

Stock Status Summary 2021



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

Assessment Authors and Year

Stewart, J. 2020. NSW Stock Status Summary 2018/19 – Eastern Sea Garfish
(*Hyporhamphus australis*). NSW Department of Primary Industries. Fisheries. 9 pp

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Eastern Sea Garfish is currently assessed as Sustainable for the NSW component of the stock.
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Stock Structure

Eastern Sea Garfish (*Hyporhamphus australis*) is found in sheltered bays, coastal waters, and occasionally in the lower reaches of estuaries from Moreton Bay in Queensland, to Eden in NSW, including Lord Howe and Norfolk Islands. They 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.

Eastern Sea Garfish 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.

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.

The stock structure of Eastern Sea Garfish has not been formally examined through genetics; however, based on their reasonably limited distribution along south-eastern Australia and the complex but southerly flowing Eastern Australian Current it is likely to constitute a single stock (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 assessment as although the distribution extends into southern Queensland landings are thought to be low and are not recorded to species level.

Stock Status Summary 2021



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

Stock Status – New South Wales

Catch Trends

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.

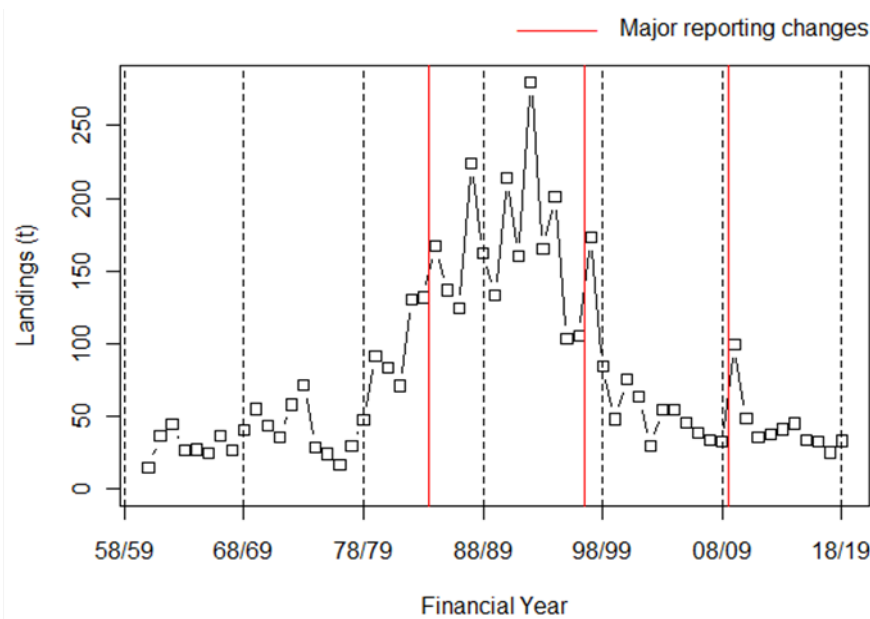


Figure 1. Commercial landings of Eastern Sea Garfish for NSW from 1960/61 to 2018/19 for all fishing methods.

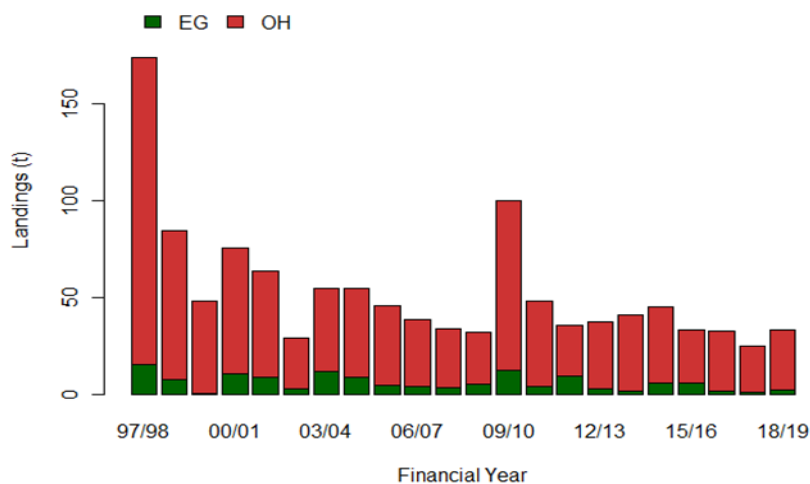


Figure 2. Landings by Fishery of Eastern Sea Garfish in NSW for years 1997/98 to 2018/19. EG = Estuary General; OH = Ocean Hauling.

