Status of **Fisheries Resources** in NSW 2008/09
STATUS OF FISHERIES RESOURCES IN NSW
2008/09

INDUSTRY & INVESTMENT NSW

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Much of the text in the background sections for each report was based upon published text within the Environmental Impact Statements of commercial fisheries in NSW. The fish illustrations were licensed to I & I NSW by Bernard Yau (who retains the copyright over these images). The overall publication was designed by Belinda Gersbach, and additional assistance was provided by Julie Pont and Lara Maloy from the I & I NSW Publishing Unit. John Matthews provided help with the species’ graphics.

A number of staff from the Wild Harvest Fisheries Branch were key to providing the policy and regulatory context to this report. Their contributions are gratefully acknowledged as is the input from the stakeholder-based Resource Assessment Review Committee. Charles Gray and Steve Kennelly provided continuous leadership and support for this project.

Finally, the editorial team would like to acknowledge the commercial and recreational fishers who provided information and insights into the status of fisheries resources in NSW. Without the co-operation of these groups, it is unlikely that our understanding of these resources would be as comprehensive as it is. There remains, however, much more information to be collected and interpreted for a large number of species.

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Preferred way to cite this publication (single species only, example given for Australian Anchovy):

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Foreword by the Minister

I am pleased to introduce the “Status of Fisheries Resources in NSW 2008/09”. This report updates the status of all species initially assessed in 2006/07, and includes a number of additional species which are significant to the marine commercial and recreational fisheries of NSW.

This document and its web-based publication mark an important component of the reporting requirements for the Fishery Management Strategies of NSW’s commercial fisheries. It provides a method to ensure that one of the key goals in these strategies is met – “to maintain stocks of key species harvested by the fishery”. I am pleased to advise that the NSW Government and Industry & Investment NSW (I & I NSW) are committed to conducting and publishing these resource assessments for key species on a regular basis. The report also supplements the I & I NSW Annual Report by providing a detailed summary of the available catch and biological information for each important species.

The NSW Government is committed to better research and management of our aquatic resources, which are owned by the whole community. We must ensure that our resources are managed in a sustainable way for the benefit of current and future generations. Assessments contained in this report detail our understanding of the status of these resources and highlight where further research may be required.

The information presented is used by I & I NSW to assess and report on the status of the State’s wild fisheries resources. The information is updated and reviewed on an annual basis, and a detailed summary report is produced biennially. This ongoing series therefore provides an important mechanism that the public can use to evaluate the continued success of our fisheries management initiatives here in New South Wales.

STEVE WHAN
Minister for Primary Industries
Minister for Emergency Services
Minister for Rural Affairs

STEVW WHAN
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Executive Summary

The Status of Fisheries Resources report provides an overview of the state of marine and estuarine fish populations that are harvested by commercial and recreational fisheries managed by the NSW Government. In particular, the 2008/09 report contains a two to four page summary on the state of knowledge of 108 fish and invertebrate species (or species groups) caught by commercial and recreational fishers. Note that this report does not include any commentary on freshwater species caught by commercial or recreational fishers.

This report is published every two years to meet public reporting requirements for the Estuary General, Estuary Prawn Trawl, Ocean Hauling, Ocean Trawl and Ocean Trap & Line fisheries. The last version of the report (Status of Fisheries Resources 2006/07) was released in 2008.

Status for each species is assessed at an annual meeting of fisheries scientists and managers from NSW, after consideration of all available relevant information for the species. Fisheries scientists from adjoining jurisdictions or with expertise in a particular species are also invited to attend the meeting.

Species assessed as ‘Overfished’ or ‘Recruitment Overfished’
The number of species assessed as ‘overfished’ or ‘recruitment overfished’ increased from 3 in the last Status Report (for 2006/07) to 6 in the current report (for 2008/09). This change reflects both an increase in the number of species considered since the last Status Report (up from 92 to 108), and changes in the status of particular species.

Since the last Status Report in 2006/07, one species (jackass morwong) was added to the ‘overfished’ category because of an assessment done by the Commonwealth fisheries agency. The majority of the catch of jackass morwong, and another species assessed as ‘recruitment overfished’ (eastern gemfish) is taken by Commonwealth-managed fisheries. Stock rebuilding for these species will depend on initiatives taken under the Commonwealth jurisdiction.

For NSW-managed species, two species (eastern sea garfish and mulloway) continue to be assessed as ‘overfished’ since 2006/07, and 2 others (blacklip abalone and grey morwong) have been recently assessed as ‘overfished’. These four species are currently subject to specific management initiatives aimed at addressing the issues which led to their assessment as ‘overfished’. Blacklip abalone is a quota-managed species, and the total allowable catch has been reduced markedly to aid the recovery of the species; indications are that this species is beginning to recover. Recovery plans are currently being developed for eastern sea garfish and mulloway, in consultation with industry groups. When these two recovery plans are complete, a recovery plan will then be developed for grey morwong.

Species assessed as ‘Growth Overfished’
Since the last Status Report in 2006/07, one species (school prawns) was removed from the ‘growth overfished’ category (now considered ‘fully fished’), and five species (redfish, silver trevally, snapper, yellowtail kingfish and eastern king prawn) continue to be considered ‘growth overfished’, where the average size at capture is smaller than the biological optimum. The status of these species will be kept under review following a number of management actions aimed at addressing their ‘growth overfished’ status.
Species assessed as ‘Uncertain’ or ‘Undefined’

About 50% of the species that have had their status considered have been assessed as ‘uncertain’ or ‘undefined’. This reflects the large number of species required to be assessed by this process (greater than 100), the limited resources available to do assessments, difficulties with the proper identification and correct reporting of many closely related and little studied species, and the ongoing need for detailed biological studies for many species.

Since the assessment process commenced nearly a decade ago there has been a very significant reduction in the proportion of species whose status has been assessed as ‘uncertain’ or ‘undefined’ – down from more than 80% to around 50%. This has been due to concentrated efforts by fisheries researchers at I&I NSW to improve our biological knowledge for a large number of important aquatic species. Also, in July 2009 more detailed catch-reporting requirements were introduced for NSW commercial fishers, and this is expected to lead to more accurate reporting of catches for some of the species currently assessed as ‘undefined’.

The assessment of species as ‘uncertain’ or ‘undefined’ should not be interpreted to mean that these species may be under threat from overfishing, as many of these species are landed in very small quantities by commercial and recreational fisheries. Similarly, these species should not be considered as only ‘lightly fished’ until sufficient information is available to undertake a proper assessment. The information reviewed for each species during the status assessment process is used to prioritise future biological research, to ensure that the necessary research is directed at the most important species in the ‘uncertain’ and ‘undefined’ categories.

