

## Myanmar's fisheries in transition: Current status and opportunities for policy reform

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### ABSTRACT

Myanmar's fisheries are among the most important globally but remain some of the least documented. The fisheries sector occupies an important place in Myanmar's economy and culture, and is set to change rapidly as the country enters a period of unprecedented political and economic transition. Building on a unique set of information sources, this article presents a broad view of the current state of knowledge on governance, livelihoods, production and supply chains across Myanmar's three main fishery sub-sectors (marine capture, inland capture, and aquaculture). The analysis is contextualized with a review of major changes in the country's policy history affecting fisheries. It is argued that Myanmar's fisheries now sit at a potential cross-road in terms of their governance. Taking advantage of Myanmar's latecomer position in its current transition, this article draws parallels with regional experiences to outline sectoral recommendations for policy reform.

### 1. Introduction

The fisheries sector occupies an important place in Myanmar's economy and culture. The country is among the top 10 global fish producing nations, producing over 3 million metric tons of fish in 2016 [22]. Fish accounts for half of the animal-source foods consumed in Myanmar [8], and fisheries are officially reported to support the livelihoods of around 6% of the population [19] – a figure that likely underestimates total employment in the sector. Despite their significance, literature on Myanmar's fisheries is scarce and highly fragmentary. Publications are comprised mainly of technical reports summarizing findings of brief field visits and reusing unreliable official statistics. Peer reviewed articles are extremely rare [7]. As a result, very little is known about Myanmar's fisheries in comparison with other major fish producing countries in the region (e.g. Bangladesh and Thailand).

The fisheries information deficit in Myanmar is attributable to five decades of political and economic isolation from 1962 to 2011. During this time, capacity for collecting and using data for fisheries management and policy development received minimal attention, with records often falsified to satisfy state targets or support bureaucratic corruption. Soe et al. [59] identify three distinct historical phases in the reporting

of fisheries statistics in Myanmar. First, prior to the mid-1990's a lack of reporting incentives led to probable under-assessment of production. Second, from the mid-1990's, the military planning system encouraged target-led approximations and the overestimation of production. Third, and ongoing from 2013, the engagement of the international community and implementation of independent stock assessments and consumption surveys has increasingly identified fallacies brought about by the first two phases. These efforts have led the Food and Agriculture Organization of the United Nations (FAO) to take the unusual step of revising Myanmar's national fish production statistics downward from about 5.6 million metric tons to 3 million metric tons in 2016 [22]. These late improvements in our understanding of Myanmar fisheries are emerging at a critical time: against a backdrop of reforms initiated in 2011, the country is now experiencing a rapid political and economic transformations and is potentially at a crossroads in terms of its approach to the governance of natural resources [52].

The present study draws on two sets of information: First, an institutional repository of fisheries research in Myanmar; Second a special consultation of experts. The Fisheries Information Center (FIC)<sup>1</sup> is the first digital repository of fisheries research in Myanmar. It aims at compiling all available research on the sector, including grey literature

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<sup>1</sup> Initiated in 2015, the FIC ([www.dof-myanmar-fic.org](http://www.dof-myanmar-fic.org)) is managed by Department of Fisheries (DoF) and encompasses 457 resources at the time of the study.

and locally published materials not available in international academic databases. This study is based on a comprehensive review of published research on Myanmar fisheries<sup>2</sup> together with additional relevant resources from the FIC.<sup>3</sup> Second, sectoral challenges and policy recommendations are identified building on a recent meeting of experts. The Myanmar Fisheries Partnership (MFP)<sup>4</sup> brought together a multi-sector group of 32 experts from government, the private sector, civil society, and universities (16 Myanmar nationals, 16 non-Myanmar of whom 8 lived in Myanmar) for a 5-day workshop in 2016, during which participants systematically identified and discussed challenges and opportunities of the fisheries sector in Myanmar. The present paper synthesizes both sources of information, making a unique and timely contribution to literature. The assessment outlines the current state of knowledge on Myanmar's fisheries, ascertains major opportunities and challenges facing the sector, and identifies policy options for addressing these. The remainder of the paper is organized following this structure.

## 2. A country and its fisheries in transition

Before examining the current state of Myanmar's fisheries, the country's recent political history is outlined. The historical perspective contextualizes the effects of successive governance regimes on the fisheries sector. The entire analysis is organized with reference to three subsectors, namely:

- Marine fisheries: covering both *inshore* fishing activities occurring within 10 nm<sup>5</sup> from the shore (including estuary) and *offshore* fishing activities taking place beyond the boundary of inshore fisheries and within the exclusive economic zone (EEZ).<sup>6</sup>
- Inland fisheries: corresponding to fishing activities occurring in the interior of the country (excluding estuaries). We further distinguish between two management regimes: leasable fisheries where exclusive exploitation rights of delimited water bodies are auctioned, and open fisheries for which fishing gears licenses are issued by the Department of Fisheries (DoF).
- Aquaculture: defined as the farming of aquatic organisms including fish, crustaceans, and mollusks.

This article identifies four major policy regimes in Myanmar's modern history, namely: The British occupation from 1824 to 1948, 'military socialism' (BSPP<sup>7</sup>) from 1962 to 1988, 'market-reform military rule' (SLORC/USDP<sup>8</sup>) from 1988 to 2010<sup>9</sup>, and the post-2010 political transition, marked by greater economic and political openness. This structure is used to help identify critical historical shifts in governance

<sup>2</sup> The authors systematically identified literature with SCOPUS searching for "Myanmar" AND "fish" (excluding medicine-related subject areas). Scopus returned a total of 82 references from which 18 were considered relevant and reviewed for the present study (see bibliography).

<sup>3</sup> The review was limited to publications relying on original data and excluded reports re-using existing datasets. In addition, the vast majority of resources focused on aquaculture production technology, and ichthyological studies. These were segregated and only partially reviewed (i.e. abstracts, introduction, and conclusion). In total the assessment comprehensively reviewed 32 (see bibliography) and partially reviewed 129 FIC documents.

<sup>4</sup> The MFP workshop was organized from 3rd to 7th April 2016 and led to the publication of 5 policy briefs (available online at [www.worldfishcenter.org/content/myanmar-fisheries-overview](http://www.worldfishcenter.org/content/myanmar-fisheries-overview)).

<sup>5</sup> With the exception of Rakhine state where inshore fisheries are within 5 nm of the coast.