Recreational and Indigenous

The most recent estimate of the recreational harvest of Eastern Sea Garfish in NSW was approximately 9,000 fish at around 1.3 t during 2017/18 (Murphy et al., 2020). This estimate is considered unreliable due to relatively few fishers surveyed who retained Eastern Sea Garfish, and likely an under-estimate as it only included households with a Recreational Fishing Fee licence holder. The previous estimate of the recreational harvest of garfish (all species combined) in NSW was approximately 19,000 fish during 2013/14 (West et al., 2015). The annual recreational harvest of Eastern Sea Garfish in NSW was previously estimated to be less than 10 t based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by NSW DPI. These survey estimates are not directly comparable due to different sampling frames used.

There are no data on Aboriginal harvest.

Fishing effort trends

Annual effort in terms of days fished using boat-based methods when Sea Garfish were reported have ranged between 242 and 122 since 2009/10. Effort during the previous 2 years has been relatively stable at approximately 150 days p.a. (Fig. 3).

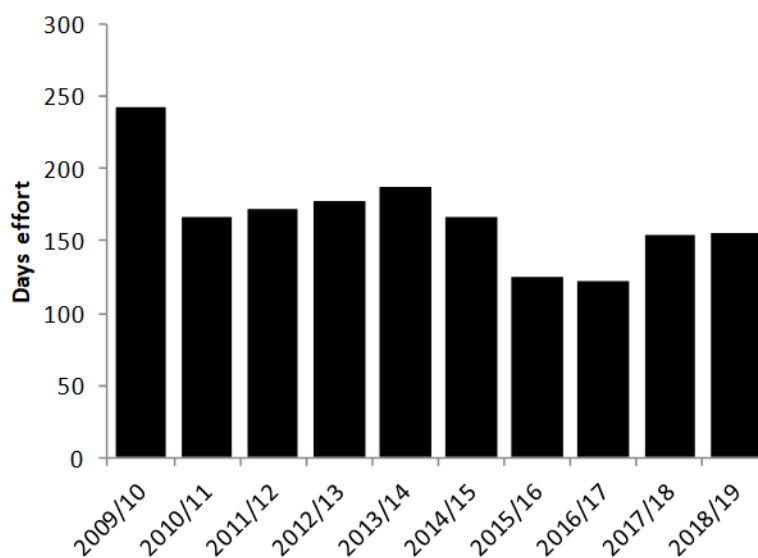


Figure 3. Annual reported days fished using the methods of garfish net (hauling) – boat based and garfish net (bullringing) 2009/10 to 2018/19.

Catch rate trends

Median nominal catch rates of Eastern Sea Garfish (kg per day garfish net hauling) have fluctuated with no overall trend since the logbook changes in 2009, and in 2018/19 were relatively high (Fig. 4).

