Assessing and Managing Fishing Capacity in the Context of World Trade Organization Disciplines on Fisheries Subsidies

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1.0 Introduction

World Trade Organization (WTO) negotiations to discipline fisheries subsidies, including "through the prohibition of certain forms of fisheries subsidies that contribute to overcapacity and overfishing" (WTO, 2005) have been underway since 2001. Based on the proposals currently on the table, future rules will likely include a prohibition of subsidies for vessels or operators engaged in illegal, unreported, and unregulated (IUU) fishing; a prohibition of subsidies for fishing or fishing-related activities regarding overfished stocks; and disciplines on subsidies that contribute to overfishing and overcapacity more broadly.

While WTO members seem to converge on the broad structure of IUU and overfished stocks disciplines, subsidies that contribute to overcapacity and overfishing remain subject to more controversy. The latest version of the draft consolidated text circulated by the chair of the rules negotiating group (RNG), Ambassador Santiago Wills, envisages a prohibition targeting certain forms of support considered as capacity enhancing, including subsidies to construction and modernization, vessel equipment, or fuel, to list just a few.[1] The general prohibition is, however, qualified by an exemption that would apply if the subsidizing member can demonstrate that it implements measures to maintain the stock(s) in the relevant fishery at a biologically sustainable level, using maximum sustainable yield (MSY), or alternative reference points.

This draft language has raised a number of questions in the negotiations, such as, for example, regarding what would constitute alternative reference points. More fundamentally, some have questioned the fact that the text only requires members to have management measures in place aimed at maintaining stocks at sustainable levels, but it does not clearly contain an obligation to show that this objective has been effectively achieved. In practice, many WTO members may have management measures in place—for example, in the form of catch limits—but still suffer from overcapacity that puts pressure on those catch limits. The current draft text on subsidies to overfished stocks also contains an exception that would allow members to provide subsidies to these stocks if they had measures in place that would ensure the rebuilding of the stock to a biologically sustainable level. On the other hand, some other members think that the requirement to "demonstrate" that there are measures in place to maintain stocks is excessively strict and could be very hard to achieve.

If these exceptions remain in the final agreement, members wanting to use them to continue providing otherwise-prohibited subsidies will need to think through how to measure their existing fishing capacity and how this relates to the resources being exploited. Members may also, of course, choose to redesign their subsidy measures so they do not fall within the category of prohibited subsidies at all. While the approach of focusing on subsidies that do in practice contribute to overcapacity and overfishing would be consistent with the overall negotiating mandate, implementing the new rules to rely on this exception may require governments to think again about how they measure and monitor existing fishing capacity in relation to marine resources. As a contribution to governments thinking about how this obligation could be implemented in practice, the present policy brief provides a general

[1] See RD/TN/RL/126/Rev.2* (Access restricted).

background on fishing capacity management and defines some of the key concepts used in this area based on existing literature. It then suggests possible options for members to establish, measure, and monitor fishing capacity, while ensuring that capacity remains within sustainable levels. Section 4 provides an overview of existing capacity in the global fleet based on available empirical evidence, while Section 5 summarizes the main findings.

2.0 Background

Since the late 1980s, following a decade of intense fleet development, too many vessels and excessive harvesting power have resulted in overcapacity in world fisheries and, in the absence of effective management, have led to overfishing and other problems like IUU fishing.

There are many reasons for this overcapacity. The prevalence of free and open access to the resource, technological improvements, and the rapid expansion of global fish markets have all contributed to over-investment. Subsidies that support the development of domestic fleets, participation in shared or high seas fisheries, or access to foreign exclusive economic zones (EEZs) have also contributed to overcapitalization of the global fleet (Food and Agriculture Organization of the United Nations [FAO], 2008). As a result, the sector has seen a continuous decline in productivity, threatening not only the sustainability of stocks but also employment, livelihoods, and food security. According to the World Bank, world fisheries are largely overcapitalized and would reach their maximum economic potential by reducing aggregate fishing effort by 44% relative to the 2012 level.

Recognizing the threat to the world's fisheries resources posed by excessive fishing capacity, Article 61 of the United Nations Convention on the Law of the Sea (UNCLOS) provides that the coastal state "shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation" (United Nations, 1982). Article 6.3 of the FAO Code of Conduct for Responsible Fisheries (CCRF) also recommends that "States should prevent overfishing and excess fishing capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization" (FAO, n.d.). In furtherance of this recommendation, FAO Members adopted in 1999 the International Plan of Action for the Management of Fishing Capacity (IPOA-Capacity) (FAO, 1999).

This voluntary instrument calls for an efficient, equitable, and transparent management of fishing capacity and provides recommendations for assessment and monitoring of fishing capacity, the preparation and implementation of national plans, the adoption of preliminary management measures, and a system of periodic review. Notably, paragraph 26 of the IPOA-Capacity recommends that "States should reduce and progressively eliminate all factors, including subsidies … which contribute, directly or indirectly, to the buildup of excessive fishing capacity thereby undermining the sustainability of marine living resources, giving due regard to the needs of artisanal fisheries" (FAO, 1999). The implementation of the IPOA-Capacity is supported by a collection of guidance materials for (1) assessing, measuring, and monitoring, (2) managing, and (3) transitioning away from overcapacity under the broader FAO Technical Guidelines for Responsible Fisheries (FAO, 2008).[2] Annex 1 to this policy brief provides detailed references for such guidance materials. Taken together, this material not only provides critical insights on the different concepts discussed in this note, it also contains practical advice on how to collect information related to them under different circumstances.

[2] This guidance includes Ward et al. (2004); Pascoe et al. (2003); and FAO (2002).

3.0 Defining Key Concepts

Assessing and managing fishing capacity has been made particularly complex due—among other things—to a proliferation and confusion of terms as well as the evolution of work on the topic over the past 20 years. It may therefore be important to clarify some key concepts at the outset. In the absence of universally recognized definitions, this note relies on definitions by the FAO in its various technical papers and guidelines.