<sup>6</sup> As per defined in the *Myanmar Marine Fisheries Law* (1990) and the *Myanmar Freshwater Fisheries Law* (1991).

<sup>7</sup> The Burma Socialist Program Party (BSPP).

<sup>8</sup> The State Law and Order Restoration Council (SLORC) followed by the Union Solidarity and Development Party (USDP).

<sup>9</sup> The terms 'military socialism' and 'market reform military rule' are attributable to Turnell [64].

conditions and priorities that underpin contemporary policy discussions on fisheries in Myanmar (summarized in Fig. 1.1.). The most significant policy changes affecting each subsector during each political period are discussed below.

During the Konbaung Dynasty (Myanmar's last period of royal rule), the extensive networks of rivers and floodplains that supplied the bulk of fish for domestic consumption were managed through a combination of public and private exploitation arrangements. Private management consisted of a traditional hereditary (so-called "Inn") system under which privileged and influential people in Burmese society had full control over large water bodies [38]. The first major shift in fisheries policy occurred during the British colonial occupation of Myanmar. Opposing the unfairness of this system, but with the foremost intent of facilitating collection of taxes on important inland fish resources, the colonial administration instated a system under which the management of the most productive inland water bodies was leased out to the highest bidder [55]. This reform profoundly reshaped the governance of inland fisheries resources in Myanmar.

The tendency to view inland fisheries as a source of revenue was further reinforced by subsequent military regimes and their extractive economic policies, which imposed a 10% yearly increase on the floor price of every auctioned license, still in force up to present day. The SLORC government initiated a new management regime in the early 1990s, following the same logic and impinging on open access areas, through the establishment of tender fisheries: large stationary fishing gears licensed to individuals through an auction system. The transition to quasi-civilian rule after 2010 saw the decentralization of inland fisheries management and revenues to regional governments, and some attempts post-2016 to allocate tender and lease licenses to groups of fishers in Ayeyarwady Region. This latter movement occurred in part as a response to growing contestation of the auction system by resource users, with leasable and tender fisheries attracting increasing criticism for excluding the poor, and incentivizing unsustainable harvesting practices [65]. These efforts have been strongly opposed by powerful individuals with interests in the fishery however, and the future of the reform program appears uncertain at present [59].

Historical evidence suggests that Myanmar traditionally had little reliance on marine fish resources [38] but from 1962, the BSPP government devoted significant efforts to developing the marine subsector (particularly offshore) as part of its "Burmese Way to Socialism" program, marking a second major fisheries policy shift. The People's Pearl and Fisheries Cooperation (PPFC)<sup>10</sup> was established with a mandate to support the modernization of the fishing industry through state-owned enterprises. The PPFC disseminated modern offshore fishing gears to newly-created cooperatives, established landing sites and worked on introducing seafood to domestic consumers [60].

Economic isolation and mismanagement by the BSPP government brought the country close to economic collapse, culminating in a coup in 1988 and the establishment of the SLORC regime. The SLORC adopted a program of partial market liberalization, marking another turning point in marine fisheries policy. Publicly owned fishing infrastructure was privatized, industrial cold storage facilities were developed, and private trade in fish and other goods was permitted. In addition, to palliate the national shortage of fishing capacity with respect to the new territorial fishing zone created following the UN Law of the Sea Convention in 1982 [45], fishing rights were granted to foreign vessels and joint-venture cooperation (JVC) was established with foreign-based fishing companies from countries including Thailand, Taiwan and Malaysia. Some remnants of these JVCs are still in

<sup>10</sup> Originally created in 1962 as the People's Pearl Fisheries Board (1962), the state-owned institution was restructured many times becoming the People's Pearl Fisheries Cooperation in 1970, the Myanmar Fisheries Enterprise in 1988 to finally be dismantled in 1993 and replaced by the private Myanmar Fisheries Federation (MFF), still existing today.

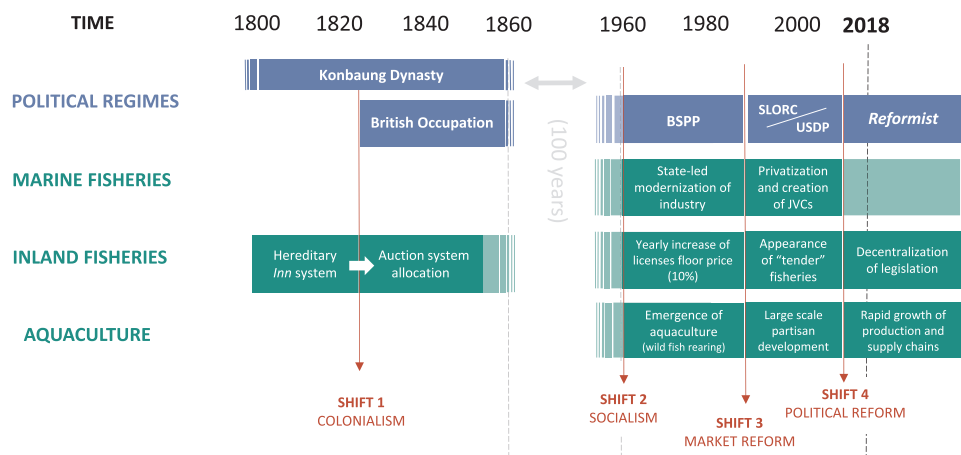


Fig. 1.1. Political transitions and key fisheries policy shifts in modern Myanmar history.

operation today [30].

From the mid-1960s onwards, farmers in the Ayeyarwady Delta began to trap wild fish in enclosed paddy fields and, gradually, to deliberately stock fish and provide them with rice bran as feed [20]. During the 1970s, new farmers started to excavate ponds as a number of government and privately-operated hatcheries were established. The sector became highly profitable as existing domestic demand for fish – mostly Indian major carps – was not fully met by capture fisheries, and developed quickly, particularly around the country’s largest city, Yangon, as early entrants began to convert paddy fields into ponds. The growing visibility of the emergent sector led to a crackdown on fish pond operators in the mid-1980s for breaching laws mandating compulsory rice production [8].

