

WHAT IS A STOCK ASSESSMENT?

The term, *stock assessment*, is used to describe the processes of collecting and analyzing biological and statistical information to determine the effects of fishing on fish populations and to predict their future condition (NMFS 2001c; FAO Fisheries Glossary 2003). Stock assessments aim to provide fisheries managers with the best possible scientific information so they can calculate the volume of fish that can be harvested without depleting the stock for the following year's catch.

Conducting a stock assessment, however, is much harder than it may seem. Fisheries biologists and managers must predict not only how many fish there are in a particular stock, but their size; the juvenile recruitment rate (i.e., the numbers of juvenile fish that come into the population and develop to adults); how the particular target fish interact with other species; and how many can be fished at a safe level, while taking into account the impact of external environmental factors, such as currents, climate pattern changes, and so on. The task becomes even more complex when we look at the quality and sources of the data available to these managers.

Data availability drives the current use of stock assessment methods—ranging from expert judgment-based estimates to sophisticated statistical and mathematical models. Simpler models that do not take into account the size or age structure of the fish stock are less data-dependent and therefore more widely used. Unfortunately, these estimates tend to depend on the catch per unit of effort reported by fishers, which can sometimes lead to inaccurate assumptions about fish abundance, recruitment, etc., especially given the high level of misreporting and unreported catch (e.g., bycatch that is returned to the ocean and not landed is not reported).

More sophisticated models that incorporate age/size structure and recruitment rates require more data, such as information on the life history of the species, and the size and age composition of the stock. These data are often only available from research surveys and are therefore limited to a few fisheries. Age-structured models, however, are being applied to the management of many commercially important fisheries. For example, 40 percent of the U.S. commercial fish species managed by the National Marine Fisheries Service, including yellowfin tuna and Alaskan Pollock, use this sort of model (NRC 1998).

Most assessment methods, such as the ones described above, focus on a single species or stock at a time (i.e., single-species assessments). In reality, fish populations do not live in isolation, but interact with other species and share the same environment. These interactions affect the abundance of a particular stock depending on their role within the fish community or ecosystem. For instance, when competitors and predators are abundant, the natural mortality of the fish may be higher than usual. A single-species approach therefore may underestimate the natural mortality rate and may overestimate the stock biomass available for harvest. Single-species assessments also ignore the fact that we rarely catch one species at a time—even when the most selective fishing gears are used. This is particularly problematic in managing tropical fisheries, where most of the catch is multi-specific. Models that incorporate the prey-predator relationships of several species require massive data collection efforts, making them prohibitive for most tropical fisheries (Jennings et al. 2001).

Finally, relatively simple ecosystem models are also being considered to assess multi-species stocks. Rather than simulating precise species-to-species relationships, ecosystem models incorporate interactions among broader components within the food web. The data requirements for these models are relatively simple, and are generally available from stock assessments, ecological studies, or the literature. Although these models are promising and useful in ecological studies, their application to actual fisheries management is limited. Multispecies stock assessment in tropical waters is in its infancy, but the limitations of single-species approaches are well understood. The use and refinement of the multispecies approach, along with the relatively simple ecosystem models are expected to grow in the near term, making stock assessments more widely used in tropical fisheries.

ANNEX B

LIMITATION OF GLOBAL FISHERIES PRODUCTION, CAPTURE, AND TRADE STATISTICS

This report relies heavily on the Food and Agriculture Organization's (FAO) fisheries database and its published technical papers and reviews. Since 1950, FAO's mandate, as agreed by member parties, has been to monitor the exploitation and condition of the world's fishery resources, including capture fisheries, aquaculture, trade in fish and fishery products, fish consumption, fishing fleets, and level of employment in the fishing sector. Current information on fisheries and the people who depend on them is far from complete, however, and the general availability of fisheries data has not really improved in the last two decades (FAO 2002b). This annex provides an overview of the quality and limitations of the existing fisheries data.

How Does FAO Compile Its Fisheries Statistics?

Fish production data includes information on capture fisheries and aquaculture, production of processed fishery commodities, the size and type of the fishing fleet, and the number of people employed in the sector. These figures are provided annually—although some countries always report with a 1–2 year delay—to the FAO Fisheries Department by national fishery offices, regional fishery commissions, and national statistical offices.

