



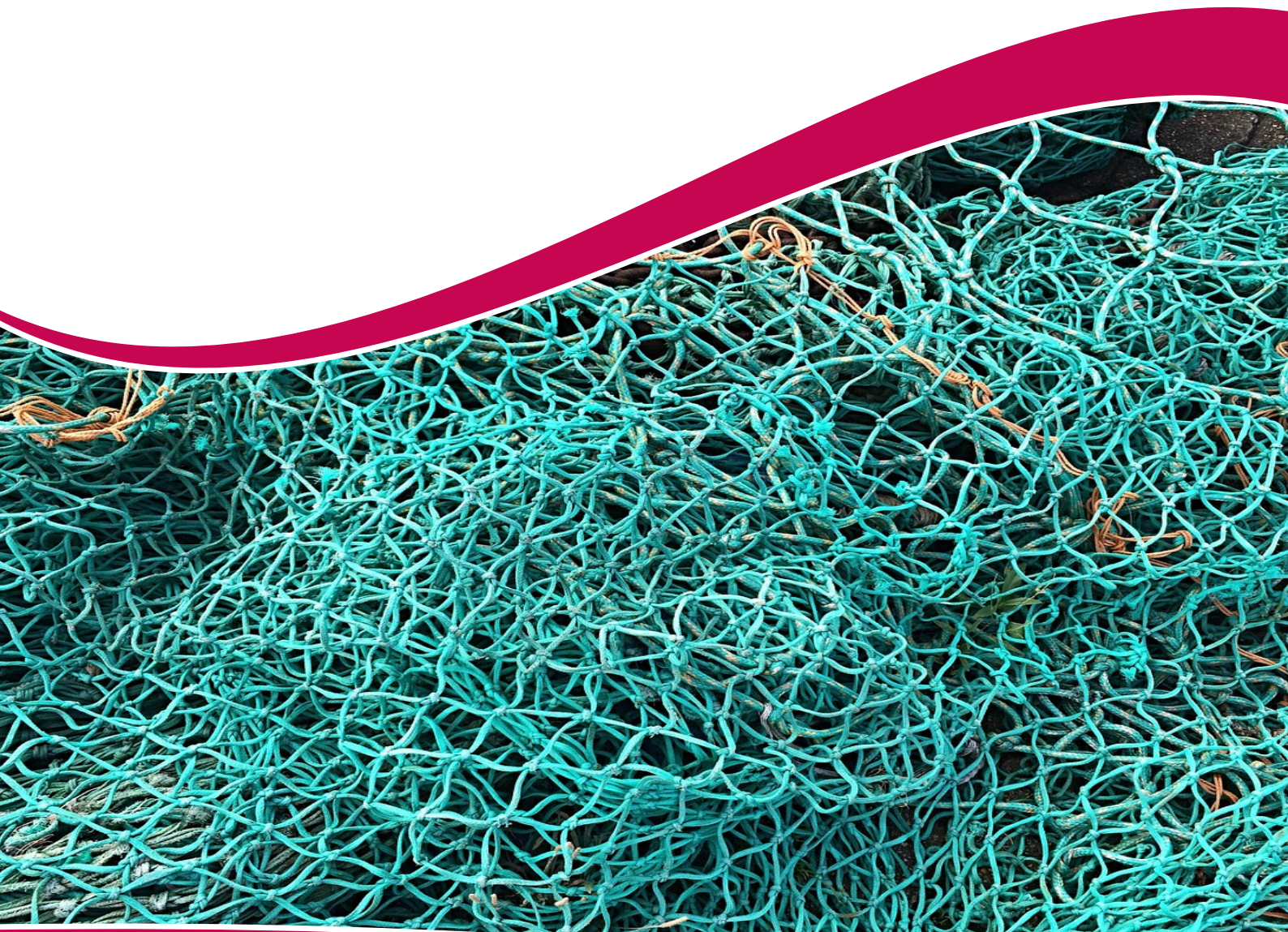
Australian Government

Australian Fisheries Management Authority

Blue warehou (*Seriolella brama*)

Stock Rebuilding Strategy

2022



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| Version | Updates | Approver |
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Executive Summary

This *Blue Warehou Stock Rebuilding Strategy 2022* (the Strategy) replaces the *Blue Warehou Stock Rebuilding Strategy 2014* (the 2014 Strategy) and maintains the objectives of the original *Blue Warehou Stock Rebuilding Strategy 2008* (the 2008 Strategy).

Although blue warehou is managed under a global catch limit, there is evidence that there are two stocks of blue warehou found in Australian waters, an eastern stock and a western stock. The 2014 Strategy was implemented as required by the *Commonwealth Fisheries Harvest Strategy Policy 2007* (2007 HSP) to continue supporting the recovery of eastern and western stocks of blue warehou to above 20 per cent of their unfished spawning biomass, the biomass limit reference point that has been adopted for these stocks.

This updated five-year strategy continues to work towards rebuilding stocks to their biomass limit reference point within a biologically reasonable timeframe, consistent with the objectives of the revised [Commonwealth Fisheries Harvest Strategy Policy 2018](#) (HSP) and [Guidelines for the Implementation of the Commonwealth Fisheries Harvest Strategy Policy](#) (HSP Guidelines).

In line with, and guided by HSP and HSP Guidelines, management actions set out in this Strategy maintain low fishing mortality to support rebuilding of stocks assessed as overfished, while continuing to monitor and assess the stocks. This will be done through:

- preventing targeted fishing for blue warehou by setting a total allowable catch (TAC) to cover incidental catches only;
- ensuring that incidental catch of the species is kept to a minimum; and
- research and monitoring to support stock assessments and to ensure the Strategy meets its objectives.

Blue warehou fishery indicator data and catch triggers are reviewed annually by the South East Resource Assessment Group (SERAG) as part of the annual review of the Strategy. The South East Management Advisory Committee (SEMAC) consider the outcomes of the annual review, including any recommended changes to the Strategy, and recommend sustainable incidental TACs for the coming Southern and Eastern Scalefish and Shark Fishery (SESSF) fishing year.

