Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform

Peter Silvester, Annabelle Bladon, Michael Akester, Khin Maung Soe and Essam Yassin Mohammed

Working Paper
March 2020

Fisheries; Sustainable markets

Keywords:
Fiscal reform; sustainable fisheries; finance; Myanmar; economic incentives

iied

WorldFish

About the authors

Peter Silvester, Thammasat University; Annabelle Bladon, IIED; Michael Akester, WorldFish; Khin Maung Soe, WorldFish; Essam Yassin Mohammed, IIED.

Corresponding author: annabelle.bladon@iied.org

Partner organisations

WorldFish is an international non-profit research organisation that harnesses the potential of fisheries and aquaculture to strengthen livelihoods and improve food and nutrition security. Globally, more than 1 billion people obtain most of their animal protein from fish and 800 million depend on fisheries and aquaculture for their livelihoods. WorldFish is a member of CGIAR, a global research partnership for a food-secure future.

Produced by IIED's Shaping Sustainable Markets Group

The Shaping Sustainable Markets group works to make sure that local and global markets are fair and can help poor people and nature thrive. Our research focuses on the mechanisms, structures and policies that lead to sustainable and inclusive economies. Our strength is in finding locally appropriate solutions to complex global and national problems.

Acknowledgments

We would like to thank the stakeholders who gave up their time to be interviewed for this report. We also thank the Ayeyarwady Region Department of Fisheries and the Myanmar Fisheries Federation for their support, and recognise the contributions of WorldFish and the CGIAR Research Program on Fish. Finally, thanks to Stephen Akester and Nilar Wynn.

Published by IIED, March 2020

Peter Silvester, Annabelle Bladon, Michael Akester, Khin Maung Soe, Essam Yassin Mohammed (2020) Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform. IIED Working Paper, IIED, London.

http://pubs.iied.org/16669IIED

ISBN: 978-1-78431-793-5

Printed on recycled paper with vegetable-based inks.

International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
www.iied.org

@iied
www.facebook.com/theIIED

Download more publications at http://pubs.iied.org/

The hilsa shad is one of the most commercially valuable fish species in Myanmar, but it is under threat. As part of a project designing a system of incentive-based management for hilsa fisheries in Myanmar, this study explores how fiscal tools such as licence fees and taxation could be used to finance the system. While our figures are based on numerous assumptions and should be interpreted with caution, we clearly demonstrate that by increasing revenue-collection efficiency and adapting current tools to better target actors nearer the top of the hilsa value chain, the government of Myanmar could triple current revenues and use these to support more inclusive and sustainable hilsa fisheries.

Contents

List of figures and tables

Summary

The fisheries sector in Myanmar employs around three million people, including in some of its most impoverished areas. Fish are also central to Myanmar's food security and nutrition. One of the most economically important fish species in Myanmar is the hilsa shad (*Tenualosa ilisha*). Yet hilsa stocks – like those of other capture fisheries in Myanmar – appear to be in decline. In the Ayeyarwady Region, exploitation rates are well beyond sustainable levels. Too many juvenile hilsa and gravid females are caught, particularly inland. Migrating hilsa are also susceptible to land-based threats such as habitat loss and water pollution. As a result, there is an urgent need to protect hilsa, particularly during peak spawning periods and in major nursery grounds.

Why is fiscal reform necessary?

Under current national and regional laws there are regulations that could potentially protect hilsa from overfishing. For example, all open-access freshwater and inshore marine fisheries are closed from May to July to protect the spawning and recruitment of commercial fish species. There are also licensing systems for fishers and fish traders. Yet these interventions were not designed with the specific characteristics of hilsa in mind and have a minimal impact on the sustainable management of the hilsa fishery. Compliance with fishing regulations also appears low, as is the capacity to enforce regulations, particularly in the offshore fishery.

Fiscal tools can deliver positive economic, social and environmental outcomes. They can therefore contribute to sustainable fisheries management in various ways: by providing negative incentives for destructive practices, positive incentives for sustainable fishing practices, or support to address inequity, such as social assistance to vulnerable fishing families. Yet fiscal fisheries policy can also be applied in a way that is harmful, or has unintended consequences. The introduction or reform of fiscal tools will always entail social, environmental and economic trade-offs, and there are likely to be winners and losers. If fiscal policy is to be equitable and inclusive, it must consider the characteristics of different social groups involved at each stage of the value chain, and the magnitude and direction of potential impacts on those groups, to target specific groups accordingly.

Exploring the potential benefits of fiscal reform

This working paper explores the outcomes of a study conducted as part of the ongoing Darwin Initiative-funded project Carrots and Sticks: Incentives to Conserve Hilsa Fish in Myanmar, also known as Darwin-Hilsa[MM]. The project aims to design and implement an incentive-based scheme for sustainable and inclusive hilsa management in the Ayeyarwady Region, which will support households to comply with regulations.

The study for this working paper explored whether fiscal reform could generate a significant and long-term source of finance for the incentive scheme, and if so, what this reform should look like. Using a literature review, focus group discussions (FGDs), key informant interviews (KIIs) and value chain analysis, the research aimed to:

- Identify and assess the efficiency of current fiscal tools for collecting revenues from the hilsa value chain
- Identify opportunities within the value chain to reform or introduce new fiscal tools that could generate a new stream of revenue, and
- Estimate how much revenue could be generated in total, and if this would be sufficient to support incentive-based hilsa fisheries management.

We used a mixed-methods value chain approach to build an understanding of how fiscal tools are currently used to collect revenues from the hilsa value chain, and how they could be reformed to raise additional revenues for investment into a more sustainable and inclusive fishery. Information was collected through a literature review, FGDs and KIIs, and analysed using qualitative and quantitative methods. We used a value chain approach ('value chain' refers to the process of adding value to a product, from raw material to final customer) to identify and characterise the key actors of Myanmar's hilsa production and trade: fishers (artisanal fishers and offshore fishers), village traders, township traders, wholesalers and exporters. We also collected information on the fiscal tools that are reportedly used to raise revenues from these value chain actors.

Key findings and recommendations

The reforms set out in this paper for increasing current revenue-collection efficiency could generate annual revenues in the region of US$56.9 million for the Department of Fisheries and government of Myanmar more broadly (more than twice the current annual revenues). Combining this increase in revenue-collection efficiency with the proposed revisions to fee and tax rates could generate revenues nearer US$91 million per year (more than three and a half times current annual revenues), by better targeting actors nearer the top of the hilsa value chain.

While our figures are based on numerous assumptions and should be interpreted with caution, this study clearly demonstrates how fiscal reform could be used to finance a system of incentives for hilsa fisheries management, simply by adapting tools that are already used. This would contribute to a more sustainable fishery with maintained, or possibly increased, landings with the added advantage of larger, more valuable fish being available.

Although we do not yet have accurate estimates of what type and level of incentives fishing households in the Ayeyarwady Region would be willing to accept for compliance with specific fishing regulations, we can make inferences based on an incentive scheme for hilsa fishing households in nearby Bangladesh. For over a decade, this scheme has been providing households with in-kind compensation during a fishing ban of one to four months, at a rough average annual cost of US$88 per household for alternative income-generating activities and US$1.40 per household for food compensation (Haldar and Ali 2014). Even at the higher end of this range, it would be possible to provide fiscal incentives to all fishers across the Ayeyarwady Region, including those who are currently not registered.

Identify and mitigate unintended consequences

Policymakers must consider the full range of potential impacts of fiscal reform (social, political, economic or environmental) to understand how they will affect different groups and what measures they can take to reduce negative impacts. Further research would be required to understand exactly how much each value chain actor could pay without prohibitively negative impacts on their income or competitiveness, or on the value chain more broadly. Designing a campaign to communicate the long-term benefits of any changes should also help to build acceptance. Providing a tangible short-term benefit to village and township traders – perhaps in the form of access to quality information on market prices, trends and foresight analysis – may further help to reduce negative perceptions. To reduce the potential for misuse of funds, technical and institutional capacity for fiscal administration may need to be strengthened.

Strengthen offshore governance

Despite a new compulsory vessel monitoring system, there is still a huge illegal, unreported and unregulated (IUU) offshore fishing fleet. Until this changes, efficient collection of revenues from the offshore fleet will not be possible, and unsustainable marine fishing activity may undermine the impacts of improved hilsa management inland.

Earmark revenues for incentive-based hilsa fisheries management

If new revenues generated by these reforms are to support a system of incentive-based fisheries management, then at least a portion of them must be earmarked for this purpose, rather than being diverted for other purposes or agencies. Department of Fisheries revenues could, for example, be channelled into its research and development fund and earmarked for hilsa conservation. Another simpler option is for funds to be managed at a decentralised level. The 2018 Ayeyarwady Region Freshwater Fisheries Law (updated in 2019) empowers the regional minister for agriculture and the environment to establish a conservation fund. Alternatively, or in addition, a Conservation Trust Fund (CTF) could be established for hilsa fisheries management. As legally independent grant-making institutions, CTFs can provide the institutional capacity at local and national levels for transparent and accountable fund generation and allocation. This approach has been used with success in developing countries around the world.

Acronyms and abbreviations

BOBLME	Bay of Bengal Large Marine Ecosystem Project
CIT	Corporate income tax
CTF	Conservation Trust Fund
DoF	Department of Fisheries
FAO	Food and Agriculture Organization of the United Nations
FGDs	Focus group discussions
IUU	Illegal, unreported and unregulated fishing
KIIs	Key informant interviews
MoALI	Ministry of Agriculture, Livestock and Irrigation
MMK	Myanmar kyat
MoC	Ministry of Commerce
MoPFI	Ministry of Planning, Finance and Industry
NGO	Non-governmental organisation
SPFWM	San Pya Fish Wholesale Market
YCDC	Yangon City Development Committee

Glossary

Bycatch	Fish or other marine species caught unintentionally while targeting other catch (ie, catch of a different species, the wrong sex, or undersized or juvenile individuals of the target species)
Capture fisheries	Harvesting of naturally occurring living resources in both marine and freshwater environments
Gravid fish	Fish carrying eggs
Lakh	A unit in the Indian numbering system equal to 100,000 that is used in Myanmar and throughout the Indian subcontinent
Nursery grounds	Locations where fish spend the initial periods of their life
Vertically integrated	An arrangement in which the supply chain of a company is owned by the company
Viss	Burmese unit of mass equal to 1.63kg

1 Introduction

1.1 The Myanmar hilsa fishery

Myanmar's fisheries sector has been one of the country's five largest sources of gross domestic product and foreign exchange earnings for many years (DoF 2018; ILO 2015). The fisheries sector employs around three million people, particularly in Myanmar's coastal and delta regions, which are some of its most impoverished areas (DoF 2015; Khaing et al. 2019). Fish are also central to Myanmar's food security and nutrition, accounting for an average of nearly 50% of household animal protein intake (FAO 2018).

The hilsa shad (*Tenualosa ilisha*), known locally as *nga-tha-lauk*, is one of the most economically important fish species in Myanmar (Akester 2019; ILO 2015). Although it only makes up a small proportion of total reported fish production, it is a high-value species due to strong and steady demand from export markets, particularly in China and India (BOBLME 2015a). Hilsa was reported to be the sixth most-exported fisheries product by volume in 2017–2018, and the fifth most valuable fisheries product exported, with a total export value of around US$32 million (DoF 2018).

Hilsa migrate seasonally between marine and fresh waters for breeding and feeding (BOBLME 2015b; Merayo et al. 2020). As such, they support both marine and freshwater fisheries, particularly in the Ayeyarwady Region, adjacent Rakhine State, and potentially Mon State (Baran et al. 2017). Nearly 50% of reported nationwide hilsa catch (11,380 metric tonnes[1]; DoF 2018) is attributed to the Ayeyarwady Region (DoF 2019). The majority of the Ayeyarwady Region's catch (55%) is attributed to offshore vessels, and the rest to artisanal fishers using boats and fixed traps in fresh and inshore marine waters, which are managed together (DoF 2019). Yet data-collection improvements implemented as part of a project led by the Food and Agriculture Organization (FAO) of the United Nations (FAO 2019) indicate that the proportion of freshwater and inshore marine catch is probably much higher than reported (67% of total catch), with 33% coming from offshore. Although Myanmar's capture fisheries statistics are generally overreported,[2] this difference is probably related to the expectation that some inland capture fisheries in Myanmar, including the hilsa fishery, produce 50% more fish than officially reported – often referred to as the 'hidden harvest' (Kelleher et al. 2012).

Hilsa stocks – like those of other capture fisheries in Myanmar – appear to be in decline (Baran et al. 2017). Exploitation rates are well beyond sustainable levels in the Ayeyarwady Region, and juveniles are being caught in fine-meshed nets, which reduces their recruitment into the fishery (BOBLME 2015c). The pressure on the freshwater fishery is disproportionately high because hilsa caught in fresh water are more likely to include juvenile fish and mature female fish with ripe gonads, which are often targeted on their spawning runs (Khaing et al. 2019). Their seasonal inland migration also means that hilsa are susceptible to land-based threats such as habitat loss and water pollution (BOBLME 2015b; Baran et al. 2017). As a result, there is an urgent need to protect hilsa in fresh water, particularly during peak

[1] This figure describes only reported export tonnage, which is composed mostly of large hilsa from the marine environment and cannot truly represent total nationwide catches.
[2] Independent surveys of inland and marine capture production in Myanmar show a systematic, possibly institutionalised, annual catch increase indicative of overreporting by around two-fold (Akester 2019; Baran et al. 2017; Fluet-Chouinard et al. 2018).

spawning periods and in major nursery grounds (Bladon et al. 2019).

1.2 Institutional, legal and policy framework

The main institution responsible for the sustainable development of Myanmar's fisheries sector is the Department of Fisheries (DoF), which sits in the Ministry of Agriculture, Livestock and Irrigation (MoALI), and operates at the union (national), state, regional, district and township levels. The DoF manages freshwater fisheries together with inshore marine fisheries under the Freshwater Fisheries Law (1991), while offshore national vessels are managed under the Marine Fisheries Law (1990). Since the enactment and management of inland fisheries legislation was decentralised in 2010, regional governments have also implemented their own laws in the states/regions where hilsa is landed and marketed. Although implementation was initially slow (Tezzo et al. 2018), the Ayeyarwady Fisheries Law of 2018 was updated in 2019 and now has a regulation in place to enact the law.

Under these national and regional laws, various regulations are in place that could potentially help to protect hilsa from overfishing. For example, all open-access freshwater and inshore marine fisheries are closed from May to July to protect the spawning and recruitment of commercial fish species. The catch and captivity of freshwater juveniles, spawning fish and fish ready to spawn are also banned from May to August. There are also various licensing systems for fishers and fish traders. Yet none of these interventions have been designed with the specific characteristics of hilsa in mind, and so they are likely having a minimal impact on the sustainable management of the hilsa fishery.

