

Chapter 30

The status determination process

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30.1 Legislation and policy

Fisheries Management Act 1991

The *Fishery status reports* assess the performance of Commonwealth fisheries against the objectives of the *Fisheries Management Act 1991* (FM Act, part 1, section 3); in particular:

- a. ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development (which include the exercise of the precautionary principle), in particular the need to have regard to the impact of fishing activities on non-target species and the long term sustainability of the marine environment; and
- b. maximising the net economic returns [NER] to the Australian community from the management of Australian fisheries; and
- c. ensuring accountability to the fishing industry and to the Australian community in AFMA's [Australian Fisheries Management Authority's] management of fisheries resources.

Commonwealth Fisheries Harvest Strategy Policy

The Commonwealth Fisheries Harvest Strategy Policy (HSP; Department of Agriculture and Water Resources 2018b) supports the implementation of the objectives of the FM Act. The objective of the HSP is the ecologically sustainable and profitable use of Australia's Commonwealth commercial fisheries resources (where ecological sustainability takes priority) – through the implementation of harvest strategies.

To pursue this objective, the Australian Government will implement harvest strategies that:

- ensure that exploitation of fisheries resources and related activities are conducted in a manner consistent with the principles of ecologically sustainable development, including the exercise of the precautionary principle
- maximise NER to the Australian community from management of Australian fisheries – always in the context of maintaining commercial fish stocks at sustainable levels

- maintain key commercial fish stocks, on average, at the required target biomass to produce maximum economic yield (MEY) from the fishery
- maintain all commercial fish stocks, including byproduct, above a biomass limit, below which the risk to the stock is regarded as unacceptable (B_{LIM}), at least 90% of the time
- ensure that fishing is conducted in a manner that does not lead to overfishing; where overfishing of a stock is identified, action will be taken immediately to cease overfishing
- minimise discarding of commercial species as much as possible
- are consistent with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Guidelines for the ecologically sustainable management of fisheries* (Department of the Environment and Water Resources 2007).

Guidelines aimed at providing practical assistance in the development of harvest strategies that meet the intent of the updated HSP were also released in 2018 (Department of Agriculture and Water Resources 2018d).

30.2 Assessing biological status

Fish stock definitions

Where feasible, status is reported for the biological stock, defined as a discrete population of a species that is typically reproductively isolated in space or time from other populations of the same species, resulting in detectable genetic, biological or morphological differences in fish from different populations. Fishing is assumed to affect the entire stock, but not adjacent stocks. This independence between populations of the same species means that separate assessments and management arrangements are often required for each, and is why status is reported separately for each defined stock. The true structure and boundaries of biological stocks are often not well understood, or a stock may straddle the jurisdictional boundaries of several management agencies. In such circumstances, the stock may be treated as a series of convenient geographic components or 'management units' that are managed separately by different jurisdictions or as separate fisheries. *Fishery status reports* aims to report on all designated units of management in Commonwealth fisheries; as a result, some stocks in this report are not discrete biological stocks of a single species, and some stocks are multispecies or 'basket' stocks.

Reference points and indicators

Two independent aspects of stock status are classified within these reports: the stock's biomass level and its fishing mortality status (Table 30.1). In cases where reference points or estimates of current biomass or fishing mortality have not been determined, other indicators are used to inform stock status. The HSP defines target and limit reference points for Commonwealth fisheries in terms of biomass (B_{TARG} and B_{LIM} , respectively) and fishing mortality (F_{TARG} and F_{LIM} , respectively).

The guidelines to the HSP allow flexibility for B_{lim} to be determined relative to spawning biomass, exploitable biomass or total biomass. This flexibility allows for reference points to be consistent with the types of data available for stock assessments – for example, stock assessments that rely mainly on catch-per-unit-effort (CPUE) estimate depletion levels related to the exploitable biomass. Alternatively, stock assessments that use catch-age analysis with auxiliary biological information allow estimates of depletion levels related to spawning biomass and overall biomass. As a result, status determination in this publication may not necessarily refer to the same portion of the biomass.