3.1 Fishing Capacity: Input vs output

The FAO technical guidelines developed to support the implementation of the IPOA-Capacity define fishing capacity as "the amount of fish or fishing effort that can be produced over a period of time by a vessel or a fleet if fully utilized. That is, if effort and catch were not constrained by restrictive management measures" (FAO, 2008).

In practice, capacity can be measured either with reference to the amount of inputs used or with reference to outputs generated. In input terms, fishing capacity can be expressed through fleet characteristics or as the ability to generate a certain fishing effort defined as the amount of fishing gear of a specific type used on the fishing grounds over a given unit of time, e.g., hours trawled per day, or number of hooks set per day. This measure is most frequently used by fisheries scientists and managers. In this context, fishing capacity is not the same as fishing effort. The first refers to a potential while the second corresponds to the share of this potential that is actually used. Proxies typically used to measure the fleet include gross registered tonnage or horsepower (FAO, 2008). For example, the European Union defines fishing effort as gross tonnage (GT) and engine power (KW) multiplied by days at sea. The key challenge consists in identifying the combination that best reflects the productivity of different and sometimes highly heterogeneous fishing units.

When expressed in output terms, as is usually done by fisheries economists, fishing capacity can be defined as "the maximum amount of fish over a period of time (year, season) that can be produced by a fishing fleet if fully utilized, given the biomass and age structure of the fish stock and the present state of the technology" (Pascoe & Gréboval, 2003). The advantage of an output-based approach is that it allows for aggregation between different segments of the fleet. It also reduces complexities related to interaction between fisheries (e.g., when by-catch of one fishery is the catch of another) and it is more adapted to deal with artisanal fisheries where inputs can change rapidly over time. The FAO guidelines nonetheless recommend that states express their national fishing capacity estimates both in terms of inputs and outputs in order to remove the need to agree on a common definition and to facilitate international cooperation.

3.2 Capacity Utilization and Target Capacity

The term "fully utilized" in the above definition refers to the normal unrestricted use of fishing capacity.[3] In practice, however, actual utilization may be lower, for example, due to effort or catch limitations as a result of management measures. In this context, capacity utilization corresponds to the ratio of actual output to the potential output of a given fleet or biomass level, or as the ratio of actual to desired levels of fishing effort.

Closely related to the notion of capacity utilization is the concept of optimal or target capacity. This is usually defined as the level of either output or inputs required in the short term to meet specific management objectives in a given fishery, be they social, economic, or environmental. For instance, if the goal is to maximize the amount of output, countries may decide to use MSY as a target output capacity or define the fleet size required to achieve MSY as a target input capacity. In practice, several countries use more conservative reference points (e.g., 80% of the MSY estimate) to account for uncertainty in stock assessments. Similarly, if the objective is to maximize the economic profitability in a particular fishery, the maximum economic yield (MEY) may be used instead as a reference point to define target capacity through limitations on catches or fishing effort (FAO, 2008). Alternatively, target capacity may be defined in terms of social indicators such as employment levels in the sector.

3.3 Excess Capacity vs Overcapacity

Excess capacity and overcapacity are assessed by comparing actual and target capacities. Excess capacity occurs when some capital is underutilized, i.e., when fewer vessels could potentially have achieved the same amount of catch or landings. This is essentially a short-term phenomenon that depends on environmental or economic factors. For example, as stocks fluctuate over time, a particular fishery may show excess or full capacity depending on the year. Similarly, market conditions, including price variations, may result in a fleet showing excess capacity in certain years and not in others.

Overcapacity, by contrast is a longer-term problem and reflects a mismatch between the actual resources used in a particular fishery and those needed to achieve a certain amount of output or inputs as defined by management objectives (FAO, 2008). Biologically, overcapacity can be expressed as a capacity level that, if fully utilized, generates a mortality rate that reduces the stock biomass below MSY levels. From an economic point of view, overcapacity occurs when fully utilized capacity reduces yields below MEY levels. To be clear, temporary underutilization of resources does not necessarily indicate overcapacity (Porter, 1998).

[3] It should be noted, however, that this does not necessarily correspond to maximum utilization. For example, in a fishery that is open for 365 days a year, vessels may only operate for 260 days on average, because markets are closed on weekends or because vessels need to undergo maintenance and repair.

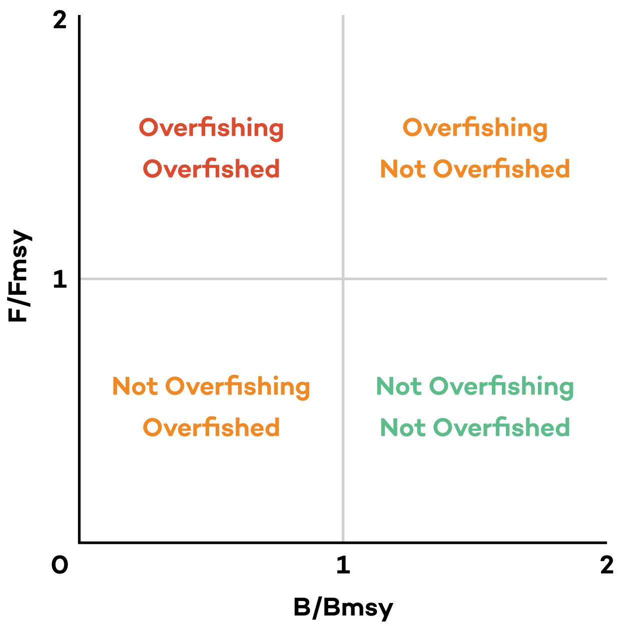
3.4 Overfishing and Overfished Stocks

In the absence of effective management of fishing capacity, overcapacity generally leads to overfishing and ultimately results in the stock(s) being overfished. From a biological perspective:

- Overfishing occurs when too many fish are harvested and what is left after harvesting cannot replace what is taken or, in technical terms, when fishing mortality (F) exceeds the maximum level that the stock can withstand on a sustainable basis (Fmsy). In Figure 1, this corresponds to the situation where F/Fmsy is above 1.
- A stock is overfished when it is reduced to the point where it cannot produce the MSY anymore or, in technical terms, once the biomass—defined as the weight of all the fish of one specific stock in the water (B)—has fallen below the level that enables a fish stock to deliver the MSY (Bmsy). In Figure 1, this corresponds to the situation where B/Bmsy is below 1.