The management arrangements contained in this Strategy may be amended as required in response to changes in stock status or in response to the ongoing monitoring and advice provided by the relevant RAG and MAC.

AFMA will undertake a formal review of the Strategy after five years.

Introduction

Under the HSP, rebuilding strategies must be developed for all species which are assessed as being below their biomass limit reference point. For blue warehou, the proxy of 20 per cent of the unfished spawning biomass is used as the limit reference point.

Blue warehou is managed under a global catch limit noting there is evidence that there are two stocks of blue warehou found in Australian waters, an eastern stock and a western stock. Originally, the 2008 Strategy was developed and implemented in response to the eastern and western blue warehou stocks being assessed to be below their limit reference points. The implementation of the 2008 Strategy was also a condition of the Southern and Eastern Scalefish and Shark Fishery (SESSF) 2007 Wildlife Trade Operation accreditation (WTO) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The 2008 Strategy was updated in 2012 to modify reporting requirements and to include the non-trawl sectors of the SESSF. At that time, AFMA committed to undertake a more complete review of the 2008 Strategy in 2014. The outcome of this review was the 2014 Strategy which was updated to reflect the 2013 WTO accreditation condition to ensure that management measures were put in place to meet the rebuilding objectives for species listed as Conservation Dependent under the EPBC Act.

This *Blue Warehou Stock Rebuilding Strategy 2022* (the Strategy) replaces the 2014 Strategy and maintains the objectives of the 2008 Strategy. The Strategy incorporates recommendations from SERAG and SEMAC as part of the five-year review of the 2014 Strategy conducted in 2019, as well as feedback received during a four-week public consultation process. Outcomes of the five-year review are available on the [AFMA website](#). Final drafts incorporating feedback and recommendations were returned to SEMAC in March 2021, for review and endorsement.

Since the implementation of the 2008 Strategy, the TAC for blue warehou has been significantly reduced to cover only incidental catches and further promote recovery of the stock. The Strategy continues to focus on methods to reduce the overall fishing mortality of blue warehou while improving monitoring and assessment approaches to understand stock status.

Various management approaches are used in the rebuilding strategy including incidental TACs, limited entry, gear requirements, fishery closures, catch triggers for east and west zones and an industry code of practice. Targeting fishing is prevented by setting a low incidental TAC based on the estimated incidental catch while targeting other species.

Historically, blue warehou has been caught by both trawl and non-trawl methods while fishing within the SESSF. As such, the Strategy applies to both trawl and non-trawl fishing concessions.

Rebuilding timeframes

The 2008 Strategy implemented a timeframe for stocks to rebuild to the limit reference point of one mean generation time (being approximately six years to 2014). However in 2013, standardised catch rates for eastern and western stocks were estimated to be below their limit reference points – suggesting that the stock had not recovered during this time. In 2013, ShelfRAG¹ considered that catch rates did not provide a reliable index of abundance. For more detail, refer to ‘**Stock Assessments**’ in this document.

¹ ShelfRAG and SlopeRAG were amalgamated into SERAG in 2016. Refer to: <https://www.afma.gov.au/fisheries/committees/south-east-resource-assessment-group>

Further guidance has been provided in the current HSP (also in the 2007 HSP) that the rebuilding timeframe to the limit reference point should occur within a biologically reasonable timeframe.

Examples of a biological reasonable timeframe specified in the HSP are the shorter of:

- a period equal to a mean generation time plus 10 years (16 years for blue warehou); or
- three times the mean generation time (18 years for blue warehou).

The 2014 Strategy adopted the rebuilding timeframe to the limit reference point of one mean generation time plus 10 years (being approximately 16 years) from the date of the 2008 Strategy. This set a timeframe for rebuilding to the limit reference point by or before 2024.

Industry actively avoids catching blue warehou and this has resulted in a lack of fishery-dependent data that would ordinarily inform an assessment to determine stock status and monitor rebuilding progress.

Consequently, rebuilding against the timeframe of 2024 is very unlikely.

When there is no credible evidence that a stock is rebuilding as expected or will rebuild within the specified timeframe, the HSP and HSP Guidelines require that the reasons be determined, and the rebuilding strategy be revised to account for these factors. In the absence of any definitive data upon which to base any change to the rebuilding timeframes, the original 2024 rebuilding timeframe will be retained.

AFMA will seek guidance from the *Department of Agriculture, Fisheries and Forestry* (DAFF) on how to address the failure of a stock to rebuild, and the inability to monitor rebuilding, within the timeframes specified under the HSP and within the rebuilding strategy.

AFMA is exploring alternatives for establishing an index of abundance, including fishery independent approaches like close-kin mark-recapture (CKMR) research. AFMA is also supporting research investigating the impacts of climate change on the biological characteristics and productivity of key SESSF species, including how to adapt harvest strategies and rebuilding strategies in a changing environment. AFMA can make annual updates to the strategy as the research progresses and management responses evolve.

Objectives

Consistent with the *Fisheries Management Act 1991* (FMA), the broad objective of this Strategy is to rebuild blue warehou stocks to levels where they can be harvested in an ecologically sustainable manner consistent with the HSP, to ultimately maximise the economic returns to the Australian community. Management arrangements focus on maintaining overall low levels of fishing mortality to promote stock recovery. The objectives are as follows:

1. To rebuild blue warehou (east and west) stocks in the SESSF to or above the default limit reference biomass point (B_{LIM}) of 20 per cent of the unfished spawning biomass within a biologically reasonable time frame; one mean generation time plus 10 years (approximately 16 years). That is, to reach or exceed B_{LIM} by no later than 2024.
2. Having reached B_{LIM} , rebuild blue warehou (east and west) stocks in the area of the SESSF to the default maximum sustainable yield biomass level of 40 per cent of the unfished spawning biomass (B_{MSY}) using the harvest control rules outlined in the SESSF Harvest Strategy Framework.
3. Once B_{MSY} is reached, pursue the biomass level which aims to maximise net economic returns, currently 48 per cent of unfished spawning biomass (B_{MEY}).