In terms of **biomass status**, stocks are classified as one of the following:

- not overfished, where the biomass is above B_{lim} and at a level where recruitment is unlikely to be significantly impaired. This indicates that the biomass is at a level sufficient to ensure that the risk to future levels of recruitment is not excessive (that is, the stock is not recruitment overfished)
- overfished, where the biomass is below B_{lim} and at a level where recruitment is likely to be significantly impaired. The B_{lim} threshold reflects the point at which the risk to future levels of recruitment is unacceptable
- uncertain, where there is inadequate information to determine the state of a stock's biomass and the risk to future recruitment.

In terms of **fishing mortality**, stocks are classified as one of the following:

- not subject to overfishing, where the fishing mortality does not exceed the limit reference point (F_{lim}). In this case, the stock is not subject to a level of fishing mortality that would move the stock to an overfished state
- subject to overfishing, where the fishing mortality exceeds F_{lim} . The stock is subject to a level of fishing that would move the stock to an overfished state or prevent it from rebuilding to a not overfished state
- uncertain, where there is inadequate information to determine whether the level of fishing mortality represents overfishing.

Some regional fisheries management organisations (RFMOs) define reference points differently from those in the HSP. For jointly managed stocks, ABARES determines stock status using the limit reference points described in the HSP, and considers the impacts of fishing mortality from all fleets on the stocks. Consequently, the status of some jointly managed stocks reported by RFMOs may differ from that reported by ABARES.

In situations where stock assessments do not provide the information to directly determine status in relation to the definitions above and those in Table 30.1, ABARES seek to meet the intent of the HSP using other information. Often, several indicators are used to assess the likely state of biomass or fishing mortality for a stock (weight of evidence). Occasionally, there will be conflicting indicators, leading to no clear picture of likely status. In this situation, an uncertain classification may be determined.

Stock status classification system

The classification system for stock status has been modified several times since the first *Fishery status reports* (1992). In 2004, the 'underfished' and 'fully fished' categories were replaced by a combined category of 'not overfished'. In addition, a distinction between biomass status and fishing mortality status was included. Before 2004, each stock was given a single status classification, based on the worst-case scenario. For example, if a stock was considered 'subject to overfishing', it was classified as 'overfished', and there was no separate determination of stock biomass status. Also, stocks were only classified as 'not overfished' if overfishing was not occurring. In 2007, this classification system was aligned with the reference points defined in the HSP (Table 30.1).

TABLE 30.1 Reference points for fishing mortality and biomass, with associated status implications in line with the HSP

		Fishing mortality rate (F)		
		F < F _{TARG} (fishing mortality is below the target)	F _{TARG} < F < F _{LIM} (fishing mortality is between the limit and the target)	F > F _{LIM} (fishing mortality is above the limit)
Biomass (B)	B ≥ B _{TARG} (biomass is greater than or equal to the target)	Not overfished Overfishing is not occurring	Not overfished Overfishing is not occurring	Not overfished Overfishing is occurring: note possible planned fish-down where overfishing would not be occurring
	B _{TARG} > B > B _{LIM} (biomass is between the limit and the target)	Not overfished: rebuild to B _{TARG} Overfishing is not occurring	Not overfished: rebuild to B _{TARG} Overfishing may not be occurring, provided that fishing mortality will allow rebuilding towards target	Not overfished: rebuild to B _{TARG} Overfishing is occurring
	B < B _{LIM} (biomass is below the limit)	Overfished: adopt and follow a rebuilding strategy to rebuild biomass above B _{LIM} within a required time frame Overfishing may not be occurring	Overfished: adopt and follow a rebuilding strategy to rebuild biomass above B _{LIM} within a required time frame Overfishing may not be occurring, provided that fishing mortality will allow rebuilding within a required time frame	Overfished: adopt a rebuilding strategy to rebuild biomass above B _{LIM} within a required time frame Overfishing is occurring: reduce fishing mortality

Note: Colours show how these reference points relate to stock status classifications used for each stock.

Fishing mortality
 Not subject to overfishing
 Subject to overfishing

Status determination framework

A weight-of-evidence decision-making framework for biological status determination was a key output of the Reducing Uncertainty in Stock Status project, undertaken from 2009 to 2012 (Larcombe, Noriega & Stobutzki 2015). Application of the framework requires the assembly of an evidence base to support status determination and is analogous to a review of fisheries indicators. The framework provides a structure for the assembly and review of indicators of biomass and fishing mortality status. The framework provides guidance on interpreting these indicators, and aims to provide a transparent and repeatable process for status determination. It requires a description of attributes of the stock and the fishery, documentation of lines of evidence for status, and presentation of the key information used to support the status classification. Expert judgement plays an important role in status determination, with an emphasis on documenting the key evidence and rationale for the decision. Separate decision-making processes are used to determine biomass and fishing mortality. This framework is relatively more important and more often applied in the absence of formal stock assessments.

