

A background illustration of several stylized fish swimming in waves, rendered in a light blue color against a darker blue background. The fish are positioned in the upper half of the page, swimming towards the right.

# Queensland harvest strategy policy

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**Queensland  
Government**

Under the *Human Rights Act 2019* a decision maker has an obligation to act and make decisions in a way that is compatible with human rights, and when making a decision under this policy, to give proper consideration to human rights.

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# 1 Policy statement

This Harvest Strategy Policy (the policy) provides a framework that guides the development and implementation of harvest strategies for all Queensland fisheries that is consistent with contemporary best practice fisheries management principles, as well as principles of ecologically sustainable development. To address the complex multispecies, multi-sector and multi-gear nature of some Queensland fisheries, the policy provides important guidance to ensure that fisheries management measures are flexible and provide the certainty needed to balance the objectives of all stakeholder groups.

Queensland's fisheries harvest strategies, together with protected species and bycatch management strategies, will provide the basis for ensuring that all species are managed in a way that pursues the objectives of the *Fisheries Act 1994* (the Act).

## 2 Background and context

The Queensland Government outlined its commitment to adopt harvest strategies to manage Queensland's fisheries resources in the Sustainable Fisheries Strategy 2017-2027 (the Strategy). The Strategy identifies the following goals:

- Queensland's fisheries resources are managed in accordance with harvest strategies, with **all fisheries to have a harvest strategy by 2020**.
- By 2020, sustainable harvest or fishing limits will be set to achieve maximum sustainable yield or 40-50% biomass.
- By 2027, sustainable harvest or fishing limits will be set to achieve **maximum economic yield or 60% biomass**.
- Harvest strategies will set out fishery-specific **targets for fishery performance, triggers for action and clear decision rules for the actions that will be taken**.

### 2.1 What is a harvest strategy?

Harvest strategies provide a transparent decision-making framework for fisheries management, by Fisheries Queensland on behalf of the Queensland Government, to provide greater certainty for fishers, managers and other stakeholders. This avoids *ad hoc* decision making to changes in fishery or stock dynamics (Sloan *et al.*, 2014) or decision making through political, or media driven processes.

A national definition is provided by Sloan *et al.* (2014) -

A harvest strategy is a framework that specifies the pre-determined management actions in a fishery for defined species (at the stock or management unit level) necessary to achieve the agreed ecological, economic and/or social management objectives.

Harvest strategies in Queensland fit within a broader fisheries management context (see Figure 1). Harvest strategies will address the fishing activities by the commercial, recreational, charter and Indigenous (commercial) sectors. The Harvest Strategy Policy applies to the management of target, secondary and byproduct species.

The Act establishes harvest strategies as the framework under which Queensland's fisheries resources will be managed in the future. The Act outlines the respective roles of the Minister and the chief executive in the development, approval, and implementation of harvest strategies. The Fisheries (General) Regulation 2019, (Commercial Fisheries) Regulation 2019 (the Regulations) and the Fisheries Declaration 2019 implement fisheries regulation, including providing authorities to take fish, as well as input and output controls for fisheries. The Fisheries Declaration 2019 and Fisheries Quota Declaration 2019 will be the instruments used to implement catch limits for commercial fisheries and changes to in-possession limits or other management controls for recreational fishers (and the charter sector), in accordance with decision rules set out in the harvest strategy.

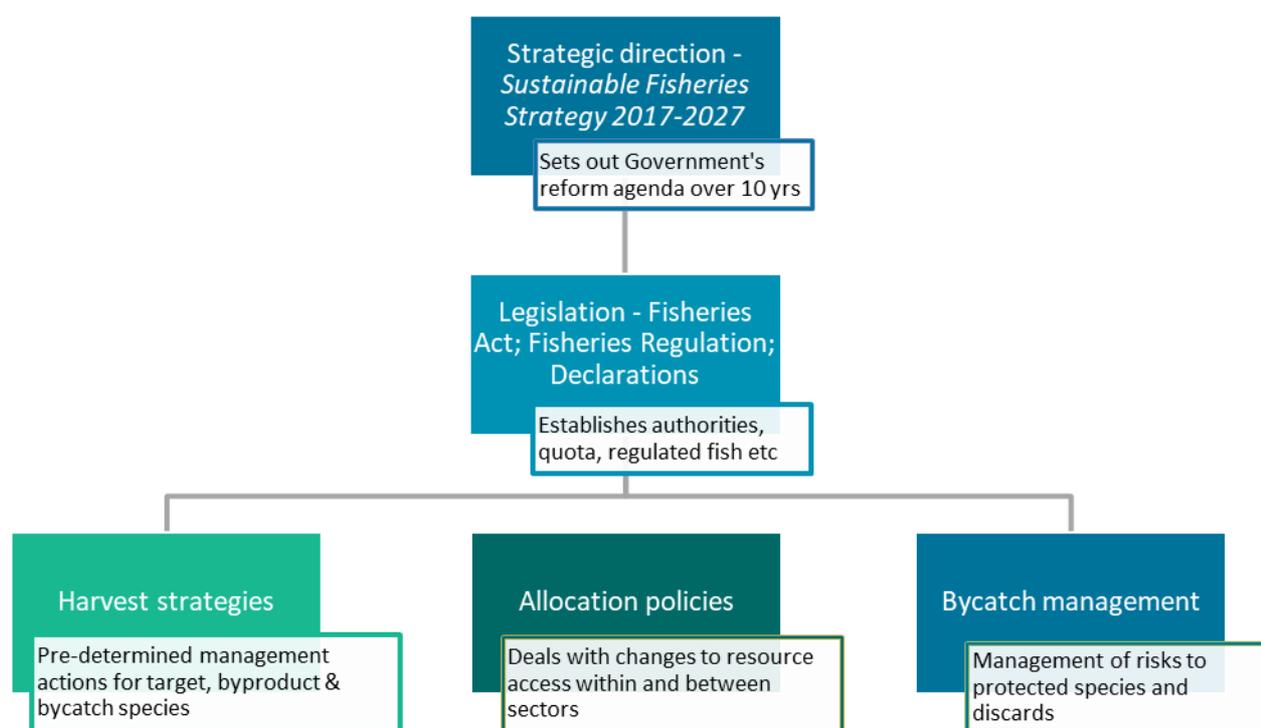


Figure 1: Fisheries management framework in Queensland

## 2.2 Elements covered in the harvest strategy policy

The policy ensures a consistent approach to defining harvest strategy elements:

1. Fishery specific **objectives**, including
  - primary fishery objectives framed around achieving a target biomass
  - other ecological, social and economic objectives that reflect the values of all stakeholders.
2. **Scope** of the harvest strategy, including
  - management units, which apply at the stock level, wherever possible
  - categorisation of fishery species into:
    - target species
    - secondary species
    - byproduct species

- management tiers, to provide added flexibility where a fishery consists of multiple management units or target species
  - setting decision rules.
3. Resource **allocation between sectors**, including:
- the harvest strategies aim to set and maintain resource allocations under changing management arrangements
  - initial resource allocations using the best available estimate of the current harvest for each sector
  - process to maintain average historic (or agreed) allocations when decision rules are applied
  - where necessary, a timeframe for review of sectoral catch shares
  - considering an appropriate initial Indigenous commercial allocation, which can be accessed under an Indigenous Fishing Permit (IFP).
4. **Monitoring** fishery performance, including:
- performance indicators related to sustainability, economic or social aspects of the fishery
    - ideally, unfished biomass, which is estimated using a stock assessment
    - alternatively, secondary indicators or proxies of stock abundance to monitor changes in the level of fishing mortality with reference to historical levels
  - Reference points for each indicator being used.

### 2.3 Out of scope

A harvest strategy is required to work within the existing management framework, data collection programs and assessment capabilities of a fishery. As a result, there are limitations on what issues harvest strategies can address. Fisheries Queensland also has a number of other policies and mechanisms that interact with harvest strategies. Consequently, in some situations, guidance should be provided by these specific policies, rather than through a harvest strategy.

A harvest strategy does not address the following issues.

#### **Regulatory changes to the management framework**

Regulatory changes may be required to the fisheries management framework to allow a harvest strategy to operate effectively, but the harvest strategy is not a vehicle for the regulatory change itself. The management tools or 'levers' applicable to each sector and fishery will differ. Where a fishery does not have a management framework in place to allow for a harvest strategy that responds to changes in stock abundance, it may require additional reform before an effective harvest strategy can be implemented. Some fisheries may need to be divided into more appropriate management units (e.g. by fish stock or region) to facilitate management arrangements at the appropriate scale. Regulatory changes may be needed to 'unitise' a fishery (e.g. formally allocating quota) to ensure that fishing mortality can be effectively managed.

### **Localised issues and conflict**

Harvest strategies are required to work within the existing monitoring, assessment, and management frameworks. As a result, they may not be able to deal with every issue arising in a fishery. For instance, most stakeholder conflict and concerns about localised depletion occurs at a scale finer than the stock level, so alternative management mechanisms may be needed to address such issues.

### **Resource re-allocation**

Transferring fishing access from one sector to another is considered to be resource reallocation and is not dealt with by harvest strategies. Any formal proposal for a permanent re-allocation through the reduction of fishing access by one sector in favour of other sectors is assessed according to the resource reallocation policy. Proposals could be from recreational fishers, commercial fishers, Indigenous communities, conservation interests, other industries or a government entity on behalf of the community's interests.

### **Managing bycatch and protected species interactions**

Harvest strategies are designed to manage target, secondary and byproduct species but not protected species. Fisheries Queensland may prepare separate Protected Species and Bycatch Management Strategies for a fishery to manage the risks of fishing where high risks to bycatch and protected species are identified.

### **Traditional or customary fishing rights**

The traditional fishing rights of Aboriginal peoples and Torres Strait Islanders are protected under native title legislation and relate to harvest for domestic, communal and non-commercial purposes. A harvest strategy may allocate a sustainable amount for commercial harvest by Aboriginal peoples and Torres Strait Islanders under an Indigenous fishing permit, which is distinct from traditional fishing activities.

## **3 Principles**

The following key principles guide this policy.

### **3.1 Consistency with relevant legislation and over-arching policy objectives**

Harvest strategies must be consistent with the objectives of the Act and comply with Part 2, Division 1 of the Act. Other relevant legislation and policy objectives should be identified and considered in developing harvest strategies for Queensland fisheries. For example, fisheries legislation, marine park legislation, *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) requirements or matters relevant to fisheries management in the Great Barrier Reef Marine Park.

### **3.2 Rely on best available information**

Harvest strategies for Queensland fisheries will use the best available information. While it may be desirable to obtain better information or establish an additional data source to use as the basis for a harvest strategy indicator, this should not be used as a reason to delay the development or implementation of a harvest strategy, or not make a decision under a harvest strategy.

### 3.3 Cost-effective and unambiguous

Queensland’s harvest strategies should be cost effective, clear and transparent. Where harvest strategies employ a complex or technical system of indicators and reference points, the development of a ‘plain English’ explanation of the harvest strategy and its relationship to the fishery may be required.

### 3.4 All fishery sectors harvest

While the primary focus of harvest strategies in Australia has been on commercial fisheries, they can also be used to inform and guide the management of other sectors, such as the recreational and charter fishing sectors. Therefore, a harvest strategy for Queensland fisheries should outline sustainable limits for all sectors involved in a fishery and establish decision rules to regulate fishing by all sectors.

### 3.5 Precautionary approach

Harvest strategies for Queensland fisheries should apply the precautionary principle (a key principle of ecologically sustainable development), in guiding how risk is managed and in the development of reference points, particularly when a high degree of uncertainty exists. This will help ensure fishing activities are consistent with ecological sustainability principles, prevent overexploitation and provide for recovery of depleting or depleted stocks within reasonable timeframes.

## 4 Process for developing harvest strategies

The process to develop and consult on developing harvest strategies is outlined in Figure 2.

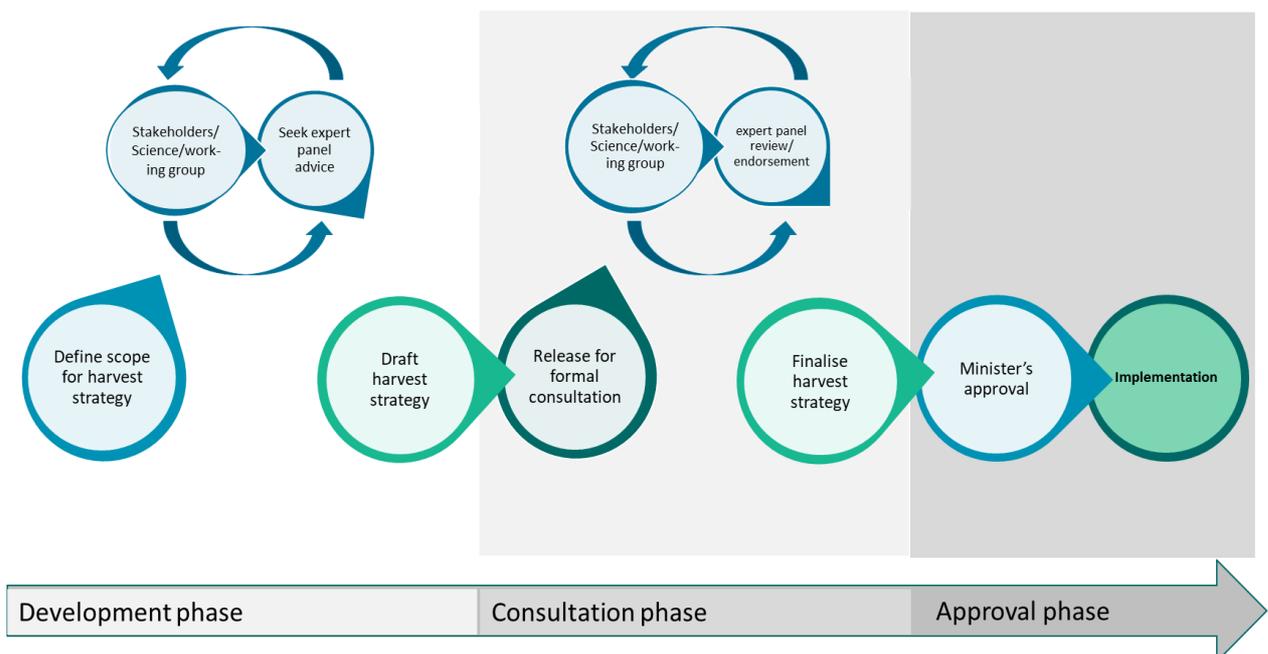


Figure 2: Broad outline of the process associated with implementing harvest strategies

## **4.1 Stakeholder input**

It is critical that all stakeholders have an opportunity to express their views and have early input in the development of a fishery harvest strategy. The aspirations of all sectors are critical to the successful development and implementation of the harvest strategy. Consequently, the relevant fishery working groups, dedicated stakeholder workshops, surveys or face-to-face meetings will be conducted to inform the development of a harvest strategy. Input from scientists in the development of a harvest strategy is critical to ensuring the outcomes are evidence-based and the performance of the harvest strategy can be evaluated.