The level of detail and accuracy of the information varies from country to country. Once the data has been received by FAO, it must be incorporated into a single database. This is already a major challenge because each country uses its own definitions and data collection protocols which must all be standardized according to international classification schemes in order to ensure that the collected statistics are comparable across countries. If no data are submitted, FAO uses previous year's figures or makes estimates based on other relevant information from regional fishery organizations, project documents, industry magazines, or from statistical interpolations. On occasion, FAO will question a country's reported estimates if it seems to differ from FAO's estimates and knowledge of the fish resources.

Annual production data are then organized by approximately 1,300 "species items"—species groups separated at the family, genus, or species level—by country of capture, and location of the capture. The location of the capture refers to FAO's designated 27 major fishing areas (19 marine and 8 inland) that divide the world oceans and inland water bodies into geographic units. The production data are also divided into marine capture, inland water capture, and aquaculture.

While there are many limitations to the FAO's fisheries data, as expressed below, its database on fishery resources is still the most comprehensive at the global level. The FAO Fisheries Department staff should also be credited for the level of effort that they have consistently invested into improving the database itself, its usability and its access for the general public. Some areas that still need strengthening, and that FAO is addressing, are small-scale fisheries, inland fishery resources, fleet size and type, and employment statistics in the fishing sector.

What Are the Main Limitations of FAO's Capture Fisheries Statistics?

Catch and Landings are not Identified at the Species Level

A major limitation of the production statistics, especially in tropical multi-species fisheries and inland fisheries is the lack of proper identification of the catch at the species level. Except in the North Atlantic and the Northeast and Southeast Pacific, only 50 to 70 percent of the catch in the rest of the world is reported by species (Caddy and Garibaldi 2000). For the Indian Ocean and the West Central Pacific, only 20–35 percent of landings and harvests are reported by species—the rest being included in higher taxonomic categories or as unidentified mixed fish (Caddy and Garibaldi 2000). FAO has also noted that as large stocks are depleted and fisheries diversify into a number of smaller stocks, the percentage of "unidentified fish" is increasing (FAO 2002b).

This lack of species-level reporting is even more critical in inland fisheries where nearly 45 percent of all the catch is reported as "freshwater fish not elsewhere included (nei)" (FAO 1999a). This makes assessments of inland fisheries particularly difficult. The large diversity of freshwater fauna that support fishery is not represented in FAO statistics; although there are 11,500 identified species of freshwater fish, the FAO lists only 100 of these species or species groups in its catch statistics categories (FAO 1999a). In Asia, the region with the largest inland fisheries production, up to 80 percent of the landings can be reported as "freshwater fish nei" (FAO 1995c).

Lack of Monitoring Capacity

The quality of the fisheries data varies because many countries lack the resources to adequately monitor landings within their borders. To record the catch landed by every single fisher or fishing boat that participates in a fishery is almost impossible. Therefore, only a proportion of the total landings are recorded and used to extrapolate to the rest of the fishery.

Again, inland fisheries are even harder to monitor because they are usually dispersed over large areas, which makes data collection difficult and very expensive. National reporting offices, particularly in developing countries, are poorly funded and justifying expensive data collection is increasingly difficult, adding to the underreporting problem (FAO 1999a).

In addition, fishers sometimes underreport their catch for a variety of reasons: for example, they have not kept within harvest limits established to manage the fishery, or the catch comes from IUU vessels. In other cases, production estimates are inflated by district or regional level administrations to increase the apparent importance of their fishing industry to the national economy. China is a perfect example where overestimation of catch has occurred: during the 1990s China consistently overestimated production statistics until 1998, when a policy of zero growth for capture fisheries was declared by the Chinese authorities (Watson and Pauly 2001).

Port sampling, log books, on-board data input systems, and observer records are also used to monitor catch data, fishing location, and fishing effort. On-board data collection system and satellite tracking can be used for larger vessels (Jennings et al. 2001), however, the cost of such data collection systems can be prohibitive for fisheries that involve a large number of small vessels or for many developing countries where the resources are limited.

Another area for which there is practically no monitoring or recording is for the level of bycatch and discards at sea. Monitoring bycatch and discards would require a much larger presence of observers on fishing vessels, something that many countries cannot afford. Some policies to reduce discards, such as Norway's discard ban, are making it easier to estimate bycatch, but this is still a drop in the bucket at the global level.

The Small-scale Sector is Overlooked

Subsistence and small-scale fisheries constitute a crucial information gap in the FAO fisheries production database as well as in national statistics because they are often overlooked in data collection efforts. Inland water fisheries statistics are notoriously poor because much of the inland fish catch comes from subsistence and recreational fisheries.