Stock Status Summary 2021



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

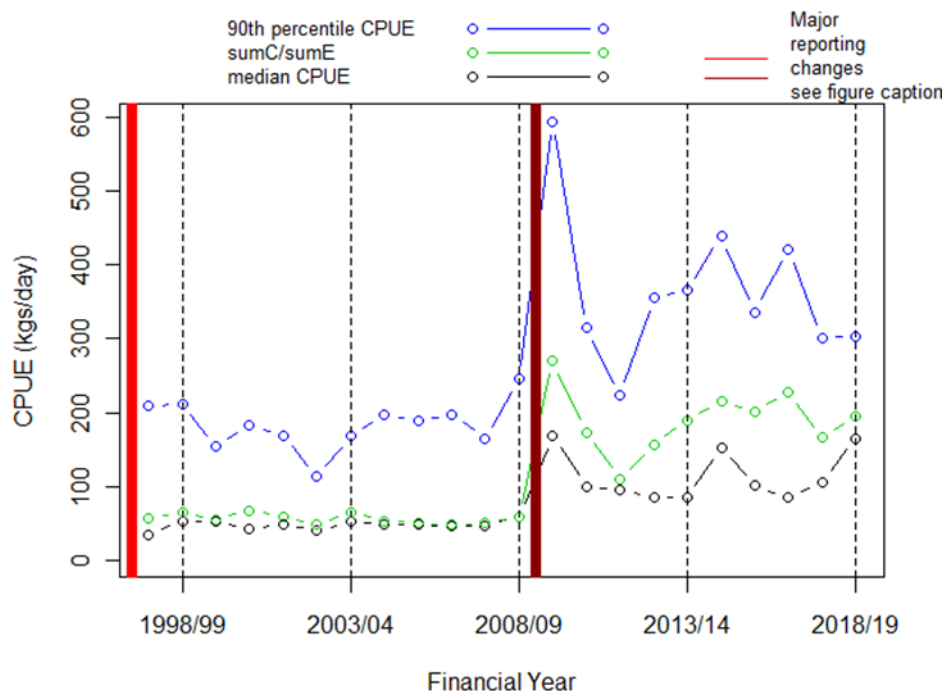


Figure 4. Commercial catch rates of Eastern Sea Garfish using Garfish Net Hauling for years 1997/98 to 2018/19 in NSW. Three indicators are provided: (1) median catch rate from available monthly records (solid line); (2) sum of the catch divided by the sum of the effort (dotted line); and (3) 90th percentile 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 Methodology

Year of most recent assessment	2020 on data up to and including 2018/19
Assessment method	Stochastic population model. Updated Broadhurst et al. (2018) model with data 2015/16 to 2018/19.
Main data inputs	Age composition 2004/05 to 2018/19. Annual landed catch 2004/05 to 2018/19. Annual fishing effort (boat days) 2004/05 to 2018/19. Average weight for each age group each year.
Key model structure and 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 and Limits Reference Levels

Biomass indicator or proxy	Biomass and recruitment estimates from model. Length and age compositions.
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Stock Status Summary 2021



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

Biomass Limit Reference Level	No formal 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.
Fishing mortality indicator or proxy	Estimated F compared to 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 Level	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.