Exploitation Status of Species

Summary of the exploitation status of species for commercial and recreational fisheries from 2001/02 to 2008/09. Note that some similar exploitation status categories have been combined to simplify the presentation in this graph.
<table>
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<th>SPECIES</th>
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<tr>
<td>Angel Sharks, <em>Squatina</em></td>
<td>Undefined</td>
<td>Species identification issues exist, and available data are insufficient to allow stock status to be determined for either species.</td>
<td>1</td>
</tr>
<tr>
<td>Australian Anchovy, <em>Engraulis australis</em></td>
<td>Undefined</td>
<td>Very little information is available for this species, but it is likely to be a fast growing species with limited concerns for overfishing.</td>
<td>5</td>
</tr>
<tr>
<td>Australian Bonito, <em>Sarda australis</em></td>
<td>Fully Fished</td>
<td>Relatively fast growing species that supports seasonally significant commercial and recreational catches.</td>
<td>9</td>
</tr>
<tr>
<td>Australian Sardine, <em>Sardinops sadax</em></td>
<td>Fully Fished</td>
<td>Comparison of current annual yield with estimated biomass indicates a fully fished stock.</td>
<td>13</td>
</tr>
<tr>
<td>Banded Rockcod, <em>Epinephelus ergastularius</em></td>
<td>Undefined</td>
<td>Small seasonal dropline fishery in NSW and recreational catches are thought to be increasing. Little information is available on the biology of the species.</td>
<td>17</td>
</tr>
<tr>
<td>Bass Groper, <em>Polyprion americanus</em></td>
<td>Undefined</td>
<td>No detailed stock assessment available. Species has a worldwide distribution, local status has not been determined.</td>
<td>21</td>
</tr>
<tr>
<td>Beachworms, Onuphidae</td>
<td>Undefined</td>
<td>The catch comprises a mixture of species and there is insufficient information to assess the status of the stocks. No precise estimate of the recreational catch is available.</td>
<td>25</td>
</tr>
<tr>
<td>Bigeyes, Priacanthidae</td>
<td>Undefined</td>
<td>Taken as a bycatch in the Estuary Prawn Trawl and Ocean Trawl Fisheries and is also caught by the recreational sector. Little biological information is available.</td>
<td>29</td>
</tr>
<tr>
<td>Blacklip Abalone, <em>Haliotis rubra</em></td>
<td>Overfished to Recruitment Overfished</td>
<td>Stock was significantly depleted by fishing during the 1980s and 1990s, and a series of increases in minimum legal length failed to produce any recovery in the stock. Abalone abundance in regions 1 and 2 has been further reduced by mortality due to parasite (Perkinsus) infection, and there are concerns that the stock is recruitment overfished in these regions.</td>
<td>31</td>
</tr>
<tr>
<td>Blue Mackerel, <em>Scomber australasicus</em></td>
<td>Moderately Fished</td>
<td>Overall the stock off NSW is believed to be moderately fished, but there may be localised depletions.</td>
<td>35</td>
</tr>
<tr>
<td>Blue Swimmer Crab, <em>Portunus pelagicus</em></td>
<td>Fully Fished</td>
<td>An important recreational and commercial species. Biological data collected for Wallis Lake indicate high fishing pressure in this estuary, with fishing mortality estimated to be greater than natural mortality.</td>
<td>39</td>
</tr>
<tr>
<td>Blue-eye Trevalla, <em>Hyperoglyphe antarctica</em></td>
<td>Fully Fished</td>
<td>Mostly a Commonwealth fishery, where blue-eye is assessed as ‘not overfished’, but there are concerns about possible local depletion in some areas. Catch rates of NSW commercial fishers and the size composition of catches appear to be stable.</td>
<td>43</td>
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<tr>
<td><strong>Bluespotted Flathead</strong>&lt;br&gt;Platycephalus caeruleopunctatus</td>
<td>Fully Fished</td>
<td>A very important commercial and recreational species. Recent research has provided preliminary estimates of growth rates and size at maturity.</td>
<td>47</td>
</tr>
<tr>
<td><strong>Boarfish</strong>&lt;br&gt;Pentacerotidae</td>
<td>Undefined</td>
<td>Three species are taken incidentally in the Ocean Trawl Fishery. Little biological information available for any of these species.</td>
<td>51</td>
</tr>
<tr>
<td><strong>Broad Squid</strong>&lt;br&gt;Uroteuthis etheridgei</td>
<td>Fully Fished</td>
<td>The main fishery for this species occurs in the Hawkesbury River and is considered to be fully fished.</td>
<td>53</td>
</tr>
<tr>
<td><strong>Brown Tiger Prawn</strong>&lt;br&gt;Penaeus esculentus</td>
<td>Undefined</td>
<td>NSW is at the southern end of the species range. Recruitment is likely to be small and variable.</td>
<td>57</td>
</tr>
<tr>
<td><strong>Bugs</strong>&lt;br&gt;Ibacus spp.</td>
<td>Fully Fished</td>
<td>Four species of bugs are marketed in NSW; but two species dominate commercial landings and both these species are considered to be fully fished. The recreational catch is insignificant.</td>
<td>61</td>
</tr>
<tr>
<td><strong>Catfish</strong>&lt;br&gt;Siluriformes</td>
<td>Undefined</td>
<td>Several species of catfishes are harvested at low levels in NSW estuaries by both commercial and recreational fishers. Very little information is available to establish exploitation status.</td>
<td>65</td>
</tr>
<tr>
<td><strong>Cobia</strong>&lt;br&gt;Rachycentron canadum</td>
<td>Undefined</td>
<td>A minor fishery in NSW waters, but significant to recreational fishers. The stock is shared with Queensland where some biological research is underway. Very little useful information currently available from NSW catches.</td>
<td>69</td>
</tr>
<tr>
<td><strong>Cockles</strong>&lt;br&gt;Arcoidea and Veneroida</td>
<td>Undefined</td>
<td>No assessment is available for any of the cockle species harvested and reported within this group. Basic biological information is available for some species, but useful fishery data are lacking.</td>
<td>73</td>
</tr>
<tr>
<td><strong>Common Jack Mackerel</strong>&lt;br&gt;Trachurus declivis</td>
<td>Uncertain</td>
<td>Predominantly a Commonwealth fishery with very few operators - Commonwealth status has been adopted.</td>
<td>77</td>
</tr>
<tr>
<td><strong>Common Silverbiddy</strong>&lt;br&gt;Gerres subfasciatus</td>
<td>Moderately Fished</td>
<td>There has been a reduction in commercial fishing pressure on this small estuarine species since the introduction of recreational fishing areas in 2002. Catch rates by haul netting are stable.</td>
<td>79</td>
</tr>
<tr>
<td><strong>Crimsonbanded Wrasse</strong>&lt;br&gt;Notolabrus gymnogenis</td>
<td>Undefined</td>
<td>A significant recreational species with minor commercial landings. Some biological data are available, but fishery data are limited and have not been analysed in detail.</td>
<td>81</td>
</tr>
<tr>
<td><strong>Cunjevoi</strong>&lt;br&gt;Pyura stolonifera</td>
<td>Lightly Fished</td>
<td>A sessile organism found in large abundance on rocky foreshores in high-energy intertidal surf zones. Harvested solely by recreational fishers for use as bait. A large proportion of the population occurs in habitats inaccessible to recreational fishers.</td>
<td>85</td>
</tr>
<tr>
<td><strong>Cuttlefish</strong>&lt;br&gt;Sepia spp.</td>
<td>Uncertain</td>
<td>Species composition issues will restrict our ability to assess these stocks. All species in this group are likely to exhibit rapid growth and have a short life span.</td>
<td>87</td>
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<tr>
<td>Dart</td>
<td>Undefined</td>
<td>No detailed stock assessment available. Mainly a recreational species, but there is little information about NSW catches.</td>
<td>91</td>
</tr>
<tr>
<td>Trachinotus spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diamondfish</td>
<td>Undefined</td>
<td>Mainly an estuary fish found around wharfs and rocky headlands. No detailed assessment likely to be completed.</td>
<td>93</td>
</tr>
<tr>
<td>Monodactylus argenteus</td>
<td></td>
<td>Species identification issues are significant. One species, Squalus megalops, is still relatively abundant off NSW, but there are very serious conservation issues for all other dogfish species. Exploitation status to remain 'undefined' until better risk assessments are available.</td>
<td>95</td>
</tr>
<tr>
<td>Dogfish</td>
<td>Undefined</td>
<td></td>
<td></td>
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<tr>
<td>Squaliformes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dusky Flathead</td>
<td>Fully Fished</td>
<td>Commercial landings and catch rates are steady, but the species is primarily harvested by recreational fishermen. Better catch information is required for the recreational fishery.</td>
<td>99</td>
</tr>
<tr>
<td>Platycephalus fuscus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Australian Salmon</td>
<td>Fully Fished</td>
<td>Commercial landings are at historically high levels and the recreational catch is significant.</td>
<td>103</td>
</tr>
<tr>
<td>Arrripis trutta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Blue Groper</td>
<td>Undefined</td>
<td>Stock was considered to be depleted in the 1960s and closures were introduced. Now a recreational line only species, and there is insufficient recent data to allow the current status to be specified.</td>
<td>107</td>
</tr>
<tr>
<td>Achoerodus viridis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern King Prawn</td>
<td>Growth Overfished</td>
<td>Status continues to be growth overfished as determined by yield-per-recruit modelling, but this will be reviewed using recent data.</td>
<td>109</td>
</tr>
<tr>
<td>Melicertus plebejus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Pigfish</td>
<td>Fully Fished</td>
<td>The age composition of commercial landings suggests that fishing mortality is approximately the same as natural mortality.</td>
<td>113</td>
</tr>
<tr>
<td>Bodianus unimaculatus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Red Scorpionfish</td>
<td>Fully Fished</td>
<td>Fishing mortality appears to be similar to natural mortality. The species has a slow growth rate and considerable longevity.</td>
<td>117</td>
</tr>
<tr>
<td>Scorpaena cardinalis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Rock Lobster</td>
<td>Fully Fished</td>
<td>Species has a long history of exploitation. The commercial fishery has been managed using Total Allowable Catch since the mid 1990s, is closely monitored, and has been relatively stable for the past decade.</td>
<td>121</td>
</tr>
<tr>
<td>Sagmariasus verreauxi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern School Whiting</td>
<td>Fully Fished</td>
<td>A significant species in the NSW Ocean Trawl Fishery. The stock is shared with the Commonwealth and the status of fully fished is consistent with the Commonwealth assessment.</td>
<td>125</td>
</tr>
<tr>
<td>Sillago flindersi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Sea Garfish</td>
<td>Overfished</td>
<td>Despite some encouraging signs in the 2007/08 age composition, the stock does not appear to be recovering and there is still a lack of older fish (2-6 years) in the population.</td>
<td>129</td>
</tr>
<tr>
<td>Hyporhamphus australis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flounders</td>
<td>Undefined</td>
<td>Species identification issues need to be resolved before stock status can be assessed.</td>
<td>133</td>
</tr>
<tr>
<td>Paralichthyidae and Pleuronectidae</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Frigate Mackerel Auxis thazard</td>
<td>Undefined</td>
<td>A small pelagic species with low and fluctuating commercial landings. Recreational catch may be significant. Minimal information currently available.</td>
<td>137</td>
</tr>
<tr>
<td>Gemfish Rexea solandri</td>
<td>Recruitment Overfished</td>
<td>Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment has been adopted.</td>
<td>139</td>
</tr>
<tr>
<td>Ghost Nipper Trypaea australiensis</td>
<td>Moderately Fished</td>
<td>A significant level of exploitation is estimated in some areas of the species’ range, but the overall level of exploitation is likely to be low to moderate.</td>
<td>143</td>
</tr>
<tr>
<td>Ghostsharks Chimaeriformes</td>
<td>Undefined</td>
<td>Small numbers of individuals are harvested as bycatch in the Ocean Trawl Fishery mainly from the outer continental shelf and continental slope. There is a lack of information with which to assess stock status.</td>
<td>145</td>
</tr>
<tr>
<td>Giant Mud Crab Scylla serrata</td>
<td>Undefined</td>
<td>Significant commercial and recreational fisheries occur in NSW which is at the southernmost extent of the species’ range. Local biological information has not been analysed in detail.</td>
<td>147</td>
</tr>
<tr>
<td>Goatfish Mullidae</td>
<td>Undefined</td>
<td>Small quantities (20 - 40 t annually) taken incidentally in prawn and fish trawls. Assessment is constrained by lack of biological information.</td>
<td>151</td>
</tr>
<tr>
<td>Goldspot Mullet Liza argentea</td>
<td>Moderately Fished</td>
<td>Exploitation rates vary between estuaries, but statewide the species is considered to be moderately fished.</td>
<td>155</td>
</tr>
<tr>
<td>Greentail Prawn Metapenaeus bennetiae</td>
<td>Undefined</td>
<td>The species is similar to school prawns, but lives entirely within estuarine waters. No detailed assessment of stock status has been made.</td>
<td>159</td>
</tr>
<tr>
<td>Grey Morwong Nemadactylus douglasii</td>
<td>Overfished</td>
<td>Long term declines are evident in both landings and catch rates, and the average size of harvested fish has also decreased substantially since the 1970s. The age composition of landings strongly suggests that fishing mortality is greater than natural mortality.</td>
<td>163</td>
</tr>
<tr>
<td>Gummy Shark Mustelus antarcticus</td>
<td>Fully Fished</td>
<td>Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment was adopted.</td>
<td>167</td>
</tr>
<tr>
<td>Hairtail and Frostfish Trichiuridae</td>
<td>Undefined</td>
<td>No local biological information available for either species in this group, but growth and maturity have been studied for Trichiurus lepturus from the East China Sea, where it supports a major fishery.</td>
<td>171</td>
</tr>
<tr>
<td>Hammerhead Sharks Sphyrna spp.</td>
<td>Undefined</td>
<td>Three species of hammerhead shark are harvested by the commercial line fishery and are also caught by the recreational gamefish fishery. Little information is available to specify exploitation status.</td>
<td>173</td>
</tr>
<tr>
<td>Hapuku Polyprion oxygeneios</td>
<td>Undefined</td>
<td>No detailed stock assessment available. NSW landings of this species are very small compared to landings in New Zealand and by Commonwealth fisheries.</td>
<td>177</td>
</tr>
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<td>SPECIES</td>
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</tr>
<tr>
<td>Jackass Morwong</td>
<td>Overfished</td>
<td>The commercial harvest is predominantly by trawlers in the Commonwealth Southern and Eastern Scalefish and Shark fishery. Commonwealth assessment is based on a full population model which shows a very significant decline in biomass since the 1980s. Recent biomass estimated to be about 20% of the unexploited level.</td>
<td>181</td>
</tr>
<tr>
<td>Nemadactylus macrophterus</td>
<td></td>
<td>Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment is 'uncertain' with respect to whether or not the stock is overfished. Given the long term relatively stable fishery in NSW, 'fully fished' is more appropriate for this jurisdiction.</td>
<td>185</td>
</tr>
<tr>
<td>John Dory</td>
<td>Fully Fished</td>
<td>A coastal tuna species for which the recreational fishery is probably more significant than the commercial fishery. There are few useful data with which to establish status.</td>
<td>189</td>
</tr>
<tr>
<td>Zeus faber</td>
<td></td>
<td>Predominantly a moderately long-lived species with significant recreational and commercial harvests. Fishing mortality rate is estimated to be about the same as natural mortality rate.</td>
<td>191</td>
</tr>
<tr>
<td>Longtail Tuna</td>
<td>Undefined</td>
<td>Small commercial fishery with low priority for assessment. Possibly more significant in the recreational fishery. Minimal information available.</td>
<td>195</td>
</tr>
<tr>
<td>Thunnus tonggol</td>
<td></td>
<td>Mainly targeted by recreational fishers, mahi mahi are likely to have high growth and mortality rates, but there is a lack of local information with which to assess stock status.</td>
<td>197</td>
</tr>
<tr>
<td>Luderick</td>
<td>Fully Fished</td>
<td>Relatively small catches occur in NSW - the majority of the catch is the shortfin mako, which has a global distribution. Mako sharks are an important target species in the recreational gamefish fishery.</td>
<td>199</td>
</tr>
<tr>
<td>Girella tricuspidata</td>
<td></td>
<td>Species identification issues need to be resolved. Very small quantities are landed and it is unlikely an exploitation status could be specified.</td>
<td>203</td>
</tr>
<tr>
<td>Mackerel Tuna</td>
<td>Undefined</td>
<td>Predominantly a Commonwealth fishery, with seasonal landings of mature fish by NSW trawlers north of Sydney during the winter months. Commonwealth status of &quot;not overfished&quot; is consistent with &quot;fully fished&quot;, which is more appropriate for the NSW fishery.</td>
<td>205</td>
</tr>
<tr>
<td>Euthynnus affinis</td>
<td></td>
<td>Age composition of samples from commercial catches was indicative of an overfished stock, and the spawning potential ratio was estimated to be below the recommended threshold.</td>
<td>209</td>
</tr>
<tr>
<td>Mahi Mahi</td>
<td></td>
<td>Stock abundance of ocean jackets appears to have increased significantly since 1999/2000. Status of all other leatherjacket species is undefined.</td>
<td>213</td>
</tr>
<tr>
<td>SPECIES</td>
<td>STATUS</td>
<td>HARVEST COMMENT</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Ocean Perch <em>Helicolenus</em> spp.</td>
<td>Fully Fished</td>
<td>Two relatively long-lived species comprise the majority of the catch of this group. Significant in both the Ocean Trawl and Ocean Trap and Line Fisheries but most of the catch comes from the Commonwealth South East Trawl fishery. Status in NSW is consistent with the Commonwealth status of ‘not overfished’.</td>
<td>217</td>
</tr>
<tr>
<td>Ocean Trawl Squid <em>Teuthida</em></td>
<td>Undefined</td>
<td>Status of Gould’s or arrow squid (<em>Nototodarus gouldi</em>) has not been assessed in NSW. The main fishery is in Commonwealth waters - although a formal assessment has not been conducted the stock is considered to be ‘not overfished’ due to relatively low recent annual landings of this species which is considered to be an annual stock.</td>
<td>221</td>
</tr>
<tr>
<td>Octopus <em>Octopus</em> spp.</td>
<td>Undefined</td>
<td>Lack of fishery information on the species harvested precludes resource assessment at this time.</td>
<td>225</td>
</tr>
<tr>
<td>Pearl Perch <em>Glaucosoma scapulare</em></td>
<td>Undefined</td>
<td>Pearl perch are predominantly harvested in Queensland. Biological research on this species has recently been completed in NSW, but results of current research in Queensland are needed before an exploitation status can be specified.</td>
<td>229</td>
</tr>
<tr>
<td>Pipi <em>Donax deltoides</em></td>
<td>Uncertain</td>
<td>Landings have declined markedly since 2005 and there is considerable concern amongst commercial fishers that catch rates have dropped to uneconomic levels, despite the reasonably high prices received. There is insufficient information to allow specification of an exploitation status.</td>
<td>233</td>
</tr>
<tr>
<td>Red Gurnard and Latchets <em>Triglidae</em></td>
<td>Undefined</td>
<td>Red gurnard is the primary species landed in NSW waters. There is little local information to assess status.</td>
<td>237</td>
</tr>
<tr>
<td>Red Morwong <em>Cheilodactylus fuscus</em></td>
<td>Undefined</td>
<td>Few data are available to assist in determining exploitation status. Very small by-catch from commercial trap fishing - the major harvesters are recreational spear fishers.</td>
<td>241</td>
</tr>
<tr>
<td>Redfish <em>Centroberyx affinis</em></td>
<td>Growth Overfished</td>
<td>Predominantly a Commonwealth fishery. The population is growth overfished and is very much depleted, but a full population model has not been successfully developed. The Commonwealth status has moved from ‘Growth Overfished’ to ‘Uncertain’, reflecting the lack of a good assessment of the extent of biomass depletion, but ‘Growth Overfished’ has been retained as it best describes the status of the stock in NSW.</td>
<td>243</td>
</tr>
<tr>
<td>River Eels <em>Anguilla</em> spp.</td>
<td>Lightly to Fully Fished</td>
<td>Stock status varies between catchments, with some areas being lightly fished and other areas subject to significant fishing effort. Overall catch rate is relatively stable, with a decline in commercial fishing effort since the late 1990s.</td>
<td>247</td>
</tr>
<tr>
<td>SPECIES</td>
<td>STATUS</td>
<td>HARVEST COMMENT</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>River Garfish</td>
<td>Fully Fished</td>
<td>Study of catches from three estuaries suggested fishing mortality was approximately equal to natural mortality. Status may vary from estuary to estuary but, state-wide, the species should be considered to be fully fished.</td>
<td>251</td>
</tr>
<tr>
<td>Hyporhamphus regularis ardelio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock Blackfish</td>
<td>Undefined</td>
<td>A coastal rocky foreshore species fished by recreational line and spear fishers. Almost no biological or fishery data are currently available for this species however a biological study is underway.</td>
<td>255</td>
</tr>
<tr>
<td>Girella elevata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Royal Red Prawn</td>
<td>Lightly Fished</td>
<td>The limited targeting of this species and the recent decline in landings is associated with the low market price received for this species.</td>
<td>257</td>
</tr>
<tr>
<td>Haliporoides sibogae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Mullet</td>
<td>Undefined</td>
<td>This species has minor commercial and recreational importance. Biological data (growth rates and size at maturity) are available, but information on length or age composition of catches is lacking.</td>
<td>261</td>
</tr>
<tr>
<td>Myxus elongatus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Whiting</td>
<td>Fully Fished</td>
<td>Sand whiting are targeted by recreational anglers and commercial fishers throughout their range. Commercial landings and catch rates are stable.</td>
<td>263</td>
</tr>
<tr>
<td>Sillago ciliata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sawsharks</td>
<td>Undefined</td>
<td>Little information is available to assess stock status. Biological information from local populations should be collected.</td>
<td>267</td>
</tr>
<tr>
<td>Pristiophorus spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Prawn</td>
<td>Fully Fished</td>
<td>Research results and modelling have established that environmental factors (river flows) generally have a major influence on landings of school prawns (and in such cases a status of 'growth overfished' is not appropriate). Research is continuing on the optimum size at first capture.</td>
<td>271</td>
</tr>
<tr>
<td>Metapenaeus macleayi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea Mullet</td>
<td>Fully Fished</td>
<td>A long history of stable landings and catch rates is evident for both the estuary and ocean fisheries.</td>
<td>275</td>
</tr>
<tr>
<td>Mugil cephalus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea Urchins</td>
<td>Undefined</td>
<td>A large amount of biological information is available for these three species, but there is insufficient useful monitoring data to allow exploitation status to be decided. Confusion over common names needs to be addressed.</td>
<td>279</td>
</tr>
<tr>
<td>Echinoidea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shovelnose Rays</td>
<td>Undefined</td>
<td>Eastern shovel nose ray is by far the most significant species in the catch of this group – research underway should improve biological knowledge for this species.</td>
<td>283</td>
</tr>
<tr>
<td>Rajiformes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver Sweep</td>
<td>Fully Fished</td>
<td>A long lived species which may be susceptible to localised depletion. Fully fished in localised areas such as Wollongong but maybe moderately fished state-wide.</td>
<td>287</td>
</tr>
<tr>
<td>Scorpius lineolata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver Trevally</td>
<td>Growth</td>
<td>Minimum legal length (MLL) of 30 cm total length was implemented in September 2007 but recent size composition data indicate silver trevally should still be considered 'growth overfished'. Status should be reviewed after the impact of the MLL implementation has been fully assessed.</td>
<td>291</td>
</tr>
<tr>
<td>Pseudocaranx dentex</td>
<td>Overfished</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIES</td>
<td>STATUS</td>
<td>HARVEST COMMENT</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Snapper</strong> Pagrus auratus</td>
<td>Growth</td>
<td>Commercial landings and catch rates have improved since the minimum legal length was increased in 2001, but recent analyses indicate the stock remains growth overfished.</td>
<td>295</td>
</tr>
<tr>
<td><strong>Soles</strong> Soleidae and Cynoglossidae</td>
<td>Undefined</td>
<td>Two species are significant in commercial catches, but little biological information and only limited size composition data are available.</td>
<td>299</td>
</tr>
<tr>
<td><strong>Southern Calamari</strong> Sepioteuthis australis</td>
<td>Undefined</td>
<td>Significant commercial and recreational landings. The biology of the species has not been studied in NSW, but in southern Australia calamari are known to be short-lived and fast growing.</td>
<td>303</td>
</tr>
<tr>
<td><strong>Southern Maori Wrasse</strong> Ophthalmocephalus lineolatus</td>
<td>Moderately Fished</td>
<td>Mainly a recreational species, but also a small targeted commercial fishery. Fishing mortality is estimated to be about half the natural mortality rate.</td>
<td>307</td>
</tr>
<tr>
<td><strong>Spanish Mackerel</strong> Scomberomorus commerson</td>
<td>Fully Fished</td>
<td>Majority of the commercial harvest occurs in Queensland waters and status from the Queensland assessment has been adopted.</td>
<td>311</td>
</tr>
<tr>
<td><strong>Spanner Crab</strong> Ranina ranina</td>
<td>Fully Fished</td>
<td>Joint fishery-independent monitoring between NSW and Queensland occurs for this shared stock, and status has been determined from the Queensland assessment.</td>
<td>315</td>
</tr>
<tr>
<td><strong>Spotted Mackerel</strong> Scomberomorus munroi</td>
<td>Fully Fished</td>
<td>Predominantly harvested in Queensland, where assessment indicates that current recreational and commercial catch approximates the maximum sustainable yield. Status is consistent with the Queensland assessment.</td>
<td>319</td>
</tr>
<tr>
<td><strong>Stout Whiting</strong> Sillago robusta</td>
<td>Moderately Fished</td>
<td>A small, fast growing species caught by trawling in ocean waters. The stock is shared with Queensland and the status has been adopted from the Queensland assessment.</td>
<td>323</td>
</tr>
<tr>
<td><strong>Striped Grunter</strong> Terapontidae</td>
<td>Undefined</td>
<td>Striped grunter are small estuary/inshore fish caught as byproduct in estuarine and inshore ocean fisheries. Little biological information is available.</td>
<td>327</td>
</tr>
<tr>
<td><strong>Striped Marlin</strong> Kajikia audax</td>
<td>Undefined</td>
<td>Status will be adopted consistent with Commonwealth status which will result from the assessment of the south-west Pacific stock by the Scientific Committee of the Central and Western Pacific Fisheries Commission, currently nearing completion.</td>
<td>329</td>
</tr>
<tr>
<td><strong>Tailor</strong> Pomatomus saltatrix</td>
<td>Fully Fished</td>
<td>Significant recreational and commercial harvests in Queensland and NSW. Queensland assessment in 2004 indicated that the stock was close to the biomass at maximum sustainable yield (Bmsy) reference point.</td>
<td>333</td>
</tr>
<tr>
<td><strong>Tarwhine</strong> Rhodosargus sarba</td>
<td>Fully Fished</td>
<td>The age composition of commercial landings indicates that fishing mortality is similar to natural mortality.</td>
<td>337</td>
</tr>
<tr>
<td><strong>Teraqlin</strong> Atractoscion aequidens</td>
<td>Fully Fished</td>
<td>Commercial catch data suggest a long-term decline in this stock, although the species appears to be fairly quick growing and may be subject to large variations in recruitment strength. There is concern that the stock may actually be 'overfished' but that insufficient information is available to support this determination.</td>
<td>341</td>
</tr>
<tr>
<td>SPECIES</td>
<td>STATUS</td>
<td>HARVEST COMMENT</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Tiger Flathead</td>
<td>Fully Fished</td>
<td>Predominantly a Commonwealth fishery, although significant landings are made by NSW trawlers north of Sydney. Exploitation status was adopted from the Commonwealth where a quantitative stock assessment has been developed.</td>
<td>345</td>
</tr>
<tr>
<td>Neoplatycephalus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>richardsoni</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiger Shark</td>
<td>Undefined</td>
<td>Tiger sharks are an important target species in the recreational club-based gamefish fishery. Commercial catches off NSW are likely to be smaller than recreational catches.</td>
<td>349</td>
</tr>
<tr>
<td>Galeocerdo cuvier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tilefish</td>
<td>Undefined</td>
<td>An incidental catch of fish trawling, tilefish apparently have a restricted distribution off NSW. Commercial landings and size composition data are available, and a biological study is underway.</td>
<td>351</td>
</tr>
<tr>
<td>Branchiostegus spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trumpeter Whiting</td>
<td>Undefined</td>
<td>Small commercial and recreational landings, mainly from a few estuaries. Biological studies of growth and maturity have recently been completed, but estimates of mortality rates from size and age composition data are lacking.</td>
<td>355</td>
</tr>
<tr>
<td>Sillago maculata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turban Shells</td>
<td>Undefined</td>
<td>Very little information available to establish an exploitation status.</td>
<td>359</td>
</tr>
<tr>
<td>Turbo spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whaler Sharks</td>
<td>Undefined</td>
<td>A complex of species that are very difficult to identify (particularly as juveniles). Insufficient information is available to determine status for any of the whaler shark species.</td>
<td>361</td>
</tr>
<tr>
<td>Carcharhinus spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitebait - Sandy Sprat</td>
<td>Undefined</td>
<td>Commercial landings average about 100 t per annum and size composition monitoring has been conducted on catches, but there is little local biological information available and mortality rates have not been estimated.</td>
<td>365</td>
</tr>
<tr>
<td>Hyperlophus vittatus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wobbegong Sharks</td>
<td>Undefined</td>
<td>The available catch data are not sufficiently accurate to use for determining stock status for any of the three species which occur off NSW. More detailed reporting is now required on commercial catch return forms.</td>
<td>369</td>
</tr>
<tr>
<td>Orectolobus spp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowfin Bream</td>
<td>Fully Fished</td>
<td>The yellowfin bream has a long history of stability of both the length composition and commercial catch rate data. The species is the basis of very significant recreational and commercial fisheries in NSW.</td>
<td>373</td>
</tr>
<tr>
<td>Acanthopagrus australis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowfin Tuna</td>
<td>Fully Fished</td>
<td>Mainly a Commonwealth fishery off eastern Australia, with some uncertainty about the degree of overlap with the much larger western and central Pacific stock. Status has been adopted consistent with the Commonwealth assessment - ‘not overfished’, but there is some concern about high rates of fishing in the western and central Pacific.</td>
<td>377</td>
</tr>
<tr>
<td>Thunnus albacares</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowtail Kingfish</td>
<td>Growth Overfished</td>
<td>Catch rates of commercial line fishers have improved since the 1990s. Size composition data indicate the stock remains growth overfished.</td>
<td>381</td>
</tr>
<tr>
<td>Seriola lalandi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowtail Scad</td>
<td>Fully Fished</td>
<td>A relatively long-lived small pelagic species which is significant in commercial and recreational catches, exploited throughout its range.</td>
<td>385</td>
</tr>
<tr>
<td>Trachurus novaezelandiae</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Resource Assessment Performance

Key species have a range of requirements for resource assessment. A target Resource Assessment Class (RAC, see page xix for explanation) was originally nominated for each species and the current class is updated at the annual Resource Assessment Workshop. The following figure summarises the difference between current and target RAC for all species combined - a reduction in this indicator signifies that RACs are approaching their target levels. The table on the following page lists the current and target RACs for each species separately.

**Performance Indicator for Resource Assessment**

![Graph](image)

The sum of the difference between the current and target Resource Assessment Class (ΔRAC) for all key commercial and recreational species, 2003/04 to 2008/09.
### Summary of the current and target Resource Assessment Classes (RAC) for all key species.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>RAC 2008/09</th>
<th>RAC TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angel Sharks</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Australian Anchovy</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Australian Bonito</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Australian Sardine</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Banded Rockcod</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Bass Groper</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Beachworms</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Bigeyes</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Blacklip Abalone</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Blue Mackerel</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Blue Swimmer Crab</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Blue-eye Trevalla</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Bluespotted Flathead</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Boarfish</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Broad Squid</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Brown Tiger Prawn</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Bugs</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Catfish</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cobia</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cockles</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Common Jack Mackerel</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Common Silverbiddy</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Crimsonbanded Wrasse</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cunjevoi</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cuttlefish</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Dart</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Diamondfish</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Dogfish</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Dusky Flathead</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Eastern Australian Salmon</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Eastern Blue Groper</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Eastern King Prawn</td>
<td>1</td>
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</tr>
<tr>
<td>Eastern Pigfish</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Eastern Red Scorpionfish</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Eastern Rock Lobster</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Eastern School Whiting</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Eastern Sea Garfish</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Flounders</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Frigate Mackerel</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Gemfish</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ghost Nipper</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ghostsharks</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Giant Mud Crab</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Goatfish</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Goldspot Mullet</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Greentail Prawn</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Grey Morwong</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gummy Shark</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Hairtail</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Hammerhead Sharks</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Hapuku</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Jackass Morwong</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>John Dory</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Longtail Tuna</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Species</strong></td>
<td><strong>108</strong></td>
<td><strong>52</strong></td>
</tr>
</tbody>
</table>

© State of New South Wales through NSW Department of Primary Industries 2008. You may copy, distribute and otherwise freely deal with this publication for any purpose, provided that you attribute NSW Department of Primary Industries as the owner.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (December 2007). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user’s independent adviser.
Exploitation Status - Defined

The NSW Department of Industry and Investment has adopted the following scheme to classify the exploitation status of key species. At the annual Resource Assessment Workshop (held in the second quarter of each year), departmental scientists review the information available on all key species and determine an exploitation status for each species (or group of closely related species). Scientific representatives from the Commonwealth and Queensland governments are also invited. Additional information on the assessment process is available in the report: NSW Department of Primary Industries, 2006. Determining the biological sustainability of wild fisheries in NSW: Concepts and definitions. An information paper by the Systems Research, Wild Fisheries Program. 27 pp.

With the recent inclusion of important recreational species in the assessment process, the characteristics for some of the status categories will be reviewed so as to include relevant recreational fishery indicators.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CHARACTERISTIC</th>
</tr>
</thead>
</table>
| RECRUITMENT    | • Recruitment is being significantly or measurably suppressed as a result of a small spawning biomass  
• Other characteristics of an ‘overfished’ stock (see below) are likely to be evident  
• Unequivocal determination will require a well-calibrated population model or stock-recruitment relationship | OVERFISHED                                                                 |
|                | • Fishing mortality rates are more than double natural mortality rates  
• Estimates of biomass are less than 30% of the estimated unfished stock  
• Catch rates are less than 30% of the initial catch rates  
• Length and age distributions unstable (excessively affected by recruitment, too few age or size classes in the exploitable population given a species’ life history)  
• Trends in length/age compositions are evident which indicate increasing (and/or excessive) fishing mortality  
• The ‘Spawning Potential Ratio’ is less than 20%                                                                                     |
| GROWTH          | • Yield per recruit would increase if length at first capture was increased or fishing mortality decreased                                                                                           |
| OVERFISHED      |                                                                                                                                | FULLY FISHED                                                                 |
|                | • Fishing mortality is approximately the same as natural mortality  
• Estimates of the biomass are greater than 30% of the estimated unfished biomass  
• Catch rates have been steady for 5-10 years and/or catch rates are greater than 30% of initial catch rates.  
• Length and age distributions are stable  
• Species are fished throughout their entire geographic range                                                                 | MODERATELY FISHED                                                                                        |
|                | • Fishing mortality is less than half of natural mortality  
• Estimates of the biomass are greater than 70% of the estimated unfished biomass  
• Catch rates are greater than 70% of initial catch rates  
• Species are fished in most of their geographic range but non-fishing areas are known to exist                                                                 | LIGHTLY FISHED                                                                                           |
|                | • Fishing mortality less than 25% of natural mortality  
• Estimates of the biomass are greater than 90% of the estimated unfished biomass  
• Catch rates are greater than 90% of initial catch rates  
• Only small proportions of the geographic range are fished  
• Markets would likely limit catch and effort                                                                                      | UNCERTAIN                                                                                               |
|                | • A significant amount of evidence has been collected and considered, but there are inconsistent or contradictory signals in the data that preclude determination of exploitation status                                                                                                                        | UNDEFINED                                                                                               |
|                | • Commercial catch data are available but no reasonable attempt has been made to determine exploitation status                                                                                           |
Resource Assessment Classes - Defined

There is a range of socioeconomic values associated with harvested species in NSW. A species harvested in the thousands of tonnes by commercial and recreational fishers cannot be given the same priority for assessment as other species harvested in much smaller quantities. In addition to this, the conservation values associated with some species (such as sharks) are more acute than those of others (such as some invertebrates), therefore additional prioritisation is justified. To manage this situation, each key species is associated with a target and current (2008/09) Resource Assessment Class. The attributes of these classes are defined in the table below. The difference between the current and target assessment class is used in the management of the assessment program and is also a performance indicator within the Fishery Management Strategy for each of the multi-species commercial fisheries.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Class of Resource Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One</td>
</tr>
<tr>
<td>Time series estimate of biomass from dynamic models</td>
<td>●</td>
</tr>
<tr>
<td>Time series estimate of total, natural and fishing mortality from dynamic models</td>
<td>●</td>
</tr>
<tr>
<td>Quantitative risk analysis of future harvesting using dynamic models</td>
<td>●</td>
</tr>
<tr>
<td>Biological reference points</td>
<td>●</td>
</tr>
<tr>
<td>Estimates of total, natural and fishing mortality (from catch-curves)</td>
<td>●</td>
</tr>
<tr>
<td>Credible indicator of abundance</td>
<td>●</td>
</tr>
<tr>
<td>Representative time-series of commercial catch</td>
<td>●</td>
</tr>
<tr>
<td>Credible estimate of recreational catch</td>
<td>●</td>
</tr>
<tr>
<td>Time series of age composition data (finfish only)</td>
<td>●</td>
</tr>
<tr>
<td>Local (NSW) information for growth, mortality, selectivity and maturity</td>
<td>●</td>
</tr>
<tr>
<td>Time series of length-composition data</td>
<td>●</td>
</tr>
<tr>
<td>Non-local (not NSW) information for growth, mortality, selectivity and maturity</td>
<td>●</td>
</tr>
<tr>
<td>Single biological species or stock</td>
<td>●</td>
</tr>
<tr>
<td>Complex of related species</td>
<td>●</td>
</tr>
</tbody>
</table>
How To Read The Species Reports

The Standard Fish Name for the species, genera, order or family that is represented by this report. In the case of some invertebrates (shellfish), a Standard Fish Name may not yet have been defined, so a common name is used. Standard Fish Names have been developed to improve reporting and marketing in Australia. For more information please visit the Standard Fish Names website.