Fishery working groups also have a role in reviewing draft harvest strategies and providing input at any stage prior to the finalisation of the harvest strategy for Ministerial approval.

## **4.2 Public consultation**

In accordance with the Act, a draft harvest strategy will be made available for public consultation for at least 28 days. This includes a public notice in a newspaper circulating generally throughout Queensland and on the Department of Agriculture and Fisheries' (the department) website.

Taking into account formal feedback, changes to the harvest strategy may be made by Fisheries Queensland. A report will be provided to the Minister about the submissions made and highlighting any changes that were made to the draft harvest strategy as a result of consultation feedback.

## **4.3 Sustainable Fisheries Expert Panel**

The Sustainable Fisheries Expert Panel (expert panel) is critical throughout the development, consultation and approval phases of harvest strategies. At various times during development, before and after the formal consultation phase, advice from the expert panel will inform the harvest strategy development process. The expert panel's input is critical for providing advice on an appropriate management framework, decision rules, compatibility of management responses with achieving harvest strategy objectives, setting reference points and generally assessing risk. The expert panel may request additional information or seek a review by external parties prior to providing this advice.

The expert panel may also suggest additional work to ensure the harvest strategy is consistent with this Harvest Strategy Policy, the National Guidelines to Develop Fishery Harvest Strategies (National Guidelines) and/or the commitments made through the Sustainable Fisheries Strategy. If further work is required, the harvest strategy will be referred to Fisheries Queensland to incorporate the appropriate changes.

The expert panel will review draft harvest strategies and provide their appraisal of the final harvest strategy before it is submitted for approval by the Minister.

## **4.4 Chief executive**

The chief executive (through Fisheries Queensland) is responsible for overseeing the development of harvest strategies, releasing a draft harvest strategy for consultation and preparing the final harvest strategy for the Minister to approve on behalf of Government. The chief executive must comply with this harvest strategy policy and the requirements of the Act, taking into account consultation submissions on draft harvest strategies, and reporting on those submissions. The chief executive is responsible for the process of amending approved harvest strategies, as well as deferring or expediting a stock assessment for use in developing or amending a harvest strategy.

## 4.5 Minister

The functions of the Minister are outlined in Part 2, Division 1 of the Act. The Minister is responsible for approving this policy as well as approving each fishery harvest strategy. In accordance with section 16 of the Act, the Minister must either approve the harvest strategy, approve the harvest strategy subject to changes, or decide not to approve the harvest strategy. The same conditions apply if an amendment to a harvest strategy is sought.

When a harvest strategy has been approved, relevant fisheries stakeholders will be notified. The harvest strategy will also be published on the Fisheries Queensland website [daf.qld.gov.au/fisheries](http://daf.qld.gov.au/fisheries).

## 5 Implementation

Once approved by the Minister, the chief executive (through Fisheries Queensland) is responsible for monitoring and assessing a fishery's performance against the established reference points, according to the schedule outlined in the harvest strategy. Management actions (e.g. changes to commercial catch or effort limits, recreational possession limits, closures) will also be implemented in accordance with this schedule. The following roles are involved in implementing each harvest strategy.

### 5.1 Fishery working groups

In addition to input in the development phase (above), and in accordance with their terms of reference, fishery working groups will also provide advice on the implementation of harvest strategies and the application of the decision rules. They will convene at least once per year to provide advice on matters including, but not limited to:

- ongoing assessment of how each fishery is performing against the fishery's objectives and reference points
- operational advice (e.g. recommendations on management action) to assist the chief executive in implementing harvest strategies
- reviewing harvest strategies as outlined in the schedule of assessment and review
- review data regarding key performance indicators and providing advice against the triggers and decision rules
- review relevant economic and social aspects associated with fishery performance
- provide recommendations associated with the proposed management advice or harvest strategy decision rule implementation.

### 5.2 Fisheries Queensland

Fisheries Queensland is responsible for developing and/or reviewing relevant technical advice on fishery performance, assessing decision rules against reference points and consulting with fishery scientists and broader fishery stakeholders.

The relevant fishery working group's recommendations will be compiled by Fisheries Queensland for the chief executive to inform what actions (catch or effort limit declarations, alternative management arrangements) may be required under the harvest strategy, to meet the objectives of the fishery and obligations under legislation.

### **5.3 Sustainable Fisheries Expert Panel**

The expert panel is responsible for providing independent expert advice on fishery performance, interpretation and applicability of stock assessments and decision rules. They may also have a role in providing advice on management approaches, where specific actions have not been defined, such as break out rules (which require a review of the target if prevailing fishery economic conditions move outside a particular range) or triggers, and social and/or economic objectives to be met when considering measures in accordance with an approved harvest strategy.

### **5.4 Chief executive**

The chief executive is responsible for most of the decisions associated with implementing harvest strategies. All decisions must be consistent with the Act, relevant harvest strategies and this Harvest Strategy Policy.

The chief executive can make a range of legislative declarations to give effect to harvest strategies (see Part 5, Division 1 of the Act), including a:

- quota declaration (total quota entitlements, otherwise known as allocated commercial catch limit, for quota species)
- regulated fish declaration (includes competitive commercial catch limits, size limits, recreational possession limits and seasonal closures)
- regulated waters declaration (includes area closures)
- regulated apparatus declaration (includes restricting apparatus types).

### **5.5 Minister**

The Act contains a provision where the Minister may direct the chief executive to make a decision that is inconsistent with a harvest strategy. There are specific obligations set out in the Act should this occur, including the requirements for public notice and a statement of reasons. For further information see section 24 of the Act.

## **6 Objectives of the harvest strategy**

The Sustainable Fisheries Strategy provides guidance on the government's broader fisheries policy objectives. This includes the statements within the Sustainable Fisheries Strategy to 'set sustainable catch limits based on achieving maximum economic yield for all Queensland fisheries (around 60% biomass)'. The management of fisheries through a harvest strategy should also be consistent with the statutory obligations of the Act, Regulations and all fisheries legislation and policy, through consideration of ecological, social and economic outcomes and the precautionary principle as encompassed within the principle of Ecologically Sustainable Development (ESD).

Harvest strategies must be designed to meet broader policy and legislative objectives in a way that is tangible and results in fishery-specific outcomes.

To achieve this harvest strategies should include fishery-specific objectives that:

- are developed in consultation with stakeholders
- consider the different sectors' aspirations at a fishery level
- have direct links back to overarching policy, and
- are measurable against performance indicators and reference points.

To ensure that these objectives are achievable harvest strategies will need to consider:

- the operational and aspirational needs and desires of each fishery sector
- the number, status and biology of target stock(s)
- the number of sectors accessing the resource
- operational costs and requirements of fishing.

Conflict between harvest strategy fishery objectives may arise (e.g. between the social, economic or ecological objectives or between sectors) and is often the result of ecological objectives being set at the resource level, with economic and social objectives being set at the sector or fishery level (Fletcher *et al.*, 2010). To remove doubt, each harvest strategy should define a primary fishery objective (or aspiration) that always takes precedence. This should be framed around achieving a target biomass. This primary biomass objective and resulting target should require that sustainable catch limits will be set to achieve maximum economic benefits of the resource, which in Queensland is taken to correspond to around 60% of unfished biomass. For fisheries where specific maximum economic yield has been determined, this may replace the default 60% maximum economic yield proxy.

A maximum economic yield biomass objective, and resulting target, is considered the primary objective as it supports each of the fishery objectives of the Act, including the triple bottom line outcomes, by providing the most economically efficient use of the resource, improving the fishing experience for all sectors and promoting resilience to adverse environmental conditions.

### **Example primary fisheries objectives**

#### Rebuilding a single-species fishery

- Rebuild the resource to a target spawning biomass level that aims to maximise economic yield (MEY) for the fishery.

#### Multispecies fishery

- Maintain all/target species in the fishery at, or returned to, target spawning biomass levels that aim to maximise economic yield (MEY) for the fishery without compromising the sustainability of other species.

#### Risk based harvest strategy

- Maintain harvesting effort at levels that are low risk to ecological sustainability for target species.

While managing the fishery to achieve the primary objective, other specific ecological, social and economic objectives can be incorporated. These will be specific to each fishery and reflect the values of all stakeholders. For instance, maximising profit, maintaining resource shares, reducing stakeholder conflict and/or minimising ecological risks. As a fishery reaches its target biomass, it may have the flexibility to consider alternative options to address other objectives. As long as the attainment of the primary fishery objective is not compromised, alternative management options that achieve the other objectives can be considered. If conflict arises between objectives, the primary sustainability objective should always take priority.

## 7 Defining the scope of each harvest strategy

Each of Queensland's fisheries is defined by a combination of gear type, area and species composition which apply across each of the fishing sectors. Harvest strategies should be designed to directly manage the operational needs of a fishery, based on the performance of key stocks that drive commercial, recreational and charter fishing effort and contribute largely towards the proportional overall harvest of a fishery. The harvest strategies guide fisheries management decisions by recommending what changes are required to meet the objectives of the fishery. This is determined by assessment of the performance of the fishery or by stock indicators, such as spawning biomass, against pre-defined reference points.

### 7.1 Management units

Defining the scope of each harvest strategy is a critical step. A management unit, or the basis upon which the fishery is managed, may be the target or a secondary species, biological stock boundaries or some other geographical boundary related to the fishery or gear, or a combination of these.

#### Defining management units

For example, in the Queensland spanner crab fishery harvest strategy, two separate management units have been defined that reflect the primary area of the fishery (managed area A), and the secondary fishing area (managed area B). This allows separate decision rules to be developed for each management unit based on differences in the existing monitoring, assessment and management framework for the areas:

- *commercial spanner crab fishery (managed area A) is the tidal waters south of latitude 23° south and east of longitude 151°45' east; and*
- *commercial spanner crab fishery (managed area B) is Queensland waters north of the commercial Spanner Crab Managed Area A and east of longitude 142°31'49".*

Because the Sustainable Fisheries Strategy advocates for the management of Queensland's fisheries at a stock level, harvest strategies should apply at a stock level wherever possible. Where justified, consideration may also be given to defining management units based on:

- grouping similar species
- grouping similar management arrangements
- grouping stocks by region where it is a mixed species fishery
- using indicator species as proxies for a group of species (e.g. more sensitive species).

## **7.2 Species categorisation**

Queensland's harvest strategies guide the management of all species with which each fishery interacts. The terms that will be used for Queensland's harvest strategies are: target, secondary, and byproduct species.

Differentiating target, secondary and byproduct species is an important component of each harvest strategy as it enables assessment and monitoring requirements to be effectively identified (sometimes across a broad range of species) and management needs to be focused on the species of greatest ecological, economic or social importance.

It is important to note that during the life of a harvest strategy, a species may move between categories. The harvest strategy should guide when this occurs, and the consequences for management.

### **7.2.1 Target species**

The categorisation of species should be undertaken through informed discussion with the fisheries working group. In targeted fisheries with little co-catch of non-target species, the identification of target stocks should be relatively straightforward. In fisheries where there are large numbers of species harvested, and the composition of species varies spatially or temporally, the delineation of target species may be more difficult. The delineation of a species into a category is to be supported by a range of information, including the annual quantity of harvest and stock status/performance, as well as the social or economic value of the stock. Where data is not available to inform metrics, advice from the fishery working groups about species that drive fishing effort may be used to establish a species or stock as a target for the fishery.

### **7.2.2 Secondary and byproduct species**

Stocks or species considered as secondary and byproduct are those which are not identified as target species, but that are retained for commercial sale (reported in commercial fishing logbooks). These may also include those which are commonly caught by recreational, charter or traditional fishers (but are not retained commercially). In some fisheries it may be appropriate to further delineate between secondary and byproduct species. Secondary species are recognised as those which drive fishing behaviour in the absence of target species (e.g. seasonally), have high annual harvest (though they may not have been temporally or spatially consistent enough to be considered as target species) or are considered of high social or ecological importance.

### 7.3 Management tiers

Management tiers may not be required for all fisheries but can provide added flexibility where a fishery may consist of multiple management units or target species.

In complex multispecies fisheries, the categorisation of species, identification of management units and status of the resource may be used to define species tiers for monitoring, assessment and management. Sorting species into tiers allows for delineation within categories as well as between.

Tiers may be important where there are a large number of true target species for a fishery and further prioritisation is required to streamline management procedures and prioritise resourcing requirements among species. Figure 3 outlines the criteria for determining management tiers.

For example, in a fishery where two target species have been identified with similar economic value and harvest level, stock A may require rebuilding to target biomass levels which may result in more intensive management or resourcing requirement (i.e. tier 1), while stock B which is at, or above, target levels requiring little management or resourcing effort (i.e. tier 2). Species may transition between tiers. For example, if stock B were to require increased assessment or management resourcing it may be transitioned to management tier 1.