Stock status

Blue warehou stocks are currently managed under the SESSF Harvest Strategy Framework and are assessed using standardised Catch Per Unit Effort (CPUE) to determine Recommended Biological Catches (RBCs). CPUE has shown that the eastern stock has been below the limit reference point since 1998 and similarly, the western stock for most years since 1995. The standardised CPUE for both stocks continue to be low and declining in 2021, however, due to avoidance of blue warehou by operators the use of CPUE as an index of abundance is no longer considered reliable.

While rebuilding by 2024 is biologically possible given blue warehou's life history characteristics (refer to '[Life history](#)'), whether this occurs depends on various factors, including successful recruitment. There are several factors that may influence recruitment success, including environmental conditions and other sources of mortality. The HSP directs that all known sources of fishing mortality should be accounted for in harvest strategies including those that cannot be managed or constrained by AFMA such as recreational catch, state-managed catch, indigenous fishing and natural variability that may impact on stock productivity, for example climate change and variability in ocean conditions.

The *Australian Bureau of Agricultural and Resource Economics and Sciences* (ABARES) Fishery Status Reports 2021 classified blue warehou as overfished with regards to biomass and uncertain with regards to fishing mortality. ABARES noted that there are no reliable indicators to determine whether current fishing mortality will allow the stocks to rebuild within the specified timeframe and that estimated spawning biomass is still below the limit reference point.

Background

Life history

Blue warehou are found in continental shelf and upper slope waters throughout south-eastern Australia (New South Wales, Victoria, Tasmania and South Australia), both in Commonwealth and State managed waters. The species is also found in New Zealand waters.

Adults are caught in depths to 500 m, although most commercial catches occur from 50 m to 300 m (Smith, 1994). Blue warehou reach maturity after two to three years at a size of approximately 32 cm, and recruit into the fishery at 35-45 cm. Maximum size and age are reported as 76-90 cm and 10-15 years, respectively (Talman *et. al.* 2003, Wilson *et. al.* 2010), although higher maximum ages have been recorded for blue warehou in New Zealand.

Spawning occurs during winter and spring in various locations (Knuckey and Sivakumaran 1999), and larvae are widely distributed. Juveniles are pelagic, commonly occurring in association with jellyfish in open coastal waters. Sub-adults often occur in the sheltered waters of large marine embayments. Growth is rapid, with a mean caudal fork length of about 20 cm being attained after one year.

Blue warehou feed mainly on salps but also euphausiids, krill, crabs and small squid. They are a schooling species, usually aggregating close to the sea bed, although there is some evidence that they move into the middle water column at night. Schools often contain fish of a similar size.

Fishbase (www.fishbase.org) reports blue warehou has a trophic level of 3.3 (± 0.4 se) (based on diet studies), a minimum population doubling time 1.4 - 4.4 years and a medium level of intrinsic resilience (based on a growth coefficient, $K=0.19$).

Given the accepted value of K is 0.37 (Klaer 2012), much higher than that used by Fishbase, and that fecundity is estimated to be 0.43–1.33 million eggs/year (Knuckey and Sivakumaran 2001), blue warehou is considered to have medium to high resilience to overfishing.

Key threats

Blue warehou were historically taken as a target and incidental catch species in the trawl and the non-trawl (primarily gillnet) sectors of the SESSF. The non-trawl sector tended to catch larger blue warehou than the trawl sector. Total landed catch (Commonwealth and State) across southern and eastern Australia peaked in 1991 at approximately 2,500 t and declined to about 4 t in the 2021-22 fishing year.

Fishing mortality

Fishing mortality is considered to have had a significant impact on blue warehou stocks and if fishing again approached the levels seen in the early years of the fishery, this could threaten the species into the future. However, it has been difficult to accurately estimate current biomass depletion levels due to the spatial and temporal patchiness of the species and significant uncertainties in the current and earlier stock assessment models which have relied on trawl CPUE trends for an index of abundance.

The management arrangements outlined in this Strategy are intended to minimise the threats to the recovery of blue warehou by reducing fishing mortality.

The impacts on blue warehou from recreational fishers are not well known nationally though there are estimates of Tasmanian recreational catch provided through recreational fishing surveys. Better mortality estimates from the recreational sector nationally could provide a clearer picture of total fishing mortality.

Environmental variability and climate change

While fishing is considered to have had a significant impact on blue warehou stocks, long term and short term environmental variability, including climate change, can also affect fish population dynamics and may also impact upon the recovery of blue warehou.

The HSP Guidelines (section 6.2.3) specify that rebuilding strategies need to adequately account for natural variability noting that stock productivity, growth and recruitment may not be static over time. Oceanographic modelling predicts that the Eastern Australian Current (EAC) flow through the Tasman Sea will intensify and generate a warming rate in the Tasman Sea that is the greatest in the Southern Hemisphere (Cai *et al.* 2005).

The potential impacts of environmental variability on fish stocks, including blue warehou, are not well known and further research may provide a better understanding of the species and threats to its recovery. In 2019, SERAG noted concerns about ecosystem shifts that may contribute to non-recovery of some stocks managed under rebuilding strategies. The current focus on these issues includes research on how to account for climate-driven changes in productivity, such as dynamic reference points, and collecting periodic data on environmental parameters and species' distributions. The rebuilding strategy can be updated annually as research progresses and management responses evolve.

Monitoring and data collection

In the SESSF, current methods of data collection include fishery logbooks, catch disposal records (CDRs), the AFMA observer program, electronic monitoring (e-monitoring), fish receiver permits, boat inspections, Vessel Monitoring System (VMS), licensing and quota management information and research projects and surveys.

Catch and effort data from commercial logbooks is used to calculate standardised CPUE and is the primary index of abundance in stock assessments for most SESSF quota species. Logbook data is also used to monitor catch and effort trends for bycatch and by-product species and monitoring and reporting of Protected species interactions to DAFF.

Catch and effort

Landed catch and effort

Catch and effort data are collected primarily through daily fishing logbooks. Landed catch is verified using CDRs, and discard, and are verified. An overview of blue warehou catch and discard data is provided below but for more detailed information, refer to the annual SESSF species summaries under 'Fishery Publications' on the [SESSF Homepage](#).