In other words, overfishing occurs when the total number of dead fish is greater than the MSY. The term "overfished" describes the situation when the stock(s) or biomass is too small to produce the MSY anymore.[4]

Figure 1. Overfished vs overfishing: the Kobe plot



Source: Author diagram, based on data from FAO.

[4] In the absence of an internationally agreed definition, this is the most common approach to identifying what constitutes an overfished stock. However, various fisheries management authorities can use different variations of the B/Bmsy ratio as the limit for a stock to be considered as overfished. The FAO itself, is sometimes using 0.8 (or 80% of Bmsy) as the limit (see for example, http://www.fao.org/3/ca4355en/ca4355en.pdf).

4.0 Managing Fishing Capacity

Paragraph 19 of the IPOA-Capacity calls on member states to develop, implement, and monitor national plans of action (NPOAs) to manage their fishing capacity (FAO, 1999). The objective consists of providing a framework for defining management goals and objectives; assessing current and target fishing capacity for each fishery; identifying mechanisms to achieve target capacities; and monitoring capacity through effective data collection. In cases where stocks are straddling or highly migratory and therefore shared among different members, paragraph 25 calls on states to "cooperate, where appropriate, through regional fisheries organizations or arrangements … with a view to ensuring the effective management of fishing capacity."

From a WTO perspective, such mechanisms would enable coastal members to avoid overcapacity and overfishing in their fleets and thus help to ensure their stocks are maintained at a sustainable level based on MSY or alternative reference points. As highlighted above, under the current draft of the consolidated text, a member that wanted to provide subsidies that could contribute to overcapacity and overfishing would need to demonstrate that it had measures in place that meant actual fishing was within sustainable limits. The same conditionalities may also apply to members subsidizing fishing or fishing-related activities targeting species managed by regional fisheries management organizations and arrangements (RFMO/A) in the waters under their jurisdiction. For these reasons, identifying instances of overcapacity and overfishing may become critical in the implementation of future WTO disciplines. The following sections provide a quick overview of how this might be done nationally according to FAO (2008) and related guidance.

4.1 Defining, Measuring, and Monitoring Target Capacity

As a first step in monitoring capacity, the FAO guidelines and related guidance call on countries to clearly define their domestic capacity management goals and objectives. These may include economic, social, or conservation objectives but also food security or export earnings objectives. Because some of them may conflict with each other and involve trade-offs, national strategies should clarify the relative priority accorded to each of them. With different stakeholders often having different priorities, such a process should be as inclusive and transparent as possible to secure broad-based buy-in as these objectives are translated into capacity targets and ensure that the rationale behind them is apparent.

Once management objectives are set, target and current capacities should be assessed. For example, if the objective is to maximize total profit, MEY would normally constitute an appropriate target capacity level. MSY would usually be used as a target when the goal is to maximize catches. Finally, if the main objective is to maximize employment, target capacity could also be set at the open-access equilibrium. In practice, such assessments should be done for each fishery separately, not least because overcapacity may differ from one fishery to the other. Aggregated figures also mask the risk of capacity being transferred from one fishery to another as management measures kick in.

In order to reach the desired target capacity, national authorities would need to design and implement appropriate management measures implemented through different types of incentives or command-and-control mechanisms. This may be done either by managing the level of fishing capacity directly (e.g., through limits on total catches, days at sea or season length and subsequently reducing the fleet size) or indirectly by providing economic incentives for fishers to control fishing capacity themselves (e.g., through the introduction of property rights and removing the open access externality) (FAO, 2008).

Finally, once management objectives are set, target capacities are defined, and management measures to achieve them are in place, monitoring fishing capacity requires the systematic collection of a set of data regarding catches and fishing effort. In practice, the method used to monitor capacity depends on the type of fishery and the kind of data available. This may be particularly challenging in data-poor fisheries in developing countries with limited data collection capacities. Keeping these challenges in mind, the Report of the FAO Technical Consultation on the Measurement of Fishing Capacity (FAO, 2000) identifies four levels of information necessary for ongoing measurement and assessment of fishing capacity, with higher levels corresponding to more complex methods. These different levels are briefly summarized in Table 1.

Table 1. Levels of data availability

Level	Data availability	
0	**Little or no quantitative data**	
1	**An estimate of total landing plus** • In vessel-based fisheries: estimated total vessels • In non-vessel-based fisheries: either number of participants or a measure of total gear units in use	→ Minimum standard needed for estimation of fishing capacity
2	**Level 1 plus** • An index of vessel size or power • Gear type • A rough index of trends in fishing success • Rough measures of total time spent fishing and maximum potential time that could be spent fishing per year or per season, under normal operating procedures • Basic relevant characteristics of fishing operations (e.g., seasonality, use of fish-aggregating and fish-finding devices, (e.g., sonars, FADs, satellite tracking), autonomy of vessels, trans-shipment practices)	

Level	Data availability	
3	**Level 2 plus** • Total catch (landings and discards), split by fleet sectors • Basic biological information: e.g., resources distribution, catch by species, size structure, rough estimate of potential MSY • Comprehensive primary vessel characteristics determining fishing power (e.g., GRT/GT or other volume measures, power (kW), fish hold capacity, vessel age) • Comprehensive information on gear type and dimensions • Prices or revenues by major species • Detailed effort and cost per unit effort (CPUE) data, including time spent fishing	→ Desired standard for the estimation of fishing capacity
4	**Level 3 plus** • Detailed biological information on fish stocks (e.g., estimated biomass, fishing mortality rates, age/size structure) • Comprehensive data on other important features such as information on fish-aggregating and fish-finding devices, fish hold capacity, skipper and crew skill levels, fuel consumption, autonomy of vessels, processing capacity, costs and earnings surveys, prices, value of capital stock, employment, subsidies and economic incentives, and fishing operations relative to fish distributions	→ Long-term desired level, particularly for high-volume or high-impact fisheries

Source: FAO (2000).

