



ACCOUNTING FOR INDUSTRIAL FISHING IN LIBERIA

HIGHLIGHTS

- Liberia lacks a systematic and consistent approach to measurements and accounting of fisheries – essential for sustainable fisheries management
- Total fish catch since the onset of industrial fishing in Liberia (1950s) is estimated to be in a range of **0.5-1 million metric tons**
- Daily average fishing efforts during 2020-2021 is estimated around **80-100 hours/day** in Liberian waters by all vessels
- Fish landing is estimated at just **over 5,000 metric tons** with an estimated market value of around **USD \$7 million** over the last two years
- Illegal, unregulated and unreported (IUU) catch is believed to be substantial, but reliable data is lacking
- Distinct spatial and temporal variation have been identified in fishing activities
- Fisheries account can support achieving key policy elements outlined in National Adaptation Programme of Action (NAPA), Fisheries and Aquaculture Policy & Strategy as well as the Pro-poor Agenda (PAPD)

BACKGROUND

Liberia has one of the longest coastlines in west Africa among neighboring Sierra Leone and Guinea to the north, and Cote d'Ivoire & Ghana to the south. The country has a large fishing ground potentially spanning over 20,000 km² off the coast. The fisheries sector makes a large contribution to GDP, going up to 10% in some years, alongside its contribution to food and nutritional security and livelihoods of hundreds of thousands of people living on the coast and further inland.

If sustainably managed, coastal and marine fisheries are expected to be a key driver in Liberia's sustained economic growth in the coming decades. However, such a transformative change requires – but is currently lacking – a systematic and consistent approach to measurements and accounting of fisheries resources.

The fisheries accounts developed through the Conservation and Sustainable Use of Liberia's Coastal Natural Capital project aims to fill that gap by generating information, statistics and indicators using most recent data obtained through a number of sources including Sea Around Us (www.seaaroundus.org)¹, Global Fishing Watch (www.globalfishingwatch.org)² and National Fisheries and Aquaculture Authority (NaFAA) of Liberia.

¹ Zeller, D. and D. Pauly. 2016. Marine fisheries catch reconstruction: definitions, sources, methodology and challenges. In: Pauly D and Zeller D (eds.) Global Atlas of Marine Fisheries: Ecosystem Impacts and Analysis. Island Press, Washington, D.C.

² Kroodsmas, DA, J Mayorga, T Hochberg, NA Miller, K Boerder, F Ferretti, A Wilson, B Bergman, TD White, BA Block, P Woods, B Sullivan, C Costello, B Worm. 2018. Tracking the Global Footprint of Fisheries. Science. 359, 6378: 904-908



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HISTORICAL CONTEXT (1950-2015)

Like most under-developed countries, Liberia lacks coherent historical information and official reporting on marine fisheries. The limited historical data available are inconsistent and often doubtful.³ The existing sporadic reporting of fish landing is difficult to use in order to get a full picture due to different methods used for estimating catch volume. Sea Around Us data provides a historical reconstruction of global marine fish catch around the world, which we utilized to extract and analyze Liberia-specific information.

Catch Volume

The reconstructed historical data showed that total fish catch by industrial fleets in Liberian waters ranged 0.5-1 million metric tons since the 1950s. Catch had been under 20 thousand metric tons/year until the mid-1980s, peaking c. 1990 when it came close to 40 thousand metric tons (see Figure 1). Thereafter, industrial catch crashed due to civil war

and political unrest in the country. In more recent years, especially over the last decade, industrial catch has been recovering, although, with high annual fluctuation depending on how many vessels are operating. Still, the total catch is hovering around 10-15 thousand metric tons/year – the pre-civil war level. These estimates, however, do not include illegal, unregulated and unreported (IUU) catch, which is believed to be substantial, but reliable data is lacking.

Key Species

A wide variety of species is harvested in open waters – a total of 219 species have been reported from industrial landings since the 1950s. Yellowfin, skipjack and bigeye tuna dominated the total catch by volume, followed by mackerels, sardinellas and croakers (Figure 2). Other available species in Liberian waters reported by NaFAA include demersal species such as cassava croaker and African threadfin, small pelagic species such as West African ilisha and shad, as well as many crustaceans including shrimp, lobsters and crabs.

