.

### Activities proposed:

<b>2.2.1 Develop a National Plan of Action to prevent and deter illegal fishing (Federal Government to coordinate).</b>	
<b>Short-term priority</b>	There is a need to develop a NPOA for IUU fishing that confirms the jurisdictional framework and agrees on basic principles, following consultation with neighboring countries, Provincial Governments, the fishing industry, the maritime defense forces, and other stakeholders.
<b>2.2.2 Update fisheries legislation and rules to reflect the new national fisheries policy (Federal and Provincial Governments).</b>	
<b>Medium-term priority</b>	There is a need to undertake an independent review of fisheries legislation across multiple levels of government to identify inadequacies. This should be guided by the revised national policy framework (Activity 1.1.1.), which needs to be reflected in laws and regulations. Subsequent updates to fisheries legislation should be made through a consultative approach.
<b>2.2.3 Mandate the use of satellite-based Vessel Monitoring Systems (VMS) on all commercial vessels greater than 15 meters (Federal and Provincial Governments).</b>	
<b>Medium-term priority</b>	Currently, tracking and monitoring of fishing activities is inadequate, where it exists at all. Pakistan needs a reliable, real-time tracking system for fishing vessels. Initially, this equipment should be required for the largest vessels in the fleet (greater than 15 meters) but eventually should become standard on a broader range of commercial vessels. A VMS system will also improve maritime safety.
<b>2.2.4 Develop MCS enabling actions (Federal and Provincial Governments).</b>	
<b>Medium-term priority</b>	Once the national plan of action on illegal fishing is established (Activity 2.2.1), Federal and Provincial agencies should work together to implement control processes, including VMS, fisheries monitoring centers, joint deployment plans (between Provinces, and between Provinces and the Pakistan Maritime Security Authority), standard operating procedures, and cross-warranting between different organizations. This will require considerable training and capacity-building. The asset base (e.g. patrol vessels for offshore and inshore surveillance) will also need improvement.

### Anticipated outcomes of these activities include:

- A nationally integrated and enforceable regulatory framework across Federal and Provincial levels, leading to comprehensive fisheries control and enforcement capabilities, backed by effective sanctions for non-compliant fishers

## Result Area 2.3: A healthy and productive marine ecosystem

**Pakistan is already introducing new management measures to nurture healthier ecosystems but could do much more.** Progress includes the recent designation of Astola Island as a Marine Protected Area (MPA), and the requirement that tuna gillnetters adhere to the Indian Ocean Tuna Commission (IOTC) conservation measure for billfish and sharks. Many of the ecosystem management efforts to date have been introduced by international NGOs. The World Wildlife Fund has been working with the Indian Ocean Tuna Commission on catch reporting, while the International Union for the Conservation of Nature has promoted marine protected areas and the use of Turtle Excluder Devices.<sup>24</sup> But ecosystems remain under-protected in many respects. The Sindh-based bottom trawl fleet, for example, continues the wide-scale removal of juvenile fish for the export-based fishmeal industry. Regulations are in place concerning minimum landing sizes for certain species, but enforcement is limited.

**The ecosystem approach to fisheries (introduced in Results Area 2.1) is a modern, precautionary approach to natural resource management and has the potential to improve the sustainability of Pakistan's fisheries.**

This approach requires increased focus on ecosystem management, by reducing the trophic impact of fishing certain species or size groups, reducing by-catch of juvenile, high-value or endangered species, and managing the habitat impacts of fishing gear. It is voluntary, and has been widely adopted in principle by the international community. The internationally agreed-on guidelines help governments formulate national policies and the supporting legal and institutional frameworks for sustainable fisheries.

**Activities proposed under this Results Area will underpin the fisheries-management measures in Results Area 2.1.** The recently implemented season restrictions on shrimp fishing have received growing support, creating an opportunity to build upon them by introducing additional targeted spatial and temporal protection of critical habitats and productive spawning, nursing, and feeding areas.

### Activities proposed:

<b>2.3.1 Identify and map critical coastal and marine habitats (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	Research is needed to identify and map critical fisheries-related habitats (e.g. spawning, nursing, and feeding zones) and to understand their structure, function, and seasonal variations. The findings of this mapping activity should be embedded into a marine ecosystem monitoring and management information system. This activity may be suited to foreign funding and technical assistance.
<b>2.3.2 Develop a NPOA to protect sharks and rays, sea turtles, and other vulnerable species (Federal Government to lead with Provincial Government input).</b>	
<b>Medium-term priority</b>	Recent surveys have found an absence of large species of sharks and rays, and very few smaller species of sharks and rays. There is a need to develop a NPOA for species that are iconic or critical to effective ecosystem function. Stakeholders would have to agree on implementation processes and responsibilities between levels of government.
<b>2.3.3 Develop a holistic Marine Protected Area (MPA) and No Take Zone (NTZ) network (Federal and Provincial Governments).</b>	
<b>Long-term priority</b>	Based on results of Activity 2.3.1, specific habitats and locations should be designated for protection, either as MPAs (which have specific ecological conservation objectives), no take zones (NTZs), or other forms of fishery management areas. This would require broad consultation with stakeholders, with the objective of building a connected network of MPAs and NTZs over time that protects key ecosystem elements. There will be a need to develop appropriate regulation of activities within zones, such as allowing certain types of fishing and other low-impact activities.
<b>2.3.4 Develop a national ocean policy framework to address wider impacts on marine habitats and resources in an integrated way (Federal Government to coordinate).</b>	
<b>Long-term priority</b>	Planning and management for multiple ocean uses requires the full range of uses, users and values to be considered. Given this, the development of an overarching framework to improve governance of the nation's marine space would be beneficial. This aims to guide integrated, ecosystem-based planning, and define strategies for achieving the goals and objectives defined in the process. The policy must both reflect existing national priorities (see Activity 1.1.1.) and international requirements. In the long run, the policy would lead to institutional changes.

<sup>24</sup> TEDs have been mandatory since 1999 but are not always used. In May 2017, the U.S. Government suspended Pakistan's export of wild-caught shrimp to the United States due to failure to use TEDs (see section 4.5.2).

### Anticipated outcomes of these activities include:

- Spatial data on spawning, nursery, and other critical habitats
- National plans of action, including concrete implementation processes, to protect endangered or keystone species such as sharks, sea turtles, and seabirds
- Protection of critical areas of habitat through spatial and temporal controls and the effective management of marine activities
- An overarching national ocean policy framework that identifies national priorities and strategies for the future development of Pakistan's maritime space

## Result Area 2.4: Evidence-based decision-making enabled through good science and information

### Although Pakistan has substantial research capabilities, considerable gaps in research and data remain.

Marine fisheries research is undertaken by the Marine Fisheries Department, which works specifically on fisheries management, and the National Institute of Oceanography, which works on marine biology, oceanography, and geology. A capture fisheries research plan is recommended to ensure that there is a strategic, cross-Provincial approach to common researchable constraints, and that industry gets a greater say in identifying researchable issues. This plan must be needs-driven, with stakeholder participation.

**A specific area for priority research is stock assessment.** To move towards more adaptive management, where targets are set and used as management action triggers, there is a need for on-going monitoring of stock status and condition. This is a pre-requisite for the effective implementation of FMPs (see Result Area 2.1). Purchase or extensive chartering of a deep-water research vessel should not be necessary. Rather, local researchers could develop biological indicators of stock health through sampling, supported by periodic short-term support from international specialists. Costs could be shared with neighboring countries interested in their own stocks.

**Research is also needed to identify critical fisheries-related habitats, such as spawning, nursing, and feeding areas, for the ecosystems management described in Results Area 2.3.** Research plans that fill well-defined knowledge gaps would assist in attracting research funding, including from international sources. Key areas for this research would include coastal habitat mapping and ecosystems that entail interactions between major commercial species.

### Activities proposed:

<b>2.4.1 Improve stock assessment capability (Federal Government to lead with Provincial Government input).</b>	
<b>Medium-term priority</b>	Insufficient data exist for on-going monitoring of stock status. There is a need to develop stock assessment capability to inform the operation of the Fisheries Management Plans (FMPs) (Activity 2.1.5), especially for stocks that are undergoing rebuilding. These FMPs should be aligned with international fisheries management bodies and neighboring countries where required.
<b>2.4.2 Develop marine fisheries and ecosystem research capabilities (Federal Government to coordinate).</b>	
<b>Long-term priority</b>	A prioritized, time-bound research plan addressing the main work areas, key research providers, and accompanied by sufficient budget, is necessary. This should reflect the needs of industry stakeholders (both industrial and small-scale) and reflect the broader requirements for collaboration with neighboring fishing nations.

### Anticipated outcomes of these activities include:

- A regular system of monitoring and assessment of fish stocks to facilitate adaptive management
- A well-funded, integrated research plan, across relevant Federal and Provincial agencies, that responds to the needs of marine ecosystem managers and resource users
- Fishery management decisions that are made based on high-quality scientific information

## 5.4. Recommendations: Inland Capture Fisheries

**Inland fisheries are poorly monitored and managed, resulting in uneconomic and unsustainable exploitation.** Inland fisheries face threats from water diversion (largely for irrigation) and poor water quality (due to reduced flows, siltation, bacterial contamination, and oil and heavy metal pollution). Reform requires management measures that improve environmental and economic outcomes including by supporting traditional livelihoods.

**This set of recommendations aims to deliver SDO 2: To ensure that inland fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits.**

### Result Area 3.1: Effective and equitable management of sustainable inland fisheries

**The management systems currently used in many inland fisheries do not adequately incentivize long-term sustainable use of resources, and may also be contributing to social inequities.** Most inland waters, especially in the lowland areas of Pakistan, are either privately owned, or publicly owned but leased to fishing groups. Many of the waters are inadequately policed or self-policed.<sup>25</sup> The system of short-term leases does not encourage adequate investment (including restocking) by rights-holders that could increase yields. In addition, the purchase of leases requires access to substantial capital, excluding many traditional fishers and leading to inequitable, illegal sub-contracting.

**Specific policy development for inland fisheries requires more information than is currently available, and should be based on a consultative approach.** This may be achieved through facilitated advocacy, an approach to policy development that enables diverse stakeholders to engage with each other in ways that empower vulnerable and marginalized communities. In addition to improving equity, sustainability, and productivity, policy changes are necessary to improve data collection, while maintaining or improving revenue collection for governments. The results of a review and consultation process should then be used by Provinces and Territories to choose between policy options for specific circumstances.

#### Activities proposed:

<b>3.1.1 Develop policy options for improved inland fisheries management through a consultative process (Federal, and Provincial and Territorial Governments).</b>	
<b>Short-term priority</b>	The right to fish in inland waters in Pakistan is auctioned and thus restricted to people with significant capital. There is a need to establish a more balanced and equitable system of allocating fishing rights, through leasing, licensing, and other types of waterbody management. A good initial step would be a broad consultation with inland fisheries stakeholders including traditional fishers, governments, and NGOs, to determine the current challenges and reform options.
<b>2.2.2 Update fisheries legislation and rules to reflect the new national fisheries policy (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	There is a need for an independent review of fisheries legislation across levels of government to identify inadequacies. This should be guided by the revised national policy framework (Activity 1.1.1.), which needs to be reflected in laws and regulations. Subsequent updates to fisheries legislation should be made through a consultative approach. This activity would be the equivalent of the same review process for marine fisheries outlined in Activity 2.3.2.

