

## Assessment Authors and Year

Stewart, J. 2023. NSW Stock Status Summary 2021/22 – Eastern Sea Garfish (*Hyporhamphus australis*). NSW Department of Primary Industries. Fisheries NSW. 10 pp.

## Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Eastern Sea Garfish is currently assessed as a <b>Sustainable</b> stock.
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## Stock structure & distribution

Eastern Sea Garfish (*Hyporhamphus australis*) are found in sheltered bays, coastal waters, and occasionally in the lower reaches of estuaries from Moreton Bay in Queensland to Eden in New South Wales (NSW), including Lord Howe and Norfolk Islands. The fishery for Eastern Sea Garfish in NSW is part of the Ocean Hauling Fishery, and uses garfish hauling nets to target schools of fish. These garfish hauling nets are designed to fish the surface layers and can be used either from boats or the shore; however the majority of fishers are currently boat-based. The fishery is seasonal, most catches being taken between December and May on the south coast and between March and June on the north coast.

Eastern Sea Garfish is considered a single biological stock. Genetic analyses indicated that Eastern Sea Garfish sampled from major ports in NSW were not significantly different, except for Eden on the far south coast that contained potential hybrids with the Southern Sea Garfish (*Hyporhamphus melanochir*) (Riley et al. 2023). The Eastern and Southern Sea Garfish were confirmed to be genetically similar but distinct species. A single biological stock confirms the previous assumption based on the species reasonably limited distribution along eastern Australia and the complex but southerly flowing Eastern Australian Current (Stewart et al., 2005). Based on this evidence, the stock status of Eastern Sea Garfish is reported at a biological stock level. NSW is the only jurisdiction involved in the SAFS assessments as although the distribution extends into southern Queensland landings are thought to be low and are not recorded to species level.

## Biology

Eastern Sea Garfish are elongate, marine, surface-dwelling fishes with posterior dorsal and anal fins, a deeply forked caudal fin with elongate lower lobe, and with the lower jaw much longer than the upper. They are multiple batch spawners in late spring and early summer (November-December) on the south coast of NSW and in winter and spring (June-October) on the north coast. They produce relatively large eggs (~2.5 mm diameter) that are covered with filaments of 5-10 mm long that allow them to attach to floating or benthic vegetation. Batch fecundity increases linearly with fish length up to approximately 3,500 eggs. Eastern Sea Garfish mature at ~21 cm fork length (measured from the tip of the upper jaw) and at 1 year of age. They have been reported to attain approximately 40 cm fork length and 6 years of age. Females grow faster and attain larger sizes than males.

## Fishery statistics

### Catch information

#### Commercial

NSW commercial landings peaked at approximately 280 tonnes in 1992/93 (Fig. 1). Since that time landings have fluctuated but have declined overall to an average of 34 tonnes p.a. during the previous 5 years. The majority of the catch is reported by ocean hauling (Fig. 2). In 2017/18 the ocean hauling component of the fishery transitioned to quota management with an Interim Total Commercial Access Level (ITCAL) of 45.5 t per financial year allocated until 2024.