30.3 Assessing economic status

The economic status of each Commonwealth fishery (excluding jointly managed Torres Strait fisheries) is determined by assessing management performance against the economic objective of the FM Act, which is to maximise NER to the Australian community from the management of Australian fisheries. Economic status is evaluated by assessing whether potential NER are being limited by prevailing management arrangements in the fishery. To do this, indicators are used to describe current economic trends in a fishery before assessing the drivers of those trends and the extent to which the fishery management arrangements are allowing NER to be maximised.

The economic status of Torres Strait fisheries is also evaluated. However, because these fisheries are managed under the *Torres Strait Fisheries Act 1984*, the HSP and its economic objective do not apply. Therefore, performance of these fisheries is assessed against fishery-specific objectives, as well as those of section 8 of the *Torres Strait Fisheries Act 1984*. These are:

- a. to acknowledge and protect the traditional way of life and livelihood of Traditional Inhabitants, including their rights in relation to traditional fishing
- b. to manage commercial fisheries for optimum utilisation
- c. to have regard, in developing and implementing licensing policy, to the desirability of promoting economic development in the Torres Strait area and employment opportunities for Traditional Inhabitants.

Key economic trends

Goody and Galeano (2003) describe a useful set of indicators that can be used to monitor the economic performance of fisheries. Some of the most important indicators are described in this section.

NER are a major indicator of a fishery's economic performance, showing the difference between the revenue earned each year and the economic costs incurred in a fishery. These costs include fuel, crew, repairs, fishery management, depreciation, and the opportunity cost of capital and owner-operator labour. Any remaining return is attributed to the fishery resource itself. Maximising NER is about maximising this return to the resource. At zero NER fishers are generating a return on their capital and labour used in the fishery, but any returns attributed to the resource itself are lost.

Survey estimates of NER calculated by ABARES are available for some of the most valuable Commonwealth fisheries. For other fisheries, indicators of fishery revenue and costs are analysed to evaluate likely changes in NER. Although estimates of a fishery's gross value of production are readily available and provide an indicator of revenue, information on costs is more difficult to obtain. Measures of fishing effort and fuel prices are used for some fisheries to provide an indication of costs.

The level of unused fishing rights ('latency') is often used for data-poor fisheries and can provide an indication of NER. High latency suggests that the fishery is operating at or beyond its theoretical open-access equilibrium – at this point, average NER are zero.

Economic productivity measures support the interpretation of a fishery's trend in NER and its overall economic status. Productivity measures indicate how effectively a fishery's inputs (such as fuel, labour, capital and the fish stock) are converted into output (catch). An improvement in fishery productivity will generally be associated with an improvement in NER if fish stock levels are not being liquidated. Productivity analysis is a useful tool to assess any benefits arising from shifting management arrangements from input controls to output controls in the form of individual transferable quotas (ITQs).

Terms of trade is a measure of the price of outputs (fish) relative to the price of inputs. It is an important indicator that also helps with interpretation of NER, because it can help explain whether any change in NER is due to changes in the price of fishing inputs or outputs that are beyond the control of fishery management.

Management in pursuit of other FM Act objectives relating to sustainability, bycatch and the environment can affect NER of commercial operators. Whether these objectives have been met with the lowest possible cost is an important consideration for fishery managers. Costs include not only the management costs incurred in meeting these objectives, but also costs associated with any reduction in NER due to the arrangements.

Performance against economic objective

Assessing performance against the economic objective requires untangling the drivers of change in economic indicators and then assessing whether the current management arrangements are allowing the long-term NER to be maximised subject to market conditions.

The first step is required because NER can change for several reasons – some of which are within the control of fishery managers (for example, management arrangements) and some of which are not (for example, the price of fish). Interpreting trends in economic indicators without such an assessment may result in incorrect conclusions being drawn about management performance. For example, NER from a fishery may be increasing over time, but interpreting this requires ruling out that this is not due to liquidation of the fish stock to unsustainable levels. Similarly, NER may be increasing due to changes in the price of fish or inputs that are not controlled by fishery managers. These increases should not be attributed to improving management performance.