#### Anticipated outcomes of these activities include:

- An updated legal framework for inland fisheries that reflects a move to waterbody-level planning, as well as more equitable co-management systems, developed in consultation with communities
- Effective incentives to promote higher productivity in inland fisheries, including pro-active management measures and private investments

<sup>25</sup> For example, in Punjab, the Forestry Wildlife and Fisheries Department have “fisheries watchers” to monitor fish catches. However, they are rarely present when fish is landed and often rely on reporting from fishing contractors who have reason to under-report landings to keep the lease value low.

## Result Area 3.2: Effective management of freshwater ecosystems

Pakistan's freshwater aquatic ecosystems produce goods and services of direct benefit to fisheries, but are subject to a range of threats, including water diversion, pollution, and exotic species, all of which can harm fisheries productivity. Likewise, fishing activity itself impacts ecosystem health. Pakistan needs research and policy action that safeguards ecosystems to maintain fisheries productivity and long-term sustainability.

Currently, systematic collection of inland fisheries data is limited, hindering ecosystems-based management. More comprehensive data collection would inform management decisions regarding catch limits and water management. More broadly, this knowledge could build understanding of the trade-offs and synergies between sectors (for example, between agriculture water use and fish production). It could also support adaptive co-management between communities and Provincial and Territorial Governments.

### Activities proposed:

<b>3.2.1 Map critical inland fisheries habitats (Federal Government to lead with Provincial and Territorial Government support).</b>	
<b>Medium-term priority</b>	New research is needed to identify and map critical fisheries-related habitats (e.g. spawning, nursing, and feeding zones) and to understand their structure, function, and seasonal variations. The results of this mapping should be embedded into an ecosystem monitoring and management information system. This activity may be suited to foreign funding and technical assistance and is the equivalent of the research process for marine fisheries outlined in Activity 2.2.2.
<b>3.2.2 Systematically collect inland fisheries data, and use them to inform management (Provincial and Territory Governments to lead with Federal Government support).</b>	
<b>Medium-term priority</b>	There is no systematic collection of inland fisheries data in Pakistan. There is a need to mandate the reporting of all landings, and for government agencies to increase inspections to ensure compliance. As more data become available, they can inform adaptive management (Activity 3.2.3).
<b>3.2.3 Develop decision support tools for freshwater ecosystems management (Federal, and Provincial and Territorial Governments).</b>	
<b>Long-term priority</b>	There is needed to develop decision support tools that integrate ecosystem and waterways information into inland fishery decision-making. These should embody the precautionary principle and adaptive management. Such decision-support tools should inform decisions on catch limits as well as broader issues of fresh water management (such as irrigation levels) that may have implications for fisheries.

### Anticipated outcomes of these activities include:

- A spatial data-management system that holds up-to-date data on critical freshwater ecosystems
- Decision support tools to facilitate freshwater ecosystem management
- A coordinated system of research and data collection that supports inland fisheries



*Inland fishing, Sindh (Thomas Koch, Shutterstock)*

## 5.5. Recommendations: Aquaculture

**Aquaculture is expanding in scope and productive capacity.** To organize, monitor, and manage development of the sector, governments require well-defined policies, an overarching strategy, and an accessible, coherent set of laws supporting policy implementation. There is also a need for a formal system of zoning and licensing for fish farms to manage potential social and environmental trade-offs. Mechanisms for managing biosecurity risks from imported aquaculture inputs are also crucial.

**More broadly, government actions to promote aquaculture should aim to provide an enabling environment for private investment in the sector.** Many of the proposed risk-reduction actions could help build a positive investment climate. However, systems such as licensing and quarantine controls must avoid stifling private sector investment, by ensuring transparent and rapid processing.

**This set of recommendations aims to deliver SDO 4: Ensure that aquaculture is managed in a way that will enable Pakistan to satisfy local demand, grow exports, provide an alternative to wild capture, and contribute to early childhood nutrition and the empowerment of women.**

### Result Area 4.1: Effective planning and management of aquaculture

**Aquaculture faces risks concerning pollution to and from the environment (including farms polluting each other), floods and storms (particularly on coastal installations), food safety and public health risks, and biosecurity risks, among others.** The following recommendations aim to manage these risks, giving industry the certainty required to invest and innovate. Most of these recommendations relate to commercial aquaculture development and the risks these operations face, including restrictions on export markets. Governments may also wish to take actions that encourage homestead aquaculture (microenterprises), which could improve food security, poverty alleviation, and women's empowerment (see also Sections 3.5 and 5.6).

**An important component of risk management in aquaculture is spatial planning, which can reduce environmental and social trade-offs, and increase efficient use of supporting infrastructure.** This planning entails determining where aquaculture development should occur and where it should not—for instance, in places where it could harm mangrove forests or water supplies. To complement this protection, the licensing of fish farms can enable monitoring and appropriate regulation, including abstraction and discharge consents, environmental impact assessments, and notifiable disease monitoring. Closely associated certification and quarantine management issues are covered in Results Area 4.2.

<b>4.1.1 Develop and implement aquaculture spatial plans, including zoning, within the broader context of completing a strategic environmental assessment for the aquaculture subsector (Federal, and Provincial and Territorial Governments).</b>	
<b>Short-term priority</b>	A key constraint for the development of aquaculture is the lack of strategic planning, including strategic environmental assessment. There is a need to undertake a specialist review to create zoning options in a participatory manner, engaging key stakeholders such as farmers, business groups, technical experts, and environmental managers. After completing the review, Governments should undertake detailed aquaculture zoning including site selection and definition of management areas (for example, areas containing farms that share a common water supply). This zoning should utilize already-available database software to record industry data and manage zoning. This activity may be suited to foreign funding and technical assistance.
<b>4.1.2 Develop and implement streamlined requirements for aquaculture site licensing (Provincial and Territorial Governments).</b>	
<b>Short-term priority</b>	An aquaculture license should be a pre-requisite for establishment of new fish farms. As such, there is a need to undertake an independent review of licensing options in a consultative manner. The resulting licensing system should be streamlined and business-friendly, and be linked with a spatial planning database (Activity 4.1.1). There should be a strong focus on minimizing costs to business.
<b>4.1.3 Streamline the oversight and management of inter-Provincial/Territorial, and Federal-Provincial/Territorial affairs and international treaties (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	To ensure that zoning and licensing systems operate effectively, with minimal cost to business, existing approval and administration processes should be streamlined, with a view to also clarifying roles and responsibilities across jurisdictions and levels of government.

**Anticipated outcomes of these activities include:**

- A comprehensive, strategic spatial planning system that guides aquaculture investments and minimizes social conflicts and environmental externalities
- A robust aquaculture site licensing system, linked to the spatial planning system, that facilitates management
- An aquaculture sector that is globally competitive and compliant with international agreements and requirements

## Result Area 4.2: Effective planning and management of aquatic animal health (AAH)

**Aquaculture entails biosecurity risk, which, if not managed, can undermine profitability and endanger the aquatic environment and human health.** This results area proposes actions aimed at managing these risks, as well as participation in international agreements, such as the Office International des Epizooties (OIE).

**Although imports already need certification by the Animal Quarantine Department (ADQ), many ports of entry (by air, sea, or land) lack facilities to quarantine consignments and have no capability to test for diseases.** Controls are often simply a visual check of live fish at the point of import and export. As is typical during the early development of an aquaculture industry, Pakistan imports seed and broodstock from other countries. Improved certification and quarantine arrangements are required to prevent importation of disease. Improved controls would also reassure investors that their investments will not be ruined by outbreaks of disease.

**Shrimp disease, in particular, has the potential to wipe out a future shrimp aquaculture industry in Pakistan, and must be avoided.** In many other countries, shrimp disease has driven harmful use of chemicals, switches in species cultured, and large-scale disinvestment. Given the current limitations in Pakistan's animal health system—specifically, its minimal viral diagnostic capacity and lack of effective quarantine—the likelihood of a shrimp disease outbreak is very high.

**The management of biosecurity risks would be helped by the creation or strengthening of a focal institution at the Federal level to drive implementation of an AAH policy.** In conjunction with this institutional reform, AAH legislation at the Federal and Provincial levels may need revision to allow for specific programs and actions.

### Activities proposed:

<b>4.2.1 Identify the components required for a unified certification and quarantine management system to regulate species introductions and disease management (Federal Government to coordinate).</b>	
<b>Short-term priority</b>	This would involve bringing together stakeholders to agree on responsibilities regarding species introductions and disease management. The process would establish a national framework for AAH, drawing also on international obligations and responsibilities (see Activity 4.2.2.). It is recommended that the Animal Quarantine Department be established and strengthened as the focal Federal institution for comprehensive AAH policy development and implementation.
<b>4.2.2 Introduce certification and quarantine (Federal Government to lead with Provincial/Territorial support).</b>	
<b>Medium-term priority</b>	To ensure international competitiveness, Pakistan should adopt international standards and agreements (i.e. the WTO Agreement on the Application of SPS, and the OIE Aquatic Code). This will include the development of measures for diagnostics, risk analysis, health certification, quarantine, surveillance, disease reporting, contingency planning, and disease control. Once such measures have been designed, and the AAH framework (Activity 4.2.1) is in place, introduction of certification and quarantine management measures could follow. This will need to include designation of specific points of entry for aquatic animals into Pakistan, ensuring that each has diagnostic capacity and quarantine facilities. These measures will require training of inspection staff and capital investment (see Activity 4.2.3).
<b>4.2.3 Develop supporting diagnostic and research capability (Federal Government to lead with Provincial/Territorial support).</b>	
<b>Medium-term priority</b>	There is a need to draw on regionally available capacity-building for AAH management and research. The AQD should develop links with the regional AAH network. This would enable Pakistan to work with specialists, donors, and grant providers to expand research capability. It is also recommended that the University of Punjab expand its diagnostic capacities and cascade its skills and techniques to other institutions throughout Pakistan. This should be undertaken in concert with a corresponding upgrade of AAH facilities at academic institutions and designated points of entry. The government should also build diagnostic capacity in AAH at its National Veterinary Laboratory.
<b>4.2.4 Undertake a national fish disease survey and establish a routine monitoring system (Federal Government to lead with Provincial and Territorial Government support).</b>	
<b>Medium-term priority</b>	Monitoring diseases in the fisheries sector is key to establishing risk-based assessments and protocols. Governments should implement a national survey of fish diseases and a reporting protocol for notifiable diseases. The government should also ensure that required notification of international organizations occurs.

### Anticipated outcomes of these activities include:

- An aquaculture industry with appropriate AAH surveillance and control systems to minimize the risks of disease
- The requisite capacity, including facilities, to undertake aquatic animal disease diagnosis, research, and control
- Fulfillment of domestic disease management responsibilities and international AAH obligations

### Result Area 4.3: Expanded and improved aquaculture extension and training

**An important role for governments in the promotion of aquaculture is the distribution of up-to-date public good knowledge through extension.** Current aquaculture practices in Punjab and Sindh are dominated by carp cultured using traditional practices. Increased diversity and intensity of production will require new techniques and technologies. There are spill-over benefits to encouraging adoption of innovative and feasible ideas in the aquaculture community. Government can learn from early adopters who are prepared to take risks, and can help transfer that knowledge (where it is not proprietary) to others within the industry.