For instance, none of the countries in the Mekong River basin (Cambodia, China, Laos, Thailand, and Vietnam) derive their inland capture statistics from actual measurements or direct observation, but from estimates based on indirect methods (Coates 2002). And because much of the subsistence catch is consumed locally, products do not always enter the

market and therefore landings are not recorded at ports or by vendors (FAO 1995c). This situation is so prevalent in many developing countries that recent evaluations carried out by the FAO show that actual catches are probably twice as large—and in some countries, three times as large—as the reported landings (FAO 1999a). Finally, data collection on recreational fisheries and fishery enhancements, especially stocking and introduction programs, are also missing from many data collection protocols.

Trade Data: Even More Limitations

Trade data on fish and fishery products may be the most problematic of all the fisheries data. FAO's import and export trade statistics are obtained primarily from reports provided to them by member countries. Data for non-reporting countries are estimated using published national reports, information from industry associations, and other relevant material, including the economic returns of major trading partners. As in the production statistics, the quality of these data varies depending on each country's ability to collect and compile such statistics. FAO evaluates data accuracy and completeness whenever possible, using industry and commodities reports, and communicates with the countries when data are questionable.

However, the mechanisms of international trade are not straightforward. Fish can be harvested by one vessel in one region and landed and sold at a foreign port, or off-loaded to another vessel at sea, and landed at a third country. These are considered exports and imports, but a number of countries do not categorize these transactions as foreign trade, or even keep track of them. All information on illegal fishing that is traded in this way is excluded from the FAO database, even though the rate of illegal activities is high for some species.

Because fish are perishable, most of the products are traded as processed items, such as fillets or canned products. When products are traded in this way, species identification is often dropped or renamed with a more general term such as "frozen white fish fillet". Information on where this fish was produced, whether it was wild or farmed, country of origin, and country of processing, may be completely lost by the time the product reaches the supermarket shelf. Improved catch documentation and product labeling are beginning to be implemented in some countries for some fishery products; however, this is still the exception rather than the norm. Progress in documenting the fisheries trade is becoming increasingly important as countries try to combat illegal, unreported, and unregulated fishing.

REGIONAL FISHERIES BODIES

Regional Fisheries Bodies (RFBs) are divided into 3 broad categories, depending on their key mandates: management bodies (M) that directly establish management measures for fish stocks, including catch quotas; advisory bodies (A) that provide members with scientific and management advice; and scientific bodies (S) that provide scientific and information advice. The following table lists the FAO and non-FAO RFBs, the year each body was established or entered into force, their role (Management, Advisory, or Scientific), where their headquarters are located, and how each body has adapted to, or is implementing the three most pressing contemporary fishing agreements: the Compliance Agreement, the UN Fish Stocks Agreement, and the FAO Code of Conduct. This table has been adapted in part from FAO (1999e) and it indicates if the particular agreement is being implemented, under consideration or discussion, or not considered by each of the RFBs. A (—) indicates that the information is not available. Other information presented in this Annex is from Lugten (1999) and FAO (2004).

FAO Regional Fisheries Bodies

Name

| |
|---|
| Asia-Pacific Fishery Commission (APFIC) |
| Commission for the Inland Fisheries of Latin America (COPESCAL) |
| Committee for Inland Fisheries of Africa (CIFA) |
| Coordinating Working Party on Fishery Statistics (CWP) |
| European Inland Fisheries Advisory Commission (EIFAC) |
| Fishery Committee for the Eastern Central Atlantic (CECAF) |
| General Fisheries Commission for the Mediterranean (GFCM) |
| Indian Ocean Tuna Commission (IOTC) |
| Regional Commission for Fisheries (RECOFI) |
| Western Central Atlantic Fishery Commission (WECAFC) |