4.2 Indicators to Assess Overcapacity

As governments monitor their domestic fishing capacity, several indicators can be used to identify instances of overcapacity. At the broadest level, overcapacity occurs when the current capacity expressed in fishing inputs (number of vessels and days spent fishing at sea, for example) or in catches is inconsistent with the target capacity—e.g., if the current fleet is greater than the target size. More specifically, the quantitative approaches for measuring capacity include: rapid appraisal (RA) techniques, peak-to-peak analysis, stochastic production frontiers (SPF), data envelopment analysis (DEA) and biological, bioeconomic & multi-objective modelling (FAO, 2003).

In addition to purely quantitative indicators such as those defined in Table 1, one or a combination of qualitative indicators may also be used (Table 2). This may be important in cases where resources to undertake more in-depth research are limited or when there is a need to act rapidly to address urgent overcapacity problems.

Table 2. Qualitative assessment of overcapacity

Qualitative indicator	Signals of potential overcapacity
Biological status of a fishery	Declining
Catch per unit effort	Decreasing
Value per unit effort	Decreasing
Conflict	Increasing, between and within sectors/segments
Compliance	Decreasing
Ratios	
Harvest/target catch	Growing as fishers race to harvest and overfish
Target or total allowable catch (TAC)/ Season length	Increasing as season gets shorter and shorter
Other measures	
Profitability	Declining
Fleet	Aging
Latent permits	Increasing as fishers are not bothering to fish

Source: based on FAO (2008).

According to the FAO (2008), qualitative indicators of overcapacity can include the biological status of a stock (e.g., if the stock is overfished); repeated instances of non-compliance with regulations and conflicts within the sector; "race for fish" phenomenon where fishers exhaust their TAC before the end of the season; unused permits; or decline in average profitability of a fleet. Another useful indicator is the catch per unit effort (CPUE) which corresponds to the quantity of fish caught with one standard unit of fishing effort (e.g., weight of fish, in tons, per hour of trawling). CPUE is often considered as an indicator of biomass or index of abundance. Generally, a decline over time in CPUE tends to indicate a decrease in the size of a particular stock, possibly as a result of overfishing and overcapacity.

4.3 Multi-Species Fisheries and Artisanal, Small-Scale Fishing

Most of the approaches highlighted above are, in principle, relatively easy to apply in fisheries made of a single fleet using one type of gear that targets a single species in a specific area. Defining, measuring, and monitoring capacity in multi-species fisheries or multi-fleet fisheries poses a set of additional challenges. Input-based capacity targets, for example, need to go beyond the number of vessels to reflect the variety of gear used. Establishing output-based targets also needs to be done differently in situations where achieving MSY or alternative reference points for all species simultaneously is almost impossible. In fisheries where many different species are targeted, or taken, at once, some experts suggest focusing assessments on the health of critical indicator species to assess the overall health of the ecosystem around the fishery (Headley, 2020). Assessing overcapacity in multi-species fisheries is also more complex. With some species being potentially overexploited while others remain within sustainable limits, traditional stock status estimates provide only part of the picture needed to assess whether a fleet is over capacity with respect to the resources it exploits. In those situations, the use of qualitative indicators such as those described above may nevertheless provide indications over time that overcapacity is occurring (e.g., when conflicts increase, catch limits are met very quickly or CPUE declines continuously).

Assessing capacity in data-poor fisheries, which are frequently small-scale and artisanal fisheries, also presents particular challenges. Estimates of stock status and of fleet capacity in these circumstances can be out of date and being data-poor, involve high levels of uncertainty. In these situations, the use of carefully selected qualitative data, including fishers' own knowledge, can help to supplement quantitative information available about the fishery (Headley, 2020).