**Aquaculture extension in Pakistan primarily takes place at the Provincial and Territorial level.** Aquaculture extension in Sindh is focused on two centers in Karachi and Chilya. In Punjab, there is the Fisheries Research and Training Institute (FTRI) at Manawan. Recent innovations have included adding novel species such as tilapia to the training content, as well as new systems such as cage culture and hatchery management. FTRI recently sent “master trainers” to the Asian Institute of Technology in Thailand for training.

**There is an element of extension in the way that the Federal FDB operates joint ventures for the introduction of new systems and species, but few formal mechanisms exist to share learning beyond immediate stakeholders.** Sometimes new equipment used for trials, such as net cages or pens, are made available to fisheries departments for subsequent use. In general, greater dissemination of learning from FDB could more effectively promote industry best practices and innovations. Universities currently play a small role in training and sharing their research; this too could be expanded.

#### Activities proposed:

4.3.1 Engage in South-South knowledge exchange (Federal, and Provincial and Territorial Governments).	
<b>Medium-term priority</b>	There is a need to develop more comprehensive aquaculture extension and training in Pakistan. It is recommended that Pakistan build on the “master trainers” approach being piloted in Punjab in consultation with the Asian Institute of Technology. This would help raise capacity by training trainers from across Pakistan in neighboring countries that have advanced aquaculture industries. Re-engaging with international and intergovernmental organizations to coordinate the sharing of learning would further support this development.
4.3.2 Share best practices, differentiated by aquaculture type (Federal, and Provincial and Territorial Governments).	
<b>Long-term priority</b>	As Pakistan builds experience in aquaculture, it needs to ensure that records are maintained of good aquaculture practices (GAPs), developed with reference to internationally recognized standards. These could serve as a resource for future capacity development. The records should be differentiated by types of aquaculture, variously addressing the needs of commercial investors, aquaculture for poverty alleviation, and aquaculture for local nutritional improvement. To support dissemination of this information, a network of “one-stop Aqua Shops” could be developed, where knowledge sharing is combined with access to aquaculture inputs and equipment.

#### Anticipated outcomes of these activities include:

- Vibrant extension services for sharing innovations in aquaculture across Pakistan and internationally

## Result Area 4.4: Expanded and improved aquaculture research and development aligned with industry needs and government objectives

**While some aquaculture research is underway in Pakistan, it could be expanded considerably.** On the Federal level, the Fisheries Development Board is piloting cage culture, sea bass farming, and shrimp farming via joint ventures with private sector partners. The National Institute of Oceanography is collaborating in coastal marine aquaculture research with a shrimp hatchery at Sonmai and grow-out ponds at Ghiro Bari. Other research actors include the Pakistan Agriculture Research Council (PARC) and the Fisheries Research and Training Institute (FTRI), which conduct research on freshwater aquaculture, feeding, and toxicology. The University of Punjab, Lahore, is investigating sustainable aquaculture, conservation, and ecosystem restoration. The private sector is also active, with feed companies experimenting with fish feeds, and entrepreneurs experimenting with new species and systems on their farms.

**A national research strategy would help build collaboration and coordination among these institutions, and better align their activities with industry needs and government objectives.** The strategy should provide more resources, international links, and inter-institutional coordination, including between public and private entities.

### Activities proposed:

<b>4.4.1 Improve aquaculture research (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	There is a need to build links between aquaculture research and development stakeholders. A research strategy could help integrate the efforts of different stakeholder groups, including between public and private actors, and provide financial support for applied, public good research.
<b>4.4.2 Support research relevant to poverty alleviation and nutritional and micro-nutritional food security (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	There is a need to support participatory research and development in aquaculture that is suited to people who have few resources, low risk tolerance, and limited capital for investment. Special attention should go to women farmers and people involved in the production of small indigenous fish with nutritional benefits. There is a need to support research (including field trials and associated extension activities) on aquaculture activities that specifically provide solutions for malnutrition and women's empowerment. Development of methodologies for the systematic evaluation of micro aquaculture practices would also advance this goal.
<b>4.4.3 The public and private sectors should co-create commercial aquaculture (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	There is an opportunity to develop new culture systems by building on the model emerging from the FDB (or to extend the FDB's activities directly), in which public institutions undertake commercially-orientated research and development in partnership with the private sector.

### Anticipated outcomes of these activities include:

- Aquaculture research and development that improves extension materials and best-practice understanding, and adapts them to local conditions based on scientific trials and evidence
- Research and development that supports sector zoning and licensing, and promotes the industry's growth in ways consistent with governments' objectives
- The development of new types of commercial aquaculture in Pakistan through collaboration between public and private sectors

## 5.6. Recommendations: Value Chain Performance

**Strengthening value chains is key to ensuring Pakistan maximizes the value on each unit of fish produced.**

Whether from inland capture, marine capture, or aquaculture subsectors, the strength of the value chain determines the economic and thus social returns to fisheries. To date, value chain enhancement has been limited, and Pakistan's fish products do not achieve their full market potential. Investment in infrastructure, labor force skills, firm productivity, and market development can change this.

**This set of recommendations aims to achieve SDO 5: Ensure the contribution of the fisheries sector to economic development through enhanced productivity, value-addition, branding, and market access.**

### Result Area 5.1: Investment in infrastructure and services that adds value and enhances quality

**Strategic infrastructure and services investments would support firms' efforts to increase the value of their product, deliver quality to consumers, and compete internationally.** These investments should focus on the common infrastructure and services that support a wide range of fishing enterprises along the value chain. Strategic placement can help build economies of scale, enhancing competitiveness and productivity.

**There is the potential to develop a "blue growth hub" at Korangi Harbor.** Existing plans to create a seafood processing hub at Korangi have stalled and should be revived. This hub can serve as a "competitiveness cluster", building a critical mass of fisheries firms that strengthens both upstream and downstream value chains. To be successful, the hub requires investment in basic infrastructure to encourage private-sector value-adding enterprises to invest and co-locate. Training and extension services could be based there. Over time, the co-location of businesses will drive productivity and efficiencies through the sharing of facilities and export services, and through peer-learning. Cost recovery may be possible through user fees.

**Similarly, investments in "fresh fish hubs" can improve the current poor state of facilities and SPS conditions found in fish markets, helping to bring buyers and sellers together in a way that improves value.** Public investment in facilities that serve as common resources for fish buyers and sellers, such as auction halls, loading facilities, cold chain facilities, and sales areas, will strengthen competitiveness, improve quality and product value.

#### Activities proposed:

<b>5.1.1 Support the development of a competitive seafood cluster at Korangi Harbor (Sindh Government to lead with federal government support).</b>	
<b>Medium-term priority</b>	There is a need to review and update the existing development model for the harbor including infrastructure planning. This review should include representatives from both the Sindh Government and the private sector, and should explore options for investment in catalyzing infrastructure, and for cost recovery based on user fees.
<b>5.1.2 Improve infrastructure, conditions and public services at fish markets (Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	Conditions in fish markets require improvement. Upgrades to facilities such as auction halls, loading facilities, cold chain facilities, and sales areas, and improvements to supporting public services, will improve quality and opportunities for value addition.

#### Anticipated outcomes of these activities include:

- A competitive business environment and supporting infrastructure that encourages value addition and productivity-enhancing investments

## Result Area 5.2: Improved productivity, quality, and market access

**Improvements in productivity, in terms of both quality and quantity, would lead to greater value addition and international competitiveness.** Poor productivity occurs due to limitations in knowledge and skills. Productivity could be improved by more effectively sharing knowledge throughout the sector, benchmarking, investing in training that utilizes the benefits of the competitiveness seafood cluster (see activity 5.1.1) and instituting codes of practice (COPs). Simultaneously, new markets should be developed through outreach, promotion and analysis to increase demand for Pakistan's improved fish products.

**Greater use of COPs can also increase productivity.** For example, UNIDO successfully introduced COPs for small fishing vessels as part of the TRTA II Project in Balochistan. Training and extension services should use and expand these COPs to further upskill stakeholders in productivity enhancement.

**Productivity indicators and benchmarking can encourage innovation, learning from others, and thus greater competitiveness.** Benchmarking would help drive improvements by allowing firms to compare their operations to those of best-practice operators. This could be organized and operated by industry associations.

### Activities proposed:

<b>5.2.1 Invest in market development activities (Federal Government to coordinate).</b>	
Short-term priority	There is a need for in-depth market and competitor analysis to identify new market opportunities internationally. This should include funding for development of branding strategies, promotional plans, participation at trade exhibitions, and network-building with potential buyers.
<b>5.2.2 Develop quality standards for selected products (Federal Government to coordinate).</b>	
Medium-term priority	There is a need to develop a grading scheme for product quality, to assess both products and producers. This should be based on stakeholder consultation and draw on international standards.
<b>5.2.3 Develop a model factory for productivity and value-add training, and promote Codes of Practice (Sindh Government to lead with federal government support).</b>	
Medium-term priority	There is a need to designate a model factory or productivity center that can be used as a best practice site for research and training, including on safety procedures. Ideally, this would be located near or within the Korangi Blue Growth Hub (see Activity 5.1.1).
<b>5.2.4 Undertake benchmarking to establish firm-level productivity indicators (Federal, and Provincial and Territorial Governments).</b>	
Medium-term priority	There is a need to establish productivity metrics, based on skills, processes, and equipment, to benchmark firms and encourage measurable improvements.

### Anticipated outcomes of these activities include:

- Access to new international markets for higher quality products
- Productivity indicators and benchmarking to ensure value-chain businesses are ready to compete internationally
- Creation of added-value products supported by attainment of accepted, industry-wide safety and quality standards

## 5.7. Recommendations: Optimizing Benefits

**Pakistan's substantial fishery resources offer significant potential for development.** With the right reforms and strategic public investment to unlock private-sector potential, fisheries could become an engine for growth, generating many times their current value and providing new and better jobs. Pakistan's fisheries could also contribute to important social goals: nutrition and food security, better livelihoods for small-holders, and increased opportunities for women.

**This set of recommendations aims to achieve SDO 6: Optimize the economic and social benefits generated by more productive and sustainable fisheries.** This will require greater visibility and accounting for food security and nutrition, community empowerment, and gender equality in capture fisheries and aquaculture.

## Result Area 6.1: Improved nutrition and food security for all

**Fish consumption can support Pakistan's efforts to combat food insecurity and malnutrition.** At present, about 20 percent of the population is considered undernourished. Childhood stunting rates exceed 40 percent, placing Pakistan among the top countries in the world for this condition (World Bank 2015). Increased fish consumption among the poor could help alleviate the problem: Fish is a good source of proteins, healthy fats, and essential nutrients such as long-chain Omega-3 fatty acids, iodine, vitamin D, and calcium. Small, micronutrient-rich fish (suitable for polyculture in homestead ponds) are particularly beneficial. Fish consumption in the country is currently very low, about 2 kg per year per capita, compared to a global average of 17 kg.

**However, there are cultural preferences that must be considered, as well as income constraints for people who are not directly involved in capture or aquaculture activities.** Greater fish production can increase fish consumption directly if smallholders who produce or catch fish eat it, or indirectly if the greater production stabilizes prices and creates wider availability in local markets. Growth in the fisheries sector may also provide jobs and boost incomes, allowing for improved consumption of nutritious food in general (see Section 3.5). However, these possibilities must be considered in the context of cultural preferences. The present low rates of consumption indicate the minor role that fish play in Pakistan's food culture; acceptance of or a preference for fish may not occur rapidly or at all.