Furthermore, compliance with fishing regulations appears to be low in Myanmar. Regulations usually impose a short-term cost on fishers, for instance by limiting access to the hilsa fishery or requiring investment in specific types of fishing gear. Fishing households in coastal and delta regions tend to have low incomes and a strong dependence on fishing, and therefore limited ability and willingness to shoulder this cost and comply with regulations (Khaing et al. 2019).

At the same time, capacity for monitoring, control and surveillance is low, and so enforcement of regulations is limited – particularly in the offshore fishery (Tezzo et al. 2018). This is largely due to a resource deficit. Although a significant portion of Myanmar's central and regional government revenues are derived from fisheries (56% in the Ayeyarwady Region), the DoF's total management budget is a fraction of that allocated to other natural resource management agencies in the country; it receives only 0.8% of the MoALI budget (World Bank 2019).

In circumstances where top-down enforcement is difficult, providing compensation for compliance with regulations can be an effective way to incentivise behaviour change (Mohammed and Wahab 2013). By offsetting or reducing the costs incurred, monetary or in-kind compensation can strengthen individual or collective motivations for sustainable fishing practices – as demonstrated in nearby Bangladesh (Islam et al. 2016). To avoid any additional burden on government resources, this kind of approach can be financed through reforming fiscal policy ie government tools for revenue collecting and spending (Table 1).

Fiscal tools can be introduced or reformed to deliver positive economic, social and environmental outcomes (World Bank 2005). They can therefore contribute to sustainable fisheries management in a variety of ways: by providing negative incentives for destructive practices, positive incentives for sustainable fishing practices, and/or support to address inequity, such as social assistance to vulnerable fishing families (Porras 2019). Fiscal tools such as taxation or licence fees can also be used to mobilise resources for sustainable fisheries management (Mohammed et al. 2018), which is what this study focuses on.

Historically, the role of Myanmar's DoF was to collect fisheries revenues through fiscal tools such as fees, taxes and fines (Tezzo et al. 2018). While these may not currently generate enough revenue to allow the DoF to fulfil its mandate of sustainable fisheries development (World Bank 2019), there may be potential to reform how revenues are collected in order to mobilise additional resources to fund an incentive-based approach to hilsa management. This could help meet sustainable fisheries management and poverty alleviation objectives.

Yet fiscal fisheries policy can also be applied in a way that is harmful, or have unintended social or environmental consequences. The introduction or reform of fiscal tools will always entail social, environmental and economic trade-offs, and there are likely to be winners and losers. For instance, reform can disproportionately harm marginalised or vulnerable people such as low-income groups, women and children, and decision-making processes can be biased towards political and economic interest groups (Merayo et al. 2019). If fiscal policy is to be equitable and inclusive, it must consider the characteristics of different social groups involved at each stage of the value chain, and the magnitude and direction of potential impacts on those groups, to target specific groups accordingly (Porras 2019).

Table 1. Summary of fiscal tools for collecting revenues and allocating resources

REVENUE COLLECTION	SPENDING
Taxes: Compulsory payments, in cash or in kind, demanded by a public authority. They are often described as 'unrequited' because they are not payments for particular services, although governments may use the funds raised in taxes to provide goods or services to others, either individually or collectively, or to the community as a whole. Example: taxes on exports of fish and fish products.	**Direct transfers:** Payments made directly from government budgets (ie financed by taxpayers) to individuals and companies. The objective of these payments is not to reduce costs for producers but to increase their incomes. Example: grants to small-scale fishers for new vessels or gear.
Fees and charges: Compulsory payments that are levied in connection with a specific activity and which clearly relate to the cost of that activity. Example: fishing or vessel licence fees.	**Cost-reducing transfers:** Payments by governments to individuals and companies that impact profitability by lowering operating costs. Example: tax exemptions or loan guarantees for fishers.
Penalties and fines: Compulsory current transfers ie they reduce the income and consumption possibilities of the penalised party and increase the income and consumption possibilities of the penalising party. Example: revenues collected for fisheries infringements.	**General services expenditure:** Government spending on services that reduce the capital and/or operating costs of producers indirectly. Example: fisheries research and development, or monitoring, control and surveillance.

Sources: OECD (2018a, 2018b); Porras (2019).

1.3 Objectives of this study

This study was conducted as part of the Darwin Initiative-funded project, Carrots and Sticks: Incentives to Conserve Hilsa Fish in Myanmar, also known as Darwin-Hilsa[MM].[3] The project is led by the International Institute for Environment and Development (IIED) in partnership with WorldFish Myanmar, Network Activities Group (NAG), the Department of Fisheries (DoF), and the Zoology Department of Yangon University. It aims to design and implement an incentive-based scheme for sustainable and inclusive hilsa management in the Ayeyarwady Region, which will support households to comply with regulations.

This is a diagnostic study exploring whether fiscal reform could generate a significant and long-term source of finance for this incentive scheme, and if so, what this reform should look like. Using a literature review, focus group discussions (FGDs), key informant interviews (KIIs) and value chain analysis, the research seeks to:

- Identify and assess the efficiency of current fiscal tools for collecting revenues from the hilsa value chain,
- Identify opportunities within the value chain to reform or introduce new fiscal tools that could generate a new stream of revenue, and
- Estimate how much revenue could be generated in total, and if this would be sufficient to support incentive-based hilsa fisheries management.

1.4 Structure of the report

This report is comprised of five sections. Following this first section, Section 2 describes the study's methodology, including the value chain approach, analysis and information sources. Section 3 gives an overview of the hilsa value chain in Myanmar, describing the activities of and interactions between key actors. Section 4 uses this information to assess the efficiency of current tools for collecting revenues from these actors, to explore opportunities for fair fiscal reform that could raise sustainable revenues for incentive-based management of the hilsa fishery. Finally, Section 5 presents conclusions and summarises the main policy recommendations. Appendices 1 to 4 provide full reports of information collected through FGDs and KIIs, as well as details of calculations used in the value chain analysis.

[3] See www.iied.org/carrots-sticks-incentives-conserve-hilsa-fish-myanmar

2 Methodology

This study uses a mixed-methods value chain approach to build an understanding of how fiscal tools are currently used to collect revenues from the hilsa value chain, and how they could be reformed to raise additional revenues for investment into a more sustainable and inclusive fishery. Information was collected through a literature review, FGDs and KIIs, and analysed using qualitative and quantitative methods.

2.1 Value chain approach

We used a value chain approach to identify and characterise the key actors of Myanmar's hilsa production and trade ('value chain' refers to the process of adding value to a product, from raw material to final customer). We collected information on the activities of each actor in the value chain, their interactions and power dynamics. This approach was largely qualitative; we did not interview enough individuals within each actor group to form confident statistical inferences. Instead, we identified dominant stories (ie those which best reflect how the value chain operates) and cross-referenced these with the literature.

From each actor group, we collected information on costs (capital, fixed and variable), volumes of fish produced or traded, prices, revenues, profit margins and profits. We collected this information for total operations and for hilsa specifically. In order to gauge the profitability or vulnerability of hilsa operations within the value chain, we triangulated stated profits and margins by estimating their values using other figures provided. Both fixed and variable costs were used to estimate profit, and these were adjusted according to the proportion of total revenues generated by hilsa. Where data were missing or unreliable, we took values from the literature.

We also collected information on the fiscal tools that are reportedly used to raise revenues from these value chain actors, as well as the rough number of individuals or companies in each actor group. In order to understand the efficiency of current revenue collection, we combined this information with data on hilsa volumes, revenues and profits, to estimate current and potential total fiscal revenues raised from each actor group. We also used profit estimates to identify opportunities within the value chain to raise taxes, fees and other charges, in line with relative profitability.

2.2 Information sources

This study used a combination of desk-based literature review, KIIs and FGDs. During the period from 28 October to 2 November 2019, a research team composed of three members (an international consultant, a national fisheries expert previously employed by the DoF, and a local university researcher) collected information from 21 individuals thought to be involved in key stages of the hilsa value chain, and five additional people adjacent to the value chain or with expert knowledge on the value chain (see Table 2 for details). The information was collected from these 26 individuals in ten separate KIIs and five focus groups of two to five individuals (see Appendix 1 for full reports). An additional KII was conducted on 13 March 2020 with the chairman of an Ayeyarwady Region fisher association to fill some information gaps.

Table 2. Hilsa value chain actors interviewed

ACTOR	NUMBER OF INDIVIDUALS INTERVIEWED AND PROFILE
Fishers	13 (5 female and 8 male) from villages across the Ayeyarwady Region
Village traders	1 male from a village in Mawlamyinegyun township (Bamar ethnicity)
Township traders	3 males from Pyapon, Hinthada and Maubin townships (Bamar ethnicity)
Wholesale traders	2 traders at San Pya Fish Wholesale Market, Yangon (male, Bamar ethnicity)
Export-oriented processors	2 managing directors of processing factories for the export market on the outskirts of Yangon (male, Chinese and Bangladeshi)
Actors adjacent to value chain	1 village processer (female) 1 general manager of a marine jetty (male) 1 DoF deputy fisheries officer in charge of marine jetty (male) 1 trawl fishing net manufacturer (male) 1 NGO staff member with relevant expertise (male) 1 Chairman of a fisher association from Mawlamyinegyun township (male)

Notes: See Appendix 1 for full reports.

We targeted fishers and traders from the Ayeyarwady Region, which is where the majority of hilsa is landed (BOBLME 2015a). All KIIs and FGDs took place in Yangon at the WorldFish Office, San Pya Fish Wholesale Market (SPFWM), and two processing factories.

Although we aimed for a gender balance, only 26% of respondents were women. This reflects the fact that although some women fish together with men, they tend not to be registered fishers and are more commonly involved in trading activities such as bringing the catch to collectors, bringing undersized catch to market, and processing activities (ILO 2015; Khaing et al. 2019; Salagrama 2015).

All value chain actors were interviewed by two interviewers or more, with one person being the lead interviewer and the other(s) either serving as an interpreter (if required) or observer. Two of those outside of the value chain were interviewed one-on-one without translation or assistance. Most KIIs and FDGs took 1 to 1.5 hours, with only a few being slightly shorter or longer.

The interviews were semi-structured, meaning that they generally followed questionnaires (available on request), but allowed respondents to answer in nuanced and unexpected ways, and to skip questions that seemed irrelevant.

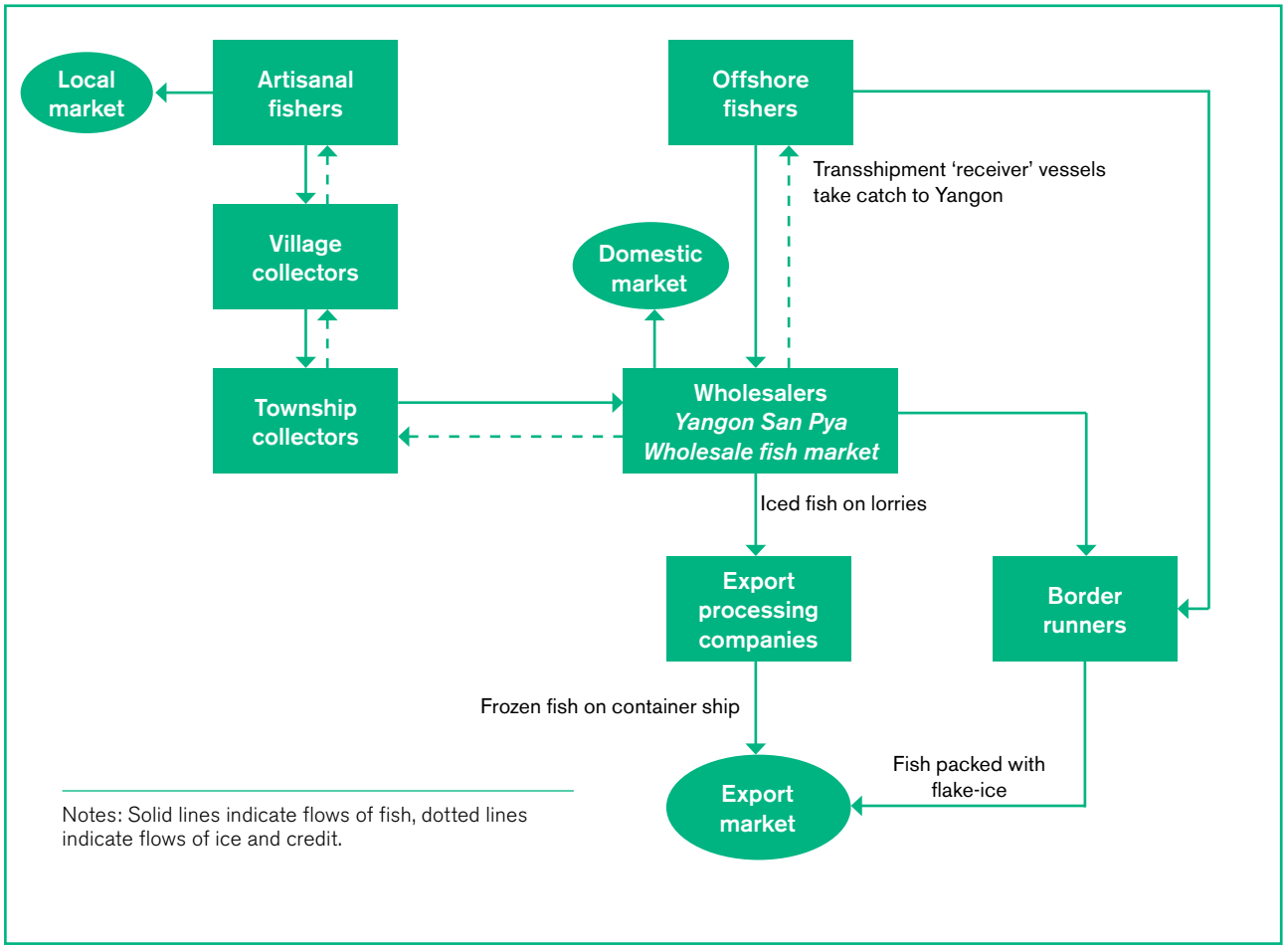
Given the limited number of individuals we were able to interview with the time and resources available, we cross-referenced our information with that collected through a previous study of the hilsa value chain in the Ayeyarwady Delta (BOBLME 2015a), where appropriate. We also held two one-day workshops on 28 February and 13 March 2020, where we shared preliminary findings with key staff members of the DoF and Ayeyarwady Region parliamentarians respectively, for validation purposes.

3

The value chain

This section describes the value chain of hilsa fish originating in the Ayeyarwady Region's waters and ending at either domestic consumption or the Myanmar border (Figure 1). We briefly describe the role of each actor in the value chain, the relationships and linkages between them, and the profitability or vulnerability of their business models (see Appendix 1 for more detail).