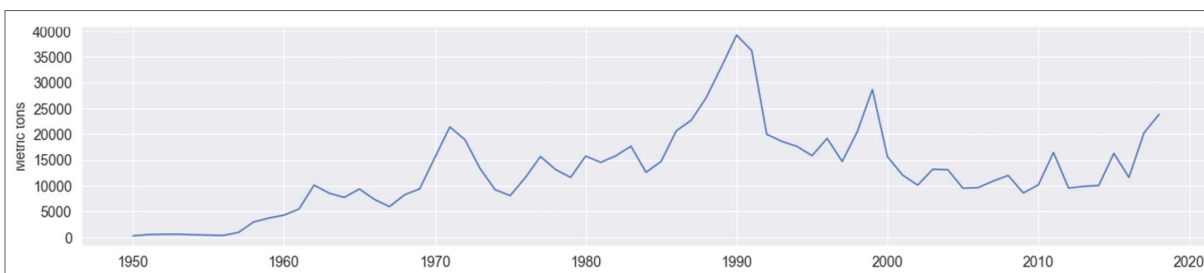


Figure 1. Reconstructed historical production of industrial fishing off the coast of Liberia.

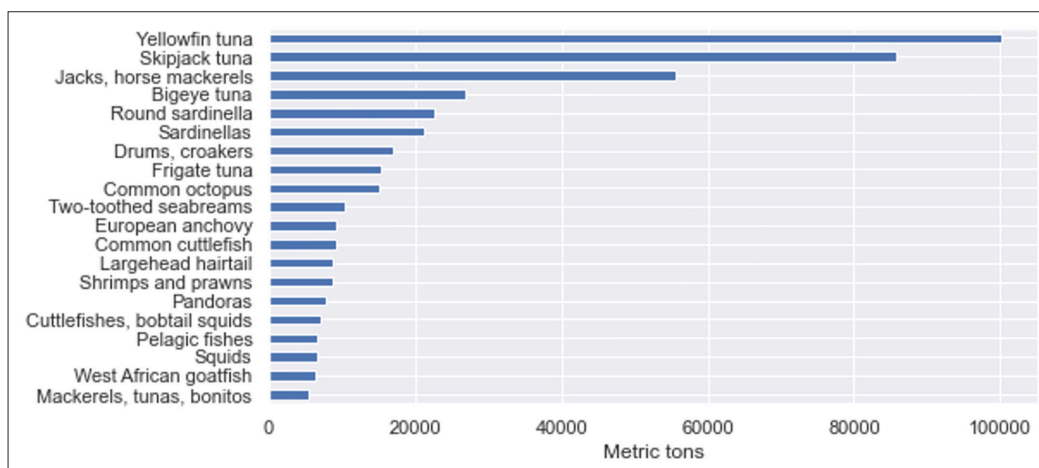


Figure 2. Top species reported from industrial landings since 1950.

³ Belhabib, D., Y. Subah, N.T. Broh, A.S. Jueseah, J.N. Nipey, W.Y. Boeh, D. Copeland, D. Zeller and D. Pauly. 2013. When reality leaves a lot to the imagination: Liberian fisheries from 1950 to 2010. Fisheries Centre Working Paper #2013-06, 19 p.

RECENT TREND (2016-2022)

While Sea Around Us is a relatively reliable data source for historical landings, the time series ends in 2018. In recent years, due to tremendous advances in geospatial bigdata availability in the public domains, it is now possible to get a more accurate picture of industrial fishing activities. Global Fishing Watch (GFW) – a cloud data platform – provides near real-time monitoring data of industrial vessel locations and their movements. With the help of this data source, we were able to estimate industrial catch for each vessel operating in Liberian waters for any given time window. Among the many information generated on recent industrial fishing in Liberia, we present here a subset that are deemed most relevant.

Fishing Efforts

Fishing efforts in this analysis are defined in terms of “apparent fishing hours” – the number of hours a vessel is apparently deployed for fishing in a particular geo-location during a given time window. The resampled daily fishing efforts (number of hours/day) by all fishing vessels combined is presented in Figure 3. The data shows that fishing efforts have been relatively low up until mid-2019 with an average of around 30 hours/day by all fleets, and since then it has been steadily increasing, fluctuating around 80-100 hours/day. A clear seasonal pattern can also be identified in this time series, which we will discuss later.

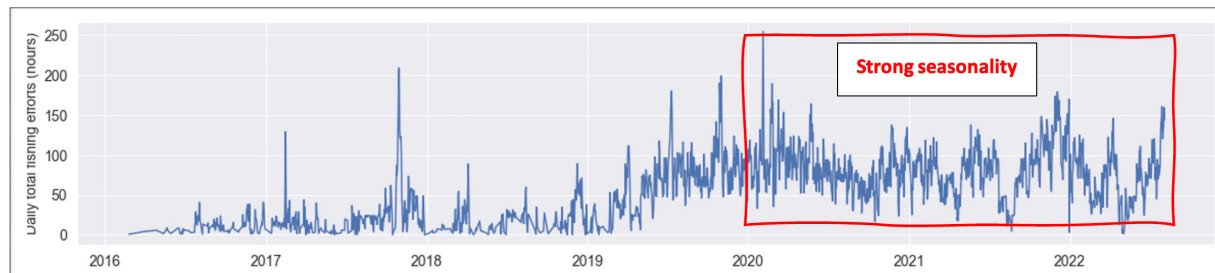


Figure 3. Industrial fishing efforts off the coast of Liberia (2016-2022).