Over time, the blue warehou TAC has decreased from 365 t in 2008–09 to 118 t in 2014–15 where it remained until the 2020-21 fishing year. Commonwealth catches of blue warehou have been consistently below the incidental TAC ([Table 1](#)), noting catches in 2018–19 were higher than in recent years (46% of the 118 t TAC). Since 2008, trawl methods have accounted for approximately 95 per cent of the catch.

| SESSF season | TAC (t) | Landed catch (t) | % TAC caught |
|--------------|---------|------------------|--------------|
| 2008-09 | 365 | 167 | 46 |
| 2009-10 | 183 | 126 | 69 |
| 2010-11 | 183 | 147 | 80 |
| 2011-12 | 133 | 98 | 74 |
| 2012-13 | 118 | 49 | 42 |
| 2013-14 | 118 | 65 | 55 |
| 2014-15 | 118 | 16 | 14 |
| 2015-16 | 118 | 2 | 2 |
| 2016-17 | 118 | 17 | 14 |
| 2017-18 | 118 | 32 | 27 |
| 2018-19 | 118 | 57 | 48 |
| 2019-20 | 118 | 11 | 9 |
| 2020-21 | 118 | 3 | 3 |
| 2021-22 | 50 | 4 | 8 |

Table 1. Blue warehou TACs and % TAC caught per fishing season

In 2020, SERAG considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species. The analysis incorporated a range of factors such as area, depth fished and gear type – also known as 'métiers'. Using logbook data from 2018 and 2019, and expected 2021-22 TACs for the main companion species, the estimated unavoidable bycatch of blue warehou for 2021 was 29.1 t, with a range between 21.2 t and 39.9 t. SEMAC subsequently recommended decreasing the incidental bycatch TAC to 50 t for the 2021-22 fishing year.

State commercial catches are typically low. While NSW have recorded catches of up to 10 t in the last ten years (11.1 t in 2017), combined catches across all jurisdictions has been less than 6 t since then. Tasmanian

recreational catches from December 2017 to November 2018 were approximately 0.8 t (pers. comm. Jeremy Lyle, UTAS).

With regards to other fisheries, blue warehou has been reported as being caught in the Coral Sea Fishery (18 kg retained in 2017, 59kg in 2018), Small Pelagic Fishery (93 kg discarded in 2016) and High Seas Fishery (4 kg retained in 2013).

Discards

Currently, discards are estimated for key SESSF species, including blue warehou, through AFMA's onboard observer program (ISMP). The validity of these estimates is dependent on representative coverage. Given the low levels of catch of blue warehou, discard estimates are inherently uncertain. AFMA is continuing to work with industry to improve the precision of discard information recorded in daily fishing logbooks.

In 2019, SERAG noted that discard estimate remains highly uncertain due to sporadic and low levels of catch, which make obtaining representative observer coverage difficult. The 2017 estimate of discards was 216 t (91%), however was based on data obtained from a single Danish seine trip in 2017. The 2018 and 2019 discard estimates were 28 t (65%) and 36 t (72%). While the discard proportion remains relatively high, the total weight of discards is more consistent with previous year's estimates. SERAG recommended monitoring future discards but were not concerned that the potential high discards estimated in 2017 had adversely impacted the stock.

Noting that discard estimates are somewhat uncertain, AFMA will continue to monitor discarding through the AFMA observer program, and will work with industry to improve discard reporting and promote research into trawl gear selectivity to help with minimising bycatch (refer to [Future focus](#)).

Monitoring programs

Integrated Scientific Monitoring Program (ISMP)

The ISMP is a data collection program which places AFMA observers on commercial fishing boats to collect independent information on fishing operations, the retained and discarded catch composition and protected species interactions. Data is collected either on-board or via port sampling.

This data stream is critical because it provides fisheries managers, research organisations, environmental agencies, the fishing industry and the wider community with independent, reliable, verified and accurate information on the fishing catch, effort and practice of Commonwealth boats. The program has provided information on the quantity, size and age composition of quota species, including blue warehou, caught in sectors of the SESSF since 1994.

The ISMP is used to:

- verify logbook information;
- determine levels of interaction with Protected species;
- quantify levels of bycatch and status of discards (mortality rates);
- collect biological data for stock assessments and research projects on-board or at port (e.g. collection of otoliths – fish ear bones – to age fish, and collect sex and length data of fish);
- record environmental observations;
- collect anecdotal information (qualitative data) for research;
- quantify level of depredation (if high coverage);
- educate fishers (e.g. data collection, species identification, handling Protected species, tag recovery, compliance regulations).

AFMA deploys observers in proportion to the number of fishing days in each strata. This translates to coverage of approximately 3-4 per cent of trawl effort in the Commonwealth Trawl Sector (CTS).

Under AFMA's data plan, ISMP targets for blue warehou include the collection of biological data including 1000 units of length/sex data from the eastern and western stocks each year.

The ISMP sampling regime and targets are reviewed annually to ensure sampling remains representative of fishing effort and to ensure optimal data collection for blue warehou and other SESSF species.

Fishery independent data

Fishery independent data provides a time-series of information, ideally an index of abundance, which can be used in addition to, or instead of, commercial CPUE data for key target species. Fishery independent surveys provide estimated abundance of fish stocks over time which are independent of commercial fishing. This is important because for some species, commercial catch rates are of limited use for providing an understanding of stock status. This is the case for blue warehou where commercial fishers actively avoid catching the species.

To support assessments of stock status, a blue warehou trawl survey was conducted during 2005 (Hudson and Knuckey 2006) and used as an alternative index of abundance in the 2006 assessment. However, due to the survey results being imprecise and to some extent contradictory (Punt 2006), they were of limited use and were not considered informative for the assessments. A repeat of the 2005 blue warehou trawl survey was run in 2011. Catch rates from 2011 were lower than those observed during the 2005 survey. While the results suggest abundance levels were lower than those during 2005, ShelfRAG² considered the results very uncertain because of the unpredictability of the species and questioned the value of continuing such surveys.