The scientific name for the species, genera, order or family that is represented by this report.

The exploitation status of the species (or group of related species) as defined by Industry and Investment NSW at the end of the 2008/09 financial year. The quantitative and qualitative criteria that were used to specify exploitation status are described on page v. This exploitation status is updated each year, but only published in this report every second year.

A short comment summarising the status of the species (or group of related species) which provides additional context for the exploitation status.

The scientific name of the individual biological species that constitute this report. Note that these names are subject to change as researchers refine the taxonomy of these species.

The Standard Fish Name of the individual biological species that constitute this report. In the case of some invertebrates, a standard name will not yet be available.

A short comment about the individual species that constitute this report. When only a single species is reported upon, this comment is usually excluded as the information is contained elsewhere in the report.

A copyright illustration of one of the species represented by this report. These colour pencil illustrations are under license from Bernard Yau and must not be reproduced without permission.

Background information about the species. This section contains a brief biological and ecological background to the species as well as summary information about the fisheries that harvest this species in NSW.
additional notes about the species. this section contains bullet points (which are easier to maintain and keep up-to-date) on recent issues that affect the species in NSW waters. examples include changes to regulations or the finalisation of research projects.

Statement on the recreational catch. there is a significant recreational catch of many species in NSW but obtaining this information is expensive and the results can be highly variable (especially for the less frequently harvested species). this section contains a state-wide estimate of the likely range of annual recreational catch based upon the results from the National Recreational and Indigenous Fishing Survey. Fish that are caught and released are not included in these estimates.
Length composition histograms of landed fish. The length composition is an effective indicator of fishing pressure. For example, as fishing pressure increases, length compositions contract towards smaller fish as the larger individuals are removed from the population. In contrast, a stable length composition over decades indicates that the fishing pressure is likely to be sustainable.

Growth information on individual fish. The relationship between the age and length of an individual fish provides valuable information on the productivity of a stock. The growth curve is plotted along with the raw data (if available).

A list of references for further reading. This list is not an exhaustive bibliography but rather an indicative guide as to where additional information on this species can be found. Recent publications by the Wild Fisheries Research Program are hyper-linked to the associated page on the DPI website. In some cases, the actual publication can be downloaded from this location.

The code or CAAB (Codes for Australian Aquatic Biota) of the individual biological species that constitute this report. In many cases, there is only a single species included on a report, but in other cases each report groups a number of species at a higher taxonomic level. The CAAB is a unique 8-digit code that is maintained by the CSIRO Division of Marine and Atmospheric Research, Australia. Please visit the CAAB web site for more information.
Angel Sharks
(*Squatina* spp.)

**Exploitation Status**

**Undefined**

Species identification issues exist, and available data are insufficient to allow stock status to be determined for either species.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Squatina australis</em></td>
<td>Australian angel shark</td>
<td>Caught in inshore waters south of Sydney.</td>
</tr>
<tr>
<td><em>Squatina albipunctata</em></td>
<td>eastern angel shark</td>
<td>Offshore species that is also caught in the South East Trawl Fishery. Caught along the entire NSW coast.</td>
</tr>
</tbody>
</table>

**Background**

Two species of angel sharks are caught off NSW. The Australian angel shark (*Squatina australis*) occurs on the continental shelf mainly in depths shallower than 130 m and is found around southern Australia from central NSW to southern WA. Although a few specimens have been caught as far north as Port Macquarie, it is mainly found south of Sydney. The eastern angel shark (*S. albipunctata*) occurs on the mid to outer continental shelf and the upper slope in depths to about 400 m, between Lakes Entrance in Victoria and Cairns in Queensland.

The size range for Australian angel sharks caught in research trawl surveys was 30-117 cm total length (TL) for females and 34-104 cm for males; the large females weighed up to 15 kg. Eastern angel sharks are slightly larger with the female size range 27-132 cm TL and males 30-106 cm, with the maximum weight of females close to 20 kg. Both species feed mainly on small fish, squid and crustaceans.

The biology of the two NSW species is not well known. The small amount of biological data collected during research surveys indicated that, for both species, males matured between 80 and 90 cm in length. For females, Australian angel sharks matured between 90 and 100 cm and eastern angels between 100 and 110 cm. Both species have around 10-13 pups and gestation probably takes about one year. Development
of direct methods to estimate ages of angel sharks has proven problematic - analysis of tag recapture data for a Californian species suggests longevity of at least 25 years.

The two species are not separated in NSW catch records but reported landings of angel sharks by the NSW Ocean Trawl Fishery have been relatively stable at 30 to 50 t per annum since the late 1990s. The relative contribution of the two species to the landed catch is not accurately known, but it is believed that the eastern angel shark comprises the bulk of landings off NSW. Angel sharks are caught infrequently by recreational fishers.

Additional Notes
- Two species of angel shark are harvested by trawling in ocean waters. Both species are likely to be relatively fast growing and reasonably fecund (although the biology of these species has not been directly studied).
- *Squatina australis* is an inshore southern species not common north of Sydney and *S. albipunctata* is caught in deeper water off NSW and Queensland.
- Angel sharks are a key secondary species in the Ocean Trawl Fishery and were assigned a ‘high’ risk in the Environmental Impact Assessment.
- Although apparently quickly reduced in numbers on the NSW upper slope by trawlers in the 1970s, catches and catch rates of angel sharks have recently been relatively stable off central NSW, probably because they occupy areas and depths that are not heavily trawled.

Catch

**Recreational Catch of Angel Sharks**
The annual recreational harvest of angel sharks in NSW is likely to be less than one tonne.
The length distribution of Australian angel shark caught during trawl surveys by the Fisheries Research Vessel *Kapala* comprised mainly of sharks between 60 and 110cm TL (total length). There is no minimum legal length for angel shark in NSW.

The length distribution of eastern angel shark caught during trawl surveys by the Fisheries Research Vessel *Kapala* comprised mainly of sharks between 50 and 120cm TL (total length). There is no minimum legal length for angel shark in NSW.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab](http://www.marine.csiro.au/caab) and search for the species code (CAAB) 37 024001 and 37 024004, common name or scientific name to find further information.
Australian Anchovy (Engraulis australis)

Exploitation Status: Undefined

Very little information is available for this species, but it is likely to be a fast growing species with limited concerns for overfishing.

### Scientific Name

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engraulis australis</td>
<td>Australian anchovy</td>
<td></td>
</tr>
</tbody>
</table>

Background

Anchovies are generally similar in appearance to pilchards and sprats but have a distinctive undershot lower jaw and are usually smaller, rarely exceeding 12 cm in length. Worldwide, there are about 140 species of anchovies, most of which are found in tropical or subtropical waters. Anchovies are mostly coastal pelagic fishes inhabiting shallow depths and, although sometimes found out to water depths of 200 m, they commonly enter large estuaries and bays. They feed predominantly on copepods and other zooplankton and, in turn, are important forage fish for many marine predators, from the many carnivorous pelagic fishes and squids to small dolphins and seabirds. Anchovies often form very large and dense schools and are commercially important in many parts of the world, being the basis of large industrial fisheries for fishmeal as well as being caught for human consumption.

The Australian anchovy (Engraulis australis) is found in temperate waters from central Queensland around southern Australia to Shark Bay in WA, although its continuous distribution throughout the Great Australian Bight is still uncertain. It is also found around Lord Howe Island and is the only species of anchovy in New Zealand, inhabiting waters around the North Island and most of the South Island. Juveniles are mainly found in estuaries and bays, whereas mature anchovies are found in open coastal waters, moving inshore in spring during the breeding season. The preferred water temperatures of the Australian anchovy range from 10 to 21°C, with breeding temperatures being between 14 to 20°C. Salinity tolerances vary greatly, from 2 to 37‰ salinity with at least 15‰ salinity needed for spawning to occur.
Around Australia, there are three distinct populations of anchovy (off western, southeastern, and eastern Australia) that, with more research, may turn out to be separate species. The eastern population, found along the Queensland and NSW coasts, begin spawning in spring and peak during summer. The anchovy in the north commence breeding some weeks before their southern counterparts. In the north, the anchovy mainly spawn in the open sea over the continental shelf, whereas in the south, they breed in inlets and harbours as well as in the open sea.

Maturity is reached within one year in both the male and female anchovy, at a length of 6–7 cm. Their maximum life span is about six years with a maximum length of about 16 cm, although few over 10 cm are found. Anchovies exhibit seasonal growth, with faster growth occurring throughout spring and summer.

Anchovies in NSW are landed at low levels throughout the year, with large catches taken only sporadically. Annual landings have exceeded 80 t (2001/02) but are mostly less than 40 t. The bulk of the anchovy catch is taken in ocean waters with purse seine nets, and smaller quantities are taken in both estuarine and ocean waters using Pilchard, Anchovy and Bait (PAB) nets. Only a small percentage of the commercial anchovy catch is sold for human consumption with the majority sold for bait or aquaculture feed.

**Additional Notes**

- Recent commercial catches have been very low (< 10 t) with few active fishers.
- Recreational landings are likely to be insignificant.
- There is a recreational bag limit of 50 for Australian anchovy.

**Catch**

*Recreational Catch of Australian Anchovy*

The annual recreational harvest of Australian anchovy in NSW is likely to be less than one tonne.

**Historical Landings of Australian Anchovy**

![Graph showing historical landings of Australian anchovy.](image)

Commercial landings (including available historical records) of Australian anchovy for NSW from 1984/85 to 2008/09 for all fishing methods. Financial years where commercial catch was reported by less than six fishermen were removed due to privacy concerns.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 086001, common name or scientific name to find further information.
## Australian Bonito

*(Sarda australis)*

### Exploitation Status

**Fully Fished**

Relatively fast growing species that supports seasonally significant commercial and recreational catches.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarda australis</td>
<td>Australian bonito</td>
<td></td>
</tr>
</tbody>
</table>

### Background

Australian bonito (*Sarda australis*) are distributed throughout the waters of southeastern Australia (southern Queensland to Tasmania) and Norfolk Island. The species has also been reported in New Zealand. Nothing is known about the stock structure within this range. Leaping bonito (*Cybiosarda elegans*) are caught in small numbers off NSW - they can be distinguished by the yellow colour of the second dorsal and anal fins, and dark spots rather than lines on the dorsal surface. Oriental bonito (*Sarda orientalis*) have a wide Indo-Pacific distribution and are commonly caught off western Australia.

Recent research has shown that Australian bonito are fast growing fish which can grow to nearly 40 cm fork length (FL) in one year, and the majority of fish in landings are less than 3 years of age. Australian bonito grow to a maximum length of about 80 cm and a weight of 9 kg, but the majority of fish in landings are 30 to 60 cm in length and less than 2 kg in weight. Australian bonito mature at about 36 to 38 cm FL, and spawning occurs during the spring/summer period. Little is known of the early life history of Australian bonito.

Since bonito was listed separately on catch returns in the early 1990s, annual commercial landings have generally been between 100 t and 150 t. Following a peak in commercial landings of bonito in 1998/99 (275 t), landings have returned to previous levels. The peak period for harvesting bonito is from March to June. Line methods within the Ocean Trap and Line Fishery account for the majority of the catch.
Additional Notes

- Biological, tag/recapture and length data have been analysed, confirming the relatively fast growth and short lifespan of Australian bonito. Maximum age of about 5 years.
- The fishery is based on just a few age classes, mostly 1 - 3 years old fish.
- Length at maturity about 36 to 38 cm fork length (approximately 1 year of age).
- Schooling species - availability appears to vary between years and areas.
- Bonito are a popular species with recreational fishers.
- Length-based monitoring of the commercial catch is continuing at the Sydney Fish Market.
- There is no minimum legal length for bonito in NSW, but there is a recreational bag limit of 10 bonito.

Catch

Recreational Catch of Bonito

The annual recreational harvest of bonito in NSW is likely to lie between 40 and 110 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Bonito

Catch Per Unit Effort Information of Bonito Harvested by All Line Methods in NSW

Catch rates of bonito harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
The length distribution of Australian bonito in commercial landings comprises mainly fish between 30 and 60 cm fork length (FL), and generally shows 2 or 3 strong modes. The strongest mode usually occurs between 30 and 40 cm FL, and there is good representation of larger fish (> 50 cm) in all years. There is no minimum legal length for Australian bonito in NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 441020, 37 441008 and 37 441006, common name or scientific name to find further information.
Australian Sardine
(*Sardinops sagax*)

**Exploitation Status**
- **Fully Fished**

Comparison of current annual yield with estimated biomass indicates a fully fished stock.

### Scientific Name

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sardinops sagax</em></td>
<td>Australian Sardine</td>
<td>Previously known as pilchard and <em>Sardinops neopilchardus</em>.</td>
</tr>
</tbody>
</table>

**Background**

Sardines occur in many temperate regions of the world, including all states of Australia except the NT. Sardines inhabit continental shelf waters and the lower reaches of estuaries. Spawning occurs from winter to spring in NSW waters. Fish mature at two to three years old and 10–15 cm fork length (FL). They reach a maximum length of 23 cm FL and age of 8 years.

Australian sardines are mainly caught by the Ocean Hauling Fishery in purse seine nets and bait nets (which are modified hauling nets). Smaller quantities are also taken in general purpose hauling nets. Highest catches occur in winter and spring, although some catches are taken throughout the year.

Results of a retrospective biomass estimate based upon the daily egg production method indicate a spawning biomass off eastern Australia of between 9,000–60,000 t, with the most probable estimate between 25,000–35,000 t (Ward *et al.*, 2008). NSW landings have recently increased to around two thousand tonnes per annum, with another one thousand tonnes being taken in adjoining jurisdictions.

Mass mortality of Australian sardines occurred in 1995 and 1998 throughout WA, SA, Victoria and NSW, apparently caused by a herpes virus. Closures were put in place during these periods preventing commercial catches of sardines.

Sardines are sold for bait, pet food and for human consumption, either fresh, smoked or canned. Sardines are an important prey item for many fish, and other species including penguins and other marine birds. Sardines were previously known as pilchards in Australia.
Additional Notes

- There has been a substantial increase in landings in NSW since 2003/04.
- Preliminary results from the Daily Egg Production Method analysis indicate a spawning biomass of between 9000 - 60 000 t, with the most probable estimate between 25000-35000 t. Data for these estimates were collected during July 2004 between Bundaberg, Queensland and Newcastle, NSW.
- Total commercial catch from NSW, Victorian and Commonwealth waters now exceeds 3000 t per year, suggesting an exploited fraction of between 8-12%.
- Commonwealth assessments do not consider Australian sardines to be overfished nor subject to overfishing (Wilson et al. 2009).
- A current project is investigating the stock structure of sardines off eastern Australia (FRDC Project 2009/21).
- There is a recreational bag limit of 50 for Australian sardine.

Catch

Recreational Catch of Australian Sardine

The annual recreational harvest of Australian Sardine in NSW is likely to be less than one tonne.

Historical Landings of Australian Sardine

Commercial landings (including available historical records) of Australian sardine for NSW from 1950/51 to 2008/09 for all fishing methods.
Further Reading


Banded Rockcod

*(Epinephelus ergastularius)*

**EXPLOITATION STATUS**

**UNDEFINED**

Small seasonal dropline fishery in NSW and recreational catches are thought to be increasing. Little information is available on the biology of the species.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Epinephelus ergastularius</em></td>
<td>Banded rockcod</td>
<td>Previously known as barcod.</td>
</tr>
</tbody>
</table>

Background

Banded rockcod or barcod (*Epinephelus ergastularius*) are only known to occur off the eastern coast of Australia between about Townsville (18°S) and Batemans Bay (36°S). The taxonomy of banded rockcod is unclear and it is possible that fish occurring off Queensland belong to another species. The NSW population however, is likely to be a single species. A similar species, *E. octofasciatus*, occurs throughout the Indo-Pacific - as its name suggests, this species has eight dark bars on the body whereas *E. ergastularius* has seven bars. These bars become less distinct as the fish grows and adult banded rockcod are a uniform grey-brown in colour.

Adult banded rockcod are found mainly in depths between 100 and 400 m while juveniles can be found as shallow as 15 m. The largest reported size of banded rock cod is 157 cm total length (TL) and 66 kg but there is little information on the biology of the species. Monitoring of the NSW commercial dropline catch at the Sydney Fish Market from 1993 to 1995 showed that the majority of fish were between 40 and 70 cm TL, equivalent to 2 to 5 kg in weight. Only a very small proportion of the catch was comprised of fish larger than 100 cm TL.
The banded rockcod is a primary species in the NSW Ocean Trap and Line Fishery which takes over 95% of the commercial harvest. Since this species was listed separately on reporting forms in 1990, the reported annual catch has fluctuated between 10 t and 30 t.

**Additional Notes**

- Size composition of commercial landings is currently being monitored.
- Size composition data from the mid 1990s indicated a large proportion of the catch was comprised of fish less than 60 cm TL which are likely to be immature.
- Associated with hard reef grounds, mainly off the north coast (south to Kiama).
- Very little biological data is available - likely to be a slow-growing, long-lived species.
- Although not well documented, recreational catches are likely to be greater than the commercial catch, particularly in certain areas and are thought to be increasing.
- There is a combined recreational bag limit of 5 hapuku, banded rockcod, bass groper, gemfish and blue-eye trevalla. Additional restrictions apply to gemfish.

**Catch**

*Recreational Catch of Banded Rockcod*

The annual recreational harvest of banded rockcod in NSW is likely to be less than 10 tonnes.
The length distribution of banded rockcod landed by commercial fishers was relatively stable from 1992 to 2002, and comprised mainly fish between 40 and 100 cm total length (TL). Recent samples show a similar size range, although the sample size is small. There is no minimum legal length for banded rockcod in NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 311147, common name or scientific name to find further information.
Bass Groper  
(*Polyprion americanus*)

**Exploitation Status**  
Undefined

No detailed stock assessment available. Species has a worldwide distribution, local status has not been determined.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Polyprion americanus</em></td>
<td>bass groper</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The bass groper (*Polyprion americanus*) is a large, cosmopolitan species found in the northern and southern Atlantic Ocean, the Mediterranean Sea, southern Indian Ocean and in the south-western Pacific. Genetic studies have revealed that there are at least three distinct stocks of this species: the North Atlantic and Mediterranean group, Brazil group and the South Pacific (Australia and New Zealand) group.

Adult bass groper mostly live in depths between 100 and 600 m, and typically inhabit deepwater rocky reefs and caves. Juveniles (< 50 cm total length (TL)) occur in surface waters around floating objects or pieces of wreckage giving rise to the name ‘wreckfish’ in other parts of the world. In Australia bass groper have been recorded around the south-east of the continent and Tasmania where they are usually caught deeper than 300 m. They also occur on offshore seamounts.

A study of bass groper in the South Atlantic (Brazil) found that males mature between 75 and 80 cm TL (9–11 years of age) and females between 80 and 90 cm (10–15 years) and their maximum life span exceeds 60 years. Off south eastern Australia bass groper reach a maximum length of 160 cm and weight of about 60 kg.

Apart from the occasional capture by trawlers, all bass groper landed in NSW commercial fisheries are by deepwater dropline fishers in the Ocean Trap and Line Fishery. Bass groper are often taken in association with blue-eye trevalla and hapuku. Since 1997/98, bass groper catches have been reported separately from hapuku and annual catches have been between 2 and 10 t.
Additional Notes

- Historical length frequency data for the mid 1990s do not suggest the population was under heavy fishing pressure, however catches and catch-rates off NSW have declined since the early years of the deepwater fishery in the 1970s.
- Local data could be compared with New Zealand and American studies for additional insights into harvesting pressure.
- There is a combined recreational bag limit of 5 hapuku, banded rockcod, bass groper, gemfish and blue-eye trevalla. Additional restrictions apply to gemfish.

Catch

Recreational Catch of Bass Groper

The annual recreational harvest of bass groper in NSW is likely to be less than 10 tonnes.

