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CWP ad-hoc Task Group on "fishing effort concepts" (TG-effort) Progress report on the review and development of CWP fishing effort concepts and measures

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Summary

CWP-26 established the ad-hoc task group on fishing effort concepts (TG-effort) to review, revise and where necessary further develop CWP fishing effort concepts and standard measures of effort (CWP-IS-2021-Inf.2). This progress report summarises the work of TG-effort to date.

TG-effort reviewed CWP's historical development of fishing effort concepts which was initiated in the 1960s when CWP developed a standardised reporting system for fishery statistics in the north Atlantic (STANA questionnaires). This system was further developed as the STATLANT questionnaires which nowadays are dispatched by FAO on behalf of the regional fishery organizations to relevant national authorities, and are subsequently compiled by FAO into global fishery statistics. While the initial focus of those developments was industrial fisheries, CWP's work in capture fisheries statistics covers all fishery sectors (i.e. industrial, small-scale/artisanal , sport/recreational).

TG-effort considered the following fishing effort concepts: fisher, fishing vessel, fishing ground, fishing trip, fishing gear, searching (for fish), fishing operation and fishing mode. Revised definitions are proposed and a fishing effort concepts diagram was developed for use in the CWP Handbook.

TG-effort reviewed the use of nominal and effective fishing effort and their application in the STATLANT questionnaires. TG-effort also developed a comprehensive list of standard measures of fishing effort by ISSCFG fishing gear categories and fishing modes to facilitate the broader application of standard measures across all fishery sectors.

TG-effort also considered the applicability and development of new fishing effort measures based on emerging technologies such as satellite-based Automatic Identification System, Synthetic Aperture

Radar systems and Visible Infrared Imaging Radiometer Suite. That work is expected to continue up to CWP-27.

CWP Members are kindly invited to provide feedback on the work of TG-effort including the development of fishing effort concepts, standard measures of effort and new measures for emerging technologies.

1. Background

1. The CWP Handbook (CWP, 2021) defines fishing effort in capture fisheries in terms of the amount of fishing gear of a specific type used on the fishing grounds over a given time period e.g. fishing day or the duration of a fishing operation, fishing activity or fishing trip. The time spent searching for fish is also taken into consideration. The measure of effort depends on the fishery and type of gear used. The term **nominal fishing effort** (or nominal effort) is generally used to quantify the unadjusted, total effort units exerted on a stock in a given time period. However, the impact of a unit of fishing effort on the fish populations and the ecosystem varies amongst vessels and/or fishers and depends on the gear deployed and the mode of fishing. As a result, effort measures are often adjusted to take account of differences in fishing power and efficiency and ensure proportionality with fishing mortality. Particularly when two or more kinds of gear are used or when the same gear is used for example by different classes of vessel, the respective efforts must be adjusted to some common standard prior to being aggregated across all classes. This measure of effort is termed **effective fishing effort** (or effective effort, also referred to as standard effort). Standard measures of effort for categories of fishing gear as currently defined in the International Standard Statistical Classification of Fishing Gear (ISSCFG, 2016) are listed below in Appendix 1.

2. Statistics on fishing effort and associated catch per unit of effort often underpin advice on the sustainable development and management of capture fisheries as they are key inputs into the various stock assessment and monitoring models. For biologists, a good measure of effort should be proportional to fishing mortality. For economists it should be proportional to the cost of fishing. CWP recognizes that fishing effort statistics are often required as detailed data (e.g. broken down by fishing fleet, gear, season, target species and geographic area or fishing zone) and national and regional fisheries organizations publish effort statistics in various forms. Recognizing that the concepts and definitions used to quantify fishing effort may differ between these organizations. In addition, fishing effort may be under-reported or not reported at all in some fisheries. As a result, varying measures of fishing effort may be compiled at national or regional levels and such differences may limit the compatibility of effort statistics and the exchange and wider use of these data in regional and global contexts.

3. CWP-26 (FAO, 2019a) established TG-effort to: (1) Review, revise and where necessary further develop CWP fishing effort concepts and associated diagram(s) and definitions including measures of nominal effort and effective effort, and elaborate their use in informing STATLANT[1] questionnaires, further building on the effort measures harmonization work initiated by the t-RFMOs (FAO, 2019b) (2) Review, further develop and define standard measures of effort for the categories of fishing gear in ISSCFG, taking account of emerging remote-sensing technologies and opportunities to develop new measures of effort. TG-effort will work in a global context and will need to consider all capture fishery sectors (i.e. industrial,

[1] STATLANT system of questionnaires is a long-standing standardized statistical inquiry developed by the CWP for the submission of national catch and effort data to international organizations by national statistical offices (http://www.fao.org/cwp-on-fishery-statistics/handbook/introduction/data-collection-systems/en/).

small-scale/artisanal[2], sport/recreational) as well as fishing which does not involve the use of vessels (i.e. land-based fishing) or designated ports.

4. TG-effort held a joint online meeting with the ad-hoc task group on catch concepts (TG-catch) on 6 July 2021, to initiate the program of work and tasks required for both TGs and to ensure any potential overlap in activities or discussions between these TGs is fully noted. The meeting was scheduled for the nominated participants of both TGs (GFCM, NAFO, IOTC, ICCAT, ICES, SEAFDEC and WECAFC). However, the meeting was open to all interested parties to contribute to the discussion and contribute to the work of the TGs. Following that meeting, TG-effort continued reviewing and developing fishing effort concepts[3] (objective 1 above) and detailed measures of effort (objective 2). Progress with this work is reported in this document.

2. CWP historical fishing effort concepts and definitions

5. Since the 1960s, the CWP supported by the participating organizations has facilitated an international and inter-organization forum for agreeing common definitions, classifications and standards for the collection of fishery and aquaculture statistics. CWP has developed common procedures for statistics collation which have streamlined the collation process and reduced the burden on national fisheries statistical offices. It has provided technical advice on fishery statistical matters to participating organizations and has facilitated the publication of methodological and reference documents. In the process the CWP has shaped the statistical programs of all participating organizations to some extent, and those of FAO in particular, while leaving organizations with complete autonomy in their areas of responsibility.

6. By integrating and coordinating the statistical programs among organizations, the CWP made possible the standardization of statistical reporting systems, resulting in the adoption of a reduced number of questionnaires. The early work of the CWP focused on the development and improvement of Atlantic fishery statistics, and the procedures and concepts served as models for fishing areas elsewhere. Standardised fishery catch and effort questionnaires developed by the CWP in the early 1960s for reporting fishery statistics in the north Atlantic (STANA questionnaires), subsequently further developed as the STATLANT questionnaires, are regularly dispatched by FAO on behalf of the regional fishery organizations to the relevant national authorities (FAO, 1995). These questionnaires are compiled by FAO into global fishery statistics.

7. While developing standardised fishery catch and effort questionnaires, CWP made several provisions for reporting effort including the following:

    - CWP-7 (FAO, 1972) noted that ‘searching time’ had always been considered an integral part of what had been defined as ‘fishing time’ when expressed in ‘days fished’. In addition, regional agencies had expressed the wish to continue to have the amount of ‘searching time’ included in ‘fishing time’ but also to be able to differentiate between ‘searching time’ and ‘fishing time’ and report these separately. As a result, CWP

[2] Small-scale/artisanal fisheries refer to fisheries which operate on a small spatial scale and/or use relatively low levels of technology (artisanality) (refer for example http://www.oceansatlas.org/subtopic/en/c/1421/).
[3] The revised CWP Handbook (CWP, 2021) defines a ‘statistical concept’ as a representation of a notion or entity based on a unique set of characteristics which defines a statistical measure, dimension or domain, and which has been developed by CWP or recommended by CWP for use.

recommended that 'searching time' be reported separately in addition to including it as an integral part of 'fishing time' when the latter is expressed in 'days fished'.