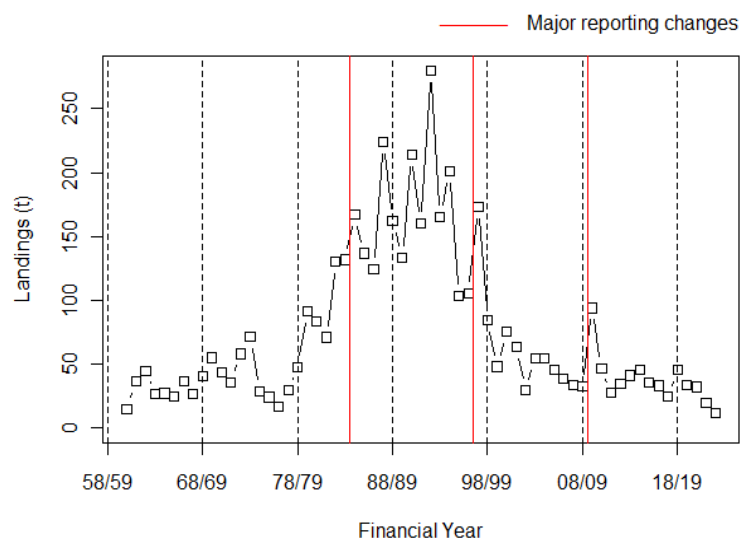


Figure 1. Commercial landings of Eastern Sea Garfish for NSW from 1960/61 to 2022/23 for all fishing methods.

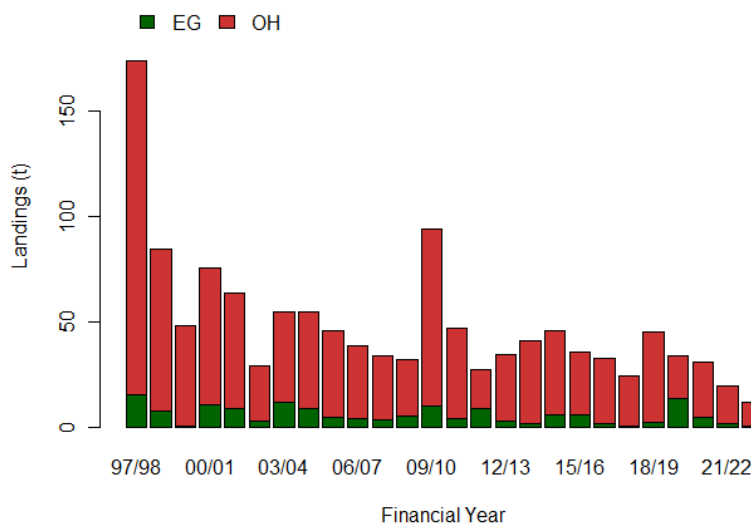


Figure 2. Landings by Fishery of Eastern Sea Garfish in NSW for years 1997/98 to 2022/23. EG = Estuary General; OH = Ocean Hauling.

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Garfish (*Hyporhamphus australis*)

## Recreational & Charter boat

*Recreational fishing for garfish is covered in the biennial. Survey of recreational fishing in NSW*, which collects information on fishing activities through telephone interviews of long-term (1- and 3-year duration) recreational fishing licence (ItRFL) holders and their household members over a 12-month survey period. Garfish are only reported as an undifferentiated group, so no species-specific information is available. In the most recent completed survey of recreational fishing (2021/22, Murphy et al. 2024), <1% of surveyed households caught and retained garfish over the 12-month survey period. This suggests that harvest of garfish is likely to be conducted by only a very small proportion of recreational fishers within this survey frame. Expansion of survey data to the broader population of ItRFL households suggested an estimated harvest of 3,656 fish in 2021/22, but due to the small number of households reporting retained catch (4 households) this estimate had a high standard error (SE, 2,746 fish). When converted to a harvest weight, this was equivalent to ~0.2 t harvested across ItRFL households. A further 2,021 garfish were estimated to be released following capture in the 2021/22 survey year. Estimates of garfish harvest from historic surveys have been greater than 2021/22, but with similarly high standard errors—e.g., 9,036 (4,496 SE) in 2017/18 and 11,584 (6,015 SE) in 2019/20 (Murphy et al., 2020; Murphy et al., 2022). The National Recreational and Indigenous Fishing Survey estimated that as many as 300,000 garfish were retained in the 2000/01 survey year (Henry and Lyle, 2003).

There has been no reported harvest of Eastern Sea Garfish in Charter boat logbooks in recent years.

## Aboriginal cultural fishery

There are no data on aboriginal harvest.

## Illegal, Unregulated and Unreported

There are few data on Illegal, Unregulated and Unreported harvest; however it is considered relatively minor in NSW waters. Non-reporting by commercial fishers does occur and has become more important as the size of the harvest has decreased.