Following the shift to market-reform military rule in 1988, industrial scale agriculture and aquaculture was actively promoted by the state, which allocated land concessions for fish farming in the Ayeyarwady Delta to favored companies and individuals. Some successful early farmers, often supported by close ties to the state bureaucracy, also began to extend their operations once more. Despite continuing prohibitions against smallholder farmers converting agricultural land to ponds, farmers living in areas adjacent to fish farming concessions also started to excavate ponds and engage in aquaculture, particularly since 2000 [7].

Since 2011, in parallel with the democratization process, Myanmar has entered a period of deeper economic liberalization, and is now the fastest growing economy in Asia [1]. The transition to a market economy has already occurred in the rest of Southeast Asia and Myanmar is often considered a “final frontier” in this regard [69]. Myanmar’s isolation from the globalizing world prior to this time meant that China became its closest ally and major trading partner [24] but the country’s integration into the ASEAN free trade area (1997), and the lifting of economic sanctions from the European Union (2011) and the United States (2016) have provided increased scope for broader international trade.

These recent changes present opportunities and challenges for fisheries: Myanmar’s recent political and economic opening offers tremendous potential to stimulate and regulate the sector. However, this

potential is accompanied by the possibility of exposure to accelerated exploitation of fisheries resources and unsustainable practices. The overview of the sub-sectors outlined in the following section should thus be understood as occurring against a backdrop of rapid political and economic transformation.

### 3. The current state of fisheries in Myanmar

The overview depicted in this section relies on a simple analytic lens structured around four themes or ‘pillars’, which are deployed to review and synthesize multiple sources of information on each of Myanmar’s fisheries sub-sectors. The themes are as follows: (1) Governance, defined here as the framework of social and economic systems and legal and political structures through which fisheries are managed [51]. (2) Livelihoods, centering analysis on the people involved in fisheries and related value chains, and the capabilities, assets, and activities determining their means of living [3]. (3) Production, assessed in terms of fishing technologies utilized, geographical distribution of fishing activities, and data on yields. (4) Supply chains, evaluated in terms of the characteristics of input supply, and the post-harvest processing, distribution and consumption of fish. Results are presented below by theme and provide the foundation for discussion of policy in the final section of the paper.

#### 3.1. Governance

All fisheries subsectors in Myanmar share poor resource monitoring and a limited capacity for resource management. Successive governments have focused on fisheries chiefly as a source of revenue, leaving the DoF ill-equipped for the task of sustainably managing fishery resources [36], and there has been little investment in improving national research or extension capacity. The lack of importance placed on fisheries was recently emphasized by the omission of fisheries from the name of the new ministry (Ministry of Agriculture, Livestock, and Irrigation - MoALI) under which the departments of agriculture, irrigation, livestock and fisheries were merged in 2016. The allocation of only 0.8% of the Ministry’s recurrent budget to the Department of

Fisheries [43] confirms the government's relative disregard towards the sector despite the size of its contribution to the revenues of some regional governments, reaching up to 56% in Ayeyarwady Region<sup>11</sup> [59]. The low political status accorded to fisheries likely reflects the wary stance adopted by the union government towards a sector long criticized for its corrupt practices. In addition, no Myanmar universities currently have a dedicated fisheries or aquaculture curriculum<sup>12</sup> and when these subjects are addressed by zoology departments, the focus is limited to basic fish anatomy and taxonomy [36,63].

Marine fisheries are characterized by a weak regulation and enforcement owing to a poor monitoring, control, and surveillance capacity and lack of coordination between the responsible authorities [39]. For offshore fisheries, management of which falls under the purview of the navy, this is evident in JVC activities that continue despite the ban on the licensing of foreign fleets [30], as well as in the poor enforcement of the annually determined closed season, and the high prevalence of illegal fishing by foreign fleets, particularly from neighboring Thailand [13].

In the case of inshore marine fisheries, these issues are exacerbated by poorly defined boundaries, which fall within the same legislative arena as inland fisheries (Table 1.1), and answer to a different management authority than offshore fisheries. Offshore bottom trawlers commonly intrude into inshore grounds resulting in destructive fishing practices, and a large fleet of illegal inshore 'baby trawlers' operates in Rakhine State [2,58]. Marine protected areas are exploited and closed seasons are ignored, contributing to ongoing degradation of marine fishery resources. Conservation zones include six marine protected areas (MPAs) and the more recent introduction of locally managed marine areas (LMMAs) but these efforts are further complicated by the fact that their jurisdiction, together with mangrove conservation, falls under a different Ministry than fisheries<sup>13</sup> [11,39].

Inland capture fisheries in Myanmar are typified by a complex rights allocation system, prompting growing concerns about the equity and sustainability of leasable and tender fisheries management regimes. The perceived monopolization of the most productive fisheries by (often non-local) business people and the difficulties faced by poorer resource users in gaining access have given rise to conflicts between rights holders and fishers. Supported by increasing civil society engagement, this contestation is motivating a process of sectoral reform at central and regional levels [47]. The latter has been made possible by recent decentralization of legislation that, in principle, allows States and Regions to enact their own policies and laws [5]. However, constitutional shortcomings and low rates of implementation have so far limited the effects of decentralization in practice (Table 1.1).

Moreover, these reforms are increasingly resisted by powerful private business interests, giving rise to political confrontation over administration of the sector [59]. Inland capture fisheries are also typified by a high prevalence of conflicts over land and water resources between wetland fishers and farmers. Such conflicts are particularly common in seasonal wetlands due to the spatial overlap of agricultural land and leasable fisheries, and priority is reportedly given to agriculture by state institutions [65]. In addition, reservoirs, which represent a significant proportion of inland water bodies (over 115,000 ha), are subject to a fishing ban which officially prohibits their exploitation by fishing communities [5,21].

The future of inland fisheries rests partly with the Ministry of

<sup>11</sup> This proportional contribution does not account for transfers from the central government.

<sup>12</sup> Only three - namely Myeik, Patheingyi, and Malawmyine - universities have a Marine Sciences department but they focus only on fauna, flora, and ecological aspects of estuarine and marine environments [63]. Sittoung University offers a relatively similar curriculum through its Zoology department.

<sup>13</sup> This responsibility falls under the Ministry of Natural Resources and Environment Conservation (MONREC), while fisheries falls under the Ministry of Agriculture, Livestock, and Irrigation (MoALI).