Figure 1. Major distribution channels of Myanmar's hilsa value chain



3.1 Fishers

We identified two main distribution channels for hilsa: one for hilsa caught by offshore fishers and one for hilsa caught by artisanal fishers fishing in fresh and inshore marine waters. These two channels connect in Yangon at San Pya Fish Wholesale Market (SPFWM), which is a central point through which the majority of Myanmar's fish trade flows. Note, however, that these channels are not clear cut, as some artisanal fishers also operate at a larger scale in offshore waters, and offshore vessels often fish illegally inshore (Ko et al. 2016; Tezzo et al. 2018).

3.1.1 Artisanal fishers

At the time of writing there are about 63,000 licensed fishers in the Ayeyarwady Region (DoF 2019), and according to KIIs, around the same number are estimated to be operating without a licence. We identified three main categories of artisanal fishers: those who fish all year round, making daily trips in rivers and estuaries; those who fish all year round on trips of up to three days, sometimes out to sea; and seasonal fishers who target high-value fish like hilsa during the most productive three to five months of the year.[4] Year-round fishers tend not to fish during monsoon season (June to September), but continue fishing during the closed season from May to July, when weather conditions allow. The Bay of Bengal Large Marine Ecosystem Project (BOBLME 2015a) also described a high season (October to February) and low season (March to September).

Our FGDs indicated that artisanal fishers tend to use powered boats[5] and fish in pairs (the boat owner is assisted by a family member or a hired labourer), but BOBLME (2015a) found the scale of village fishing activities to vary widely according to the size of boat and net. BOBLME (2015a) reported an average daily hilsa catch per fisher of 4kg in the low season and 13kg in the high season, which we estimate equates to around 1,694kg per year.[6] Total hilsa landings from the freshwater and inshore marine areas where these fishers operate were reported to be 2,485 metric tonnes in 2017–2018 (DoF 2019), although this is likely overreported (Baran et al. 2017). Data collected by the FAO (unpublished) indicated that this was nearer 938 metric tonnes in the same year, but inland capture fisheries in Myanmar are also thought to produce an additional 50% in unreported catches (Kelleher et al. 2012).

Artisanal fishers sell most of their hilsa to village or township traders (sometimes called collectors), but often sell directly to city traders in the high season (BOBLME 2015a). Fishers depend on collectors for informal interest-free cash loans called 'advances', which allow fishers to cover their costs (boat, nets and other equipment) at the start of a fishing season and support their families. Fishers tend to repay their lenders by selling their catch back to them at a price determined by the lender, based on information from Yangon. However, the township traders we interviewed said that fishers have more leverage when catches are high (see Appendix 2 for more details on this credit relationship).

Juvenile bycatch – ie hilsa weighing less than 0.2–0.3 viss[7] (0.3–0.5kg) – tend not to be accepted by traders. Instead, they are consumed in the household, or more frequently sold by fishers and their household members to local retailers, sometimes after salting or other basic processing, or discarded if they are very small. This local processing appears to be an important way for women to generate income.

The average household monthly income reported by the artisanal fishers who we interviewed was 3.8 *lakh* Myanmar kyat (MMK) (roughly equivalent to US$270)[8] – the lowest of all the value chain actors. Hilsa represented a significant portion of that income for some of the fishers interviewed. Because fishers tend to lack negotiating power with traders, their revenues from fishing are driven by volume rather than price. Based on our interviews, a typical artisanal fisher would have an annual revenue of MMK 32 *lakh* (US$2,273) per year from hilsa, with a profit margin of 60%, and an annual profit of MMK 20 *lakh* (US$1,421). BOBLME (2015a) data indicate a much higher average annual profit from hilsa of US$3,728. This difference could be a reflection of differences in lines of questioning between the two studies, different time periods, or different sample sizes; we interviewed only 13 fishers, whereas 72 were interviewed for BOBLME (2015a).

3.1.2 Offshore fishers

Hilsa are also caught in offshore marine waters by industrial vessels, which target multiple species. Fishing companies own between one and 30 of these vessels, and typically employ crews of 10–25 people, depending on the size of the vessel (ILO 2015). In 2017–2018 there were 448 offshore vessels registered to operate in the Ayeyarwady Region, but it is probable that vessels registered in other regions also fish there (DoF 2019).

[4] Year-round fishers fish tend to fish every day when conditions allow, apart from periods when tides are lowest, which amount to about seven days per month.
[5] There are also numerous non-powered boats in operation (over 6,000 in 2017–2018) but not many of these catch hilsa.
[6] Based on an average of 22 days of fishing per month for eight months (excluding monsoon season).
[7] Viss is a Burmese unit of mass equal to 1.63kg.
[8] A *lakh* is a unit in the Indian numbering system equal to 100,000 that is used in Myanmar and across the Indian subcontinent.

Nationwide, 3,172 offshore vessels were registered in 2017–2018 (DoF 2019), with another 50% expected to be engaging in illegal, unreported and unregulated (IUU) fishing. Total estimates of offshore hilsa landings in the Ayeyarwady Region in 2017–2018 ranged from 456 metric tonnes (FAO 2019) to 3,086 metric tonnes (DoF 2019). However, since offshore hilsa catch is landed in Yangon, it is likely that some of this catch comes from the offshore waters of other regions were hilsa are found, such as Rakhine State and Mon State.

Offshore vessels may often transfer their catch to Yangon via transshipment 'receiver' vessels so that they can remain at sea for longer, only returning to port when they have reached their maximum legal time at sea (around 60 days). The catch will likely be sold to city traders at San Pya Fish Wholesale Market (SPFWM), or directly to exporters (see Section 3.4). ILO (2015) reported the average monthly salary of a crew member to range from US$80 to 120, with a captain earning about US$150 to 250 per month.

We were not able to interview any offshore fishing company owners or crew, nor could we locate any information on typical business models. However, given the large scale of their operations, we can assume that they are near the top of the value chain. Based on a rough estimate of offshore hilsa landings (5,943 metric tonnes)[9] and a typical landing price of MMK 26,000 per kg, we estimate that revenues from hilsa are about MMK 46.6 million (US$32,648) per licensed vessel. We estimate the typical annual operating cost of an offshore vessel in Myanmar to be about MMK 302.5 million (US$211,761), of which US$1,016 can be attributed to hilsa fishing (see Appendix 4). This means that typical annual hilsa profits could be up to US$31,631 per offshore vessel, and up to US$950,000 per company, depending on number of vessels owned. These offshore fishing enterprises therefore appear to profit significantly less from hilsa than export companies do, but at least eight times more than artisanal fishers. Since this is a multispecies fishery, these profits could potentially make up a very small proportion of total profits for some vessels; our estimate for offshore hilsa production makes up less than 1% of Myanmar's total offshore fishery production (FAO 2018). However, anecdotal evidence suggests that declines in fish stock in Myanmar have led to a decline in offshore catch per unit effort and therefore profitability.

3.2 Local traders (collectors)

Village traders buy and collect catch from fishers at village landing sites, whereas township traders buy fish from fishers and village traders at town collection sites. They both keep the fish in iceboxes before sending them to Yangon.

3.2.1 Village traders

There are usually one to three traders per village, according to BOBLME (2015a), and an estimated total of 1,165 in the region. They buy from artisanal fishers with whom they have complex relationships based on long-term business and credit relationships, as described in Section 3.1.1. The village trader interviewed in this study reported buying from 18 fishers, with no competition from other collectors in his village, but lots of competition in other villages nearby. Although they have low setup costs, this lending comes with financial risk, and so trust is important in these relationships (see Appendix 2). Our respondent reported always being paid back by fishers in full. Village traders transport and sell the fish they purchase to township traders, unless they are close enough to Yangon to sell direct to wholesalers (BOBLME 2015a).

Based on reported daily volumes of hilsa traded by village traders (28kg during low season and 112kg during peak season), BOBLME (2015a) reported daily profits of US$23 in low season and US$146 in peak season, which we estimate amounts to around US$175,38 per year.[10] This is nearly five times what artisanal fishers make from hilsa in a year, although profit margins are similar. However, our village trader respondent reported making only MMK 4 *lakh* (US$284) per year from hilsa, and a total monthly household income of less than half that of the artisanal fishers – evidence that not all village traders profit more from hilsa than fishers do.

3.2.2 Township traders

Some fishers and most village traders sell their fish to the traders in larger riverside towns of the Ayeyarwady (such as Maubin, Pyapon, Hinthada, Pathein and Labutta). Each town has five to ten traders, depending on the size of the township (BOBLME 2015a), and there were 773 licensed in the region in 2018–2019 (DoF 2019). This is a substantial decline from 1,195 in 2017–2018, which could be a reflection of the decline in

[9] Assuming that the majority of total reported export volume (11,886 metric tonnes in 2017–2018; DoF 2018) is marine, and – based on the spread of catch data between offshore and inshore marine fisheries – that around half of it is caught offshore (FAO 2019).
[10] Based on the assumption that traders collect hilsa the same number of days per year that artisanal fishers catch it (an average of 22 days per month for eight months of the year).

fish stocks. Township traders pack the fish in insulated boxes part-filled with ice and transport them by boat to jetties in Yangon. Traders employ between three and 300 workers, and an average of nine to ten workers. It appears from our FGDs that some township traders have similar credit relationships with fishers to that of village traders (see Appendix 2).

Township traders sell most of their hilsa to wholesalers at SPFWM in Yangon, but according to BOBLME (2015a), there are around ten agents in the value chain who sometimes broker the business between the township traders and the Yangon wholesalers and exporters. These traders have low setup costs, but do not have much bargaining power because the price is determined by wholesalers in Yangon. Some township traders have a credit relationship with wholesalers, which allows them to cover the costs of providing credit to fishers or village traders (BOBLME 2015a).

Township traders generally make a better living than both artisanal fishers and traders, handling an average of 862kg during peak season and 151kg during low season (BOBLME 2015a). Based on daily profits reported by BOBLME (2015a) – US$21 and US$271 in low and high season respectively – we estimate average annual profits to be in the region of US$31,205 (ibid). This is nearly twice what village traders make in a year, and more than eight times what fishers make.[11]

3.3 Wholesalers (city traders)

Wholesale companies in Yangon buy fish mostly from town traders (sometimes via agents) and also from village traders, artisanal fishers and offshore fishers, for distribution to domestic retailers and/or exporters. Once received by dock workers at SPFWM, fish are sorted for size (small for local consumers, medium for local restaurants and retail, and large for export; BOBLME 2015a), repacked into larger insulated containers with fresh ice, and loaded onto lorries for onward transport. Since all local collectors bring their hilsa to SPFWM, the wholesalers have a powerful position in the value chain, but there is a substantial capital cost associated with acquiring space in the market, dependent on the type and size.

According to BOBLME (2015a), there are about 150 wholesalers in Yangon. All of them trade hilsa, but only a few specialise in hilsa. The study found daily volumes of hilsa traded by these wholesalers to vary from 160kg in low season to 1,440kg in high season, which comes to an annual average of 248 metric tonnes.[12] BOBLME (2015a) identified a group of five wholesalers at SPFWM who specialise in hilsa for export. They purchase hilsa from offshore fishers at private jetties in Yangon, agents or wholesalers at the market, and also from Dawei city in the Tanintharyi coastal area. They keep the purchased fish in cold storage until there is enough for export. Their trade volumes and frequency of sales were found to vary according to the season; they could handle up to 20,000kg of hilsa per day during high season (when as much as 83% of hilsa is exported) and 176kg per day in low season. This comes to an estimated daily average of 3,054 metric tonnes per year (ibid).

Based on trade volumes, the respondents we interviewed at SPFWM appear to fall into the latter category of export specialists. One of them reported owning a market jetty and trading between 2 million and 10 million viss (3,260 to 16,300 metric tonnes) of hilsa per year, which made up 60% of total revenues. They described most of this hilsa as coming from the marine fishery (and the bulk of marine hilsa coming into the market) and claimed to sell to 30 different export-oriented processing companies in Yangon (see Section 3.4).

The other respondent operated on a smaller scale, sharing a jetty with others but owning a market warehouse space, and trading up to 2 million viss (3,260 metric tonnes) of hilsa every year, constituting 70% of total revenues. They reported targeting hilsa caught inland for the Chinese market – which pays a premium for large, gravid hilsa – selling 70% to 20 different processing companies in Yangon, and the rest to ten companies that transport hilsa across the land border to China in trucks (see Section 3.4).

The divergence between these respondents' operations and some inconsistencies in figures made it difficult to elucidate typical profits for wholesalers specialising in hilsa export. Their stated annual household incomes from hilsa ranged from MMK 600 *lakh* per year (US$41,941) to MMK 1,400 *lakh* (US$97,862). Based on stated profit per unit of hilsa and the average of the range of hilsa volumes reported, annual profits at the company level are probably nearer MMK 1.1 billion (US$820,750) – 26 times more than what township traders make from hilsa, and more than 200 times artisanal fishers' hilsa profits. We do not have data for wholesalers as an entire group, but wholesalers not specialising in hilsa for export would have substantially lower hilsa profits.

[11] Conversely, the typical profit margins elicited from local traders interviewed for this study were very similar to artisanal fishers' margins (albeit with lower risk). This is probably because a village trader with very low profits from hilsa was included in the same group as township traders with much more profitable hilsa trade (see Appendix 1).
[12] Based on the assumption that wholesalers typically operate every day with a reduced supply of hilsa for around three months of the year (151 days during high season and 193 during low season). Note that wholesalers who specialise in hilsa may only trade hilsa during more specific periods.

3.4 Exporters

Export companies move fish and fish products (including hilsa) in bulk from Myanmar to more than 40 countries, including China, India, Malaysia, Singapore, Dubai, USA, Bangladesh and countries across the European Union. The majority of exported hilsa comes from the marine fishery, but different export markets have different size requirements; for instance, China imports the largest fish (and fish with full egg sacks). Our interviews indicated that hilsa are typically transported via trucks from Yangon wholesalers to export-oriented processing companies in and around Yangon, to be sorted for size and quality, cleaned, frozen, packaged and stored before export in refrigerated containers via the international port facility. These processors add value by linking wholesalers and offshore fishers to international demand, and in properly preparing hilsa for export. Only a very small amount of processed hilsa is distributed and consumed within Myanmar.

We estimate that there is a total of 80 companies exporting hilsa from Myanmar, around 30 of which are in Yangon and move significant volumes of hilsa, and ten of which move the highest volumes of hilsa. Some of these companies hire the services of processing companies for export (one of the factories that we visited provided processing services for third-party exporters), while others are vertically integrated so own their own processing facilities as well as distribution processes in destination countries (as was the case for the other factory we visited).