Tier 1	Tier 2	Tier 3
<ul style="list-style-type: none"> <li>• Usually target species</li> <li>• High volume catch</li> <li>• High economic value</li> <li>• Managed via individual Transferable Quota (ITQ)</li> <li>• Major driver of overall fishing effort in a fishery</li> <li>• May be a secondary species high assessment or management needs due to stock status</li> <li>• Usually prescribed sectoral allocations</li> </ul>	<ul style="list-style-type: none"> <li>• Usually secondary species</li> <li>• Important species to the fishery</li> <li>• Input or output controls in place to manage harvest</li> <li>• Drives some fishing effort in the fishery (i.e. certain region or gear component of a fishery)</li> <li>• May be a byproduct species that Requires high assessment or management needs due to stock status</li> </ul>	<ul style="list-style-type: none"> <li>• Usually byproduct species</li> <li>• Mostly aren't targeted</li> <li>• May not have specified management controls in place</li> <li>• Opportunistically fished or co-caught as opposed to driving fishing effort</li> <li>• Lower historical catch by all sectors</li> </ul>

Figure 3: Criteria for guiding the development of species tiers

## 8 Resource allocation

Setting and managing resource allocations through the harvest strategies provides an informed and transparent approach to the equitable management of Queensland's fisheries.

The harvest strategy should use the best available estimate of the current harvest for each sector accessing the fishery (e.g. commercial and recreational sectors) when initially determining sectoral resource allocation.

The harvest strategy should aim to maintain current average historic (or agreed) resource allocations and monitor the proportional harvest of each sector to minimise allocation creep (one sector increasing above their allocated proportion), particularly when decision rules are applied. Where allocation creep is detected to be beyond the defined change buffer, adjustments to the management of that sector should be made to re-adjust back to the agreed allocations.

The only exceptions to this are where a formal reallocation has been made, under the *Fisheries Resource Reallocation Policy*, and the Minister has approved a reallocation; or where the reallocation relates to a pre-specified review point due to information uncertainty. If there is information uncertainty, the harvest strategy should specify this and how it may be resolved.

## 8.1 Sector allocation or assessing historic sector shares

Generally, resource allocations will only be set in a harvest strategy for target or secondary species with commercial catch or effort limits, such as Total Allowable Commercial Catch (TACC), Total Allowable Commercial Effort (TACE), Individual Transferrable Quota (ITQ) or Individual Transferable Effort (ITE). The most recent available and reliable data will be used to determine each sector's share of the resource allocation (i.e. catch share) at the time of drafting the harvest strategy. Where a catch limit exists for the commercial sector (e.g. TACC), this should be used to guide an initial commercial sector allocation. The exception to this will be where an existing TACC for a species was set with no reference to the harvest share of other sectors, in which case reported commercial harvest (long term average) will inform the commercial sector allocation.

For the purposes of resource allocation, the recreational catch share should account for the estimated total harvest from the recreational and charter fishing sectors (i.e. recreational anglers possessing fish caught during a charter fishing trip). To inform the recreational catch share, the most recent state-wide recreational harvest estimates should be considered. Where there is a known level of reported charter sector harvest (from logbooks), this should be included as part of the recreational sector harvest.

In cases where the available data for a sector may be limited or information poor (e.g. recreational harvest estimate only reported at the species-group level), alternative sources of information may be considered, including relevant fisheries working group advice, expert advice or external data sources.

**Table 1: Example of how sectoral allocation will be included in each harvest strategy**

Species	Management tier	Commercial fishing	Recreational fishing (including charter)
Species A	1	90%	10%
Species B	2	40%	60%
Indigenous commercial fishing development	X tonnes (combined – all species)		

### 8.1.1 Review of catch shares

In some circumstances where the confidence in establishing sectoral allocations is low (either because the commercial or the recreational catch data are limited) the harvest strategy will contain an initial sectoral catch allocation and include a timeframe for when catch shares will be reviewed during the life of the harvest strategy (i.e. after new data becomes available to validate the allocation). Where a review of the resource allocation is flagged within the life of a harvest strategy, any minor changes to catch shares resulting from that review can apply for the remaining years of the harvest strategy, without the need to formally amend sectoral allocation shares. A minor change to the sectoral allocations will be taken as endorsed with the approval of the harvest strategy.

Resource allocation arrangements can only be updated if the catch allocations have been pre-specified for review (i.e. when updated information becomes available), and if the new information indicates the defined sectoral proportions are no longer consistent with effective management of the fishery. For example, if a review point for the allocations has been pre-specified and a new recreational harvest estimates become available, this harvest should be compared to the commercial catch or TACC for the same period of time. An update of the resource sharing arrangements would only be undertaken in this instance to ensure that catch shares are based on the most recent and reliable information for all sectors.

## **8.2 Indigenous commercial fishing allocation**

To support fishing-related economic opportunities for Aboriginal peoples and Torres Strait Islanders and their communities, a harvest strategy will establish an appropriate and sustainable Indigenous commercial allocation, which can be accessed under an Indigenous Fishing Permit (IFP).

A specific allocation may be identified in the harvest strategy for an individual species, management region or fishery. Noting that:

- If a commercial fishery or stock cannot reasonably support additional fishing effort without creating a sustainability risk (e.g. sea cucumber), an appropriate allocation or alternative approach may need to be negotiated over time.
- Where there has been no historical interest in Indigenous commercial fishing development activities (e.g. Trawl fisheries), an initial Indigenous commercial allocation may not be specified in the harvest strategy and access would be considered on a case-by-case basis.

Adjustments to the Indigenous commercial allocation may be required to ensure stock sustainability or fair and equitable access. For example, where a stock is recognised as depleting or depleted, access may need to be decreased or temporarily retracted, in line with management action for the other sectors.

Indigenous commercial allocation may be increased within the life of a harvest strategy to support economic development through fishing related business, where:

- there is no impact to the sustainability of the stocks resulting from increasing the Indigenous commercial allocation; AND
- the number of applicants seeking to access the Indigenous commercial allocation is at the point where not all could viably be issued an IFP and have the opportunity to be successful, OR
- an Indigenous commercial allocation has been fully utilised through issuing IFPs for two consecutive years.

If increased, the new allocation may not exceed 5% of total allowable catch (TAC) or the allocation of another fishing sector, without triggering the need for a resource reallocation. The increase would be undertaken as part of a pre-specified review and is not considered a formal 'amendment' to the harvest strategy.

### 8.3 Traditional fishing by Aboriginal peoples and Torres Strait Islanders

The traditional fishing rights of Aboriginal peoples and Torres Strait Islanders are protected under native title legislation and relate to harvest for domestic, communal and non-commercial purposes. Accordingly, traditional and customary fishing is recognised in Queensland and is not a defined sectoral allocation.

## 9 Monitoring fishery performance

Under a harvest strategy, an indicator is a quantitative source of information (statistic) that can be used to measure performance that may be related to sustainability, economic or social aspects of the fishery.

The following sources of information are considered appropriate lines of evidence for use as harvest strategy indicators:

- estimates from quantitative stock assessments including, biomass and fishing mortality
- fishery information (e.g. catch, effort) collected through commercial fishing logbooks, quota and vessel monitoring systems, recreational fishing surveys and other programs administered by Fisheries Queensland or other relevant parties
- information collected through socio-economic monitoring programs
- risk rating (e.g. low, medium, high, extreme) for target, byproduct and bycatch species and habitats identified through an ecological risk assessment
- other information collected as part of fisheries monitoring programs
- any other line of evidence endorsed by the Sustainable Fisheries Expert Panel as being appropriate for use as a harvest strategy indicator.

Indicators on their own provide little context regarding a fisheries performance at any given point in time. It is for this reason harvest strategies must also clearly state reference points for each indicator being used.

### 9.1 Performance indicators

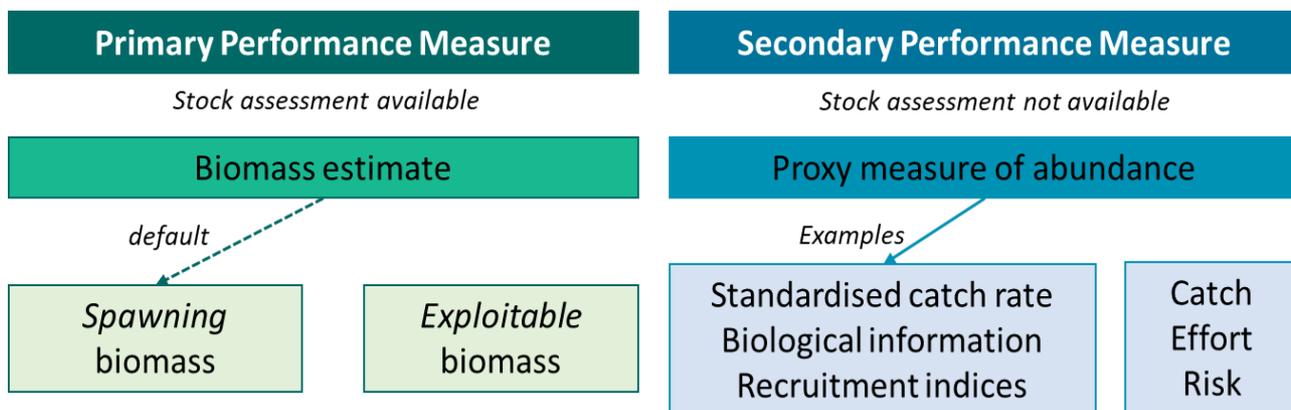
Where possible the management of target stocks will be undertaken using a data rich performance indicator, such as the unfished biomass estimated using a stock assessment. Data rich indicators use a range of data sources when determining the performance of the fishery and developing management advice. Stock assessment also allows for the inclusion of economic data, so that bioeconomic models can be developed. This allows for better estimates of maximum economic yield through time.

Where estimates of biomass are used as the primary performance measure, the default measure will be *unfished spawning biomass*. For some species, such as those where input controls restrict the selectivity of a large demographic component of the stock, including with single sex harvest policies, restrictions on the harvest of berried females, the use of slot limits or single sex policies, an *exploitable biomass* measure may be used instead.

Where stock assessment models may not be able to accurately estimate biomass, secondary performance (fishery or stock) indicators (or proxies) of stock abundance may be used. Secondary performance indicators may include biological information (e.g. age/length composition), recruitment indices, and standardised fishery-independent or -dependent catch rates. Where a secondary performance indicator is used, there should be confidence that it is reflective of a meaningful biological or operational metric.

To ensure that the performance indicator is meaningful, and decisions are being made in line with objectives of the fishery (i.e. achieving target biomass levels), the indicator should be standardised to account for influence from external factors to the stock, such as fishing power (O'Neill and Leigh 2007). In addition, any secondary performance indicator linked to explicit decision rules should be subject to additional assessment, such as management strategy evaluation (MSE) or retrospective analysis, before being used to inform management decisions. See Figure 4.

The management of secondary and byproduct species will commonly require the use of a secondary performance indicator, as biomass estimates are unlikely to be available. In these instances, the fishery should aim to monitor changes in the level of fishing mortality, with reference to historical levels. Secondary indicators, such as catch and/or effort may be used to monitor changes in fishing effort, mortality or fishing behaviour. Where secondary indicators are used, any associated assessment or management of the indices should either be subject to testing (i.e. retrospective testing or MSE) or should be precautionary to account for uncertainty.



**Figure 4: Types of primary and secondary performance measures in harvest strategies**

Ecological Risk Assessments (ERAs) are used to evaluate the relative risk posed by fishing on species, habitats and communities within a fishery and may also be used as a performance indicator. The scope of ERAs ranges from qualitative assessment through to semi-quantitative assessment of risk. For Queensland harvest strategies the ecological risk rating for a stock (i.e. low to high) may be used as a fishery indicator for target, secondary and byproduct stocks if it is the only assessment information available. A change in the ecological risk for a species may be driven by a modification in fishing behaviour, management or biological information, and therefore the primary driver of the change in risk should be clearly articulated where an ecological risk assessment is being used to inform a harvest control rule.

## 9.2 Setting reference points

Reference points are benchmarks for a fishery's performance that can be measured using a specific indicator. Clearly defined and determined reference points are a fundamental aspect of ensuring that the fishery's performance is able to meet the aspirations outlined in the fishery's objectives. All reference points should be measurable and be directly associated with a performance indicator (e.g. catch per unit effort (CPUE) or biomass). Reference points in Queensland's harvest strategies can either be a target (the ideal state), a limit reference points (the point beyond which the performance is unacceptable), or a trigger reference point (a noticeable change in performance triggering review or action). See Figure 5.

