

2. Trends and Prospects of Inland Fisheries

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Introduction

Inland fisheries are any activity conducted to extract fish and other aquatic organisms from "inland waters". The term "inland waters" is used to refer to lakes, rivers, streams, ponds, inland canals, dams, and other land-locked (usually freshwater) waters (FAO, 2014). While most inland waters are freshwater, there are many areas that are classified nationally as inland waters which have daily or seasonal fluctuations in salinity (e.g. estuaries, deltas, some coastal lagoons). Fisheries in inland waters have long provided an important source of food for mankind. Inland fisheries are critical for a group of developing countries in the world, providing an important source of nutrition and income. Inland fisheries serve important economic, cultural, and recreational roles and play a major role in sustainable ecosystem function throughout the world (Lynch *et al.*, 2015). More than 60 million people in the developing world work with various aspects of inland fisheries and women represent more than half of this workforce. Individuals can relatively easily begin fishing in inland waters because basic equipment needs (e.g., nets, hooks, traps) are generally inexpensive and do not require substantial skill to operate or maintain. Despite being 'low-tech,' and inexpensive, these fishing techniques are highly effective at catching large amounts of fish and are used extensively in inland fisheries around the globe (Welcomme *et al.*, 2010). Inland fisheries are predominantly small-scale in nature, but large-scale and commercial inland fisheries do make a contribution to livelihoods and food security. In many developed countries, and increasingly in developing countries, inland fisheries support recreational fisheries which enjoy high levels of public participation and contribute to local, regional, and national economic prosperity and human well-being.

Present status of inland fisheries

Global inland fish production reached 63.3 million tonnes in 2018 as per FAO 2020 (Table 1). The trend in global-aggregated catch indicates that inland fisheries catch has risen more or less linearly over the past 20 years increasing by 222,000 tonnes, or 2.3 per cent, per year (1996–2016; FAO FishStatJ, 2018). Inland capture fisheries production was 12 million tonnes accounting 12.5 % of world capture fish production. Inland aquaculture production was 51.3 million tonnes.

Table 1: Global inland fish production

Production type	1986- 1995	1996- 2005	2006- 2015	2016	2017	2018
Average per year						
(million tonnes, live weight)						

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Inland (Capture+ 15.0 28.1 47.4 59.4 61.5 63.3
Aquaculture)

However, this continuously rising trend in inland fisheries production may be misleading, as the increase in catches can partially be attributed to improved reporting and assessment at the country level rather than entirely due to increased production. Many of the data collection systems for inland waters are unreliable, or in some cases non-existent, while improvements in reporting may also mask trends in individual countries. Inland water catches are more concentrated than marine catches, both geographically and by country. Sixteen countries produced more than 80 percent of the total inland catch, with Asia accounting for two-thirds of global inland production since the mid-2000s. China leads in inland fish production followed by India .

Four major species groups account for about 85 percent of total inland water catches. The first group “carps, barbels and other cyprinids” has shown a continuous increase, rising from about 0.6 million tonnes per year in the mid-2000s to over 1.8 million tonnes in 2018, and explains most of the increase in catches from inland waters in recent years. Catches of the second-largest group “tilapias and other cichlids” have remained stable at between 0.7 million tonnes and 0.85 million tonnes per year, while catches of freshwater crustaceans and freshwater molluscs have also remained relatively stable from about 0.4 million tonnes to 0.45 million.

Inland capture fisheries

Inland capture fisheries play important role in the global challenge to sustainably feed the growing population, as they deliver quality nutrition to some of the world’s most vulnerable populations in a manner that is both accessible and affordable. Catches from inland capture fisheries were at their highest ever in 2018 at 12.0 million tons. Global catches in inland capture fisheries have increased steadily year on year, reaching over 12 million tonnes in 2018. **Table 2: Inland capture fisheries production, by region**