The officially reported volume of hilsa exported in 2017–2018 was 11,380 metric tonnes, with a total revenue of US$32.172 million (DoF 2018). However, unreported exports could constitute another 50% in volume, based on Myanmar's estimated hidden harvest (Kelleher et al. 2012). Not only do illegal transhipments occur at sea, there is evidence of smuggling via land borders to China and Bangladesh (Kubo and Lwin 2010). Our research indicated that some hilsa are transported from wholesale traders in Yangon (and potentially directly from offshore vessels at private jetties) across international borders via trucks. Most seem to be going to China, around a 1,000km drive away via Shan State, but we have little information about these trucks, or what happens to the hilsa once it enters China.

The respondent from the vertically integrated company visited claimed to have the capacity to process 12 metric tonnes of fish per day, around 30–40% of which is hilsa, which alone generates 70–80% of revenues. At a price of US$7 per kg of hilsa, this would suggest that they move between 70 and 90 metric tonnes of hilsa per month, with revenues of US$485,333–606,667. If around ten processing companies are dominating the hilsa export market, as suspected, this range of volume would align with the official export volume reported from 2017–2018. Revenues are around double what might be expected given official export revenues, which could be evidence of the hidden harvest.

The respondent's reported operating costs (labour, electricity, refrigerant ammonia and packaging materials) came to around US$60,000 per month, when adjusted for hilsa operations alone, bringing our estimate of their annual hilsa profits to US$5.1–6.6 million (with an 85–90% profit margin) – much higher than other value chain actors. A typical export-oriented processing company would also require significant capital investment (around US$1 million) to set up their operation – the most expensive components being purchase (or rent) of a property and air-blast freezers. As such, they must be set up by people of wealth (although they do employ vulnerable low-skilled workers, including women; ILO 2015).

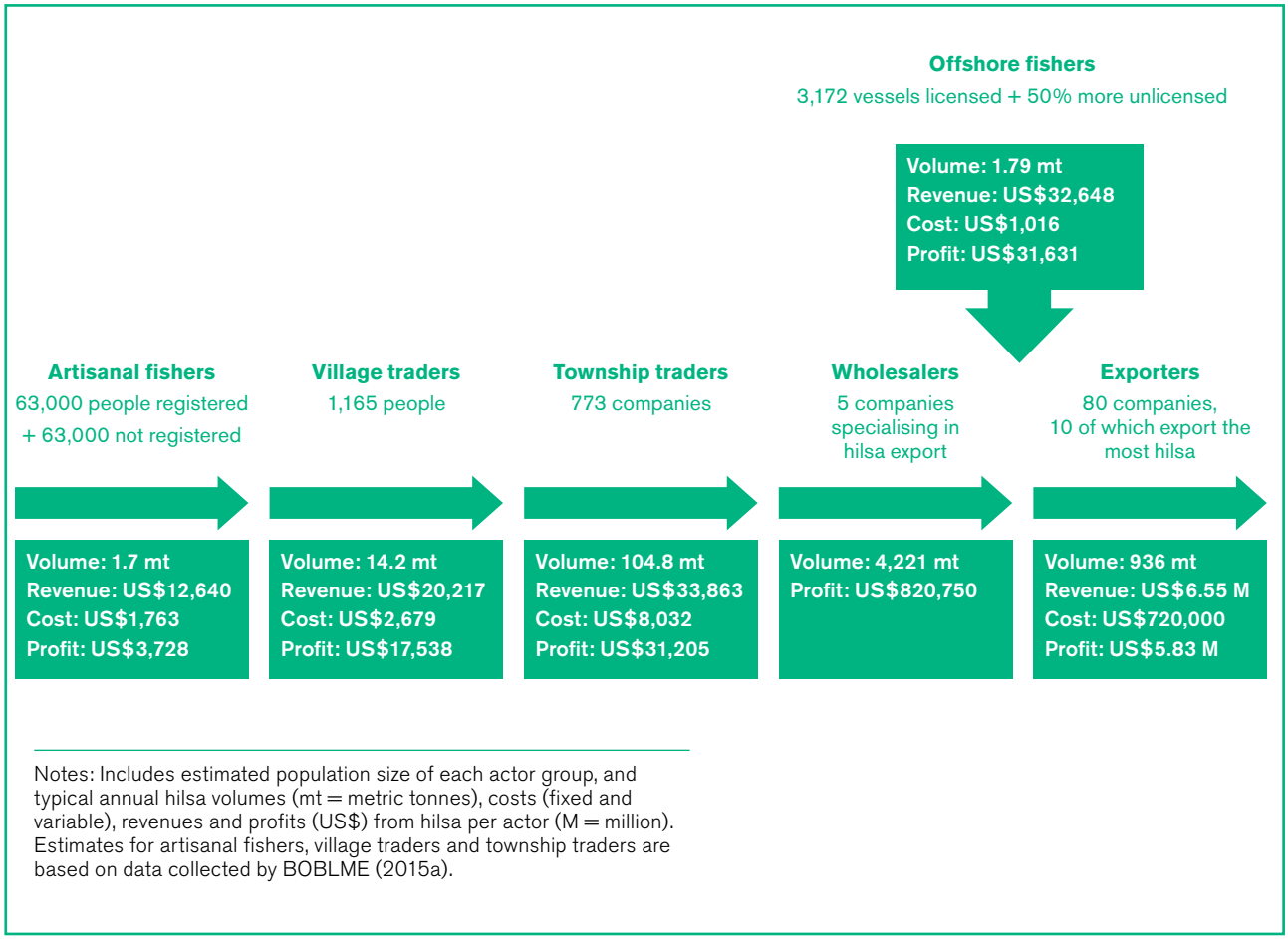
3.5 Value chain summary

The main value chain actor groups identified in this study are fishers (artisanal fishers and offshore fishers[13]), village traders, township traders, wholesalers and exporters. The most numerous types of actors are fishers, followed by smaller numbers of village and township traders, and yet smaller numbers of city traders and exporters (Figure 2). Men are traditionally more involved in fishing and trading while women are more often engaged in local-level vending, processing and net repair.

Overall, value accumulates mostly in Yangon. Artisanal fishers tend to be rural and poor, producing low volumes of hilsa with low net profits; whereas actors nearer the top of the chain (exporters, wholesalers and offshore fishers) tend to be urban and wealthy, moving high volumes of hilsa with higher net profits. Profit margins are highest for offshore fishers, followed by exporters and artisanal fishers, declining through the middle part of the value chain from village traders to wholesalers. The actors at the top of the chain appear to be somewhat protected from competition owing to high barriers to entry, such as prized market space, technology- and capital-intensive processes, linkages to international buyers, and provision of important value-added services such as ice, boxes, and credit – supplies of which flow through the value chain in the opposite direction to hilsa (see Appendices 2 and 3).

[13] We use the term 'offshore fishers' throughout to describe the companies who own the vessels, rather than the individuals involved.

Figure 2. Summary of key actors in Myanmar's hilsa value chain



Notes: Includes estimated population size of each actor group, and typical annual hilsa volumes (mt = metric tonnes), costs (fixed and variable), revenues and profits (US$) from hilsa per actor (M = million). Estimates for artisanal fishers, village traders and township traders are based on data collected by BOBLME (2015a).

4

Raising revenues through fiscal reform

Based on the value chain analysis, here we identify various opportunities for fiscal reform to improve revenue collection and management, and thereby generate a source of sustainable finance for incentive-based hilsa fisheries management. The introduction of new tools can be a lengthy process requiring new laws, and so we have focused on opportunities to adapt current revenue-collection tools.

4.1 Opportunities to increase efficiency of revenue collection

There are numerous fiscal tools used by the DoF, as well as other institutions such as the Ministry of Planning, Finance and Industry (MoPFI), Yangon City Development Committee (YCDC) and the Ministry of Commerce (MoC), to collect revenues from hilsa value chain actors. DoF revenues collected from the marine fishery (inshore and offshore) are managed at union (national) level, whereas revenues collected from the freshwater fishery are decentralised by region or state. There is room to improve revenue-collection efficiency across many of these tools, which by our calculations could increase revenues by nearly two and a half times. Table 3 provides a summary of current revenue-collection tools applied to different actors in the hilsa value chain, along with typical fees, estimated revenues and revenue potential if collection efficiency were increased.

Artisanal fisher registration and licence fees: There are 63,000 artisanal fishers currently registered in the Ayeyarwady Region, each paying an average of MMK 11,000 in registration and licence fees per year, totalling MMK 693 million in revenues for the DoF (US$488,200). If all of the individuals thought to engage in fishing activity (126,000 individuals) were charged these fees, then double that amount of revenue could potentially be collected. It is possible that many of the people who avoid paying these fees do so because they have very low incomes from fishing, but as long as fees remain at the level they are for artisanal fishers, the fees should not have a disproportionately negative impact on vulnerable groups. Furthermore, our interviews indicated that the fees would normally be paid for using traders' advances. It may not be realistic to expect that every farmer who occasionally fishes pays to register themselves as a fisher. Their fishing activities are essentially subsistence and usually tolerated even by the leaseholders of leased floodplains and stretches of rivers, providing the fish is only for family consumption at times of hardship. Without registration, these farmer–fishers would not be eligible to participate in any incentive scheme. If fees were collected from just 50% more fishers, an additional MMK 346.5 million (US$242,500) could be generated for the DoF every year.

Table 3. Summary of current hilsa revenue-collection tools, typical fees, estimated revenues and revenue potential

FISCAL TOOL	ESTIMATE OF CURRENT ANNUAL REVENUES COLLECTED	POTENTIAL ANNUAL REVENUES WITH EFFICIENT COLLECTION
Artisanal fishers		
Fisher registration (ID) card (MMK 1,000 per year to DoF)	MMK 1000 x 63,000 fishers = MMK 63 million per year (US$44,100)	MMK 63 million x 1.5 = MMK 94.5 million per year (US$66,150)[a]
Fishing licences for boat, engine and gear (MMK 10,000 per year to DoF)	MMK 10,000 x 63,000 fishers = MMK 630 million per year (US$441,000)	MMK 630 million x 1.5 = MMK 945 million per year (US$661,500)[a]
Offshore fishers		
Seaworthiness certificate (MMK 34,500 per vessel per year) and waterway management fee (MMK 37,500 per vessel per year)	MMK 72,000 x 3,172 offshore vessels licensed nationwide = MMK 228 million (US$159,869)	MMK 228 million x 1.5 = MMK 343 million (US$239,803)[b]
DoF licensing fees (MMK 500,000 per vessel per year)	MMK 500,000 x 3,172 vessels = MMK 1.5 billion (US$1.1 million)	MMK 1.5 billion x 1.5 = MMK 2.4 billion (US$1.7 million)[b]
Corporate income tax (25%)	25% of MMK 45.2 million x 3,172 vessels – 35% = MMK 23.3 billion (US$16.3 million)[c]	25% of MMK 45.2 million x 3,172 vessels US$ x 1.5 = MMK 53.8 billion (US$37.6 million)[b]
Village trader		
Collector's licence (MMK 5,000 per 100 metric tonnes per year)	MMK 708 x 1,165 traders = MMK 825,286 (US$577)[d]	MMK 825,286 x 1.5 = MMK 1.2 million (US$867)[e]
Town trader		
Collector's licence (MMK 5,000 per 100 metric tonnes per year)	MMK 5,239 x 773 traders = MMK 4 million (US$2,835)[d]	MMK 4 million x 1.5 = MMK 6.1 million (US$4,252)[e]
Corporate income tax (25%)	MMK 11.1 million x 387 traders = MMK 4.3 billion (US$3 million)[f]	MMK 11.1 million x 773 traders = MMK 8.6 billion (US$6 million)
Wholesalers		
Collector's licence (MMK 5,000 per 100 metric tonnes per year)	MMK 82,552 x 150 traders = MMK 12.3 million (US$8,668)[d]	MMK 12.3 million x 1.5 = MMK 18.6 million (US$13,002)[e]
Corporate income tax (25%)	25% of MMK 25 million x 5 traders – 35% = MMK 953 million (US$666,859)[c,g]	MMK 953 million + 35% = MMK 1.4 billion (US$1 million)[g]
YCDC fees (MMK 90,000 per year)	MMK 90.000 x 150 traders = MMK 13.5 million (US$9,450)[h]	MMK 90.000 x 150 traders = MMK 13.5 million (US$ 9,450)[h]

Table 3. Continued

FISCAL TOOL	ESTIMATE OF CURRENT ANNUAL REVENUES COLLECTED	POTENTIAL ANNUAL REVENUES WITH EFFICIENT COLLECTION
Exporters		
Collector's licence (MMK 5,000 per 100 metric tonnes per year)	MMK 596,000 (US$398)[i]	MMK 596,000 x 1.5 = MMK 853,500 (US$597)[ei]
Exporter registration (MMK 50,000–100,000 per year)	MMK 750,000 x 80 exporters = MMK 6,000 (US$4,200)[h]	MMK 750,000 x 80 exporters = MMK 6,000 (US$4,200)[h]
2% advanced income tax offset against 25% corporate income tax	2% of national official export revenues = US$643,440; 25% of US$27.3 million – 35% = US$4.4 million; total tax = US$3.8 million[c,j]	2% of 1.5 x national official export revenues = US$965,160; 25% of 1.5 x US$27.3 million = US$10.3 million; total tax = US$9.3 million[e,j]
YCDC fees (MMK 90,000 per year)	MMK 90,000 x 30 Yangon companies = MMK 2.7 million (US$1,889)[h]	MMK 90,000 x 30 Yangon companies = MMK 2.7 million (US$1,889)[h]
Total	MMK 36.5 billion (US$25.6 million)	MMK 76.1 billion (US$56.6 million)

Notes: [a] Based on the assumption that half of all artisanal fishers are registered, and that registration could be increased by 50%. [b] Based on the assumption that another 50% of vessels operate without licences and certificates. [c] Based on the assumption that some companies take advantage of tax 'loopholes' with a subsequent 35% loss of tax revenue. [d] Based on average volumes traded (BOBLME 2015a). [e] Based on the assumption of 50% hidden harvest. [f] Based on the assumption that 50% of township traders have gone through the formal business registration process and pay tax at the official rate. [g] Based only on typical income of the ~five wholesalers specialising in hilsa for export, excluding the ~145 that do not specialise in hilsa. [h] Although there are probably some informal payments, we assume these are not great. [i] Based on official hilsa volume exported in 2017–2018. [j] Based on an 85% profit margin as indicated by this study.

Offshore vessel fishing and licence fees: Offshore vessels are currently required to pay an average of MMK 500,000 per year in fees to the DoF,[14] and around MMK 72,000 to the Port Authority, which we estimate comes to a total of MMK 1.8 billion (US$1.3 million). However, there are estimated to be 50% more unlicensed vessels in operation that do not pay these fees, which could generate an additional MMK 907.2 million (US$635,034) in revenues if they were included.