Non-FAO Regional Fisheries Bodies

Name

| |
|---|
| Advisory Committee on Fisheries Research (ACFR) |
| Atlantic Africa Fisheries Conference (AAFC) |
| Bay of Bengal Programme Inter-Governmental Organization (BOBP-IGO) |
| Comisión Permanente del Pacífico Sur (CPPS) |
| Comisión Técnica Mixta del Frente Marítimo (COFREMAR) |
| Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) |
| Commission for the Conservation of Southern Bluefin Tuna (CCSBT) |
| Forum Fisheries Agency (FFA) |
| Inter-American Tropical Tuna Commission (IATTC) |
| International Baltic Sea Fishery Commission (IBSFC) |
| International Commission for the Conservation of Atlantic Tunas (ICCAT) |
| International Council for the Exploration of the Sea (ICES) |
| International Pacific Halibut Commission (IPHC) |
| International Whaling Commission (IWC) |
| Lake Victoria Fisheries Organization (LVFO) |
| Mekong River Commission (MRC) |
| Network of Aquaculture Centers in Asia-Pacific (NACA) |
| North Atlantic Marine Mammal Commission (NAMMCO) |
| North Atlantic Salmon Conservation Organization (NASCO) |
| North Pacific Marine Science Organization (PICES) |
| Northwest Atlantic Fisheries Organization (NAFO) |
| Organización Latinoamericana de Desarrollo Pesquero (OLDEPESCA) |
| Pacific Salmon Commission (PSC) |
| Regional Fisheries Committee for the Gulf of Guinea (COREP) |
| Secretariat of the Pacific Community (SPC) |
| South East Atlantic Fisheries Organisation (SEAFO) |
| Southeast Asian Fisheries Development Center (SEAFDEC) |
| Sub-Regional Commission on Fisheries (SRCF) |
| The North Pacific Anadromous Fish Commission (NPAFC) |
| The North-East Atlantic Fisheries Commission (NEAFC) |
| Western Indian Ocean Tuna Organization (WIOTO) |

| Year Established | Main Role | Headquarters | Compliance Agreement | UN Fish Stocks Agreement | Code of Conduct |
|------------------|-----------|----------------------|----------------------|--------------------------|------------------|
| 1948 | A | Bangkok, Thailand | Under Discussion | Implemented | Not Considered |
| 1976 | A | Santiago, Chile | — | — | — |
| 1971 | A | Accra, Ghana | — | — | — |
| 1959 | S | Rome, Italy | Not Applicable | Not Applicable | Not Applicable |
| 1957 | A | Rome, Italy | — | — | — |
| 1967 | A | Accra, Ghana | Under Discussion | Under Discussion | Under Discussion |
| 1949 | M | Rome, Italy | Not Considered | Not Considered | Under discussion |
| 1993 | M | Victoria, Seychelles | Under Discussion | Implemented | Under Discussion |
| 1999 | A | Dokki, Egypt | — | — | — |
| 1973 | A | Barbados | Under Discussion | Under Discussion | Implemented |

| Year Established | Main Role | Headquarters | Compliance Agreement | UN Fish Stocks Agreement | Code of Conduct |
|-------------------|-----------|----------------------|----------------------|--------------------------|------------------|
| 1993 | S | Rome, Italy | — | — | — |
| 1995 | A | Rabat, Morocco | — | — | — |
| 2003 | A | Tamil Nadu, India | — | — | — |
| 1952 | A | Guayaquil, Ecuador | Not Considered | Under Discussion | Under Discussion |
| — | A | Montevideo, Uruguay | — | — | — |
| 1982 | M | Tasmania, Australia | Implemented | Implemented | Under Discussion |
| 1994 | M | Deakin, Australia | Under Discussion | Implemented | Implemented |
| 1979 | A | Honiara, Solomon Is. | Under Discussion | Under Discussion | Under Discussion |
| 1950 | M | California, USA | Under Discussion | Implemented | Under Discussion |
| 1973 | M | Warsaw, Poland | Not Applicable | Not Applicable | Implemented |
| 1969 | M | Madrid, Spain | Implemented | Implemented | Under Discussion |
| 1964 | S | Copenhagen, Denmark | Not Applicable | Not Applicable | Under Discussion |
| 1923 | M | Seattle, USA | Not Applicable | Under Discussion | Under Discussion |
| 1946 | M | Cambridge, UK | Under Discussion | Implemented | Under Discussion |
| 1994 | A | Jinja, Uganda | — | — | — |
| 1995 | A | Phnom Penh, Cambodia | — | — | — |
| — | S | — | Not Applicable | Not Applicable | Not Applicable |
| 1992 | A | Tromsø, Norway | — | — | — |
| 1983 | M | Edinburgh, UK | Under Discussion | Not Applicable | Under Discussion |
| 1992 | S | Br. Columbia, Canada | — | — | — |
| 1949 ¹ | M | Nova Scotia, Canada | Under Discussion | Under Discussion | Under Discussion |
| 1982 | A | Lima, Peru | Under Discussion | Under Discussion | Under Discussion |
| 1985 | M | Vancouver, Canada | — | — | — |
| 1984 | A | Libreville, Gabon | Under Discussion | Under Discussion | Under Discussion |
| — | S | — | Under Discussion | Under Discussion | Under Discussion |
| 2001 | M | Windhoek, Namibia | — | — | — |
| 1967 | A | Bangkok, Thailand | — | — | — |
| 1985 | A | Dakar, Senegal | — | — | — |
| 1992 | M | Vancouver, Canada | Not Considered | Not Applicable | Not Applicable |
| 1982 | M | London, UK | Under Discussion | Implemented | Implemented |
| 1994 | A | Victoria, Seychelles | — | — | — |