Length Frequency of Bass Groper

The length distribution of bass groper landed by NSW commercial fishers in the 1990s comprised fish between 60 cm and 140 cm total length (TL), with a high proportion of large fish (>100cm TL) present in the catch. There are no recent length data for bass groper, which does not have a minimum legal length in NSW.

Commercial landings (including available historical records) of bass groper for NSW from 1997/98 to 2008/09 for all fishing methods. Note that before 1997/98, bass groper were reported in combination with hapuku.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 311170, common name or scientific name to find further information.
Beachworms (Onuphidae)

EXPLOITATION STATUS  UNDEFINED

The catch comprises a mixture of species and there is insufficient information to assess the status of the stocks. No precise estimate of the recreational catch is available.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australonuphis parateres</td>
<td>[a polychaete worm]</td>
<td>Also known as slimy.</td>
</tr>
<tr>
<td>Australonuphis teres</td>
<td>[a polychaete worm]</td>
<td>Also known as kingworm and stumpy.</td>
</tr>
<tr>
<td>Hirsutonuphis mariahirsuta</td>
<td>[a polychaete worm]</td>
<td>Also known as wiry.</td>
</tr>
</tbody>
</table>

Background

Beachworms are large members of the Onuphid family. Three species are considered important to commercial and recreational fishers. Australonuphis teres, also known as the ‘kingworm’ or ‘stumpy’, and A. parateres, known as the ‘slimy’, are the most valued. Hirsutonuphis mariahirsuta, known as the ‘wiry’, is also caught by fishers.

Australonuphis teres is found on surf beaches from Lakes Entrance in Victoria to Maroochydore in Queensland and A. parateres is found on surf beaches from Adelaide in SA to Yeppoon in Queensland. H. mariahirsuta occurs on protected beaches from Camden Haven, northern NSW to Yeppoon in Queensland.

Beachworms bury themselves in inter-tidal and sub-tidal sand habitats. They move horizontally through the sediment towards sources of food and emerge from the sand when feeding. When beachworms are at rest, they live vertically with their head towards the top of their burrow.

In contrast to other members of the Onuphidae family which build permanent tubes, beachworms build temporary burrows. For example, H. mariahirsuta create very thin and fragile sand encrusted tubes whilst A. teres and A. parateres strengthen the surrounding sediment with mucus.

Beachworms have biology typical of polychaete worms, with segmented bodies that absorb oxygen. These species reproduce with external fertilisation with male and female beachworms expelling gametes into the water column.
Beachworm larvae live as zooplankton that feed on phytoplankton. At about 3 cm long, the planktonic worms settle in the sand as juveniles. *Australonuphis parateres* can grow up to 300 cm long and 1.5 cm wide, whilst *A. teres* and *H. mariahirsuta* can both grow to 100 cm long and up to 1.5 and 1 cm wide respectively. *Australonuphis* spp. reach sexual maturity at a length of around 40 cm.

Beachworms are scavengers that feed on dead fish, birds, molluscs, and other invertebrates and are also known to consume seaweed. The worms are a common source of food for fish and birds.

Beachworms are collected for bait by recreational and commercial fishers in NSW. They are collected by hand, using a bait to lure the worm out of its burrow. The worm is then caught and pulled out of the sand by hand or with pliers.

Commercial beachworm collecting occurs primarily during the summer. In NSW, collecting peaks in January, slowly declines until July, and increases again in the spring. The majority of collecting occurs along the north coast. Currently there is no evidence of over harvesting of beachworms and overfishing is unlikely given the labour intensive method of collection. There have been, however, complaints about localized depletions on beaches that have high rates of collection.

### Additional Notes

- Three species occur in catches but they are not reported separately.
- Commercial landings have declined from 20 t to 10 t in recent years, although fishing effort has also declined and catch rates have remained stable.
- Recreational landings are not accurately known, and may be significant in some areas.
- There is a recreational bag limit of 20 beachworms.

### Catch

**Recreational Catch of Beachworms**

The annual recreational harvest of beachworms in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

#### Historical Landings of Beachworms

![Graph showing historical landings of beachworms]

**Commercial landings (including available historical records) of beachworms for NSW from 1997/98 to 2008/09 for all fishing methods.**

#### Landings by Commercial Fishery of Beachworms

![Graph showing landings by commercial fishery of beachworms]

**Reported landings of beachworms by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.**
Catch rates of beachworms harvested using hand gathering for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 22 030001, 22 030002 and 22 030020, common name or scientific name to find further information.
Bigeyes
(Priacanthidae)

**EXPLOITATION STATUS** UNDEFINED

Taken as a bycatch in the Estuary Prawn Trawl and Ocean Trawl Fisheries and also caught by the recreational sector. Little biological information is available.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priacanthus macracanthus</td>
<td>spotted bigeye</td>
<td>Also known as red bullseye.</td>
</tr>
<tr>
<td>Cookeolus japonicus</td>
<td>longfin bigeye</td>
<td></td>
</tr>
<tr>
<td>Priacanthus hamrur</td>
<td>lunartail bigeye</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The bigeye or red bullseye family (Priacanthidae) contains about 17 species distributed worldwide in tropical and subtropical seas. Nine species of bigeyes are known from Australian waters and at least five occur in NSW. They are small to medium sized fishes and their most obvious characteristics are their very large eyes and overall reddish-brown colour.

Since about 2000, there have been small but regular landings of ‘red bullseye’ in NSW, reported from the Ocean Trawl Fishery. It is likely that most of the catch comprises the spotted bigeye (*Priacanthus macracanthus*) but it is probable that smaller quantities of the longfin bigeye (*Cookeolus japonicus*) and occasional lunartail bigeye (*P. hamrur*) are included in the catch. The longfin bigeye can be distinguished from the spotted bigeye by its deeper body and long ventral fin; the fins are generally dark-coloured without spots. Because it mostly inhabits hard substrates, it is not as commonly caught in trawls as the spotted bigeye, but its average size (20-30 cm) is usually larger.

The spotted bigeye is commonly found in estuaries and inshore waters along Australia’s east coast, and also further north in tropical areas of the west Pacific and around Taiwan. Juveniles can have a dark mottled appearance when freshly caught but larger fish are plain red with light coloured fins with rows of dark yellow-green spots. In NSW, bigeyes usually live in depths less than 100 m. Juveniles (< 20 cm in length) are commonly caught on eastern king prawn grounds. During exploratory fishing in 1982, Fisheries Research Vessel *Kapala* caught three boxes of large spotted bigeye (around 30 cm total length) in 275 m off the northern NSW coast. This species is reported to grow in excess of 40 cm but no information has been collected on the size composition or biology of spotted bigeye in Australia.
The longfin bigeye has a widespread cosmopolitan distribution and is normally found in deeper water than the spotted bigeye. Fisheries Research Vessel Kapala records for longfin bigeye on NSW trawl grounds were from depths between 30 and 275 m but the majority were caught on the mid to outer continental shelf between 100 and 150 m depth. The longfin bigeye also frequents reef areas.

Additional Notes

- Species is a bycatch of estuarine and ocean prawn trawl fishing - annual landings generally less than 5 t.
- Bigeyes are also harvested by the deepwater recreational fishery in small numbers at around 30 cm in length.
- Creel surveys in Lake Macquarie indicate that there are considerable catches of this species (Steffe et al. 2005).
- Very little biological information is available for bigeyes.

Catch

Recreational Catch of Bigeyes

The annual recreational harvest of bigeyes in NSW is likely to be less than one tonne.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 326001, 37 326002 and 37 326005, common name or scientific name to find further information.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Blacklip Abalone

*(Haliotis rubra)*

**EXPLOITATION STATUS**

| Stock is currently recovering from historically low levels that occurred due to a combination of overfishing and mortality due to the parasite *Perkinsus* sp. There are concerns about possible recruitment overfishing in the northern regions. |

<table>
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<tr>
<th>SCIENTIFIC NAME</th>
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<th>COMMENT</th>
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<tbody>
<tr>
<td><em>Haliotis rubra</em></td>
<td>Blacklip abalone</td>
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</tr>
</tbody>
</table>

**Background**

Blacklip abalone (*Haliotis rubra*) is a large, flattened marine gastropod mollusc which occurs in rocky reef habitats on the southeastern Australian coastline from northern NSW to Rottnest Island in Western Australia, including Tasmania. Blacklip abalone form the basis of the abalone fishery in NSW. The species is also harvested in the other southern Australian states along with the greenlip abalone *H. laevigata*. The bulk of the Australian production of abalone is exported to lucrative markets in south-east Asia.

Blacklip abalone can live for over 20 years and can reach a maximum size of 22 cm shell length (SL) and a weight of over 3 kg. The majority of abalone landed in NSW are however, close to the minimum legal length of 11.7 cm. Blacklip abalone mature at about 9-10 cm SL (3 to 6 years of age). Spawning occurs between Spring and Autumn, with peaks in early Spring and late Summer. Abalone spawn throughout their distribution. Growth is highly variable in terms of both rates of growth and maximum size. They may reach maximum size in as little as 5 years but at some locations, populations may exhibit stunted growth with few individuals ever reaching legal size. Larvae settle after a short time and post-larvae, juveniles and adults all occur in the same habitat. This suggests that local recruitment is dependent on the proximity of adults. This, combined with the restricted movement of adult abalone, gives rise to stocks which are spatially highly structured. Increasingly sophisticated management regimes are being developed to properly account for this structuring.

Commercially, blacklip abalone are harvested by endorsed divers, usually using compressed air supplied from a hookah unit, although in some cases SCUBA or free diving may be used. A chisel shaped abalone iron is used to pry the abalone away from the rock surface. After landing, abalone are shucked (the meaty foot is removed from the rest of the body and the shell), usually at a local processing establishment, and the product is packed for marketing or export.

The NSW fishery for blacklip abalone developed during the 1960s and annual landings had increased to 1200 t by the early 1970s. Concerns about the sustainability of landings led to the implementation of a minimum legal length of 10 cm and controls on fishing effort during the mid 1970s. The fishery became the first restricted-entry fishery in NSW in 1980.
By the late 1980s, the minimum legal length had been increased, in several increments, to 11.5 cm and a quota of 10 t per commercial diver was introduced. Provisional shares were allocated in 1996 with an associated total allowable commercial catch (TACC) of 333 t. The final stage of transition to share management occurred in 2000 when a TACC of 305 t was shared among 37 shareholders. The fishery was assessed as “Fully exploited” with adequate and stable biomass levels and a value at first point of sale of about $15 million. There was, however, concern about declining stocks of blacklip abalone in the northern parts of the fishery, due to a combination of fishing pressure and mortalities due to a protistan parasite (*Perkinsus* sp.). During the following 5 years (2000 – 2005), catch rates declined markedly across the fishery to historical lows. Increasingly pessimistic stock assessments resulted in a series of significant reductions in TACC.

Despite improving catch rates during the past 4 years (2006 – 2009) and some positive signs of recovery of stocks, the minimum legal length was increased by 2 mm to 11.7 cm in 2008 and the TACC was reduced to its historical low of 75 t in 2009/10. In response to the impact on the stock of infection by the *Perkinsus* parasite, harvesting of abalone by both commercial and recreational fishers has been banned in the area between Port Stephens and Jervis Bay. Whilst, during the past few years, the blacklip abalone stock has experienced a period of increased productivity, due to a pulse of recruitment and/or improved growth rates, the stock remains at a very low level. Consequently, the most recent determination of a TACC of 82 t for 2010/11 represents a small increase on the previous year but is still low compared with historical catch levels.

In summary, the past decade has seen significant declines in stock abundance, fishery production and fishery value. Moreover, market prices have fallen due to increased competition from aquaculture product.

Recreational divers are permitted to take abalone from areas that aren’t closed to fishing by free diving (no use of compressed air). However, there is a significant problem with illegal landings (both greater than the bag limit and abalone smaller than the minimum legal length), and efforts to improve compliance with the fishery regulations continue.

### Additional Notes

- A high value species caught mainly on the south coast of NSW on rocky ocean shores and shallow reefs.
- The commercial fishery is managed by TACC and is closely monitored, with annual assessment by the Total Allowable Catch Committee.
- Prior to 2008 a fishery independent survey was used to index the abundance of blacklip abalone, however surveys have not been conducted in recent years.
- Stock is assessed annually using a dynamic population model - biomass is estimated relative to the 1994 benchmark level.
- There is a minimum legal size of 11.7 cm shell length in NSW. The bag limit for abalone was reduced from 10 to 2 in 2005.

### Catch

*Recreational Catch of Blacklip Abalone*

The annual recreational harvest of blacklip abalone in NSW is likely to be less than 20 t. Recreational landings of abalone are considered to have declined following the reduction in the bag limit from 10 to 2, and the TAC committee believes that annual recreational landings are currently around 10 t or less (TAC Committee, 2009).

*Historical Landings of Blacklip Abalone*

![Graph showing historical landings of blacklip abalone from 1960 to 2009](image)

Commercial landings (including available historical records) of blacklip abalone for NSW from 1960 to 2009 for all fishing methods.
Annual CPUE (kg/hr) of blacklip abalone from the commercial fishery in NSW, by region, 1987 - 2009. Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Note: No data for 1989. Region 1 and 2 affected by recent closures.
Blacklip Abalone Management Regions

NSW coast showing abalone assessment regions 1-6: marine parks (dark grey) and aquatic reserves (*) where abalone harvesting is limited; and the current general closure to the taking of abalone (light grey) (Ecology Lab, 2005).

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 24 038006, common name or scientific name to find further information.
Blue Mackerel
(*Scomber australasicus*)

**Exploitation Status**

**Moderately Fished**

Overall the stock off NSW is believed to be moderately fished, but there may be localised depletions.

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<tr>
<th>Scientific Name</th>
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<tbody>
<tr>
<td><em>Scomber australasicus</em></td>
<td>blue mackerel</td>
<td>Also known as slimy mackerel</td>
</tr>
</tbody>
</table>

Background

Blue mackerel (*Scomber australasicus*) occur in sub-tropical and temperate waters of the Pacific and Indian Oceans. Blue mackerel occur off all states of Australia except the NT. The species inhabits inshore and continental shelf waters, with older fish occurring further offshore.

In the last decade there has been considerable research into the biology and stock assessment of blue mackerel. Blue mackerel grow relatively quickly, reaching approximately 17-22 cm fork length (FL) after one year. They reach a maximum age of about 7 years and length of 50 cm. Blue mackerel mature at about 24-28 cm FL and spawning takes place during late winter and spring in outer continental shelf waters off northern NSW and southern QLD. Off NSW the oldest fish occur offshore, beyond state waters, and are targeted by Commonwealth licensed purse seine and mid-water trawl fishers. In 2008/09 Commonwealth fishers landed about 2,000 tonnes of blue mackerel.

Relatively young (less than 2 years old) blue mackerel are caught by the Ocean Hauling Fishery in purse seine nets. Smaller quantities are also taken in bait nets (which are modified hauling nets) and general purpose hauling nets. Similar catch levels occur in all months of the year.

Commercial landings of blue mackerel since the mid 1980s have generally been between 300 and 500 tonnes annually but show considerable fluctuations. These fluctuations are likely to reflect changes in stock availability due to recruitment variability and may also reflect changes in the distribution of fish due to oceanographic processes.
**Additional Notes**

- South Australian Research and Development Institute have provided a biomass estimate based on a daily egg-production model of 25,000-33,000 t off the east coast of Australia. (Ward and Rogers, 2007).

- The minimum recreational catch off NSW is likely to be in the order of 90 t, while annual commercial landings off NSW have recently been around 500 t. Additional quantities are utilised by both recreational and commercial fishers as ‘bait for own use’.

- Commonwealth assessments do not consider the species to be overfished nor subject to overfishing (Wilson *et al.* 2009).

- There is a recreational bag limit of 50 blue mackerel.

- Considerable quantities also taken for bait by tuna fishers (under permit).

**Catch**

*Recreational Catch of Blue Mackerel*

The annual recreational harvest of blue mackerel in NSW is likely to lie between 90 and 200 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Historical Landings of Blue Mackerel*

Commercial landings (including available historical records) of blue mackerel for NSW from 1955/56 to 2008/09 for all fishing methods. Landings were low until the commencement of purse seining in the 1980s.
The length distribution of blue mackerel landed by NSW commercial purse seine fishers is comprised mainly of fish between 25 and 35 cm FL and has remained relatively stable in recent years. There is no minimum legal length for blue mackerel in NSW.

Further Reading


Stewart, J. and D.J. Ferrell (2001). Age, growth, and commercial landings of yellowtail scad (Trachurus novaezelandiae) and blue mackerel (Scomber australasicus) off the coast of New South Wales, Australia, New Zealand Journal of Marine and Freshwater Research 35 (3): 541-551.

Stewart, J. and D.J. Ferrell and N.L. Andrew (1998). Ageing Yellowtail (Trachurus novaezelandiae) and Blue Mackerel (Scomber australasicus) off the coast of New South Wales, Australia, Final report to Fisheries Research and Development Corporation - Project 95/151. Cronulla, NSW Fisheries.


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 441001, common name or scientific name to find further information.
Blue Swimmer Crab

*(Portunus pelagicus)*

**Exploitation Status**

*Fully Fished*

An important recreational and commercial species. Biological data collected for Wallis Lake indicate high fishing pressure in this estuary, with fishing mortality estimated to be greater than natural mortality.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Portunus pelagicus</em></td>
<td>blue swimmer crab</td>
<td>Sometimes recorded as sand crabs in historic catch records.</td>
</tr>
</tbody>
</table>

**Background**

The blue swimmer crab (*Portunus pelagicus*) inhabits coastal waters in all Australian states except Tasmania, and is also widely distributed throughout the Indo-Pacific region. In NSW waters, blue swimmer crabs are found primarily within estuaries and inshore coastal waters. In estuaries, they are found in mud, sand and seagrass habitats, and are often buried in the sediment. Blue swimmer crabs mostly prey on slow-moving invertebrates such as bivalve molluscs, crustaceans and worms, but also scavenge on material including dead fish and squid.

In NSW a number of other species of crabs are sometimes landed in smaller numbers, including the common sand crab, *Ovalipes australiensis*, and the three-spotted crab, *P. sanguinolentus*.

Based on research in SA and WA, blue swimmer crabs are likely to spawn in both lower estuarine and oceanic waters, with peak spawning expected in spring or summer. The larvae may drift well out to sea before settling in shallow estuarine or inshore waters, similar to those inhabited by adults. Blue swimmer crabs reach the minimum legal size at almost 10 months of age and can grow to a maximum size in excess of 9.5 cm carapace length (CL) and live for up to 3 years. In a recent study it was found that the estimated size at which 50% of females and males reached maturity was 4.6 cm and 4.4 cm CL, respectively.

Blue swimmer crabs are caught in crab pots, hoop nets and mesh nets in the Estuary General Fishery, and are also caught as an incidental catch in the Estuary Prawn Trawl and Ocean Trawl Fisheries. There is also a large recreational catch.
Additional Notes

- Commercial landings and catch rates by crab potting have declined in recent years - the reasons for this need to be investigated.
- Five estuaries account for 95% of the commercial catch, with Wallis Lake being the most important.
- Populations in Wallis Lake are subject to very high levels of mortality (Johnson, 2007).
- Ocean prawn trawling appears to catch mature female crabs, but landings are small.
- Length-based monitoring of commercial catches is continuing at Wallis Lake - there has been little change in the size composition of commercial landings since 2005/06.
- Recreational landings are likely to be greater than the commercial catch, but no recent estimates are available.
- There is a minimum legal length of 6 cm carapace length and a recreational bag limit of 20 blue swimmer crabs.

Catch

**Recreational Catch of Blue Swimmer Crab**

The annual recreational harvest of blue swimmer crab in NSW is likely to lie between 150 and 310 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
The length distribution of blue swimmer crabs in commercial landings from Wallis Lake ranged between 6 and 10 cm carapace length (CL), and remained relatively stable between 2006/07 and 2008/09. The minimum legal length of blue swimmer crabs in NSW is 6 cm CL.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 911005 and 28 911003, common name or scientific name to find further information.
Blue-eye Trevalla
(Hyperoglyphe antarctica)

**Exploitation Status**

**Fully Fished**

Mostly a Commonwealth fishery, where blue-eye is assessed as 'not overfished'; but there are concerns about possible local depletion in some areas. Catch rates of NSW commercial fishers and the size composition of catches appear to be stable.

<table>
<thead>
<tr>
<th>Scientific Name</th>
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<th>Comment</th>
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<tbody>
<tr>
<td>Hyperoglyphe antarctica</td>
<td>blue-eye trevalla</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Blue-eye trevalla (*Hyperoglyphe antarctica*) are distributed in continental slope waters off South America, South Africa, New Zealand and Australia. Their Australian distribution stretches along the southern continental margin in waters from Moreton Island in Queensland to 30°S in WA. Blue-eye trevalla also occur on the seamounts off eastern Australia and south of Tasmania, Lord Howe Island and probably Norfolk Island. The species supports a significant fishery in New Zealand, where it is known as 'blue-nose'.

Adults and sub-adults occur in mid-water at depths of around 500 m and are associated with rocky ground on the continental slope where the majority of fish are found between 200 and 600 m, but a small number have been reported to occur at depths of up to 900 m. Juveniles have been found at the surface but may also occur in the mid-water region. The colour of juvenile blue-eye trevalla (3-6 cm fork length (FL)) was reported to be remarkably similar to the colour of kelp, and this has led to the suggestion that some juveniles are dependent on drift algae for shelter.