Collector's licence fees: Traders at all levels (village, town and city) are required to pay the DoF for a licence to operate, per unit volume of fish collected. No export licence is currently required for hilsa (Myanmar National Trade Portal), but exporters are still required to have a collector's licence.[15] Based on average fees and rough volumes of fish collected by each actor, we estimate that the DoF could be collecting a total of MMK 26.7 million per year (US26,022) – 1.5 times more than current estimates.

Personal income tax: In 2019, personal income tax rates ranged from 0% (for earnings of MMK 1–2 million) to 25% (for earnings of more than MMK 30 million) (VDB Loi 2019). It is likely that many artisanal fishers are therefore not required to pay income tax, but the efficiency of personal income tax collection in any actor group is beyond the scope of this study since we have assessed most of them at a business level rather than individual level.

Corporate income tax: VDB Loi (2019) reported the corporate income tax (CIT) rate for companies in Myanmar to be 25%. It is difficult to estimate current revenue generation, but we can assume that 50% of township traders do not go through the formal registration and tax-paying process, and that some offshore fishing companies, wholesale companies and export companies take advantage of tax loopholes with a subsequent loss of around 35% of potential revenue. If all companies were to pay the official tax rate on their profits from hilsa, it could potentially generate a total of US$53.4 million per year for the MoPFI – more than double our estimate of current revenues.

[14] On 28 February 2020, the DoF informed us of an agreed plan to double offshore fishing vessel licence fees, said to come into effect in the last quarter of 2020.
[15] This excludes export-oriented processing companies which provide processing services to exporters.

Commercial tax: Taxpayers whose revenue from trading, sale of goods and services in the income year exceeds the minimum threshold of MMK 50 million are obliged to charge, collect and pay commercial tax (usually 5% of expected revenues) to the Internal Revenue Department of the MoPFI, but production and trade of fresh fish are exempt, as are export activities (VDB Loi 2019), meaning that no hilsa value chain actor is required to pay it.

City fees: The YCDC levies fees for use of market spaces by traders in SPFWM, as well as processing facilities. If these were collected from each individual company involved in the hilsa value chain in Yangon, at least MMK 16.2 million (US$11,340) could be generated in annual revenues for YCDC.

Export taxes and other charges: Exports from Myanmar are controlled by the Customs Department of the MoPFI, which is responsible for collecting applicable taxes. Companies exporting goods must pay 2% advanced income tax on the assessed value of goods, which is offset against the 25% annual corporate income tax due at the end of the year (VDB Loi 2019). Based on the total reported revenues of US$32.172 million from hilsa export in 2017–2018, the MoPFI likely made a total of MMK 5.4 billion (US$3.8 million) in tax revenues. But given that there could be a 35% loss of revenues through tax loopholes, and another 50% of exports which go unreported, it is possible that through better monitoring and regulation, the MoPFI could collect up to MMK 13.3 billion (US$9.3 million) – nearly 2.5 times current tax revenues from this group.

Businesses wishing to export must first register as a company authorised to engage in international trade with the Department of Trade (Ministry of Commerce), which costs MMK 40,000–50,000 per year, plus another 3,000–53,000 in additional fees depending on the number of representatives (Myanmar National Trade Portal). Assuming there are around 80 companies exporting hilsa from Myanmar, this would generate a negligible MMK 4 million (US$2,400) per year for the MoC. These fees could feasibly be doubled (see Section 4.2).

4.2 Opportunities to better target actors with greater ability to pay

Currently, value chain actors with the highest profits from producing or trading hilsa are required to spend the lowest proportion of their profits on licence fees and other charges (Table 4). For example, although a fisher typically makes less than 0.1% of the annual hilsa profits that an export company makes, fees and charges typically comprise around 0.2% of a typical artisanal fisher's annual profit, as opposed to less than 0.1% for an export company. Similarly, corporate income tax is set at a flat rate, regardless of the relative incomes made by different value chain actors. This means that an export company is required to pay the same 25% tax as a township trading company, even though their profits are typically two orders of magnitude higher.

Not only should these fees and taxes be distributed more equitably across the value chain (ie to better target those actors with greater ability to pay), it is clear from our value chain analysis that more revenues could be collected from actors nearer the top of the chain without affecting their business models. Table 4 shows a summary of current fees and taxes as a proportion of profits from hilsa by each value chain actor, plausible fee revisions, and potential annual revenues that could be generated if fee and tax revisions were implemented efficiently. If each of the revisions in Table 4 were made, and revenues were collected efficiently as demonstrated in Table 3, a total of MMK 130.3 billion (US$91.2 million) could be generated annually – over 3.5 times more than our estimate of current revenues.

4.2.1 Fees and charges

The collector's licence fee of MMK 30,000 is negligible for traders at village and township levels (0.1% of typical annual profit), and generates an estimated US$3,412 per year. Raising the fees to just 1% of annual profit for village traders, and 3% for township traders, could generate a total of US$1.4 million in annual revenues for the DoF, if collected efficiently, without damaging these actors' bottom lines.

The collector's licence and other fees required of wholesalers and exporters are even more trivial, given the large scale of their operations and their dominant positions in the value chain, generating an estimated annual total of US$685,484. Overall, wholesaler and exporter fees could easily be increased to 5% and 7% of profits, respectively, with minimal influence on their business models and the value chain. This could generate at least US$15.4 million in revenues. Given the annual profits typically made by export companies compared to other city traders, it would be plausible to introduce a special export licence fee – although this may be too institutionally demanding if requiring new legislation.

By our calculations, offshore fishing vessels pay the highest fees of any value chain actor, proportionally to their hilsa profits (see Table 4). The DoF has reportedly agreed to double offshore vessel licence fees – a change which would come into force after the general election scheduled for the end of 2020 – bringing total fees to 2.37% of profits from hilsa. Although the profits

Table 4. Summary of value chain actors, current fees and taxes as % of profits, plausible fee revisions, and potential annual revenues (per actor and total)

VALUE CHAIN ACTOR	TYPICAL ANNUAL FEES (US$ AND AS % OF PROFIT)	POTENTIAL FEES (US$ AND % OF PROFIT)	TYPICAL TAX (US$ AND % OF PROFIT)	POTENTIAL TAX (US$ AND % OF PROFIT)	POTENTIAL TOTAL ANNUAL REVENUES (US$)
Artisanal fishers	US$7.70 (0.21%)	No change	–	–	US$727,650[a]
Village traders	US$0.50 (<0.01%)	US$175 (1%)	–	–	US$306,479[b]
Township traders	US$3.67 (0.01%)	US$936 (3%)	US$7,801 (25%)	US$8,113 (26%)	US$10.5 million[b]
Wholesalers	US$120 (0.02%)	US$41,037 (5%)	US$205,187 (25%)	US$229,810 (28%)	US$11.0 million[b,c]
Export companies	US$40 (<0.01%)	US$408,240 (7%)	US$77,414 (2% export tax offset against 25% CIT)	US$659,526 (5% export tax offset against 30% CIT)	US$16.0 million[b,d]
Offshore vessels	US$400 (1.26%)	US$1,581 (5%)	US$7,907 (25%)	US$8,224 (26%)	US$52.5 million[e]
Total					US$91.0 million

Notes: Total potential annual revenues were calculated based on an efficient revenue-collection scenario as described in Table 3. CIT = corporate income tax. [a] Based on 63,000 artisanal fishers + 50% paying. [b] Based on the assumption of 50% hidden harvest. [c] Fees based on 150 wholesalers and tax based only on profits of the ~5 wholesalers specialising in hilsa for export. [d] Fees based on the assumption that ten companies dominate hilsa exports in Yangon, and taxes based on official hilsa export revenues reported in 2017–2018. [e] Assuming 3,712 offshore vessels plus 50% more operating without a licence.

of offshore vessels appear to be on a par with those of township traders, at a company level they are probably nearer those of wholesalers, and so we expect that offshore fishers could withstand much higher fees. If their fees were set at a similar level to wholesalers' (5% of hilsa profits), this could generate around US$8.8 million per year in revenues for the DoF and Port Authority – a huge increase on the current $1.3 million.

4.2.2 Taxes

A more progressive corporate income tax system is another option that would allow more tax revenues to be collected while distributing the cost more fairly throughout the value chain. If taxes were progressively raised by 3% for township traders, 5% for wholesalers and offshore fishers, and 7% for exporters, this alone could generate US$44.1 million in tax revenues per year for the MoPFI – nearly double our estimate of current tax revenues from hilsa.

4.3 Factors for successful reform

Here we identify factors which we expect to maximise the success of these reforms in not only generating new revenues, but also in contributing to more sustainable and inclusive hilsa fisheries management.

4.3.1 Identify and mitigate unintended consequences

Policymakers must consider the full range of potential impacts of fiscal reform (social, political, economic or environmental) to understand how they will affect different groups and what measures they can take to reduce negative impacts.

For example, there is a risk that raising fees or taxes could drive hilsa trade and export further underground,

if rates were deemed unacceptably high. Further research would be required to understand exactly how much each value chain actor could pay without prohibitively negative impacts on their income or competitiveness, or on the value chain more broadly. Designing a campaign to communicate the long-term benefits of any changes should also help to build acceptance. Providing a tangible short-term benefit to village and township traders – perhaps in the form of access to quality information on market prices, trends and foresight analysis – may further help to reduce negative perceptions.

Another risk with increasing fees for traders – particularly village traders – is that they could pass on the increased costs to artisanal fishers by reducing purchase prices and imposing or raising interest rates on credit. Access to affordable loans from formal institutions could help to reduce the dependence of fishers on these forms of credit, and therefore reduce this risk. Cost-offsetting initiatives targeted towards village-level ice production or provision of boxes might also shift more power into fishers' hands and reduce their dependence on traders.

A potential unintended environmental consequence of increasing the registration and licensing coverage among artisanal fishers is that seasonal or occasional fishers could increase their fishing effort to make the fees worth their money – especially if there is the promise of compensation during closed seasons. This could have negative impacts on hilsa and other fish stocks. Awareness campaigns may help to prevent unsustainable or damaging fishing practices, such as targeting and trading juvenile hilsa, but policymakers would need to explore and balance trade-offs between increasing revenues and encouraging more individuals to enter the hilsa fishery.

The creation of new opportunities to collect, manage and distribute funds can create new opportunities for misuse of these tools and funds in immature and underprepared public-sector administration systems. There is evidence, for example, of rent seeking in other areas of Myanmar's fisheries sector, where fishers are subjected to additional government charges beyond normal rates. This behaviour can in turn undermine perceptions of legitimacy and willingness for stakeholders to cooperate. To reduce the potential for misuse of fiscal tools, technical and institutional capacity for fiscal administration may need to be strengthened (see Section 4.3.3).

4.3.2 Strengthen offshore governance

Despite a new compulsory vessel monitoring system, there is still a huge illegal, unreported and unregulated (IUU) offshore fishing fleet that is encroaching on the inshore fishery. Until this changes, efficient collection of revenues from the offshore fleet will not be possible, and unsustainable marine fishing activity may undermine the impacts of improved hilsa management inland.

4.3.3 Earmark revenues for incentive-based hilsa fisheries management

For a long time in Myanmar there has been a focus on generating revenues rather than management or sustainability of fisheries (Tezzo et al. 2018), and measures must be taken so as not to revert to this approach. If new revenues generated by these reforms are to support a system of incentive-based fisheries management, then at least a portion of them must be earmarked for this purpose, rather than being diverted for other purposes. There must also be strong enough institutional capacity for effective management and use of the funds (Mohammed et al. 2018).

DoF revenues could, for example, be channelled into the DoF's research and development fund and earmarked for hilsa conservation. Currently, 2–3% of DoF revenues are supposed to be reserved for this fund, but any proposal for revenue flows to be used in this way requires both state/region approval and subsequent union-level concurrence. Owing to this lengthy bureaucratic process, the policy has not yet been used. For any revenues to be managed through this fund, the approval process must be streamlined.

Another potentially simpler option is for DoF funds to be managed at a decentralised level. The 2018 Ayeyarwady Region Freshwater Fisheries Law (updated in 2019) empowers the regional minister for agriculture and the environment to establish a conservation fund (article 20d), in accordance with the Budgetary Law.

Alternatively, or in addition, a Conservation Trust Fund (CTF) could be established for hilsa fisheries management. As legally independent grant-making institutions, CTFs can provide the institutional capacity at local and national levels for transparent and accountable fund generation and allocation (Bladon et al. 2014). This approach has been used with success in developing countries around the world.

5 Conclusions

The reforms we set out in this paper for increasing current revenue-collection efficiency could generate annual revenues in the region of US$56.9 million for the DoF and government of Myanmar more broadly (more than twice our estimate of current annual revenues). Combining this increase in revenue-collection efficiency with the proposed revisions to fee and tax rates could generate revenues nearer US$91 million per year (more than three and a half times current annual revenues), by better targeting actors nearer the top of the hilsa value chain.

These estimates clearly demonstrate that fiscal reform offers a low-cost approach to funding a system of incentives for hilsa fisheries management. This would contribute to a more sustainable fishery with maintained, possibly increased, landings with the added advantage of larger, more valuable fish being available. We do not yet have accurate estimates of what type and level of incentives fishing households in the Ayeyarwady Region would be willing to accept for compliance with specific fishing regulations, but we can make inferences based on an incentive scheme for hilsa fishing households in nearby Bangladesh. For over a decade, this scheme has been providing households with in-kind compensation during a fishing ban of one to four months, at a rough average annual cost of US$88 per household for alternative income-generating activities and US$1.40 per household for food compensation (Haldar and Ali 2014). Even at the higher end of this range, it would be possible to provide fiscal incentives to all fishers across the Ayeyarwady Region, including those who are currently not registered.

It may be that some of the proposed reforms should take priority over others, owing to feasibility and revenue collection potential. For instance, since value accumulates in Yangon – with most hilsa appearing to pass through SPFWM and a relatively small number of export-oriented processing companies – targeting wholesalers and particularly export companies might be the most effective way to increase revenues. However, the most realistic reforms will be those that are managed at the decentralised level within the scope of the 2018 Ayeyarwady Region Freshwater Fisheries Law (updated in 2019) and its regulations.

It should be noted that the figures presented in this study are based on a rough analysis involving numerous assumptions and limitations. They should not be interpreted as accurate figures for revenues that are currently, or could be, generated from the hilsa value chain, but are instead intended to demonstrate the revenue potential of fiscal reform, and to prompt consideration and discussion of the approach. First, information collected through FGDs and KIIs likely involved reporting and social desirability biases, due to the social context of the interview and sensitivity of questions. Questions about hilsa volumes, total income and income from hilsa were also likely subject to errors arising from difficulty in accurately conveying concepts, erroneous translation, or incomplete knowledge (for example, it was sometimes difficult to ascertain whether respondents were reporting total revenue from sales, or total profit after expenses are paid).

