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THE USE OF BEST AVAILABLE SCIENCE IN DEVELOPING AND PROMOTING BEST PRACTICES FOR TRAWL FISHING OPERATIONS

1. Trawl is one of the major fishing gear types in marine capture fisheries with about one quarter of marine fish production by bottom trawls on continental shelves around the world. Based on the vertical strata in which they operate, trawls are usually classified as pelagic trawls that do not touch the seabed, semi-pelagic trawls that partially or lightly touch seabed, and bottom trawls that heavily touch the seabed. The bottom trawls (both otter trawl and beam trawl), along with other bottom-contacting gear such as shellfish dredges, have brought great concerns during the last two decades due to their impact to physical structure of the seabed, and potential effect on benthic communities, consequently commercial species. Bottom trawls, especially shrimp bottom trawls, are also widely criticized for large amounts of bycatch and discards. However, trawls are very versatile and in many cases very economical in harvesting many fish species, and trawl fisheries greatly contribute to the alleviation of poverty through the provision of food and livelihoods for many people in coastal communities around the world.

2. To objectively assess the impact of bottom trawls on a global scale and to develop trawling best practices in support of the Code of Conduct for Responsible Fisheries, FAO, in collaboration with the Trawl Study Committee, held three expert workshops between 2014 and 2017. The Trawl Study Group[1], led by Professors Ray Hilborn (University of Washington), Mike Kaiser (Bangor University) and Simon Jennings (International Council for the Exploration of the Sea), coordinates an international initiative "Finding common ground on the scientific knowledge regarding best practices in trawling". The workshops were held in Asia (Bangkok, Thailand), Latin America (Cartagena, Colombia), and Africa (Marrakech, Morocco), and were titled "Use of best available science in developing and promoting best practices for trawl fishing operations in Southeast Asia".[2]

3. The purposes varied slightly among the three workshops, but generally included: i) identify and evaluate data on trawling distributions and impacts in the region; ii) develop and propose

[1] https://trawlingpractices.wordpress.com.

[2] The Bangkok workshop report was published in 2017 and it is available at www.fao.org/3/a-i6611e.pdf. The Cartagena and Marrakech workshop reports are in the publication process and will be available soon.

collaborative arrangements for sharing expertise in the region; and iii) evaluate best practices for trawling to enhance sustainability of food security, livelihoods and ecosystems. It was hoped that by collaboratively working with scientists and managers from different regions, common themes would emerge, leading to the development of best trawling practice guidelines that would either be applicable to the region, or globally.

4. The workshop found that the trawl footprint estimates were heavily dependent on the grid resolution that was used. Typically, finer grid resolutions (e.g., 1 km^2) result in much lower proportion of areas trawled compared with coarser resolutions (e.g., 100 km^2). The workshop recommended that the finer resolution grid such as 1 km^2 should be used when possible to more accurately depict the proportion of area disturbed by bottom-contacting gears. Overall, European waters were found to have higher proportion of area trawled than other continents for both shallower regions ≤200 m, and deeper regions 200-1000 m, regardless of the grid resolution used for analysis.

5. Trawling frequency also varied greatly among the regions. In the most heavily trawl area with the highest swept area ratio (SAR) (Adriatic Sea), more than 50 percent of the seabed was found to have been trawled at least once, while in Australasian region with low SARs, the seabed was trawled less than once in every 10 years, as is the case in the South Benguela Current, East Agulhas Current, North California Current, East Bering Sea, Aleutian Islands and Gulf of Alaska.

6. Commercially trawled areas on continental shelves are characterized by 'hotspots' of fishing in which the trawling frequency is in the range of 1 to 5 times per year, and extensive areas in which there is either no fishing or less than once every four years. Overall, such intensities of trawling caused declines of up to 26 percent in abundance, biomass and species richness. The effect was strongly gear-specific. Effects on total community abundance and biomass were stronger for gears such as dredges that penetrate the sediment more deeply, and weaker for gears such as otter trawls that penetrate not as deep. Sediment composition and the history of trawling prior to an experimental fishing event were also important predictors of depletion. The effect of trawling was also weaker in areas where a higher primary production results in a higher recovery potential. Communities in areas that were previously unfished, predominantly muddy, or biogenic habitats were more strongly affected by fishing. Sessile and low mobility biota with longer life-spans such as sponges and soft corals would require much longer duration to recover than with shorter-lived mobile biota such as polychaetes.