In 2007, a fishery wide survey was designed to provide an independent index of abundance of as many SESSF quota species as possible, including blue warehou. SESSF Fishery Independent Surveys (FIS) were conducted in 2008, 2010, 2012 and 2014. To date, the surveys have not produced consistent estimates for blue warehou, and the FIS was discontinued because it was not considered a cost-effective option for providing fishery independent data for a range of SESSF species.

AFMA is investigating options for obtaining fishery independent data, including the use of CKMR for rebuilding species. The *Fisheries Research and Development Corporation* (FRDC) are also pursuing the development of an '[Abundance estimation toolbox](#)' to identify options for estimating abundance for a range of species.

Industry data collection

AFMA is supportive of industry data collection programs which can provide a valuable supplement to existing data streams. Data collected by industry provides a cost effective approach to improving spatial and temporal coverage with data collected on-board by crew.

Unlike the observer program, crew collected data is not independently verified but can be used to:

- collect biological data for stock assessments and inform research projects;
- record environmental observations; and
- collect anecdotal information (qualitative data) for research.

² ShelfRAG and SlopeRAG were amalgamated into SERAG in 2016.

Industry collection of blue warehou length measurements commenced in 2011, supported by the South East Trawl Fishing Industry Association (SETFIA), to supplement the ISMP observer program. These data will be incorporated into future length-based assessments where applicable. To date, over 2,000 samples have been collected. As of 2019, there is no ongoing crew-based data collection for blue warehou.

Electronic Monitoring

Electronic monitoring (EM) systems (cameras and sensors) have been used in the SESSF gillnet sector since 2010 and have proven effective at monitoring catch and detecting interactions with Protected species. The systems automatically record fishing activity as the catch is brought on board. AFMA is investigating the capability of the systems for use in the CTS for supplementing the ISMP, including whether it is possible for the systems to provide estimated size and species composition of catch.

A trial was completed in 2020 which showed EM is effective at monitoring interactions with large protected species, however was less effective at monitoring landed and discarded catch to the species level because of the nature of trawl operations, where catch is typically brought on board in large quantities and composed of multiple species. AFMA will continue to review the application of EM in the CTS.

Management approaches

There is currently no reliable index of abundance for blue warehou. The lack of a robust stock assessment means that it is not clear what level of catch will allow rebuilding to the limit reference point within the target timeframe. For this reason, management is focused on preventing targeting and limiting bycatch.

Management arrangements for the current fishing season across the SESSF can be accessed in the 'SESSF management arrangements booklet' which is distributed to all concession holders prior to the commencement of each SESSF fishing season commencing on 1 May each year.

A copy of the booklet is available from: <https://www.afma.gov.au/fisheries-services/fisheries-management-plans>.

Move-on provision

In 2019, AFMA implemented a move-on provision which requires boats to shift their fishing activities for at least 24 hours if they catch in excess of 200 kg of blue warehou in any shot. This measure replaces the previous rule that specified reporting of catches in excess of 250kg, and was introduced for the 2019-20 season amid reports of large numbers of small fish observed across the fishery.

The move-on provision is an appropriate management response noting that eLogs provide an indication of catches in real time. The move-on rule aims to prevent operators shooting back on schools of blue warehou, but still allows for small incidental catches when targeting other species.

The provision has been specified in concession conditions and states:

'If the holder catches more than 200 kg of blue warehou in any shot, the holder must not fish within 3 nautical miles of the location at which the shot is hauled for a period of 24 hours.'

Each year, SERAG reviews the effectiveness of this measure as part of the annual review. In conjunction with this move-on provision, AFMA will continue educating industry about this requirement with the assistance of SETFIA.

Incidental catch limit and targeting behaviour

For blue warehou, AFMA sets an incidental catch limit or bycatch TAC as part of the management arrangements for rebuilding. The incidental catch limit allows for unavoidable bycatch and aims to minimise discarding within the fishery. AFMA also reviews catches against the limits and analyses targeting behaviour on an annual basis.

In terms of setting the incidental catch limit, statistical analyses by CSIRO indicated that of the 154 t of blue warehou catch in 2010, 118 t was unavoidable. This level of unavoidable catch provided the basis for subsequent incidental catch TACs up to 2020. An updated targeting and companion species analysis in 2020 estimated that the unavoidable bycatch had decreased, and SEMAC subsequently recommended an incidental bycatch TAC of 50 t for the 2021-22 fishing year. This was maintained for the 2022-23 fishing year.

The HSP and this Strategy stipulate zero targeted catch for blue warehou. AFMA monitors operator targeting behaviour and if an increase in targeting of blue warehou was identified, AFMA, in consultation with SERAG and SEMAC, may reduce the incidental TAC and introduce additional management measures including specifying move-on provisions in concession conditions or implementing spatial closures.

Annual review and catch triggers

Each year AFMA conducts a review of progress achieved under the rebuilding strategies. The annual review considers a range of indicators that help assess rebuilding progress achieved over the preceding 12 month period along with progress overall across the five-year strategy period. The analysis helps identify whether the current measures are adequate or if they need to be adjusted or new arrangements implemented.

Outcomes of the annual review are presented to SERAG and SEMAC during the annual assessment meetings. As a minimum, the annual review will focus on the following key considerations:

- Indications of how stock status is tracking against the Strategy objectives using available assessments, data, intelligence or fishery indicators;
- Analysis of current management measures implemented;
- Review of catch and effort data, heat maps and other data collected including consideration of potential data gaps and needs;
- Review of catches against incidental catch limits;
- A companion species and targeting analysis (incorporating métiers approach), and
- Consideration of potential changes to management measures or data collection approaches.

The incidental catch TAC for blue warehou is applied to both eastern and western stocks. To ensure catches in each zone are monitored, AFMA reviews catches against regional triggers during the season. These are reviewed by SERAG annually and may be recalculated each fishing year based on updated targeting and companion species analyses. Further detail on specific catch triggers are outlined at [Appendix A – east and west catch triggers](#).