4.4 High Seas Fishing, Migratory Species and Straddling Stocks

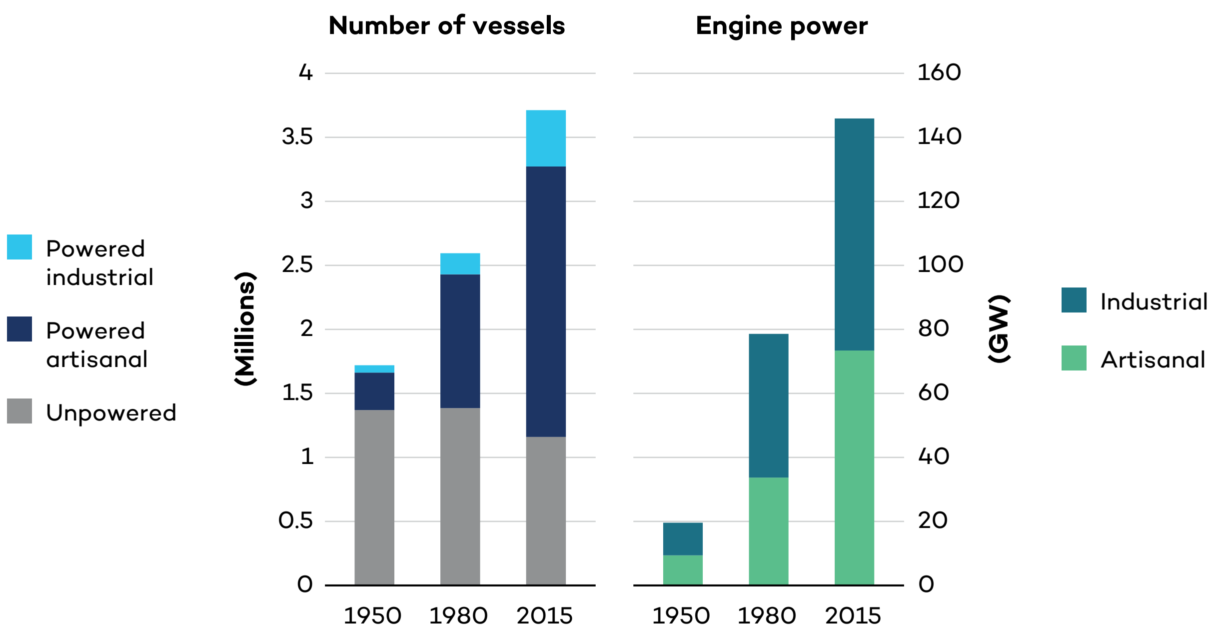
Another complication occurs in cases of straddling stocks, highly migratory species, or fishing in open access areas, which include areas within EEZs and on the high seas. For migratory species or stocks straddling across different EEZ, defining target capacity would need to take into account fishing activities taking place in other jurisdictions. Such activities may be subject to conflicting target fishing capacity, reflecting different management objectives across different EEZ (e.g., MEY vs. MSY). In these situations, the FAO IPOA-Capacity calls for RFMOs to play a role in coordinating the definition, measurement, and monitoring of fishing capacity in the waters and for the species under their respective jurisdictions. In the case of high seas fisheries, however, there are no established rules, so governments will likely need to find a way to cooperate to limit capacity of fleets fishing in particular areas or for particular species to increase the profitability of the capacity that is retained. In the context of the WTO negotiations, the draft consolidated text includes specific prohibitions on subsidies to fishing on the high seas outside the competence of an RFMO. The proposed rule does not include an exception allowing members to prove stocks are healthy, likely because doing so for fleets and stocks on the high seas in the absence of RFMO oversight would be impracticable.

5.0 Assessing Global Fishing Capacity: An overview of internationally available data

This section provides examples of existing datasets to measure fishing capacity for illustration purposes. Despite significant progress in gathering information about the size and composition of the world's fishing fleet, data regarding global fishing capacity remains sparse and important gaps persist. On the one hand, technological progress, including the use of automatic identification systems (AISs), has allowed the generation of critical data on the behaviour of the larger components of the industrial fleet (see, e.g., Pew Charitable Trusts, n.d.). At the same time, the size and impact of the artisanal fishing fleet—and particularly unpowered artisanal vessels in developing countries—remain largely unknown, with many governments collecting data only on industrial fishing. By compiling data from different sources, recent work by Rousseau et al. (2019) attempts nonetheless to reconstruct vessel numbers, engine power, and effort of the global marine fishing fleet in both the artisanal and industrial segments of the sector.

Based on this dataset, Figure 2 provides an overview of the evolution of global fishing capacity between 1950 and 2015. It shows the growth in total number of vessels broken down by industrial and artisanal including powered and unpowered artisanal vessels. The second part of the graph illustrates the growth in engine power between 1950 and 2015 and the respective share of artisanal and industrial fishing.

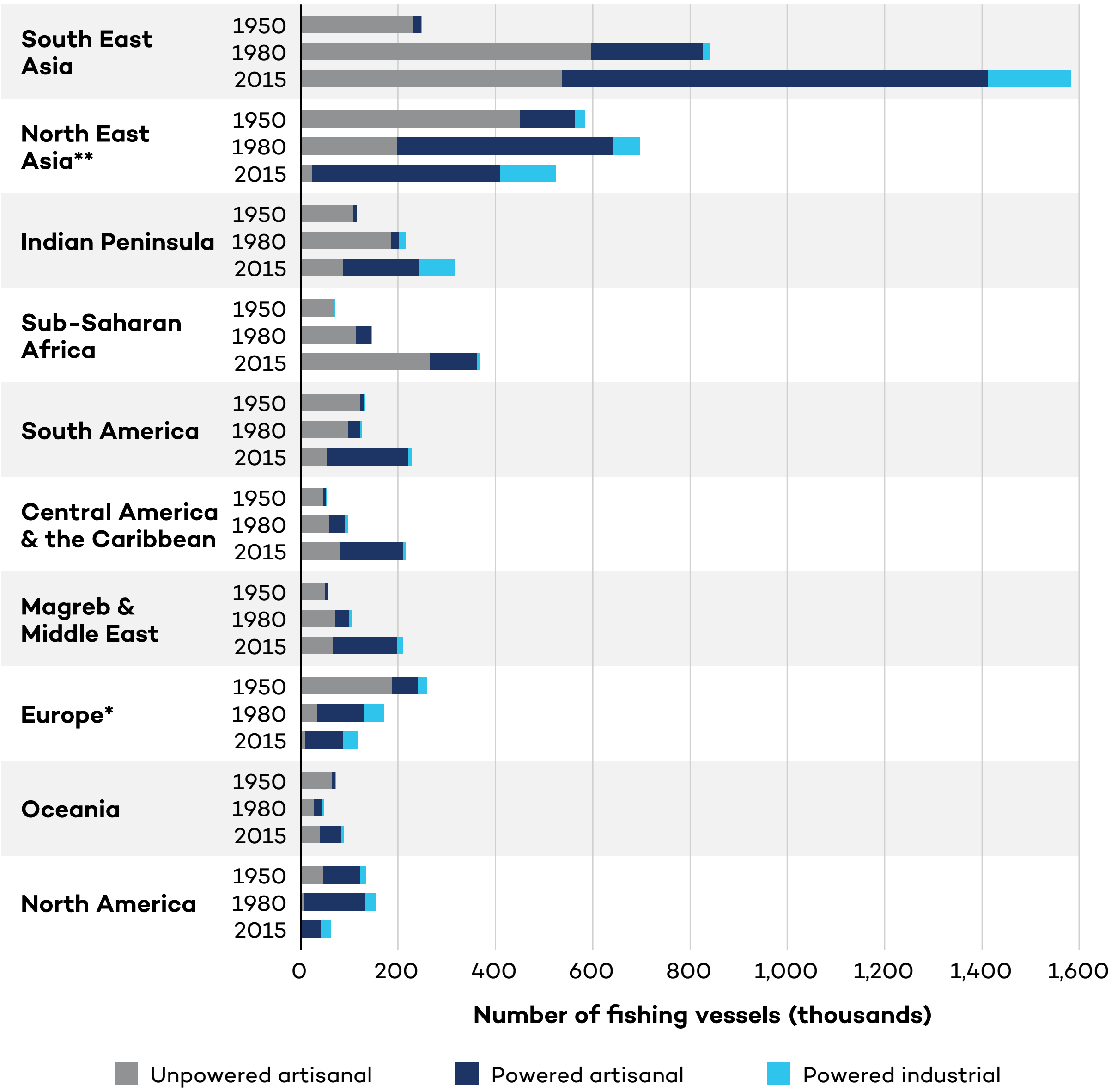
Figure 2. Evolution of global fleet capacity 1950–2015