- CWP-8 (FAO, 1974) reviewed the definition of 'days on ground' which was being used in reporting Atlantic fishery statistics. 'Days on ground' was defined as follows:

  Days on ground: the number of days (24-hour periods, reckoned from midnight to midnight) in which the craft was on the fishing ground, and included in addition to the 'days fishing' and 'searching' also all the other days while the craft was on the ground.

  CWP considered that such a definition was adequate, but that each agency should define the concept of 'fishing ground' within its own management regime when attempting to collect these statistics for purposes of management on an effort basis. CWP-8 further noted that for some gear categories there was a need for further studies to clarify in terms of biological effect (fishing mortality), as well as in terms of practicability, the best effort unit. Fishing effort units to be reported in the STATLANT system were listed for each relevant gear category (FAO, 1974, Appendix 7 'Proposals For Fishing Effort Measures By Gear Category'). Although this list tended to set up the various options in order of priority, the CWP-8 discussions indicated that the order of priority varied somewhat between the agencies due to the nature of the various regional fisheries. Also, the agencies, although generally requesting more than one measure of effort for each category, did not necessarily request the same set of measures for each gear category. CWP requested that each agency collecting statistics clearly indicate the measures which they wished recorded. Definitions for fishing effort measures by gear categories were updated at CWP-9 (FAO, 1977, Appendix 8).

- CWP-9 (FAO, 1977) also noted that the extension of national jurisdictions was expected to lead to an increased reliance on logbooks in the management of fisheries. CWP thus, thought it useful to identify components of a logbook which were necessary for the retrieval of data essential for management purposes. However, no proposal for a standard logbook was made since national considerations could greatly affect the type and format of logbook used. In considering the essential elements of a logbook, CWP recognized that logbooks served two main functions: (1) providing a tool in the enforcement of fishing regulations, and (2) informing a method of collecting primary fishery statistics. In certain circumstances, these two functions may not be reconcilable within a single logbook format but it was believed that this generally should not present a major problem.

8. During CWP-10 (FAO, 1980), CWP-11 (FAO, 1982) and CWP-12 (FAO, 1984) and associated intersessional periods further work was undertaken in developing general guidelines for logbooks and related systems. The published guidelines for logbooks (Pope, 1986), considered a primary reference for collection of logbook information, referred to the collection of detailed data on vessels, trips and fishing. The measures of effort associated with these data were: searching time, number of sets, number of effort units, number of hours fished, number of days fished, number of days on ground, number of days absent from port, number of trips made. In addition, the guidelines included a list of standard effort measures by fishing gear categories as reflected in the CWP-9 report tables (FAO, 1977). CWP standard effort measures by fishing gear category have since been further developed and expanded by others (FAO, 1999; Halls et al., 2005; refer also excel file 'TG-effort review of CWP fishing effort concepts' for a timeline

and summary of developments, available on request) and the current list with definitions is provided in Appendix 1 (below).

9. More recently, the CWP ad-hoc Task Group on reference harmonization for capture fisheries and aquaculture statistics (TG-RH), established in the CWP 25th session, organized a workshop with a focus on Tuna fisheries statistics. The TG aims at establishing the CWP standard for reference harmonization, a unified data structure composed of harmonized statistical concepts and definitions to meet the needs of CWP parties and countries for data reporting and interoperability across different organizations' databases. CWP parties participated in the activities of the TG and presented their definitions of catch and effort used in the data collection frameworks. The technical workshop on global harmonization of tuna fisheries statistics (t-RFMO workshop) (FAO, 2019b) led to proposals on data structures standard of reference harmonization, and produced an inventory of the commonly used effort measures in combination with gear used across t-RFMOs. Proposals for revising CWP handbook's definition of fishing effort, its categories and combinations with gears were submitted to the CWP-26 (CWP, 2019a) for review by all CWP parties and endorsement. A proposal for global guidelines for capture fisheries logbooks during the 26th session have extended the work on refining, developing and harmonizing fishing effort concepts in support of the work of CWP.

3. CWP use of fishing effort in STATLANT questionnaires

10. The STATLANT system of questionnaires provides for the reporting of fishing effort statistics at four levels (categories) of precision (e.g. CWP, 2021). From a practical level, the STATLANT system provides a way of reporting effort at the most basic level. CWP has defined three main levels of precision (categories A, B and C) and an additional level (D) as follows:

    - Category A refers to a detailed unit of measure, e.g. hours fished or number of sets, etc. These units of measure will vary with the gear used (refer Appendix 1)

    - Category B refers to the number of days fished, i.e. the number of days on which fishing took place. For those fisheries in which searching is a substantial part of the fishing operation, days in which searching occurred, but no fishing took place should be included in the number of days fished.

    - Category C refers to the number of days on the fishing ground in addition to days fishing and searching; here all other days while the vessel was on the fishing ground should be indicated.

    - Category D (specifically for STATLANT form B21) uses the percent of pro-rated effort to estimate the percentages of the catches when data are incomplete.

11. The STATLANT approach for reporting effort was further considered in 2018 when the t-RFMOs at a technical workshop on global harmonization of tuna fisheries statistics (FAO, 2019b) proposed revisions to the CWP definitions for fishing effort to include and harmonize effort measures used by the t-RFMOs (Appendix 2 below). This proposal included:

    - Combining the three categories A, B and C above into a single comprehensive list of fishing effort measures which would include the number of days fished (B) and number of days on the fishing ground C)

- Developing a fishing practice data structure module (referred to TG-RH2) that combines the concepts of fishing gear (based on ISSCFG) and fishing mode.

12. The t-RFMO workshop also proposed including a module on fishing practice that combines two concepts fishing gear and fishing mode in the data structure "catch and effort". Fishing mode accounts for the three modes generally used when fishing with a purse seine: free-school/unassociated (i.e. fishing on schools not associated with floating objects); associated (i.e. fishing on schools associated with floating objects; both/mixed (i.e. fishing on unassociated and associated schools). Workshop participants agreed to work after the workshop to finalize the definition used in the fishing practice and inventory of fishing mode.

13. CWP-26 welcomed the t-RFMOs proposals and additionally requested that this work be extended to the other RFBs with particular consideration of small-scale fisheries (FAO, 2019a). Towards this goal, CWP-26 established an ad-hoc task group, TG-effort, to progress this work.

    [TG-effort may consider this matter further in the intersession period to CWP-27.]

4. Further development of fishing effort concepts

14. Towards the need to characterize world capture fisheries and aquaculture from a global/regional view, statistical programs of national fisheries must utilize a common set of regional/interregional standards which apply internationally recognized definitions, classifications, and codes. Towards this need the CWP handbook[4] provisions for various statistical concepts associated with fishing effort, including fishing vessel, fishing ground, fishing trip, fishing day, fishing gear and searching (for fish). These concepts have been used inter alia to develop the measures of fishing effort and are presented in Appendix 1. TG-effort reviewed these concepts and provided additional clarification in the following section. In doing so, TG-effort acknowledges that needs exist on multiple levels: the need to maintain continuity and consistency in the reporting of effort statistics, ensure comprehensive coverage of fishing effort across all capture fishery sectors, fishing gears and fishing modes, and facilitate the integration of any new concepts and measures with current and established reporting practices.

4.1 Fisher

15. Historically CWP has focussed on the socio-economic statistics from fishers who derive a livelihood or revenue from fishing activities. Fishing activities encompass a broad range of activities and, for example, NAFO defines fishing activities as 'the harvesting or processing fishery resources, landing or transhipping of fishery resources or products derived from fishery resources, or any other activity in preparation for, in support of, or related to the harvesting of fisheries resources in the Regulatory Area, including the actual or attempted searching for, catching or taking of fishery resources; any activity that can reasonably be expected to result in locating, catching, taking, or harvesting of fishery resources for any purpose; and any operation at-sea in support of, or in preparation for, any activity described in this definition, but does not include any operations related to emergencies involving the health and safety of the crew members or the safety of a vessel' (Article 1.5 of its Conservation and Enforcement Measures).