Second, we were unable to provide a complete picture of the entire value chain, or a full and detailed picture of each actor's profitability or vulnerability – including fishing vessel crew members, providers of inputs such as ice and fishing gear, boat builders, receiver vessel operators, the actors who transport hilsa over the border into China, Chinese processors and distributors, and other overseas agents and customers. Further research into these actors would further illuminate how and where value accumulates and help to generate more accurate estimates of revenue-collection potential.

Furthermore, many of the figures used for current fees, taxes and actor population sizes were ballpark estimates provided by experts. A more rigorous value chain analysis with larger respondent sample sizes, and consultation with government officials, would be required to properly guide fiscal reform. Finally, any potential revision to tax rates should consider the elasticity of demand – otherwise a higher tax could lead to a fall in demand for hilsa and higher prices.

References

Akester, M (2019) Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem. *Deep Sea Research Part II: Topical Studies in Oceanography* 163: 46–56.

Akester, S, personal communication with authors, 17 March 2020.

Baran, E, Nwe, KM, Swe, T, Hanshein, S, Keomonyneath, P, Sokvisal, R, Lunn, Z and Gätke, P (2017) Consultation of fishers on fishery resources and livelihoods in the Ayeyarwady Basin. Ayeyarwady State of the Basin Assessment (SOBA) Report 4.3. National Water Resources Committee (NWRC), Myanmar. https://bit.ly/344i02Q

Bladon, AJ, Mohammed, EY, Milner-Gulland, EJ (2014) A review of conservation trust funds for sustainable marine resources management: conditions for success. IIED, London. https://pubs.iied.org/16574IIED

Bladon, AJ, Myint, KT, Ei, T, Khine, M, Thu Aye, P, Lay Thwe, T, Leemans, K, Maung Soe, K, Akester, M, Merayo, E and Mohammed, EY (2019) Spawning seasonality of hilsa (Tenualosa ilisha) in Myanmar's Ayeyarwady Delta. IIED, London. https://pubs.iied.org/16661IIED/

BOBLME (2015a) The value chain of Hilsa shad in the Ayeyarwady Delta, January 2015. BOBLME-2015-Socioec-13. https://boblme.org/documentRepository/BOBLME-2015-Socioec-12.pdf

BOBLME (2015b) Distribution, migration and breeding of Hilsa (Tenualosa ilisha) in the Ayeyarwady system in Myanmar, September 2015. BOBLME-2015-Ecology-39

BOBLME (2015c) Stock assessment of hilsa shad (Tenualosa ilisha) in Myanmar. BOBLME, Yangon, Myanmar. https://bit.ly/2w7BSWh

DoF (2015) Fisheries statistics 2015. Republic of the Union of Myanmar, MoALI. Naypyidaw, Myanmar.

DoF (2018) Fishery statistics 2018. Republic of the Union of Myanmar, MoALI. Naypyidaw, Myanmar.

DoF (2019) Unpublished fishery statistics 2019. Republic of the Union of Myanmar, MoALI. Naypyidaw, Myanmar.

FAO (2018) FAO Yearbook. Fishery and aquaculture statistics 2016. FAO, Rome. www.fao.org/documents/card/en/c/I9942T/

FAO (2019) Improvement of data collection on fisheries and aquaculture production: pilot system for the Yangon Region. FAO, Rome. www.fao.org/documents/card/en/c/CA1927EN

Fluet-Chouinard, E, Funge-Smith, S and McIntyre, PB (2018) Global hidden harvest of freshwater fish revealed by household surveys. *Proceedings of the National Academy of Sciences* 115(29): 7,623–7,628.

Haldar, GC and Ali, L (2014) The cost of compensation: transaction and administration costs of hilsa fish management in Bangladesh. IIED, London. https://pubs.iied.org/15522IIED

ILO (2015) Value chain analysis and competitiveness strategy: marine capture fisheries: Myeik and Yangon, Myanmar. International Labour Organization, Myeik and Yangon, Myanmar. https://bit.ly/2R1BKyH

Islam, MM, Mohammed, EY and Ali, L (2016) Economic incentives for sustainable hilsa fishing in Bangladesh: an analysis of the legal and institutional framework. *Marine Policy* 68: 8–22. https://bit.ly/3bLjCkU

Kelleher, K, Westlund, L, Hoshino, E, Mills, D, Willmann, R, de Graaf, G and Brummett, R (2012) Hidden harvest: the global contribution of capture fisheries. Worldbank and WorldFish. https://bit.ly/2ykiRk7

Khaing, WW, Akester, M, Garcia, EM, Bladon, A and Mohammed, EY (2019) Socioeconomic characteristics of hilsa fishing households in the Ayeyarwady Delta: opportunities and challenges. IIED, London. https://pubs.iied.org/16656IIED

Ko, WK, Htay Oo, A, Thwin, S, Naing, AA, Callow, M, Johnstone, G, Hosch, G, and Hermes, R (2016) Myanmar offshore fisheries. International Center for Living Aquatic Resources Management (ICLARM), Yangon, Myanmar.

Kubo, K and Lwin NN (2010) Smuggling and import duties in Myanmar. Institute of Developing Economies. https://bit.ly/39yWBQn

Merayo, E, Porras, I, Harper, S, Steele, P and Mohammed, EY (2019) Subsidy reform and distributive justice in fisheries. IIED, London. https://pubs.iied.org/16645IIED

Merayo, E, Myint, KT, Ei, T, Khine, M, Aye, PT, Twhe, TL, Leemans, K, Soe, KM, Akester, M, Bladon, AJ, Mohammed, EY (2020) Migratory patterns of Hilsa shad in the Myanmar Ayeyarwady delta. Lessons for fisheries management. IIED, London. https://pubs.iied.org/16665IIED

Mohammed, EY and Wahab, MA (2013) Direct economic incentives for sustainable fisheries management: the case of hilsa conservation in Bangladesh. IIED, London. https://pubs.iied.org/16527IIED/

Mohammed, EY, Steinbach, D and Steele, P (2018) Fiscal reforms for sustainable marine fisheries governance: delivering the SDGs and ensuring no one is left behind. *Marine Policy*, *93*: 262–270. www.sciencedirect.com/science/article/pii/S0308597X17301574

Myanmar National Trade Portal, Ministry of Commerce, Commodity search. https://myanmartradeportal.gov.mm/index.php/en

OECD (2018a) Revenue statistics 2018. OECD Publishing, Paris. www.oecd.org/publications/revenue-statistics-2522770x.htm

OECD (2018b) OECD review of fisheries 2017: general survey of fisheries policies. https://bit.ly/2wZcPVI

Porras, I (2019) Fair fishing: supporting inclusive fiscal reform in fisheries. IIED, London. https://pubs.iied.org/16647IIED

Salagrama, V (2015) Fisheries value chain assessment: opportunities for strengthening the position of the small-scale fishers in the value chain. Network Activities Group, Yangon, Myanmar.

Tezzo, X, Belton, B, Johnstone, G, and Callow, M (2018) Myanmar's fisheries in transition: current status and opportunities for policy. *Marine Policy* 97: 97–100.

VDB Loi (2019) Myanmar tax booklet 2019. VDB Loi, Yangon. https://bit.ly/2xHFv5I

World Bank (2005) Environmental fiscal reforms: what should be done and how to achieve it. The World Bank, Washington, DC. http://siteresources.worldbank.org/INTRANETENVIRONMENT/Publications/20712869/EnvFiscalReform.pdf

World Bank (2019) Myanmar country environmental analysis 2019: fisheries sector. https://bit.ly/34bdHTC

Appendix 1. Focus group discussion and key informant interview reports

Artisanal fishers

Costs

The costs listed here are for a fishing operation of multiple types of fish, including those requiring different fishing methods (eg shrimp).

Boat: There were a range of boats bought by fishers, usually from builders in nearby townships, with costs ranging from MMK 5 *lakh* (US$331) which would need to be replaced every few years, to MMK 10 *lakh* (US$662) for a new boat made of teak that would last for 10 years. Aside from the annualised replacement cost of between MMK 1–1.3 *lakh*, repairs were needed (except not usually for new boats) of MMK 15,000–20,000 per year. Altogether, an artisanal fisher could expect to pay between MMK 1.2–1.5 *lakh* per year to have a working fishing vessel, not including the engine. Additionally, there is a risk of boating accidents (one respondent reported having 15 boat collisions in one year) or weather events which could require more repairs and replacements. Much of this cost would be fixed, in that it would occur irrespective of how much fishing is done.

Boat engine: Similarly, engines varied in cost from MMK 1.4–2.9 *lakh* purchase price, and with a replacement rate of every few years, and service costs of around MMK 40,000–50,000 per year. Altogether, an artisanal fisher could expect to pay between MMK 85,000–150,000 per year to maintain a working boat engine, not including fuel. One fisherman who would take multi-day fishing journeys mentioned the need to have a backup engine. Similarly, much of this cost would be fixed, in that it would occur irrespective of how much fishing is done.

Fishing nets: Net purchase and maintenance is also a significant cost, owing to the need to replace nets yearly, and repair them frequently. Particularly, the usual 'surrounding net' used had a lot of risks associated with it, such as getting snagged in driftwood, tangled with other nets (such as fixed-position setups), or confiscated by DoF officials (if the net mesh size is judged too small). As such, this seemed to be a significant frustration of village-level fishers, who reported total yearly net-related costs ranging from MMK 1–6 *lakh* per year.

Licences: Fishers reported a few licensing requirements: fisher registration cards (MMK 1,000 per year), fishing-net licence (MMK 2,000–6,000 per year), engine licences (MMK 8,000 per year, reported in Pyapon only), and a driver's licence (MMK 1,000 per year in Hinthada and Pyapon). These licenses were reportedly available at the township DoF office. At most, these costs could add up to MMK 16,000 per year. However, failure to renew licences in time attracts an additional fine of MMK 1.5–2 *lakh*.

Fuel: Fuel is a significant variable cost. One fisherman reported a single-day fishing trip costing around MMK 1,500 in fuel, which would buy between 1.5–2 litres of fuel (prices for diesel and unleaded fuel fluctuate between MMK 750–950 per litre, and depend on where it is purchased). One fisherman who took multi-day fishing journeys reported a need to purchase only 4 gallons (about 15 litres) of fuel, which would cost between MMK 11,000 and 14,000 and reported spent around MMK 60,000 per month – assumedly for between 4 and 6 journeys per month.

Labour: Artisanal fishers interviewed went fishing in pairs: one person driving, one handling nets, etc. For the second person, they will use a household member when

available, but would pay MMK 1,000 (less than US$1) per day of fishing to a low-skilled labourer when not.

Ice: Five of the 13 fishers interviewed mentioned that fishers from Pyapon would go to sea for up to three days at a time to fish for hilsa. Ice costs approximately MMK 8,000 per insulated box (in Yangon), but fishers are likely to use smaller boxes. Fishers who take daytrips do not use ice at all.

Financing: Village-level collectors reported offering loans (or 'advances') to most fishers throughout the fishing season, mainly to help support their household with living expenses while the fishers were fishing. Some, but not all, fishers reported getting interest-free advances and loans from fish collectors, but also from ice producers, and even friendly net producers. However, there were also reports of interest-bearing loans from others providers: local money lenders also offered loans of anywhere between 3 to 8%. There were also non-governmental organisations (NGOs) offering loans, such as the Nargis Action Group (offering fishers in Pyapon six-month loans of MMK 150,000 at 2% interest per month), as well as the Mya Sein Yaung Project, microfinance operators, and another NGO offering loans managed by the DoF. Overall, although it seemed common for fishers to be in debt to collectors, or others, it was usually on interest-free terms, so financing costs would be rare and minor.

Catch volumes

For each fisher's operation, revenues seem driven primarily by volumes rather than prices, which are set by the market. Volumes of hilsa are driven by the location and the amount of time spent fishing during the right times of the year. One fisher reported going fishing 24 days per month on average. Another claimed to work every day. Fishers reported days and even seasons where they would catch no hilsa (in the Hinthada area). Yet good days would yield between 3 and 5 viss of hilsa for the average fisher during the October to March fishing season. Good days during peak season can yield up to 30 viss for the most industrious fishers. Overall, the annual catch of hilsa varies greatly between fishers, but an average catch would be around 200 viss per season.

Prices

The price of hilsa depends on the size of the individual fish, which are priced according to a range of sizes. Noting variance in the sizes that the fishers priced, and in the prices themselves, Table 5 shows the average prices that fishers got for their catch (as of October 2019).

The hilsa are invariably sold to village and township traders (collectors). It seems common for a fisher to sell only to one collector, either due to a relationship being built over time, or because of a need to repay outstanding advances/loans with fish. Hilsa are generally considered too valuable to consume or give as gifts, but some fishers claimed to do so at a very low level.

Collectors do not deal in hilsa below 0.5 viss in size, although most collectors still quote a price for fish sized at 0.35 viss. Hilsa below 0.35 viss, and especially lower than 0.2 viss, will generally be sold locally in village or town markets by the fishers and their household members, or consumed in the household.

Prices drop by around 25 to 35% during festival periods including Chinese New Year (late January or early February), Thingyan (April) and Thadingyut (October). This is because the Yangon central market closes for several days, and likely other later parts of the value chain do also, which means that there is excess supply in the value chain.

One fisher who lived in a smaller and more remote town reported a duopoly in the town for fish collection. This led to poorer prices, which meant it was sometimes worth making the trip to a nearby town to sell their catch at more agreeable prices.

Business model

Based on those interviewed, the business model of a 'typical' artisanal fisher would look roughly as shown in Table 6.

Overall, this is a strong business model. Noting that the above is purely for hilsa fishing, and is not counting landing other species that could be caught with the same investment in setup costs, fixed costs, and on the same day of fishing, this would mean that around 40 to 50% of the cited annual incomes of artisanal fishers could be earnt in just two months of fishing.

Table 5. Average prices for hilsa based on size of fish

	FISH SIZE (VISS PER FISH)						
	<0.2	0.2–0.35	0.35–0.5	0.5–0.65	0.65–0.8	0.8–1.0	>1.0
Average price (MMK per viss)	7,000	11,333	16,000	21,750	27,000	32,000	32,750

Table 6. Business model of a 'typical' artisanal fisher

Total setup costs	12 *lakh*
Total fixed costs	6 *lakh* per year
Total variable costs	MMK 5,000 per day, or MMK 6 *lakh* per year (for ~215 days of fishing, around 50 of which would be during two-month hilsa season)
Total quantities	200 viss per year
Weighted average price	MMK 16,000/viss
Margin rate	60% or MMK 10,000/viss
Total revenues	MMK 32 *lakh*
Total profit from hilsa	MMK 20 *lakh* per year, or MMK 1.6 *lakh* per month
Breakeven quantity	50 viss of hilsa
Time to repay setup costs	< 1 season

Chairman of fisher association

The Helmsman hilsa fisher association covers seven villages. It has been in existence since 2004 and was legally constituted once the Ayeyarwady Freshwater Fisheries Law came into force in 2018. The association was promoted by the DoF and registered with the township general administration department. There are 470 fisher members and they have established a 25-acre (10 ha) fish sanctuary along a 10km stretch of tidal river.