Analysis of blue-eye trevalla samples from Tasmania found that 72 cm FL is the average size at maturity for females (corresponding to about 11-12 years of age) and for males the average is 62 cm FL (8-9 years of age). Most spawning activity occurs in the waters from central NSW to north-eastern Tasmania, with evidence that spawning also takes place in southern Australia. Spawning occurs in summer and autumn but timing varies regionally, with spawning occurring in NSW waters from April to June. Female blue-eye trevalla are highly fecund with females producing 2-11 million eggs per year. Allozyme surveys on the genetic structure of the blue-eye trevalla stock found no population differentiation in samples examined from NSW, Tasmania and SA.
The estimated ages of blue-eye trevalla in commercial catches are thought to range from 2 to 3 years at first capture, to 42 years for females and 39 years for males, with great variation in the size of fish at age.

Approximately 99% of the blue-eye trevalla caught by NSW managed commercial fisheries is from the Ocean Trap and Line Fishery. Droplining is the primary method by which this species is taken. Blue-eye trevalla are caught year-round but landings are greatest during autumn and winter.

A similar species Schedophilus velaini (previously S. labyrinthicus) commonly known as ‘Ocean Blue-eye Trevalla’ is occasionally taken by dropline fishers off NSW. This species has a circumglobal distribution in southern oceans and occurs off the north coast of NSW in similar depths to blue-eye trevalla. Little is known of the biology of this species.

Additional Notes

- In New Zealand, concerns about declining catch rates since about 2003 led to a reduction in TAC for ‘blue-nose’ in all fishery areas for 2009.
- Size composition of NSW landed catch from 1993 to 2000 provides evidence of relatively stable proportion of older fish in the population. Size composition of NSW catch is currently being monitored.
- Decline over last decade in directed fishing effort in the NSW continental slope line fishery has led to reduced landings but with relatively stable catch per unit effort.
- Significant amounts of biological and fishery data are available; however, the data vary with season, area, depth and fishing method, and a full age-structured population model has not been developed.
- Commonwealth assessments do not consider the species to be overfished, however there are concerns about the potential for localised depletion. (Wilson et al. 2009).
- There is a combined recreational bag limit of 5 hapuku, banded rockcod, bass groper, gemfish and blue-eye trevalla. Additional restrictions apply to gemfish.

Catch

Recreational Catch of Blue-eye Trevalla

The annual recreational harvest of blue-eye trevalla in NSW is not accurately known but is thought to be less than 20 t.
The length distribution of blue-eye trevalla landed by NSW commercial fishers is comprised mainly of fish between 45 and 100 cm fork length (FL), with strong modes at around 50-55 and 65-70 cm FL. There is no minimum legal length for blue-eye trevalla in NSW.

Catch rates of blue-eye trevalla harvested using droplining for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Growth curve for blue-eye trevalla using parameters from Morison and Robertson (1995a, b). Lengths are presented as fork length (FL).

The length distribution of blue-eye trevalla landed by NSW commercial fishers is comprised mainly of fish between 45 and 100 cm fork length (FL), with strong modes at around 50-55 and 65-70 cm FL. There is no minimum legal length for blue-eye trevalla in NSW.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 445001 and 37 445014, common name or scientific name to find further information.
Bluespotted Flathead

(*Platycephalus caeruleopunctatus*)

**EXPLOITATION STATUS**  FULLY FISHED

A very important commercial and recreational species. Recent research has provided preliminary estimates of growth rates and size at maturity.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
</table>
| *Platycephalus caeruleopunctatus* | bluespotted flathead | Also known as sand flathead.

**Background**

The bluespotted or sand flathead (*Platycephalus caeruleopunctatus*) is a coastal species living in deep estuarine and ocean waters to depths of about 100 m between southern Queensland and northeastern Victoria. It is an important commercial and recreational species, growing to a maximum length of about 70 cm and a weight of 3 kg.

Despite its significance to commercial and recreational fisheries in NSW, there has been little research and monitoring of bluespotted flathead. Preliminary results from current studies show that bluespotted flathead grow relatively quickly, reaching a length of 30 cm after 2 to 3 years. They mature at a length of 20-30 cm off northern NSW and 25-35 cm in the south, and spawning occurs over an extended period through late winter, spring and summer.

Size composition data collected by Fisheries Research Vessel *Kapala* show that juveniles (< 25 cm) favour depths less than 30 m while mature flathead mainly inhabit deeper water.

Reported commercial landings for NSW have been generally stable at around 120-150 t during the past decade, and recreational landings are estimated to be much greater than the current commercial catch.
**Additional Notes**

- Annual trawl landings have been stable at about 150 t since 1990 and the size composition of commercial catches has been relatively stable since the 1970s. Catch rates by fish trawl appear to have increased in recent years.
- The recreational catch is estimated to be many times larger than the commercial catch.
- Recent research has provided estimates of growth rates and size at maturity from the northern part of the species’ range.
- Length-based monitoring of commercial catches is continuing at the Sydney Fish Market.
- There is a minimum legal length of 33 cm total length for bluespotted flathead and a combined recreational bag limit of 20 for all flathead (including only 10 dusky flathead).

**Catch**

**Recreational Catch of Bluespotted Flathead**

The annual recreational harvest of bluespotted flathead in NSW is likely to lie between 320 and 450 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Bluespotted Flathead**

Commercial landings (including available historical records) of bluespotted flathead for NSW from 1990/91 to 2008/09 for all fishing methods.
The length distribution of bluespotted flathead landed by NSW commercial fishers has remained relatively stable since the 1970s, and is comprised mainly of fish between 35 and 50 cm total length (TL). The minimum legal length of bluespotted flathead in NSW is currently 33 cm TL.

**Length Frequency of Bluespotted Flathead**

<table>
<thead>
<tr>
<th>Year</th>
<th>Proportion</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969/70−1999/00</td>
<td>n = 14,176</td>
<td>0.00</td>
</tr>
<tr>
<td>2000/01−2006/07</td>
<td>n = 8,674</td>
<td>0.00</td>
</tr>
<tr>
<td>2007/08−2008/09</td>
<td>n = 2,788</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 296007, common name or scientific name to find further information.
Boarfish
(Pentacerotidae)

**Background**

Members of the boarfish family (Pentacerotidae) are found in temperate waters of all oceans, but total only 13 species of which 10 are found off Australia. All species feature strong spines and heads with rough striated bony plates, giving rise to the name ‘armourhead’ for some deepwater species. Other features such as extended fin rays and elongation of the mouth are greatly developed in some species. A few species are restricted to deepwater, others are found in coastal depths less than 50 m, while the pelagic armourhead inhabits oceanic seamounts and ridges.

At least six species of boarfishes are known to inhabit NSW waters. Two are relatively small, non-commercial species including the bigspine boarfish (*Paristiopterus labiosus*), which is commonly caught on the upper slope by trawl in 250-600 m, and the threebar boarfish (*Histiopterus typus*) that has been recorded once from 100 m depth off Port Stephens.

The NSW commercial catch of boarfishes comprises three inshore species, of which, the giant boarfish (*Paristiopterus labiosus*), and the longsnout boarfish (*Pentaceropsis recurvirostris*) are the most commonly marketed. The smaller blackspot boarfish (*Zanclistius elevatus*) is also sometimes marketed.

The giant boarfish is found in temperate waters from northern NSW to southern Tasmania, including coastal waters of eastern Victoria to Port Philip Bay, and is also found around New Zealand. The fish’s primary habitat is over sandy or muddy substrates in shallow water less than 100 m, but it has been recorded to depths of 170 m. Observations by divers suggest juveniles form small schools but, as adults, boarfish are typically seen in pairs that tend to stay in the same area for extended periods.

The longsnout boarfish is more widely distributed, occurring around southern Australia from about Sydney to Rottnest Island in WA. It is similar in size and shape to the giant

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**EXPLOITATION STATUS**

UNDEFINED

Three species are taken incidentally in the Ocean Trawl Fishery. Little biological information available for any of these species.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Paristiopterus labiosus</em></td>
<td>giant boarfish</td>
<td></td>
</tr>
<tr>
<td><em>Pentaceropsis recurvirostris</em></td>
<td>longsnout boarfish</td>
<td></td>
</tr>
<tr>
<td><em>Zanclistius elevatus</em></td>
<td>blackspot boarfish</td>
<td></td>
</tr>
</tbody>
</table>

*Paristiopterus recurvirostris*

Image © Bernard Yau
boarfish but has a distinctly more elongated and slender snout and adults of both sexes have distinctive black stripes across their silvery-white body and head. The blackspot boarfish is found in depths of 50-300 m from southern Queensland throughout NSW to southern WA, including Tasmania.

Juvenile giant boarfish have wide, contrasting dark bands over a silver-white coloured body. Adult females retain this colour pattern whereas males lose the banding as they mature, becoming uniformly brown with numerous yellowish spots. Giant boarfish are characterised by their strong protruding snout and fleshy lips. The species typically use their elongated snouts to forage in sand and mud for shell-fish and other invertebrates. The maximum-recorded size for the boarfish is about 90 cm in total length and 12 kg in weight but most fish caught are 45-60 cm and 1.0-2.5 kg.

Annual landings of boarfish in NSW are small, (generally ranging between 5 and 12 t) and have recently been less than 5 t. All are taken by the Ocean Trawl Fishery. The boarfish is considered a fine table fish and commands a high market price. There is no minimum legal length for boarfish in NSW.

**Additional Notes**

- There has been a recent decline in landings of boarfish, but catch rates by fish trawl are stable.
- Giant boarfish are targeted by spear fishers when seen in relatively deep water, but boarfish are not caught in any numbers by recreational line fishers.

**Catch**

**Recreational Catch of Boarfish**

The annual recreational harvest of boarfish in NSW is likely to be less than one tonne.
**Broad Squid**

*(Uroteuthis etheridgei)*

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**Exploitation Status**

**FULLY FISHED**

Broad squid comprises the bulk of squid landings from NSW estuaries. The Hawkesbury River fishery for *Uroteuthis etheridgei* is fully fished.

**Scientific Name**

*Uroteuthis (Photololigo) etheridgei*

**Common Name**

broad squid

**Comment**

Majority of the estuarine squid catch.

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**Background**

At least three species of squid belonging to the family Loliginidae are caught in NSW shallow coastal waters and estuaries. Two relatively large species are the broad squid *Uroteuthis (Photololigo) etheridgei*, and the ‘slender’ or ‘pencil’ squid *Uroteuthis (Photololigo)* sp. which is yet to be properly classified. Both are tropical species found along the Queensland and northern NSW coasts, extending south to about Sydney. The broad squid is probably endemic to eastern Australia and is found in estuaries and inshore ocean waters in depths less than 50 m, while the slender squid possibly ranges through the Indo-Pacific region and is caught in depths out to about 100 m.

A third loliginid squid caught in NSW estuaries is the small bottle squid *Uroteuthis (Loliolus) noctiluca* which inhabits estuaries, bays and near-shore coastal waters along the whole of Australia's east coast from the Gulf of Carpentaria to Port Philip Bay in Victoria. This squid is also called the luminous bay squid in reference to the light organ in its mantle cavity.

Broad squid are relatively fast growing, short lived animals. Recent research in the Hawkesbury River estuary found that females attained a maximum size of about 20 cm mantle length (ML) and a maximum age of about 180 days; males generally grew faster with some reaching almost 30 cm ML and an age of 200 days. However, breeding began at a relatively small size. About 50% of males were mature at ~9 cm ML and age 120 days, while 50% of females were mature around 11 cm ML and age 130 days. There was evidence that female broad squid spawned a number of times during their final month of life, and that males could mate for at least the final 50 days of their life. It was also found that broad squid spawned throughout the year.

There is no detailed biological information available for the other squid species. However, data from Fisheries Research Vessel *Kapala* survey catches on ocean school prawn grounds showed that female bottle squid reached a maximum of 8.5 cm ML and males grew to about 6.5 cm ML.
In NSW, the main catch of broad squid is by the Estuary Prawn Trawl Fishery, particularly in the Hawkesbury River system where they are targeted. Annual landings from the Hawkesbury are between 20 and 40 t. Bottle squid are also mostly caught in estuaries and are marketed for human consumption or bait. Minor quantities of broad and bottle squid are also caught by the Ocean Trawl Fishery, particularly on school prawn grounds, and are usually reported as ‘unspecified’ squid.

**Additional Notes**

- There are issues associated with the accurate identification and reporting of species - taxonomy of this group has been little studied.
- Most of the estuary squid catch taken is in the Hawkesbury River fishery (principally *U. etheridgei* see O’Donnell, 2004).
- Bottle squid are harvested in small quantities from estuaries and school prawn grounds, and are mainly sold for use as bait.
- There is a combined recreational bag limit of 20 for all squid and cuttlefish.

**Catch**

*Recreational Catch of Estuary Squid*

The annual recreational harvest of estuary squid in NSW is likely to be less than 20 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Historical Landings of Estuary Squid*

Reported landings of estuary squid by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

*Catch Per Unit Effort Information of Estuary Squid Harvested by Estuarine Squid Trawling in NSW*

Catch rates of estuary squid harvested using estuarine squid trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 23 617901, common name or scientific name to find further information.
Brown Tiger Prawn

(*Penaeus esculentus*)

### Exploitation Status

**UNDEFINED**

NSW is at the southern end of the species’ range. Recruitment is likely to be small and variable.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Penaeus esculentus</em></td>
<td>brown tiger prawn</td>
<td>Native to NSW waters</td>
</tr>
<tr>
<td><em>Penaeus monodon</em></td>
<td>black tiger prawn</td>
<td>Also known as leader prawn and giant tiger prawn - farmed in NSW.</td>
</tr>
</tbody>
</table>

### Background

There are a number of large striped ‘tiger’ prawns known from Australian waters. Species such as the black tiger prawn (*Penaeus monodon*) and grooved tiger prawn (*P. semisulcatus*) have wide tropical distributions throughout the Indo-West Pacific and northern Australia. The brown tiger prawn (*P. esculentus*) is also mainly tropical but appears to be endemic to Australia, inhabiting shallow coastal waters and estuaries from central NSW (Sydney), around the north of the continent, to Shark Bay in WA. This species is fished commercially throughout its range and contributes almost 30% of the ~1800 t tiger prawn fishery (70% grooved tiger prawn) in the Northern Prawn Fishery of northern Australia.

Of the three species above, the brown tiger prawn is the only one landed in significant quantities by NSW fishers. Juvenile brown tiger prawns settle and grow in seagrass beds in estuaries before migrating as pre-adults to the ocean for spawning. Adults occur in coastal waters in mud, sand or silt substrates less than 30 m deep. Off northern Australia, female brown tiger prawns mature between 2.5 and 3.5 cm carapace length (CL) and grow to a maximum of about 5.5 cm CL; males grow to a maximum of about 4 cm CL. Spawning occurs mainly in water temperatures around 28-30°C, and the resulting planktonic larvae are dispersed by coastal currents back into the estuaries to settle.

Compared to northern Australian states, the NSW tiger prawn catch is extremely small. Since 2000, reported landings have been between 3 and 6 t per year, with about half taken in pocket nets by estuary general fishers (particularly in Wallis Lake) and the remainder by ocean prawn trawlers. The ocean prawn trawl catch also includes small numbers of black tiger prawns believed to have escaped from prawn farms.
**Additional Notes**

- Caught mainly by the Ocean Trawl Fishery, and the Estuary General Fishery in Wallis Lake.

- *Penaeus esculentus* is endemic to sub-tropical and tropical waters around Australia. Catches are generally incidental when fishing for other species of prawn.

- There is a small fishery for *P. esculentus* in NSW waters, mostly in Wallis Lakes and off northern NSW.

- *P. esculentus* is the smallest of the three ‘tiger prawn’ species found in the Gulf of Carpentaria.

- There is a combined recreational bag limit of 10 litres for all prawns.

**Catch**

*Recreational Catch of Brown Tiger Prawn*

The annual recreational harvest of brown tiger prawn in NSW is likely to be less than one tonne.

**Historical Landings of Brown Tiger Prawn**

Commercial landings (including available historical records) of brown tiger prawn for NSW from 1986/87 to 2008/09 for all fishing methods.

**Landings by Commercial Fishery of Brown Tiger Prawn**

Reported landings of brown tiger prawn by NSW commercial fisheries from 1997/98. * Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

**Growth Curves of Brown Tiger Prawn**

Growth curve for brown tiger prawn using parameters from Kirkwood and Somers (1984). Lengths are presented as carapace length (CL).
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 711044 and 28 711051, common name or scientific name to find further information.
I & I NSW

wild fisheries research Programe

Bugs

(Ibacus spp.)

EXPLOITATION STATUS  FULLY FISHED

Four species of bugs are marketed in NSW; but two species dominate commercial landings and both these species are considered to be fully fished. The recreational catch is insignificant.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibacus chacei</td>
<td>smooth bug</td>
<td>Inshore species found mainly off central and northern NSW.</td>
</tr>
<tr>
<td>Ibacus peronii</td>
<td>eastern Balmain bug</td>
<td>Inshore species found mainly off southern and central NSW.</td>
</tr>
</tbody>
</table>

Background

Trawlers off NSW catch four of the eight known species of Ibacus, collectively marketed as ‘Balmain bugs’. The most commonly caught NSW species are the ‘true’ eastern Balmain bug (Ibacus peronii) and the smooth bug (I. chacei) which both grow in size to 8-9 cm carapace length (CL) and weigh between 300 and 400 g. The eastern Balmain bug occurs mainly on inshore grounds (<80 m deep) and is distributed around southern Australia from about the NSW-Queensland border to southern WA including the east coast of Tasmania and Bass Strait. The smooth bug is mostly caught on deeper grounds (40 to 120 m) and is found off eastern Australia north from about Sydney to central Queensland.

A less commonly caught species is the smaller (< 7.5 cm CL) Bruce’s bug (I. brucei) that mainly inhabits outer continental shelf and upper slope depths (120-300 m) off northern NSW and Queensland. A second small species (< 6.5 cm CL) is the deepwater bug (I. alticrenatus) which occurs mainly at depths of 200 to 400 m around southern Australia; it is also found in New Zealand waters. Bruce’s bug is occasionally targeted by prawn trawlers off the NSW north coast and small quantities of deepwater bugs are caught by trawlers targeting fish or prawns on the upper continental slope.

More than 85% of the Australian Balmain bug catch of about 200 t annually is harvested from northern NSW and southern Queensland waters,
mostly as a by-product of prawn trawling; about 80% of this catch consists of smooth bugs. Balmain bugs are also taken as an incidental catch by other trawl fisheries off southern NSW and in other states, and small quantities of bugs are caught incidentally in spanner crab traps. There is no recreational fishery for bugs in NSW. It should be noted that an annual catch of around 400 t of Moreton Bay bugs or Bay lobsters (*Thenus* spp.) are also landed by Queensland trawlers.

Research into NSW bugs revealed distinct differences in life histories between the eastern Balmain and smooth bugs. Eastern Balmain bugs may live for more than 15 years whereas smooth bugs have a maximum life span of about 7 years. Tagged smooth bugs showed a northward movement pattern that was not evident for tagged eastern Balmain bugs. Studies of their reproductive biology showed that maturing smooth bugs moved northwards to spawn in waters off Queensland, whereas eastern Balmain bugs spawned throughout their range along the NSW coast. It appears that smooth bug larvae (phyllosomata) disperse south on the East Australian Current and settle as juveniles on the NSW continental shelf.

Size at maturity for eastern Balmain and smooth bugs is around 5 cm CL. In 1999, a minimum legal size of 10 cm (carapace width) was introduced for eastern Balmain and smooth bugs based on their average size of female maturity. Little is known of the biology of the other species although the peak egg-bearing period for all NSW bugs is winter.

The two large species of bugs (*I. chacei* and *I. peronii*) are not differentiated in catch returns but sampling will be used to assess the catch composition. Collectively, bugs are considered to be fully fished in NSW waters although no detailed stock assessments have been completed. In Queensland, the fact that bugs are relatively long-lived crustaceans, with low fecundity and relatively low population densities has led to concern that they may be vulnerable to over-exploitation.

### Additional Notes

- Bugs are taken incidentally by prawn and fish trawling in ocean waters off NSW.
- The two main species, smooth bug, *Ibacus chacei*, and eastern Balmain bug, *I. peronii*, are inshore species found mainly in depths less than 100 m, whereas *I. brucei* and *I. alticrenatus* are found on the outer shelf and upper slope (150-400 m).
- Smooth and Balmain bugs have overlapping distributions; however smooth bugs are a more northern species and are abundant in Queensland waters.
- Landings of these species continue to be monitored with length-based sampling.
- There is a minimum legal length of 10 cm carapace width and a recreational bag limit of 20 bugs.

### Catch

**Recreational Catch of Bugs**

The annual recreational harvest of bugs in NSW is likely to be less than one tonne.

**Historical Landings of Bugs**

![Historical Landings of Bugs](chart)

Commercial landings (including available historical records) of bugs for NSW from 1969/70 to 2008/09 for all fishing methods. Records from the mid to late 1980s are incomplete.
The length distribution of eastern Balmain bugs in NSW commercial landings has remained relatively stable since the 1990s, and is mainly comprised of bugs between 5 and 9 cm carapace length (CL). The introduction in June 1999 of a minimum legal length of 10 cm carapace width (approximately 5 cm CL) has apparently had little impact of the size composition of landings of eastern Balmain bugs.

**Length Frequency of Eastern Balmain Bugs**

The length distribution of smooth bugs in NSW commercial catches included a high proportion of bugs less than 5 cm CL prior to the introduction in 1999 of the minimum legal length of 10 cm carapace width (approximately 5 cm CL). In recent years the length distribution of smooth bugs landed by NSW commercial fishers has mainly comprised bugs between 5 and 7 cm CL.

**Length Frequency of Smooth Bugs**

The length distribution of smooth bugs in NSW commercial catches included a high proportion of bugs less than 5 cm CL prior to the introduction in 1999 of the minimum legal length of 10 cm carapace width (approximately 5 cm CL). In recent years the length distribution of smooth bugs landed by NSW commercial fishers has mainly comprised bugs between 5 and 7 cm CL.