Source: Author's elaboration based on Rousseau et al. (2019).

Overall, the number of vessels grew from 1.7 to 3.7 million between 1950 and 2015 of which 68% are motorized.[5] While unpowered artisanal vessels declined by roughly 15% during this time, this was largely compensated by a steep increase in the number of powered artisanal and industrial vessels. Similarly, engine power of the global fleet grew more than sevenfold between 1950 and 2015 from 19.5 gigawatts (GW) to 145.9 GW, with artisanal fishing becoming more prevalent, as the growth of industrial fleets slowed down over the last three decades. As illustrated in Figure 3 and 4, the increase in the number of vessels and engine power varies significantly across regions.

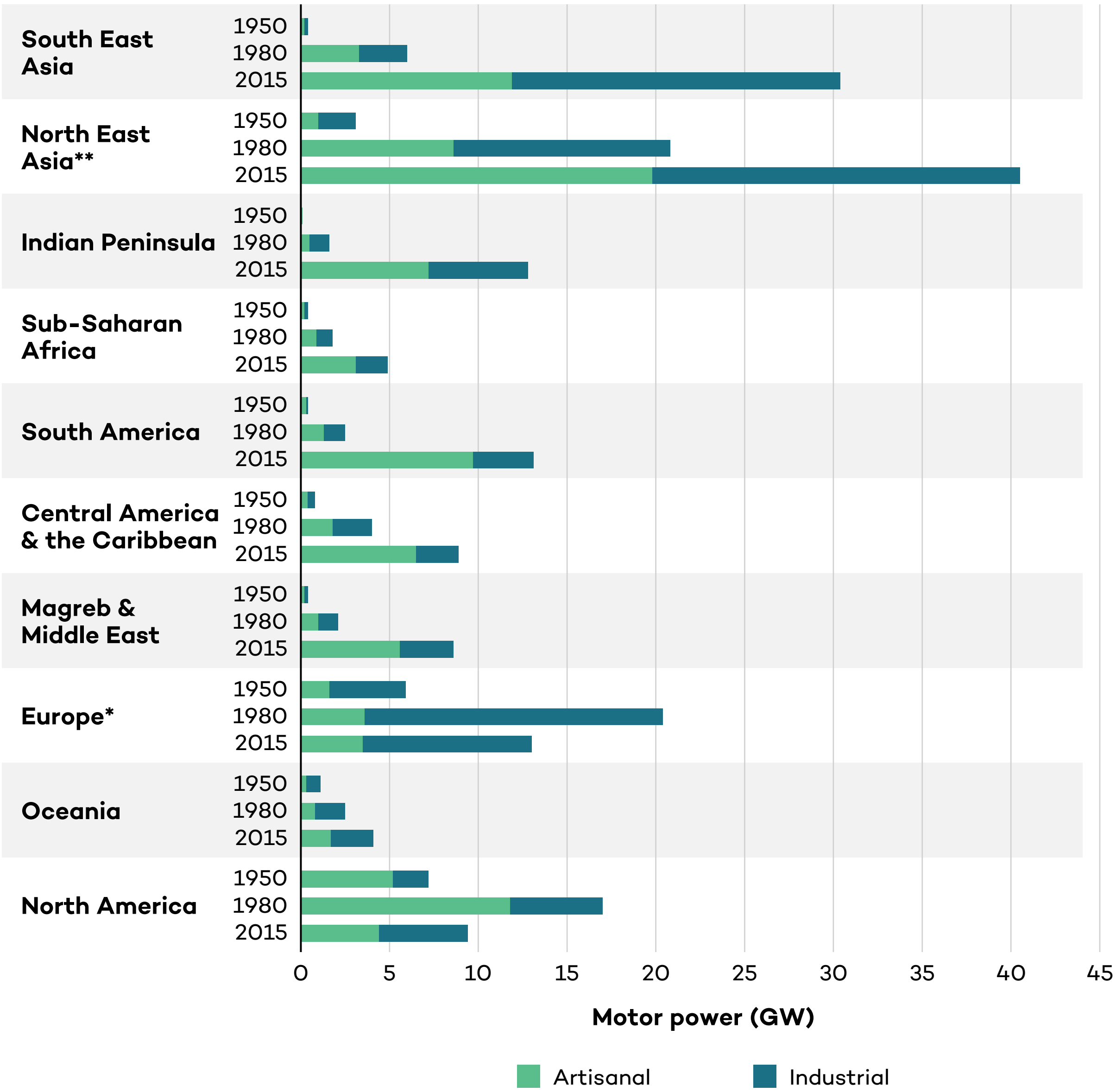
Figure 3. Evolution of fishing vessels by region and type of fishing



* Including Russia
** Includes China, Japan, Chinese Taipei, and Korea
Source: Author's elaboration based on Rousseau et al., 2019.