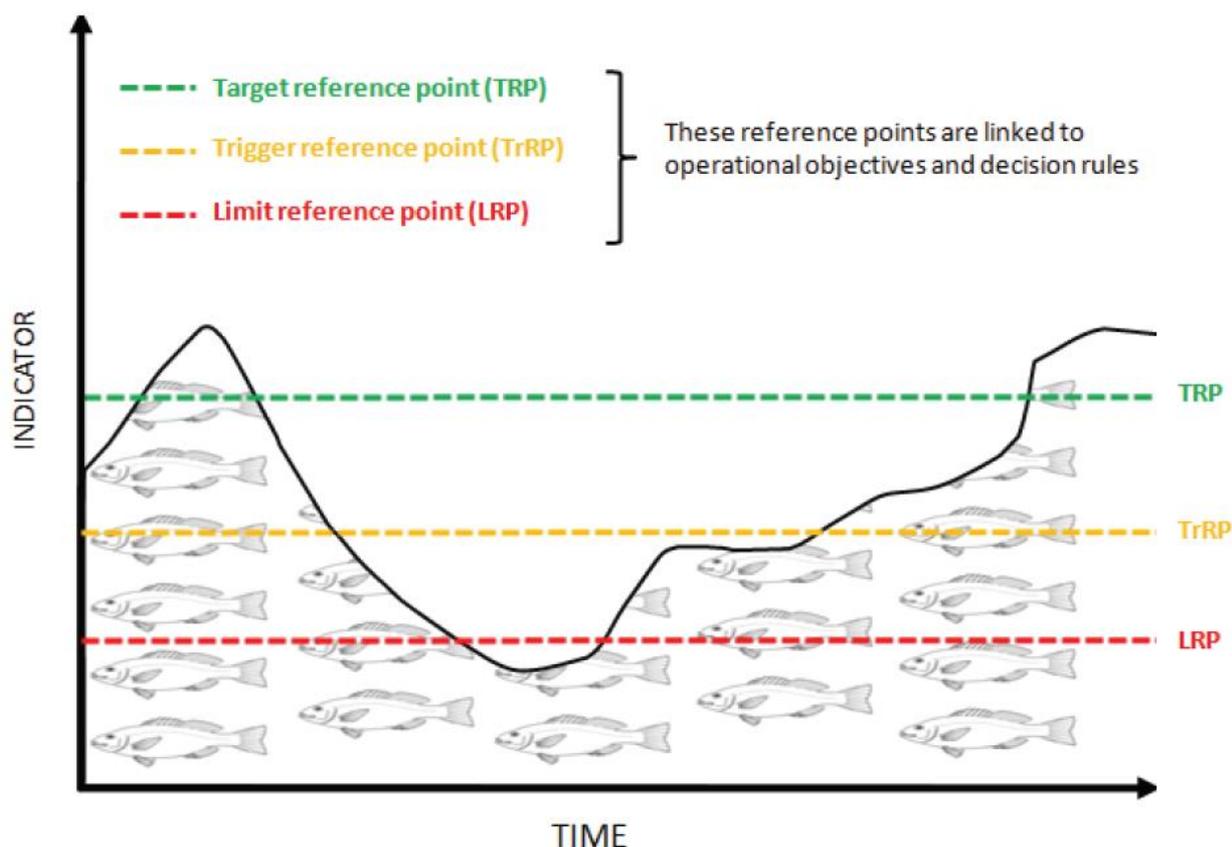


Figure 5: The relationship between a performance indicator (e.g. biomass shown as the solid line on the graph), the different types of reference points, operational objectives and decision rules (Sloan et al., 2014)

### 9.2.1 Target reference points

Target reference points should reflect the fishery objectives under a harvest strategy and/or broader government policy (where appropriate). The Sustainable Fisheries Strategy notes that the target reference point for all fisheries should be based on achieving at least maximum sustainable yield (MSY) initially (around 40-50% biomass where a more specific estimate is not available) and moving towards achieving maximum economic yield (MEY) (around 60% biomass where a more specific estimate is not available) by 2027.

The MEY target level BMEY (biomass at maximum economic yield) as outlined in the Sustainable Fisheries Strategy, recognises the need to promote the most economically efficient use of the resource, improve the fishing experience for all sectors (e.g. recreational fishing satisfaction) as well as to ensure that the stock and ecosystem is at a level that provides resilience to adverse or changing environmental conditions (e.g. floods, bleaching and cyclones). The use of default proxies for BMEY and BMSY (biomass at maximum sustainable yield) - 60% and 40% of unfished biomass respectively), provides a clear and consistent approach for setting target reference points in the absence of species or stock specific data (e.g. economic information).

Where bioeconomic models may be available to inform fishery based MEY estimates, these may be used to replace these proxy values, with fishery- or species-specific values, estimated in each case. If no direct estimate of biomass or abundance is available, due to use of a data limited performance indicator, a secondary target reference point may be developed, based on a reference period in the fishery that corresponds to a profitable and stable period of operation for the fishery (as a proxy for MEY). The use of alternative decision rules may require testing (e.g. MSE) to ensure that they meet the objectives of the harvest strategy and broader policy objectives (O'Neill *et al.*, 2010).

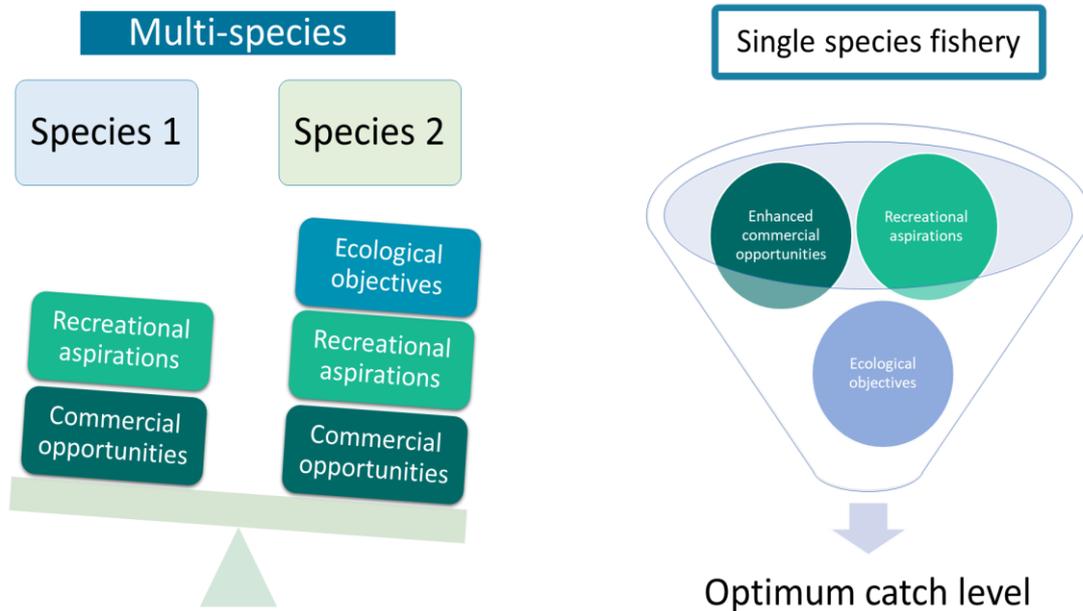
Where there is sufficient scientific evidence that the productivity, growth or recruitment of a stock may be impacted by environmental factors (e.g. ecosystem or carrying capacity shift) or high natural variability, this should be taken into account when setting appropriate alternative reference points.

### **9.2.2 Optimising target reference points in complex fisheries**

Once a harvest strategy is in force it is expected that the target reference point should be maintained for the five-year duration of the harvest strategy. However, if new economic data indicates that an adjustment of the target reference point would optimise MEY for the fishery or species, it may be appropriate to adjust the target reference point. Where an adjustment to the target reference point is suggested for economic reasons, it is important to consider whether the adjustment may compromise social or ecological objectives specified under the harvest strategy. For example, a lower biomass target that results in greater economic profitability may result in a reduced satisfaction or experience for the recreational and charter fishing sectors (i.e. loss of a user's experience, known as experiential yield), or loss of resilience for a vulnerable stock or ecosystem.

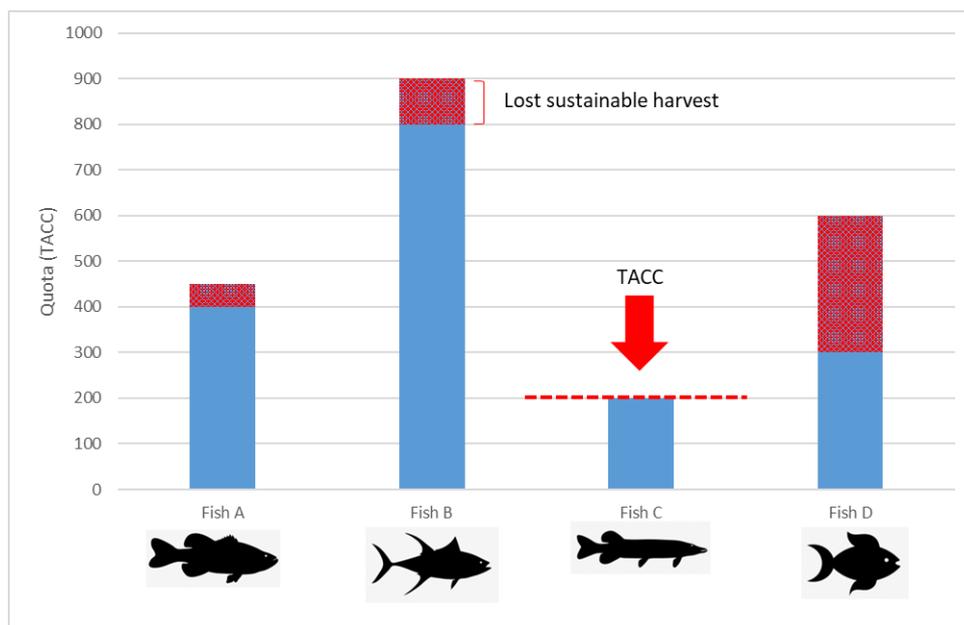
The principles outlined in section 6 regarding harvest strategy objectives should be adhered to when adjusting reference points that may affect triple bottom line fishery outcomes.

In a single species fishery, an MEY estimate may be able to be calculated, and will often equate to the optimal harvest level of that species (given the level of fishing effort and stock size) meeting the objectives for all sectors (See Figure 6).



**Figure 6: Schematic demonstrating the different considerations for setting reference points in multispecies and single species fisheries**

For a multispecies fishery, MEY may require balancing each species biomass, catch rates, and profit levels in the fishery. As individual fish stocks in a multispecies fishery are likely to be different in their biological, fishing and economic characteristics, the biomass and effort levels that support MEY will vary according to species (Figure 6, Bastardie *et al.*, 2010, Klaer and Smith, 2012). This may require setting harvest rates to achieve maximum economic return across species in the fishery. Therefore, the target biomass level ( $B_{TARG}$ ) of some secondary or byproduct species may need to be set higher or lower than the 60% level, but never below the BMSY (See Figure 7).



**Figure 7: Hypothetical representation of a 'choke species' – in this example the TACC properly constrains the catch of fish species C (choke species), but also effectively limits the harvests of species A and B to near their TACCs (near 90% of the TACCs were filled) and fish species D to half of their TACC**

Adjusting  $B_{TARG}$  for secondary and byproduct species may be important for ensuring that their total allowable catch does not unnecessarily impede maximum economic returns at the fishery level or result in adverse unintended consequences (Punt *et al.*, 2014). For example, setting of targets for multispecies fisheries should aim to reduce the potential for large ‘choke species’ within a fishery (stocks with disproportionately lower TACs which restrict the ability of fishers to fully catch or access the quota for a key commercial stock) or increased discard mortality of target, secondary or byproduct species.

Issues of any choke species need to be quantitatively verified, taking into consideration all fishing sectors. In situations where a lower  $B_{TARG}$  is adopted for secondary or byproduct species to promote MEY for target species, consideration must also be given to ensuring the risks of falling below limit reference points for affected species remains low.

For fisheries where the distribution of target stocks overlaps with adjacent management jurisdictions (Australian, Northern Territory or New South Wales Governments), adjustment to reference points may be required to align management across jurisdictions.

Cross-jurisdictional management is important for ensuring shared responsibility in rebuilding or maintaining stocks and should aim to set management targets that achieve long-term sustainability (above  $B_{MSY}$ ) and maximise broad economic, ecological or social benefits through a consistent MEY target. Where target reference points are adjusted to facilitate cross jurisdictional management, the target reference point must not be set below  $B_{MSY}$ .

### 9.2.3 Limit reference points

The limit reference point (LRP) is defined as the biomass level below which the risk to recruitment of the stock, due to overfishing, is regarded as unacceptably high. For Queensland harvest strategies, a proxy of 20% of the unfished (spawning or exploitable) biomass ( $B_{20}$ ) is the default value for the LRP (deemed  $B_{LRP}$ ) (See Figure 8). The LRP clearly identifies the point at which targeted fishing must cease for the stock and a rebuilding strategy must be developed to rebuild the biomass above  $B_{LRP}$ . Assessment of the stock’s performance against  $B_{LRP}$  should be undertaken against a 90% risk criterion. That is, there should be a 90% probability that the stock is above the LRP in each and every year. Below this, targeted fishing must cease.

The  $B_{20}$  proxy is also the minimum level for a LRP in this Policy. That is, no LRPs to be designated below  $B_{20}$ . Consistent with the Commonwealth Harvest Strategy Policy and Guidelines, the Harvest Strategy Policy allows for LRP to be designated above  $B_{20}$  where a more appropriate biological limit has been determined. The LRP may need to be set higher than  $B_{20}$  for stocks:

1. that show life history traits such as lower productivity and may be at higher risk of depletion
2. where adjustment to reference points may be required to align management across jurisdictions.

For stocks where biomass estimates are unavailable, a LRP will need to be determined using an alternative fishery performance indicator. Where an alternative performance indicator is used, the level at which the LRP is set at should be tested through MSE or population simulation to ensure that it manages the risk of recruitment impairment and meets the objectives of the harvest strategy.