**There is also a need to better understand the food security and nutrition implications of different types of development within the fisheries sector.** Policy choices will lead to trade-offs and synergies. For example, a more export-orientated fisheries sector (which may be the most feasible expansion in the short term, given low domestic consumption) will play a smaller direct role in providing food security and nutrition to the domestic population, particularly for the poor, but can still have important indirect benefits (via increased incomes) for food security and nutrition. Likewise, the impact of certain capture fisheries activities, such as the use of juvenile, edible, fish for non-food fishmeal, should be considered in terms of national food security.

### Activities proposed:

<b>5.1.1 Assess demand for fish and fill knowledge gaps on the trade-offs and impacts of current practices (including exports of fishmeal and imports of pangasius) on food security (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	There is a need to understand the opportunities and trade-offs for food security and nutrition that result from development of the fisheries sector. An important knowledge gap is the impact of fishmeal production on domestic fish consumption (as well as the size of lost export potential from alternative, higher-value uses of these stocks). There is a further need to assess fish consumption and preferences among different subsets of consumers, to better understand opportunities for targeted fish promotion. Research on the nutritional value of species currently consumed and marketed would also be useful.
<b>5.1.2 Promote the consumption of fish (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	Based on the findings from Activity 5.1.1., within-government discussions could be initiated to emphasize the role fish can play in nutrition and human health. Existing health programs could be augmented to include fish, where appropriate. New nutrition campaigns about the benefits of fish consumption would need to be sensitive to cultural preferences.
<b>5.1.3 Promote the culture of small indigenous fish as a key source of nutrients and micronutrients (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	There is a need for research into the feasibility of polyculture production methods for small nutrient-rich indigenous fish species, drawing on the experience of other countries, Bangladesh in particular. The findings from this research could be integrated into extension activities (see Results Area 4.3 and 4.4). Promotion would also be assisted by making small fish cultivation eligible for microenterprise grants.

### Anticipated outcomes of these activities include:

- An increased proportion of fish in Pakistani diets, contributing to improved food security and nutrition
- Higher production through aquaculture resulting in wider availability of affordable and nutritious fish to poorer groups, particularly in rural areas

## Result Area 6.2: Greater attention for gender issues and progress towards gender equality

**The proportion of women who work in fisheries in Pakistan, and the wages they are paid, are highly unequal.** This mirrors broader social inequities: across the workforce as a whole, Pakistan has a strong gender disparity with 81.1 percent male and 24.3 percent female participation (ILO 2016). Pakistan ranks 143rd out of 144 countries in the 2016 Global Gender Gap Report and 130th out of 159 in the 2015 Gender Inequality Index. Reforms to fisheries should prioritize actions that disproportionately provide opportunities for women. Monitoring and evaluation of reforms should pay special attention to gendered impacts.

**Actions that enable growth in the post-harvest activities and value-add subsectors are likely to improve the status of women.** Women are much more likely to take on these roles than roles in harvesting (FAO 2016a and Weeratunge et al. 2010). These roles are also safer and better paid than most harvesting jobs.

### Activities proposed:

<b>5.2.1 Include gender considerations in every fisheries development intervention (Federal, and Provincial and Territorial Governments).</b>	
<b>Short-term priority</b>	All large investment or reform programs should develop an explicit gender strategy. Project activities should ensure that investments made under the Fisheries Development Funds (see Results Area 1.2) disproportionately benefit components of the fisheries value-chain that employ women. Government offices involved in fisheries programs should demonstrate leadership by ensuring above-average female representation among staff, including at higher decision-making levels.
<b>5.2.2 Improve data collection to capture women's participation in the sector (Federal Government to coordinate).</b>	
<b>Medium-term priority</b>	There is a need to revise data collection templates and protocols to allow for the disaggregation of data (e.g. employment, production, income, and access to resources) by gender. To support this, a program of training and awareness of gender issues should be implemented at government fisheries institutions.
<b>5.2.3 Increase the attractiveness of aquaculture for women's employment and entrepreneurship (Federal, and Provincial and Territorial Governments).</b>	
<b>Medium-term priority</b>	There is a need to attract more women into aquaculture. A good first step would be to increase the number of female students in aquaculture-related higher education and training. This could be facilitated by promoting employment opportunities for newly graduated women throughout the fisheries industry. The FDFs could be used to support women-led or women-supporting enterprises. Programs could also require that FDF-supported enterprises commit to equal opportunities and equal pay, and report on hiring practices during grant renewal periods.

### Anticipated outcomes of these activities include:

- Greater contribution by fisheries and aquaculture towards gender equality in Pakistan
- New opportunities for entrepreneurship and income for women through higher participation in aquaculture.

## Result Area 6.3: Community empowerment and improved livelihood opportunities

**Small-scale fishing communities are some of the poorest communities in Pakistan.** Coastal communities of small-scale fishers have been hit particularly hard by the decline in fish numbers. Inland, more than 60 percent of fishing households in communities in the Indus Ecoregion are living below the poverty line (WWF 2015), and for some communities, fishing is no longer a viable source of income.

### Ensuring fisheries sustainability requires greater community involvement in fisheries decision-making.

At present, there is little culture of stakeholder participation in fisheries management. Co-management of natural resources brings governments and local communities together to collaboratively provide management and enforcement. The model has been widely used internationally (Pomeroy and Rivera-Guieb 2006). Co-management allows communities to fashion regulations that best suit local conditions and moves enforcement responsibility towards those closer to the resource. Communities must be supported in their efforts to take responsibility. An overarching framework should be developed to guide co-management.

**Fishing-dependent communities also require support to diversify livelihoods.** Financial and technical support can provide new agricultural and micro-enterprise opportunities. These may be within fishing value chains or aim to reduce pressure on capture fisheries by providing non-capture fisheries alternatives (including homestead aquaculture). Support for alternative livelihoods is also an important complement to any fisheries management changes that restrict access to fisheries (done to ensure the sustainability of stocks).

### Activities proposed:

<b>6.3.1 Empower fishing communities to develop their own management plans (community based natural resource management) (Provincial and Territorial Governments to lead with federal government support).</b>	
<b>Medium-term priority</b>	There are opportunities to promote community co-management of resources and increased participation in governance over artisanal capture fishing. Through a consultative process, communities can be given the option to take on a greater management role of their capture fisheries resources, based on community fisheries resource management plans developed in partnership with government. Support should be provided to ensure communities have the capacity to implement their plans. This will likely be best suited to inland, near-shore or estuarine resources which can be managed at smaller spatial scales.
<b>6.3.2 Provide extension and financial support (grants or small loans) for households to diversify incomes through homestead aquaculture (Provincial and Territorial Governments to lead with Federal Government support).</b>	
<b>Medium-term priority</b>	Homestead aquaculture opportunities should be made available to very poor households through community-based technical and financial support. Financial support could take the form of micro loans or small grants for constructing and stocking small ponds or investing in post-harvest activities. Low input aquaculture systems, which could include small-nutrient rich fish polyculture systems, are likely most suitable.
<b>6.3.3 Provide extension and financial support (grants or small loans) for households to diversify incomes away from reliance on vulnerable or declining capture fish stocks (Provincial and Territorial Governments to lead with Federal Government support).</b>	
<b>Medium-term priority</b>	For fishing communities that are highly reliant on declining capture fish stocks, alternative livelihood opportunities should be made available through community-based technical and financial support. These may include agricultural or small enterprise activities. Support should be implemented in parallel with community-based management activities that reduce pressure on fish stocks where required (see activity 6.3.1).

### Anticipated outcomes of these activities include:

- Greater contribution of communities towards the management decisions over their local resources
- Diversified rural incomes and improved economic opportunities in marginalized rural areas
- Reduced economic dependence on vulnerable or declining capture fisheries stocks, alleviating pressure on stocks



Fishing boats at Karachi Harbor (Shayan Shaukat, licensed under CC BY-SA 3.0)

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# ANNEX 1: FISHERIES MODELLING METHOD

The projected benefits of fisheries capacity reduction are determined using a bioeconomic model. Benefits are calculated as the difference in profits between a range of defined policy scenarios (in which fleet capacity is controlled by policy) and a status quo scenario. Profits are calculated from costs, which are assumed to scale linearly with fishing effort, and revenues, which are assumed to scale linearly with projected catch.

## 5.1. Data

The bioeconomic model separately estimates stocks and catches for 13 species groups, representing the most important commercial species and approximately 70 percent of total reported landings by volume. Fanning et al. (2015) provide stock parameters for shrimp, demersal, and small pelagic species groups, as well as fishing effort data in the form of an estimated time series of standardized effort.<sup>26</sup> Different effort series are available for shrimp, demersal, and pelagic species groups.<sup>27</sup>

Prices data comes from the value of landings by species in the Sea Around Us (2017) database. A weighted average of prices is taken over species contained within each functional group. Cost of fishing data is obtained from Lam et al. (2011), who estimated the costs for specific gears, countries, and inputs (including labor).

To determine cost of harvesting, the species groups were aligned with FAO FishStat categories, and attributed to newly collected data describing the quantity of species landed using each gear type at the country level (pers. comm. Tim Huntington 2017). For price and cost data, species groups cannot be completely reconstructed from the other datasets, and hence both are approximations. The average cost of fishing for each gear type for each species group is determined using the weighted proportion of each species' catch landed with each gear type.

## 5.2. Bioeconomic Model

The analysis uses a bioeconomic model (the Schaefer-Gordon model<sup>28</sup>) to project outcomes under different effort levels. Effort at each point in time is chosen exogenously for simplicity, based on assumptions about how a particular policy will influence effort.

The Schaefer-Gordon model predicts fish populations assuming a logistic growth function in population size. Stock,  $B_t$ , at time  $t$ , is a function of fishing mortality,  $C_t$ , the intrinsic rate of growth,  $r$ , and the carrying capacity (proxied by estimates of initial stock size,  $B_o$ ):

Eq. 1 
$$B_t = B_{t-1} + rB_{t-1} \left( 1 - \frac{B_{t-1}}{B_o} \right) - C_t$$

<sup>26</sup> Fishing effort is a function of the number of vessels and workers, the capacity of vessels, the size and type of equipment used, and the amount of time these inputs are applied to the fishery. Many of these details are unknown in the case of Pakistan. MFD maintains annual records of the number of vessels in three categories (trawlers, gillnetters, and sail/onboard vessels). Fanning et al. (2016) combine these data with port clearance data to develop the standardized effort series.

<sup>27</sup> While within these categories (shrimps, demersal, and small pelagic species), species groups are often caught together, different gear types and limited species selectability means that the fishing effort faced by a species group may differ slightly from the effort series determined for the aggregate groupings. Effort levels are scaled for each species group so that the predicted harvest in 2015 matches the observed harvests from 2012-14. This gives a conservative estimate of effort and serves to calibrate the model based on recent historical experience.

<sup>28</sup> This model was chosen over alternatives to ensure consistency in assumptions between this report and Fanning et al. (2016), who estimate Schaefer surplus production parameters. Estimates are made by fitting the observed catch and effort data with a Gaussian likelihood function. More detail and assumptions underpinning the use of the Schaefer-Gordon model are available in Clark (1985) and Seijo et al. (1998).