Electricity and Energy (MOEE). The widening energy supply-demand gap in Myanmar together with the sizeable regional appetite for the country's untapped hydropower potential<sup>14</sup> has encouraged the reformist government to plan for major development. At the time of writing, at least 50 hydropower plants with a combined capacity exceeding 40 GW are under consideration, generating opposition from environmental activists and threatened fish-dependent communities [37,44].

Policy and legislation adopted under the military regime to promote industrial scale farming has favored the establishment of very large-scale fish farms through the confiscation of untitled land and its reallocation as concessions [7]. Smallholder aquaculture growth in Myanmar has been limited by the long term agricultural policy prioritization of rice production [20,35]. As a result, aquaculture is not legally recognized as "agricultural land use" and conversion of agricultural land to ponds necessitates the completion of a lengthy and expensive approval process involving multiple government departments and informal payments [10]. These informal arrangements weaken tenure security for smallholders practicing aquaculture (*ibid*; [26]). Enforcement of these restrictions is uneven however, partly explaining the clustered development pattern of the sector in the Ayeyarwady Delta, where regulations have been applied less strictly than elsewhere [8].

In keeping with the revenue focused approach adopted by successive governments to fisheries overall, DoF only keeps records of taxable ponds (i.e. which area exceeds 116 m<sup>2</sup>) and has devoted meager efforts in providing technical support to relatively disadvantaged small and medium producers [20,35]. The prevailing ban on reservoir fisheries also proscribes their use for farming fish [5,21].

An overview of key legislations regulating the fisheries sector in Myanmar is provided in Table 1.1.

### 3.2. Livelihoods

Government estimates that around 6% of Myanmar's population is employed in the fisheries sector on a full-time, part-time, or seasonal basis [19]. These approximations are derived from DoF records of official licenses and therefore, considering both poor monitoring capacity and the significance of the sector for subsistence, most likely underestimate the importance of fisheries to livelihoods (FAO & NACA, 2003). Organization of production and labor arrangements are diverse, particularly for capture fisheries, which encompass a wide variety of fishing methods and scales. The summaries below thus outline key characteristics of major prevailing employment and labor conditions in each fishery sub-sector, but are not exhaustive.

Marine fisheries are of special livelihood importance given that nearly half of the population resides in coastal states and regions [27]. For instance, in Mon State, small-scale inshore fisheries are reported to account for around 10% of rural employment and 11% of rural income, with 34% of households in areas engaging in commercial small-scale fishing [15].

Inshore fishing activities involve many women and children who participate in gleaning or trapping marine resources close to shore and using unmotorized dugout canoes, whereas daily fishing trips are performed mostly by men targeting nearshore (including reef habitat) species. These activities are for both subsistence and sale [29]. A level above are inshore fishing operations from motorized vessels which venture to sea for between one and a few days, returning frequently to land. These fishing operations are organized by boat owners who usually recruit crew members from their own villages (3–5 per boat), providing them with on-the-job training. Crew are customarily

<sup>14</sup> It is estimated that hydropower currently generates 5 GW, representing two thirds of Myanmar's installed capacity. MOEE estimates there is a potential for up to 100 GW nationwide.

**Table 1.1**  
Overview of key legislations regulating the fisheries sector in Myanmar.

MARINE FISHERIES (OFFSHORE)	MARINE FISHERIES (INSHORE)	INLAND FISHERIES	AQUACULTURE
<p>Across all sub-sectors laws tend to focus on revenue with limited provision for management, sustainability or incentive for accurate reporting. Their official translation into English, along with that of directives and notifications, often suffers from mistakes</p> <ul style="list-style-type: none"> <li>• Sub-sector is regulated under the Myanmar Marine Fisheries Law (1990)</li> <li>• The Fishing Right of Foreign Fleet (1989) and the establishment of joint-venture cooperation (JVC) through foreign-based companies underpinned the export-oriented strategy adopted under the 'market-reform military rule' regime (SLORC/USDP).</li> </ul>	<ul style="list-style-type: none"> <li>• Both Sub-sectors are regulated under the Union-level <i>Freshwater Fisheries Law</i> (1991). Inshore marine fisheries is covered under this legislation since the <i>2015 Constitutional Reform</i>.</li> <li>• Decentralization under the <i>New Constitution</i> (2008) allows each State and Region to draft their own freshwater fisheries legislation (at the time of this study, only Rakhine State and Ayeyarwady Region have effectively drafted new fisheries laws).</li> </ul>		<ul style="list-style-type: none"> <li>• Sub-sector regulated under the <i>Union Aquaculture Law</i> (1987).</li> <li>• Development of the subsector has been limited by the <i>Land Nationalization Act</i> (1953) and <i>Farmland law</i> (2012).</li> <li>• The <i>Wasteland Instructions</i> (1991) and <i>Vacant, Fallow and Virgin Land Law</i> (2012) have contributed to weakening security tenure for small-land holders.</li> </ul>

provided with wages and meals, and there is a relative sense of reciprocal responsibility between them and boat owners [27,30,31].

Offshore fishing operations are often enterprises running multiple vessels, contracting captains and crew members (10–20 per boat). These workers are often indebted migrants from other areas of the country (see [48,49]). Fishing trips usually last several months, during which crew members work in precarious conditions, sleeping in cramped quarters on vessels commonly poorly equipped in terms of safety [30,31,48,58]. There is growing evidence of human trafficking and forced labor involving Myanmar migrant workers on Thai offshore vessels working in non-Myanmar waters [42], and emerging evidence that similar problems exist in Myanmar itself [32,68].

The organization of laborers in inland fishing activities using boats resembles those in inshore marine fisheries, with operations carried out by crew hired on a per trip basis and provided with a daily wage and meals [56]. Yet a large proportion of inland river and floodplain resources are harvested without boats. Subsistence fishing activities with a large diversity of small gears are widespread across the country and generally practiced by rural dwellers on a part-time basis in designated public fishing areas (i.e. open fisheries), and paddy fields [12,5].

In privately licensed tender and lease fisheries, fish are often harvested with large barrage fences and stow nets, respectively [4]. License holders at the larger end of the spectrum commonly rely on seasonal workers to harvest, sort, and sometimes market the fish. A recent study in Ayeyarwady Region showed that the majority of the leases are managed as culture-based fisheries with a high occurrence of stocking (79%) and feeding (59%) [65]. Thus, workers are also employed for feeding activities, and as security agents to prevent poaching by members of neighboring communities [67].