The second step requires assessing 3 key components of management arrangements to determine whether NER are being maximised. These are:

1. managing fish stocks to the level associated with MEY
2. management arrangements to allow fishers to maximise revenue and minimise costs for a given level of harvest
3. costs of fishery management.

Managing fish stock levels to MEY

The objective of the HSP is to have ecologically sustainable and profitable Commonwealth fisheries. To pursue this, harvest strategies are to maintain key commercial fish stocks, on average, at the biomass associated with MEY. Assessing whether harvest strategies have targets consistent with this is relatively straightforward for information-rich stocks that either have a B_{MEY} estimate from a bio-economic model or use proxies set out in the HSP. For information-poor stocks, this assessment becomes more subjective. If a fishery does not have harvest strategy targets, the evaluation focuses on how well the intent of the HSP is being met under the current harvest strategy. For example, whether the harvest strategy is likely to result in a profitable fishery in the long run.

Management arrangements to maximise fishing revenue and minimise costs

ITQs are the dominant form of output control used in Commonwealth fisheries – a stock's total allowable catch (TAC) is allocated to holders of ITQs. An advantage of ITQs is that, once fishers have been allocated a share of a TAC, the incentive to race to fish may be diminished and replaced with an incentive to maximise profit for their given catch allocation (Grafton 1996). By directly controlling catch, the need to restrict inputs (and operator efficiency) to indirectly limit catch is reduced, and operators are afforded greater flexibility to choose the most efficient mix of fishing inputs. The transferability of ITQs also means that quota can move to the most efficient fishers, improving overall economic performance of the fishery. However, ITQs may not always be appropriate due to the characteristics of the stock and the associated difficulty in setting annual TACs, or the value of the fishery may not justify the expense of setting up ITQs.

Costs of fishery management

Choosing the appropriate level of management services for a fishery – for example, how much information to gather or how complex the management arrangements are – will depend on the size and potential returns from a fishery. Ideally, the last dollar spent on gathering information or management services should generate an increase in NER of 1 dollar. However, given the difficulty in precisely estimating this, fishery managers should consider individual decisions in a benefit–cost framework and only implement management proposals when the expected benefits outweigh the costs. Simple indicators such as minimising the costs of management or minimising the ratio of the costs of fishery management to gross value of production may be of general interest, but are poor indicators of economic performance because they do not consider the incremental benefits and costs of the last dollar spent on fishery management to NER performance. For status determination purposes, detailed assessments are not conducted on the cost of fishery management, with commentary usually restricted to cases where a fishery has recently undergone a significant change in its management arrangements or the fishery is of relatively low value.

30.4 Assessing environmental status

The Australian Government's fisheries management objectives recognise the need to consider the broader effects of fishing on bycatch species (including species protected under the EPBC Act), marine habitats, communities and ecosystems. *Fishery status reports 2021* reports on key bycatch issues in each fishery and information from ecological risk assessments (ERAs) by AFMA.

Bycatch species

In 2018, the Department of Agriculture released the *Commonwealth fisheries bycatch policy* (Department of Agriculture and Water Resources 2018a). The bycatch policy aims to minimise fishing-related impacts on general bycatch species in a manner consistent with the principles of ecologically sustainable development, and with regard to the structure, productivity, function and biological diversity of the ecosystem. The bycatch policy advocates the use of bycatch strategies that will meet the objectives of the policy and was released with an associated set of guidelines – *Guidelines for the implementation of the Commonwealth fisheries bycatch policy* (Department of Agriculture and Water Resources 2018c).

Ecological risk assessment

In the early 2000s, AFMA and CSIRO, with funding from the Australian Government, initiated the development of ERAs to assess the impacts of fishing activities on ecological components of fisheries, such as target, bycatch and byproduct species; protected species; habitats; and communities. Broadly speaking, the ERA methodology is hierarchical, moving from a low-level, qualitative analysis of risks (level 1) to fully quantitative assessments of the level of fishing mortality (level 3) (Hobday et al. 2007). Low-risk activities and species are screened out at each step in this process.

The ERA methodology has evolved since its initial implementation and now focuses on aspects of the fishery that are not assessed in other ways (for example, through stock assessment). The AFMA website details each ERA. AFMA has developed an ecological risk management guide (AFMA 2017) that helps fishery managers to better implement ERA and ecological risk management across fisheries.