¹ Prior to 1979 it was the International Commission of the Northwest Atlantic Fisheries.

Note: The Indian Ocean Fishery Commission (IOFC) established in 1967 was dissolved in February 1999 by the FAO Council (Resolution 1/16).

LIST OF ACRONYMS

- ADB:** Asian Development Bank
CBD: Convention on Biological Diversity
CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources
CCSBT: Commission for the Conservation of Southern Bluefin Tuna
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNROP: National Oceanographic and Fisheries Research Centre of Mauritania
COP: Conference of the Parties (for a given Convention)
CSIRO: Commonwealth Scientific and Industrial Research Organisation of Australia
DFO: Department of Fisheries and Oceans Canada
DWF: Distant Water Fleet
EC: European Commission
EEZ: Exclusive Economic Zone
EU: European Union
FAO: Food and Agriculture Organization of the United Nations
FOC: Flag of Convenience
GATT: General Agreement on Tariffs and Trade
GEF: Global Environment Facility
GESAMP: Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GIS: Geographic Information System
IATTC: Inter-American Tropical Tuna Commission
ICCAT: The International Commission for the Conservation of Atlantic Tunas
ICES: International Council for the Exploration of the Seas
ICJ: International Court of Justice
ICLARM: WorldFish Center
IDAF: Programme for the Integrated Development of Artisanal Fisheries in West Africa
IFREMER: French Research Institute for Exploitation of the Sea
IOTC: Indian Ocean Tuna Commission
ISSCAAP: International Standard Statistical Classification of Aquatic Animals and Plants
ITQ: Individual Transferable Quota
IUCN: The World Conservation Union
IUU: Illegal, Unreported, and Unregulated fishing
IWC: International Whaling Commission
JMAFF: Japanese Ministry of Agriculture, Forestry, and Fisheries
LVEMP: Lake Victoria Environmental Management Project
MAC: Marine Aquarium Council
MARPOL: International Convention for the Prevention of Pollution from Ships
MHLC: Multilateral High Level Conference on the Convention and Management of Highly Migratory Fish Stock in the Western and Central Pacific
MPA: Marine Protected Area
MRC: Mekong River Commission
MSC: Marine Stewardship Council
MSY: Maximum Sustainable Yield
NACA: Network of Aquaculture Centres in Asia Pacific
NAFO: International Commission for the Northwest Atlantic Fisheries
NEAFC: North-East Atlantic Fisheries Commission
NGO: Non-Governmental Organization
NMFS: US National Marine Fisheries Service
NOAA: US National Oceanic and Atmospheric Administration
NPAFC: Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean
NRC: US National Research Council
OECD: Organisation for Economic Co-operation and Development
OPRT: Organization for Promotion of Responsible Tuna Fisheries
PBFAR: Philippines Bureau of Fisheries and Aquatic Resources
SEAFDEC: Southeast Asian Fisheries Development Center
SERNAPESCA: National Fisheries Service of Chile
SPC: Secretariat of the Pacific Commission
TAC: Total allowable catch
TED: Turtle Exclusion Device
UNCLOS: United Nations Convention on the Law of the Sea
UNEP: United Nations Environment Programme
USGS: United States Geological Survey
USTR: United States Trade Representative
VMS: Vessel Monitoring System
WCPOC: Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
WRI: World Resources Institute
WSSD: World Summit on Sustainable Development
WTO: World Trade Organization

GLOSSARY

Active gear

Active gear usually involves a vessel towing a net or dredge in pursuit of target species, while passive gear is set statically to trap or entangle the target species that move toward or into them.