Catch is to be a function of effort,  $E$ , (controlled exogenously by an assumed policy), fishery biomass in the previous season,  $B_{t-1}$ , and catchability,  $q$ . We approximate  $q$  from the linear relationship between observed catch per unit effort (CPUE) and biomass. This relationship captures the constant rate of change in CPUE as a function of biomass, approximating catchability.

$$\text{Eq. 2} \quad C_t = B_{t-1} * E_t * q$$

Combining equation 1 and 2 gives:

$$\text{Eq. 3} \quad B_{t+1} = B_t + rB_t \left(1 - \frac{B_t}{B_0}\right) - B_t * E_t * q$$

Which can be solved for the equilibrium (i.e. static) sustainable yield,  $Y^*$  by setting  $B_{t+1} = B_t$ :

$$\text{Eq. 4} \quad Y^* = B_0 q E \left(1 - \frac{qE}{r}\right)$$

This equation gives a parabola that represents the long-term production function of the fishery (Figure 7). Maximizing  $Y^*$  with respect to  $E$  gives the maximum sustainable yield,  $E^{MSY}$ , which informs the effort target for our MSY scenario. This target is determined for each species group, over which is then taken the weighted average (weighted on 2014 revenue) to determine a single MSY effort target for all species groups within the demersal, shrimp, and small pelagic fisheries. It is also possible (although likely difficult) that individual MSY effort targets could be developed for each fishery via individual fisheries management plans (FMPs), informing the “targeted” policy scenarios (described below).

### 5.3. Policy Scenarios

The status quo comparison is simply 2014 levels of capacity held constant. While it is unlikely that capacity would stay constant over this time, it may represent a conservative assumption given that effort levels have been rising for many years and continue to rise. Predicting effort levels on the basis of sector profitability, while possible, adds an additional layer of complexity and assumptions to the analysis.

Policy scenarios are defined by three variables: time taken to reduce capacity (achieved through fleet limits, gear limits, and seasonal limits, as appropriate for each species group), the level of capacity reached at the end of the policy period, and the change in capacity in the post-policy period (Table A - 1). Changes are assumed to progress smoothly over the defined time periods. The analysis does not make claims about the likely success of any policy. It instead calculates expected outcomes should a scenario’s target level of effort (e.g.  $E^{MSY}$ ) eventuate.

**Table A - 1: Policy Scenario Descriptions**

Policy scenario	Scenario characteristics		
	Capacity reduction period (years)	Capacity level targets (percent of 2014 levels)	Post-policy period capacity levels
Reform policy	10	MSY averaged over main species groups: demersal 55%, shrimp 61%, small pelagic species 41%	Remains at target level
Temporary reform policy	10	75%	Gradual return to status quo (2014) levels by end of analysis period
Fast reform policy	5	MSY averaged over main species groups: demersal 55%, shrimp 61%, small pelagic species 41%	Remains at target level
Fast and temporary reform policy	5	75%	Gradual return to status quo (2014) levels by end of analysis period
Targeted reform policy	10	MSY calculated for each main species group (as per MSY outcomes shown in Figure 7)	Remains at target level
Fast and targeted reform policy	5	MSY calculated for each main species group (as per MSY outcomes shown in Figure 7)	Remains at target level

# ANNEX 2: SUMMARY OF POLICY RECOMMENDATIONS

Result Area 1.1: Reformed governance for greater oversight and coordination			
<b>Context:</b> <ul style="list-style-type: none"> <li>The current governance system for fisheries and aquaculture is highly fragmented.</li> <li>There is a lack of strategic policy vision for fisheries and aquaculture development at the national level</li> <li>There is a need for greater attention on the problems faced by small-scale inland and coastal fishing communities</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>An overarching national policy framework, agreed to by key stakeholders, that can provide the basis for the establishment of detailed Provincial and Territorial policies, strategies, and action plans that are consistent across borders but tailored to fit local context</li> <li>The implementation of a robust framework of laws and regulation to guide the sustainable development of fisheries and aquaculture across Pakistan</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
1.1.1 Develop a national, unified policy for fisheries and aquaculture inclusive of Provincial and Territorial provisions for implementation	<ul style="list-style-type: none"> <li>Update the contents of the 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan.</li> <li>Agree on an overarching policy framework harmonizing the handling of issues straddling Federal and Provincial and Territorial levels. These include harvest strategies, catch reporting and MCS, certification and quarantine management, spatial planning of aquaculture, disease monitoring, and management of external affairs and international treaties.</li> <li>Agree on roles and responsibilities of Federal, and Provincial and Territorial Governments.</li> </ul>	Federal Government to coordinate	Short-term priority
1.1.2 Assess institutional capacity and options for institutional strengthening	<ul style="list-style-type: none"> <li>Conduct an institutional analysis to determine the capacity of key Federal and Provincial and Territorial fisheries bodies.</li> <li>Determine options for institutional reform of the sector's Federal governance.</li> <li>Consider a single Federal body to plan and coordinate national issues in capture fisheries and aquaculture, with agreed-upon mandate, budgets and staff.</li> </ul>	Federal Government to coordinate	Medium-term Priority
1.1.3 Achieve jurisdictional clarity in light of autonomy law, and strengthen legislation at both Federal and Provincial and Territorial levels	<ul style="list-style-type: none"> <li>Undertake an independent review of Federal and Provincial and Territorial fisheries legislation to identify inadequacies.</li> <li>Update fisheries legislation at all jurisdictional levels through a consultative approach (including spatial planning), to allow for implementation of a new national framework (Activity 1.1.1).</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority
1.1.4 Prioritize the needs of small-scale fishers and fish farmers	<ul style="list-style-type: none"> <li>Conduct a baseline assessment to understand needs and vulnerabilities of small-scale fisher communities in accordance with the FAO's SSF Guidelines.</li> <li>Seek closer collaboration between MNFSR and the Ministry for Planning Development and Reform at Federal level, and Departments of Fisheries and Planning Commissions at Provincial and Territorial levels, to design programs for social protection and gender equality in fisheries and aquaculture based on FAO's SSF Guidelines.</li> <li>Programs should pay attention to offsetting any negative impacts that new resource management measures may cause for small-scale fishers.</li> <li>Update the National Food Security Policy to better encompass the role of fisheries in the nutrition and food security of poorer groups.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Long-term Priority

### Result Area 1.2: Provision of finance for structural investments

#### Context:

- There are few sources of finance for the private fisheries sector, for either large commercial and microenterprises. The existing Federal FDB and traditional credit mechanisms are likely insufficient for transformational investments in the fishery sector

#### Desired Outcomes:

- Federal, and Provincial and Territorial institutions that deliver targeted finance to support investments needed to sustainably grow the sector and to support enabling reforms
- Socially beneficial investment based on public anchor finance with private sector co-financing
- Support for fishers and their communities to allay disruptions they may suffer from fisheries management reforms. Associated investments may take the form of retraining, provision of investment capital, and business support services

#### Recommended Activities

Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>1.2.1 Study the design and feasibility of Fisheries Development Funds (FDFs)</b>	<ul style="list-style-type: none"> <li>• Seek technical assistance for a review of Fisheries Development Funds, and outline the design of the funding facility: legal measures required, institutional framework, staffing, and operational procedures to manage disbursement, monitor investments, and ensure transparency.</li> </ul>	Federal and Provincial and Territorial Governments	Short-term priority
<b>1.2.2 Plan an operational program, including operational procedures, eligibility, accountability, and monitoring and evaluation</b>	<ul style="list-style-type: none"> <li>• Plan the type and size of investments to be supported (to be validated by wide consultation).</li> <li>• Draft procedural rules, transparency requirements, and a monitoring and evaluation system.</li> <li>• Make required updates to legislation.</li> </ul>	Federal and Provincial and Territorial Governments, based on activity and geographic jurisdiction	Short-term priority
<b>1.2.3 Establish FDFs</b>	<ul style="list-style-type: none"> <li>• Design organizational structure.</li> <li>• Prepare internal regulations.</li> <li>• Choose project/financial management system software.</li> <li>• Prepare annual investment budget and targets.</li> <li>• Establish project ex ante evaluation, monitoring system, and system integrity checks.</li> <li>• Recruit and train staff.</li> </ul>	Federal and Provincial and Territorial Governments, based on activity and geographic jurisdiction	Short-term priority
<b>1.2.4 Implement FDFs, first as pilots, with limited geographical area or investment scope, followed by full roll-out</b>	<ul style="list-style-type: none"> <li>• Launch of calls for proposals from investors (via information campaign, website, online application system).</li> <li>• Train consultants, NGOs, stakeholder representative organizations, and fisheries administration staff to advise and support investors in applications.</li> </ul>	Federal and Provincial and Territorial Governments, based on activity and geographic jurisdiction	Medium-term priority

### Result Area 1.3: Build the capacity of education institutions to improve labor force skills

Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>Context:</b> <ul style="list-style-type: none"> <li>Existing training suppliers in different institutions are not coordinated, nor linked to strategic needs of the private sector</li> <li>Training capacity has deficiencies in facilities, training content, and staff</li> <li>Knowledge and skills among fisheries and aquaculture operators (including production and post-harvest value addition) fall short</li> <li>There are limited extension services and direct support for fish farmers</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>The establishment, in each jurisdiction with fisheries and aquaculture potential, of a leading training institute, following a curriculum with strong links to the private sector, to train an appropriate number of skilled workers</li> </ul>	
<b>Activity 1.3.1: Assess the current capacity of, and development needs for, fisheries technical training</b>	<ul style="list-style-type: none"> <li>Review existing provision of training at key training centers, and determine deficiencies vis-a-vis industry needs.</li> <li>Assess the feasibility of technology-enabled extension services.</li> <li>Develop a training and capacity-building strategy.</li> </ul>	Federal Government to coordinate	Medium-term priority
<b>Activity 1.3.2: Plan and make investments in fisheries training institutions, with a focus on aquaculture</b>	<ul style="list-style-type: none"> <li>Plan and cost educational facility upgrades, including practical learning-based facilities (e.g. demonstration aquaculture ponds, laboratories, and feed mills).</li> <li>Contract works for upgrading of pre-existing facilities and construction of new facilities.</li> <li>Recruit new staff, and invest in staff capacity through industry experience placements and study tours.</li> <li>Deliver training through formal diploma/certificates, training of trainers in Government and other extension services, and short courses for operators.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Long-term priority

**Result Area 1.4: Improved SPS measures and enforcement to protect consumers and align with international standards to facilitate trade**

<b>Context:</b> <ul style="list-style-type: none"> <li>• There are limited Federal or Provincial controls on aquatic animal health (AAH), and the system is not in line with OIE aquatic code</li> <li>• Federal SPS controls on fishery products are divided between ministries. Export controls are limited to the EU. Import controls are not risk-based.</li> <li>• Provincial SPS controls have limited and variable capacity, no integration with food safety functions, and in Punjab, overlap with Federal functions.</li> <li>• SPS and AAH border controls are not risk-based, and lack facilities for detention and quarantine.</li> <li>• Non-compliant products are exported, and the sector is exposed to risk of imported fish disease.</li> </ul>	<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>• Effective risk-based SPS measures on fish products for human consumption, in line with OIE and <i>Codex Alimentarius</i> standards</li> <li>• Effective risk-based controls at border inspection posts, adequately equipped with quarantine and testing facilities to protect against the import and export of non-compliant products</li> <li>• Scientifically-accredited testing services for food safety</li> </ul>
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**Recommended Activities**

Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>Activity 1.4.1 Support the development and reform of Provincial and Territorial SPS policies for fishery products</b>	<ul style="list-style-type: none"> <li>• Establish Provincial organization structures for SPS controls for fisheries.</li> <li>• Draft Provincial SPS regulations addressing a control system and technical requirements (integrated with food safety legislation).</li> <li>• Prepare inspection guidelines, protocols, checklists, non-compliance procedures etc.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Short-term priority
<b>Activity 1.4.2 Strengthen SPS controls and inspection capacity in fish production and distribution</b>	<ul style="list-style-type: none"> <li>• Recruit Federal and Provincial staff in SPS controls for fishery products.</li> <li>• Implement national training courses and study tours in fish food safety.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Short-term priority
<b>Activity 1.4.3 Strengthen the capacity of laboratories providing food safety testing to the fishery sector</b>	<ul style="list-style-type: none"> <li>• Identify laboratories and develop business plans for provision of testing services to the fishery sector.</li> <li>• Establish or upgrade Provincial Fish quality control laboratories.</li> <li>• Train staff in analytical methods, and seek accreditation for laboratories.</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Short-term priority
<b>Activity 1.4.4 Establish a risk-based SPS border control system for exports and imports of fish products for human consumption</b>	<ul style="list-style-type: none"> <li>• Assess risks of food safety hazards and fish disease hazards in relation to trade in live fish (including larvae, eggs, and gametes) and fish for human and animal consumption.</li> <li>• Specify relevant risk-based control measures.</li> <li>• Develop software modules for import/export border control for fishery products to reflect assessed risks and control policy (integrated with existing customs software).</li> <li>• Identify and stratify border inspection posts according to products and risks.</li> <li>• Establish live fish quarantine facilities, and chilled/frozen product storage facilities at selected border posts.</li> <li>• Nominate and train risk management and border inspection staff to apply new controls.</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Medium-term priority
<b>Activity 1.4.5 Establish national data collection for SPS</b>	<ul style="list-style-type: none"> <li>• Design ICT system to capture and store web-based GIS-referenced SPS and AAH data from all parts of fishery sector.</li> <li>• Supply and install ICT equipment.</li> <li>• Develop software, commission, and test, based on established inspection and control systems.</li> <li>• Train database managers and operators.</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Long-term priority

### Result Area 2.1: Effective management of sustainable marine fisheries

Result Area 2.1: Effective management of sustainable marine fisheries			
Context:		Desired Outcomes:	
<ul style="list-style-type: none"> <li>Marine fish resources are depleted and overfished, especially the higher value species groups.</li> <li>The bottom trawl fishery has very high by-catch levels, mainly composed of potentially high value juvenile species</li> <li>Fishing capacity is high, and thus harvests exceed maximum sustainable yield, with few mechanisms to limit further expansion</li> <li>Management of straddling or migratory stocks is not coordinated across Federal and Provincial boundaries</li> </ul>		<ul style="list-style-type: none"> <li>A strategy for fleet-capacity reduction that includes a range of management measures, including enforced licensing and spatial and temporal restrictions based on stocks' habitats and seasonal vulnerabilities. These measures should result in fishing capacity and effort that are commensurate with the reproductive capacity of available stocks</li> <li>Harvest strategies, in the form of FMPs, for key commercial stocks, based on scientific advice and the ecosystem approach to fisheries management</li> <li>Sustained increase in the productivity of marine fish stocks over the long term (30 years)</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>2.1.1 Impose a temporary freeze on the entry of new vessels to the fishery.</b>	<ul style="list-style-type: none"> <li>Impose a temporary freeze on the entry of new vessels into the marine capture fishery.</li> <li>Implement more robust access control measures (activities 2.1.3 and 2.1.4).</li> <li>Develop and implement an enforcement strategy of existing licensing systems.</li> </ul>	Federal and Provincial Governments	Short-term priority
<b>2.1.2 Impose restrictions on fishing access to the most depleted fish stocks, and in conjunction implement alternative livelihood measures.</b>	<ul style="list-style-type: none"> <li>Identify the most depleted fish stocks, including certain demersal fish and shrimps.</li> <li>Identify the most harmful types of fishing gear.</li> <li>Establish appropriate temporal and spatial restrictions, including restrictions on the use of the most harmful fishing gear.</li> <li>Develop alternative livelihood programs for people, especially those in vulnerable communities, affected by restrictions.</li> </ul>	Federal and Provincial Governments	Short-term priority
<b>2.1.3 Agree to ecosystem-based principles and objectives for marine fisheries.</b>	<ul style="list-style-type: none"> <li>Adopt principles from the FAO Code of Conduct for Responsible Fisheries (CCRF) and EAF guidelines.</li> <li>Integrate principles into key fisheries policy documents. Update and adopt the 2007 National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan (Activity 1.1.1.).</li> </ul>	Federal and Provincial Governments	Medium-term priority
<b>2.1.4 Develop an NPOA for fishing capacity.</b>	<ul style="list-style-type: none"> <li>Survey the fishing fleet and its contribution to mortality of key stocks.</li> <li>Decide on target capacity (based on FMPs) for key stocks.</li> <li>Decide on mechanisms for reducing fishing capacity, in consultation with industry.</li> <li>Regularly assess impact of mechanisms.</li> </ul>	Federal Government to lead with Provincial Government input to implement	Medium-term priority
<b>2.1.5 Develop FMPs for key commercial species</b>	<ul style="list-style-type: none"> <li>Identify commercial species groups and spatial areas to be covered in each FMP.</li> <li>Agree on FMP content and design, based on scientific advice.</li> <li>Review and update at appropriate intervals.</li> </ul>	Federal Government to lead with Provincial government input to implement	Medium-term priority

Result Area 2.2: A well-regulated and compliant fishing sector			
Context:		Desired Outcomes:	
<ul style="list-style-type: none"> <li>An extensive, but in places incomplete regulatory framework</li> <li>Limited capability to detect and prevent IUU fishing</li> </ul>		<ul style="list-style-type: none"> <li>A nationally integrated and enforceable regulatory framework across Federal and Provincial levels leading to comprehensive fisheries control and enforcement capabilities, backed by effective sanctions for non-compliant fishers</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>2.2.1 Develop a NPOA to prevent and deter illegal fishing</b>	<ul style="list-style-type: none"> <li>Prepare NPOA based on consultation with neighboring countries, Provincial governments, the fishing industry, the maritime defense forces, and other stakeholders.</li> </ul>	Federal Government to coordinate	Short-term priority
<b>2.2.2 Undertake fisheries legislation and rules to reflect the new national fisheries policy</b>	<ul style="list-style-type: none"> <li>Undertake an independent review of Federal and Provincial fisheries legislation to identify inadequacies.</li> <li>Update fisheries legislation at all jurisdictional levels through a consultative approach, to allow for implementation of a new national framework (Activity 1.1.1).</li> </ul>	Federal and Provincial Governments	Medium-term priority
<b>2.2.3 Mandate the use of satellite-based Vessel Monitoring Systems (VMS) on all commercial vessels greater than 15 meters</b>	<ul style="list-style-type: none"> <li>Effectively track and monitor fishing activities using real-time tracking system for fishing vessels.</li> <li>Initially require VMS for the largest vessels in the fleet (greater than 15 meters) but eventually mandate the technology across a broader range of commercial vessels.</li> </ul>	Federal and Provincial Governments	Medium-term priority
<b>2.2.4 Develop MCS enabling actions</b>	<ul style="list-style-type: none"> <li>Develop a national fisheries control plan that implements the NPOA on IUU fishing, including agreeing on institutional roles and responsibilities for MCS in Federal and Provincial waters.</li> <li>Develop fisheries control processes, potentially including (1) VMS on larger, higher risk fleets, (2) Fisheries Monitoring Centers, and (3) joint-deployment plans between Provinces, and between Provinces and the PMSA), Standard Operating Procedures (SOPs), and cross-warranting between different organizations.</li> <li>Establish cost-effective fisheries control mechanisms, e.g. risk-based prioritization, joint intelligence gathering, and asset sharing. This will require considerable training and capacity building. The asset base (e.g. patrol vessels for offshore and inshore surveillance) will also need to be developed.</li> </ul>	Federal and Provincial Governments	Medium-term priority

### Result Area 2.3: A healthy and productive marine ecosystem

Result Area 2.3: A healthy and productive marine ecosystem			
Context:		Desired Outcomes:	
<ul style="list-style-type: none"> <li>• Extensive, indiscriminate catch of juvenile fish, contributing to removal of high trophic levels and “ecosystem flattening”</li> <li>• Fishing effort that has spread from inshore areas in Zone I to the larger EEZ, with all of the demersal zone now fished</li> <li>• A broader range of marine activities adversely impacting marine habitats and resources, requiring an integrated approach to marine management</li> <li>• The beginning of a largely NGO-driven designation of MPAs, rather than a holistic network that protects key ecosystems on the coast and in deeper waters</li> </ul>		<ul style="list-style-type: none"> <li>• Spatial data on key spawning, nursery, and other critical habitats</li> <li>• National plans of action for key vulnerable species, including concrete implementation processes, to protect endangered or keystone species such as sharks, sea turtles, and seabirds</li> <li>• Protection of critical areas of habitat via spatial and temporal controls and the effective management of marine activities</li> <li>• An overarching national ocean policy framework that identifies national priorities and strategies for the future development of Pakistan’s maritime space</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
2.3.1 Identify and map critical coastal and marine habitats	<ul style="list-style-type: none"> <li>• Use GIS-based coastal and marine habitat surveys to map the distribution and extent of critical or vulnerable habitats.</li> <li>• Embed survey results into a marine ecosystem monitoring and management information system.</li> <li>• Note: This activity may be suited to foreign funding and technical assistance.</li> </ul>	Federal Government to coordinate	Medium-term priority
2.3.2 Develop an NPOA to protect sharks and rays, sea turtles, and other vulnerable species	<ul style="list-style-type: none"> <li>• Identify species groups requiring protection based on existing research.</li> <li>• Prepare an NPOA with public consultation.</li> <li>• Agree on implementation processes and responsibilities between levels of government.</li> </ul>	Federal Government to lead with Provincial Government input	Medium-term priority
2.3.3 Develop a holistic Marine Protected Area (MPA) and No Take Zone (NTZ) network	<ul style="list-style-type: none"> <li>• Based on results of Activity 2.3.1, prioritize specific habitats and locations to be protected, either through MPAs (which have specific ecological conservation objectives) or no take zones (NTZs).</li> <li>• Consult with stakeholders in the designation of MPAs and NTZs, with the objective of building a connected network of MPAs and NTZs over time that protects all the key ecosystem elements.</li> <li>• Consult with stakeholders to develop appropriate regulation of permitted activities within zones (certain types of fishing and other low impact activities).</li> </ul>	Federal and Provincial Governments	Long-term priority
2.3.4 Develop a National Ocean Policy Framework to address wider impacts on marine habitats and resources in an integrated way	<ul style="list-style-type: none"> <li>• Develop a multi-agency marine coordination and planning mechanism.</li> <li>• Agree on priorities and trade-offs for the development of Pakistan’s maritime space.</li> <li>• Prepare a multiuse National Ocean Policy with wide stakeholder consultation.</li> </ul>	Federal Government to coordinate	Long-term priority