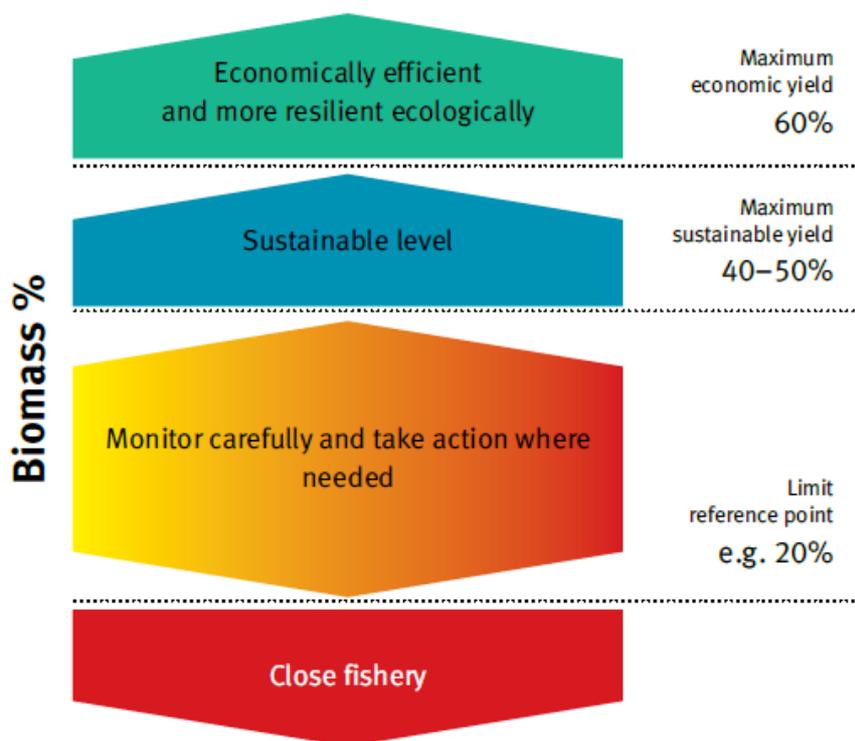


Figure 8: Example of biomass reference points

#### 9.2.4 Trigger reference points

Trigger reference points are the agreed point at which additional review, assessment or management action may be taken in a fishery. Not all harvest strategies will require trigger reference points. The primary difference between a trigger reference point and a target or a limit reference point is that the response to triggers is more flexible. Often this might result in a review, additional assessment to inform management actions, or an interim management action, rather than explicit management action.

The reason that trigger reference points require flexibility is because they are often linked to information-poor secondary indicators where a change in fishery performance could be caused by a range and/or combination of factors (i.e. from a change in the stock abundance or from a shift in fishing behaviour). Where no direct estimate of biomass or abundance is available, the trigger reference point should be based on a reference period in the fishery that represents a profitable or stable period of operation. Using a reference period to develop a trigger level allows for the assessment of fishery performance to be undertaken with a consistent approach and is based on known historical information of the fishery's performance.

To ensure that the response is appropriate for managing the change in fishery performance, trigger reference points can also be used to instigate varying degrees of management response, based upon a fishery's performance. The use of multiple trigger reference points allows a harvest strategy to be responsive to changing conditions and helps mitigate potential risks. For example, there could be increasing responses at higher thresholds.

Trigger reference points are commonly used in secondary or byproduct species, where the reason for breaching a trigger may be unknown because of the use of an information-poor secondary performance indicator. An example of a trigger reference point is the use of an historical average annual harvest level to represent the point above which a shift in the fishery behaviour, or level of fishing mortality for that species, may be deemed an increased risk to the stock, triggering review, assessment or management action.

## **10 Schedule of assessment**

To ensure consistency of decision-making over the life of a harvest strategy, how and when the performance of each stock will be assessed should be clearly articulated. Regular assessments for target species are required and should be associated with relevant decision points under the harvest strategy. The timing for these assessments is included in the assessment schedule of each harvest strategy. The details in the assessment schedule should include the point in the season or year when a fishery's performance will be assessed, and the time period of information used in the assessment (e.g. up until the most recent calendar or financial year). By ensuring consistency in monitoring and assessment processes throughout the life of a harvest strategy, stability in decision-making will be promoted.

All target stocks should be assessed against their established harvest strategies at least once every three years. In some circumstances (e.g. if there are multi-year TACs/TAEs) it may be appropriate that indicators are only reviewed every few years on a specified schedule.

Where known, the schedule should outline timeframes for the availability of key assessment information that will inform management action. For example, if it is known that a stock assessment or a recreational survey will be available in a certain year, this should be included in the schedule, along with an appropriate timeframe for taking management action in response. Some commonly used terms and their definitions are included in Table 2 as a guide and reference for harvest strategy schedule of activities.

**Table 2: Overview of different performance measures used to inform the status of a stock and harvest control rules**

<b>Performance measures</b>	<b>Definition</b>
Catch and effort monitoring	Fishery-dependent catch, effort, and catch rate (catch-per-unit-effort) information usually on calendar or financial year basis. Boat ramp surveys are undertaken to monitor recreational fishing activity. They review trends for information on stock abundance, effort shift and harvest risk.
Standardised catch rate	The average catch rates adjusted/scaled to a constant vessel and fishing power through time
Stock assessment	Stock assessment (modelled), taking account of all relevant data (e.g. fishery-dependent and -independent data, biological monitoring, environmental impacts, recruitment etc).
Social and economic monitoring	Surveys which provide updated information of the social and economic status of Queensland Fisheries and/or relevant stakeholders.
Fishery-independent monitoring	Fishery-independent survey results (e.g. pre-recruit trawl survey, the spanner crab survey) that contribute to performance monitoring.
Biological monitoring	When the collection of biological data, for example, age, length, recruitment, mortality, reproduction, habitat preference, becomes available to contribute to performance monitoring or assessment.
Ecological risk assessments	Assessment of ecological risks to species or species-groups and ecological communities/habitats based on current fishery dynamics, management and species biology.
State-wide Recreational fishing survey	Published results of a state-wide or national recreational fishing survey data, including estimates on participation and harvest by species.
Management decision on TAC	The Total Allowable Catch for all sectors is reviewed. This can mean a decision in relation to the commercial quota (TACC) and/or recreational management action (Total Allowable Recreational Catch - TARC) to realign agreed catch share allocation to each sector as appropriate.
Decision rules on catch allocation	Where new information becomes available to assess whether the specified catch share allocation in the harvest strategy remains appropriate for each sector.
Harvest Strategy Review	Usually specified in year 5 of a harvest strategy. Requires full assessment of the objectives, catch shares, targets, references and other key harvest strategies.

### **10.1 Deferring or expediting an assessment**

There may be instances where an assessment may need to be either brought forward or delayed from the scheduled date. Such changes may be due to competing priorities for assessment by the department, emerging issues associated with target or other stocks (e.g. changes in a performance indicator that suggests an assessment should be brought forward), or other technical issues.

Any changes to the assessment schedule in the harvest strategy are considered significant, and should be considered by the working group and decided on by the chief executive, based on the pre-specified criteria below:

- If, during the period between scheduled stock assessments, the chief executive is concerned that a performance indicator (e.g. stock status, length frequency distributions, standardised commercial catch rates, total harvest, age distributions etc.) suggests that the stock is not performing in a way that will achieve the target biomass level, the chief executive may decide that a stock assessment will be undertaken before the scheduled timeframe.
- If the chief executive is satisfied that; (1) indicators for the stock suggest that it is achieving, or rebuilding to, target biomass levels, and there is a low ecological risk to the stock under the current management arrangement (i.e. TAC levels); or (2) if resourcing requirements prohibit the ability for an assessment to be delivered in the scheduled timeframe, the chief executive may decide that a scheduled stock assessment will be delayed.

## 11 Monitoring and research

Monitoring and research are important components in determining whether a fishery is meeting its objectives or in improving future assessment or management. Information, monitoring and research needs should be clearly articulated in the Monitoring and Research Priorities section of a harvest strategy and should be updated periodically, based upon the recommendations of the fishery's working group. These priorities identify monitoring or research that could lead to improved broader management outcomes. For example, biological research (e.g. size of maturity or stock structure) that may inform management (e.g. size limits or management units). Fisheries Queensland will work with the relevant working group to identify and prioritise research and monitoring needs, taking into consideration the priority of the research (importance of the outcomes to improving the management of the fishery); justification for the research; and potential avenues for progressing the research (e.g. funded through Fisheries Research and Development Corporation or direct stakeholder funding). These will be incorporated into the broader Fisheries Queensland Monitoring and Research Plan, as it is updated, to ensure continual progress in the management of each fishery.

## 12 Decision rules

Decision rules (also known as harvest control rules) are an important component of a harvest strategy that provide a transparent and consistent management approach to help achieve harvest strategy fishery objectives. Each harvest strategy must specify decision rules that identify actions to be taken in response to a target or trigger reference point being reached (e.g. changes to TACs, TAEs, bag limit by a certain amount) and what actions will be taken where performance falls below a limit reference point (e.g. close the fishery for all sectors or other management responses). The best practice approach is to develop decision rules that reference a precise measure, with the prescribed action as explicit as possible, and designed to ensure the fishery is likely to meet its stated objectives.

However, there is a trade-off to being too explicit, such as where information, content or data may be limited. Flexibility is needed to ensure control rules can respond to unanticipated or unexpected circumstances. Another risk is that decision rules will not be explicit enough, and instead of prescribing certain action, will simply direct that 'a review' be undertaken. This section of the Harvest Strategy Policy provides direction on balancing flexibility and rigidity in developing the control rules that guide Queensland's harvest strategies.

## 12.1 Target species management

The default decision rules for key target species in Queensland's fisheries should be explicit and respond unambiguously to prescribe trends in stock performance measures. Decision rules for target species aim to manage fishing mortality (F) at a level that rebuilds or maintains the performance indicator at target levels. There are several different approaches for managing fishing mortality including constant catch approaches; dynamic adjustments to targets and timeframes; or fishing mortality ramps (referred to herein as the hockey stick rule). The default type of decision rule used to manage target species in Queensland harvest strategies is the hockey stick rule. However, alternative approaches should be used when this may be considered inappropriate.

Regardless of the approach used, all decision rules should be measurable against reference points and result in an intended response. Decision rules for target species should clearly define a target reference point that points to the level to which the resulting management actions should move the fishery. The decision rules should also define a LRP, below which, there should be no more targeted fishing of the stock (unless starting from a point below  $B_{LRP}$ ) and where a rebuilding strategy is required. The decision rule to cease all targeted fishing of the stock if there is a 10% probability that the stock is below the LRP (90% criterion), takes precedence over all other rules.

The hockey stick rule approach allows for the recommended biological total allowable catch to be determined based on a linear relationship between  $B_{LRP}$  ( $B_{lim}$  in Figure 9) where the level of fishing mortality (F) is equal to zero, and  $B_{TARG}$  where the exploitation rate and TAC is set at the level to achieve MEY (See Figure 9). This approach takes into account the current biomass level of the stock for determining the TAC to achieve the  $B_{TARG}$ .

The recommended TAC is calculated by applying the rate of fishing mortality to achieve  $B_{TARG}$  to the current spawning biomass level. As a result, the recommended TAC represents the total catch from all sectors (including discards, post capture mortality and depredation) that can be harvested in the following years, to move the current biomass level towards the target level. Importantly this tool/process to inform decision rules ensures that any recovery back to target levels occurs in a balanced timeframe and provides consistent adjustments to the TAC throughout the transition from  $B_{LRP}$  to  $B_{TARG}$ . Where the biomass is above  $B_{TARG}$ , the decision rules will also adjust the fishing pressure on the stock with the aim of achieving an equilibrium harvest that will maintain the stock on average at  $B_{TARG}$ .

While the hockey stick approach is the default harvest control rule, there are certain stocks or fisheries where other decision rules may be more appropriate. Situations where other types of decision rules should be considered include (but are not exclusive to) when a stock is below or close to  $B_{LRP}$ , if a data-limited or information-poor assessment method is used, or where there are pre-specified timeframes on rebuilding. Use of alternative decision rules should be subject to testing (e.g. MSE) to ensure that they meet the objectives of the harvest strategy and broader policy objectives.

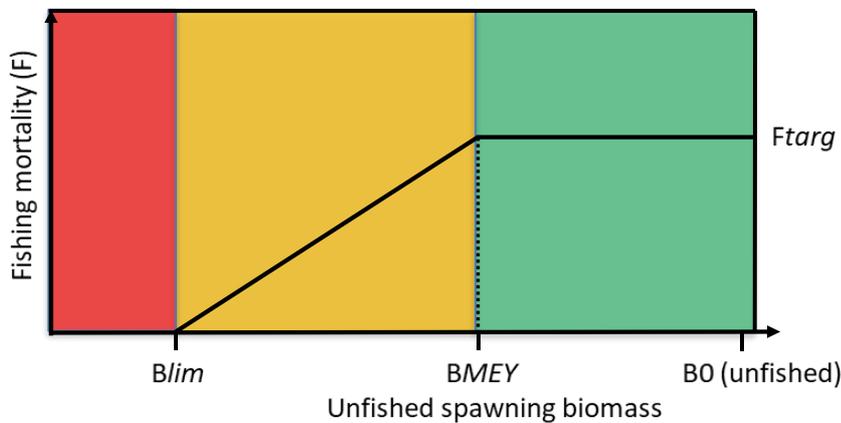


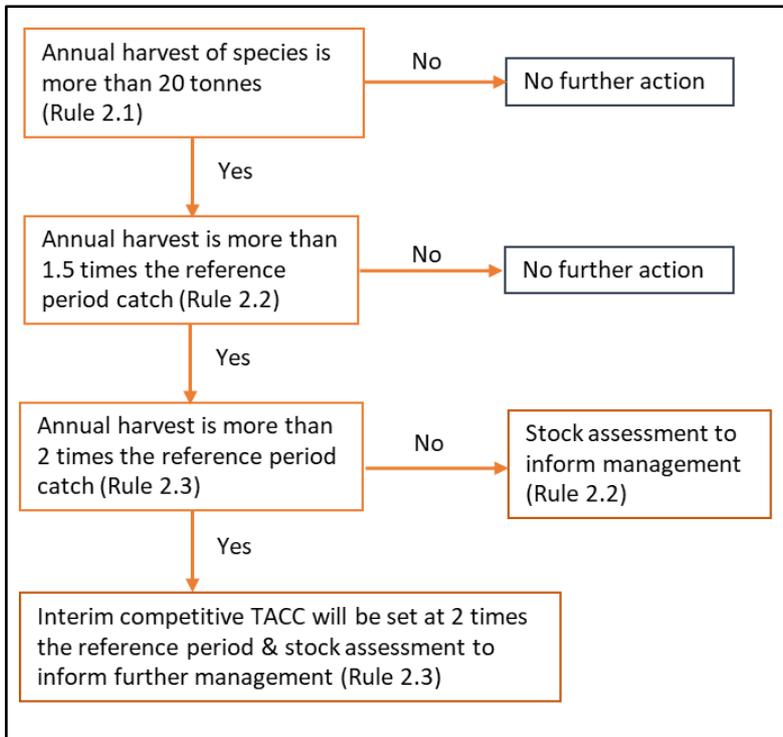
Figure 9: The “hockey stick” rule, **BLIM** is limit reference point, **BMEY** is the biomass target **BTARG** for **MEY**, **B0** is the unfished biomass (at 100% biomass), **F** is fishing mortality and **FTARG** is the level of fishing mortality for **BMEY**

In addition to the standard form of harvest control rule (outlined above), complementary rules may be required to ensure the management of a stock. These complementary rules could include a specified upper limit level, either in the form of an upper harvest limit (in tonnes), or a maximum level of fishing mortality level. As an example, that the rate of fishing mortality should not exceed that required to achieve  $B_{TARG}$  (i.e.  $F_{60}$ ), or to maintain a stock at  $MSY$ .