Anadromous fish

Fish that spend their adult life in the sea but swim upriver to freshwater spawning grounds in order to reproduce.

Aquaculture

The farming of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants with some sort of intervention in the rearing process to enhance production.

Artisanal fisheries

Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively low technology and small fishing vessels (if any) and making short fishing trips close to shore.

Beach seine

A light-weight, encircling net deployed parallel to the shore and then drawn in to the beach by long ropes attached to the wingends of the net.

Beam trawl

A bottom trawl that is kept open laterally by a rigid beam.

Benthic

Refers to the bottom of water bodies, such as the sea floor.

Biodiversity

The variability among living organisms from all sources including, among others, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and ecosystems.

Biomass

The total weight of a group (or stock) of living organisms (e.g. fish, plankton) or of some defined fraction of it (e.g. spawners), in an area, at a particular time.

Bottom trawl

A trawl net that is towed across the sea floor rather than through a water column. They are also referred to as demersal trawls and include both beam trawls and otter trawls.

Brackish waters

Water bodies with a salinity intermediate between seawater and freshwater, usually showing wide salinity fluctuations.

Bycatch

Fish and other animals besides the primary target species that are caught incidental to the capture of the primary target species. Bycatch may be retained or discarded.

Capture fishery

The sum (or range) of all fishing activities on a given resource. It may refer to the activities of a single type of fishing, such as location, the target species, and the technology used.

Catadromous fish

Fish that spawn in seawater but feed and spend most of their life in estuarine or fresh water.

Catch

(1) Any activity that results in killing any fish or bringing any live fish onboard a vessel. (2) The total number (or weight) of fish caught by fishing operations. Catches that are not landed are called discards.

Catch controls—see output controls

Catch per unit effort (CPUE)

Catch per unit of fishing effort. The total catch divided by the total amount of effort used to capture the fish. For example, CPUE can be expressed as weight of fish captured per fishing trip, per hour spent at sea, or number of fish taken per 1,000 hooks per day.

Cephalopods

Invertebrate animals (molluscs) with tentacles converging at the head, around the mouth (e.g., squids, cuttlefish, and octopus).

Cetaceans

Marine mammals of the order Cetacea. Includes whales, dolphins, and porpoises.

Closed season

A period during which fishing for a particular species, often within a specified area, is prohibited.

Coastal waters

Areas of ocean that extend from the shore to the outer edge of the continental shelf, or to a depth of 200 meters.

Collapsed fish stock

Prolonged lack of annual recruitment of juvenile fish due to excessive fishing pressure that leads to the reduction of stock abundance to levels at which production is negligible compared to historical levels.

Co-management

A process of management in which government shares power with resource users, with each given specific rights and responsibilities relating to information and decision-making.

Common property resource

A term that indicates a resource owned by the public. It can be fish in public waters, trees on public land, and the air.

Continental shelf

The part of the continental margin which is between the shoreline and the shelf break or, where there is no noticeable slope, usually to a water depth of between 100 and 200 meters.

Crustaceans

Invertebrate animals in the group Crustacea, which includes crabs, lobsters, and shrimp.

Demersal fish

Fish that live and depend on the bottom of a water body, marine or freshwater, during their adult life (e.g., groupers, cods). They are often referred to as ground fish.

Depleted stock

A fish stock where a high proportion of one or all age classes of individuals are harvested because of excessive fishing pressure that leads to a reduction in the spawning stock, limiting the natural reproduction or annual recruitment levels.

Diadromous

Fish that spend part of their life in freshwater and part in saltwater; e.g., anadromous salmon and catadromous eels.

Discards

Fish and other animals that are disposed of, usually at sea, after being caught.

Distant water fleet

Fishing fleet that operates far outside of the Exclusive Economic Zone of the home country.

Dredges

Gear dragged along the bottom, usually to collect molluscs such as mussels, oysters, scallops, and clams, that live either on the surface of the seabed or within the sediment down to depths of 100 cm.

Drift nets

Curtains or sheets of netting that hang vertically in the water, either at the surface or lower in the water column.

Effort control

A system of fishery management that focuses on limiting the quantity of fishing gear or the duration of its deployment rather than on limiting the quantity of catch that can be taken. (See also TAC and quota.)

Endangered—see threatened

Endemic

A natural or naturalized population that is normally found in a particular area.