Region	Production (average/ year)			Production				% of total 2018
	1980s	1990s	2000s	2015	2016	2017	2018	
	(million tonnes, live weight)							
Asia	2.87	4.17	5.98	7.30	7.44	7.90	7.95	66
Africa	1.47	1.89	2.34	2.84	2.87	3.00	3.00	25
Americas	0.56	0.54	0.58	0.57	0.60	0.58	0.63	05
Europe	0.28	0.43	0.36	0.43	0.44	0.41	0.41	3
Oceania	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0
Others ¹	0.51	-	-	-	-	-	-	0
World total	5.70	7.05	9.27	11.15	11.37	11.91	12.02	100

¹ Includes the Union of Soviet Socialist Republics. Source: FAO, 2020



Share of inland waters in the total for global captures increased from 8.0 % in late 1990s to 12% in 2018. The apparent low proportion of fish provided by inland capture fisheries globally can be misleading and most likely does not reflect adequately the importance of inland capture fisheries in today’s society. Major share of capture fisheries came from Asian (66%) region followed by Africa (25%) (Table 2). Inland water catches have been relatively stable in China, the top producer, averaging about 2.1 million tonnes per year over the last 20 years. The increase in total inland water catches has largely been driven by a number of other major producing countries – notably, India, Bangladesh, Myanmar and Cambodia (Table 3).

Table 3: Inland capture fisheries: Major producing countries

Sl. No.	Country	Production (average/year)			Production				% of total 2018
		1980s	1990s	2000s	2015	2016	2017	2018	
		(million tonnes, live weight)							
1.	China	0.54	1.46	2.11	1.99	2.00	2.18	1.96	16
2.	India	0.50	0.58	0.84	1.35	1.46	1.59	1.70	14
3.	Bangladesh	0.44	0.50	0.86	1.02	1.05	1.16	1.22	10
4.	Myanmar	0.14	0.15	0.48	0.86	0.89	0.89	0.89	7
5.	Cambodia	0.05	0.09	0.34	0.49	0.51	0.53	0.54	4

Source: FAO, 2020

Inland aquaculture

Inland aquaculture produces most farmed aquatic animals, mainly in freshwater. Inland aquaculture produced 51.3 million tonnes of aquatic animals, accounting for 62.5 percent of the world’s farmed food fish production in 2018, as compared with 57.9 percent in 2000 (Table 4). The farming of aquatic animals in 2018 was dominated by finfish, however dominant position of finfish was gradually reduced from 97.2 percent in 2000 to 91.5 percent (47 million tonnes) in 2018, reflecting the strong growth of other species groups, particularly crustacean farming in freshwater in Asia, including shrimps, crayfish and crabs.

Despite the great diversity in the species raised, aquaculture production by volume is dominated by a small number of “staple” species or species groups at the national, regional and global levels. Finfish farming include 27 species and species groups, which accounted for over 90 percent of total finfish production in 2018 of which the top 7 species together contributed to around 50% (FAO,2020). They are Grass carp, *Ctenopharyngodon idella*, Silver carp, *Hypophthalmichthys molitrix*, Nile tilapia, *Oreochromis niloticus*, Common carp, *Cyprinus carpio*, Bighead carp, *Hypophthalmichthys nobilis*, Catla, *Catla catla* and *Carassius* spp. Compared with finfish, fewer species of crustaceans, molluscs and other aquatic animals are farmed. Inland aquaculture of finfish production is dominated by developing countries such as