**Growth Curves of Eastern Balmain Bugs**

Growth curves of eastern Balmain bug using parameters from Stewart and Kennelly (2000). Lengths are presented as carapace length (CL).

**Growth Curves of Smooth Bugs**

Growth curves of smooth bug using parameters from Stewart and Kennelly (2000). Lengths are presented as carapace length (CL).
Landings by Commercial Fishery of Bugs

Comercial landings of bugs by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Bugs Harvested by Ocean Prawn Trawling in NSW

Catch rates of bugs harvested using Ocean Prawn Trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 821019, 28 821004, 28 821001 and 28 821010, common name or scientific name to find further information.
Catfish
(Siluriformes)

**EXPLOITATION STATUS**  
**UNDEFINED**

Several species of catfishes are harvested at low levels in NSW estuaries by both commercial and recreational fishers. Very little information is available to establish exploitation status.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cnidoglanis macrocephalus</em></td>
<td>estuary cobbler</td>
<td>The major component of catches.</td>
</tr>
<tr>
<td><em>Euristhmus lepturus</em></td>
<td>longtail catfish</td>
<td>Minor component of catches.</td>
</tr>
<tr>
<td><em>Plotosus lineatus</em></td>
<td>striped catfish</td>
<td>Small species infrequently caught.</td>
</tr>
<tr>
<td><em>Arius graeffei</em></td>
<td>blue catfish</td>
<td>Also known as forktailed catfish.</td>
</tr>
</tbody>
</table>

**Background**

In NSW, catfish are typically low-value, non-target species with virtually all the landed catch (20-30 t per year) taken by mesh nets in the Estuary General Fishery. Commercial landings are dominated by the estuary cobbler (*Cnidoglanis macrocephalus*) but the catch also includes small numbers of long-tailed (*Euristhmus lepturus*), striped (*Plotosus lineatus*), and blue (*Arius graeffei*) catfishes.

The estuary cobbler is an eeltail catfish belonging to the family Plotosidae. As the name suggests, catfishes of this family have long tapering tails similar to an eel. The estuary cobbler is endemic to Australia being found around most of the southern half of the continent between southern Queensland and southern NSW, and from SA to the Houtman Abrolhos Islands in WA; the species is apparently rare in Victorian and Tasmanian waters. They inhabit estuaries and inshore coastal waters to a depth of about 30 m.

Estuary cobbler grow to about 75 cm in length and a weight of 2.5 kg. In NSW, they were found to mature at a length of 45-50 cm at an age of 2 to 3 years, and recent studies indicate that they can live up to 20 years. Peak spawning was found to occur in spring and summer. In WA, estimates of fecundity ranged from 500 - 3,500 eggs. Estuary cobbler have a large serrated spine on their dorsal and pectoral fins - these spines are poisonous and capable of inflicting a painful wound.

The longtail and striped catfishes are also eeltail catfishes but have more tropical distributions than the estuary cobbler. The longtail catfish, which can attain a length of 46 cm, is found in
estuarine and near-coastal waters of northern Australia and southern New Guinea. Striped catfish, which commonly form small dense schools or ‘balls’, are found throughout the Indo-Pacific, inhabiting fresh to marine waters up to 60 m deep. They attain a maximum length of about 30 cm and an age of 7 years; a Japanese study estimated their age at maturity to be 1-3 years, at a length of about 14 cm total length (TL).

The blue catfish belongs to the large tropical family of forktail catfishes (Ariidae). Forktail catfishes primarily inhabit freshwater, estuarine and inshore coastal waters, and are important food fishes in Asia. A characteristic of the family is that the eggs and larvae are incubated in the mouths of the male parent, but their low fecundity makes them susceptible to overfishing. Blue catfish inhabit rivers, estuaries and shallow coastal waters of northern Australia and southern New Guinea and attain a maximum length of 50 cm TL; small numbers are caught in the estuarine parts of NSW rivers, north from the Clarence River.

Historically, the catfish species have not been differentiated in commercial catch returns, however from 2009/10 eeltailed and forktailed catfish will be separately recorded.

Additional Notes

- Commercial landings of ‘catfish’ are stable at 20 - 30 t. Recreational landings are likely to be of a similar magnitude, but are not accurately estimated.
- Estuary catfish or estuary cobbler (Cnidoglanis macrocephalus) is more commonly marketed than forktailed catfish (Arius graeffei), which are a bycatch species in the Clarence River Estuary Prawn Trawl.
- A growth curve for C. macrocephalus is now available, indicating that the species can live up to 20 years.
- Commercial catch returns now segregate catfish into two groups: forktail catfish (‘Ariidae - undifferentiated’); and eeltail catfish (‘Plotosidae – undifferentiated’).

Catch

Recreational Catch of Catfish

The annual recreational harvest of catfish in NSW is likely to lie between 30 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW. It is probable that large numbers of catfish are discarded by recreational fishers as they are not generally seen as a desirable catch.

Historical Landings of Catfish

Commercial landings (including available historical records) of catfish for NSW from 1990/91 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Catfish

Reported landings of catfish by NSW commercial fisheries from 1997/98. * Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
Catch rates of catfish harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 192001, 37 192004, 37 192002 and 37 188005, common name or scientific name to find further information.
Cobia
(Rachycentron canadum)

EXPLOITATION STATUS  UNDEFINED
A minor fishery in NSW waters, but significant to recreational fishers. The stock is shared with Queensland where some biological research is underway. Very little useful information currently available from NSW catches.

SCIENTIFIC NAME  STANDARD NAME  COMMENT
Rachycentron canadum  cobia  Also known as black kingfish.

Background
Cobia (Rachycentron canadum) has an almost world-wide distribution in tropical and subtropical waters, except in the eastern Pacific Ocean. In Australian waters, cobia are common around the tropical north of the country and south to south-western Western Australia and central NSW. They are a large, wide-ranging species generally observed as solitary fish; however they occasionally form small schools that associate with floating objects, fixed structures and large oceanic animals including sharks, rays, turtles and whales. Cobia are often referred to as a pelagic species, although dietary studies reveal that a large portion of their diet is comprised of benthic and demersal prey including crabs, stingrays, flatfishes and stomatopods. In Australia, cobia populations make seasonal migrations over large distances; moving north with migrating whales in winter and returning south in summer.

Cobia grow extremely quickly and can reach more than 75 cm after 3 years, and attain a maximum length of 1.8 m fork length (FL) and weight of about 60 kg, at about 13 years of age. In Queensland, cobia have a protracted spawning season between September and June but with a peak around October to December. The length at 50% maturity for females is around 78 cm FL.

Cobia are only a minor commercial species; however their large size and excellent table qualities make them a prime recreational sport and table fish. Their rapid growth rate also makes cobia an attractive species for aquaculture. In NSW, cobia have no minimum legal length and no specific bag limit, but they are included in the 'general' bag limit of 20. In Queensland cobia have a minimum legal length of 75 cm total length and a bag limit of 2.
Additional Notes

- A northern species which occurs seasonally off NSW - the annual commercial catch is less than 10 t and fluctuates from year to year.
- Cobia are mainly taken by line fishing, but there is also a small by-catch from prawn trawling.
- Queensland commercial fishery is estimated to be 20 to 40 t - the recreational fishery is significant but is not well estimated.

Catch

Recreational Catch of Cobia

The annual recreational harvest of cobia in NSW is likely to be less than 20 tonnes. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Historical Landings of Cobia

Commercial landings (including available historical records) of cobia for NSW from 1990/91 to 2008/09 for all fishing methods.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 335001, common name or scientific name to find further information.
Cockles
(Arcoida and Veneroida)

EXPLOITATION STATUS  UNDEFINED

No assessment is available for any of the cockle species harvested and reported within this group. Basic biological information is available for some species, but useful fishery data are lacking.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anadara trapezia</td>
<td>Sydney cockle</td>
<td>Sometimes called blood cockles.</td>
</tr>
<tr>
<td>Katelysia rhytiphora</td>
<td>sand cockle</td>
<td>Marketed as vongoli.</td>
</tr>
<tr>
<td>Katelysia scalarina</td>
<td>sand cockle</td>
<td>Marketed as vongoli.</td>
</tr>
<tr>
<td>Glycymeris flammeus</td>
<td>shiny dog cockle</td>
<td>Also called flame dog cockle.</td>
</tr>
<tr>
<td>Callista (Notocallista) kingii</td>
<td>venus shell</td>
<td>Marketed as baby clams.</td>
</tr>
<tr>
<td>Eucrassatella kingicola</td>
<td>King island crassatella</td>
<td>Marketed as surf clams.</td>
</tr>
</tbody>
</table>

Background

Cockles commercially harvested from NSW estuaries are principally the sand cockles Katelysia scalarina and K. rhytiphora (family Veneridae), and the Sydney cockle or mud ark, Anadara trapezia (family Arcidae). The main target species in the commercial fishery is K. scalarina which is generally marketed as ‘vongoli’.

Sand cockles can reach shell sizes of 4 cm (K. scalarina) or 6 cm (K. rhytiphora), while the Sydney cockle can attain a maximum size of about 7 cm. These two types of cockles are easily distinguishable from each other by their shell sculpture and colouration. Sand cockles are oval in shape with raised concentric ridges around the shell, which is light grey or brown in colour. In contrast, the Sydney cockle is more oblique in shape and has strong ribs that radiate out across the shell from the hinge; its underlying colour is plain cream or white, although this is usually partially covered by a dark, horny periostracum. The shells of the Sydney cockle are thick which results in the recovery of only a small amount of meat compared to the weight of the cockle.

Sand cockles are distributed around southern Australia from the south coast of NSW to the southern shores of WA, and including Tasmania.
They inhabit fine to medium grained sand and mud habitats in protected estuarine tidal flats and are usually found less than 5 cm below the surface of the sand. The Sydney cockle also inhabits mud, sand and seagrass beds in sheltered estuaries. Its main distribution is eastern Australia from southern Queensland to Port Philip Bay in Victoria; there is also an isolated population of *Anadara* at Albany, WA.

In NSW, cockles are harvested throughout the year with most landings in August to December. The method of harvest is by hand-gathering on mud flats and sand banks during low tide.

In NSW ocean waters there is currently a single operator collecting cockles under permit. The species taken include *Glycymeris flammeus*, *Eucrassitella kingicola* and *Notocallista kingii*.

**Additional Notes**

- A number of species are harvested commercially within the Estuary General Fishery and the recreational harvest of some species may be significant.
- Proper identification of the species and consistency of common names needs to be implemented.
- There is a combined recreational bag limit of 50 cockles, mussels and pipis.

**Catch**

**Recreational Catch of Cockles**

The annual recreational harvest of cockles in NSW is unknown but there may be significant fishing pressure on accessible populations.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 23 226001, 23 380003, 23 380004, 23 380005, 23 3800039, and 23 330004, common name or scientific name to find further information.
Common Jack Mackerel

*(Trachurus declivis)*

**Exploitation Status:** Uncertain

Predominantly a Commonwealth fishery with very few operators - Commonwealth status has been adopted.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachurus declivis</td>
<td>common jack mackerel</td>
<td>Also known as cowanyoung.</td>
</tr>
</tbody>
</table>

**Background**

The common jack mackerel or cowanyoung (*Trachurus declivis*) is found in coastal waters of southern Australia from Wide Bay, Queensland to Shark Bay, WA, including Tasmania. It is a member of the trevally family (Carangidae) as opposed to most mackerels which belong with the tunas in the family Scombridae. It is very similar and closely related to the common yellowtail scad (*T. novaezelandiae*) and the larger Peruvian jack mackerel (*T. murphyi*) which is occasionally found among jack mackerel catches off southern Australia.

There are three jack mackerel subpopulations in Australian waters: one in the Great Australian Bight, another in NSW waters, and the third off Tasmania. They are pelagic, forming schools over the continental shelf and outer shelf margin. Individuals have been found in depths of 460 m but this species is more commonly found between 20 m and 300 m. The common jack mackerel shows a preference for water temperatures less than 17°C and entire schools will move to stay below this temperature. Large schools of jack mackerel regularly appear during winter-spring in surface waters off southern NSW.

The common jack mackerel feeds during the day primarily on planktonic crustaceans. Jack mackerel in deeper offshore waters include light fish (Sternopychidae) and lantern fish (Myctophidae) in their diet. The jack mackerel is, in turn, preyed upon by large fish such as tuna, barracouta and gemfish.

Individuals grow to at least 64 cm in length (1.6 kg in weight) and 25 years of age. The common jack mackerel matures between 3 and 4 years old at a length of about 27 cm and a weight of 250 g. Spawning in NSW occurs between October and January in waters above the thermocline. After spawning, the eggs and larvae travel on currents into inshore waters where most juveniles remain during early growth.

Despite its schooling behaviour, the common jack mackerel is seldom targeted in NSW by commercial fishers as it has poor market acceptance. The bulk of the catch is caught by purse-seine (Ocean Hauling fishery) with small quantities landed by trawlers; most is sold for aquaculture feed or bait.

This species was the subject of a large fishery off Tasmania in the 1980s, but recent catches have been very small. A lack of assessment data has led to the status of the jack mackerel stock being classified as ‘uncertain’.
**Additiona Notes**

- Not the basis for a significant fishery in NSW.
- There is only a small incidental purse-seine catch in winter off Wollongong.
- After very significant landings (up to 42,000 t in the late 1980s) this is now a very small fishery within the Commonwealth ‘Small Pelagics’ fishery Jack mackerel landings were around 400 t in 2008/09 (Wilson et al. 2009).

**Catch**

**Recreational Catch of Common Jack Mackerel**

The annual recreational harvest of common jack mackerel in NSW is likely to be less than 10 t.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 337002, common name or scientific name to find further information.

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**Historical Landings of Common Jack Mackerel**

[Graph showing historical landings of common jack mackerel for NSW from 1984/85 to 2008/09 for all fishing methods.]
Common Silverbiddy
*(Gerres subfasciatus)*

**Exploitation Status**

Moderately fished

There has been a reduction in commercial fishing pressure on this small estuarine species since the introduction of recreational fishing areas in 2002. Catch rates by haul netting are stable.

**Background**

The common silverbiddy (*Gerres subfasciatus*) is widely distributed, occurring on both the east and west coasts of Australia. In NSW waters, silverbiddies are found in estuaries and inshore waters. Within estuaries, they are generally found over sand and mud bottoms. Their diet consists of small invertebrates, particularly polychaetes.

Spawning appears to occur in coastal waters and marine-dominated estuaries, primarily during summer and early autumn. Small juveniles live in sheltered shallow water habitats (particularly where cover such as seagrass or algae are available). Larger juveniles appear to be less dependent on such cover, and are found over bare sandy substrates. Common silverbiddies are thought to mature at around 20 cm in length. Maximum length is only about 23 cm total length. Little is known about growth rates or migration patterns.

Common silverbiddies are one of the smallest finfish commercially harvested in NSW. Silverbiddies are similar in appearance to small bream, and this often causes mistaken concern amongst people viewing commercial fishing operations or browsing at fish in retail outlets. Prior to the 1980s silverbiddies were landed in small quantities and sold as an incidental catch in hauling operations as their market value was low. Common silverbiddies are sometimes caught by recreational fishers but are usually returned to the water due to their small size.
Additional Notes

- Commercial landings have declined by about 30% since the 1990s due to reduction in fishing effort following establishment of recreational fishing havens.
- This species is not commonly retained by recreational fishers.
- Biological and fishery data are available and will be more fully analysed when resources allow.

Catch

Recreational Catch of Common Silverbiddy

The annual recreational harvest of the common silverbiddy in NSW is likely to be less than one tonne.

**Historical Landings of Common Silverbiddy**

Commercial landings (including available historical records) of common silverbiddy for NSW from 1969/70 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Common Silverbiddy

Reported landings of common silverbiddy by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 349005, common name or scientific name to find further information.
Crimsonbanded Wrasse  
(*Notolabrus gymnogenis*)

**Exploitation Status**  
**Undefined**

A significant recreational species with minor commercial landings. Some biological data are available, but fishery data are limited and have not been analysed in detail.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Notolabrus gymnogenis</em></td>
<td>crimsonbanded wrasse</td>
<td>Major component of catches.</td>
</tr>
<tr>
<td><em>Notolabrus tetricus</em></td>
<td>bluethroat wrasse</td>
<td>Minor catches in southern NSW waters.</td>
</tr>
</tbody>
</table>

### Background

Crimsonbanded wrasse (*Notolabrus gymnogenis*) are endemic to rocky reefs of south-eastern Australia. They are found from southern Queensland to Mallacoota (Victoria) in depths of 2 m to at least 40 m. Juveniles are cryptic—favouring reefs with high algal coverage. Individual males and loose aggregations of females are distributed over available hard substrates.

Like other members of the family Labridae, crimsonbanded wrasse are protogynous hermaphrodites (juveniles first develop female reproductive organs that may change into male reproductive organs in certain circumstances). They are sexually dichromatic with males exhibiting a crimson transverse band through the midsection; crimson dorsal and anal fins; white caudal peduncle; yellow caudal fin; and a head exhibiting a dark upper and light lower half.

Juveniles mature as females at approximately 18 cm total length (TL) and 2 years of age. Females change to the terminal phase male at approximately 28 cm and 4.5 years old. The peak reproductive season is from April to October.

Crimsonbanded wrasse grow quickly initially, attaining approximately 28 cm TL after 5 years, with growth slowing thereafter. They can reach 45 cm in length and have been aged up to 10 years.

Crimsonbanded wrasse are important to the recreational fishery in NSW and ranked within the top 25 species by number retained during both years of a survey of offshore trailerboat fishers (Steffe *et al.*, 1996). They are not considered a commercially important species with on average less than 100 kgs being reported each year since 2000.

A similar species, the bluethroat wrasse *Notolabrus tetricus*, occurs in southern Australian coastal waters, and is taken by both recreational and commercial fishers on the far south coast of NSW.
Additional Notes

- Crimsonbanded wrasses are caught by recreational line and commercial trap fishers in rocky reef habitats of NSW coastal waters.
- Known to be a sex-changing hermaphroditic species.
- Not targeted commercially - incidental catches only.

Catch

Recreational Catch of Crimsonbanded Wrasse

The annual recreational harvest of crimsonbanded wrasse in NSW is likely to be less than 20 tonnes. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Length Frequency of Crimsonbanded Wrasse

The length distribution of crimsonbanded wrasse landed by recreational trailer-boat fishers between 1993 and 1996 was comprised mainly of fish between 25 and 35 cm total length (TL). There is no minimum legal length for crimsonbanded wrasse in NSW.

Growth Curve of Crimsonbanded Wrasse

Growth curve of crimsonbanded wrasse using parameters from Morton et al. (2008). Lengths are presented as total length (TL).

Historical Landings of Crimsonbanded Wrasse

Commercial landings (including available historical records) of crimsonbanded wrasse for NSW from 1998/99 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 335001, common name or scientific name to find further information.
Cunjevoi
(Pyura stolonifera)

**EXPLOITATION STATUS**  LIGHTLY FISHED

A sessile organism found in large abundance on rocky foreshores in high-energy intertidal surf zones. Harvested solely by recreational fishers for use as bait. A large proportion of the population occurs in habitats inaccessible to recreational fishers.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyura stolonifera</td>
<td>cunjevoi</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Cunjevoi (**Pyura stolonifera**) occurs abundantly on rocky substrates in the intertidal zone on exposed coastlines around southern Australia from Queensland to Western Australia. Cunjevoi also occurs in South Africa and in one bay on the west coast of Chile, South America - although a study using mitochondrial DNA suggested that the South American occurrence represents a recent introduction from Australia. Castilla *et al.* 2002 argued that the correct species name for Australian cunjevoi (the species introduced to South America) is *Pyura praeputialis*, whereas the African form is *P. stolonifera*. However, CSIRO Codes for Australian Aquatic Biota (CAAB) still lists the latter scientific name for Australia, with CAAB No. 35 032041.

Adult cunjevoi is a sessile (permanently attached to the rock surface) filter-feeding animal enclosed in a tough leathery outer case or ‘tunic’. Many animals can occur together in a large clump, which provides a substrate for a diverse range of intertidal invertebrate and plant species. Cunjevoi has a free-swimming larval stage which possesses a notochord (precursor of the vertebrate's backbone) and is the reason that cunjevoi is classified in the phylum Chordata.

Little has been published on growth or mortality rates of cunjevoi. Dalby (1995) reported reasonably fast growth from 30mm to about 70mm upper test diameter over a two year period, but did not calculate growth parameters. The results of this study also suggested that the growth of individual cunjevoi was greater when they were not closely associated with other individuals.

Cunjevoi are not harvested commercially - all harvesting is by recreational fishers, with the majority being used for bait. In NSW recreational fishers are subject to a bag limit of 20 cunjevoi. The National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) did not report catches of cunjevoi separately, and there is no estimate available of the quantity taken annually by recreational fishers, but it is likely to be low in comparison to the total biomass.

Despite some earlier research findings that the effects of harvesting might potentially deplete cunjevoi populations, in NSW the species remains abundant and is not considered to be under any threat from current harvest.
levels. The exploitation rate of cunjevoi is likely to be quite low, as a significant proportion of the population occurs on inaccessible rocky substrates in high-energy surf zones. Localised depletion is possible in areas open to recreational harvesting, but areas where heavy harvesting occurs appear to be few in number and limited to easily accessible rock platforms.

For the cunjevoi population as a whole, it is likely that environmental effects (e.g. strong storm surges removing large clumps of cunjevoi; coverage of cunjevoi beds by mobile sands near beaches) play a more significant role in cunjevoi mortality than harvesting by humans.

Additional Notes

- No commercial fishery, and no accurate estimate of the quantity harvested by recreational fishers - however it is likely to be low in comparison to the effects of storms and mobile sand on cunjevoi beds.
- For the population as a whole, fishing mortality is probably low in relation to natural mortality - however localised depletions may occur in some heavily utilised areas.

