Indicator	
23	Fish stocks and fish landings
Measurement	
23.1	State of the main fish stocks by species and sea areas

What should the measurement tell us?

EU policies and in particular the Common Fisheries Policy (CFP), aim for sustainable fishing over a long period through appropriate stock assessment within a healthy ecosystem.

This indicator relates to the catches of a number of stocks that have been assessed to be outside safe biological limits. In general terms, it is considered that a stock is within safe biological limits if its current biomass is above the value corresponding to a precautionary approach advocated by the International Council for the Exploration of the Sea (ICES). Further details on the way ICES formulates advice in precautionary terms can be obtained from the ICES website.

Stock assessment generally aims to estimate the current stock size and its potential for an increase in size. These results can be used to predict future stock sizes based on a range of possible management measures. In the simplest case, all the fish in the stock are assumed to be the same so sex, size, maturity and other species are ignored.

In general, a stock becomes over-fished when mortality from fishing and other causes exceeds recruitment and growth. An indication of the sustainability of fisheries in a particular area is the ratio of the number of over-fished stocks (those that are outside safe biological limits) to the total number of commercial stocks. A high value of this ratio identifies areas under heavy pressure from fishing.

Parameters	
(i)	Percentage of the number of over-fished stocks and stocks fished within the safe biological limits to the total number of commercial stocks per fishing area.
(ii)	Numbers of commercial, exploited and over-fished stocks by fishing area

Coverage	
Spatial	**Temporal**
European fishing areas	From 2001 onwards.

Data sources

The data needed are the stocks of fish by species and by European fishing area.

FAO's Fisheries Department prepares and publishes Fishery Country Profiles (FCP). Each FCP summarises the Department's assessment of activities and trends in fisheries and aquaculture for the country concerned. The FCP can be consulted at:

http://www.fao.org/fi/fcp/fcp.asp

For each country, information on general fisheries topics can be consulted at this website. The main fisheries institutions of the country are also listed. From that information, it is easy to know which institutes of fishing investigation/administration can be contacted in order to obtain the data and to acquire information on data holders for this measurement.

The International Council for the Exploration of the Sea (ICES) (https://www.ices.dk) is the organisation that co-ordinates and promotes marine research in the North Atlantic. ICES holds data cover the fishing areas of the North East Atlantic which are managed autonomously or jointly by the EU as well as adjacent seas such as the Baltic Sea and North Sea. They include catches by third-party countries in these areas. Arctic stocks managed by Norway or Russia are excluded.

Stock assessment is based on data collected by scientists. Its results are expressed in terms of mid to long-term trends of recruitment, spawning stock biomass, landings and fishing mortality. For the last 15 years, EU effort has been focused on scientific surveys carried out on a yearly basis along with routine market sampling programmes. Data on catches are collected annually by ICES.

ICES acts as a meeting point for a community of more than 1600 marine scientists from 20 countries around the North Atlantic. ICES plans and co-ordinates marine research through a system of committees, more than 100 working groups, symposia and its Annual Science Conference.

The 20 member countries of ICES are: Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, the United Kingdom and the United States of America.

The Commission, DG FISH, receives information on a regular basis. Information is made available to the public and EEA uses it to produce indicators. Both temporal and spatial data sets are available. Monitoring activities are based on scientific surveys rather than commercial catches leading to low values of SSB estimates and, therefore, biased exploitation patterns (ICES, 2001).

Data must be obtained by contacting the Working Groups Stock Assessments. The names and addresses of national offices can be consulted in: https://www.ices.dk/fish/Snatoff.htm

Other regional projects of the FAO, where information on the management of stocks and data holders can be obtained, can be found at:

GFCM
General fisheries commission for the Mediterranean
http://www.fao.org/fi/body/rfb/GFCM/gfcm_home.htm

IBSFC
The International Baltic Sea Fishery Commission
www.fao.org/fi/body/rfb/IBSFC/ibsfc_mapandmem.htm

ADRIAMED
Scientific Co-operation to Support Responsible Fisheries in the Adriatic Sea.
http://www.faoadriamed.org/

COPEMED
Advice, Technical Support and Establishment of Co-operation Networks to Facilitate Co-ordination to Support Fisheries Management in the Western and Central Mediterranean: http://www.faocopemed.org

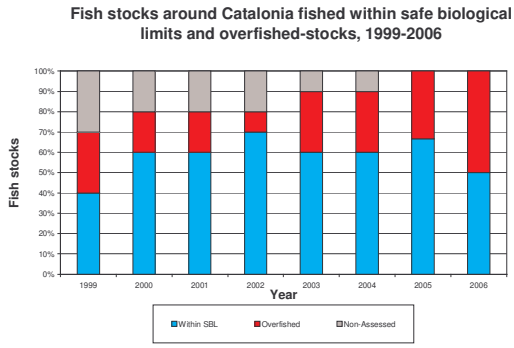
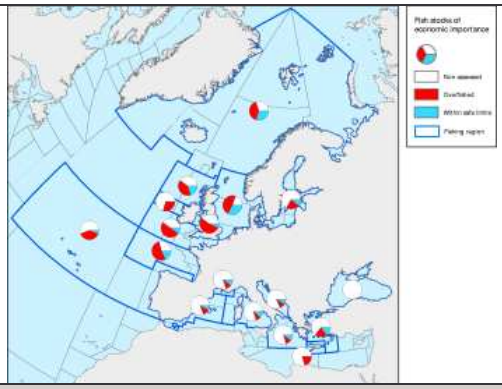
ICCAT
Commission for the Conservation of Atlantic Tunas is an inter-governmental fishery organisation responsible for the conservation of tuna and tuna-like species in the Atlantic Ocean and its adjacent seas: http://www.iccat.es/