16. CWP has defined full-time, part-time and occasional fishers as follows (CWP revised Handbook): full-time fishers receive at least 90% of their livelihood from fishing or spend at

[4] http://www.fao.org/cwp-on-fishery-statistics/handbook/en/

least 90% of their working time in that occupation; part-time fishers receive at least 30% but less than 90% of their livelihood from fishing or spend at least 30% but less than 90% of their working time in that occupation; occasional fishers: receive under 30% of their livelihood from fishing or spend under 30% of their working time in that occupation. However, it is also recognized that fishing activities may be carried out for other purposes such as sport or recreation which may not generate a revenue. Based on these considerations, TG-effort proposes to define a fisher as follows:

Fisher (concept): a person who engages in fishing activities for the purpose of deriving a livelihood or revenue or pursuing sport or recreation. A full-time, part-time or occasional fisher receives some or all of their livelihood from fishing or spends some or all of their working time in that occupation. A sport or recreational fisher (or angler) conducts fishing in pursuit of sport or recreation.

4.2 Fishing vessel

17. CWP has developed the International Standard Statistical Classification of Fishery Vessels (ISSCFV) (FAO, 2021) which provides a global structure for the classification of fishery vessels including fishing vessels. In doing so, CWP distinguishes between a fishery vessel (or fishery fleet) and a fishing vessel, and these concepts are defined as follows (CWP revised Handbook): fishery vessel is a mobile floating platform of any kind and size, operating in fresh, brackish or marine waters which is used for catching, harvesting, searching, transporting, landing, preserving and/or processing fish, shellfish and other aquatic organisms, residues and plants; fishing vessel: is a [fishery] vessel engaged only in catching operations. Based on these definitions, the stand-alone CWP definition for a fishing vessel is as follows:

    Fishing vessel: a mobile floating platform of any kind and size, operating in fresh, brackish or marine waters which is used for catching fish, shellfish and other aquatic organisms, residues and plants.

18. CWP defines a non-fishing vessel as a vessel performing other functions related to fisheries, such as supplying, protecting, rendering assistance or conducting research or training.

19. Fishery and fishing vessels may be characterised inter alia by their type (ISSCFV classification), tonnage, length, powered or not-powered, and decked or undecked (CWP revised handbook).

20. The ISSCFV classifies fishing vessels (e.g. trawler, seiner, longliner) and vessels supporting fishing related activities (e.g. mothership, reefer, support vessel, research vessel, patrol vessel) using terminology in line with international instruments such as the Port State Measure Agreement (PSMA). PSMA defines a vessel as any vessel, ship or another type of boat used for, equipped to be used for, or intended to be used for, fishing or fishing related activities.

21. Other agencies may use different definitions. For example, the FAO glossary defines a fishing vessel as any vessel, boat, ship, or other craft that is equipped and used for fishing or in support of such activity. For management purpose, particularly for monitoring and surveillance, a fishing vessel may be considered to include any vessel aiding or assisting one or more vessels at sea in the performance of any activity relating to fishing, including, but not limited to, preparation, supply, storage, refrigeration, transportation, or processing (e.g. mother ships).

22. Based on these considerations, TG-effort proposes to define a fishing vessel as follows:

    Fishing vessel (concept): a vessel, ship, boat or other type of craft used for, equipped to be used for, or intended to be used for, fishing or fishing related activities. A fishing vessel may be powered or unpowered, and decked or undecked and a classification of fishing vessels is provided in the International Standard Statistical Classification of Fishery Vessels (ISSCFV) (FAO, 2021)

23. Based on ISSCFV, TG-effort also proposes to define a fishery-support vessel as follows:

    Fishery-support vessel: a vessel, ship or boat performing non-fishing functions related to fisheries, such as re-supply, transportation and refrigeration, factory processing, fishery patrol, search and rescue, research or training.

24. Also based on ISSCFV, TG-effort noted that the term 'fishery vessel' includes both fishing vessels and fishery-support vessels (as defined above).

4.3 Fishing ground

25. A fishing ground is generally understood to represent a geographic location where fishing takes place. This location may be further defined by the depth range or zone where fishing occurred and whether fishing was pelagic, semi-pelagic or on the bottom. For example, a fishing ground may represent a local reef, a patch of water, or a fishing zone or area.

26. For statistical purposes, CWP uses the FAO major fishing areas (refer http://www.fao.org/fishery/area/search/en). These fishing areas (or statistical areas) are arbitrary areas with boundaries determined in consultation with international fishery agencies on various considerations, including: the boundary of natural regions and the natural divisions of oceans and seas; the boundaries of adjacent statistical fisheries bodies already established in inter-governmental conventions and treaties existing national practices; national boundaries; the longitude and latitude grid system; the distribution of the aquatic fauna; the distribution of the resources; and the environmental conditions within an area. The rationale of the FAO major fishing areas has been that the areas should, as far as possible, coincide with the areas of competence of fishery commissions when existing. This system facilitates comparison of data, and improves the possibilities of cooperation in statistical matters in general. For statistical purposes, 27 major fishing areas have been internationally established to date: 8 major inland fishing areas covering the inland waters of the continents, and 19 major marine fishing areas covering the waters of the Atlantic, Indian, Pacific and Southern Oceans with their adjacent seas.

27. CWP also recognises other fishing areas which may be considered as 'grounds' including marine waters (oceans and seas including adjacent saltwater areas), inland waters (lakes, rivers, brooks, streams, ponds, inland canals, dams, and other land-locked usually freshwater waters such as the Caspian Sea, Aral Sea, etc.) and water jurisdiction areas.

28. CWP follows the UNCLOS definitions for water jurisdiction areas (United Nations, 1982) which are summarised in the revised handbook (CWP, 2021) as follows:

    - Internal waters and archipelagic waters (waters of the sea on the landward side of the baseline used by the national authorities of the coastal country to measure further

seawards the width of the territorial sea and any adjacent marine waters, whether salt, brackish, or fresh in character)

- Territorial sea (a band of 12 nautical miles in width seaward calculated from the baseline[5]. Internal waters/archipelagic waters are not part of a territorial sea)

- Contiguous zone (a band extending from the outer limit of the territorial seas up to a limit of 24 nautical miles from the baseline)

- Exclusive economic zone (EEZ) (a band extending from the territorial sea up to a limit of 200 nautical miles seaward, or in some cases up to the outer limit of the continental shelf if it goes beyond 200 nautical miles. EEZs give nations sovereign rights for exploring and exploiting marine resources below the level of the sea, including fishing activities)

- International waters, high seas and Areas Beyond National Jurisdiction (ABNJ) (the water column beyond the EEZs).

29. Based on these considerations, TG-effort proposes to define a fishing ground as follows:

Fishing ground (concept): a geographic location where fishing takes place. This location may be further defined by the water jurisdiction area, FAO major fishing area, depth range, zone or feature where fishing occurs.

4.4 Fishing trip

30. The concept of a fishing trip is implied in the CWP definitions of the fishing effort measures 'number of fishing trips' and 'number of days absent from port' (Appendix 1). According to these definitions, a fishing trip may be defined as follows.

Fishing trip: a voyage during which fishing took place, beginning on the day the vessel sailed from port and ending on the day the vessel returned to port, excluding the day(s) of landing if landing after the day of return to port.