Catch Volume & Value

Following the estimation of fishing efforts in a fine temporal resolution, we then calculated total catch volume and monetary value using separately calculated catch per unit effort (CPUE) with information obtained from NaFAA and a constant market price (note that market prices will be updated with surveys, therefore, the estimates will change slightly).

Monthly aggregated catch volumes presented in Figure 4 show that total catch took off since 2019, consistent with industrial fishing efforts presented above. For example,

monthly estimated catch in early-2019 was about 50 metric tons/month, which rose to an average of more than 300 metric tons/month in most of 2020 and 2021.

Table 1 below synthesizes annual catch and their monetary values for the last 5 years. In 2016, total catch was only 250 metric tones which increased by a factor of 20 in 2020. The market value of industrial fishing efforts in 2020 and 2021 was around US \$7 million. Note that, in all likelihood, these estimates will vary depending on how the CPUE is calculated and what market price is used – an important area of future research for increasing precision in estimates.

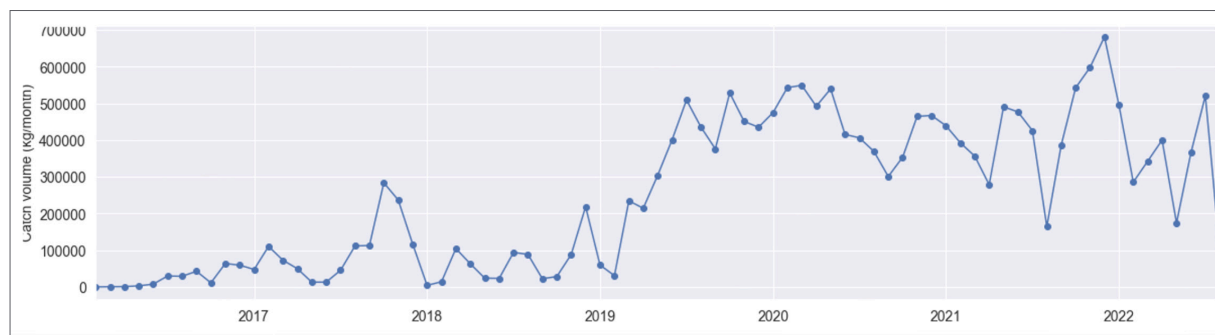


Figure 4. Aggregated volume of monthly fish catch between 2016-2022.

	2016	2017	2018	2019	2020	2021
Catch (10^3 kg)	249	1215	774	3981	5377	5234
Value (USD)	323661	1579972	1006677	5175442	6990293	6804850

Table 1. Annual industrial catch and monetary value between 2016-2021.

Spatial & Temporal Variation

Industrial fishing activities in Liberian waters in 2020 show strong seasonality and temporal variability. The fishing fleet kicks off their operation in January with annual vessel registration with NaFAA and continue fishing until May/June in a consistent manner. Thereafter, their activities decline until Sept/Oct, presumably due to the onset of rainy season, followed by a slight increase in activity towards the end of the season (Figure 5).

Spatial variation of fishing activities is also distinctive and may have some correspondence with the temporal variation driven by the rainy season. During the first quarter of the year, fishing activities are prevalent all along the Liberian

coast and some in the offshore. At the onset of rains in June/July the limited fishing activities are mostly concentrated in the north, near Monrovia where landing and processing activities take place. At the end of rains in Sept/Oct, activities elevate a bit with higher concentration in the south.

Whether this spatial variability is due to movement of fish species or due to other factors is subject to further research. This includes any potential connection between fishing activities and the presence of intact coastal ecosystems, which provide refuge and breeding grounds for many marine species. Outcomes from such research will support Liberia's marine spatial planning/coastal development policy.