### Result Area 2.4: Evidence-based decision-making enabled through good science and information

<b>Context:</b> <ul style="list-style-type: none"> <li>• Marine fisheries research in Pakistan that is insufficiently resourced and coordinated between agencies, and does not fully deliver the information needed by industry and managers</li> <li>• Insufficient capability to monitor key commercial fish stocks, undermining the ability to develop and implement FMPs</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>• Regular monitoring and assessment of fish stocks to facilitate adaptive management</li> <li>• A well-funded, integrated research plan, across relevant Federal and Provincial agencies, that responds to the needs of marine ecosystem managers and resource users</li> <li>• Fishery management decisions that are made based on high quality scientific information</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>2.4.1 Improve stock assessment capability</b>	<ul style="list-style-type: none"> <li>• Develop stock assessment methodologies, timing and resourcing to inform operation of FMPs. These should be aligned with international fisheries management bodies and neighboring countries where required.</li> <li>• Implement an ongoing stock assessment program, responding to the needs of FMPs, especially for stocks undergoing rebuilding.</li> </ul>	Federal Government to lead with Provincial Government input	Medium-term priority
<b>2.4.2 Develop marine fisheries and ecosystem research capabilities</b>	<ul style="list-style-type: none"> <li>• Develop a joint Federal-Provincial five-year research plan that includes main work areas, key research providers, and budget contributions. This should reflect the needs of managers and industry stakeholders (both industrial and small-scale).</li> <li>• Discuss collaboration with other nations bordering the Arabian Sea.</li> <li>• Commission annual, independent reporting on the outcomes of research, further research needed, and lessons learned. Further funding would be dependent upon this evaluation of the relevance, effectiveness, and efficiency of past work.</li> </ul>	Federal Government to coordinate	Long-term priority

### Result Area 3.1: Effective and equitable management of sustainable inland fisheries

<b>Context:</b> <ul style="list-style-type: none"> <li>• An extensive, but in places incomplete regulatory framework</li> <li>• Socio-economic challenges including exclusion due to ethnicity and caste, insufficient infrastructure (such as landing sites, chilling units, and roads), and lack of access to capital</li> <li>• Leasing arrangements that are inaccessible to traditional fishers due to capital requirements</li> <li>• Unfavorable subcontracting arrangements</li> <li>• Leasing arrangements that do not incentivize restocking, effort restraint, and other management measures</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>• An updated legal framework for inland fisheries that reflects a move to waterbody-level planning, as well as more equitable co-management systems, developed in consultation with communities</li> <li>• Effective incentives to promote more productive inland fisheries (including pro-active management measures and private investments)</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>3.1.1 Develop policy options for improved inland fisheries management through a consultative process</b>	<ul style="list-style-type: none"> <li>• Determine options for equitable and productive leasing, licensing, and other waterbody management approaches.</li> <li>• Convene consultation with inland fisheries stakeholders including traditional fishers, governments, and NGOs.</li> <li>• Determine reform options that ensure equitable sustainability and productivity, as well as the collection of revenues and data for governments.</li> </ul>	Federal, and Provincial and Territorial Governments	Short-term priority
<b>3.1.2 Undertake a holistic update of fisheries legislation and rules</b>	<ul style="list-style-type: none"> <li>• Undertake an independent review of Federal and Provincial fisheries legislation to identify inadequacies.</li> <li>• Update fisheries legislation at all jurisdictional levels through a consultative approach, to allow for implementation of new national framework (Activity 1.1.1).</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority

Result Area 3.2: Effective freshwater ecosystem management			
<b>Context:</b> <ul style="list-style-type: none"> <li>Freshwater ecosystems that are threatened by climate change, extraction of water for agriculture and other uses, pollution, habitat destruction, and over-fishing</li> <li>Lack of systematic data collection on inland fisheries</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>A spatial data-management system that contains up-to-date data on critical freshwater ecosystems</li> <li>Decision support tools to support freshwater ecosystem management</li> <li>A coordinated system of research and data collection that supports inland fisheries</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>3.2.1 Map critical inland fisheries habitats</b>	<ul style="list-style-type: none"> <li>Use GIS-based inland habitat surveys to map the distribution and extent of critical or vulnerable habitats.</li> <li>Embed survey results into a freshwater ecosystem monitoring and management information system.</li> <li>Note: This may be suited to foreign funding and technical assistance.</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Medium-term priority
<b>3.2.2 Systematically collect inland fisheries data, and use to inform management</b>	<ul style="list-style-type: none"> <li>Develop an inland fisheries research framework.</li> <li>Mandate reporting of all landings, and increase inspections to ensure compliance.</li> <li>Ensure mechanisms are in place to utilize the emerging data in adaptive management.</li> </ul>	Provincial and Territory Governments to lead with Federal Government support	Medium-term priority
<b>3.2.3 Develop decision support tools for freshwater ecosystems management</b>	<ul style="list-style-type: none"> <li>Develop decision support tools that integrate ecosystem information into inland fishery decision-making and embody the precautionary principle and adaptive management.</li> <li>Utilize decision-support tools to advise on catch limits and irrigation water management that has implications for fisheries.</li> </ul>	Federal, and Provincial and Territorial Governments	Long-term priority

Result Area 4.1: Effective Planning and Management of Aquaculture			
<b>Context:</b> <ul style="list-style-type: none"> <li>Limited organization, management (including licensing), and monitoring of the aquaculture sector</li> <li>Non-existent or limited zoning of farms to improve site selection, disease prevention, environmental management and to assist support service delivery, post-harvest handling and marketing</li> <li>Lack of mechanisms for management of matters of international compliance</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>A comprehensive, strategic spatial planning system that guides aquaculture investments and minimizes social conflicts and environmental externalities</li> <li>A robust aquaculture site licensing system, linked to the spatial planning system, that facilitates management</li> <li>An aquaculture system that is globally competitive and compliant with international agreements and requirements</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>4.1.1 Develop and implement aquaculture spatial plans, including zoning, within the broader context of completing a strategic environmental assessment for the aquaculture subsector</b>	<ul style="list-style-type: none"> <li>Commission specialists to review zoning options in a participatory manner, engaging key stakeholders such as farmers, business groups, technical experts, and environmental managers, and propose spatial planning.</li> <li>Elaborate detailed plans for aquaculture zoning including site selection and management areas containing farms that share a common water supply or proximity.</li> <li>Use already-available database software to record industry data and manage zoning.</li> <li>Note: This activity may be suited to foreign funding and technical assistance.</li> </ul>	Federal, and Provincial and Territorial Governments	Short-term priority
<b>4.1.2 Develop and implement streamlined requirements for aquaculture site licensing</b>	<ul style="list-style-type: none"> <li>Commission specialists to review licensing options in a participatory manner, engaging key stakeholders, and propose implementation of a licensing system.</li> <li>Elaborate a streamlined and business-friendly system for licensing aquaculture activity, linked with a spatial planning database.</li> <li>Implement licensing requirements, with a focus on minimizing costs to business.</li> </ul>	Provincial and Territorial Governments	Short-term priority
<b>4.1.3 Streamline the oversight and management of inter-Provincial/Territorial, and Federal-Provincial/Territorial affairs and international treaties</b>	<ul style="list-style-type: none"> <li>Identify all inter-Provincial and Federal-Provincial operational mechanisms, and clarify roles and responsibilities.</li> <li>Streamline existing approval and administration processes.</li> <li>Develop a pathway towards adherence to international treaties and obligations related to aquaculture, ensuring Pakistani presence in relevant international bodies.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority

Result Area 4.2: Effective planning and management of aquatic animal health (AAH)			
<b>Context:</b> <ul style="list-style-type: none"> <li>Limited monitoring and reporting of diseases of international significance, which is an obligation as a member of the Office International des Epizooties (OIE)</li> <li>Non-participation by Pakistan in the regional AAH network</li> <li>Lack of a legally nominated authority responsible for fish disease surveillance or control, lack of legislation which specifies notifiable diseases, reporting requirements, and powers to restrict movement</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>An aquaculture industry with appropriate AAH surveillance and control systems to minimize the risks of disease</li> <li>Requisite capacity, including facilities, to undertake aquatic animal disease diagnosis, research, and control</li> <li>Fulfillment of domestic disease management responsibilities and international AAH obligations</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>4.2.1 Identify the components required for a unified certification and quarantine management system to regulate species introductions and disease management</b>	<ul style="list-style-type: none"> <li>Establish and strengthen AQD as the focal institution at the Federal level to drive an AAH policy and ensure its implementation</li> <li>Bring together stakeholders to agree on responsibilities regarding regulation of species introductions and disease management</li> </ul>	Federal Government to coordinate	Short-term priority
<b>4.2.2 Introduce certification and quarantine</b>	<ul style="list-style-type: none"> <li>Adopt internationally available standards and agreements (WTO-SPS and OIE Aquatic Code)</li> <li>Develop measures for diagnostics, risk analysis, health certification, quarantine, surveillance and disease reporting, contingency planning, and disease control strategies</li> <li>Revise animal health policies and supporting regulation to provide a national framework for AAH, and introduce national certification and quarantine management measures</li> <li>Designate specific points of entry for aquatic animals into Pakistan, ensuring each point has diagnostic capacity and quarantine facilities</li> <li>Invest in training of Federal and Provincial inspection staff (courses, study tours, and higher degrees)</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Medium-term priority
<b>4.2.3 Develop supporting diagnostic and research capability</b>	<ul style="list-style-type: none"> <li>Access regionally available capacity-building support for AAH management and research</li> <li>Link AQD with the regional Aquatic Animal Health network</li> <li>Commission the Department of Zoology, University of Punjab, to expand its diagnostic capacities and to cascade its skills and techniques to other institutions throughout Pakistan</li> <li>Upgrade AAH facilities at academic institutions and at points of entry</li> <li>Build diagnostic capacity in AAH at the National Veterinary Laboratory</li> <li>Catalyze a network of aquatic animal health specialists, and build links with donors and research grant providers to begin to build research capability</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Medium-term priority
<b>4.2.4 Undertake a national fish disease survey and establish a routine monitoring system</b>	<ul style="list-style-type: none"> <li>Monitor diseases in the fisheries sector and establish risk-based assessments and protocols</li> <li>Implement a national survey of fish diseases and a reporting protocol for notifiable fish diseases</li> <li>Ensure that required notification of international organizations occurs</li> </ul>	Federal Government to lead with Provincial and Territorial Government support	Medium-term priority

Result Area 4.3: Expanded and improved aquaculture extension and training			
<b>Context:</b> <ul style="list-style-type: none"> <li>Limited aquaculture extension services</li> <li>Inadequate connections and information exchange between providers in different Provinces</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>Vibrant extension services for sharing innovations in aquaculture across Pakistan and internationally</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
4.3.1 Engage in South-South knowledge exchange	<ul style="list-style-type: none"> <li>Build on the “Master Trainers” approach being piloted in Punjab in consultation with the Asian Institute of Technology, to design a system of capacity development that trains trainers from across Pakistan in neighboring countries that have advanced aquaculture industries.</li> <li>Re-engage with international and intergovernmental support organizations to coordinate the sharing of learning.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority
4.3.2 Share best practices, differentiated by aquaculture type	<ul style="list-style-type: none"> <li>Maintain records on Good Aquaculture Practices (GAPs) developed with reference to internationally recognized standards.</li> <li>Differentiate promotion of GAPs for different sectors of the aquaculture industry, addressing the needs of commercial investors, those supporting aquaculture for poverty alleviation, and those promoting aquaculture for local nutritional and micro-nutritional security and empowerment.</li> <li>Develop a network of “one-stop aqua shops” where knowledge sharing is combined with access to aquaculture inputs and equipment, as piloted in India, Pakistan, Vietnam, and Kenya.</li> </ul>	Federal, and Provincial and Territorial Governments	Long-term priority