Updated monthly catch information for all SESSF quota species, including blue warehou, can be accessed through AFMA's 'catchwatch' reports at: <https://www.afma.gov.au/fisheries-services/catchwatch-reports>.

Limited entry

Under the SESSF Management Plan 2003, fishing access to the SESSF is limited to the number of concessions that currently exist. New operators can access the fishery only by purchasing or leasing an existing concession. This assists with restricting any future expansion of incidental catch of blue warehou within the TAC limit.

In 2006, a structural adjustment package resulted in the removal of 59 boat Statutory Fishing Rights (reduction of approximately 50 per cent) and 32 boats from the CTS of the SESSF. This structural adjustment led to an immediate and significant reduction of total shots and effort (trawl hours) across the CTS.

Gear requirements

CTS operators are required to use gear designed to reduce the mortality (catch and discards) of juvenile fish. From the start of the 2019–20 season, the minimum mesh size in the codend of a Danish seine net was increased to 75 mm when targeting flathead. For demersal trawl, net mesh must not be less than 90 mm in any part of the net and in most cases a bycatch reduction device must be used. For gillnets the mesh size must be between 15cm and 16.5cm.

Various gear selectivity trials have demonstrated the effectiveness of increased mesh size towards excluding small fish. An FRDC project (project number 2019-027) commenced in 2021 that seeks to quantify the performance of discard and bycatch reduction strategies in the GABT and CTS. Pending the outcomes of this research and upon advice from SERAG, additional gear requirements may be considered.

Fishery closures

Fishery closures in the SESSF, while not specifically implemented for the purpose of protecting blue warehou, overlap with the distribution of blue warehou and provide some protection to stocks.

Approximately 86 per cent of the CTS is closed to trawl fishing. Closures in the Gillnet, Hook and Trap sector of the SESSF of waters deeper than approximately 183m prevent fishing in areas where blue warehou historically were targeted by gillnet fishers.

Historically, a voluntary industry closure was implemented from 2008 to 2012 for the eastern stock based on a historical understanding of blue warehou spawning grounds. These grounds were closed to all trawl fishing for a six week period beginning in mid-August through to the end of September, covering two full moons. The closure dates changed according to the moons. Voluntary closures were recommended in place of closures set by legislative direction as they were more cost effective and provided flexibility in setting and/or changing closures. Compliance with the closures was monitored through VMS.

Following review in 2013, the voluntary closure was discontinued due to the patchiness and unpredictability of the species, as identified in the 2005 and 2011 Fishery Independent Surveys for blue warehou (Hudson and Knuckey (2006) and Knuckey et al. (2012)). This meant that the closure was not providing the stock with significant protection. A summary report by Knuckey (2012) stated that ‘the large changes in variance and abundance from year to year are of concern, but may represent the real dynamics of a spatially and temporally patchy stock distribution or availability’.

At the time of finalising this Strategy, a revised network of spatial closures is being considered to reduce the level of catch of at-risk species. Details will be incorporated into future drafts of this Strategy once they are finalised.

Industry code of practice

In early 2012, SETFIA with support from AFMA, developed an industry code of practice and an education and awareness program to help operators actively avoid catching blue warehou and to emphasise the importance of accurately recording data. A copy of the code of practice is provided at [Appendix B – industry code of practice](#).

This industry code captures operator requirements outlined in the Strategy as well as additional measures which require operators to communicate the location of blue warehou schools in an effort to increase avoidance and reduce incidental catches.

To meet an action arising from the development of bycatch and discarding workplans, AFMA is working with SETFIA to develop training programs to educate fishers more broadly about rebuilding measures, reporting requirements and the industry code of practice.

Future management

The key challenge for future management of blue warehou is getting more data to support a future stock assessment and to help assess the effectiveness of existing measures. As more data becomes available, additional management arrangements may be implemented to help achieve the objectives of this Strategy. This includes consideration of, or progress towards:

- implementation and/or revision of triggers and move-on provisions for boats reporting large catches or if the annual analysis indicates that some boats are targeting blue warehou;
- spatial and temporal closures of areas of likely high blue warehou abundance or believed to be spawning grounds;
- gear optimisation and bycatch reduction approaches;
- improved reporting techniques including consideration of electronic monitoring approaches; and
- development of alternative monitoring and assessment methods including close-kin genetic assessments and companion species analyses, to update estimates of unavoidable bycatch and to complement the multi-species harvest strategy approach.

Stock Assessments

Since 2005, blue warehou has been assessed under a Tier 4 assessment model which relies on CPUE to indicate stock abundance. This is because the Tier 1 assessment was not considered robust. The standardised CPUE for both stocks continued to be low and declining. In 2013, ShelfRAG considered that Tier 4 assessments for blue warehou were not reliable because industry avoidance of the species meant that CPUE was not reflective of abundance. As such, there continues to be uncertainties regarding the stock status and other indicators of abundance are required.

Assessing the status of blue warehou is difficult because of the lack of reliable and representative data for the stocks. The problem has persisted because:

- fishers now avoid catching blue warehou, so catch rates do not reliably reflect abundance, and
- length and age samples, which can be used to assess stock status, do not reflect the stocks because:
 - blue warehou tend to school in the same size classes,
 - distribution of the stocks is patchy and unpredictable, and

- in some years sampling is poor reflecting the unpredictable distribution of the stocks and the difficulty for AFMA observers to collect samples.

SERAG noted that the data currently available may provide a signal if there is a recruitment-driven recovery or an availability-driven recovery. There is no indication of range contraction and there appears to be a small increase in frequency of larger shots. However, an alternative primary index of abundance needs to be developed as a high priority to update the stock assessment.

Industry has reported that during the past when boat numbers and catches were higher, they were able to overcome the patchiness of aggregations by working as a fleet. This search efficiency is lost due to the reduction of the fleet and the restriction against targeting of blue warehou.

Stock assessments undertaken before 2000 assumed that blue warehou formed a single stock off south east Australia. In 2003, several techniques including DNA testing, otolith microchemistry and otolith shape analysis, indicated significant differences in the populations east and west of Bass Strait (Talman et. al. 2003, Robinson et. al. 2008). Given this strong evidence for separate stocks, recent stock assessments assume there are two distinct stocks.