## 12.2 Secondary and byproduct species management

Development of decision rules for secondary and byproduct species depends on the performance indicators that are available. Where possible, they should outline explicit actions in response to specific performance measures. Where estimates of biomass are available, they should be used to determine the level of fishing mortality in order to achieve the target level for the stock. In many cases alternative performance indicators, that may be of lower information content, could inform the management of secondary and byproduct stocks. Where possible, the development of decision rules with alternative fisheries indicators should be tested or developed to ensure that they are meeting the broader objectives of the fishery. (See Figure 10)

A common decision rule for secondary and byproduct species is the use of total catch triggers. These may be set for total harvest or relate only to the catch of a particular sector (e.g. commercial line catch exceeds an historical total level of harvest for a sector). Catch triggers can provide understanding of whether there has been a change in the stock or fishery that has resulted in an increase or decrease in the level of fishing mortality. As a result, a review, additional assessment requirement, or interim management action may be triggered.



**Figure 10: Example of secondary and byproduct species harvest control rules from the reef line fishery harvest strategy**

The management of secondary species could also consider hierarchical decision rules which assess the response of multiple secondary performance indicators (i.e. investigating independent trends in catch, effort, or a biological parameter) and/or apply a weight of evidence decision.

The assessment of ecological risk may be an appropriate mechanism for achieving the objectives of the fishery for many byproduct species. In cases where an ERA is the only assessment option available, the level of risk for a species or stock may be used to inform a response. Appropriate responses may include a review, further assessment work or taking management action. For example, the decision rules may trigger action because fishing pressure is observed that poses high or increasing risk to any secondary or bycatch species populations. In this case, the action triggered is to undertake a review to determine the reason for the high or increased risk. The results of the review will then guide fishery management action to mitigate the risks or may result in the need for up to date biological or fishery information.

Where a fishery is identified as having high ecological risks related to secondary and byproduct stocks and this is due to fishing, a more detailed review or assessment should be undertaken as a priority. This will help understand the cause of the high risk and determine the status of the stock in relation to reference points. If required, appropriate management action should be taken to reduce the risk to an acceptable level (e.g. fishing mortality may need to be constrained to reduce the risk of breaching the LRP). Such stocks may be a priority for a more detailed assessment to better understand stock status in relation to reference points or may be the target for research.

### 12.3 Guidance for recreational and charter management

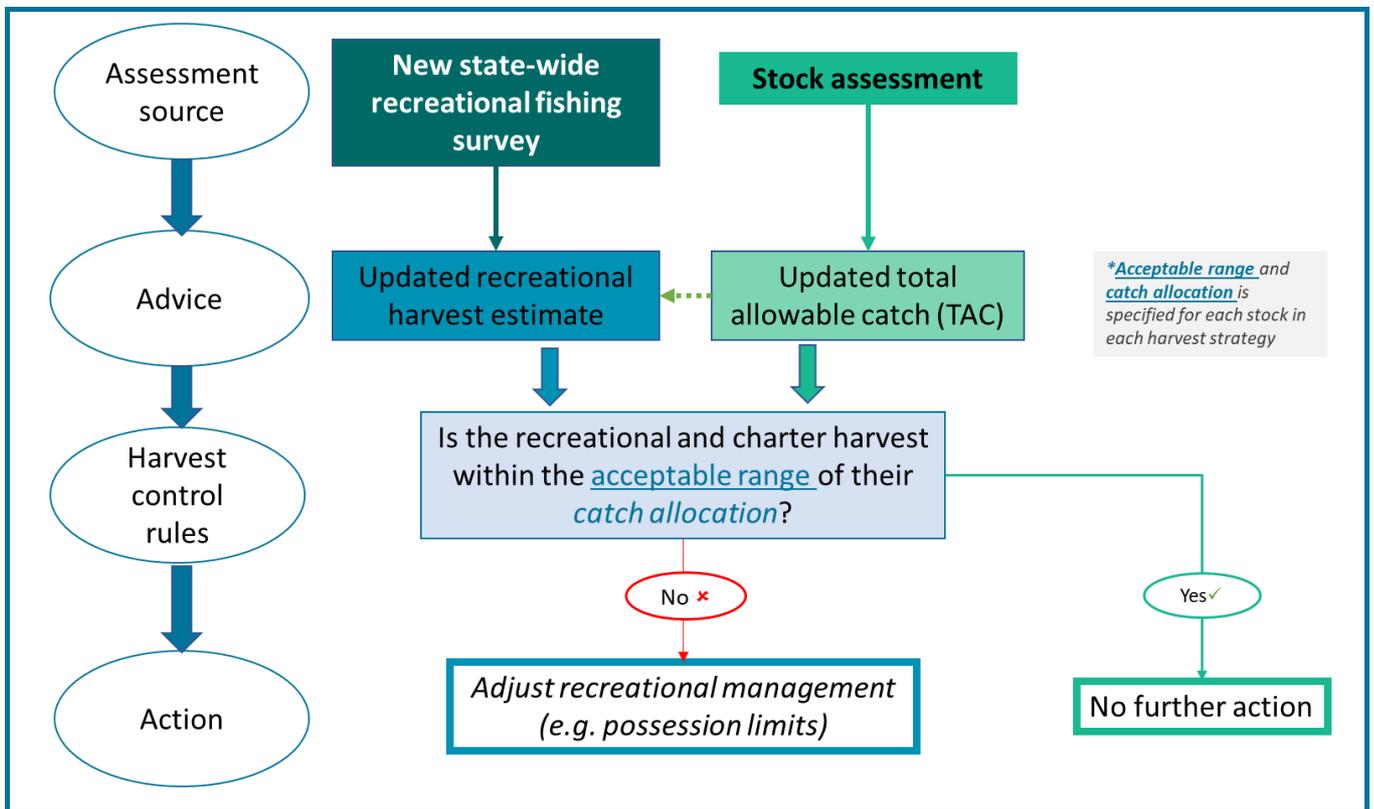
Recreational and charter sector management should be undertaken through decision rules that primarily respond to changes in the performance of the stock (commensurate to the sector's impact), and to maintain the sector within their allocated catch share.

This means that adjustments to the management of the recreational and charter sectors may be triggered in response to changes in the performance of the stocks (e.g. change in biomass), or to rebalance allocations (where a sector may have exceeded their allocated catch share). The following evaluation will be used to monitor, assess and manage catch sharing arrangements:

- The harvest strategy will define the acceptable range, taking into consideration confidence in the harvest estimate (buffer) and the level of risk to the stock (See section 12.4 change buffers). For instance, while the catch share of the recreational and charter sector (TARC) may be specified at 40% in the harvest strategy, an acceptable range (given the uncertainty in the estimate) may be from 35 to 45% of the TAC.
- An evaluation of total harvest against each sector's acceptable range for their catch share will be undertaken according to the schedule in the harvest strategy (e.g. an updated state-wide recreational harvest estimate, or available stock biomass estimate).
- Where key fishery species have a commercial catch limit (TACC), the commercial sector are prevented from exceeding their share, therefore management action will focus on adjusting the recreational/charter sector's take to within an acceptable range of their catch share.
- If a sector's harvest is estimated to be above the acceptable range for a species or stock, management action will be triggered to bring the harvest for the sector back to within their sectoral share.
- The harvest strategy may recommend that a management review be undertaken with the aim to return recreational harvest to within its catch share. A review should consider what recreational management changes would have an impact to return the sectoral harvest to within its catch share.

A range of measures can be considered, including but not restricted to size limits, in-possession limits, seasonal closures, or use of certain apparatus. In general, however, the primary tool for adjusting recreational harvest might often be in-possession limits. The estimated effectiveness of the chosen management tools will be stated.

Adjustments to the recreational harvest should consider use of all available recreational data to determine the relative influence of the proposed change to the harvest of the stock (i.e. using boat ramp survey data to determine what proportional reduction in the total harvest is required, as estimated by the statewide harvest estimate and charter logbooks). By considering the best available information it should be taken that the management change (e.g. adjustment to in possession limit or closure period) will achieve the intended outcome in maintaining harvest within a sector's allocated catch share. (Refer Figure 11)



**Figure 11: Example flow diagram to outline the decision process for management of recreational harvest (including recreational harvest taken in the charter fishery)**

The harvest strategy may define specific recreational management actions where there is a high level of confidence in the catch shares and there is enough information to enable modelling of alternative recreational management measures. For instance, if a biomass estimate for a species hits a trigger reference point (e.g. 50%) the possession limit for recreational take can be dropped by one fish. If such an approach is implemented, it must be tested (e.g. through MSE) to provide certainty that the action will achieve the desired result. Biomass recovery could then be monitored in the fishery after implementation, to test the efficiency, effectiveness and fit to the predicted model *in situ*.

## 12.4 Change buffers

Change buffers (also known as change limiting rules) are restrictions on how small or large a change to the allowable harvest of a sector (i.e. TACC) should be in a given year. Generally, change buffers may be considered for both the commercial and recreational sectors when designing decision rules to minimise impacts on business planning, burden through regulatory processes (red tape), uncertainty in data and to provide market certainty by reducing product availability over the short-term. It is preferable that assessment-based harvest strategies, with decision rules for setting the TAC based on biomass estimates, do not have change buffers.

If used, a minimum change buffer should outline a level (e.g. 50 tonnes or 5%) below which a change (e.g. in the TACC) may be deemed unnecessary, while still allowing the objectives of the fishery to be achieved.

If used, a maximum change buffer should outline the maximum adjustment to the allowable catch limit that can occur in a single year, as a mechanism for avoiding large management action that could result in high economic and social impacts (e.g. single year TACC adjustment greater than 1200 tonnes or 15%). Where a maximum change buffer is triggered for either sector, advice should be provided to determine whether the remaining unchanged amount should be adjusted in subsequent years (e.g. staggered across years) to ensure that the management remains consistent with the objectives of the fishery.

## 12.5 Social and economic considerations

The harvest strategies outline targets to set sustainable catch limits based on achieving maximum economic benefits from the resource, taken initially to correspond to around 60% of biomass. As this target level is set to support the most economically efficient use of the resource, improve the fishing experience for all sectors (e.g. a user's satisfaction or experience known as 'experiential yield') and promote a resilient system that can bounce back from other adverse environmental conditions (e.g. floods, cyclones and bleaching), it is taken that the appropriate design and implementation of the decision rules for target and secondary species will also meet social and economic aspirations.

In addition to meeting the social and economic objectives through the primary objective (based on achieving a  $B_{TARG}$ ), each harvest strategy may also outline supplementary social and economic management considerations. Taking account of these may provide for a change to management as recommended by the decision rules, but only when the fishery is operating at the target reference point or where an alternative decision will not comprise achievement of the primary objectives. These management options should focus on optimising the social and economic outcomes of the fishery to reasonably achieve each of the fishery objectives. For example, where a fishery may be approaching the target reference point, and a large TAC reduction is required, to balance economic and social objectives a number of smaller adjustments to the TAC could be made over a set period of time, provided that this alternative approach still means the fishery achieves its primary sustainability objective. Ultimately, social and economic considerations should be assessed with regard to the current performance of the fishery and impact of management changes, based on a pre-defined list of performance indicators in the harvest strategy. Where possible, the alternative management option should be modelled to ensure it will still meet the goals and objectives of the harvest strategy.

## 12.6 Testing decision rules

Testing of harvest strategy decision rules will ensure they achieve the stated objectives, considering incomplete information, uncertainty in the available data and complex relationships between management action and fishery responses. Testing approaches include formal simulation models of the fishery to evaluate the impact of the harvest strategy options on future fishery performance (e.g. MSE and references within Sloan *et al.*, 2014) or alternatively, qualitative evaluations of 'what if' scenarios applied to historical fishery performance (e.g. Smith *et al.*, 2004; Prince *et al.*, 2011, Dichmont *et al.*, 2011, Dichmont *et al.*, 2013). Monitoring and review testing should ensure that the implemented harvest strategy operates in the way it is intended, is considered robust and doesn't result in unintended or detrimental outcomes.

## 12.7 Dealing with scientific uncertainty – best practice

The methods for assessing a fishery can be diverse, ranging from data-limited performance indicators up to data-rich bio-economic models. Accounting for scientific uncertainty in the assessment approach allows management procedures to reduce the risk to a resource or fishery. An example of this is when determining the recommended level of fishing mortality. An assessment that does not account for scientific uncertainty is likely to have a higher risk of a fishery not achieving its objectives, or depleting below a reference point, than an assessment where uncertainty is accounted for when determining the recommended harvest levels which reduce the risk.