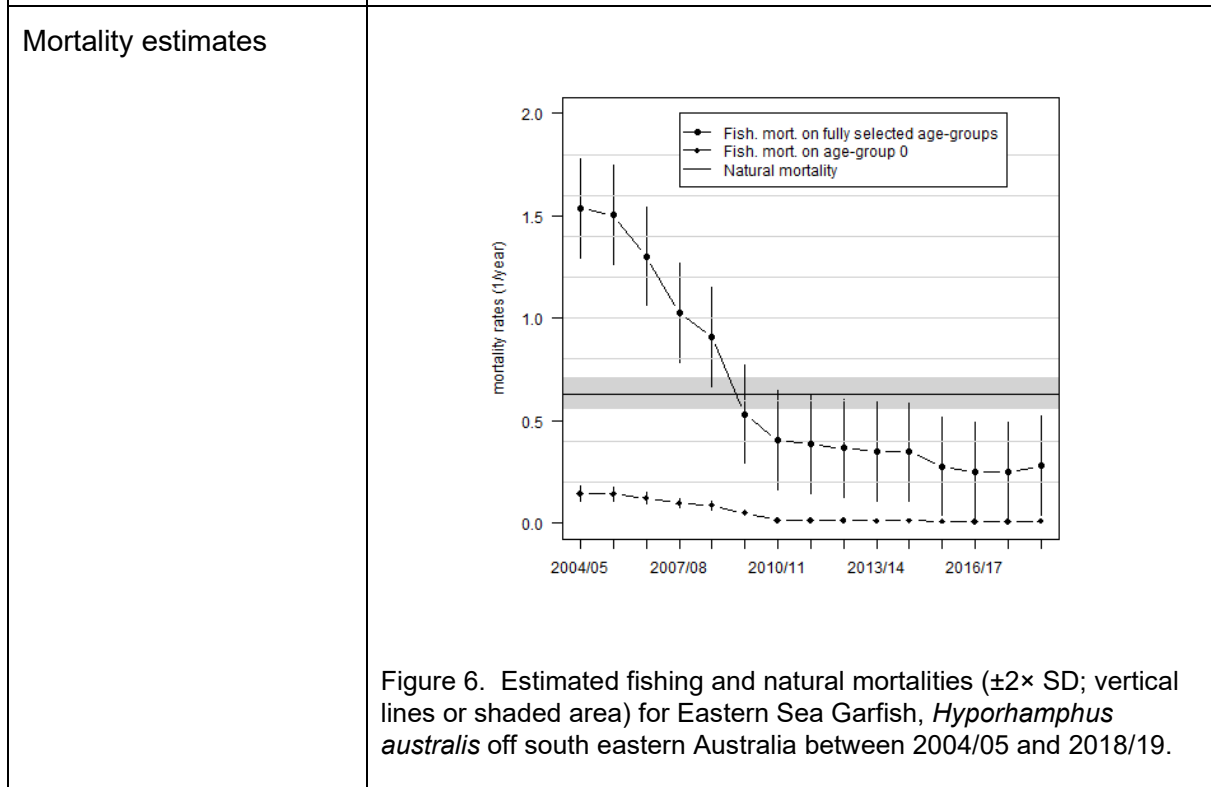
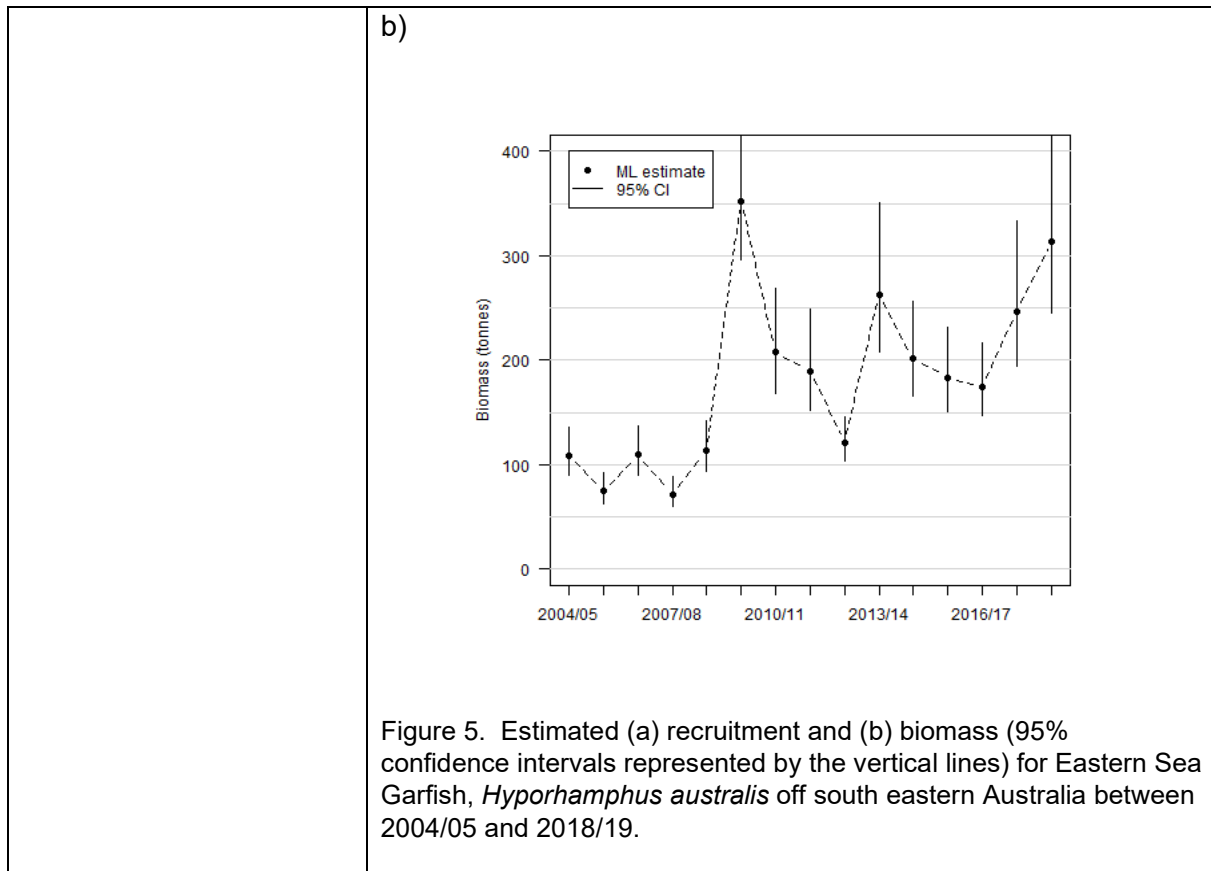
Stock Assessment Results