## **Fishing effort**

Annual effort  
have ranged  
2018/19 at 2  
(Fig. 3). On

reported  
) days) in  
each year

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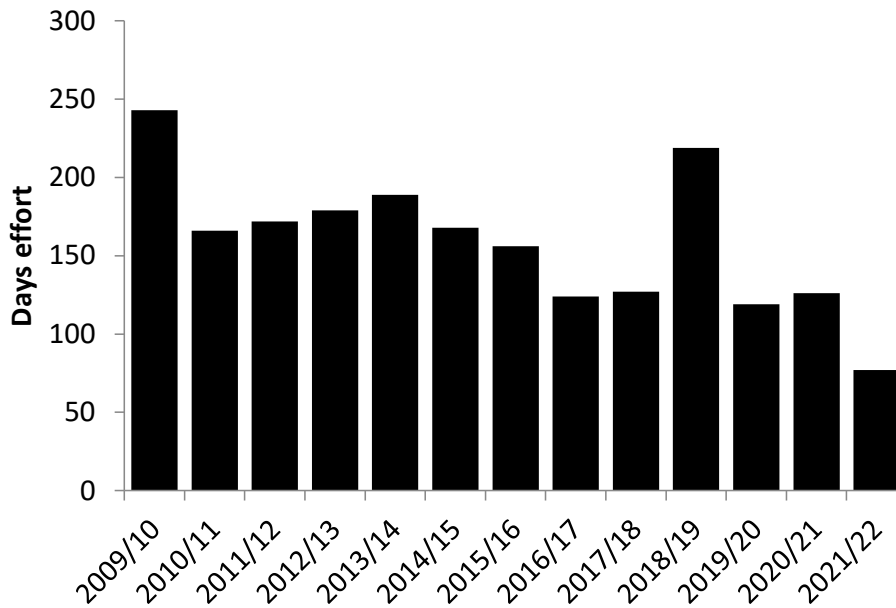


Figure 3. Annual reported days fished using boat-based garfish nets 2009/10 to 2021/22.

## Catch Rate information

Median nominal catch rates of Eastern Sea Garfish (kg per day garfish net hauling) have fluctuated with a low during 2016/17 followed by a generally increasing trend to be at high levels during the last two years (Fig. 4).