The majority of fish pond area in Myanmar is under large-scale farms that employ permanent labor for security and feeding. As noted above, there are also an increasing number of small-medium scale commercial fish farms. All farm operations typically employ temporary workers for harvesting [8]. Fish farms in the Ayeyarwady Delta generate demand for almost four times more employment per acre than crop farms, with a tendency for smaller commercial operations to create more employment per unit area than large farms [23]. In addition, wages offered by fish farms are reportedly higher than crop farms, particularly for women [9]. Despite high variability in yields and profitability among farms, average per acre profits generated by fish farms in the Ayeyarwady Delta are approximately four times higher than those earned from nearby crop farms, making the activity attractive to potential entrants who are able to amass sufficient capital to invest (*ibid*).

Besides the concentrated cluster of commercial fish farms around Yangon, there are also large numbers of small scattered 'homestead' ponds, particularly in Ayeyarwady, Yangon and Bago Regions. These were originally excavated to harvest and store water for domestic use, but there is emerging evidence that farmers are actively managing them to attract wild fish from surrounding rice fields and wetlands, or, in

some cases, are stocking hatchery seed [50,8].

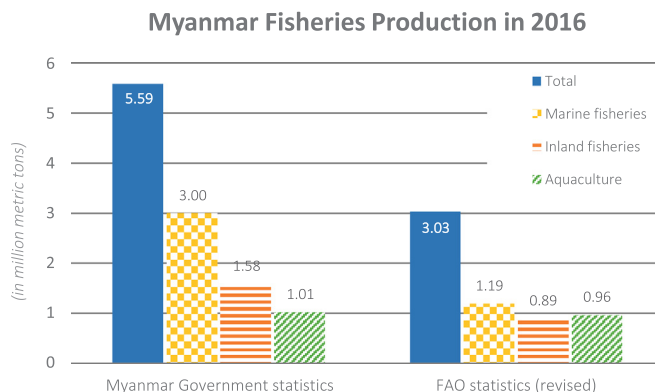
In all three subsectors, women play a major role in post-harvest activities, accounting for the majority of the workforce processing (e.g. fish drying) and retail trade, which generate large numbers of jobs on-land. Women also play a significant role in many wholesale trading operations.

### 3.3. Production

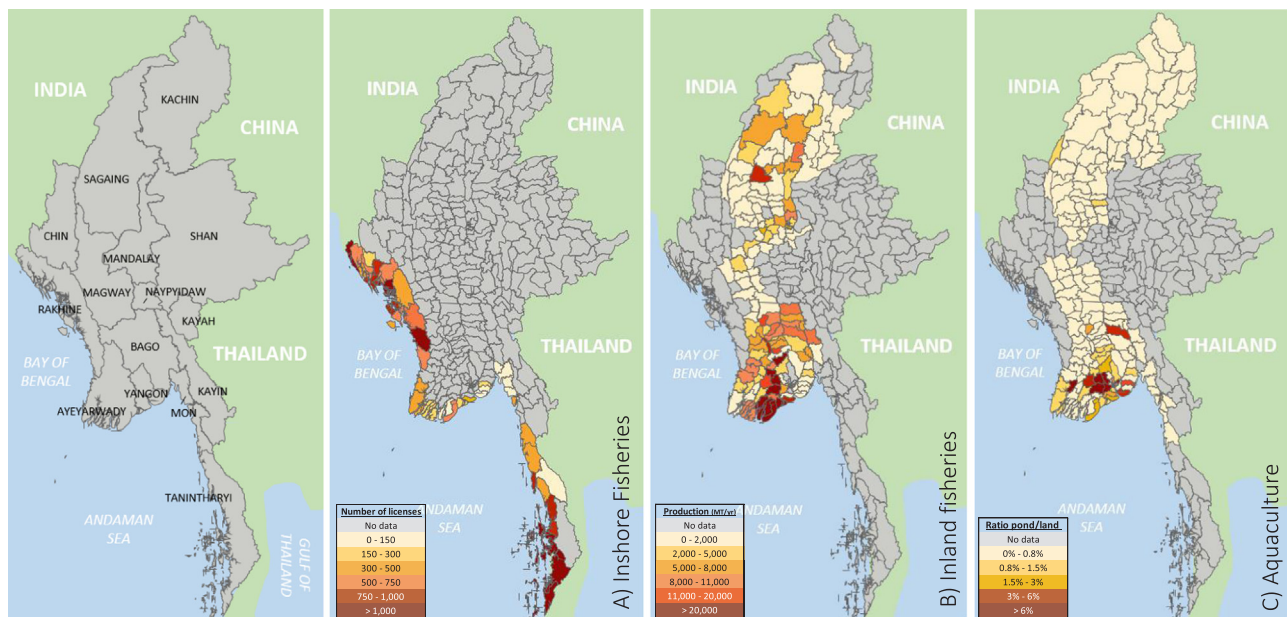
Government statistics for 2016 report annual fish production of 5.6 million metric tons, with respective contributions of marine fisheries, inland fisheries, and aquaculture at 54%, 28%, and 18% [19]. However, recent independent stock assessments and analyses of data from food consumption surveys have identified inconsistencies between these and ever increasing catch statistics [46,8].

The gap between reported and apparent production is believed to originate largely from the fact that since 1994, production statistics have fallen under the responsibility of the Planning Division of DoF [12], and that capture fisheries yields are estimated at the township level rather than being actually measured [61]. According to a recent re-assessment of production statistics by the FAO, Myanmar fish production is estimated to be composed of one third marine capture fish, one third inland capture fish, and one third aquaculture fish, for a total of above 3 million metric tons in 2016 [22 Fig. 2.1.]. The present study does not attempt to resolve these discrepancies. The intention is simply to emphasize the unreliability of official statistics.

Although their fishing fleets and methods differ significantly, offshore and inshore fisheries are grouped together in the national production statistics. Offshore waters are fished by large wooden-hulled fishing boats (from 80 to 150 GRT) using trawls, driftnets, purse seines, set bagnets and, occasionally, traps. According to records of licenses issued by DoF, there are over 2700 of these boats dispersed along the



**Fig. 2.1.** Myanmar fisheries production statistics in 2016 (in million metric tons) Source: DoF [19] and FAO-FIGIS [22].