Result Area 4.4: Expanded and improved aquaculture research and development aligned with industry needs and government objectives			
<b>Context:</b> <ul style="list-style-type: none"> <li>Lack of well-coordinated aquaculture research and development that is aligned with industry and government objectives, and supports poverty alleviation, nutrition, and food security</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>Aquaculture research and development that improves extension materials and best-practice understanding, and adapts them to local conditions based on scientific trials and evidence</li> <li>Research and development that supports sector zoning and licensing and promotes the industry’s growth in ways consistent with governments’ objectives</li> <li>Development of new types of commercial aquaculture in Pakistan through collaboration between public and private sectors</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
4.4.1 Improve aquaculture research	<ul style="list-style-type: none"> <li>Bring together aquaculture research and development stakeholders to plan a research strategy that integrates efforts and shares outcomes.</li> <li>Provide financial support for applied, public good research in line with the research strategy.</li> </ul>	Federal Government to coordinate	Medium-term priority
4.4.2 Support research for poverty alleviation and nutritional and micro-nutritional food security	<ul style="list-style-type: none"> <li>Support participatory research and development in aquaculture, suited to people with few resources, low risk tolerance, and limited capital for investment, particularly targeting women farmers in production of small indigenous fishes.</li> <li>Support research on aquaculture-based solutions for malnutrition and women’s empowerment.</li> <li>Develop standard methodologies and indicators to evaluate homestead aquaculture.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority
4.4.3 Co-create commercial aquaculture	<ul style="list-style-type: none"> <li>Building on the model emerging from the FDB, co-undertake commercial research and development to develop new culture systems.</li> </ul>	Federal Government to coordinate	Medium-term priority

### Result Area 5.1: Investment in infrastructure and services that adds value and enhances quality

<b>Context:</b> <ul style="list-style-type: none"> <li>Limited production of added-value products, with imported fish increasingly serving the domestic market</li> <li>Lack of infrastructure to support value-adding private investment and value chains</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>A competitive business environment and supporting infrastructure that encourages value addition and productivity-enhancing investments</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>5.1.1 Support the development of a competitive seafood cluster at Korangi Harbor</b>	<ul style="list-style-type: none"> <li>Review and update the existing Korangi Harbor development model and identify infrastructure needs.</li> <li>Form a steering group of private sector and government representatives.</li> <li>Invest in catalyzing infrastructure.</li> <li>Develop a cost-recovery model based on user fees.</li> </ul>	Sindh Government to lead with Federal Government support	Medium-term priority
<b>5.1.2 Improve infrastructure, conditions, and public services at fish markets</b>	<ul style="list-style-type: none"> <li>Review market facilities and services and identify investment needs.</li> <li>Form a steering group of private sector and government representatives.</li> <li>Invest in market infrastructure and services shared by buyers and sellers (common resources that facilitate commerce and competition).</li> <li>Develop a cost-recovery model based on user fees.</li> </ul>	Provincial and Territorial Governments	Medium-term priority

### Result Area 5.2: Improved productivity, quality, and market access

<b>Context:</b> <ul style="list-style-type: none"> <li>Limited production of added-value products, with imported fish increasingly serving the domestic market</li> <li>Limited access to international high value markets</li> <li>Shortage of facilities for training in productivity, added-value production, and quality control</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>Access to new international markets for higher quality products</li> <li>Productivity indicators and benchmarking to ensure value-chain businesses are ready to compete internationally</li> <li>Creation of added-value products supported by attainment of accepted, industry-wide safety and quality standards</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>5.2.1. Invest in market development activities</b>	<ul style="list-style-type: none"> <li>In-depth market and competitor analysis to identify new market opportunities.</li> <li>Design branding and promotion strategies and plans.</li> <li>Support participation at trade exhibitions and other market development activities.</li> </ul>	Federal Government to coordinate	Short-term priority
<b>5.2.2 Develop quality standards for selected products</b>	<ul style="list-style-type: none"> <li>Develop a grading scheme of quality by which products and producers can be assessed and benchmarked.</li> </ul>	Federal Government to coordinate	Medium-term priority
<b>5.2.3 Develop a model factory for productivity and value-add training, and promote Codes of Practice</b>	<ul style="list-style-type: none"> <li>Designate a model factory or productivity center to function as a best practice site for research and training, including on safety practices. Ideally it would be located near or within the Korangi Blue Growth Hub (see 5.1.1).</li> </ul>	Sindh Government to lead with Federal Government support	Medium-term priority
<b>5.2.4 Undertake benchmarking to establish firm-level productivity indicators</b>	<ul style="list-style-type: none"> <li>Establish productivity metrics, based on skills, processes, and equipment.</li> <li>Recruit a specialist team to carry out productivity benchmarking within the sector.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority

### Result Area 6.1: Improved nutrition and food security for all

Result Area 6.1: Improved nutrition and food security for all			
Context:		Desired Outcomes:	
<ul style="list-style-type: none"> <li>About 20 percent of the population currently undernourished, and childhood stunting rates exceeding 40 percent (World Bank 2015)</li> <li>Very low fish consumption in Pakistan, even though fish is an excellent source of protein and nutrients</li> </ul>		<ul style="list-style-type: none"> <li>Fish constituting an increased proportion of Pakistani diets, and contributing to improved food security and nutrition</li> <li>Production of fish through aquaculture resulting in wider availability of affordable and nutritious fish to poorer groups, particularly in rural areas</li> <li>An increased proportion of fish in Pakistani diets, contributing to improved food security and nutrition</li> <li>Higher production through aquaculture resulting in wider availability of affordable and nutritious fish to poorer groups, particularly in rural areas</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>6.1.1 Assess demand for fish and fill knowledge gaps on the trade-offs and impacts of current practices (including exports of fishmeal and imports of Pangasius) on food security</b>	<ul style="list-style-type: none"> <li>Assess the impacts of fishmeal production on domestic fish consumption and food security.</li> <li>Assess fish consumption and preferences among consumers, comparing coastal and inland areas, urban and rural areas, different wealth levels, ethnicity, gender, and age.</li> <li>Document the nutritional value of species currently consumed and marketed, and the nutritional and health benefits for different categories of consumers.</li> </ul>	Federal Government to coordinate	Medium-term priority
<b>6.1.2 Promote the consumption of fish</b>	<ul style="list-style-type: none"> <li>Initiate inter-ministerial and inter-departmental discussions to emphasize the role fish can play in nutrition and human health programs.</li> <li>Run nutrition awareness campaigns about the benefits of fish consumption.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority
<b>6.1.3 Promote the culture of small indigenous fishes as a key source of nutrients and micronutrients</b>	<ul style="list-style-type: none"> <li>Undertake research on the feasibility of polyculture production methods for small nutrient-rich indigenous fish species, drawing on the experience of other countries, Bangladesh in particular.</li> <li>Integrate small fish cultivation into extension activities for promotion (see Results Area 4.3 and 4.4).</li> <li>Make small fish cultivation eligible for microenterprise grants.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority

Result Area 6.2: Greater attention for gender issues and progress towards gender equality			
<b>Context:</b> <ul style="list-style-type: none"> <li>• Large inequalities between men and women in Pakistan, including in fisheries-dependent communities.</li> <li>• Unequal tenure rights (access and ownership to land and other aquatic resources) that curtail women's opportunities in the fishing sector</li> <li>• Gender issues that require greater attention during policy design and evaluation</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>• Greater contribution by fisheries and aquaculture towards gender equality in Pakistan</li> <li>• New opportunities for entrepreneurship and income for women through higher participation in aquaculture</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>6.2.1 Include gender considerations in every fisheries development intervention</b>	<ul style="list-style-type: none"> <li>• Include an explicit gender strategy in each large program or intervention.</li> <li>• Ensure that investments made under the Fisheries Development Funds (see Results Area 1.2) disproportionately benefit sectors of the fisheries value-chain that employ women.</li> <li>• Encourage Government offices involved in fisheries programs to demonstrate leadership by ensuring above-average female representation among staff, including at higher decision-making levels</li> </ul>	Federal, and Provincial and Territorial Governments	Short-term priority
<b>6.2.2 Improve data collection to capture women's participation in the sector</b>	<ul style="list-style-type: none"> <li>• Revise data collection templates and protocols to always disaggregate data collection (e.g. employment, production, income, access to resources) by gender.</li> <li>• Impart training/awareness concerning gender issues in institutions in charge of design and/or implementation of fisheries initiatives.</li> </ul>	Federal Government to coordinate	Medium-term priority
<b>6.2.3 Increase the attractiveness of aquaculture for women's employment and entrepreneurship</b>	<ul style="list-style-type: none"> <li>• Advertise and attract a greater number of female students to higher education fisheries and aquaculture training.</li> <li>• Promote employment opportunities for newly graduated women in upstream and downstream sectors.</li> <li>• Allocate a portion of Fisheries Development Funds' resources to prioritize women-led or women-supporting enterprises.</li> <li>• Require publicly-supported enterprises to commit to equal opportunities and equal pay, and report on hiring practices during grant renewal periods.</li> </ul>	Federal, and Provincial and Territorial Governments	Medium-term priority

Result Area 6.3: Community empowerment and improved livelihood opportunities			
<b>Context:</b> <ul style="list-style-type: none"> <li>• Small-scale fishing communities are some of the poorest communities in Pakistan</li> <li>• Limited stakeholder participation and community co-management in fisheries</li> <li>• Insufficient livelihood options in vulnerable, fishing dependent communities</li> </ul>		<b>Desired Outcomes:</b> <ul style="list-style-type: none"> <li>• Greater contribution of communities towards the management decisions over their local resources</li> <li>• Diversified rural incomes and improved economic opportunities in marginalized rural areas</li> <li>• Reduced economic dependence on vulnerable or declining capture fisheries stocks, alleviating pressure on stocks</li> </ul>	
Recommended Activities			
Activity	Key elements or steps for implementation	Roles	Prioritization and sequencing
<b>6.3.1 Empower fishing communities to develop their own management plans (community based natural resource management)</b>	<ul style="list-style-type: none"> <li>• Design a framework for co-management between fishing communities and Government, outlining areas of respective responsibility, through a consultative process.</li> <li>• Determine eligibility criteria and invite communities to design community fisheries resource management plans in partnership with government, within the framework.</li> <li>• providing ongoing support (technical and financial) for participating communities, and monitor management plan outcomes.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Medium-term priority
<b>6.3.2 Provide extension and financial support (grants or small loans) for households to diversify incomes through homestead aquaculture</b>	<ul style="list-style-type: none"> <li>• Design a community-based technical and financial support program for homestead aquaculture. Support could take the form of micro loans or small grants for constructing and stocking small ponds or investing in post-harvest activities.</li> <li>• Determine criteria for financial support (at both household and community level).</li> <li>• Potentially implement in partnership with non-government organizations who have existing relationships with fishing communities.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Medium-term priority
<b>6.3.3 Provide extension and financial support (grants or small loans) for households to diversify incomes away from reliance on vulnerable or declining capture fish stocks</b>	<ul style="list-style-type: none"> <li>• Design a community-based technical and financial support program for micro-enterprises and livelihood diversification.</li> <li>• Determine criteria for financial support (at both household and community level).</li> <li>• Potentially implement in partnership with non-government organizations who have existing relationships with fishing communities.</li> </ul>	Provincial and Territorial Governments to lead with Federal Government support	Medium-term priority