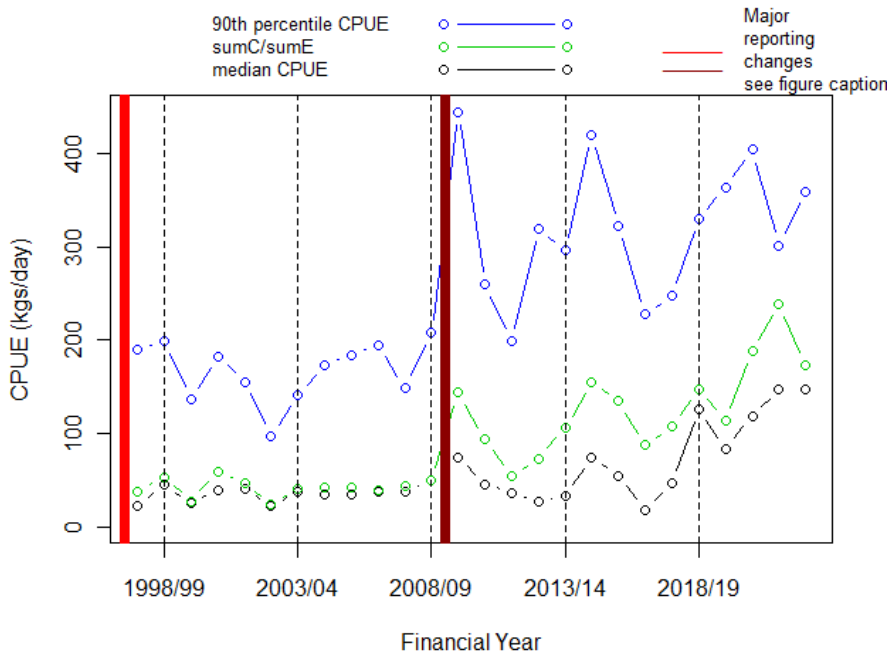


Figure 4. Commercial catch rates of Eastern Sea Garfish using Garfish Net Hauling for years 1997/98 to 2022/23 in NSW. Three indicators are provided: (1) median catch rate from available monthly records (solid line); (2) sum of the catch divided by the sum of the effort (dotted line); and (3) 90th percentile of the catch rate from available monthly records (dashed line). Records with a zero catch rate (i.e. no catch

recorded) are not included in these analyses.

## Stock assessment

### Stock Assessment Methodology

Year of most recent assessment:

2023 on data up to and including 2021/22

Assessment method:

Stochastic population model. Updated Broadhurst et al. (2018) model with data 2004/05 to 2020/21. Spawning stock biomass for 2021/22 was estimated from the almost exact relationship with CPUE (Kienzle et al., 2021).

Main data inputs:

- Age composition 2004/05 to 2020/21.
- Annual landed catch 2004/05 to 2020/21.
- Annual fishing effort (boat days) 2004/05 to 2020/21.
- Average weight for each age group each year.

Key model structure & assumptions:

Age-structured population model (See Broadhurst et al., 2018).

Sources of uncertainty evaluated:

Mortality, biomass and recruitment. (See Broadhurst et al., 2018).

## Status Indicators - Limit & Target Reference Levels

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Garfish (*Hyporhamphus australis*)

Biomass indicator or proxy	Biomass, spawning stock biomass and recruitment estimates from the model. Length and age compositions.
Biomass Limit Reference Point	No formal limit reference levels determined. Trends in length and age compositions in the landed catch, recruitment and biomass estimates are used to infer whether the spawning biomass is sufficient to produce adequate recruitment.
Biomass Target Reference Point	No formal target reference point has been defined; however, spawning stock biomass at Maximum Sustainable Yield (MSY) is used.
Fishing mortality indicator or proxy	Estimated fishing mortality (F) compared to natural mortality (M) for fully recruited age groups. Estimated F on juveniles. Reported effort (boat days). Catch as a fraction of estimated biomass.
Fishing mortality Limit Reference Point	No formal reference levels determined. The rule of thumb that F should be less than M is used to infer sustainable levels of fishing mortality on adults and juveniles. Trends in reported effort are used to compare current versus historical levels of F. Catch as a proportion of estimated biomass as a guideline for harvest fraction.
Fishing Mortality Target Reference Point	No formal target reference point has been defined; however, fishing effort (boat days) to achieve MSY is used.

## Stock Assessment Results

Estimated biomass and recruitment of Eastern Sea Garfish have increased considerably since the stock was assessed as being overfished during the early 2000s, and in 2020/21 the biomass was estimated at approximately 190 t (95% CI 160 to 230 t) (Fig. 5). Recruitment has been variable, with peaks evident in 2008/09 and 2013/14 and 2017/18 (Fig. 5).