**Fig. 2.2.** Heat maps illustrating the geographical importance of the different fisheries sub-sectors Note: Subsectors are proxied by: A) Number of license by Township; B) Production figures by Townships; and C) Ratio pond/land by Township. Offshore fisheries data (number of licenses) are only available at the Regional and State level (Tanintharyi: 1243; Naypyidaw: 863; Ayeyarwady: 395; and Mon: 209).

Source: Heat maps were generated using a combination of data from DoF (2015–16) and the recent SOBA survey with the dedicated MIMU mapping tool.

three coastal areas of Tanintharyi, Ayeyarwady-Mottama (comprised of Ayeyarwady, Yangon, Bago and Mon), and Rakhine, with the highest concentrations in the first two zones (DOF, 2015).

The use of large bagnets attached to anchored bamboo rafts is a widespread practice in the Gulf of Mottama and a recent study estimates there are between 5000 and 10,000 such units in operation [48]. Apart from JVC, offshore fishing activities tend to not operate in the deep-sea. Their catch is commonly composed of penaeid shrimps, demersal and semi-pelagic finfish, cephalopods and small pelagic species [30]. JVC operations mostly consist of trawlers from Thailand operating in the deeper EEZ but their catches are not landed in Myanmar (*ibid*). A recent stock assessment suggests that there has been a decline of over 80% in offshore fish stocks since 1979 [40].

The inshore fishing fleet is composed of about 26,400 wooden vessels (mostly below 30 ft in length) with the vast majority spread across Rakhine State and Tanintharyi Region, and a less significant presence in Mon State, Yangon and Ayeyarwady [19, Fig. 2.2. A]. Only half of that fleet is motorized and fishing operations mostly entail the use of small fishing gears such as seines, stow nets, long lines, gill nets, and traps. Their catch is composed of pelagic and demersal coastal finfish species, mollusks, and crustaceans [30,58].

A large diversity of fishing gears are used for inland fisheries, encompassing stationary traps, bamboo stake traps, drift nets, gillnets, pole-and-line, pots and small traps [21]. Most production is concentrated in the Ayeyarwady Delta (Fig. 2.2. B), where average productivity of the most productive fisheries can reach 1.8 metric tons per hectare [67], comparable to the higher end of the range observed in seasonal floodplains and rice field fisheries in Bangladesh and Cambodia. These gears are typically located in river systems on fish migration paths, sometimes covering spawning areas where fish congregate seasonally (*ibid*; [17]). Inland fish catches are characterized by a broad diversity of finfish species, the largest proportion of the catches composed of carps, barbs, catfish, climbing perch, snakehead and, increasingly, exotic tilapia species [21,33]. There is growing evidence of decreasing catch per unit effort and a rapid reduction in abundance of high market value fish species leading to increasing fishing intensity and a tendency to target smaller individual fish [5,61].

A key sectoral response by the government to the overall decline of

fisheries resources has been the investment of DoF in stock enhancement strategies (*ibid*; [21]). This practice, which has been widely popularized over the years to legitimize the role of DoF, makes use of most of the fingerlings produced in government hatcheries across the country. Together with the reverse practice consisting in collecting wild seed from important breeding grounds to stock fish ponds [50], this practice illustrates a continuum between inland capture fisheries and aquaculture in Myanmar. To date, there has been no assessment of the potential effects of these practices on biodiversity, nor the economic efficacy of government stock enhancement programs [36].

Aquaculture in Myanmar is relatively underdeveloped in comparison to neighboring countries in terms of the diversity of species and production technologies utilized, geographical distribution of operations, and total production volumes [8]. Ninety percent of Myanmar's aquaculture production takes place in freshwater earthen ponds in the Ayeyarwady Delta (Fig. 2.2.C). Farms are located mainly within a 50 km radius from Yangon and consist primarily of semi-intensively managed polycultures dominated by Indian major carp species. Rice bran and peanut oilcake are major feeds, with only 15% of farms using formulated pelleted feeds [9]. Rohu (*Labeo rohita*) alone represents over 70% of total production [10]. Yields from carp farms are relatively modest, averaging 4.9 t/ha [9].

Coastal shrimp farms are found mostly in Rakhine state. Operations are predominantly extensive and produce tiger shrimp (*Penaeus monodon*). The shrimp farm sector experiences severe constraints, most notably a lack of hatchery produced shrimp seed [66], with the result that yields are extremely low, reaching an average of 60 kg/ha/year in major production hubs (pers. commun., Myanmar Shrimp Association, April 2018).

### 3.4. Supply chains

Fish supply chains in Myanmar are primarily domestically-oriented and traditional.<sup>15</sup> Reported exports of fish landed in Myanmar are fairly

<sup>15</sup> “Traditional” supply chains are understood here as per defined by Gomez and Ricketts [25].

limited in comparison to Southeast Asian countries such as Thailand and Vietnam, representing around 8% of officially recorded fish production (DOF 2016). However, it appears that a large share of offshore marine catch from Myanmar's EEZ is captured by foreign vessels and trans-shipped illegally, notably to Thailand, Malaysia, and Taiwan, and thus is not recorded [30]. In their recent global marine catch reconstruction project, Booth and Pauly [13] go as far as to claim that landings of fish from Myanmar waters in Thailand alone are comparable in volume to domestic marine landings in Myanmar. Offshore landings are thus of relatively minor importance for the domestic market, and fish originating from them are commonly exported or supply high-end urban markets (ILO, 2015b). Most industrial cold storage and fish processing plants are concentrated in Yangon and Taintharyi Regions and target export markets, particularly China. Fish are simply frozen whole and packaged, with very little value added processing taking place [19,66].

Inshore landings on the other hand are an important contributor to fresh fish consumption in coastal areas [27]. Moreover, inshore species (including the bulk of landings from Rakhine State's large anchovy purse seine and illegal baby trawler fishery, as well as the Ayeyarwady and Mon bagnet fisheries) are the main raw material for dried and fermented fish products. Dried, fermented and salted fish products account for about one third of all fish consumption in Myanmar [8] and are distributed throughout the country, fulfilling a critical nutritional role, particularly in remote, arid and upland areas where fresh fish are scarce [34,36].

Away from the coast, there is a strong preference for freshwater fish (Tezzo et al., 2016). Fish from inland fisheries are also processed by drying, fermenting and salting, but to a somewhat lesser degree than marine catch. Wet markets continue to be the dominant retail format for fresh food across the country [8]. The expansion of road and water transport infrastructure and ice plants have contributed to the development of supply chains capable of moving fresh fish swiftly from major landing sites to major cities (*ibid*), but remoter coastal and inland areas often remain underserved by ice plants and cold storage facilities [33,34].