[5] These figures are lower than the FAO estimate of 4.6 million for 2014 and 2015: see FAO (2018).

Figure 4. Evolution of engine power by region and type of fishing



* Including Russia

** Includes China, Japan, Chinese Taipei, and Korea

Source: Author's elaboration based on Rousseau et al., 2019.

While overall vessel numbers decreased in Europe, North America, and North East Asia due to a decline in the number of artisanal boats, figures in all other regions show increases in the size of domestic fleets. This is particularly the case in South East Asia and Sub-Saharan Africa, which saw fleets grow more than sixfold and fivefold, respectively. With the exception of Sub-Saharan Africa, it is interesting to note that the decline in unpowered artisanal vessels went hand in hand with a rapid increase in powered artisanal vessels, mostly as a result of modernization efforts. However, as illustrated in the second graph, the evolution in size of the different fleets is not necessarily commensurate with total engine power. This is particularly clear in the case of North East Asia, Europe, and North America, where a relatively smaller number of boats account for a proportionately larger engine power compared to all other regions.

More recent estimates by the FAO indicate that in 2018, the global fleet, including non-motorized boats to large industrial vessels, reached 4.56 million vessels with Asia accounting for 68% of the total, followed by Africa, with 20% of total vessels, and the Americas, with 10%. Overall motorized vessels represented 63% of the total fleet in 2018 (FAO, 2020).

Using AIS data extracted by Global Fishing Watch, the Pew Charitable Trust (n.d.) recently published a unique data set measuring fishing effort across the world both in terms of kWh and the number of fishing hours. This was made possible thanks to advances in satellite technology, cloud computing, and machine learning, which increasingly allow for near real-time tracking of fishing activities. It should be noted, however, that vessels using AIS tend to be larger and more capital-intensive vessels.[6] This technology may therefore overlook a significant share of artisanal and small-scale fishing activities.[7] It nonetheless provides an interesting albeit partial picture of the geographical spread of fishing efforts by the larger scale segment of the global fleet.

Alternatively, as highlighted in Section 3.1, fishing capacity can also be measured in terms of outputs. Data from The Sea Around Us project at the University of British Columbia provides estimates of global fishing catch, by scale of fishing, in specific geographic maritime areas, and for specific groups of countries and by region. The data covers both officially reported catch and estimates of unreported catch and discards. It also provides a breakdown by type of fishing, namely subsistence, artisanal, recreational, and industrial fishing based on national definitions (The Sea Around Us, n.d.).

Assessing whether global fisheries suffer from overcapacity requires comparing existing capacity with the amount of resources available. This may be estimated in different ways by using indicators of fishing effort (an input approach) or production (an output approach). At the broadest level, the FAO estimates that the percentage of stocks fished at biologically unsustainable levels increased from 10% in 1974 to 34.2% in 2017 (FAO, 2020) indicating a continuous decline in the state of marine resources and clear signs of overcapacity. Using a bioeconomic model treating global marine fisheries as one single fishery, the World Bank estimates that the sector suffered an economic loss of USD 83 billion in 2012 compared to a situation where global catches would be situated at the maximum economic yield equilibrium (MEY) (World Bank, 2015). Finally, Rousseau et al. (2019) compare the evolution of CPUE and stock abundance of the global fleet since 1950 as indicators of overcapacity. CPUE is measured in both nominal and effective terms, assuming a 2.6% increase in technological creep per annum.

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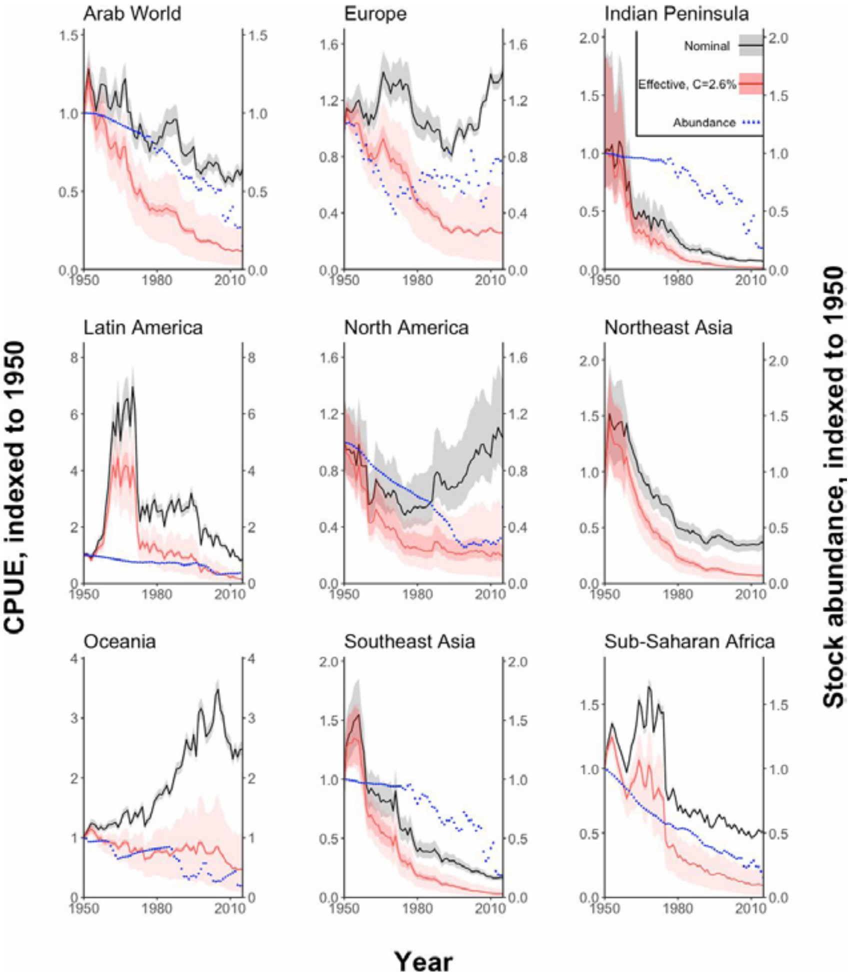
[6] Data from Global Fishing Watch covers all vessels equipped with AIS transponders, and some vessels with vessel monitoring system (VMS) transponders. It covers more than 300,000 vessels with country designation based on the flag the vessel is registered under. In terms of fishing effort, this corresponds to more than 50% of all fishing effort beyond 100 nautical miles from shore and as much as 80% of the fishing in the high seas.