Catch

Recreational Catch of Cunjevoi

The annual recreational harvest of cunjevoi in NSW is not accurately known but is likely to be significant. There is no commercial harvest.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 35 032041, common name or scientific name to find further information.
## Cuttlefish

*(Sepia spp.)*

**Exploitation Status**: Uncertain

Species composition issues will restrict our ability to assess these stocks. All species in this group are likely to exhibit rapid growth and have a short life span.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepia rozella</td>
<td>Rosecone cuttlefish</td>
<td>Major species caught in ocean trawls.</td>
</tr>
<tr>
<td>Sepia hedleyi</td>
<td>King cuttlefish</td>
<td>Smaller quantities caught in offshore trawling off central and southern NSW.</td>
</tr>
<tr>
<td>Sepia apama</td>
<td>Giant cuttlefish</td>
<td>Only small quantities are caught.</td>
</tr>
<tr>
<td>Sepia spp.</td>
<td>Cuttlefish (group code)</td>
<td>At least three other Sepia species are caught off NSW.</td>
</tr>
</tbody>
</table>

### Background

Cuttlefish (family Sepiidae) are cephalopods characterized by an internal calcareous cuttlebone located dorsally beneath the skin of the mantle. World-wide there are about 100 species with more than 30 known from Australian waters and at least 12 from NSW. Cuttlefish live in a range of habitats including rocky and coral reefs, on sandy or muddy substrates, and among seagrass and seaweed. In NSW, they are found in estuaries, across the continental shelf and upper slope to depths of about 600 m. The giant cuttlefish (*Sepia apama*) can reach 50 cm in mantle length and weigh 12 kg but the maximum size of most Australian species is less than 20 cm mantle length and 300 g in weight.

While there have been biological and stock structure studies on the giant cuttlefish in SA, little has been published about other Australian species. In general, cuttlefish are short lived (1-2 years) but have relatively high productivity. They grow quickly and, like most cephalopods, have one breeding event in their life. Males use specialized (hectocotylus) arms to transfer sperm packets to the females. When the females are ready to spawn, the eggs are fertilized externally and attached on or under hard substrates on the seafloor. The young are well-developed when they hatch and immediately adopt an adult-like lifestyle.

At least 12 species of cuttlefish are known to occur in trawl catches off NSW, but as with octopus, most of the landed catch consists of a few species. Trawl-survey catches by Fisheries Research Vessel *Kapala* found the most commonly encountered species of commercial size in prawn trawls off northern NSW was *S. rozella* with smaller numbers of *S. plangon* and *S. opipara*, while in fish trawls off central and southern NSW, *S. rozella* was again the most abundant inshore and *S. hedleyi* was commonly caught offshore. An assessment of cuttlefish consignments through the Sydney Fish Market }
was consistent with these observations by finding that almost 70% of sales were *S. rozella*, 17% were *S. hedleyi* and 10% were *S. apama* (giant cuttle).

Reported landings of cuttlefish in NSW were 150 – 250 t in the mid 1980s and peaked at 450 t in 1994/95. In the late 1990’s changes to catch reporting arrangements meant that cuttlefish caught in Commonwealth waters were no longer reported on NSW catch returns, and this led to a decline in reported landings. However there has recently been a further decline in landings, the reasons for which are unknown. Cuttlefish are an important by-product of trawling, particularly the Ocean Prawn Trawl fishery which takes around 80% of the catch. However, because of the mixed-species nature of the catches there have been no stock assessments for any cuttlefish species in NSW.

**Additional Notes**

- Cuttlefish are short-lived species with high natural mortality rates taken incidentally by trawl fishing.
- Giant cuttlefish is also significant in recreational catches.
- There is a combined recreational bag limit of 20 squid and cuttlefish.

**Catch**

*Recreational Catch of Cuttlefish*

The annual recreational harvest of cuttlefish in NSW is likely to be less than 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Cuttlefish**

Landings (including available historical records) of cuttlefish for NSW from 1979/80 to 2008/09 for all fishing methods. Note that some of the decline in reported catch during the 1990s may have been due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

**Landings by Commercial Fishery of Cuttlefish**

Reported landings of cuttlefish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 23 607010, 23 607001, 23 607021 and 23 607901, common name or scientific name to find further information.
Dart

*(Trachinotus spp.)*

**EXPLOITATION STATUS**

**UNDEFINED**

No detailed stock assessment available. Mainly a recreational species, but there is little information about NSW catches.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Trachinotus coppingeri</em></td>
<td>swallowtail dart</td>
<td>This species constitutes the majority of the commercial catch.</td>
</tr>
<tr>
<td><em>Trachinotus baillonii</em></td>
<td>smallspotted dart</td>
<td>Likely to form only a minor fraction of the catch.</td>
</tr>
</tbody>
</table>

**Background**

Dart belong to the genus *Trachinotus* of which there are about 20 species occurring worldwide in tropical and subtropical waters. Although they are members of the trevally family (Carangidae), dart lack the scutes (raised scales) along the lateral line that are typical of trevallies. Other distinguishing features are their long, thin and slightly curved anal, dorsal and tail fins. While juveniles are unsptotted, adults have dark spots along or above the lateral line.

Dart are wide ranging pelagic fish found in sheltered bays, estuaries, and shallow coastal waters, particularly in the surf zone of ocean beaches; they are also known to school offshore around reefs and cays. Dart do not appear to undertake directed migrations, but adults can move considerable distances throughout the year. Some species have strong bones inside their mouths capable of cracking open oysters and other shellfish.

Species found in NSW, more commonly on the north coast, include the swallowtail dart (*T. coppingeri*), smallspotted dart (*T. baillonii*), and very occasionally snubnose dart (*T. blochii*). Commercial catches comprise almost totally swallowtail dart but may include an occasional smallspotted dart.

The swallowtail dart is endemic to eastern Australia, ranging from northern Queensland to the south coast of NSW, and including Lord Howe Island. It is a fast swimming, schooling fish, often found in the surf darting into waves and then back out again just before the wave breaks. It has 5 to 7 large dark spots just above the lateral line and can weigh up to 3 kg. The smallspotted dart is more widely distributed, being found north from the Solitary islands in NSW, across northern Australia to the Abrolhos Islands in WA. It is mainly found on the surface, and can form schools of several hundred fish. Adults have 1 to 4 dark spots directly on the...
lateral line and grow to 56 cm and 1.5 kg. In general, dart feed on small fish, worms, insects, zooplankton, and shellfish. The smallspotted dart is known to feed at night on small shellfish picked off beach rocks.

In NSW, dart are occasionally targeted by a small number of beach hauling crews in the Ocean Hauling Fishery; total annual commercial landings can be up to about 15 t, but are usually around 5 t. Dart are significant sport and food species for recreational anglers who fish from ocean beaches and rocky headlands.

**Additional Notes**

- Important recreational beach fishery on the northern and central NSW coast.
- The most commonly caught species in NSW waters is apparently swallowtail dart *Trachinotus coppingeri*.
- Research in Queensland (McPhee, 1999) on common dart *Trachinotus botla* found that it is a short-lived species growing to a maximum of 6 years. It is possible that *T. botla* is synonymous with *T. coppingeri*.

**Catch**

**Recreational Catch of Dart**

The annual recreational harvest of dart in NSW is likely to lie between 15 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Dart**

Commercial landings (including available historical records) of dart for NSW from 1989/90 to 2008/09 for all fishing methods.

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**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab](http://www.marine.csiro.au/caab) and search for the species code (CAAB) 37 337076 and 37 337074, common name or scientific name to find further information.
Diamondfish

*(Monodactylus argenteus)*

**Exploitation Status:** Undefined

Mainly an estuary fish found around wharfs and rocky headlands. No detailed assessment likely to be completed.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Monodactylus argenteus</em></td>
<td>diamondfish</td>
<td>Also known as silver batfish.</td>
</tr>
</tbody>
</table>

**Background**

The diamondfish or silver batfish is a small subtropical species, widely distributed around the west Pacific and Indian Oceans. In NSW, adults are found as far south as Jervis Bay in depths to about 10 m. They mainly inhabit large coastal estuaries and often form large schools around breakwalls and jetties. Juveniles can be found in brackish to almost fresh water. Diamondfish attain a maximum size of about 25 cm but are usually smaller than 20 cm. They feed on animals and plants which live on the jetty piles and surrounding substrates.

Reported commercial landings in NSW are sporadic and very small, generally about 1 t or less. All are caught by the Estuary General and Ocean Hauling Fisheries.
Additional Notes

- Mainly an inshore fish found around wharfs and rocky headlands.
- More commonly referred to as ‘silver batfish’.
- Sporadic commercial landings mainly reported in the Ocean Hauling Fishery, and of unknown recreational significance.
- Diamondfish are a conditional target species in the Ocean Hauling Fishery.

Catch

Recreational Catch of Diamondfish

The annual recreational harvest of diamondfish in NSW is likely to be less than one tonne.

Historical Landings of Diamondfish

![Graph showing historical landings of diamondfish](image)

Commercial landings (including available historical records) of diamondfish for NSW from 1997/98 to 2008/09 for all fishing methods.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 356002, common name or scientific name to find further information.
Dogfish
(Squaliformes)

**EXPLOITATION STATUS** UNDEFINED

Species identification issues are significant. One species, *Squalus megalops*, is still relatively abundant off NSW, but there are very serious conservation issues for many other dogfish species. Exploitation status to remain 'undefined' until better risk assessments are available.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Squalus megalops</em></td>
<td>piked spurdog</td>
<td>Distribution southern Australia (QLD-WA); endemic</td>
</tr>
<tr>
<td><em>Squalus albifrons</em></td>
<td>eastern highfin spurdog</td>
<td>Queensland-NSW; endemic</td>
</tr>
<tr>
<td><em>Squalus grahmani</em></td>
<td>eastern longnose spurdog</td>
<td>Queensland-NSW; endemic</td>
</tr>
<tr>
<td><em>Squalus montalbani</em></td>
<td>Philippine spurdog</td>
<td>Indo-Pacific - NSW, WA</td>
</tr>
<tr>
<td><em>Squalus chloroculus</em></td>
<td>greeneye spurdog</td>
<td>Southern Australia; endemic</td>
</tr>
<tr>
<td><em>Centrophorus harrisoni</em></td>
<td>Harrisson's dogfish</td>
<td>SW Pacific; Queensland-NSW</td>
</tr>
<tr>
<td><em>Centrophorus moluccensis</em></td>
<td>Endeavour dogfish</td>
<td>Indo-Pacific; NSW, WA</td>
</tr>
<tr>
<td><em>Centrophorus niaukang</em></td>
<td>Taiwan gulper shark</td>
<td>Japan, Taiwan– northern Australia; recently caught off Coffs Harbour</td>
</tr>
<tr>
<td><em>Centrophorus squamosus</em></td>
<td>leafscale gulper shark</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
<tr>
<td><em>Centrophorus zeehaani</em></td>
<td>southern dogfish</td>
<td>Southern Australia; endemic</td>
</tr>
<tr>
<td><em>Centroscymnus coelolepis</em></td>
<td>Portuguese dogfish</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
<tr>
<td><em>Centroscymnus owstonii</em></td>
<td>Owston's dogfish</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
<tr>
<td><em>Centroselachus crepidater</em></td>
<td>golden dogfish</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
<tr>
<td><em>Deania calcea</em></td>
<td>brier shark</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
<tr>
<td><em>Deania quadrispinosa</em></td>
<td>longsnout dogfish</td>
<td>Southern Australia; cosmopolitan</td>
</tr>
</tbody>
</table>

**Background**

The taxonomy of Australian dogfishes was reviewed in 2007 by CSIRO scientists. Where previously it was thought that there was a small number of species with world-wide distributions, the study confirmed that some were a complex of species, each with relatively small regional distributions. Many Australian dogfishes are now believed to be endemic (found only in Australian waters), although a number have a cosmopolitan distribution (found in many of the world's oceans).

NSW dogfish landings are mainly from the outer shelf and upper slope depths (100-700m) and include several species from a number of families. They are usually marketed in three groupings: greeneye or spiky dogfish/spurdog (*Squalus* spp.; *Squalidae*), Endeavour sharks (most *Centrophorus* spp.; *Centrophoridae*) and rough-skin or platypus sharks (*Deania* spp.; *Centrophoridae*). Three species of ‘black rough-skin sharks’ (two *Centroscymnus* species and *Centroselachus crepidater*; family Somniosidae) and the leafscale gulper shark (*Centrophorus squamosus*) also occur on the NSW midslope (depths > 700 m) but to date there has been only limited commercial fishing at these depths.

The most common species of dogfish in NSW is the small piked spurdog (spiky dog) found in relatively shallow outer-shelf and upper slope depths (100 to 580 m) around the southern half
of Australia. Males mature at about 38 cm total length (TL) and grow to a maximum of about 45 cm (0.6 kg); females mature at 48 cm and reach a maximum of about 60 cm (1.5 kg). Typical of deepwater sharks, piked spurdog fecundity is very low with females bearing up to 5 young every two years. Several larger species of *Squalus* are also found off NSW, mostly inhabiting upper slope depths (200-700m). These dogfishes have maximum lengths between 70 and 100 cm and fecundities between 5 and 10 young; they are also unlikely to breed more frequently than every two years.

The deepwater shark family Centrophoridae includes large dogfishes internationally referred to as gulper sharks. Five species of *Centrophorus* and two species of *Deania* have been recorded from NSW waters. Harrisson’s dogfish is mainly found off eastern Australia (central Queensland to Bass Strait), the southern dogfish occurs between central NSW and WA, while the Endeavour dogfish has a more northern distribution along the east and west coasts of mainland Australia. Landings of the leafscale gulper have recently increased off NSW in depths > 700m, and at least two specimens of the large Taiwan gulper shark were recently caught off Coffs Harbour. The maximum length of Endeavour, Harrisson’s and southern dogfishes is about 100-115 cm TL whereas leafscale and Taiwan gulpers grow to about 170 cm. Gestation in gulper sharks takes at least two years with the smaller species producing only one or two young while the leafscale and Taiwan gulpers bear 4-8 pups. Studies of leafscale gulper sharks from the Atlantic suggest the age at maturity is between 30 and 35 years, and that the species attains a maximum age in excess of 60 years.

The two species of *Deania* caught off NSW – the longsnout dogfish and the more common brier shark – are both taken on the slope, mainly in depths between 500 and 1000 m. Males grow to about 100 cm and females to 120 cm TL with maturity at about 80% of their maximum length. Litter sizes are relatively large with up to 17 pups recorded from Australian specimens.

The slow growth rates and low fecundities of deepwater sharks make them particularly susceptible to over-exploitation. Apart from the spiky dogfish and possibly the brier shark, offshore trawling has greatly depleted the stocks of upper slope dogfishes off NSW. A trawl survey in the 1990s found that the relative abundances of the larger spurdogs (*Squalus* spp.) had been reduced to less than 10% of the catch rates achieved 20 years earlier, while the numbers of Endeavour sharks (*Centrophorus* spp.) were less than 1% of their earlier catch rates. Subsequently, several species have been red-listed by the International Union for the Conservation of Nature and Natural Resources (IUCN) as ‘vulnerable’, with Harrisson’s dogfish listed as critically endangered. In Australia concerns about the severely depleted status of many species have led to increased research and management measures aimed at conserving the remaining stocks of these species.

### Additional Notes

- Recent landings of this group are small. Low numbers are harvested by the Ocean Trap and Line Fishery, as well as the Ocean Trawl Fishery. Difficulties with species identification in past catch reporting makes species-based assessment difficult.
- There are three categories of conservation status for this group: *Squalus megalops* is abundant; most *Centrophorus* spp. and other deepwater *Squalus* spp. are almost totally extirpated from NSW trawl grounds (with 100% mortality when caught in trawls); and the status of other dogfish species is unknown (Graham et al., 1997).

### Catch

**Recreational Catch of Dogfish**

The annual recreational harvest of dogfish in NSW is likely to be less than 10 t.

**Historical Landings of Dogfish**

Commercial landings (including available historical records) of dogfish for NSW from 1990/91 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was in part due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.
Landings by Commercial Fishery of Dogfish

Reported landings of dogfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 020006, 37 020038, 37 020041, 37 020047, 37 020048, 37 020010, 37 020001, 37 020053, 37 020009, 37 020011, 37 020025, 37 020019, 37 020012, 37 020003 and 37 020004, common name or scientific name to find further information. Please note that common names have been adopted from Last and Stevens (2010) and may differ to those contained on the CAAB website.
Dusky Flathead
(*Platycephalus fuscus*)

**Exploitation Status**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
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<tr>
<td><em>Platycephalus fuscus</em></td>
<td>dusky flathead</td>
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</tbody>
</table>

Commercial landings and catch rates are steady, but the species is primarily harvested by recreational fishers. Better catch information is required for the recreational fishery.

**Background**

The dusky flathead (*Platycephalus fuscus*) is endemic to Australia occurring from Cairns in Queensland to SA. In NSW waters, dusky flathead are found primarily within estuaries, but also occur in inshore ocean waters. They are a bottom dwelling fish and are normally found on soft substrates, including mud, sand and seagrass. Dusky flathead eat small fish and a variety of invertebrates including prawns, crabs and squid. They are essentially ambush predators that lie and wait (often partly buried) for passing prey.

Spawning appears to occur both in the lower reaches of estuaries and in the sea, typically during summer. The larvae enter estuaries and the small juveniles subsequently live in the same habitats as the adults. Dusky flathead grow quickly, reaching 40 cm total length (TL) after 3 years in NSW. They mature at around 20 cm TL (males) and 55 cm (females). They are reported to reach 120 cm in length, and about 10 kg in weight, but the majority of fish caught are 40 to 50 cm in length and 0.5 to 1 kg. The oldest fish in a recent NSW study was aged 16 years, but the majority of fish in catches are aged 2 to 5 years.

The recreational catch of dusky flathead greatly exceeds the commercial catch. The commercial catch of dusky flathead is mostly taken by the Estuary General Fishery. The highest levels of commercial catches occur during the winter months when overnight setting of mesh nets is permitted.
**Additional Notes**

- Results of studies of growth and reproductive biology have recently been published (Gray and Barnes, 2008).
- The commercial catch declined after 2000 because of licence buy-outs during the creation of Recreational Fishing Havens and Marine Parks but landings have increased again since 2004/05.
- Assessments for this species need to acknowledge the variability between estuaries.
- There is a minimum legal length of 36 cm total length (TL) and a recreational bag limit of 10 dusky flathead (with only one fish greater than 70 cm TL).

**Catch**

*Recreational Catch of Dusky Flathead*

The annual recreational harvest of Dusky Flathead in NSW is likely to lie between 570 and 830 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Historical Landings of Dusky Flathead*

Commercial landings (including available historical records) of dusky flathead for NSW from 1952/53 to 2008/09 for all fishing methods. Note the decrease after 1999/00 with the introduction of Recreational Fishing Havens.
Age-length data with fitted growth curve for male dusky flathead (Gray and Barnes, 2008). Lengths are presented as total length (TL).

Age-length data with fitted growth curve for female dusky flathead (Gray and Barnes, 2008). Lengths are presented as total length (TL).

The length distribution of dusky flathead in NSW commercial landings was relatively stable from the 1970s to the 1990s. There was an increase in the relative proportion of larger fish (>40 cm total length (TL)) in catches during the period 1995 to 1997. The minimum legal length for dusky flathead was increased from 33 cm to 36 cm TL in July 2001.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 296004, common name or scientific name to find further information.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Eastern Australian Salmon

*(Arripis trutta)*

**Exploitation Status**

**Fully Fished**

Commercial landings are at historically high levels and the recreational catch is significant.

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<tr>
<th>Scientific Name</th>
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<tbody>
<tr>
<td><em>Arripis trutta</em></td>
<td>eastern Australian salmon</td>
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</tbody>
</table>

**Background**

Eastern Australian salmon (*Arripis trutta*) occur in continental shelf waters and in estuaries of NSW, Victoria and Tasmania. Juveniles occur in sheltered coastal waters and estuaries, mainly in the southern part of the species range. The diet of eastern Australian salmon includes plankton and small pelagic fish. Eastern Australian salmon mature at approximately 4 years old and 39 cm fork length, and aggregate to spawn in coastal waters from November to February. Spawning is thought to occur in the surf zone.

Eastern Australian salmon are primarily caught using haul and purse-seine nets in the Ocean Hauling Fishery. Catches occur throughout the year and the highest annual landings have tended to occur south of Sydney. Significant quantities of salmon are also taken by recreational fishers.

Tagging in the early 1960s found movement of fish from Tasmania to eastern Victoria and NSW, probably a one-way movement along the island chain that includes Flinders Island. In Victoria and Tasmania, there is an overlap in distribution between stocks of eastern and western Australian salmon – these are similar species in the same family. Australian salmon caught on the southern and western Australian coasts are the western species (*Arripis truttaceus*), which is rarely caught in NSW.
Additional Notes

- Commercial landings are highly variable and not expected to be a good indicator of abundance.
- Current landings are in the high range of historic catches.
- A current project is providing fishery and biological information (Australian salmon (Arrpis trutta)): Population structure, reproduction, diet and composition of commercial and recreational catches in NSW. This project is nearing completion.
- There is a recreational bag limit of 5 eastern Australian salmon.