EPBC Act and its interactions with fisheries management

The EPBC Act is the key piece of national legislation for conserving the biodiversity of Australian ecosystems and protecting the natural environments that support these ecosystems. Commonwealth marine areas are 'matters of national significance' under the EPBC Act. The EPBC Act broadly requires that fishing activities do not have a significant negative impact on the Commonwealth marine environment and its biodiversity, including protected species and ecological communities. This is achieved through the requirement for all Commonwealth fisheries to undergo a strategic environmental assessment to determine the extent to which management arrangements will ensure that the fishery is managed in an ecologically sustainable way.

The strategic assessments determine whether a fishery should be accredited for the purposes of part 13 (protected species provisions) and part 13A (wildlife trade provisions) of the EPBC Act. Fisheries management also needs to consider the requirements of species recovery plans, wildlife conservation plans and threat abatement plans that are implemented under the EPBC Act. Accreditations and any attached conditions are reported for each fishery.

Protected species

If a species is protected under the EPBC Act (with the exception of those listed as conservation-dependent), it is an offence to kill, injure, take, trade, keep or move an individual unless the action is covered by a permit issued by the environment minister or is otherwise exempt. In the case of fisheries, interactions with protected species are not offences if they have occurred in a fishery with a fishery management plan or regime accredited under the EPBC Act. This recognises that some level of interaction may be inevitable, but that all reasonable steps should be taken to minimise interactions. Fishers are obliged to report any interactions with protected species, and it is an offence under the EPBC Act and the FM Act not to do so. Interactions with protected species are reported in the *Fishery status reports* for each fishery.

30.5 Presentation of fisheries data

Graphing

Data presented in *Fishery status reports 2021* were obtained from a number of sources. Most were obtained from AFMA daily fishing logs, AFMA catch disposal records, observer databases and the ABARES commodities database. Other sources include fishery-specific stock assessments, CSIRO, the Commission for the Conservation of Antarctic Marine Living Resources, public-domain catch-and-effort data from the Western and Central Pacific Fisheries Commission, the Indian Ocean Tuna Commission nominal catch database (public domain data), and databases of the Commission for the Conservation of Southern Bluefin Tuna and the South Pacific Regional Fisheries Management Organisation.

Mapping

Maps presented in the *Fishery status reports 2021* use data from a number of sources, including AFMA, the Australian Antarctic Division, Geoscience Australia, RFMOs, Esri, the Flanders Marine Institute and the Scientific Committee on Antarctic Research. Relative fishing intensity was mapped only where 5 or more vessels fished within a certain area, to conform with AFMA's information disclosure policy. Fishing intensity was mapped using the kernel density function in ArcGIS. A radius from each fishing operation point was set, with the distance depending on the extent and spacing of fishing operations. Gear type was also a consideration; a pelagic longline covers a much greater area than, for instance, a scallop dredge. The density function resulted in a smoothing and spreading of estimated fishing effort, and can result in the total area over which fishing operations take place appearing larger than it was. Where necessary, areas of fishing intensity were truncated to limit fishing to management areas.

Fishing intensity was usually mapped as effort, but, in some fisheries (for example, the Bass Strait Central Zone Scallop Fishery), it was mapped as catch. Three levels of fishing intensity are shown, arbitrarily classified as low, medium and high. As far as possible, the same range classes were used as in previous years. However, if there was a major shift in effort or catch, this may not have been possible. Fishing operations were mapped for the season being assessed or as shown on the map.

The maximum area of waters fished was mapped for most fisheries, except for those fisheries with a restricted range, such as the Torres Strait fisheries. The maximum area of waters fished was mapped at 111 km² (the equivalent of 1 degree of latitude squared) and does not show catch or fishing effort. This is also to conform with AFMA's information disclosure policy (AFMA 2010).

Fishery management area boundaries are shown for reference, but area closures are not shown. The 200 m isobath (bathymetric contour) is shown on all maps, where relevant. This approximates the edge of the continental shelf. Some place names, including ports, capes, islands and seas, have been included for reference and orientation.

In most cases, the maps are in the geographic coordinate system (that is, without being projected). All maps of domestic fisheries use the geocentric datum for Australia 1994 (GDA94).

30.6 References

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