31. This definition of a fishing trip historically has focused on industrial fishing and assumes that the trip begins and ends in the port, and that a fishing vessel is used for the trip. As such, this definition may not be suited to small-scale/artisanal or sport/recreational fisheries where a trip does not involve a port and/or a vessel is not used. Consideration may also need to be given to the use of 'motherships' and the application of a fishing trip in that context. In addition, a fishing trip may be defined in accordance with specific regulatory requirements, for example a trip which includes 'the time from [a vessel's] entry into until its departure from the Regulatory Area and continues until all catch on board from the Regulatory Area is unloaded or transhipped' (NAFO Conservation and Enforcement Measures, Article 1.7, 2022). This NAFO definition is based on the fact that some NAFO authorized vessels are also NEAFC authorized vessels and these vessels may fish in both jurisdictions in one continuous voyage. Ending a fishing trip at the point of beginning a transhipment (to a carrier vessel at sea), is important to cater for the independent monitoring of the transhipped catch to be compared to the vessel's record of trip catch.

[5] In some cases a territorial sea may extend to 3 miles only.

32. Industrial fisheries generally operate from a designated port or ports, where a port is a location with permanent facilities at which vessels can load or discharge cargo moving in maritime traffic.

33. Small-scale and recreational fisheries generally operate from a (home) base which may be a port or another geographic location such as a private or public dock, berth, ramp, beach or seawall which is used repeatedly by a fishing vessel or fisher.

34. While fishing vessels are used extensively in fishing, not all fisheries involve the use of fishing vessels. Some fisheries are land-based/shore-operated and examples include the harvesting of cockles, diving from shore, beach seining, ice fishing, angling from shore, fishing from bridges or piers, using stationary lift nets etc. These land-based fisheries may involve fishing trips where, for example, a fisher commutes/drives/walks from a base to a fishing location/ground.

35. Recreational fishing trips can be characterized as fishing during part or all of 1 day in one mode. An angler who fished from both a pier and a beach on the same day made one fishing trip since the pier and the beach are both in the shore mode. However, an angler who fished from a head boat in the morning and from a pier in the afternoon is counted as having made two fishing trips--a head boat trip and a shore trip.

36. Based on these considerations, TG-effort proposes to define a fishing trip as follows:

    Fishing trip (concept): a voyage during which fishing takes place, beginning on the day the fisher or fishing vessel departs from a base and ending on the day the fisher or fishing vessel returns to a base, or on initiating a transhipment or landing. A base may include a port or other geographic location such as a private or public dock, berth, ramp, beach or seawall which is used repeatedly by a fisher or fishing vessel. A fishing trip may be also defined by an operational requirement such as entry and exit from a regulatory area or a fishing mode such as an angler shore mode or boat mode.

4.5 Fishing gear

37. CWP has developed the International Standard Statistical Classification of Fishing Gear (ISSCFG, 2016) (FAO, 2021b) which provides a global structure for the classification of fishing gear and provides for national or regional variations in gear to be included at sublevels of the classification. Although this classification was initially designed to improve the compilation of harmonized catch and effort data in the STATLANT B questionnaires and fish stock assessment exercises, it has also been found useful for fisheries technology development and the training of fishers. The ISSCFG has been used in particular for reference in work dealing with the theory and construction of gear and for the preparation of specialized catalogues on both artisanal and industrial fishing methods.

38. While CWP does not specifically define fishing gear, it is generally understood that the meaning of fishing gear is as follows:

    Fishing gear: the equipment used for fishing, e.g. baitboat, gillnet, handline, harpoon, haul seine, longline, midwater trawl, purse seine, rod-and-reel, trap, and trawl. Each of these gears can have multiple configurations (FAO glossary)

39. Based on these considerations, TG-effort proposes to define a fishing gear as follows:

Fishing gear (concept): any equipment used to capture fish or other aquatic organisms during the course of fishing. A classification of fishing gears is provided in the International Standard Statistical Classification of Fishing Gear (ISSCFG) (FAO, 2021b).

4.6 Searching

40. CWP has long recognised that searching for fish[6] is an integral part of fishing, and it has recommended that 'searching time' be reported separately in addition to including it as an integral part of 'fishing time' when the latter is expressed in 'days fished' (e.g. FAO, 1972). However, the extent of 'searching' can be complicated by the use of aircraft spotting as well as by the dissemination of information from vessel to vessel via electronic communications including receiving of satellite information. In recent developments, fishing companies may also employ analysts to remotely monitor sonar buoys on drifting FADs and information is relayed back to vessels at sea. Measures such as searching time are appropriate when school size and density are unrelated to stock abundance and a set is only made when a school has been located (Appendix 1).

41. While CWP does not specifically define searching, it is generally understood that the meaning of searching for fish is as follows:

    Searching (for fish): actively investigating a location for the presence of fish or suitable fish habitat using visual or electronic methods and prior to deploying fishing gear.

42. Based on these considerations, and noting that the term 'fish' is used in a general fishery context (i.e. fish or other aquatic organisms)5, TG-effort proposes to define searching for fish as follows:

    Searching for fish (concept): any activity which investigates a location for the presence of fish, other aquatic organisms or their habitat using visual or electronic methods or remote technology and prior to deploying fishing gear.

4.7 Fishing operation

43. The concept of a fishing operation involving fishing gear is implied in the CWP definitions of fishing effort measures such as the number of sets and number of operations (Appendix 1). While CWP does not specifically define a fishing operation, it is generally understood that a fishing operation in the context of CWP is a set of routine tasks required to operate fishing gear. Fishing operations may involve for example the deployment and retrieval of a trawl or longline, casting of a pole or handline, diving to harvest shellfish, throwing a spear and clearing the gear (i.e. removing the catch). In addition, a fishing operation may be modified by a fishing mode (refer below) such as operating a purse seine in association with floating objects or casting a line from a charter boat. Fishing operation may also be associated with searching for fish (refer below).

44. Based on these considerations TG-effort proposes to define fishing operation as follows:

[6] In the general context of fishery statistics, the term 'fish' may be interpreted as meaning all species of aquatic organisms, whether processed or not (e.g. PSMA definition). CWP has requested that ad-hoc TG-catch further consider a definition and use of the term 'fish' in the context of the catch concepts.

Fishing operation (concept): A set of routine tasks required to operate fishing gear and which may involve *inter alia* the deployment and retrieval of fishing gear and removal of catch from the gear.

4.8 Fishing mode

45. The concept of fishing mode was proposed by the technical workshop on global harmonization of tuna fisheries statistics (FAO, 2019b), for consideration by CWP. TG-effort noted that fishing mode would be used in association with fishing gear and would account for the three fishing modes for purse seine: free-school/unassociated (i.e. fishing on schools of fish not associated with floating objects); associated (i.e. fishing on schools associated with floating objects; both (i.e. fishing on unassociated and associated schools).

46. TG-effort also noted that fishing modes may apply to other types of fishing such as recreational fishing where fishing modes may be associated with the type of place or platform from which recreational fishing occurs. For example, NOAA identifies three main modes for sport and recreational fishing including fishing from: shore (beach, bank, bridge, pier, dock, causeway), private or rental boat, and for hire-sectors charter boats and headboats[7].

47. Based on the examples above, a fishing mode is a specific practice or method of operating fishing gear which may apply inter alia in some fisheries (e.g. tuna fisheries) or fishing sectors (e.g. sport and recreational fishing), be species-specific or apply in a local context. TG-effort proposes to define fishing mode as follows:

    Fishing mode (concept): A specific practice which modifies the operation of fishing gear such as the deployment of purse seines on schools of fish associated with floating objects.

4.9 Fishing effort concepts diagram

48. A diagrammatic presentation of fishing effort concepts (Fig. 1) was developed for use in the CWP handbook and to complement the handbook diagram on catch concepts (http://www.fao.org/3/bt981t/bt981t.pdf). The diagram illustrates the fishing effort concepts and relationships developed by TG-effort.