Eutrophic

Water bodies or habitats with high concentrations of nutrients, particularly phosphorus and nitrogen. Excessive nutrient enrichment may result in the depletion of dissolved oxygen and eventually to species mortality and replacements.

Exclusive Economic Zone (EEZ)

A zone of water up to 200 nautical miles from the boundary of a coastal State declared in line with the provisions of the 1982 United Nations Convention on the Law of the Sea, within which the coastal State has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources.

Exploited stock

Any stock of fish that is subject to commercial fishing activity.

Fish stock

Scientifically, a population of a species of fish that is isolated from other stocks of the same species and does not interbreed with them and can, therefore, be managed independently of other stocks.

Fishing effort

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, number of hooks set per day, or number of hauls of a beach seine per day. At its most basic, it is the total number of boats engaged in a fishery and/or the number of days they were fishing.

Fixed gear

Any fishing gear that is anchored or attached in some other way to the seabed so that it does not drift or move while it is in fishing mode, e.g., crab pots, and bottom set gill nets .

Flag of convenience (FOC)

The term pertains to cases where a boat is registered in a different country than that of ownership, for reasons of convenience.

Fully fished stock

A stock is considered to be fully fished when increases in fishing effort do not significantly increase the yields, but substantially increase the risk of overfishing. These stocks are said to be exploited at their biological limit—an upper limit of the stock biomass which marks a threshold that, if surpassed, causes a substantial decline in recruitment.

Ghost fishing

The continued capture of animals by fishing gear that has been lost or abandoned at sea. Such gear can continue to capture fish until it is retrieved, destroyed (by time and weather), or otherwise ceases to function, e.g., from being weighed down with weed, debris, and/or cadavers.

Gill nets

Gill nets and entangling nets are strings of single, double, or triple vertical netting walls, placed near to the surface, in midwater, or on the bottom of the water column in which fish will entangle or enmesh themselves.

Groundfish

A species or group of fish that live most of their life on or near the sea bottom. See also demersal fish.

Habitat

Particular ‘living space’ or environment in which an animal or plant lives, eats, and breeds.

High grading

A profit-driven practice that involves discarding smaller fish of the target species to make room in the fish hold for larger, more valuable fish caught later in the day.

High seas

High seas is a legal term used to describe the areas of water outside of a country’s EEZ.

Highly migratory species or stocks

Species or stocks that carry out extensive migrations through out the oceans, usually crossing territorial boundaries such as EEZs and between EEZs and the high seas. This term is usually used to describe tuna and tuna-like species such as marlins, and swordfish.

Illegal, unreported, and unregulated fishing (IUU fishing)

A wide range of fishing practices and activities that: do not respect applicable laws and regulations, or the standards set forth by international agreements; have not been reported, or have been misreported to the relevant authority; or for which there are no applicable conservation or management measures.

Incidental catch—see bycatch.

Individual quotas

An individual quota is the maximum amount of fish that an individual can catch, where ‘individual’ may be a person or a legal entity. A catch quota is the maximum amount of fish that can be caught in a certain period.

Individual transferable quota (ITQ)

A type of quota management system that typically entails the allocation of a part of the Total Allowable Catch to individual fishermen or vessel owners. The quota, once distributed, can be sold to others.

Input control—see effort control

Introduced species

Any species that occurs outside its normal geographic range as a direct or indirect result of human activity and one that has not been found to occur naturally in the area within historic time.

Juvenile

A young animal that has not reached sexual maturity.

Keystone species

A predator at the top of a food web, or discrete sub-web, capable of consuming organisms of more than one trophic level beneath it.

Landings

The number or weight of fish unloaded at a dock by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the locations where fish are brought to shore.

Limited entry

A program that restricts the participation of individuals in a fishery, virtually changing a common property resource into private property for individual fishermen. License limitation and the individual transferable quota (ITQ) are two forms of limited entry.

Longline

A type of fishing gear consisting of a mainline with evenly spaced baited hooks, which is kept near the surface of the water or at a certain depth by means of regularly spaced floats.

Mangrove forest

A shoreline ecosystem dominated by mangrove trees, with associated mud flats.

Marine protected area (MPA)

An area of seabed and the water above it that has some level of legal protection from exploitation. The level of protection varies depending on its purposes and many allow limited fishing and other extractive uses, as well as recreational activities.

Marine reserve

A marine protected area that is semi-permanently protected from all forms of resource exploitation and direct destructive activities. Also referred to as a “no-take zone” or a “marine sanctuary.”