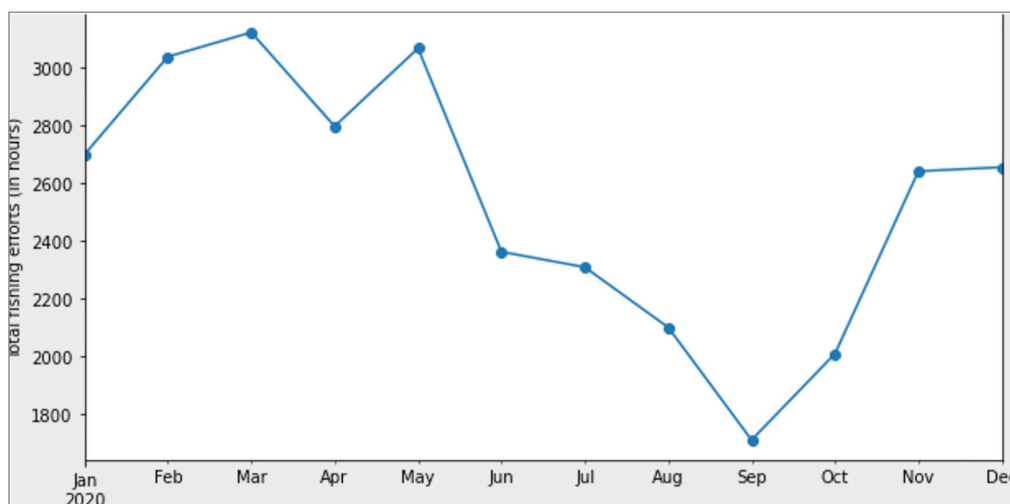


Figure 5. Temporal variation (seasonality) of industrial fishing off the coast of Liberia (2020).

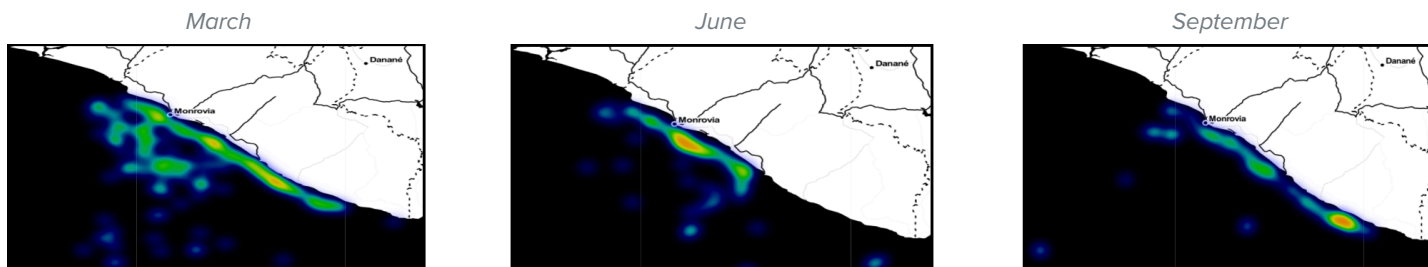


Figure 6. Spatial variation/seasonality of industrial fishing in March, June, and September (2020).





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POLICY APPLICATIONS

Reliable data and scientific evidence are prerequisites in effective policy and decision-making, yet Liberia has consistently lacked both since industrial fishing commenced in the 1950s. The consistent generation of statistics and information on an annual basis and using a standardized approach such as System of Environmental Economic Accounting (SEEA) is thus proposed as an important priority for improved decision and policy-making related to fisheries in the country. Below is an illustrative example of some relevant policies which the accounting-generated data on fisheries can support:

FISHERIES-RELATED POLICIES	POLICY STATEMENTS	CONTRIBUTION OF FISHERIES ACCOUNTS
Fisheries Sector Adaptation Strategies from Liberia National Adaptation Programme of Action (NAPA) (2008)	<ul style="list-style-type: none"> Research aimed at fishery-related database development Regulating fishing practices to prevent overexploitation and fishing in restricted areas Reducing the number of fishing licenses issued to foreign vessels 	<ul style="list-style-type: none"> Development of time series datasets on key fisheries indicators Determination of spatial and temporal fishing restrictions Determining number of fishing licenses optimized for revenue and conservation needs Supporting climate-smart fisheries development in Liberia
Fisheries and Aquaculture Policy & Strategy (2014)	<ul style="list-style-type: none"> Conserving of aquatic ecosystems associated with fish production Restoring fish biomass capacities to produce at maximum sustainable yield levels 	<ul style="list-style-type: none"> Through extent accounts, identifying coastal ecosystems which are important for juvenile fish nursing and habitat Assessment of fish stock and maximum sustainable yield
Pro-poor Agenda - PAPD (2018-2023)	<ul style="list-style-type: none"> Factors affecting profitability of fisheries sector (limited use of modern technology and high cost of electricity cited as limiting factor to profitability in PAPD) Extent and magnitude of illegal, unreported and unregulated (IUU) fishing 	<ul style="list-style-type: none"> Economic analysis of fisheries to determine profitability and efficiency and opportunities for new revenue sources Quantitative assessment of IUU

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