[7] NOAA defines charter boats as vessels that take a group of anglers—usually six or fewer—on a fishing trip with a licensed captain and crew. The anglers hire or charter the vessel, and pay a fee for the captain's services. Charter boats engage in a full range of fishing techniques, including drift fishing, trolling, and bottom fishing. Headboats are vessels that take multiple individual and/or small groups of anglers on a fishing trip with a licensed captain and crew. Headboats are generally larger than charter boats, and almost always take more than six anglers on a given trip. https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-data-glossary#type-of-fishing-(mode).

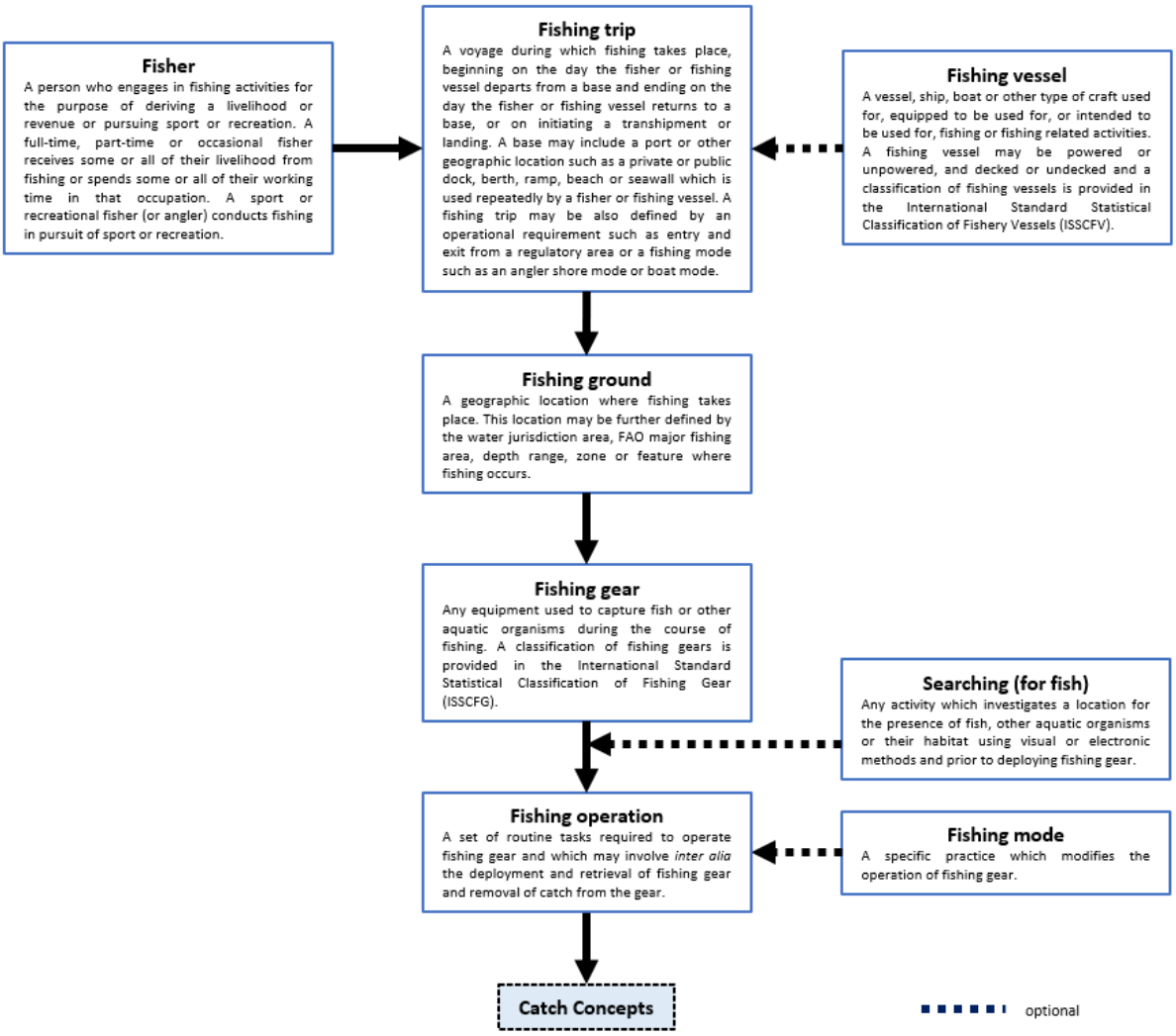

Figure 1: Diagrammatic presentation of fishing effort concepts with definitions and relationships. The catch concepts are being reviewed by TG-catch and the original catch concepts diagram and definitions are published in the CWP Handbook (http://www.fao.org/3/bt981t/bt981t.pdf). Note that the term 'fish' in these diagrams is used in a general fishery context (i.e. fish and other aquatic organisms).

5. Review of nominal and effective effort and their application in STATLANT questionnaires.

49. The CWP Handbook currently defines nominal and effective effort as follows:

- Nominal fishing effort: general measure of effort used to quantify the unadjusted, total effort units exerted on a stock in a given time period.

- Effective fishing effort: adjusted measure of effort to take account of differences in fishing power and efficiency and ensure proportionality with fishing mortality, and when two or more kinds of gear are used or when the same gear is used for example by different classes of vessel, the respective efforts are adjusted to some common standard before being aggregated across all classes (strata).

50. In general, nominal fishing effort describes the resources allocated to fishing, such as time (days or hours fished), capital (number of vessel days, length or horsepower of vessel), labour (number of person hours or number of crew) or gear (number of hooks). Nominal fishing effort can also be thought of as a measure of fishing power, i.e. the capacity of a fishery to produce a potential yield level. Effective fishing effort is a standardized measure of effort, such as the rate of fish capture, or instantaneous rate of fishing. The calculation of a catch rate or catch per unit effort requires both catch or landings data and some metric of nominal effort, such as net length and soak time. Unlike nominal fishing effort, effective fishing effort is a means to account for variability in the efficiency of fish capture, such as differences in fisher skill or technological differences among vessels (e.g. engine size, vessel length, etc.) or fleets (from McCluskey and Lewison, 2008).

51. Measures of fishing effort may also be dependent on, or independent of the type of fishing gear used. Gear-dependent measures are specific to the type of fishing gear used, e.g. number of hooks set, trawl tow duration, while gear-independent measures apply generally to all types of fishing gear, e.g. number of days fished, number of fishing trips. In addition, some measures may apply to aggregated data (e.g. number of sets made) while other measures apply to dis-aggregated (e.g. per set or per haul) data (e.g. longline soak time).

52. Measures of nominal fishing effort are generally reported in fishery statistics including STATLANT questionnaires. CWP has identified two measures of fishing effort, number of days fished and number of days on the fishing ground, which are gear-independent and apply across all fisheries. These measures are defined as follows:

    - Number of days fished: the number of days on which fishing took place, including the number of days in which searching occurred but no fishing took place

    - Number of days on the fishing ground: total number of days a vessel was on the fishing ground including days fishing and searching[8].

53. Other general measures of nominal fishing effort include the number of fishing vessels, number of fishing trips, searching time, number of fishing gear units and number of fishing operations.

54. The detailed measures of effort, such as those in Appendix 1, are also reported as nominal effort in fishery statistics and the STATLANT questionnaires. These measures of effort may also be standardised as effective fishing effort and used in fishery analyses including stock assessment and resource management.

55. The STATLANT system of questionnaires provides for the reporting of fishing effort statistics at three main levels of precision as follows:

    - Category A refers to a detailed unit of measure, e.g. hours fished or number of sets, etc. These units of measure will vary with the gear used (refer Appendix 1)

    - Category B refers to the number of days fished, i.e. the number of days on which fishing took place. For those fisheries in which searching is a substantial part of the fishing

[8] TG-effort noted that the number of days on the fishing ground may also include non-fishing days such as when a vessel is heaved too, at anchor or transhipping.

operation, days in which searching occurred, but no fishing took place should be included in the number of days fished.