In Mawlamyinegyun township there are 580 villages (under 108 village tracts). The township has 10 fish collectors. The respondent's village tract has 42 villages and here there are three village traders (trading all kinds of fish not just hilsa). The fishers fish all year round apart from the lowest low tide days which amount to around seven days a month. Within the 25-acre sanctuary area no fishing is allowed at any time of the year. Before 2014, the average catch per fisher per annum was 40 viss (64kg). In 2019, the average annual catch has increased to 70 viss/fisher (112kg). In addition, larger fish are now being caught (up to 3kg) and 10% of the fish caught are gravid.

The fishers patrol the area using borrowed vessels. The DoF pays the fishers a per diem of MMK 7,000 to assist with the patrolling. The funds provided by the DoF come from fines imposed on fishers who have either no fishing licence or an expired licence. This can be considered as a type of fisheries co-management with shared monitoring, control and surveillance functions. Sixty-five% of the fishers have no land and are 100% dependent on fishing for their livelihood. Their sons are expected to continue the family fishing tradition. Women also participate in fishing and net mending as a family exercise; however, they are not registered fisherfolk. Fishers do not think that climate change is having an impact on the hilsa fishery although they do believe that their collective conservation efforts are having a positive effect.

Village processors

Bycatch from artisanal fishers is turned into a salt-fermented fish product, and this is likely a secondary source of income and nutrition for poorer artisanal fishing households. Juvenile hilsa are used in 25% of the production of the fermented fish product when they are available in June and July.

The (single) fermented fish producer interviewed made 100 viss of fermented fish per year, of which approximately 75 viss of fish are added to 25 viss of salt. Roughly 3 viss of juvenile hilsa would be used per year in this production. Fish that are too small, which may include very young hilsa fish, are thrown away (assumedly dead).

Fermenting bycatch is likely an activity that is an important source of additional household income, particularly for women without other income-earning opportunities. Although almost half the production of fermented fish is consumed in the household, there is also strong demand in the village, and the rest is sold to villagers who come to their home and pay MMK 2,000 per viss.

Considering that the producer interviewed did not pay for the fish (as it is bycatch and sourced from other household members), the margins on this income are excellent – approximately MMK 1,950/viss sold, which would result in roughly MMK 1 *lakh* in household

income per year on top of the roughly 50 viss of fermented fish consumed by the household per year. In a household that makes 30 *lakh* from a mix of income-earning activities, this amount is not insignificant, given that the labour intensity of the activity is assumedly low. If bycatch is to be paid for from other fishers, it would cost MMK 750/viss. If the fish input into production was bought, it would still mean that there would be a margin of over 50% from this activity.

There are few barriers to entry for this economic activity. It requires only the purchase of three large (100-viss capacity) ceramic pots (MMK 50,000 each), three rattan sieves (MMK 5,000 each, which are also used in other household activities), and a scale (around 1 *lakh*, but which is also used in other fishing activities). All these inputs are readily available in small towns. There is no licence required, but the availability of free bycatch fish is dependent on the fishing rights of other members of the household.

The household interviewed was one of 19 other producers in a village of 100 households. This means that almost 10% of households were small-scale producers, likely producing from the bycatch of the primary fishing activity of the household.

The government neither encourages or discourages this activity. The use of conical nets, which was the primary fishing type for the household of the producer interviewed, was reportedly encouraged by the government though a low-interest loan. There was no mention of the fishing ban.

Township and village traders (collectors)

Township collectors generally make a better living than artisanal fishers: their average income was quoted at around MMK 15.67 *lakh* (US$1,040) per month, compared to the MMK 4 *lakh* per month earned by artisanal fishers.

The village collector reported earning only 1.25 *lakh* per month in household income. He made most of his household income in rice paddy cultivation, with only about MMK 6 *lakh* per year coming from fish collecting. He reported two thirds of his fishing income as deriving from hilsa, which was about one quarter of his annual household income. He had about 18 other collectors that he was competing with in the village, and around 30 others in his wider township. Given that he is sharing this income with his wife and two (assumedly adult) daughters, he would be living below the national poverty line (of MMK 1,590 per day).

By contrast, the wealthiest township collector made 16 times this income (MMK 20 *lakh* per month). Fish collecting was his only source of income. He claimed that 75% of this income was derived specifically from collecting hilsa (although it is unclear whether this was specifically during the hilsa season).

How they operate

Collectors' primary value-addition service is linking the artisanal supply of inland hilsa and points of demand at city level with the right timing and conditions to preserve the value of the hilsa fish. Township collectors interviewed operated in major riverside towns that serve a number of nearby villages, but there are likely more collectors operating in fishing villages. They have a cycle of activities repeated 2 to 5 times per week, depending on the scale of their operation:

- Receiving: They first receive freshly caught fish from artisanal fishers.
- Chilling: They pack the fish in insulated boxes part-filled with ice.
- Transporting: When the boxes are full, they transport the boxes by boat to buyers in the city. They employ someone to continue to receive fish in their absence.
- Selling: They sell and unload the fish from the boxes in the city.
- Renewing ice: They refill the boxes with ice (a service usually offered by the buyer).
- Returning: They return to their town with boxes of fresh ice and cash to buy new fish.

Other than the trading service, the township collectors also provide cold-chain transport and distribution services, and short-term lending.

Costs

The collectors invariably own all of the assets needed to run the operation and can be sourced locally. These include:

Boat: Each collector has a vessel to transport fish from their town to the city. The prices vary considerably, from MMK 6 *lakh* to MMK 150 *lakh*, but roughly correlate with the size of their operation. The replacement rates would also vary, from three years to 15 years.

Insulation boxes: For the larger operators, five boxes cost MMK 4 *lakh*, and are replaced annually.

Generator: This is necessary to receive fish from fishermen after dark, but a generator need not be large, with costs ranging from MMK 0.8 to 1.8 *lakh*, and replacement rates being between five and six years.

Scale: For measuring the weight of fish. Costs MMK 1 *lakh* and lasts many years.

Boat and engine repairs: Between MMK 1 and 6 *lakh* per year, depending on the size and age of the boat.

Fuel: Depends on the size of the boat and the frequency of trips, with the village-level collector spending MMK 37,500/month (for 15 gallons), and the larger collectors likely using 10 times this amount.

Collector's licence: Issued by the local DoF office at the cost of MMK 20,000 per year (for larger operators) and 4,000 MMK per year (for village-level operators).

Labour: Between one and three people were employed, and each paid MMK 6,000 per day, and were required almost every day, for a monthly cost of between MMK 1.8 and 4.8 *lakh*.

Ice: Once the fish are sold, the boxes are refilled with ice and paid for by the city-level traders. For the larger collectors with five boxes, it costs MMK 8,000 per box per trip. These are refilled three to five times per week, which would equate to between MMK 1.2 *lakh* and 2 *lakh* per month (the smaller-scale collector had an equivalent cost of around 0.5 *lakh* per month).

Bad debts: Some collectors did not report any borrowers defaulting on their debts. However, others reported around five borrowers defaulting per year. With the average loan of between MMK 1 and 5 *lakh*, this would represent a loss of between MMK 5 and 25 *lakh* per year. But given the variability, and that there are likely other variables driving loan defaults, it is a difficult factor to appropriately cost.

Collection volumes

Table 7 shows the average hilsa volumes traded during the full three to four-month peak season, by size of the fish and scale of the collector's operation.

Prices

Table 8 shows the average prices by fish size quoted by the collectors.

All collectors reported a set mark-up cost of MMK 2,000 per viss for all fish sizes. This means that although fishers are incentivised to catch a larger proportion of larger fish sizes, the collectors accept all sizes (so long as it is of a minimum acceptable size). Perhaps this is part of the reason that most of the fish traded are small.

Business model

Based on our interviews, the business model of a 'typical' collector would look roughly as shown in Table 9.

Given that the township collectors operate all year round, and collect a mix of fishes with the same operation and cost items, it is difficult to separate the profitability of hilsa collecting. However, it would appear that hilsa is very profitable, requiring only 350 viss of hilsa to be traded to cover the ongoing operational costs.

Table 7. Average hilsa volumes traded during peak season by fish size and scale of collector operation

	SCALE OF COLLECTION OPERATION			
	SMALL (0.35–0.5 VISS)	MEDIUM (0.5–1.0 VISS)	LARGE (>1.0 VISS)	TOTAL OVER THE SEASON
Small collector	180 viss (60%)	75 viss (25%)	45 viss (15%)	300 viss
Larger collector	780 viss (65%)	300 viss (25%)	120 viss (10%)	1,200 viss

Table 8. Average prices by fish size quoted by collectors

	FISH SIZE (VISS PER FISH)						
	<0.2	0.2–0.35	0.35–0.5	0.5–0.65	0.65–0.8	0.8–1.0	>1.0
Average buy price (MMK/viss)	N/A	10,000	15,000	20,250	26,000	31,000	34,500
Average sell price (MMK/viss)	N/A	12,000	17,000	22,250	28,000	33,000	36,500
Margin (MMK/viss)	N/A	2,000	2,000	2,000	2,000	2,000	2,000

Table 9. Business model of a 'typical' collector

Total setup costs	14 *lakh*
Total fixed costs	10 *lakh* per year (only 1 to 3 *lakh* for the peak hilsa season)
Total variable costs	MMK 30,000 per trip, or MMK 20 *lakh* per year (for 75 trips, around 20 trips of which would be for hilsa
Total quantities	1,200 viss of hilsa per year
Margin	MMK 2,000 per viss of hilsa
Total revenues/margin for hilsa	MMK 24 *lakh*
Total profit from hilsa	MMK 20 *lakh* per season
Breakeven quantity	350 viss to cover costs during the peak hilsa season, or 1,450 viss to cover the whole year's costs
Time to repay setup costs	< 1 season

Wholesale (city) traders

We interviewed two of the main traders specialising in hilsa for export at Yangon's San Pya Fish Wholesale Market (SPFWM).

How they operate

The primary value addition done by these traders is linking township supply of artisanal hilsa, and offshore hilsa supply, with the points of demand in Yangon and internationally, with the right timing and scale to preserve the value of the hilsa fish.

The jetties at the SPFWM seem to be the only place collectors can bring their fish to the city, which means that those who control the limited market space have a powerful position in the value chain. The larger trader interviewed owned his own jetty in the market, for which he had exclusive access for his operation, and the smaller trader used a shared jetty. Offshore fishers did land fish at SPFWM, but seem also to use other jetties as well, such as private jetties owned by fishing companies. It seems at this point in the value chain that much of the total hilsa catch is handled by only a few operators, fewer than anywhere else in the value chain.

Scale is also an important factor. In such a lengthy value chain for such a perishable product, SPFWM seems to be the only place where the supply is numerous and voluminous enough that a standard truck can be filled and dispatched to buyers quickly and at all hours of the day (the market is only closed during festivals). Although there may be similar fish markets in the other fishing zones (Rakhine, Mon and Tanintharyi), they are unlikely to be equal to the volume of fish traded at SPFWM as it is the point between the Ayeyarwady Delta fishery and Yangon's international trading infrastructure.

Costs

Space in the market: The marine-caught hilsa trader purchased private jetty space adjacent to the market for MMK 7,000 *lakh* 10 years ago. The other shares a jetty with other traders at no cost, but bought a private warehousing space inside the market area for MMK 300 *lakh* 10 years ago. They both feel that their investments have appreciated considerably. As such, there is a substantial up-front cost associated with space in the market, assumedly from between MMK 1,000 to 10,000 *lakh*, depending on the type and size of space.

Ice: Bought from a local ice factory, ice adds costs of around MMK 200 *lakh* per year for the marine-caught hilsa trader, and MMK 100 *lakh* per year for the inland-caught hilsa trader.

Boxes: The marine-caught hilsa trader rotates 300 boxes which cost MMK 0.9 *lakh* per box, with an annual replacement rate of between 10 and 20% or between 27 and 54 *lakh* per year. The inland-caught hilsa trader rotates 150 boxes, with the same costs and replacement rates, and so between MMK 13.5 and 27 *lakh* per year.

Labour: The marine-caught hilsa trader employed 50 people at MMK 10,000–20,000 per day, or between MMK 1,400 and 2,750 *lakh* per year. The inland-caught hilsa trader employed between 25 and 40 people at MMK 10,000 per day, or between MMK 690 and 1,100 *lakh* per year.

DoF collector's licence: MMK 30,000 per year, which is the same as in the regional towns.

Council charges: MMK 90,000 per year fees for the space in the market, which is paid to the YCDC.

Volumes of hilsa traded

Hilsa represented 90% of the volume and 70% of the revenues of the inland-caught hilsa specialist, and 82% of volume and 60% of revenues of the marine-caught hilsa specialist (with most of the remainder coming from prawns). This is assumed to be on an annual basis.

The marine-caught hilsa trader, when asked directly, stated moving 2 million viss of hilsa per year, and when asked a different way he stated moving 10 million viss of hilsa per year. He also mentioned that he has supply contracts with 17 boats, and he claimed to receive between 30,000 to 70,000 viss of hilsa in each boat for every 14-day trip during the hilsa season, which adds to between 5.1 million and 11.9 million viss of hilsa per season.

The inland-caught hilsa trader, when asked directly, stated moving 10 *lakh* viss of hilsa per year, and when asked a different way stated moving 4 *lakh* viss of hilsa per year. He claimed to have around 150 suppliers, which provided 8,000 to 10,000 viss of hilsa per boat per visit during six months of the year. If the average visit frequency is once every two weeks, this would equate to approximately 15.7 million to 19.6 million viss of hilsa per year, but the average collector claimed to be visiting the market four times as often as that. As such, it is difficult to determine how much inland-caught hilsa he was really trading.

Prices

Table 10 shows the average prices by fish size quoted by wholesalers.

Gravid hilsa (females carrying eggs) caught inland sell for between MMK 500 and 1,000 per viss more than non-gravid hilsa, because they are prized by the Chinese market.

Business model

The quality of data obtained limited our ability to calculate a 'typical' business model for wholesale traders (see Table 11). However, it is likely that the two traders are doing exceedingly well financially. They claimed to make MMK 2,000 *lakh* and MMK 1,000 *lakh* per year each in household income from their operations, but also claimed to be moving an average of 3.3 million viss per year of hilsa, at an average margin of MMK 350 per viss, which comes to an average profit of MMK 1.2 billion per year.