Assessment approaches

2011 workshop

In 2011, a blue warehou specific workshop was held to determine if there was a better approach to assessing stock status. The outcomes included a recommendation to broaden the sampling of size structure data by having commercial operators measure length frequencies which could be correlated with catch weight estimates. However, it was noted that the low TAC and catches in the east would likely constrain industry sampling.

2013 workshop

AFMA held a workshop in 2013 to consider how to determine a suitable index of abundance for blue warehou. Options explored included Tier 1, Tier 3 and Spawning Potential Ratio (SPR) assessment methods, however these assessment methods were ruled out due to lack of data to inform them, and issues relating to bimodal distribution, dome shaped selectivity, episodic recruitment, potentially unrepresentative sampling, and the spatially and temporally patchy nature of the species.

AFMA notes that new assessment methods that are currently being evaluated for 'data poor' situations may be suitable for application to blue warehou. Results of these methods, and methodological developments elsewhere, will be monitored and used to expand the options currently provided in the SESSF Harvest Strategy Framework.

AFMA is also considering the potential for new genetic approaches (such as close-kin genetics) to provide improved estimates of population size that are not dependent on CPUE or surveys. Refer to the points extrapolated under '[Future management](#)'.

Evaluation and reporting

Reviewing the strategy

SERAG has primary responsibility for monitoring the status of the blue warehou stocks to determine if rebuilding is occurring. The parameters of the annual review process are outlined under [Annual review and catch triggers](#) and the outcomes are presented to SERAG for their expert input and advice.

AFMA will also consider SERAG or SEMAC advice on whether the incidental catch TAC should be adjusted to account for any inefficiency in the quota market. Outcomes of the annual review are considered by SEMAC when recommending unavoidable bycatch TACs.

The management arrangements contained in this Strategy may be amended as required in response to changes in stock status or in response to the outcomes of the annual review.

AFMA will undertake a formal review of the Strategy after five years.

Reporting and consultation

AFMA reports annually on the stock status of blue warehou and performance against the goals of the Strategy to DAFF to meet reporting requirements under the SESSF Wildlife Trade Operation (WTO) accreditation and requirements under the EPBC Act for Conservation Dependent species. AFMA reviews the level of observer coverage and overall industry compliance with the Strategy and at the conclusion of the five-year strategy period, the review report is published on the AFMA website. This in-depth review supports AFMA's development of the next iteration of the rebuilding strategy.

During the development of this Strategy, AFMA has consulted with:

- DAFF, including the Threatened Species Scientific Committee (TSSC);
- SESSF, SERAG and SEMAC;
- SETFIA and individual operators, particularly those in the Commonwealth Trawl Sector, and
- Key stakeholders including environmental non-government organisations, through a formal public consultation process – a call for public comments on AFMA's website.

Economic impacts

This Strategy observes a risk-based management approach as outlined in the HSP (section 3.5). This entails an assessment of, and balancing of, risk, cost and catch - referred to as a risk-cost-catch trade-off between the level of fishing mortality applied to one or more stocks (catch) and the cost of managing the fishery in pursuit of specified objectives. In practical terms, more caution is used when there is uncertainty about stock status increases.

Economic impacts associated with the recovery blue warehou include the costs of monitoring, research and the stock assessment process. Management costs are apportioned between industry and the Australian Government under AFMA's Cost Recovery Impact Statement (CRIS) which reflects the Australian Government's Cost Recovery Guidelines.

There is an additional impact on the fishing industry because targeted fishing is not permitted and only incidental catch TACs are set. However, some of these costs may be offset in the longer term, subject to the stock rebuilding and commercial fishing re-commencing.

Future focus

Consistent with the objectives of the *Fisheries Management Act 1991* and aligning with the HSP, this revised strategy will maintain the existing rebuilding objectives – to rebuild to the limit reference point by or before 2024. The available evidence and expert advice suggest that rebuilding to B₂₀ is unlikely to be

achieved during the life of this strategy, however the target will be retained in the absence of definitive data upon which to change it. AFMA will focus on exploring other potential avenues, including a stronger focus on research priorities and alternative approaches.

The management arrangements outlined in this strategy follow on from the 2014 Strategy and focus on maintaining the overall low fishing mortality to promote stock recovery and obtaining more data so stock status and recovery can be better monitored.

Based on advice from SERAG and SEMAC, in the period of this rebuilding strategy, AFMA will focus on the following:

Close-kin genetic assessments

As CPUE for blue warehou is no longer a reliable index of abundance due to avoidance by industry, unknown discards and low catches, AFMA will pursue close-kin genetics as an alternative to provide an estimate of absolute abundance. This will be included in SESSF research priorities in conjunction with other projects under consideration by COMRAC and FRDC.

Companion species analysis

A recent companion species analysis (using métiers) found that changes in the flathead TAC have the most impact on catches of redfish, and to a lesser extent, blue warehou and eastern gemfish. While the analysis does not generally provide an indication of targeting, AFMA determines whether targeting has occurred from observations, catch composition or a combination of inputs. In the most recent annual reviews, there were no indications of targeting by industry.

Accordingly, this companion species approach, using up to date data, will be used for blue warehou analysis annually to update estimates of unavoidable bycatch and aligns with AFMA's multi-species harvest strategy approach.

ISMP Program

AFMA notes the importance of onboard AFMA observers for data collection particularly for discard estimates; and will continue to prioritise ISMP data targets for this species.

Recreational catches

The Tasmanian Department of Primary Industries, Park, Water and Environment (DPIPWE) provide AFMA with recreational catch data. AFMA will explore additional avenues for obtaining further information on recreational catch of blue warehou.

Move-on provision

A review of available data indicates that the existing move-on provision has been successful since its introduction and will be retained and reviewed annually, along with educative campaigns for industry, in conjunction with SETFIA.

Variability and climate change

AFMA is committed to sustainable fisheries management, and better understanding how Commonwealth fisheries can adapt to the effects of climate change is an important priority. The FRDC Project - [Adaptation of Commonwealth fisheries management to climate change](#) – reviewed the existing Commonwealth

fisheries management framework, to guide AFMA and other fisheries on how to adapt their regulatory environment to account for climate change impacts on fisheries.