- Category C refers to the number of days on the fishing ground in addition to days fishing and searching; here all other days while the vessel was on the fishing ground should be indicated.

56. The t-RFMO workshop (FAO, 2019b) proposed combining the three categories A, B and C above into a single comprehensive list of fishing effort measures which would include the number of days fished (B) and number of days on the fishing ground C).

57. TG-effort task (TOR 2): Consider measures of nominal and standard effort and their use in informing STATLANT questionnaires. Also consider the t-RFMO workshop proposal to combine the three categories A, B and C above into a single comprehensive list of fishing effort measures.

[TG-effort may consider this matter further in the intersession period to CWP-27. In addition, consideration by TG-RH2 of fishing activity information may inform some of the work of TG-effort and planned consultation between these TGs will provide an opportunity to elaborate fishing effort concepts such as fishing trip, fishing activity, and fishing operation.]

6. Further development of fishing effort measures

58. Standard measures of fishing effort by gear categories were initially developed by the CWP (e.g. FAO, 1977) and subsequently expanded by others (notably FAO, 1999) (Appendix 1). This work included five priority levels for the collection of effort measures for use in fishery statistics. Further revision and development of fishing effort measures was proposed at the t-RFMO workshop (FAO, 2019b), including consideration of measures applicable to the fishing modes for purse seine (free-school/ unassociated and associated). The proposal from the t-RFMO workshop is in Appendix 2 and includes priority levels which are 'recommended' or 'alternate'.

59. Based on these considerations TG-effort proposes a composite list of standard measures of fishing effort by ISSCFG gear categories and fishing modes which is presented in Appendix 3. This list includes the initial work of CWP (FAO, 1977), further development by FAO (1999) and Halls et al. (2005) and the t-RFMO proposal (FAO, 2019b). The levels of priority for collecting (and reporting) the effort measures are also indicated using five levels of priority: priority 1 indicates the recommended measure for each fishing gear, and priorities 2-5 indicate alternate measures. Halls et al (2005) and the t-RFMO workshop also proposed measures of effort for sport and recreational fishing and while sport and recreational fishing gears are not explicitly mentioned in ISSCFG, they are included under each of the gear categories (e.g. handlines and hand-operated pole-and-lines, trolling lines, cast nets). Fishing gears commonly used in sport and recreational fishing are listed in Appendix 4.

60. TG-effort also reviewed and further developed the definitions for the standard measures of fishing effort which are listed in Appendix 1 and were based on FAO (1999) and Halls et al (2005). Edits and additional definitions (shown in bold and strikethrough below) are proposed to facilitate the broader application of standard measures across all ISSCFG gear categories, fishing modes and fishery sectors. In doing so, consideration was given to any proposed change

to a measure and its definition which may have a consequential change to its intended application (e.g. Appendix 3) and the compilation of effort statistics.

6.1 Standard measures of fishing effort

61. Length of net set: **Length of net which has been set**, expressed in 100-metre units.

62. Number of casts **made**: Number of **instances** ~~times~~ the net ~~gear~~ has been cast **within a defined time period**, whether or not a catch was made.

63. Number of days absent from **base** ~~port~~: The number of days absent from **base (including a port)** on any one trip, **including** ~~should include~~ the day of **departure from base** ~~the fishing craft sailed~~ **and excluding** ~~but not~~ the day of **arrival back to base**. Where it is known that fishing took place on each day of the trip, the number of ~~"~~days absent from **base** ~~port"~~ should include ~~not only~~ the day of departure **and** ~~but~~ also the day of arrival back to **base** ~~port~~. Where on any trip a **fisher or** fishing vessel ~~craft~~ visits more than one ~~"~~fishing area~~"~~ (as defined for statistical purposes) an appropriate fraction of the total number of days absent from **base** ~~port~~ should be allocated to each ~~"~~fishing area~~"~~ in proportion to the number of days spent in each, so that the total number of days absent on the trip will be the sum of the number of days allocated to all of the different ~~"~~fishing areas~~"~~ visited.

64. Number of days fished: The number of days (24-hour periods, reckoned from midnight to midnight), on which any fishing took place, including days during which searching took place without fishing.

65. Number of days on ground: The number of days (24-hour periods, reckoned from midnight to midnight), in which a **fisher or** fishing ~~the~~ vessel was on the fishing ground, and includes ~~in addition to~~ the days fishing, ~~and~~ searching **and** ~~also~~ **all** ~~the~~ other days **when** ~~while~~ the **fisher or** vessel was on the ground.

66. Number of effort units - there are multiple definitions and meanings in Appendix 1 and these would be replaced by the following measure:

    Number of **gear units set** ~~effort units~~: **Number of fishing gear units set or deployed within a defined time period, whether or not a catch was made**.

67. Number of hours fished - there are multiple definitions and meanings in Appendix 1 and these would be replaced by the following measure:

    Number of hours fished: **Number of hours during which the gear was at its fishing depth and fishing, whether or not a catch was made**.

68. Number of hours since last fishing this FAD: Time **period since a particular** ~~in which~~ FAD (Fishing Attracting Device) is left in the water since it was last fished.

69. Number of gear-days ~~line days~~ fished: **Number of days (24-hour periods, reckoned from midnight to midnight) during which the gear was in the water multiplied by the number of gear units used within a defined time period** ~~Total number of line days in the given time period~~.

70. Number of gear-hours ~~line-hours~~ fished: Number of hours during which the **gear was** ~~lines were~~ in the water **multiplied** ~~times~~ **by the** number of **gear units** ~~lines~~ used **within a defined time period**.

71. Number of operations **made**: **Number of fishing operations made within a defined time period** ~~Those small scale gears including push net, scoop net, drive in net etc. Number of fishing operation,~~ whether or not a catch was made.

72. Number of poles used: **Number of poles used within a defined time period, whether or not a catch was made.**

73. Number of sets **made**: Number of **instances** ~~times~~ the gear has been set or **deployed** ~~shot~~, whether or not a catch was made.

74. Number of trips **made**: Any **trip** ~~voyage~~ during which fishing took place in only one ~~"~~fishing area~~"~~ **(as defined for statistical purposes)** is to be counted as one trip. When in a single trip **a fisher or fishing vessel** ~~craft~~ visits more than one ~~"~~fishing area~~"~~ an appropriate fraction of the trip~~s~~ should be apportioned to each ~~"~~fishing area~~"~~ in proportion to the number of days spent fishing in each, so that the total number of trips for the Statistical Area as a whole will be **equal to** ~~the same as~~ the sum of trips to each ~~"~~fishing area~~"~~.

75. Numbers of hooks set: Number of hooks **set** ~~fished~~ **within a defined** ~~in a given~~ time period, **whether or not a catch was made**.

76. Searching time: ~~This represents time~~ **A time period** on the fishing grounds ~~less~~ **excluding the** time spent ~~shooting net~~ **deploying the gear** and retrieving the catch **and any** ~~as well as~~ time **spent** hove to. ~~This measure is complicated by the use of aircraft spotting as well as by the dissemination of information from vessel to vessel. The measure is appropriate when school size and packing density are unrelated to stock abundance and a set is only made when a school has been located.~~

[TG-effort may consider this matter further in the intersession period to CWP-27.]

7. Development of new fishing effort measures for emerging technologies

77. While electro-optical (EO) visible imagery has been readily available from a growing number of sources since LandSat was launched in 1972 by NASA and NOAA and is well understood by most law enforcement and regulatory agencies, recent research in this area has focused on newer and emerging remote sensing technologies (Anon, 2021). Emerging technologies such as satellite-based Automatic Identification System (AIS), Visible Infrared Imaging Radiometer Suite (VIIRS), and Synthetic Aperture Radar systems (SAR) may provide opportunities to:

    - Validate or provide more informed measures of effort
    - Provide advanced technologies for minimizing vessel collisions (AIS, VMS)
    - Provide new technologies in addition to AIS and VMS, VIIRS for use in monitoring illegal, unregulated and unreported fishing activities (IUU)
    - Support the development and application of new measures of effort which may be integrated with existing measures defined by CWP.