<p>Both 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 2018/19 the exploitable biomass was estimated at approximately 300 t. Recruitment is variable, with peaks evident in 2008/09 and 2013/14 and the greatest predicted recruitment in 2018/19 (Fig. 5). This spike in recruitment should be considered a preliminary one as too few data are available for the model to accurately estimate recruitment in the final year.</p>	<p>a)</p> <p>Recruitment estimates</p> <table border="1"> <caption>Approximate data points from the Recruitment estimates graph</caption> <thead> <tr> <th>Year</th> <th>ML estimate (t)</th> <th>95% CI (t)</th> </tr> </thead> <tbody> <tr><td>2004/05</td><td>2.0e+06</td><td>1.5e+06 - 2.5e+06</td></tr> <tr><td>2005/06</td><td>1.5e+06</td><td>1.0e+06 - 2.0e+06</td></tr> <tr><td>2006/07</td><td>1.5e+06</td><td>1.0e+06 - 2.0e+06</td></tr> <tr><td>2007/08</td><td>2.5e+06</td><td>2.0e+06 - 3.0e+06</td></tr> <tr><td>2008/09</td><td>4.5e+06</td><td>3.5e+06 - 5.5e+06</td></tr> <tr><td>2009/10</td><td>3.5e+06</td><td>2.5e+06 - 4.5e+06</td></tr> <tr><td>2010/11</td><td>3.0e+06</td><td>2.0e+06 - 4.0e+06</td></tr> <tr><td>2011/12</td><td>2.5e+06</td><td>1.5e+06 - 3.5e+06</td></tr> <tr><td>2012/13</td><td>3.0e+06</td><td>2.0e+06 - 4.0e+06</td></tr> <tr><td>2013/14</td><td>4.0e+06</td><td>3.0e+06 - 5.0e+06</td></tr> <tr><td>2014/15</td><td>3.0e+06</td><td>2.0e+06 - 4.0e+06</td></tr> <tr><td>2015/16</td><td>1.5e+06</td><td>1.0e+06 - 2.0e+06</td></tr> <tr><td>2016/17</td><td>2.5e+06</td><td>2.0e+06 - 3.0e+06</td></tr> <tr><td>2017/18</td><td>3.5e+06</td><td>3.0e+06 - 4.0e+06</td></tr> <tr><td>2018/19</td><td>7.0e+06</td><td>5.0e+06 - 9.0e+06</td></tr> </tbody> </table>	Year	ML estimate (t)	95% CI (t)	2004/05	2.0e+06	1.5e+06 - 2.5e+06	2005/06	1.5e+06	1.0e+06 - 2.0e+06	2006/07	1.5e+06	1.0e+06 - 2.0e+06	2007/08	2.5e+06	2.0e+06 - 3.0e+06	2008/09	4.5e+06	3.5e+06 - 5.5e+06	2009/10	3.5e+06	2.5e+06 - 4.5e+06	2010/11	3.0e+06	2.0e+06 - 4.0e+06	2011/12	2.5e+06	1.5e+06 - 3.5e+06	2012/13	3.0e+06	2.0e+06 - 4.0e+06	2013/14	4.0e+06	3.0e+06 - 5.0e+06	2014/15	3.0e+06	2.0e+06 - 4.0e+06	2015/16	1.5e+06	1.0e+06 - 2.0e+06	2016/17	2.5e+06	2.0e+06 - 3.0e+06	2017/18	3.5e+06	3.0e+06 - 4.0e+06	2018/19	7.0e+06	5.0e+06 - 9.0e+06
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Catch and effort

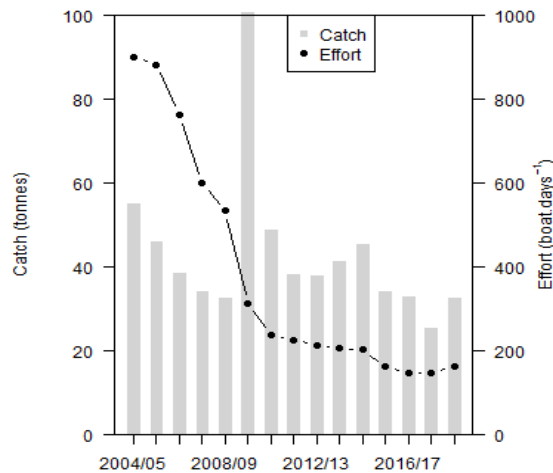


Figure 7. Historical (2004/05–2018/19) variation among catches (t) and fishing effort (boat-days) for the lampara-net fishery targeting Eastern Sea Garfish, *Hyporhamphus australis* off south eastern Australia.