[7] It should also be mentioned that while developed countries have often adopted regulations to enforce use of AIS on vessels (in many cases over 15 metres) developing countries have not done so at a similar level, and therefore are de facto under-represented. Finally, AIS reception is quite poor in important portions of the ocean—and often in areas where vessel density is high—impeding reliable global comparisons among areas. For further details on AIS, see the Global Atlas of AIS-based fishing activity which assesses the potential of AIS but also describing its limitations and caveats (FAO, 2019).

Figure 5. CPUE and stock abundance by region (1950–2015)



Source: Rousseau et al., 2019.

The data shows a systematic decline in both CPUE and stock abundance in virtually all the regions. This decrease has happened as the global fishing fleet continued to expand in terms of vessel number and engine power, as described in Figure 2, clearly indicating a problem of overcapacity.[8] However, it should be noted that this global decline hides contrasting situations between areas, with improvements in stock status in areas with effective management policies (FAO, 2020). For a more disaggregated approach, the Global Record of Stocks and Fisheries (GRSF) developed under the Fisheries and Resources Monitoring System (FIRMS) umbrella with Ram Legacy database and FishSource (iMarine, n.d.) provides information on the status of more than 1,800 stocks. This number will soon go over 2,000 stocks when all records are validated and available online.

[8] One needs to be careful about using decline in abundance though. It is arguably normal to expect a decline in CUPE as one moves from virgin stocks in the 1950s to those of the late 1970s. The critical story is the one that happened since then. There, flattening of the decline in abundance tells a story that there may likely be some gains due to improved management, as in Europe, Latin America, and North America. The fact that effective capacity has also declined and then flattened in some cases (usually before abundance stops declining) is also a sign of managing fishing capacity, as seen in Europe and North America.

6.0 Conclusion

Available evidence suggests that global fisheries suffer from overcapacity and overfishing. As a result, the sector has seen a continuous decline in productivity, threatening not only the sustainability of stocks but also employment, livelihoods, and food security. Since the early 1990s, excessive fishing inputs and overcapitalizations have highlighted the need to manage the fishing capacity of the global fleet. Elaborating on the UNCLOS obligation to manage resources in order to prevent overexploitation, this concern gave birth to the FAO IPOA-Capacity in 1999, Technical Guidelines for Capacity Management, and technical guidance to assess, measure, monitor, and transition away from overcapacity.

The causes of overcapacity and overfishing are varied. Among them, however, it is widely recognized that fisheries subsidies that reduce the cost of fishing and enhance revenue contribute to the buildup of fishing overcapacity and ultimately the depletion of fish stocks. As part of ongoing WTO negotiations on fisheries subsidies, members are considering prohibiting some of the most harmful forms of support. In particular, the draft consolidated text, which forms the basis of current talks, envisages the prohibition of subsidies to those fishing overfished stocks in some circumstances and to subsidies that contribute to overfishing and overcapacity. The draft text nonetheless envisages exceptions in cases where members can demonstrate that certain management measures are in place to return, or to maintain, stocks at biologically sustainable levels. If these exceptions remain in the final agreement, members wanting to use them to continue providing otherwise-prohibited subsidies will need to think through how to measure their existing fishing capacity and how this relates to the resources being exploited. Members may also, of course, choose to redesign their subsidy measures so they do not fall within the category of prohibited subsidies at all.

Ensuring they are compliant with the new rules, including a possible exception will likely require members to define capacity management goals and objectives; assess their current and target fishing capacity for each fishery; identify mechanisms and policy measures to achieve the respective target capacities; and monitor these through effective data collection to ensure stocks are healthy. Existing FAO guidelines provide specific guidance on how to do this. In particular, members may have to pay special attention to preventing or reducing any overcapacity that may exist in domestic fleets. This will require enhanced data collection but also the use of qualitative indicators to assess instances of overcapacity. This process is likely to be more challenging in multi-species fisheries as found in numerous developing countries and for the small-scale artisanal segment of the sector, in particular because of a lack of reliable data.

In recognition of this, the chair's draft consolidated text already includes some provisions that aim to provide flexibility in how members demonstrate that the stocks in subsidized fisheries are healthy. Dedicated technical assistance and capacity building may also be highly beneficial in this area. In the case of straddling stocks and highly migratory species, capacity management should be undertaken in close collaboration with relevant coastal states and the relevant RFMO(s). Subsidies to fishing outside these areas may be prohibited outright under the new agreement, but governments may find it useful to consider ways to cooperate to manage capacity on the high seas anyway, for the profitability of these fleets.

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