Maximum sustainable yield (MSY)

The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions, without significantly affecting the reproduction capacity of the stock.

Minimum landing size

The smallest size at which it is legal to retain a fish or offer it for sale.

Minimum mesh size

The smallest size of mesh that can be used legally in any given type of net.

Molluscs

A group of freshwater and saltwater animals with no skeleton and usually one or two hard shells made of calcium carbonate. Includes the oyster, clam, mussel, snail, conch, scallop, squid, and octopus.

Nautical mile

Unit of distance equivalent to 1 minute latitude of the great circle of earth (=1852 meters or 1.1508 miles).

Open access

The condition where access to the fishery is unrestricted. The right to catch fish is free and open to all.

Open ocean

Waters above the sea bottom that extend beyond the edge of the continental shelf, or are deeper than 200 meters.

Output controls

The management measures that limit the weight of catch fishers can take. These options include the Total Allowable Catch (TAC), and individual quotas (IQ) which permit each fisher to take a percentage of TAC for a certain species during the fishing season.

Overfished stock

A fish stock is considered to be overfished when it is exploited beyond an explicit limit considered “too low” to ensure safe reproduction. A stock may remain overfished (i.e., with a biomass well below the agreed limit) for some time even though fishing pressure might be reduced or suppressed, because it takes time for the fish population to recover.

Overfishing

The action of exerting fishing pressure beyond an agreed optimum level that allows for replenishment of the fish stock through natural reproduction.

Pelagic fish

Fish that spend most of their life swimming in the water column with little contact with, or dependency on, the sea or lake bottom. They often travel and feed in large groups or schools. Common pelagic fish include anchovies, sardines, and tuna.

Predator

A species that feeds on other species. The species being eaten is the prey.

Quota

Amount of catch allocated to a fishing license.

Recreational fishery

Harvesting fish for personal use, fun, and challenge. Recreational fishing does not include sale of catch.

Recruitment

A measure of the number of fish that enter a class—such as the spawning class or fishing-size class—during some time period.

Sashimi

Japanese term for a dish with sliced fish and shellfish served and consumed in raw form.

Sea ranching

In general, sea ranching (or sea farming) is the practice of raising wild-caught juvenile fish within controlled boundaries in the open ocean, where they grow using natural food supplies or formulated feed. Once the fish reach a certain size they are harvested, and production is therefore reflected in aquaculture figures, instead of capture statistics. Sea ranching is a form of aquaculture, and the term is many times used interchangeably with stocking of marine fish stocks.

Shellfish

General term for crustaceans and molluscs.

Species

A population or a group of animals or plants having common characteristics, able to breed together to produce fertile offspring, and reproductively isolated from all other populations.

Species richness

The number of species in an area or biological collection.

Stock enhancements

A range of practices carried out to enhance or increase the size or growth of the fishery resource. Enhancements can consist of releasing juveniles raised in hatcheries or captured elsewhere in the wild, into a sea, lake, or river for subsequent fishing when they have reached a larger size. Other enhancement practices involve the introduction of new or non-native species to an aquatic system, where it reproduces and grows using natural food supplies.

Stocking

The practice of putting artificially reared young fish into a sea, lake, or river. These are subsequently caught, preferably at a larger size.

Straddling stocks

Any stock that migrates regularly across one or more international jurisdictional boundaries, such as EEZs.

Surrounding nets

Large netting walls set for surrounding groups or schools of fish, both from the sides and from underneath. An example of this type is the purse seine, which is used to target pelagic species such as anchovies, tuna, and mackerel.

Threatened

A species, stock, or population is considered threatened if it is facing a high risk of extinction in the wild in the near future. According to IUCN-The World Conservation Union, species with a *Red List* status of Critically Endangered, Endangered, and Vulnerable are all considered to be threatened with extinction.

Total Allowable Catch (TAC)

The annual recommended catch for a species or species group. Usually a regional council or similar administrative body sets the TAC based on the range of the allowable biological catch.

Trawl

A large, funnel-shaped net that is towed through the water by single or paired boats.

Trolling

A method of hook-and-line fishing where the lines with baits or lures are dragged by a vessel. It is used to catch surface swimming pelagic species such as mackerel and tuna.

Trophic level

Classification of natural communities or organisms according to their place in the food chain.

Undersize fish

Any fish that is less than the legal minimum landing size.