It has been demonstrated that bias and uncertainty generally increase with less information. The Commonwealth Fisheries Harvest Strategy Policy and Guidelines outline a best practice approach for dealing with changes to scientific uncertainty, based on the information content of an assessment approach. This approach categorises assessments from data-rich to data-limited, each of which corresponds to a recommended biological catch discount factor.

The discount factors are based on the assessment of uncertainties by Ralston *et al.* (2011) and provide a transparent process, whereby increasing information content of an assessment provides for a decrease in the TAC discount factor (Table 3). This approach of applying an appropriate discount to the recommended catch or effort level, resulting from the harvest control rules in harvest strategies, will be the preferred best practice approach for dealing with scientific uncertainty.

While using this systematic approach to account for uncertainty is generally preferred, there may be some fisheries which may not require discount factors, such as if a fishery aims for a more conservative measure of biomass (e.g. unfished exploitable biomass) or has precautionary input management controls that protect a large proportion of the stock.

An alternative to placing an assessment into a tier system is to undertake simulation tests to determine whether a harvest strategy (and its component decision rules) conforms to the requirements of this Policy. This approach would be beneficial, especially for single species or input-controlled fisheries.

**Table 3: Uncertainty tier system from The Commonwealth Harvest Strategy Guidelines – uncertainty discount as calculated values using Ralston et al. (2011)**

Assessment category	Criteria	Description	Uncertainty discount factor
1-2 (data-rich)	<ul style="list-style-type: none"> <li>1) Reliable estimates of biological and economic reference points</li> <li>2) Reliable estimates of biological reference points</li> </ul>	<ul style="list-style-type: none"> <li>1) Bioeconomic assessment</li> <li>2) Integrated stock assessment or Reliable biomass dynamic model</li> </ul>	0.91
3 (data-rich)	<ul style="list-style-type: none"> <li>3) Less reliable estimates of biological and/or economic reference points</li> </ul>	<ul style="list-style-type: none"> <li>3) Catch only methods such as depletion corrected average catch / stock reduction analysis, less reliable stock assessment or out of date stock assessment</li> </ul>	0.87
4-8 (data-moderate)	<ul style="list-style-type: none"> <li>4) Reliable trends in B</li> <li>5) Reliable trends in F</li> <li>6) Less reliable trends in B and F</li> <li>7) Reliable short-term estimates of B and F</li> <li>8) Less reliable short-term estimates of B and F</li> </ul>	<ul style="list-style-type: none"> <li>4) Biomass proxy indexes such as CPUE or survey indexes.</li> <li>5) Regular catch curve analyses</li> <li>6) Regular catch curve analyses where some assumptions are breached or data is less consistent year on year</li> <li>7) Once-off catch curve analysis, once-off or out of date eSAFE, Once-off GIS mapping overlap methods</li> <li>8) Once-off catch curve analyses where some assumptions are breached or data is less consistent year on year</li> </ul>	0.82-0.87
< 9 (Data-limited)	<ul style="list-style-type: none"> <li>9) Triggers applied to single species</li> <li>10) Triggers applied to multiple species or groups</li> <li>11) Triggers based on ecological indicators</li> </ul>	<ul style="list-style-type: none"> <li>9) Relative levels of current and historical catch (or snapshot catch rates)</li> <li>10) Relative levels of current and historical catch and catch composition</li> <li>11) Patchy catch and survey data. Patchy data from a single source (e.g. survey or catch)</li> </ul>	0.68
MSE	N/A	Management strategy evaluation performed	No buffer

\*Refer to *Appendix B in the Commonwealth Harvest Strategy Guidelines* (DAWR 2018) for more information on the structure and risk equivalency.

## 13 Exceptional circumstances

### 13.1 Information uncertainty

As outlined earlier, harvest strategies must avoid being ambiguous, particularly when it comes to the development of operational objectives and decision rules. However, a balance must be struck between the harvest strategy being too rigid and providing for a level of flexibility necessary to allow adaptation to issues that are not anticipated and for new information to be considered. In most cases, the decision rules and/or the stock assessment should contain sufficient buffers and ranges to allow for reasonable levels of uncertainty.

There may be times when the decision rules need to be set aside and alternative decisions made, due to new information becoming available that suggests that a specific component of the harvest strategy may need to be adjusted, or the entire harvest strategy be remade, to meet its objectives. To reflect this each harvest strategy should include the below statement:

*If any new information becomes available indicating that the assessment and TAC/TAE-setting arrangements are not consistent with the sustainable management of the fishery, decision rules must be reviewed and, if appropriate, the reference points or timeframes should be adjusted.*

An adjustment to a specific component of the harvest strategy may be made when new information becomes available that demonstrates the action recommended by the harvest strategy decision rules is not consistent with the fishery objectives harvest strategy goals or broader government policy, for example, new biological research that indicates the need for an adjustment to a reference point, or an assessment of the management performance. Under this scenario an alternative management decision or a deferral of management action may be permitted. Any revision to the harvest strategy should be documented and considered by the relevant fisheries working group, before proceeding with implementation of the adjusted harvest strategy.

If the new information is significant enough to suggest the harvest strategy and/or decision rules are incorrect and require adjustments to more than one component of the harvest strategy, then a formal amendment or harvest strategy remake should be undertaken. Under this scenario an alternative management decision or a deferral of management action may be permitted.

### 13.2 Pre-specified reviews

Some harvest strategies may lack recent or accurate information that may be important to the effective management of the fishery. An example of this is where catch shares may have been established based on an older state-wide recreational fishing survey, with estimates that might not reflect the current state of the fishery. In these circumstances, a harvest strategy may pre-specify that a specific element may be reviewed (e.g. catch shares  $B_{UNFISHED}$  levels may be reviewed, or research into the environmental capacity may shift  $B_{100}$  down, as in snapper) if new data becomes available, and a revision may be made without triggering the amendment provisions in the Act. Where this occurs, adjustments should only be made to the specified components of the harvest strategy and, if an adjustment is needed to a component that has not been pre-specified, this will be considered as either an information uncertainty or remake.

### **13.3 Harvest strategy remake**

While harvest strategies provide certainty and transparency in terms of management decisions in response to fishery information, there must be flexibility to allow new information or changing circumstances to be considered.

A harvest strategy will remain in place for a period of five years, after which time it will need to be fully reviewed in accordance with the Act. In addition, a harvest strategy may be subject to further review, amendment or remake as appropriate within the five-year period if the following circumstances arise (Sainsbury 2008):

- there is new information that substantially changes the status of a fishery
- drivers external to management of the fishery increase the risk to fish stock/s
- new information becomes available to suggest that the defined sectorial catch shares may have been set incorrectly, or may be unrepresentative due to a resource reallocation
- it is clear the harvest strategy is not working effectively, and the intent of the policy is not being met.

If the remake is following the 5-year review requirement, the existing harvest strategy should remain in place and continue to be used to inform management advice until the new harvest strategy is implemented.

If there is uncertainty about the existing harvest strategy's effectiveness in managing the fishery sustainably, interim decision rules may be applied until the new harvest strategy is implemented.

The Act specifies a number of legislative obligations including public consultation, Ministerial approval timeframes and amendment (see Part 2, Division 1 of the Act) that must be complied with in remaking a harvest strategy.

## **14 Establishing rebuilding strategies**

If a stock is identified as overfished, whereby the primary performance indicator falls below the defined LRP, immediate and drastic management response may be required to stop the decline and promote the recovery of the stock. Under this situation a rebuilding strategy must be developed and where possible, all targeted fishing for the stock should cease until a rebuilding strategy can be developed. In addition, a rebuilding strategy may be considered for species that are listed as conservation dependent under the EPBC Act.

Rebuilding strategies will define a target level and a rebuilding timeframe for stock recovery to the target level, with a reasonable level of certainty. Factors influencing the timeframe and target level could include the species' biology, productivity, recruitment, current level of biomass and any factors external to the fishery that may have impacted on the stock status (e.g. disease or environment).

In determining an appropriate timeframe in which to rebuild stocks, there must be consideration of the social and economic costs and impacts associated with various management actions. While a fishery closure, or reduction to catch limits for other species, may lead to the best outcomes for an overfished stock, it can come at severe social and economic cost. It also is a challenge for ongoing data inputs (catch rates, commercial harvest) necessary to understand the stock and how it is

responding to management intervention. In most cases it will be preferred that a rebuilding strategy allows restricted fishing on the stock, provided it still allows rebuilding to above the LRP within the specified timeframe. The trade off in this type of scenario may be acceptance that stocks will take longer to rebuild.

Where a harvest strategy is being developed for a stock that is already below the LRP, and no previous harvest strategy exists, the fishery may not be required to implement a fishery closure and develop a rebuilding strategy. However, if a stock that is being rebuilt from below the LRP under a harvest strategy and shows signs of further decline in the stock biomass (i.e. not a continuous rebuild), an immediate management response should be required (where possible all targeted fishing for the stock should cease) and a rebuilding strategy should be developed.

If a stock became overfished while being managed under a harvest strategy, that harvest strategy must be reviewed, and if necessary remade, to ensure it meets its objectives.

### **14.1 Rebuilding timeframes and reference points**

A rebuilding timeframe is the specified time for the stock to rebuild above its LRP with a reasonable level of certainty. Rebuilding strategies should also outline an interim target reference point and timeframes for rebuilding back to target levels. Rebuilding targets should be set at levels above the LRP, in order to reduce the risk of the stock falling below the 90% risk criterion for the LRP after the recommencement of targeting fishing, and to enable the rebuild strategy to transition into a harvest strategy. The default target level for a rebuilding strategy should be achieving BMSY.

Timeframes can differ between fisheries, depending on the biological life history characteristics, level of depletion, and social and economic impacts for various fisheries. However, in accordance with the Commonwealth Harvest Strategy Policy, rebuilding timeframes should be specified relative to the minimum timeframe for rebuilding in the absence of fishing (TMIN). Typically, timeframes should be defined within the range of TMIN and 2TMIN (Commonwealth 2018).

The 2TMIN timeframe defines the maximum time for which the fishery should be closed and is used for defining a maximum recovery time for stocks, where there may be ongoing mortality on a stock that does not allow the fishery to recover within TMIN. An example of this may be a fishery with high co-catch of different species and therefore the potential for ongoing discard mortality, despite there being non-targeted fishing pressure.

For stocks where data-limited methods are used for the assessment and TMIN cannot be estimated with reasonable confidence, the rebuilding time frame should be represented in terms of the estimated generation time of the stock (defined as the average age of a reproductively mature animal in an unexploited population). In this case, rebuilding times may be defined with regard to mean generation time and may be specified as the lesser of 3 times the mean generation, or the mean generation time plus 10 years (Commonwealth 2018).

Where there is scientific evidence that the productivity, growth or recruitment of the stock may be impacted by environmental factors (e.g. regime shift) or high natural variability, the rebuilding strategy should consider these when determining appropriate timeframes and reference points. Such decisions should be documented and supported by scientific evidence as this may have ongoing implications for the success of management actions aimed at rebuilding the stock.

## **14.2 Setting incidental TACs to cover unavoidable bycatch**

Reducing the TACs for other stocks in a fishery may be necessary to avoid or minimise the incidental catch of a stock under a rebuilding strategy. All forms of mortality should be taken into account when developing the strategy (including those from other jurisdictions). Once efforts to stop targeted fishing in a multi-stock fishery have been made; and if bycatch levels of the depleted stocks remain too high to allow rebuilding, reducing the TACs of companion or associated stocks may be necessary. In this case, the composition of catch should be monitored to detect and respond to changes in the relative proportions of stocks over time (Commonwealth 2018).

## **14.3 Recommencement of target fishing**

To ensure that adequate information is available to assess the performance of the stock in the absence of fishing (i.e. loss of fishery-dependent data), a dedicated monitoring program should be developed and built into the rebuilding strategy. Targeted fishing should not recommence until the biomass for the stock has rebuilt to above the specified LRP, and there is a harvest strategy developed to ensure that the stock does not fall below LRP with the recommencement of fishing mortality.

## **14.4 Review**

A rebuilding strategy must specify performance measures to be used to monitor how well the strategy is working to rebuild the stock. This Harvest Strategy Policy requires that a review of the rebuilding strategy be undertaken where there is evidence that a stock is not rebuilding as expected or will not rebuild in the specified timeframe.

Such reviews should document and evaluate the performance of the present rebuilding strategy and detail possible reasons for its failure. The review should identify how the failings will be addressed (including revised actions), and whether a new rebuilding strategy or timeframe is required. Following consideration of the review, the rebuilding strategy should be revised as necessary and re-implemented.