Table 10. Average prices by fish size quoted by wholesalers

	FISH SIZE (VISS PER FISH)						
	<0.2	0.2–0.35	0.35–0.5	0.5–0.65	0.65–0.8	0.8–1.0	>1.0
Average buy price (MMK/viss)	N/A	9,758	13,325	23,452	31,706	38,267	37,082
Average sell price (MMK/viss)	N/A	9,958	13,585	23,772	32,086	38,707	37,582
Margin (MMK/viss)	N/A	200	260	320	380	440	500

Table 11. Business model of a 'typical' wholesaler

Total setup costs	MMK 30 million to MMK 7 billion
Total fixed and variable costs	MMK 137.7 million (where 65% can be allocated to hilsa)
Total volumes of hilsa (average of stated volumes)	3,350,000 viss (4,221 metric tonnes)
Hilsa margin	MMK 350 per viss
Total profit from hilsa (margin x volume)	MMK 1.2 billion

Export-oriented processors

How they operate

Processing factories add value by linking city-level traders and marine fishing operators to international demand in the following ways:

- **Sales:** Sourcing demand abroad, particularly in countries where the senior managers and owners have personal networks or vertically integrated operations.
- **Supply sourcing:** At Yangon's SPFWM, and at the marine vessel jetties.
- **Sorting:** For quality and size to meet customer orders.
- **Preparing for transport:** Cleaning, freezing and packaging the hilsa for travel and as per customer requirements.
- **Arranging export:** Documentation, customs clearance and transport.

Processing steps:

1. Boxes of ice and fish arrive.
2. Boxes of fish are emptied onto a table where they are checked for quality and accepted (including passing through a metal detector).
3. Individual fish are dipped in seawater and cleaned.
4. Individual fish are sized and sorted as per the buyer's requirement.
5. Groups of fish are put in trays and racks for freezing.
6. Trays of fish are placed in an air-blast freezer for 8 to 9 hours at minus 40 degrees Celsius.
7. Individual fish are cleaned of blood (important for hilsa, which have bleeding that is more sensitive to temperature than most fish) and dipped in seawater again.
8. Individual fish are packaged for export.
9. Packaged fish await export in cold storage at minus 20 degrees Celsius.
10. Packaged fish are loaded into a refrigerated container set to minus 18 degrees Celsius.
11. Containers of fish are shipped to port for export.

Costs

The following costs were mentioned by the vertically integrated factory processor.

Setup costs:

- Air blast freezer (10ft x 8ft, up to 6,000kg): US$200,000 x 2 = US$400,000.
- Contact freezer (up to 250kg): US$10,000–15,000.
- Contact freezer (up to 500kg): US$30,000.
- Metal detector (1 pass-through and 1 hand-held): US$5,000.
- 330k volt generator: US$5,000.

Operating costs:

- Ammonia liquid gas: 150kg per month @ MMK 1,100 per kg = MMK 165,000 per month.
- Labour (machine, security, general workers): 100 people @ 8 hrs per day = US$15,000 per month (the first factory employed 200 people at MMK 140,000 per month plus bonuses).
- Packaging: US$8,000 per month.
- Electricity: US$14,000 per month (was US$11,000 per month before recent price increase). The first factory spent US$40,000 per month.
- Diesel (for electricity generation): The first factory spent US$2,656 per month, and had two backup generators to the second factory's one.

Taxes and fees:

- Export taxes: 2% of value of product or around US$20,000 per month.
- DoF licence: Negligible.
- Export licence from Department of Commerce: Negligible.

Volumes of hilsa traded

The factory offering export-processing services processed roughly 500 metric tonnes of all fish per month, with around 5% being hilsa, or 25 metric tonnes. They claimed to compete with ten other factories, which process lesser volumes of hilsa. The vertically integrated factory representative stated that hilsa represented about 30 to 40% of total fish volume and 70 to 80% of revenue. As such, hilsa is somewhere between 450% to 550% more lucrative than the average fish per unit weight. They had a total capacity of 12 metric tonnes per day, with 4 to 5 metric tonnes per day being hilsa.

Prices

In the first factory, where the processing is run as a service, the margins for hilsa are between MMK 100 to 130 per viss, depending on the services requested. This was irrespective of size. The vertically integrated factory quoted the average price of hilsa as US$7 per kg.

Business model (of vertically integrated company)

Based on their stated 2–3% profit margin, the vertically integrated company could be making a maximum of US$14,000 in profits from hilsa per month during low season, and US$24,000 per month during the high season. However, if the 2–3% margin reported was based on total revenues less variable costs, this would mean the company is operating at a loss, since revenues would not cover operating costs. Stated revenues were much higher than revenues estimated through triangulation of other figures, which could be a result of reporting bias, or evidence of hidden harvest earnings. Our estimate of hilsa profits based on triangulated revenue minus operating costs indicated that profit margins could be nearer 90% (Table 12).

Table 12. Business model of a 'typical' export-oriented processor

	LOWER ESTIMATE	UPPER ESTIMATE	ANNUAL AVERAGE
Volume of hilsa (metric tonnes)	4 per day	5 per day	936 per year
Stated hilsa revenue	US$700,000 per month	US$800,000 per month	US$9 million per year
Triangulated hilsa revenue	US$485,333	US$606,667	US$6.5 million per year
Stated margin	2%	3%	
Hilsa profit based on stated revenue and 2–3% margin	US$14,000 per month	US$24,000 per month	US$228,000 per year
Hilsa profit based on triangulated revenue and 2–3% margin	US$9,707 per month	US$18,200 per month	US$167,440 per year
Operating costs attributed to hilsa	US$60,000 per month		US$720,000 per year
Hilsa profit based on stated revenue minus operating costs	US$425,333 per month	US$546,667 per month	US$8.6 million per year
Hilsa profit based on triangulated revenue minus operating costs	US$640,000 per month	US$800,000 per month	US$5.8 million per year

Appendix 2. Credit and informal supply contracts

Collectors and fishers

Given the importance of timing in the value chain, and the importance of building reliable relationships with suppliers to reach scaled operations, village and township collectors seek to build sole-source relationships with reliable suppliers. As such, interest-free cash loans are a significant component of collectors' business models.

Collectors give zero-interest loans (which they call 'advances') to artisanal fishers at the beginning of the fishing season to allow fishers to purchase fishing supplies, and to help support their household living expenses during the fishing season.

The fishers repay the collectors with the fish that they land. Prices of fish are therefore agreed in advance, and the collectors keep an account book which tracks lending, and the progress of each fisher in repaying their loan throughout the season. The average loan size from the township collector was MMK 3 *lakh*, but ranged between MKK 1 and 5 *lakh*. The larger township collectors have maintained relationships with between 400 and 500 fishers, of which between 75% and 90% took on loans. This means that at any one time, there was MMK 900–1,350 *lakh* (US$60,000–90,000) lent out each year by a larger township collector.

In the context of small towns in Myanmar, this is a significant financing operation. It would create a significant barrier to starting a town-level collecting business, or scaling up a small one. Yet the lending operations of township collectors are made without formal or legally enforceable contracts, and without oversight by regulators. No township collectors bought insurance against risks such as natural disasters that could cause widespread defaults from their suppliers. No township collectors mentioned taking collateral for the loan.

The performance of loans, at least for the township collectors we interviewed, was good. Township collectors reported that only a few fishers repay their loans in full at the end of the season, but more did so within a month of the end of the season. The bulk of fishers were unable or unwilling to repay the loan before the start of the next season, and their debts were carried forward cumulatively. Only a small number of fishers each year defaulted on their loans, which usually required 'skipping town'.

Rather than loan performance, the township collectors were more concerned about the extent to which their lending translated into reliable supply. The township collectors reported a common practice of fishers demanding additional funds from the collectors during the season, with the threat of selling their catch to another collector who could offer extra cash if the collectors did not. This practice was more pronounced when the fishing was good: a good hilsa catch, for example, offered village fishers leverage.

As such, the township collectors we spoke to did not feel that the act of lending gave them increased power in the value chain (over the fishers, or over competing collectors). Rather, they felt that it created a greater need for keeping on good terms with fishers. Further research may be necessary to ascertain the nature of the debtor-creditor relationship, and how this plays out at times when the fishers' catches are poor.

Overall, lending operations – rather than price, assets or monopolistic behaviours – seemed to be the most important basis upon which township collectors compete for a reliable supply of fish. There was pressure to provide higher levels of debt on better terms. According to the township collectors, the larger the size of the debt, the more secure the supply relationship, so there are incentives to lend more and more.

This could mean taking on more debt from buyers at Yangon's SPFWM, and more risk of default if there is an event which decreases the supply of fish. One of the township collectors we spoke with remarked that, during the fishing ban, he had to continue to provide zero-interest cash loans to fishermen for their subsistence living, but this required getting loans from a money lender at a 5% monthly interest rate, which he then lent out at a 0% interest rate. For this individual, events that could cause his operation to stop – such as natural disasters, equipment failure or a mass default on loans – would put him in a vulnerable financial position.

The lending practices of township collectors seem to be an essential component to the hilsa value chain in Ayeyarwady. It helps artisanal fishers undertake a season of fishing without interruption due to short-term cash-flow pressures. It also helps reduce the risks inherent in the township collectors' business models, given the importance of reliability of supply. Yet despite having a relatively more-lucrative business model than the fishers, the dynamics of lending and supply mean that the township collectors' position in the value chain is not as all-powerful as one might think, and under certain circumstances they may even be vulnerable.

This has two positive effects on their business. Firstly, it ensures more loyalty from suppliers. The marine-caught hilsa trader was confident that the loans meant that the supplier was strictly bound to supplying him alone. Secondly, it creates a significant financial barrier to entry into the market, which adds to the significant price for property at SPWFM.

Wholesalers and their suppliers

Although the township collectors we spoke to reported not needing financing for their operation, the wholesaler we spoke with who focused on inland-caught hilsa lent between MMK 20 and 50 *lakh* to around 20% of his approximately 150 suppliers. This means that he would manage between MMK 600 and 1,500 *lakh* (US$40,000–100,000) in loans during the fishing season. Yet, when asked directly, he claimed to have lent around MMK 5,000 *lakh* (US$330,000) in loans. The wholesaler who specialised in marine-caught hilsa lent an average of MMK 300 *lakh* per marine fishing vessel that he buys from, which adds up to around MMK 5,100 *lakh* (US$340,000) in loans made during the fishing season. Both wholesalers claimed to finance this from their own savings, rather than borrowing themselves. Yet despite claiming that the lending practices were informal, wholesalers did not seem to be as at risk of poor loan performance as the township collectors were. So other than the opportunity cost of investing the money elsewhere, the lending operation did not seem to have a significant cost or risk.

Appendix 3. Ice

Once caught, hilsa needs to be chilled in ice quickly to ensure freshness before it reaches points in the value chain where it can be blast frozen. So ice accompanies the hilsa in the value chain from the point that it is caught (in either offshore vessels or by small-scale fishers doing sea journeys with boxes of ice), or at the point it is collected by township collectors from artisanal fishers.

The production of ice is an operation that requires a steady electrical supply, which is not available in most of Myanmar. Even Yangon has rolling blackouts, which likely requires ice factories to have backup generators to supplement mains supply. The mains electricity supply in small towns is worse – generally counted by the hours it is on rather than off – and ice production there would likely be more expensive, or unfeasible.

As such, there is a supply of ice largely travelling from the ice factories in the city to towns – the opposite direction of the fish. In practice, when a township collector offloads fish to the Yangon fish market, the wholesaler arranges for the collectors' boxes to be refilled with fresh ice to take back to the towns. At the same time, the wholesaler arranges for their own boxes to be filled with ice before being put on a truck (to travel within Yangon or all the way to China).

The rate at which ice melts puts timing constraints on the value chain. The township collectors need to travel from Yangon back to their towns, refill their boxes with fish and return to the city before their ice melts and the fish spoils. Generally, the cycle most collectors said they adhere to is three days. The artisanal fishers who do sea fishing trips with buckets of ice also reported going out only for a few days. Also, the journey from Yangon to China by truck is made possible by the speed of travel on the roads and border crossing, which is likely to be less than a three-day journey.

If we apply a three-day rule of thumb, the scale of operations of township collectors would likely also be limited by the amount of time that it would take to refill boxes with fish, which would be determined by the number of artisanal fishers that supply them. So, although it would be easier to scale-up operations by buying more boxes and a larger boat, the challenge would be in scaling up reliable supplier relationships with artisanal fishers.

Appendix 4. Offshore fishing vessel operating costs

The table below shows an estimate of total operating cost for Myanmar's offshore fishing vessels (US$211,760 per year). Since our estimate of offshore hilsa production (5,943 metric tonnes)[16] makes up less than 1% of Myanmar's total offshore fishery production (FAO 2018), we can allocate at least 1% of these operating costs (US$1,016) to hilsa fishing.

Table 13. Breakdown of estimated operating costs of an offshore fishing vessel in Myanmar

	UNIT	QUANTITY	PRICE (MMK)	COST (MMK)	COST (US$)
Labour*	People	18	200,000	3.5 million	2,450
Food*	Person days	1,050	3000	3.15 million	2,205
Ice*	kg	26,000	132	3.432 million	2,402
Fuel	Litres	80,400	776	62.39 million	43,673
Cigarettes/betel nut*	People	18	7,500	131,250	91.875
Total per trip (60 days at sea)				72.6 million	50822
Total per year (assuming 250 days at sea per year)				302.52 million	211760

Notes: Components marked* were extrapolated from inshore vessel data, using typical number of days at sea (60) and typical numbers of people onboard (18) for offshore vessels (ILO 2015). These figures are the averages of ranges provided by ILO (2015). Fuel costs and typical number of days at sea per year were provided through a personal communication (Akester 2020)

[16] Assuming that the majority of total reported export volume (11,886 metric tonnes in 2017–2018 – DoF 2018) is marine, and – based on the spread of catch data between offshore and inshore marine fisheries – that around half of it is caught offshore (FAO 2019).

The hilsa shad is one of the most commercially valuable fish species in Myanmar, but it is under threat. As part of a project designing a system of incentive-based management for hilsa fisheries in Myanmar, this study explores how fiscal tools such as licence fees and taxation could be used to finance the system. While our figures are based on numerous assumptions and should be interpreted with caution, we clearly demonstrate that by increasing revenue-collection efficiency and adapting current tools to better target actors nearer the top of the hilsa value chain, the government of Myanmar could triple current revenues and use these to support more inclusive and sustainable hilsa fisheries.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them – from village councils to international conventions.

iied

International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
www.iied.org

Knowledge Products

Funded by:

DARWIN INITIATIVE

UKaid from the British people

Sida

This working paper has been financed by the Swedish International Development Cooperation Agency, Sida. Responsibility for the content rests entirely with the creator. Sida does not necessarily share the expressed views and interpretations.