AFMA has noted concerns about ecosystem shifts over time that may lead to non-recovery of some stocks and that there has been a declining trend in commercial CPUE for the majority of SESSF quota stocks, despite a decrease in effort over time.

AFMA is exploring this issue and the potential impacts on rebuilding species like blue warehou to provide a better understanding of the threats to its recovery. AFMA will maintain this focus with expert advice from SERAG and SEMAC and by supporting research proposals in this emerging field, noting current projects underway that are investigating climate-driven changes in productivity, including application of dynamic reference points in harvest strategies, and collecting periodic data on environmental parameters and species' distributions.

Rebuilding timeframe

AFMA notes that industry actively avoid catching blue warehou which is resulting in a lack of data that would ordinarily help AFMA to determine stock status and rebuilding progress. Noting that within this context, the rebuilding timeframe of 2024 is unlikely to be met, AFMA will seek guidance from DAFF on how to address the failure of a stock to rebuild within the timeframes specified under the HSP and within the rebuilding strategy.

Electronic monitoring

AFMA is investigating the capability of electronic monitoring systems for deployment in the CTS as a supplement to the ISMP, including whether it is possible for the systems to provide estimated size and species composition of catch automatically as the catch is brought on board. A trial was completed in 2020 which showed EM is effective at monitoring interactions with large protected species, however was less effective at monitoring landed and discarded catch to the species level because of the nature of trawl operations, where catch is typically brought on board in large quantities and composed of multiple species. AFMA will continue to review the application of EM in the CTS.

AFMA will maintain a stronger focus on research priorities and developing alternative approaches to monitoring stock status. As research emerges and based on expert advice, AFMA may review and update management and monitoring approaches. The annual review of the strategy will incorporate updates and in response, this strategy may be updated.

Appendix A – east and west catch triggers

Each year, an incidental (bycatch) TAC is set for the eastern and western stocks with a trigger set at 22 per cent in the east and set at 78 per cent in the west.

For the 2021-22 fishing season, the bycatch TAC is 50 t with the following catch triggers:

Eastern zone

The 2021-22 season catch limit in the eastern zone is 11 t.

Western zone

The 2021-22 season catch limit in the western zone is 39 t.

Monitoring regime

If the catch limit of blue warehou is reached in either zone, all landings of blue warehou will cease in that zone. AFMA will monitor catch reports for both zones on a quarterly basis and contact operators prior to the limits being reached.

Appendix B – industry code of practice

Industry Code of Practice to:

Rebuild and Assess Blue Warehou Stocks



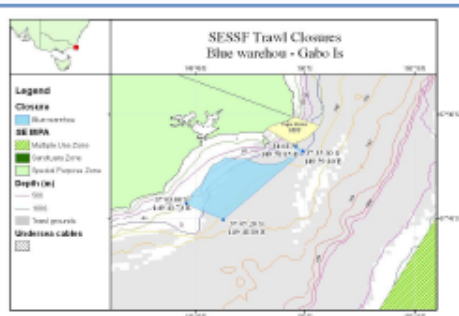
sustainable
fishing
practises
protect
our future

Introduction:

The code of conduct sets down what SETFIA members consider to be reasonable steps, in line with the Blue Warehou Stock Rebuilding Strategy, to rebuild stocks of Blue Warehou. This code was adopted by members on October 19, 2012.

What is a Stock Rebuilding Strategy and why is it needed?

The current stock assessments of both the western and eastern stocks of this species places the biomass at below 20% of the unfished biomass. Because of this the Commonwealth Fisheries Harvest Strategy states that there must be a formal recovery plan. The existence and adherence to this rebuilding strategy is also a requirement of the SESSF's Wildlife Trade Operation (WTO) certification – this allows the fishery to export fish. The species has been nominated for listing under the EPBC Act. Good environmental stewardship by Industry will be considered favourably within the listing decision.



Seasonal Closure

There is an existing voluntary closure (shown left) that was proposed by industry in 2009. Since this time this box is closed for a few days before and after the full moons in August and September. The dates change year by year but can be obtained from SETFIA (see over for contact details) or from the management arrangements booklet.

Blue Warehou *Seriolella brama*



Part of the South East Trawl Fishing Industry Association Code of Conduct Series
Code 4.4 October 2012

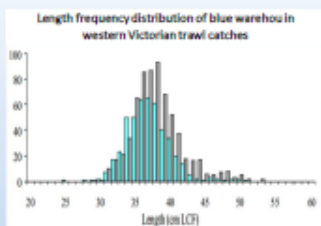
Industry Code of Practice to:

Rebuild and Assess Blue Warehou Stocks



Industry sampling program

Due to uncertain timing and location of catches it has been difficult for AFMA to obtain length frequency data and industry has been providing this data. Report sheets should be filled in on a shot by shot basis carefully following the instructions given out with the sheets. It is hoped that these data can be used to increase the reliability of the Blue Warehou stock assessment.



What must be done:

1. Report all retained and discarded catches. (see box to the right).
2. Obey closures. (see box on page 1)
3. Do not target.
 - This includes not repeating shots if blue warehou was the dominant species in the shot.
 - Do not target any quota you have remaining at the end of the year; instead lease this to other operators.
4. Welcome observer coverage.
5. Report all shots of more than 250kgs (10 bins) to AFMA ASAP (see box to the right).
6. Participate in the blue warehou industry measuring program (see box to the right).
7. Communicate blue warehou catches to all vessels working within 20 miles daily.

For more information contact:

On seasonal closures, datasheets or questions on how to collect LF's:

Simon Boag
CEO SETFIA
0428-141591
simonboag@setfia.org.au

To report a shot greater than 250kgs:

AFMA Duty Manager
demersalreporting@afma.gov.au
Fax 02-62255440

Send length frequency data forms to:

AFMA logbook section
(with fish logbooks)
Box 7051
Canberra BC
CANBERRA ACT 2610

Useful links and references

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