## 15 Acronyms and definitions

Term/acronym	Definition
Biomass	Total weight or volume of a stock or component of a stock (e.g. spawning stock biomass would refer to all adult (reproductively mature) fish in a population)
Biomass limit reference point ( $B_{LIM}$ )	The point beyond which the risk to the stock is regarded as unacceptably high
Biomass at maximum economic yield ( $B_{MEY}$ )	The average biomass which corresponds to maximum economic yield. See also 'Maximum economic yield'
Biomass at maximum sustainable yield ( $B_{MSY}$ )	The average biomass which corresponds to maximum sustainable yield. See also 'Maximum sustainable yield'
Biomass target ( $B_{TARG}$ )	The desired biomass of the stock
Bycatch	A species that is incidentally either: <ul style="list-style-type: none"> <li>taken in a fishery and returned to the sea</li> <li>killed or injured as a result of interacting with fishing equipment in the fishery, but not taken.</li> </ul> Bycatch can include protected species
Byproduct	Any part of the catch which is kept or sold by the fisher, but which is not the target species. Byproduct makes some contribution to the value of the catch in a fishery but less than that of key commercial species
Catch	In relation to fishing, means capture, take or harvest
Catch-per-unit-effort (CPUE)	The number or weight of fish caught by a unit of fishing effort. Can be used as an index of relative abundance or indicator of change in the fishery
Change buffers	Restrictions on how small or large a change to the allowable harvest of a sector (i.e. TACC or TARC) can be in a given year. Also called Change Limiting Rules.
Choke species (or stock)	Generally those species (or stocks) that are not a key commercial stock, but the management of which restricts the ability of fishers to fully catch or access the quota for a key commercial stock
Decision rules	Pre-determined rules that control fishing activity according to the biological, social and economic conditions of the fishery (as defined by monitoring or assessment). Also called Harvest Control Rules (HCR), and are a key element of a harvest strategy
Department	Department of Agriculture and Fisheries (Queensland)
Discards	Any part of the catch which is returned to the sea, whether dead or alive
Ecologically sustainable development (ESD)	Using, conserving and enhancing the community's fisheries resources and fish habitats so that the ecological processes on which life depends are

Term/acronym	Definition
	<p>maintained; and the total quality of life, both now and in the future, can be improved. Principles of ecologically sustainable development (as per the <i>Fisheries Act 2019</i>):</p> <p>(a) enhancing individual and community wellbeing through economic development that safeguards the wellbeing of future generations</p> <p>(b) providing fairness within and between generations</p> <p>(c) protecting biological diversity, ecological processes and life-support systems</p> <p>(d) in making decisions, effectively integrating fairness and short and long-term economic, environmental and social considerations</p> <p>(e) considering the global dimension of environmental impacts of actions and policies</p> <p>(f) considering the need to maintain and enhance competition, in an environmentally sound way</p> <p>(g) considering the need to develop a strong, growing and diversified economy that can enhance the capacity for environmental protection</p> <p>(h) that decisions and actions should provide for broad community involvement on issues affecting them</p> <p>(i) the precautionary principle</p>
Ecological Risk Assessment (ERA)	An assessment process that evaluates the relative risk posed by fishing on species, habitats and communities within a fishery
Effort	Also, called fishing effort. A measure of the resources (such as fishing hours or hook sets) used to harvest a fishery's stocks
EPBC Act	The Commonwealth <i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPBC Act-listed species	EPBC Act-listed species comprises all those protected under Part 13 of the EPBC Act including whales and other cetaceans and listed threatened, marine and migratory species (except for conservation-dependent species which are managed through rebuilding strategies under the Harvest Strategy Policy)
<i>Fisheries Act 1994</i> (The Act)	Queensland Act that provides the legal framework for fisheries managed by the Australian Government. The Act sets out, among other things: fisheries management objectives and arrangements for regulating; permitting; and taking enforcement action with respect to fishing operations
Fisheries (Commercial Fishing) Regulation 2019	Queensland regulation setting out the management and operation of commercial fisheries (authorisation of commercial fishing activities)

Term/acronym	Definition
Fisheries (General) Regulation 2019	Queensland fishing setting out the general management of all fisheries in Queensland
Fisheries Queensland	Means the Queensland Government agency that, among other things, has responsibility for management of Queensland's fisheries
Fishing	<p>fishing includes:</p> <ul style="list-style-type: none"> <li>a) searching for, or taking, fish; and</li> <li>b) attempting to search for, or take, fish; and</li> <li>c) engaging in other activities that can reasonably be expected to result in the locating, or taking, of fish; and</li> <li>d) landing fish (from a boat or in another way), bringing fish ashore or transshipping fish</li> </ul>
Fishing mortality rate (F)	The rate of mortality due to fishing activities
Generation time	The average time taken for an individual to replace itself within the population. Taken in this document to be the average age of fish that have reached maturity <i>and spawned</i> once
Hockey stick rule	'Hockey stick rule' is shorthand for the default type of decision rule used to manage target species in Queensland. It is based on the level of fishing mortality and is described in detail in chapter 12.1
Incidental catch	The portion of the catch that was not the intended target of a fishing operation.
Indicator	Provides information on the state of the stock or fishery
Input controls	Management measures that place restraints on fishing, e.g. who fishes (licence limitations), where they fish (closed areas), when they fish (closed seasons) or how they fish (gear restrictions)
Indigenous fishing permit (IFP)	An IFP allows an Aboriginal or Torres Strait Islander person or community to trial a commercial fishing activity without having to initially acquire commercial fishing authorities
Individually Transferable Effort (ITE)	Amount of effort allocated to an individual fisher or company
Individually Transferable Quota (ITQ)	Amount of catch allocated to an individual fisher or company
Limit reference point (LRP)	The level of an indicator (such as biomass or fishing mortality) below which the risk to the stock is regarded as unacceptably high (for example, $\leq B_{20}$ )
Management strategy evaluation (MSE)	A procedure whereby alternative management strategies are tested and compared using simulations of stock and fishery dynamics

Term/acronym	Definition
Management Unit	A management unit may be the target or a secondary species or stock, biological stock boundaries or some other geographical boundary related to the fishery or gear, or a combination of these
Maximum Economic Yield (MEY)	Sustainable level of harvest that allows net economic returns (profit) to be maximised
Maximum Sustainable Yield (MSY)	The maximum average sustainable annual fishing mortality that can occur on a stock over an indefinite period under prevailing environmental conditions
National Guidelines	Refers to the Fisheries Research and Development Corporation's National Guidelines to Develop Fishery Harvest Strategies
Output controls	Management measures that place restrictions on the outputs from fishing, including how much is caught, what species are taken and the size of those species
Overfished	A fish stock with a biomass below its biomass limit reference point or below its specified indicator limit reference point
Overfishing	A stock that is experiencing too much fishing. The rate of removals from a stock is likely to result in the stock becoming overfished. For a stock that is already overfished, overfishing is a rate of removals that will prevent stock recovery in accordance with its rebuilding strategy
Performance measure	Provides information on management performance. A measure of where an indicator is in relation to a reference point
Population	All the organisms of the same species, which live in a particular geographical area, and have the capability of interbreeding
Precautionary principle	The principle that, if there is a threat of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason to postpone measures to prevent environment degradation, or possible environmental degradation, because of the threat
Proxy	In the context of the Harvest Strategy Policy, a more easily estimated figure used to represent the value of a reference point. For example a target biomass of 60% is a proxy for $B_{MEY}$ where the actual value of $B_{MEY}$ may be unknown.
Recommended biological catch (RBC)	An output from (certain) harvest control rules. Provides an estimate of the total fishing mortality (landings from all sectors plus discards) recommended to achieve a predefined target. Distinct from total allowable catch (TAC)
Rebuilding strategy	A strategy designed to rebuild an overfished stock to above its limit

Term/acronym	Definition
	reference point and towards its target reference point
Recruit to the fishery or Fishery Recruit	A fish that has just become susceptible to catch in the fishery. Sometimes used in relation to population components (for example, a recruit to the spawning stock when a fish reaches maturity)
Recruitment	The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age
Species	A group of animals in which members can breed with one another and produce fertile offspring
Sector (fishing)	a part of the fishing industry representing: <ul style="list-style-type: none"> <li>a) commercial fishing; or</li> <li>b) charter fishing; or</li> <li>c) recreational fishing; or</li> <li>d) Indigenous fishing</li> </ul>
Stock (or Unit Stock)	A unit of management (subpopulation) of a particular fish species with or without common intrinsic population parameters (growth, recruitment, mortality and fishing mortality) and for which extrinsic factors (immigration and emigration) may be ignored. A stock may encompass the whole distribution of a species, in which case they are in effect the same thing. Or it may be some subset of the distribution of a species, in which case a species would have stock structure and comprise multiple stocks. See also 'Management Unit'.
Stock assessment:	A scientific analysis of a fish stock to estimate quantities of management or scientific interest such as fishing mortality and biomass, particularly in the context of reference levels
Strategy	The Sustainable Fisheries Strategy 2017-2027
Target species	The key species that drive fishing behaviour in a fishery or by a fishing sector
Target reference point (TRP):	The desired state of the stock or fishery (for example, MEY or 60%)
TMIN (and 2TMIN)	rebuilding timeframes specified relative to the minimum timeframe for rebuilding in the absence of commercial fishing
Total Allowable Catch (TAC)	The harvest limit set as an output control on fishing for all fishing sectors
Total Allowable	The harvest limit set for the commercial fishing sector usually achieved

Term/acronym	Definition
Commercial Catch (TACC)	through setting TACC or TACE, but sometimes through input controls
Total Allowable Commercial Effort (TACE)	The annual effort limit set for a stock, species or species group. Used to control commercial fishing mortality within a fishery
Total Allowable Recreational Catch (TARC)	The annual harvest limit set for the recreational fishing sector Usually achieved through possession limits, temporal and geographical closures etc. and measured through recreational fishing surveys
Trigger reference point (TrRP)	Agreed point at which additional review, assessment or management action may be taken in a fishery
Triple bottom line	referring to Ecological, Economic and Social objectives. See also Ecological Sustainable Development

## 16 Related and reference documents

- *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
- [Fisheries Act 1994 \(Qld\)](#)
- [Fisheries legislation \(regulations and declarations\)](#)
- [Sustainable Fisheries Strategy 2017 - 2027](#)
- [Commonwealth Fisheries Harvest Strategy Policy and Guidelines](#)
- Aboriginal and Torres Strait Islander commercial fishing development policy
- Resource Reallocation Policy

### 16.1 References

Bastardie, F., Vinther, M., Nielsen, J.R. and Ulrich, C 2010, Stock-based vs. fleet-based evaluation of the multi-annual management plan for the cod stocks in the Baltic Sea. *Fisheries Research*, 101: 188-202.

Butterworth, D.S. and Punt, A.E 1999, Experiences in the evaluation and implementation of management procedures. *ICES Journal of Marine Science*, 56: 985-998.

Commonwealth of Australia. 2015, *Reef 2050 Long-Term Sustainability Plan*. Australian Government. 111pp.

Department of Agriculture and Water Resources 2018, *Guidelines for Implementation of Commonwealth Fisheries Harvest Strategy Policy*. Canberra, Australia ISBN 978-1-76003-158-9. [www.agriculture.gov.au/fisheries/domestic/harvest\\_strategy\\_policy](http://www.agriculture.gov.au/fisheries/domestic/harvest_strategy_policy)

Dichmont, C.M., Dowling, N.A., Smith, A.D.M., Smith, D.C., and Haddon, M 2011, *Guidelines on developing harvest strategies for data-poor fisheries*. CSIRO Marine and Atmospheric Research, Hobart, Australia. 27pp

Dichmont, C.M., Pascoe, S., Jebreen, E., Pears, R., Brooks, K., and Perez, P 2013, Choosing a fishery's governance structure using data poor methods. *Marine Policy*, **37**:123-131

Dowling, N.A., Haddon, M., Smith, D.C., Dichmont, C.M., and Smith, A.D.M 2011, *Harvest strategies for data poor fisheries: a brief review of the literature*. CSIRO Marine and Atmospheric Research, Hobart, Australia. 43pp.

Fletcher, W. J., Shaw, J., Metcalf, S. J., and Gaughan, D.J 2010, An ecosystem based fisheries management framework: the efficient, regional-level planning tool for management agencies. *Marine Policy*, 34: 1226–1238.

Klaer, N.L. and Smith, D.C 2012, Determining primary and companion species in a multi-species fishery: implications for TAC setting. *Marine Policy*, 36: 606-612.

O'Neill, M.F., Campbell, A.B., Brown, I.W. and Johnstone, R 2010, Using catch rate data for simple cost-effective quota setting in the Australian spanner crab (*Ranina ranina*) fishery. *ICES Journal of Marine Science*, 67(8), pp.1538-1552.

O'Neill, M.F. and Leigh, G.M 2007, Fishing power increases continue in Queensland's east coast trawl fishery, Australia. *Fisheries Research*, 85(1-2), pp.84-92.

- Pelletier, D. and Ferraris, J 2000, A multivariate approach for defining fishing tactics from commercial catch and effort data. *Canadian Journal of Fisheries and Aquatic Sciences*, 57: 51-65.
- Punt A.E., Smith, A.D.M., Smith, D.C., Tuck, G.N., Klaer, N.L 2014, Selecting relative abundance proxies for  $B_{MSY}$  and  $B_{MEY}$ . *ICES Journal of Marine Science*, 71: 469-483.
- Prince, J.D., Dowling, N.A., Davies, C.R., Campbell, R.A., and Kolody, D.S 2011, A simple cost-effective and scale-less empirical approach to harvest strategies. *ICES Journal of Marine Science*, 68:947-960.
- Queensland Government, Department of Agriculture and Fisheries (DAF) (2017). *Queensland Sustainable Fisheries Strategy 2017-2027*.
- Ralston, S., Punt, A.E., Hamel, O.S., DeVore, J.D. and Conser, R.J 2011, A meta-analytic approach to quantifying scientific uncertainty in stock assessments. *Fishery Bulletin*, 109(2).
- Rindorf, A., Dichmont, C.M., Levin, P., Mace, P.M., Pascoe, S., Punt, A.E., Reid, D.G., Stephenson, R., Ulrich, C., Vince, M., Clausen, L.W 2017, Food for thought: pretty good multispecies yield. *ICES Journal of Marine Science*, 74: 475-486.
- Sainsbury, K 2008, *Best practice reference points for Australian fisheries* (pp. 156-pp). Canberra, Australia: Australian Fisheries Management Authority.
- Sloan, S., Smith, T., Gardner, C., Crosthwaite, K., Triantafillos, L., Jeffriess, B. and Kimber, N 2014, *National guidelines to develop fishery harvest strategies*.
- Smith, A.D.M., Sachse, M., Smith, D.C., Prince, J., Knuckey, I.A., Baelde, P., Walker, T.J., and Talman, S 2004. *Alternative management strategies for the Southern and Eastern Scalefish and Shark Fishery. Qualitative Assessment Stage 1*, Report to the Australian Fisheries Management Authority, Canberra, Australia. 94pp.