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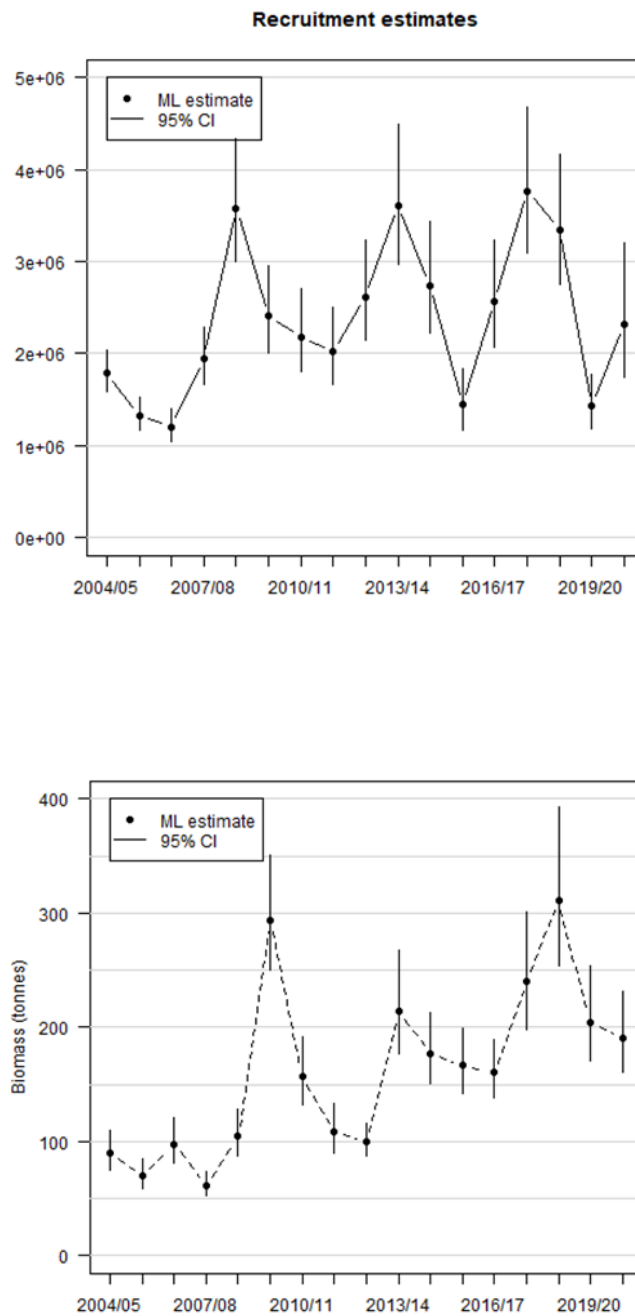
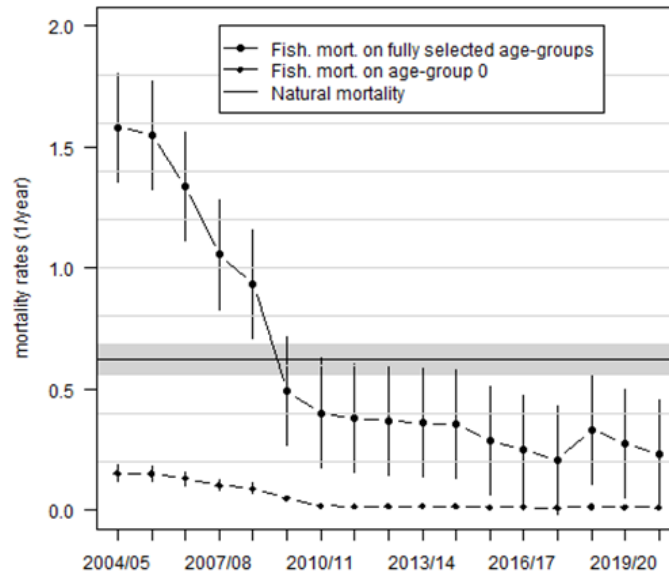


Figure 5. Estimated (A) recruitment and (B) biomass (95% confidence intervals represented by the vertical lines) for Eastern Sea Garfish off south eastern Australia between 2004/05 and 2020/21.

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Spawning biomass has been relatively stable since 2014/15, averaging around 120 t, and in 2021/22 was estimated to be 130 t (Fig. 6).