There are many similarities in trading arrangements for fish originating from inshore and inland fisheries, with fishers usually selling their catches to village-level collectors [33,56]. These traders commonly sell to township-level brokers who distribute to wholesalers in major urban wholesale markets as well as to local retailers. In both sub-sectors, it is common practice for wholesalers and consolidators to provide cash advances to fish collectors, who extend similar services to fishermen. Such financial arrangements generally require repayments in installments, often deducted from catch sales. They are developed over time based on experience and trust and help downstream actors to secure a regular supply of fish (*ibid*).

Nearly all fish farmed in Myanmar is consumed in fresh form, and most is absorbed by the domestic market. Only a small proportion is exported, frozen whole, and mostly targeting the niche market of South Asian migrant workers in the Middle East [8]. More than three quarters of Myanmar's farmed fish is traded through a single wholesale market in Yangon ("San Pya"). Fish is transported to San Pya from farms close to Yangon by boats or trucks, from where it is auctioned and re-packed in crushed ice before being dispatched to the rest of the country by truck or bus (*ibid*). The penetration of farmed fish into domestic markets is most significant in Yangon and in urban centers in upper Myanmar [36].

Finally, on the upstream side of aquaculture supply chains, Myanmar is characterized by the highest price of commercially manufactured pelleted feed in Asia, owing mostly to a lack of competition [8]. This has encouraged some large fish farming operations to vertically integrate production, establishing their own feed mills, hatcheries, ice plants, and sometimes even processing and marketing infrastructures (*ibid*; [36]).

#### 4. Discussion: sectoral recommendations

The assessment presented above shows that, while distinct in their characteristics, Myanmar's fisheries subsectors face a number of common challenges. Policy recommendations, formulated during the special consultation of experts on which this paper draws, are presented in the following section. For each fishery sub-sector, recommendations reflect the main issues identified in the preceding analysis. The discussion also draws parallels with comparable regional and global examples of policy reform, taking advantage of Myanmar's "late-comer" position, which provides an opportunity to learn from experiences elsewhere, both positive and negative.

Adopting many of the recommendations below will require an overall strengthening of national institutional and research capacity. Current fisheries statistics in Myanmar provide a weak basis for effective governance, and very few DoF staff have been specifically trained in fisheries management. Hence the training and resourcing of DoF officers in collecting, analyzing and acting upon fisheries data will be central in improving overall fisheries governance. The increasing engagement of non-governmental organizations, donors and investors aspiring to a 'blue economy' could serve as a timely support to foster change.

##### 4.1. Marine fisheries

Myanmar's marine fish resources have been negatively impacted by an acute lack of monitoring, control, and surveillance. This is particularly critical in view of foreign offshore fishing operations that have been allowed to persist at the expense of social and environmental welfare. The recent formulation of a National Plan of Action to deter, combat and eliminate Illegal, Unreported and Unregulated fishing (NPOA-IUU), together with adherence to the Port State Measures Agreement (PSMA) convened by the United Nations following similar regional and global efforts towards improved marine governance, offer blueprints to improve the legal framework, and support stock recovery in Myanmar EEZ [30]. Yet administering more transparent governance of offshore fish stocks while improving collection and exchange of information between the multiple entities involved in managing this sub-sector remain paramount challenges ahead for policy makers.

In many ways, the analysis presented in this article shows an historical disregard of coastal communities and points to an urgent need to secure a productive future for inshore fisheries and the communities that depend upon them. Here, drawing parallels with the legal reform of marine tenure in Indonesia provides an opportunity to ascertain some of the challenges lying ahead. A process of major fisheries reform initiated in Indonesia in 1999, aimed at recognizing and integrating the rights of coastal small-scale fishing communities in an archipelagic state where a large majority of fish catch originates from artisanal operations. Measures initiated under the reforms included the establishment of the Ministry of Marine Affairs and Fisheries (MMAF) to administer both offshore and inshore operations, together with the progressive transfer of legislative and regulatory authority to provincial governments [16]. This process was accompanied by the definition and recognition of a special status for "small-scale fishers" allowing them to operate anywhere inside Indonesia's EEZ, as well as the establishment of concession rights in coastal waters granted to individuals, communities, or the private sector over a period of up to 20 years (*ibid*, [57]). While these developments are widely acknowledged as positive steps towards securing better tenure for coastal communities, they are still very much hindered by the difficulty of obtaining legal and institutional recognition for the diversity of local customary tenure systems [16].

In many respects, the recent decentralization of inshore fisheries authority in Myanmar follows a path comparable to Indonesia's. The Rakhine State Government, in particular, is pioneering approaches aimed at securing stronger tenure for coastal communities. Supported by non-governmental organizations and bilateral donors, the Rakhine

Fisheries Partnership (RFP) was formed in 2012, comprising the State DoF, the private sector, universities, Civil Society Organizations (CSOs) and fishermen to support the development of fisheries legislation and governance based on shared interests and the recognition of historical, structural, and political relationships that shape traditional coastal fisheries. The initiative resulted in the development and passing of the *Rakhine State Freshwater Fisheries Law* in November 2014 [53].

This achievement holds the potential to establish a landmark for rights-based co-management approaches in Myanmar, paving the way for other Coastal States and Regions. Yet, despite widespread consensus on the potential benefits brought by merging science-based support with participatory planning processes [28], some regional experiences call for caution against considering community-based management as a panacea. For example, a recent impact assessment in the Philippines demonstrated that while such approaches had supported important benefits from a social equity perspective, sustainability improvements – particularly short term stock recovery – have yet to be established [70].

#### 4.2. Inland fisheries

The scale and significance of the contribution of inland fisheries to livelihoods and food and nutrition security in Myanmar has historically received insufficient recognition by policy makers. The experience of Lower Mekong Basin countries, where similar policy neglect has resulted in decisions that have seriously negatively impacted inland fisheries productivity and biodiversity (e.g. [6]), indicates that rural development policy should attach greater value to these resources and their maintenance. The historical priority accorded to agricultural expansion in seasonally flooded environments has created tensions around land and water use with no formal mechanism for conflict resolution. These tensions have been further exacerbated by the fact that, until recently, agriculture and fisheries fell under two different ministries. Here, the recent integration of agriculture, irrigation and fisheries under a single Ministry offers a unique opportunity to open dialogue between government departments and to establish more formal mechanisms for cross-sectoral coordination and integrated management of land and water resources. The ‘intersectorality’ of inland fisheries governance [62] is further underlined by the looming threat to inland fisheries posed by government ambitions to expand hydroelectricity generation.