7. Based on the results of the gradient studies, it was estimated that recovery of community biomass to 95 percent of unfished levels takes between 2.2 years and 0.7 years for community abundance. However, this does not mean that the community has recovered to the same species, size and age composition that it had before trawling started, but it does mean that the ecosystem processes that are related to biomass or abundance such as secondary production will have largely recovered.

8. The effects of bottom trawling detected by the studies reported at the workshops were quite modest, unless areas had been trawled at very high frequencies. This meant that either the fraction of animals killed by a trawl was low or that the recovery from trawling was fast, or both. These results showed that the impacts of trawling could be reduced by redirecting fishing to areas that would recover more quickly and by developing or switching to gears that do not penetrate so deep into the seabed.

9. Bottom trawling seemed to affect diet composition and prey quality of commercial fish species rather than the amount of prey consumed. Scavenging discarded fish seemed to make only a small contribution to annual food intake. While more studies are required, some research indicated that weight- and length-at-age of North Sea plaice declined by up to 16 percent with increasing trawl disturbance on gravel and mud habitats, but not on sand. These observations, combined with modelling exercises, suggested that flatfish might benefit from light trawling levels on sandy substrates, but higher intensity trawling on more vulnerable habitats would have a negative effect. However, the distribution of fishing effort is very patchy; small fractions of fishing grounds are heavily fished, while large fractions are lightly fished or unfished. This patchiness of fishing, coupled

with the foraging behaviour of demersal fish might mitigate the indirect effects of bottom trawling on fish productivity.

10. The workshops identified several best practice measures that might limit or reduce impact of trawling, such as:

- Gear design and operation (prohibition by gear type, gear and operation modifications)
- Spatial control (freeze fishing footprint, nearshore restrictions, habitat-type related prohibitions, broad-scale habitat management, rolling hot spots, move-on rules)
- Impact quotas (invertebrate bycatch quotas, habitat impact quotas)
- Effort control (effort reduction)

11. The workshops also established a set of performance metrics of management measures and industry practices that would compare the efficacy of different approaches, using an evidence-based analytical framework:

- Benthic biota - Biomass, species diversity/richness, species composition, size spectra, and other ecological proxies for indirect impacts on fish populations
- Sustainable food production and food security - Harvest levels and catch composition affecting domestic consumption and export markets
- Ecosystems and ecosystem services - Spatial extent and inclusion of representative habitats, especially those supporting vital ecological functions such as spawning, feeding, and growth to maturity
- Fleet performances - Direct costs affecting operational efficiency, including those related to gear changes or modification, fuel usage, and catch rates

12. It was recognized that best practices to minimize trawling impacts on the benthos in overfished systems would include efforts to rebuild stocks to increase target biomass, which would not only reduce effort required to harvest the quota (thus impacts), but also support a variety of other socioeconomic goals including less fuel consumption and greenhouse gas emission, and reduced poverty and improved livelihood of many coastal communities. It was understood that the definition of best trawling practices might differ by location, region, or country, and by prevailing circumstances; therefore, useful guidelines and performance metrics should be flexible and account for a broad range of biological, technical, socioeconomic factors, and the local and regional policy drivers for fishery management. Developing best trawling practice guidelines would need to include stakeholder consultations on elements of the best practice analytical framework, a global review of successful and unsuccessful applications of the different management options, and continuing collaborations with researchers, managers and fishing industry from all continents.

13. Managing bottom trawling involves trade-offs between production of food and jobs from fishing, and protection of biota. Different countries or regions may make different choices on where along this trade-off they wish to be, and thus best practice guidelines should identify management actions that would achieve the best outcomes at a minimum social and economic costs.

14. Based on work summarized in these workshops which primarily dealt with the effect of trawling on the seabed and vast amount of work FAO carried out on bycatch and discards in trawl fisheries, it is prudent for FAO to consider the development of best practice guidelines for trawl fishing operations to support FAO’s Code of Conduct for Responsible Fisheries and to supplement the International Guidelines on Bycatch Management and Reduction of Discards.