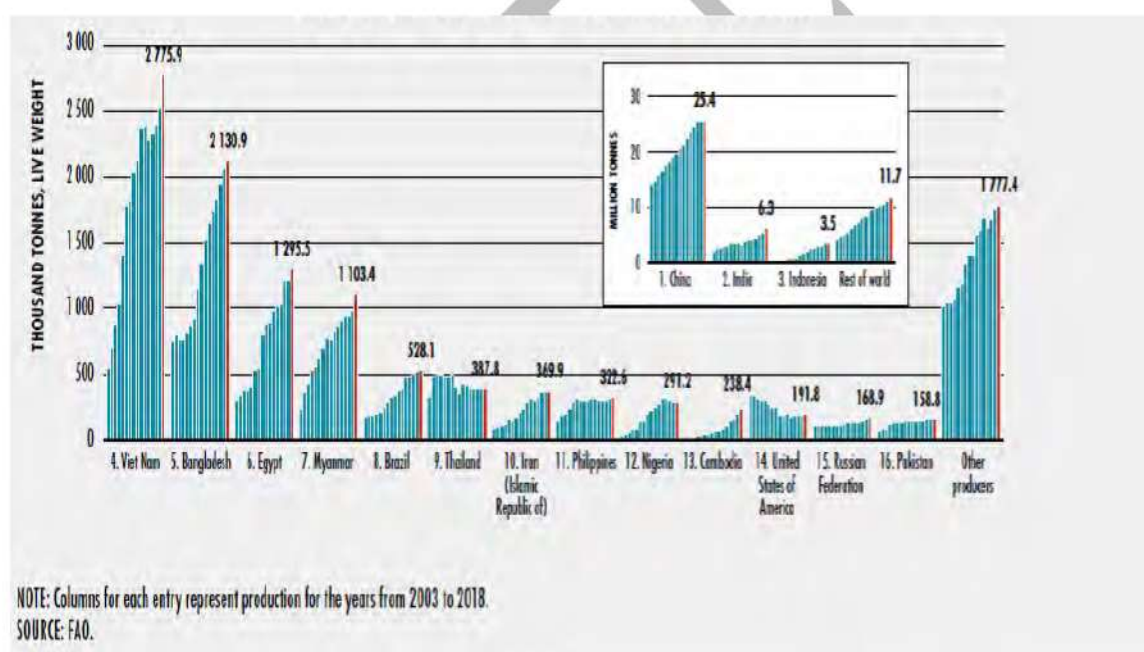
China, India and Indonesia (Figure 1).

Table 4: Aquaculture production of main species groups

Category	Africa	Americas	Asia (- Cyprus)	Europe (+ Cyprus)	Oceania	World
<i>(thousand tonnes, live weight)</i>						
Inland aquaculture						
1. Finfish	1 893	1 139	43 406	508	5	46 951
2. Crustacea	0	73	3 579	0	0	3 653
3. Molluscs	207	207
4. Other aquatic animals	...	1	528	0	...	528
Subtotal	1 893	1 213	47 719	508	6	51 339

(Source: FAO, 2020)

Figure 1: World Inland aquaculture finfish production by major producers



Challenges in inland fisheries development

Freshwater species and habitats are some of the most threatened in the world with an estimated one fifth of the described freshwater fish species are extinct, threatened or endangered. Inland fish species face higher declines relative to marine and are disproportionately understudied. Inland fisheries are subjected to a suite of anthropogenic stressors across aquatic-terrestrial landscapes. Numerous challenges and threats are hampering the production and health of inland fisheries.



Improper representation of inland fisheries data

The major issue associated with inland fisheries development are the under estimation of inland fisheries data. The lack of routine monitoring across a wide range of inland fisheries constrains the ability to provide an indication of the status or health of global inland fisheries. This limitation covers both the effect of fishing activity, as well as that arising from anthropogenic drivers (including climate variability). Recent developments in the statistical coverage may have contributed to the rapid increase in reported landings particularly since the mid2000s (FAO 2012), however the production in many waters may still be grossly underestimated. The underlying reasons for the improper representation of inland catches are as follows (Table 5)

Table 5: Reasons for inland fisheries receiving less official attention

Main reason	Underlying reasons
Inland fisheries catches are often hidden or “invisible”	Inland capture fisheries landings tend to be low volume and widely dispersed
	No centralized landing site, fishes sold locally or consumed by households
	Catch rarely recorded and production often underestimated
	Fisheries in smaller tributaries and waterbodies are generally overlooked
Governments do not consider inland fisheries important contributors to food security, GDP and livelihoods.	Monitoring mostly for commercial fisheries
	Lack of monitoring/recording of fishing activities in river tributaries, minor waterbodies, small streams, floodplains
	The costs of monitoring small-scale fisheries are not returned in revenues to the state