The legal reform currently unfolding in Myanmar's freshwater fisheries offers some encouraging prospects for addressing issues of social equity. Yet, the history of similar attempts at reform cautions against over-optimism. As far back as the colonial era, a special commissioner for fisheries<sup>16</sup> made the recommendation to allow participation in fishing rights auctions, “only to *bona fide* fishermen, for a period of five years” and to “divide existing fishing lots in smaller units affordable by smallholders” [65]. Neither recommendation has ever been implemented.

In addition, the dramatic example of Cambodian inland fisheries reform – where political considerations propelled major policy shifts in advance of required enabling institutional capacity, leading to increased conflict and resource degradation – can serve as an example to avoid and an important reminder that a successful reform of freshwater fisheries will require a comprehensive understanding of their political, socio-economic, and ecological contexts [54]. The Cambodian example further underlines that attempts to foster change should be evidence-based and implemented gradually, using trial, evaluation and adaptation.

In parallel, there is also an urgent need to improve monitoring of the inland fisheries resource base. Yet, the prevailing culture-based

exploitation regime of most leasable fisheries suggests that the limits to their sustainable exploitation may be close at hand. Here, experiences from neighboring Bangladesh with successful implementation of community-based inland fisheries management approaches, suggest possible paths that Myanmar could embark on to sustain (perhaps even increase) the productivity of these resources [18].

A summary of the sub-sectoral recommendations discussed above is provided in Table 2.2.

#### 4.3. Aquaculture

Freshwater aquaculture has developed rapidly in Myanmar and plays an increasingly important role in national fish supply, but its full potential is far from being realized. Historically, much of this growth has been attributable to large enterprises promoted under the SLORC and USDP governments, with negative social justice implications resulting from the confiscation of land from other users. Since this time, closer attention to social considerations has resulted in calls for policies to create a level playing field for farmers of all sizes, thereby encouraging more inclusive growth of the sector [10]. Evidence indicates that aquaculture in Myanmar holds the potential to generate substantial incomes and employment and stimulate rural growth [23]. In order for this to occur, regulatory reforms are needed, most importantly the re-design of the Farmland Law, which currently fails to recognize aquaculture as a category of agricultural land use, limiting the sector's potential growth.

Building human and institutional capacity to effectively support the modernization of the aquaculture industry will also be crucial if it is to follow a similar development trajectory to that of neighboring countries. DoF can contribute to sectoral modernization and sustainability by engaging with the private sector in regulating the use of chemicals and drugs, ensuring the implementation of safe farm practices, and providing effective veterinary and extension services to farmers. The DoF can also increase engagement with universities through a structured approach for curriculum development, very much required to meet the industry's future needs. More accurate and detailed collection of farm statistics is also a necessary support for better-informed decision making.

However, while the sector makes an increasingly important contribution to the diets of consumers in domestic markets [9], neighboring countries such as Thailand and Vietnam provide clear illustrations of how rapid export-oriented aquaculture growth (particularly shrimp farming) have often occurred at the cost of major environmental degradation and associated social ills [14], as well as facing significant setbacks from periodic crises linked to animal health, food safety and reputational problems. These experiences demonstrate the need for strong national planning and regulation of the aquaculture industry to avoid pitfalls that have occurred during periods of rapid expansion elsewhere [41]. Responding successfully to growing opportunities for international trade will therefore require greater policy attention and more proactive state facilitation.

### 5. Conclusion

This review represents the first comprehensive assessment of Myanmar's fisheries, synthesizing a unique set of information sources to generate a broad view of the current state of the knowledge. Whilst the knowledge base has grown rapidly since 2011, the sub-sectoral analyses presented here point to significant gaps, and to an urgent need for further research and data collection efforts to support better policy and management. The analytical framework used in this article locates the present status of fisheries in Myanmar within the context of recent historical and political developments. It also highlights the interconnectedness of these fisheries subsectors, which are too often treated in a disjointed manner by governing institutions, policy makers, academics and development actors.

<sup>16</sup> In 1896, Captain F.D. Maxwell was commissioned to investigate how the sector had evolved under the new Burma Fisheries Act (1875). This Act had officially extended the fishing rights auction system to the whole country.



**Table 2.2**  
Summary of policy recommendations across Myanmar fisheries sub-sectors.

MARINE FISHERIES	INLAND FISHERIES	AQUACULTURE
<p>Strengthening of national institutional and research capacity together with improved collection of production statistics</p> <ul style="list-style-type: none"> <li>● Ensure a more transparent governance of offshore fish stocks</li> <li>● Secure tenure of coastal communities resources</li> </ul>	<p>research capacity together with improved collection of production statistics</p> <ul style="list-style-type: none"> <li>● Acknowledge the importance of inland fisheries for domestic livelihoods and food security and incorporate into decision making affecting water resources</li> <li>● Improve the overall knowledge of inland fisheries resource base</li> </ul>	<ul style="list-style-type: none"> <li>● Enact regulatory reforms to create a level playing field for farmers of all sizes</li> <li>● Strengthen human and institutional capacity for improved service delivery</li> </ul>

Myanmar now sits at a potential cross-road in terms of its fisheries governance. Choosing pathways that maximize human and environmental wellbeing, while avoiding mistakes made by other countries in the region that have already undergone similar periods of transition, will ultimately depend on adequate recognition of the sector's importance by government, the strengthening of governing institutions, building human capital through education tailored to the needs of the sector, a commitment to gathering (and acting upon) better data, more effective intersectoral collaboration within and across ministries, and meaningful cooperation among donors, CSOs, and private sector actors. However, as illustrated by the review of the country's recent political history, it is important to acknowledge that any fisheries policy reform will entail trade-offs. Recognizing, prioritizing and balancing co-existing policy agendas (i.e. economic development, food security, environmental and social welfare) will require deeper coordination in the context of current reforms.

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### Conflicts of interest

We have no conflicts of interest to disclose.

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