78. For example, a pilot study by Taconet et al. (2019) demonstrated the use of AIS tracks from industrial fishing vessels to provide estimates of fishing activity and effort in near real time. A global database of AIS data from fishing vessels reported for 2017 indicated these data tracked the majority of the world's large fishing vessels (above 24m LOA) especially those from upper and middle-income countries and territories, distant water fleets and vessels operating on the high seas. AIS performed less well on smaller vessels as only a small fraction of vessels under 24m, which account for the vast majority of fishing vessels globally, used AIS. Of the 60000 vessels reported in the data, some 22000 vessels were matched to publicly available vessel registries. Classification algorithms performed well at classifying the most common fishing gears used among large vessels such as longlines, trawls and purse seines. The algorithms did less well at differentiating gears commonly used by small coastal vessels, such as set gillnets, trolling lines, pots and traps. Algorithms assigned only single gear categories which limited the ability to classify the type of fishing when vessels switched gears during, or between, fishing trips. Catch reconstruction generally indicated that areas with high catch also recorded high activity by vessels with AIS. The authors concluded that the study helped improve AIS methods and align AIS-based metrics with fishery statistical standards.

79. Other advanced technologies include exploring the potential of SAR and VIIRS to quantify the movements and activities of fishing vessels (e.g. Global Fishing Watch https://globalfishingwatch.org/our-technology/). SARs combines the technology of AIS and/or VMS with use of high resolution radar images. SAR is the most efficient instrument, which provides high-resolution data for wide ocean area surveillance under all weather conditions. The intrinsic capability of this instrument is to provide a quick view of the oceanic surface features such as vessels, waves and currents, oil spills, laver facilities and wind fields (Chaturvedi 2019). Stimson (1983) provided detailed background on SAR. Early use of SAR was noted as: (a) Sea and ice monitoring, (b) Oil pollution and environment monitoring, (c) Vessel monitoring and surveillance, (d) Snow and sea ice monitoring, (e) Classification of earth terrain, (f) Wave spectra and significant wave height measurements etc., and (g) Marine laver cultivation monitoring.

80. Previously, Krumme et al. (2013) and Al-Abdulrazzah and Pauly (2014) described the use of satellite images to enumerate fixed fishing gear. Krumme et al. (2015) extended that work further describing the use of SAR in combination with aerial photos to characterize artisanal fishing gear metrics providing added levels of resolution needed to quantify gear specific catchability. Specifically, these tools enabled researchers and managers to better monitor/track the spatial and temporal distribution of large tidal weirs in areas not routinely well sampled, in vast and remote areas of the Amazonia. This study also highlights the use of SAR in surveillance operations.

[TG-effort may consider this topic further in the intersession period to CWP-27, including adding AIS- SAR- and VIIRS- to the composite list of effort measures.]

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Appendix 1: Fishing effort measures by gear categories

From CWP-9 (FAO, 1977) with additions and edits (grey highlight) from FAO (1999) (also referred in Halls et al., 2005)

Fishing gear	Effort measure descriptor	Definition
First priority		
Surrounding nets (e.g. purse seines)	Number of sets	Number of times the gear has been set or shot, whether or not a catch was made. This measure is appropriate when school size and packing density is related to stock abundance or sets are made in a random manner.
Surrounding nets (e.g. purse seines)	Searching time	This represents time on the grounds less time spent shooting net and retrieving the catch as well as time hove to. This measure is complicated by the use of aircraft spotting as well as by the dissemination of information from vessel to vessel. The measure is appropriate when school size and packing density are unrelated to stock abundance and a set is only made when a school has been located.
Surrounding nets (e.g. purse seines) if fishing with Fish Attracting Device (FAD)	Number of hours since last fishing this FAD	Time in which FAD (Fishing Attracting Device) is left in the water since it was last fished.
Boat seines (Danish seine, etc.)	Number of hours fished	Number of hours during which the seine was on the bottom and fishing.
Beach seines	Number of sets	Number of times the gear has been set or shot, whether or not a catch was made.
Castnet	Number of casts	Number of times the gear has been cast, whether or not a catch was made.
Trawls	Number of hours fished	Number of hours during which the trawl was in the water (midwater trawl), or on the bottom (bottom trawl), and fishing.
Boat dredges	Number of hours fished	Number of hours during which the dredge was on the bottom and fishing.
Gillnets (set or drift)	Number of effort units	Length of nets expressed in 100-metre units multiplied by the number of sets made (= accumulated total length in metres of nets used in a given time period divided by 100).
Gillnets (fixed)	Number of effort units	Length of net expressed in 100-metre units multiplied by the number of times the net was cleared.
Lift net	Number of hours fished	Number of hours during which the net was in the water, whether or not a catch was made.
Traps (uncovered pound nets)	Number of effort units	Number of days fished times the number of units hauled.

Covered pots and fyke nets	Number of effort units	Number of lifts times the number of units (= total number of units fished in a given time period).
Longlines (set or drift)	Numbers of hooks	Number of hooks fished in a given time period.
Pole-and-line	Number of days fished	The number of days (24-hour periods, reckoned from midnight to midnight), on which any fishing took place, including days during which searching took place without fishing.
Rod-and-reel (recreational)	Number of line-hours	Number of hours during which the lines were in the water times number of lines used.
Troll	Number of line-days	Total number of line days in the given time period.
Jigs (hand and mechanical)	Number of line-days	Total number of line days in the given time period.
Other small-scale net gears	Number of operations	Those small scale gears including push net, scoop net, drive-in net etc. Number of fishing operations, whether or not a catch was made.
Other small-scale stationary gears	Number of hours fished	Those gears include guiding barriers, bag net, stow net, portable net, etc. Number of hours during which the gears were in the water for fishing, whether or not a catch was made.
Harpoons, spears etc.	Number of days fished	The number of days (24-hour periods, reckoned from midnight to midnight), on which any fishing took place, including days during which searching took place without fishing.
Second priority		
Boat seines (Danish seine, etc.)	Number of sets made	Number of times the gear has been set or shot, whether or not a catch was made.
Trawls	Number of sets made	Number of times the gear has been set or shot (either in mid-water or to the bottom), whether or not a catch was made.
Lift net	Number of hours fished	Number of times the net was set or shot in the water, whether or not a catch was made.
All gears	Number of days fished	The number of days (24-hour period, reckoned from midnight to midnight) on which any fishing took place. For those fisheries in which searching is a substantial part of the fishing operation, days in which searching but no fishing took place should be included in “days fished” data.
Third priority		
All gears	Number of days on	The number of days (24-hour periods, reckoned from midnight to midnight), in which

	ground	the vessel was on the fishing ground, and includes in addition to the days fishing and searching also all the other days while the vessel was on the ground.
Fourth priority		
All gears	Number of days absent from port	The number of days absent from port on any one trip should include the day the fishing craft sailed but not the day of landing. Where it is known that fishing took place on each day of the trip the number of "days absent from port" should include not only the day of departure but also the day of arrival back in port. Where on any trip a fishing craft visits more than one "fishing area" (as defined for statistical purposes) an appropriate fraction of the total number of days absent from port should be allocated to each "fishing area" in proportion to the number of days spent in each, so that the total number of days absent on the trip will be the sum of the number of days allocated to all of the different "fishing areas" visited.
Fifth priority		
All gears	Number of trips made	Any voyage during which fishing took place in only one "fishing area" is to be counted as one trip. When in a single trip a craft visits more than one "fishing area" an appropriate fraction of the trips should be apportioned to each "fishing area" in proportion to the number of days spent fishing in each, so that the total number of trips for the Statistical Area as a whole will be the same as the sum of trips to each "fishing area".