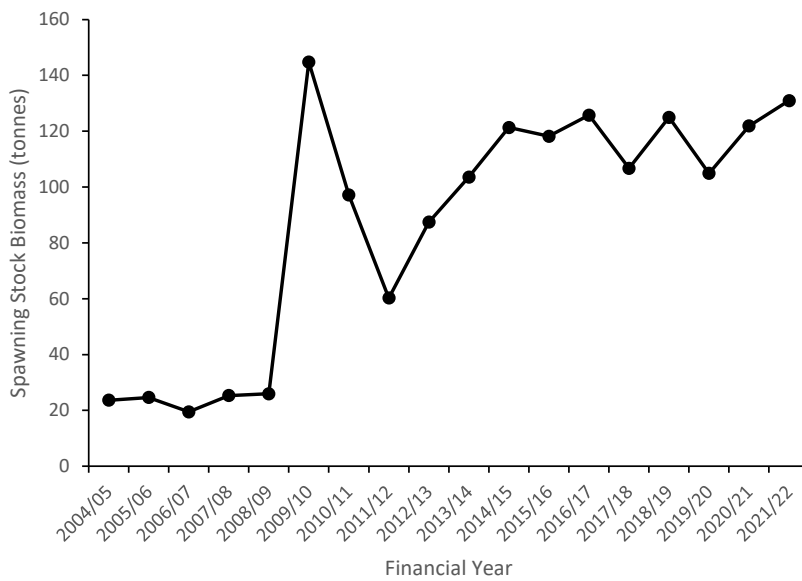


Figure 6. Estimated spawning stock biomass for Eastern Sea Garfish off south eastern Australia between 2004/05 and 2021/22.

Kienzle et al. (2021) estimated the maximum sustainable yield (MSY) for *H. australis* to be 78 t p.a., that could be achieved with a constant fishing effort of 700 boat-days per year. The spawning stock biomass that generates MSY was estimated at 62 t. Catch and effort have been well below these estimates since 2010/11 (Figs. 1, 3). The model indicated that fishing mortality dropped below the estimated natural mortality level in 2009/10 and has remained there since, with fishing mortality on juveniles (age-group 0) very low (Fig. 7). The reported commercial catch in 2021/22



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was approximately 19.8 t, which is approximately 15% of the estimated spawning stock biomass in that year and is considered a sustainable harvest fraction.

The sizes of Eastern Sea Garfish in landings have remained between approximately 20 and 30 cm FL (Fig. 8). The fishery continues to rely on only a few year classes with variable interannual strengths (Fig. 8).

Figure 7. Estimated fishing and natural mortalities ( $\pm 2 \times SD$ ; vertical lines or shaded area) for Eastern Sea Garfish off south eastern Australia between 2004/05 and 2020/21.