Habitat loss

The status of marine fisheries is mainly influenced by fishing pressure whereas the status of inland fisheries depends heavily upon the quantity and quality of freshwater and diversity of fish habitats—all of which are predominantly influenced by factors external to the fisheries. Both natural and anthropogenic environmental drivers affect aquatic habitats, water flows, habitat connectivity and water quality. About 10% of the world’s freshwaters are abstracted annually for human use. Loss of wild habitat and water flows because of changes in rivers, wetlands and waterbodies caused by changing land use, watershed development and drainage of freshwater wetlands, reduces the available habitat to sustain populations. Physical obstruction and changing water flow regimes impacts upstream and downstream migration and reproduction of riverine species caused by damming of rivers and loss of connectivity in waterways.



Pollution

Pollution have caused substantial decline or change in inland fishery resources. Direct effect include discharge of toxins and heavy metals from untreated industrial discharges leading to fish kills. Indirect effect of effluents from urbanization leads to eutrophication and water quality changes and food chain disruptions. Pesticide runoff from agriculture directly affects fish, or indirectly through ecosystem level impact on prey/food chains.

Overfishing

In spite of the trend of gradually increasing inland catches in the global scale, there has been a reduction in the catches of certain species, apparently due to reduction in population sizes (FAO 2010). The decline may have been partly masked by the recent improvements in catch data collection and aggregation of catches, and because the total number of fishers may still be increasing. Excess fishing pressure can change the community composition of inland ecosystems by removing the larger, slower growing species (fishing down the food web). Fishing also exerts a selective pressure on target species, e.g. early maturity and small size at age of first maturity, as well as on non-target species through by-catch and discards.

Non-native species

Introduction of non-native species can increase production and value of inland ecosystems, but they can also have a profound and devastating impact upon an ecosystem such as serious effects on natural habitats and wild fish stock. Negative impacts include reduced biodiversity because of predation, competition and habitat alteration. In many lakes and rivers, introduced species are a major threat as their occurrence may change the fish community structure and nutrient cycle. Also leads to spreading of disease and parasites to other native species.

Climate change

Inland fisheries are highly vulnerable to the impacts of climate variability. Inland biodiversity is often confined to specific river basins or streams and therefore cannot migrate as marine species when habitat starts to degrade. Negative impacts include reduced numbers and range of populations because of habitat degradation, e.g. temperature increase and acidification. For aquaculture, although the sector is expected to continue growing to meet the world's demand for aquatic food, climate change could result in favourable, unfavourable or neutral changes, with negative impacts likely to predominate in developing countries as a result of a decreased productivity due to suboptimal farming conditions and other perturbations.

Measures for responsible inland fisheries

Human population is expected to exceed 9 billion by 2050 and the growing populations will call for significant increases in food production at an affordable price. The need for animal protein, including fish, will increase dramatically. Because most marine fish stocks are already fully exploited or overexploited, it is assumed that fishing pressure on inland fish stocks will rise. The role of inland fisheries in meeting challenges faced by individuals, society, and the



environment is often underappreciated or ignored despite its importance (Lynch *et al.*, 2016). Inland fisheries can be a significant contributor to poverty alleviation and prevention of poverty escalation, where they are a primary livelihood, a secondary livelihood, or even as a subsistence source of nutrition. The following steps will be a path towards responsible use of inland resources for optimally managing the resources so that they can play a significant role in providing food security, income generation and sustaining economic growth for the future generations.

Improve the assessment of inland fishery

Develop, promote and support standardized methods for the assessment of inland fisheries harvest and aquaculture production including: data collection methods, besides the traditional catch and effort surveys, such as population census, consumption studies, market surveys and habitat classification. Also, a minimum set of data requirements that would be practical for countries to collect can be established which would allow cross-sectoral comparisons. In addition to that, increase support for efforts to improve capacity of fishery resource officers to collect information on the sector.