Appendix 2: Proposed standard list of required effort units for fishing gear.

From the technical workshop on global harmonization of tuna fisheries statistics (t-RFMO workshop) (FAO, 2019b)

Fishing gear	**Fishing mode**	**Potential CWP standard**		
		Recommended	**Alternate1**	**Alternate2**
Longline		Hooks		
Purse seine	All	Days fishing	Sets	Fishing/searching hours
Purse seine	Free school	Sets	Days fishing	Fishing/searching hours
Purse seine	Associated	Sets	Days fishing	
Pole-and-line		Days fishing	No. of poles used	Sets
Troll		Days fishing	No. lines set	
Handline		Days fishing	Hooks set	
Drift gillnet		Days fishing	Net length set	
Ring-net		Days fishing	Sets	Trips
Harpoon		Days fishing		
Recreational (sport)		Days fishing		
Trawl		Days fishing	Fishing hours	
Trap		Days fishing		

Appendix 3: Composite table of standard measures of fishing effort by ISSCFG gear categories and fishing mode

This table is based on measures of fishing effort by gear categories reported in Halls et al. (2005) and measures of fishing effort by gear categories and fishing mode proposed at the t-RFMO workshop (FAO, 2019b). The gear categories as those listed in ISSCFG (2016) (FAO, 2021b) and identified fishing modes are currently limited to purse seines (i.e free-school/ unassociated: fishing on schools not associated with floating objects; Associated: fishing on schools associated with floating objects).

Gear category (ISSCFG, 2016)	**Fishing mode**	**Effort measure descriptor**					**Source**
		Priority 1 (Recommended)	Priority 2	Priority 3	Priority 4	Priority 5	
SURROUNDING NETS		Number of sets	Number of hours fished	Number of days on ground	Number of days absent from port	Number of trips	Halls et al 2005
Purse seines	Free-school/unassociated	Number of sets	Number of days fished	Number of hours fished			t-RFMO workshop
Purse seines	Associated	Number of sets or Number of hours since last fishing this FAD (Halls et al 2005)	Number of days fished	Number of hours fished			t-RFMO workshop/ Halls et al 2005
Purse seines		Number of days fished	Number of sets	Number of hours fished			t-RFMO workshop
Surrounding nets without purse lines		Number of sets	Number of days fished	Number of days on ground			Halls et al 2005
Surrounding nets (nei)		Number of days fished	Number of sets	Number of days on ground			t-RFMO workshop/ Halls et al 2005

SEINE NETS		Number of sets	Number of days fished	Number of days on ground	Number of days absent from port	Number of trips	Halls et al 2005
Beach seines							
Boat seines		Number of hours fished	Number of sets				Halls et al 2005
Seine nets (nei)							
TRAWLS		Number of days fished or Number of sets (Halls et al 2005)	Number of hours fished	Number of days on ground	Number of days absent from port	Number of trips	t-RFMO workshop/ Halls et al 2005
Beam trawls							
Single boat bottom otter trawls							
Twin bottom otter trawls							
Multiple bottom otter trawls							
Bottom pair trawls							
Bottom trawls (nei)							
Single boat midwater otter trawls							
Midwater pair trawls							
Midwater trawls (nei)							
Semipelagic trawls							
Trawls (nei)							
DREDGES		Number of hours fished	Number of sets [consider including]	Number of days on ground	Number of days absent from port	Number of trips	Halls et al 2005
Towed dredges							
Hand dredges							

Mechanized dredges							
Dredges (nei)							
LIFT NETS		Number of days fished	Number of hours fished	Number of days on ground	Number of days absent from port	Number of trips	t-RFMO workshop/ Halls et al 2005
Portable lift nets							
Boat-operated lift nets							
Shore-operated stationary lift nets							
Lift nets (nei)							
FALLING GEAR		Number of casts	Number of days fished	Number of days on ground	Number of days absent from port	Number of trips	Halls et al 2005
Cast nets							
Cover pots/ Lantern nets							
Falling gear (nei)							
GILLNETS AND ENTANGLING NETS		Number of effort units	Number of days fished	Number of days on ground	Number of days absent from port	Number of trips	Halls et al 2005
Set gillnets (anchored)							
Drift gillnets		Number of days fished	Length of net set				t-RFMO workshop
Encircling gillnets							
Fixed gillnets (on stakes)							
Trammel nets							
Combined gillnets-							

trammel nets							
Gillnets and entangling nets (nei)							
TRAPS		Number of effort units or Number of hours fished	Number of days fished	Number of days on ground	Number of days absent from port	Number of trips	t-RFMO workshop/ Halls et al 2005
Stationary uncovered pound nets							
Pots							
Fyke nets							
Stow nets							
Barriers, fences, weirs, etc.							
Aerial traps							
Traps (nei)							
HOOKS AND LINES		Numbers of hooks set	Number of sets	Number of days on ground	Number of days absent from port	Number of trips	t-RFMO workshop/ Halls et al 2005
Handlines and hand-operated pole-and-lines	line						
	pole and line	Number of poles used					t-RFMO workshop
Mechanized lines and pole-and-lines	line						
	pole and line	Number of poles used					t-RFMO workshop
Set longlines							
Drifting longlines							
Longlines (nei)							
Vertical lines		Number of line-days	Number of days				Halls et al 2005

			fished				
Trolling lines							
Hooks and lines (nei)							
MISCELLANEOUS Gear		Number of operations	Number of days fished	Number of days on ground	Number of days absent from port	Number of trips	t-RFMO workshop/ Halls et al 2005
Harpoons							
Hand implements							
Pumps							
Electric fishing							
Pushnets							
Scoopnets							
Drive-in nets							
Diving							
Gear nei							
GEAR NOT KNOWN		Number of days on ground	Number of days absent from port	Number of trips			Halls et al 2005
Gear not known							
SPORT AND RECREATIONAL		Note: Sport and recreational fishing gears are not explicitly mentioned in ISSCFG, however they are included here for further consideration by TG-effort including whether these could be considered as 'fishing modes'.					
All gears		Number of days fished					t-RFMO workshop
Rod-and-reel		Number of line-hours	Number of days fished	Number angler trips			Halls et al 2005
Dive hours		Number of hours in water	Number da				NOAA, SEFSC, US Caribbean USVI l
Dive tanks		Number tanks used in					NOAA, SEFSC, US

		dive					Caribbean USVI logbook form

Appendix 4: ISSCFG gear categories commonly used in sport and recreational fishing and associated measures of fishing effort

This table lists the ISSCFG gear categories (Appendix 3) which are commonly used in sport and recreational fishing and associated measures of fishing effort. Examples are given with reference to sport and recreational fishing gear.

Gear category (ISSCFG, 2016)	**Examples of gear**	**Effort measure descriptor**		
		Priority 1 (Recommended)	Priority 2	Priority 3
ALL GEAR		Number of days fished	Number of hours fished	Number of trips
SEINE NETS				
Beach seines	Beach seine			
LIFT NETS				
Portable lift nets	Dilly net			
FALLING GEAR				
Cast nets	Throw net			
GILLNETS AND ENTANGLING NETS				
Set gillnets (anchored)	Gillnet			
TRAPS				
Stationary uncovered pound nets	Pound net			
Pots	Pot			
Fyke nets	Fyke net			
HOOKS AND LINES				
Handlines and hand-operated pole-and-lines	Handline, rod and reel	Number of line-hours	Number of days fished	Number angler trips
Vertical lines	Dropline			
Trolling lines	Trolling line			
MISCELLANEOUS Gear				
Harpoons	Spear			

Hand implements	Knife, rake			
Pumps	Bait pump			
Pushnets	Cockle net			
Scoopnets	Scoopnet			
Diving	Free diving, SCUBA	Number of hours in water, Number of tanks used in dive		