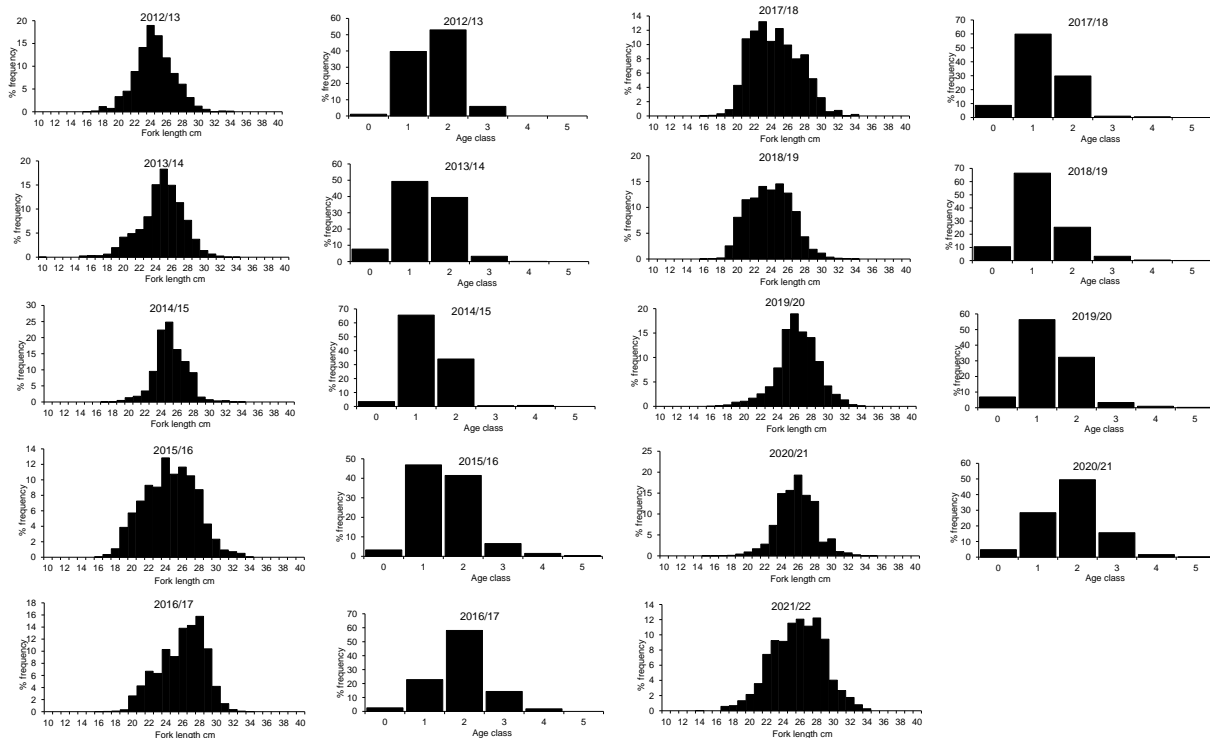


Figure 8. The length and age compositions in landings of Eastern Sea Garfish off south eastern Australia between 2012/13 and 2021/22. No age samples were taken during 2021/22.

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NSW Stock Status Summary 2021/22 – Eastern Sea Garfish (*Hyporhamphus australis*)

## Stock Assessment Result Summary

Biomass status in relation to Limit	Biomass and recruitment have been variable, but with no pattern of decline. Spawning stock biomass has been relatively stable since 2013/14. Size and age compositions have been consistent, noting variable year class strength that is likely a natural phenomenon in this species. These indices suggest that the biomass is not depleted to a level that will inhibit recruitment.
Biomass status in relation to Target	The spawning stock biomass in 2021/22 was estimated at approximately 130 t, well above that estimated to achieve MSY of 62 t.
Fishing mortality in relation to Limit	Fishing mortality dropped below the estimated natural mortality level in 2009/10 and has remained there since (Fig. 7). Fishing effort has declined to historical lows during the past 3 years (Fig. 3). Harvest in 2021/22 was approximately 19.8 t, being approximately 15% of the estimated spawning stock biomass and considered a sustainable harvest fraction.
Fishing mortality in relation to Target	Boat-days have been well below the estimated effort needed to achieve MSY (700 days), being less than 250 days p.a. since 2009/10
Current SAFS stock status	<p>The stock in NSW is not considered to be recruitment impaired.</p> <p>The current level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired.</p> <p>On the basis of the evidence provided above, Eastern Sea Garfish is classified as a sustainable stock.</p>

## Fishery interactions

Eastern Sea Garfish occur in southern Queensland waters; however, the quantities harvested are unknown and believed to be low. Within NSW the predominate sector is the commercial quota-managed ocean hauling fishery, with smaller quantities harvested by the estuary general fishery. Recreational harvest is thought to be minimal.

## Qualifying Comments

The stock assessment remains uncertain, with the data used to develop the assessment only available after the stock was overfished during the 1980s and 1990s. Given that the fishery peaked at 280 t during the 1980s the current estimates of MSY (78 t) is uncertain. Nevertheless, while the stock is rebuilding such a precautionary model is appropriate.

The ocean hauling sea garfish fishery transitioned to quota-management in 2017/18, with an allocation of 45.5 t p.a. It is unknown what effect the transition to quota management has had on catch and catch rates to date; however, the fishery has failed to catch the allocated quota in recent years.

## References

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