Correctly value inland aquatic ecosystem

The true economic and social values of healthy, productive inland aquatic ecosystems are often overlooked, underestimated and not taken into account in decision-making related to land and water use. Promote and support the adoption of approaches that include assessment of the ecosystem services provided by inland aquatic ecosystems to value their contribution to ecosystem health and societal wellbeing.

Promote the nutritional value of inland fisheries

The relative contribution of inland fisheries to food security and nutrition is higher in poor food-insecure regions of the world than in many developed countries that have alternate sources of food. Maintain or improve the accessibility/availability of nutrient-rich fish in areas with traditionally high fish consumption and/or high levels of under-nourishment and malnourishment by ensuring fair and equitable access regimes.

Develop science-based approaches to inland fishery management

Many inland waterbodies do not have fishery or resource management arrangements that can adequately address sustainable use of resources. This may result in excessive fishing pressure, decreased catch per unit effort, and conflicts between fishers, as well as changes in the productivity of fishery resources. Adopting ecosystem approach to fisheries in inland waters will help to achieve the integrated management of land, water and living resources for promoting their conservation and sustainable use in an equitable way. Also support effective governmental, communal/co-operative, or rights-based governance arrangements and improve compliance with fishery management regulations.



Improve communication among freshwater users

Information on the importance of the inland fishery and aquaculture sectors is often not shared with or accessed by policy-makers, stakeholders and the general public, thereby making it difficult to generate political will to protect inland fishery resources and the people that depend on them. Appropriate and accessible communication channels can be used to disseminate information about inland fish, fishers and fisheries to raise awareness of inland fisheries' values and issues, to alter human behaviour, and influence relevant policy and management. The fisheries sector should engage other users of freshwater resources and participate in national and international fora that address freshwater resource issues, conflicts and synergies.

Improve governance, especially for shared waterbodies

Many national, international and transboundary inland waterbodies do not have a governance structure that holistically addresses the use and development of the water and its fishery resources. Establish governance institutions (e.g., river or lake basin authorities) or expand and strengthen the mandate and capacity of existing institutions to address inland fisheries needs in the decision making processes. Legal frameworks for multistakeholder-based decision-making and management can be identified and strengthened.

Make aquaculture an important ally

Aquaculture is the fastest-growing food production sector and an important component in many poverty alleviation and food security programmes. It can complement capture fisheries, e.g., through stocking programmes, by providing alternative livelihoods for fishers leaving the capture fisheries sector, and by providing alternative food resources. However, the use of non-native species in aquaculture development has to be properly managed and regulated.

Develop an action plan for global inland fisheries

In light of the threats and challenges in inland fisheries, there exists a great need for policies to be closely integrated with those of other sectors. Inland action plan based on the above steps will be helpful to ensure the sustainability and responsible use of inland fisheries and aquatic resources for future generations.

Reference

FAO 2012. The state of world fisheries and aquaculture 2012. FAO, Rome

FAO, 2014. CWP Handbook of Fishery Statistical Standards Section G: Fishing Areas – General. FAO, Rome.

FAO, 2018. Review of the state of the world fishery resources: inland fisheries. FAO Fisheries and Aquaculture Circular No.C942 Revision 3

FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. FAO, Rome.



Lynch, A.J., Beard, T.D., Cox, A., Zarnic, Z., Phang, S.C., Arantes, C.C., Brummett, R., Cramwinckel, J.F., Gordon, L.F., Husen, M.A., Liu, J., Nguyen, P.H., Safari, P.K., 2016. Drivers and synergies in the management of inland fisheries: searching for sustainable solutions. In: Taylor, W.W., Bartley, D.M., Goddard, C.I., Leonard, N.J., Welcomme, R.L. (Eds.), *Freshwater, Fish and the Future: Proceedings of the Global Cross-Sectoral Conference*. American Fisheries Society Press, Bethesda, Maryland, pp.183–200.

Welcomme, R.L., Cowx, I.G., Coates, D., Béné, C., Funge-Smith, S., Halls, A., & Lorenzen, K. 2010. Inland Capture Fisheries. *Philosophical Transactions of the Royal Society B*, 365: 2881–2896

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