MedSudMed
Assessment and Monitoring of the Fishery Resources and the Ecosystems in the Straits of Sicily: http://www.faomedsudmed.org/

Methodology		
	Steps	**Products**
1	Identify and delimit the fishing area related to the fisheries in your regional or national coverage.	Spatial coverage delimitation.
2	After contacting the data holder of your region/country and making the necessary recompilation of information on stock management in your region/country, select a set of commercial stock for which data and temporal coverage is easily available.	Set of fish stocks selected for their importance to commercial fisheries and their data availability.
The next steps must be calculated for each year from 2001 onwards.		
3	Obtain the total number of commercial stocks per fishing area and assign one of the next categories to each stock - over-fished, safe and non-assessed stocks.	Number and status category of commercial stocks per fishing area.
4	Adding the overfished to the safe stocks, obtain the number of assessed stocks.	Number of assessed stocks.
5	Obtain the number of non-assessed stocks.	Number of non-assessed stocks
6	Obtain the percentage of non-assessed/stocks of economic importance.	Percentage of non-assessed/stocks of economic importance.
7	Obtain and represent the percentage of over-fished/stocks of economic importance.	Percentage of over-fished/stocks of economic importance. (Graph 1)
8	Obtain and represent the percentage of safe/stocks of economic importance.	Percentage of safe/stocks of economic importance. (Graph 1)

9	From the percentages of safe, non-assessed and over-fished stocks by fishing area develop a map representing the data you've analysed.	Numbers of commercial, exploited and over-fished stocks by fishing area (Map 1)

Presentation of the data

Graph 1	Bar chart showing percentage of the number of over-fished stocks and stocks fished within the safe biological limits compared to the total number of commercial stocks per year and fishing area.	
Map 1	Map showing the percentages of safe, non-assessed and over-fished stocks by fishing area.	

Adding value to the data

In general, a stock becomes over-fished when mortality from fishing and other causes exceeds recruitment and growth. A fairly reliable picture of stock development can be derived by comparing trends over time in recruitment, spawning stock biomass, landings and fish mortality. Hence not only is the quantity of fish taken from the sea important but also their species and size as well as the techniques used to catch them.

Aggregation and disaggregation

Notes

Stock assessment = scientific assessment of the status of commercial stocks
Commercial stocks = the stocks of economic importance on which the fishing effort is focused in each area aiming at a profit, i.e. a subset of exploited stocks. It is a broader term encompassing target species, by-catches and industrial species that are of economic importance to the market.
Over-fished stocks = stocks outside safe biological limits
Safe stocks = stocks inside safe biological limits
Non-assessed stocks = stocks for which no assessment has been carried out

Stock assessment methodologies

The number of fish in an ocean, sea, lake or river at any time depends upon the previous number of fish together with those factors that caused it to change. The changes can be attributed to natural and fishing mortality, recruitment, immigration and emigration. A stock is so defined as to exclude immigration and emigration (i.e. a self-contained fish population).

Models of recruitment and natural mortality need to be assumed, while fishing mortality can be estimated using catch data. A number of the indicators on stock size are used to define the state of a stock and the controls necessary to conserve it. For example, replacement yield is the estimated current population growth, such that if that quantity of fish is caught there will be no overall change in the population size; it can be used to set overall quotas. Current fishing mortality can be estimated relative to that which would obtain the maximum sustainable yield, which could be used to set a limit to fleet expansion. Similar combinations of indices and reference points can be used to set limits on effort, numbers of licences and other controls relevant to management objectives.

Variables and sources

To estimate stock size requires a time series of the total catches (including discards) and an index of stock size. The time series should ideally be complete since the start of the fishery.

Even if data are incomplete, the total catches will have to be present or estimated for the entire period as these are used in the population model and provide proxy estimates for resource potential and variability. They are a measure of the impact the fishery has had on the stock.

CPUE is often used as the main indicator of stock size. The catch and effort series need not be complete over the life of the fishery but the more catch and effort data there are, the better the assessment will be. This is because CPUE is used as an index to link observations to the underlying fish population model, rather than an integral part of the population model itself.

An alternative indicator of stock size is obtained from scientific surveys of biomass (e.g. trawls or acoustic surveys). Scientific surveys are independent of the fishery and so avoid many of the problems of bias which occur with CPUE indices. However, they tend to be expensive and therefore little data may be available. Combining the results of scientific surveys and CPUE of the commercial fishery is often the best course.

As stock size is strongly affected by annual recruitment, recruitment indices, provided by regular egg, larvae or juvenile surveys or an environmental index (such as rainfall or upwelling strength), may be necessary. Stock can be estimated either as numbers of fish or as biomass (the numbers of fish multiplied by their mean weight). If catches are only measured as weight, assessment methods based on numbers of fish will require the mean fish weight. In many cases it will be necessary to identify individual stocks (self-contained fish populations) for stock assessments. While this can be done using special research projects, routinely collected biological data including samples of meristic characters, parasites, blood samples, number of vertebrae or spawning season will help separate one stock from another.

Catch and effort variables are available from vessel activity and landings data. Recruitment indices may be collected through fishing surveys, larval collectors or may be obtained from outside sources.

Other scientific data would be collected on sample surveys undertaken by the responsible scientific institute or agency.