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 a few year classes with variable strengths from year to year. The proportion of fish aged 2+ in landings has declined in recent years and may reflect stronger 1+ cohorts entering the fishery.

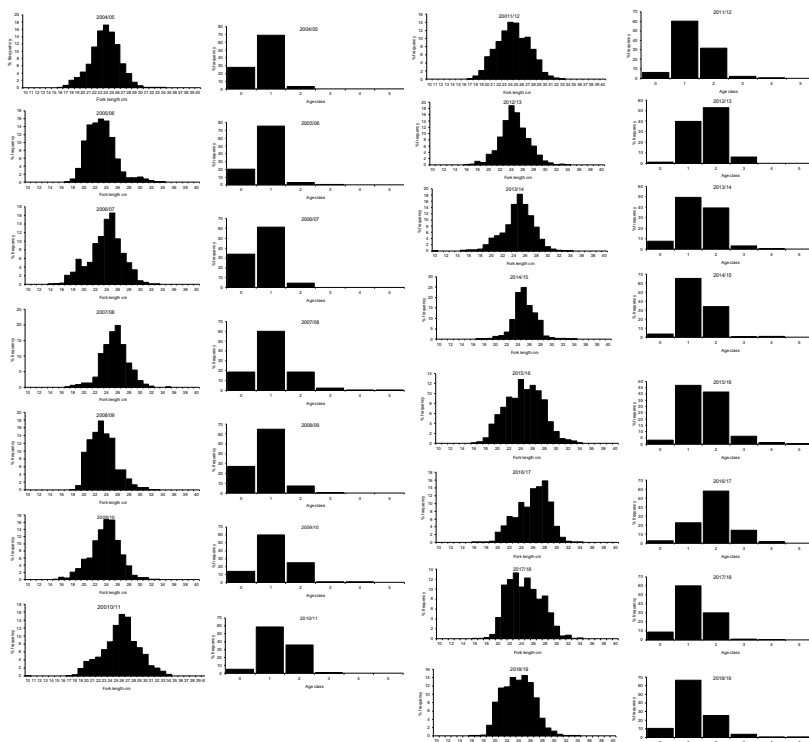


Figure 8. The length and age compositions in landings of Eastern Sea Garfish, *Hyporhamphus australis* off south eastern Australia between 2004/05 and 2018/19.

Stock Status Summary 2021



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

Biomass status in relation to Limit	Reasonably stable landings, stable and increasing catch rates, increasing estimated biomass and potentially very high recent recruitment levels and stable size compositions suggest that the biomass is not depleted to a level that will inhibit recruitment. Variable year class strength in the fishery may be a natural phenomenon, or a sign that the stock is continuing to recover and remains dependent upon recent recruitment success.
Fishing mortality in relation to Limit	Fishing mortality dropped below the estimated natural mortality level in 2009/10 and has remained there since (Fig. 6). Fishing effort has declined slightly but been quite stable during the past 4 years (Fig. 7). The reported commercial catch in 2018/19 was approximately 33 t, which is approximately 10% of the estimated biomass in that year and is considered a sustainable harvest fraction.
Previous SAFS stock status	Overfished in NSW assessments 2002/03 to 2012/13. Fully Fished in NSW assessments 2013/14 to 2014/15. SAFS: Sustainable (2018).
Current SAFS stock status	The stock in NSW is not considered to be recruitment impaired. The current level of fishing mortality is unlikely to cause the biological stock to become recruitment impaired. On the basis of the evidence provided above, Eastern Sea Garfish is classified as a sustainable stock

Qualifying Comments

It is unknown what effect the transition to quota management has had on catch and catch rates to date. Current work on estimating maximum sustainable yield will inform quota setting beyond 2024.

References

- Broadhurst, M. K., Kienzle, M. and Stewart J. 2018. Natural and fishing mortalities affecting eastern sea garfish, *Hyporhamphus australis* inferred from age-frequency data using hazard functions. Fisheries Research 198: 43-49.
- Henry, G.W. and J.M. Lyle. 2003. The National Recreational and Indigenous Fishing Survey. Final Report to the Fisheries Research & Development Corporation and the Fisheries Action Program Project FRDC 1999/158. NSW Fisheries Final Report Series No. 48. 188 pp. Cronulla, NSW Fisheries.

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West, L.D., K.E. Stark, J.J. Murphy, J.M. Lyle and F.A. Doyle. 2015. Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series.