Catch

Recreational catch of Eastern Australian Salmon

The annual recreational harvest of eastern Australian salmon in NSW is likely to lie between 150 and 210 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Eastern Australian Salmon

Commercial landings (including available historical records) of eastern Australian salmon for NSW from 1944/45 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Eastern Australian Salmon

Reported landings of eastern Australian salmon by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Eastern Australian Salmon Harvested by Beach Hauling in NSW

Catch rates of eastern Australian salmon using beach hauling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Growth Curve of Eastern Australian Salmon

Age-length data with fitted growth curve for eastern Australian salmon (internal data). Lengths are presented as fork length (FL).
Further Reading


The length distribution of eastern Australian salmon landed by NSW commercial fishers has been relatively stable since the 1980s, and comprises mainly fish between 40 and 60 cm fork length (FL). There is no minimum legal length for eastern Australian salmon in NSW.


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 344002, common name or scientific name to find further information.
Eastern Blue Groper

*(Achoerodus viridis)*

### Exploitation Status

**Undefined**

Stock was considered to be depleted in the 1960s and closures were introduced. Now a recreational line only species, and there is insufficient recent data to allow the current status to be specified.

### Scientific Name

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<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Achoerodus viridis</em></td>
<td>Eastern blue groper</td>
<td></td>
</tr>
</tbody>
</table>

### Background

The eastern blue groper (*Achoerodus viridis*) occurs around rocky headlands and coastal reefs from southern Queensland to eastern Victoria. A similar species, the western blue groper (*A. gouldii*) occurs in coastal waters of southern Western Australia and through the Great Australian Bight. These two species are the largest members of the family Labridae (wrasses) in southern Australian waters, and are frequently seen by divers close in to the shore.

The eastern blue groper can grow to over a metre in length and a weight of 25 kg. Although growth of blue groper has not been studied in detail, it is likely they are long-lived and relatively slow growing. The species is noted for its social structure, with the one large blue male often being attended by a number of smaller females, which are red-brown in colour. Blue groper are hermaphrodites - females generally change into males at around 50 cm in length, although the timing of this change can be influenced by environmental and social factors.

In NSW, the stock of eastern blue groper was considered to be significantly depleted by fishing, and a five year fishing closure was imposed between 1969 and 1973. In 1974 commercial fishing and recreational angling were permitted again, but the ban on spearfishing was continued. In 1980 the commercial sale of eastern blue groper was prohibited and since then the species has been restricted solely to capture by recreational line fishing.
Additional Notes

- This long lived species is endemic to eastern Australia and occurs close inshore in rocky reef areas.
- Although the blue form is often male and the red form female, research has shown this is not always the case.
- Recreational trailer boat study estimated landings at 5 thousand fish / 16 t in the mid 1990s.
- Blue groper have a minimum legal length of 30 cm, and a bag limit of 2 fish with a maximum of 1 fish over 60 cm.

Catch

Recreational Catch of Eastern Blue Groper

The annual recreational harvest of eastern blue groper in NSW is likely to be between 20 to 50 t. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW. Blue groper are not permitted to be taken by commercial fishers.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/CAAB/ and search for the species code (CAAB) 37 384043 , common name or scientific name to find further information.

The length distribution of eastern blue groper landed by recreational trailer-boat fishers between 1993 and 1996 was comprised mainly of fish between 40 and 80 cm total length (TL).
Eastern King Prawn
(*Melicertus plebejus*)

**Exploitation Status**

**Growth overfished**

Status continues to be growth overfished as determined by yield-per-recruit modelling, but this will be reviewed using recent data.

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<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Melicertus plebejus</em></td>
<td>Eastern king prawn</td>
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</tbody>
</table>

**Background**

Eastern king prawns are endemic to the waters off eastern Australia having been recorded from Mackay (Queensland) southwards to north-east Tasmania in depths from 1 m to 200 m, and off Lord Howe Island.

Eastern king prawns live for a maximum of three years and in NSW waters reach maximum lengths of around 6 cm carapace length (CL) and 4.5 cm CL for females and males respectively. The shortest length at which 50% of female eastern king prawns carry eggs is 4.2 cm CL. Eastern king prawns spawn predominantly in waters from northern NSW to Swains Reef in Queensland. One female may carry up to 200,000 eggs. Larger female prawns carry more eggs than smaller ones.

There is no information on the length of the larval phase of the life cycle of eastern king prawns in the wild, but generally for prawn species it is around three weeks. Nauplius larvae hatch and develop through a series of moults into post-larvae. This is the transitional phase between the planktonic larva and benthic living juveniles.

Post-larval to adolescent eastern king prawns inhabit bare and vegetated substrates in areas of marine influence within estuaries and probably within shallow embayments in ocean waters. They emigrate from estuaries over spring and summer and then move northwards over long distances prior to spawning.

Eastern king prawns are opportunistic omnivores. Food items include small crustaceans, annelid worms, bivalve molluscs and foraminifers. Eastern king prawns are eaten by most carnivorous marine species and higher order predators such as birds.

Eastern king prawns constitute a single population along the east coast of Australia and are managed as a unit stock by I & I NSW. There is a large domestic market for eastern king prawns for human consumption.

This species is harvested using prawn trawl nets in ocean waters by the Ocean Trawl Fishery (otter trawling) and in estuarine waters by the Estuary Prawn Trawl Fishery (otter trawling) and by numerous methods in the Estuary General Fishery (set pocket nets, running nets, hauling and seine nets).
Eastern king prawns are also caught by recreational fishers within estuaries and are the most abundant prawn species in the catches of recreational fishers. This is probably because recreational fishers fish for prawns at night when eastern king prawns are most active. Methods used by recreational fishers include fishing with scoop nets, scissor nets or six metre hand haul nets.

**Additional Notes**

- Both landings and unstandardised catch rates increased for the Ocean Prawn trawl in 2007/08. Catch rates remained high in 2008/09 but landings returned to pre-2007/08 levels.

- Strong evidence exists that fishing power in Queensland is increasing and there has been increased targeting by the Queensland fleet on the mature population well offshore.

- Yield-per-recruit modelling suggests that estuarine fisheries and oceanic fisheries south of Port Stephens take prawns below the optimum size at first capture (Montgomery, 2000) - recent changes in the geographical distribution of catch need to be incorporated in these analyses.

- Population modelling (Ives and Scandol, 2007) indicated that the NSW stock was very resilient under the assumption of stable levels of recruitment from Queensland.

- A joint NSW-Queensland stock assessment has been undertaken by the Queensland Department of Employment, Economic Development and Innovation (formerly Queensland Department of Primary Industries and Fisheries).

- There is a combined recreational bag limit of 10 litres for all prawns.

**Catch**

*Recreational Catch of Eastern King Prawn*

The annual recreational harvest of eastern king prawn in NSW is likely to be less than 110 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Catch rates of eastern king prawn harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 711052, common name or scientific name to find further information.
Eastern Pigfish

*(Bodianus unimaculatus)*

**EXPLOITATION STATUS**

**FULLY FISHED**

The age composition of commercial landings suggests that fishing mortality is approximately the same as natural mortality.

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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>Bodianus unimaculatus</td>
<td>eastern pigfish</td>
<td>The most commonly harvested species of pigfish in NSW.</td>
</tr>
</tbody>
</table>

**Background**

Eastern pigfish (*Bodianus unimaculatus*) are distributed in the south-west Pacific from southern Queensland to Victoria, including Lord Howe and Norfolk islands, and the Kermadec Islands. This eastern species was previously thought to be the same as the WA species, *B. vulpinus*. Two other species are caught in small quantities in the NSW fishery. The goldspot pigfish (*B. perditio*) is a sub-tropical species that occurs from central Queensland to the north coast of NSW. The yellowfin pigfish (*B. flavipinnis*) is a temperate species from south eastern Australia and New Zealand. It occurs in catches between central NSW and eastern Victoria.

Eastern pigfish are protogynous hermaphrodites, i.e. juveniles first develop female reproductive organs that may change into male reproductive organs in certain circumstances. The two sexes have distinct colour patterns, although occasionally fish are found with an intermediate colouration.

Eastern pigfish can live to about 30 years of age, but the majority of fish caught are between 5 and 15 years old. Pigfish have been shown to be associated with kelp forests in New Zealand. They have also been found to be significantly more abundant in NZ marine parks than in adjacent areas however this could be due to the quality of habitat within the reserve rather than a reserve effect. In Australia, pigfish are generally caught in depths greater than 50 m.

Most pigfish are taken as incidental catch in the Ocean Trap and Line Fishery, and there is a small but significant recreational catch.
Additional Notes

- Pigfish comprise a small but consistent catch in the commercial trap fishery and fetch high prices ($25/kg).
- Recreational catches are significant, and it is possible that the recreational catch is greater than the commercial catch.
- Pigfish mature at a relatively small size (<23 cm) and are hermaphrodites, changing sex from female to male at around 30 cm.
- Fishing mortality is estimated to be similar to natural mortality.
- Commercial landings have declined since the 1990s but there has also been a decline in trap fishing effort, and catch rates of pigfish in the trap fishery have remained low and stable.
- Pigfish is a key secondary species within the Ocean Trap and Line Fishery and is not subject to any specific bag limit or minimum size regulations for recreational fishers.

Catch

Recreational Catch of Pigfish

The annual recreational harvest of pigfish in NSW is likely to be less than 20 t. This estimate is based upon the results of the recreational offshore trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Historical Landings of Pigfish

Landings by Commercial Fishery of Pigfish

Reported landings of pigfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Pigfish Harvested by Fish Trapping in NSW

Catch rates of pigfish harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Commercial landings (including available historical records) of pigfish for NSW from 1990/91 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 384061, 37 384007 and 37 384035, common name or scientific name to find further information.

Age-length data with fitted growth curve for eastern pigfish (Stewart and Hughes, 2008). Lengths are presented as fork length (FL).

Length Frequency of Eastern Pigfish

The length distribution of eastern pigfish landed by NSW commercial fishers during 2004 to 2006 was comprised mainly of fish between 25 and 35 cm fork length (FL). There is no minimum legal length for pigfish in NSW.
Eastern Red Scorpionfish
(*Scorpaena cardinalis*)

**EXPLOITATION STATUS**
FULLY FISHED

Fishing mortality appears to be similar to natural mortality. The species has a slow growth rate and considerable longevity.

<table>
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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td><em>Scorpaena cardinalis</em></td>
<td>eastern red scorpionfish</td>
<td>Also known as red rockcod.</td>
</tr>
</tbody>
</table>

**Background**

The eastern red scorpionfish (*Scorpaena cardinalis*), also known as the red rockcod, is a member of the scorpionfish family Scorpaenidae, a large family containing about 350 species worldwide and occurring in all temperate and tropical seas. The eastern red scorpionfish is distributed along the east coast of Australia from southern Queensland (Noosa Heads) to eastern Victoria and is also recorded from New Zealand. The species inhabits estuarine and inshore ocean waters and is common on coastal reefs of NSW.

Eastern red scorpionfish grow slowly, reaching approximately 22cm in length after 5 years. They have a maximum reported age of 33 years. Males grow faster and attain greater lengths than females.

Eastern red scorpionfish mature between 17 and 26 cm, probably between 3 and 6 years of age. They spawn between December and April, with peak gonad development in February/March. However, the mode of spawning is unknown.

Eastern red scorpionfish are taken in small numbers in the NSW ocean trap and line fishery where they are listed as a secondary species. The catch of eastern red scorpionfish by recreational fishers is thought to be at least three times bigger than the commercial catch. They are well represented in catches from offshore recreational fishing and ranked 22nd and 21st in abundance during surveys of offshore trailerboat fishers during 1993/94 and 1994/95 respectively. In NSW, there is no minimum legal length for eastern red scorpionfish and a recreational bag limit of 5.
**Additional Notes**

- A relatively long-lived inshore species (maximum reported age 33 years), targeted by both recreational and commercial fishers.
- Relatively high price received through Sydney Market but commercial landings remain low (5 to 10 t per annum).
- Bag limit since 2007 for recreational fishers of 5 fish.

**Catch**

*Recreational Catch of Eastern Red Scorpionfish*

The annual recreational harvest of eastern red scorpionfish in NSW is likely to be between 20 t and 50 t. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

**Landings by Commercial Fishery of Eastern Red Scorpionfish**

Reported landings of eastern red scorpionfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

**Growth Curve of Eastern Red Scorpionfish**

Growth curve of eastern red scorpionfish using parameters from Stewart and Hughes (2008). Lengths are presented as total length (TL).
The length distribution of eastern red scorpionfish landed by recreational trailer-boat fishers between 1993 and 1996 was comprised mainly of fish between 20 and 40 cm total length (TL). There is no minimum legal length for eastern red scorpionfish in NSW.

The length distribution of eastern red scorpionfish landed by NSW commercial fishers during 2004/05 to 2005/06 comprised mainly fish between 20 and 40 cm total length (TL). There is no minimum legal length for eastern red scorpionfish in NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 287066 , common name or scientific name to find further information.
Eastern Rock Lobster
(Sagmariasus verreauxi)

Exploitation Status: FULLY FISHED

Species has a long history of exploitation. The commercial fishery has been managed using Total Allowable Catch since the mid 1990s, is closely monitored, and catch rates and biomass have been increasing over the past decade.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>Sagmariasus verreauxi</td>
<td>Eastern rock lobster</td>
<td>Previously known as Jasus verreauxi (see Booth and Webber, 2001)</td>
</tr>
</tbody>
</table>

Background

The eastern rock lobster (Sagmariasus verreauxi) comprises about 99% of commercial landings of rock lobsters in NSW. Landings can also include small numbers of southern rock lobsters Jasus edwardsii, and two species of painted rock lobster (Panulirus longipes and P. ornatus). Eastern rock lobsters occur on rocky reefs and sand/mud substrates at depths from a few metres to about 200 m, from southern Queensland to Port MacDonnell in South Australia, including around Tasmania. However, greatest abundances occur along the NSW coast. The species also occurs in New Zealand.

The eastern rock lobster is reported to be the largest species of rock lobster in the world and can grow to weights in excess of 7 kg at a carapace length (CL) of about 25 cm. Lobsters in NSW landings are between 10.4 cm (minimum legal length) and 18 cm CL (maximum legal length) and weigh from 0.5 kg to 2.5 kg. Female eastern rock lobsters mature between 14 and 18 cm CL (16.7 cm CL on average) and mature lobsters occur in catches from the northern part of the species’ range (north of about Newcastle).

Records of commercial landings of eastern rock lobsters are available from the late 1800s and reported annual landings ranged between 93 t and 365 t from the early 1900s through to the late 1970s. Estimates of total landings (including non-commercial and 'unreported' catches) showed a significant decline in the late 1980s. Concerns about the sustainability of the resource led to a restriction in the number of commercial fishers allowed to take lobsters, the introduction of a maximum legal length, individually numbered management tags and the implementation of a total allowable commercial catch (TACC) in the mid-1990s. The TACC, originally set at 106 t in 1994/95, increased during the following years to 150 t by 2000/01, but was subsequently reduced to 102 t by 2005/06. The TACC was increased again in recent years and in 2009/10, the TACC was set at 131 t, managed as Individual Transferable Quotas amongst a total of about 106 shareholders.

Following the management changes in the mid-1990s, a formal Share Management Plan (SMP) for the fishery was established in 2000 and a Fishery Management Strategy (FMS) in 2007. These plans specify objectives,
performance indicators and trigger-points for the lobster stock and fishery. An annual resource assessment provides an assessment of fishery performance and the status of the lobster stock and informs the annual review of the TACC. The fishery is closely monitored and supports several ongoing surveys and research projects including: (i) collection of fishery-dependent catch and effort data from the commercial fishery via a daily logbook; (ii) monitoring the annual settlement of pueruli (post-larval lobsters); (iii) a fishery-independent trap survey of the abundance of spawning stock; and (iv) an observer survey of the magnitude of retained and discarded catches of lobsters and by-catch. A length-structured model of the lobster population and fishery incorporates biological data, information about fishery selectivity and catch and abundance data from the monitoring programs.

Based on the most recent resource assessment (March 2010), all performance indicators related to CPUE and stock abundance were above the associated trigger-points. Patterns in CPUE and estimates of stock biomass from the model demonstrate that the abundance of eastern rock lobsters has been increasing since the low point of the early 1990’s. Catch rates achieved during each of the last 2 years (2007/08 and 2008/09) were the greatest observed during the past 36 years. Indices of abundance of spawning stock (derived from the fishery-dependent logbook and fishery-independent survey) demonstrate substantial increases in biomass since the 1990’s. Abundance of spawning stock in 2008 (the most recent survey) was the greatest observed during the 14 years of the data series. Based on the “base-case scenario” of the length-structured model, spawning biomass at the commencement of 2009/10 was estimated to have increased to 26% of the pre-exploitation level, having more than doubled since 1994/95.

Significant numbers of eastern rock lobsters are captured by recreational fishers who are allowed to use a single trap (pot) in waters less than 10 m depth, or to capture lobsters by hand while diving without the use of compressed air. The high commercial value of rock lobsters has led to concerns that there is a significant trade in ‘black market’ lobsters, despite the implementation of a number of initiatives to encourage compliance with the fishery regulations.

Additional Notes

- A high value (approximately $60 per kg in 2008/09) species caught along the length of the NSW coast, from close inshore to depths of 200 m.
- The commercial fishery is managed by TACC and is closely monitored, with annual assessment by the Total Allowable Catch Committee.
- In 2007/08 and 2008/09 over 95% of TAC was caught
- There is a minimum legal size of 10.4 cm carapace length (CL) and a maximum legal size of 18 cm CL for eastern rock lobsters in NSW. Recreational fishers are subject to a bag limit of 2 rock lobsters (eastern and southern combined).

Catch

Recreational Catch of Eastern Rock Lobster

The annual recreational harvest of eastern rock lobster in NSW is likely to be less than 30 t. Estimated recreational landings of 25.8 t per annum are incorporated in the population model for eastern rock lobster (TAC Committee, 2010).

Historical Landings of Eastern Rock Lobster

Commercial landings (including available historical records) of eastern rock lobster for NSW from 1939/40 to 2008/09 for all fishing methods.
Catch rates of eastern rock lobster harvested using lobster trapping for NSW. Indicator provided is median catch rate. Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Biomass Estimates of Eastern Rock Lobster

Median estimates of total biomass and spawning biomass from 1920/21 to 2008/09 ("base-case scenario" of the length-structured model). Dashed line indicates 25% virgin spawning biomass, the reference point above which spawning biomass is to be maintained.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 820002, common name or scientific name to find further information.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Eastern School Whiting
(Sillago flindersi)

EXPLOITATION STATUS
FULLY FISHED

A significant species in the NSW Ocean Trawl Fishery. The stock is shared with the Commonwealth and the status of fully fished is consistent with the Commonwealth assessment.

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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tr>
<td>Sillago flindersi</td>
<td>eastern school whiting</td>
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</table>

Background

Eastern school whiting (also known as redspot whiting) occur in ocean waters to a depth of about 100 m, from southern Queensland to eastern Victoria (Westernport Bay) and north-eastern Tasmania. Although there is some evidence suggesting that there are two stocks in this range with the division between the ‘northern’ and ‘southern’ stocks in the Sydney – Jervis Bay area, current management assumes a single stock. It is an inshore demersal species caught almost exclusively by trawling or Danish seining (in Victoria).

Eastern school whiting are reported to attain a length of 32 cm, but few are seen exceeding 25 cm. Maturity occurs at about 2 years of age and 15 cm in length, and they reach a length of about 25 cm after seven years. The bulk of fish in catches are between 15 and 20 cm in length.

With annual landings by the NSW Ocean Trawl Fishery exceeding 800 t per year, school whiting are the most important species (by weight) in the fishery. In the Commonwealth managed Southern and Eastern Scalefish and Shark Fishery (SESSF), there used to be an annual Total Allowable Catch (TAC) of over 1000 t but recent catches, mainly by Danish seiners operating from Lakes Entrance in eastern Bass Strait, have been less than 500 t.

Both eastern school and stout whiting frequently occur together in prawn-trawl catches off northern NSW and, historically, fishers reported landings of both species as ‘school whiting’. New catch reporting forms which were introduced in July 2009, require separate reporting of the two species.

In the early years of the fishery, school whiting were mostly discarded by the NSW prawn trawlers, and minimum codend mesh-size restrictions limited the catch by fish trawlers to very low levels. However, with the development of export markets in the 1970s, annual landings by the prawn fleet increased to about 600 t by the mid 1980s before declining to around 400 t in the early 1990s due to a softening of the export demand. With increased domestic and export demand, landings again increased significantly to exceed 800 t per year by the late 1990s. This increase has been largely driven by the fish trawl sector which developed fish-trawl gear to target whiting such that annual landings of whiting by fish trawlers now almost equal those by prawn trawlers.
Additional Notes

- Landings for this species are sometimes confounded with stout whiting (*Sillago robusta*) as the two species have overlapping distributions.
- NSW landings have been relatively stable between 800 and 1000 t in recent years.
- The Commonwealth assessment includes NSW catch data - the species was not considered overfished, nor experiencing overfishing (Wilson et al. 2009).
- There is no minimum legal length for eastern school whiting, but the species is included in a combined recreational bag limit of 20 for all whiting species.

Catch

*Recreational Catch of Eastern School Whiting*

The annual recreational harvest of eastern school whiting in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Historical Landings of Eastern School Whiting*

**Landings by Commercial Fishery of Eastern School Whiting**

Reported landings of eastern school whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

**Catch Per Unit Effort Information of Eastern School Whiting Harvested by Ocean Prawn Trawling in NSW**

Catch rates of eastern school whiting harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Commercial landings (including available historical records) of eastern school whiting for NSW from 1984/85 to 2008/09 for all fishing methods.
The length distribution of eastern school whiting landed in the 1970s comprised mainly larger fish (>20 cm fork length (FL)) as smaller fish were discarded. Since the expansion of markets in the 1980s the length distribution of landed school whiting has been reasonably stable, comprising mostly fish between 15 and 25 cm FL. There is no minimum legal length for eastern school whiting in NSW.

Age-length data with fitted growth curve for eastern school whiting (internal data). Lengths are presented as fork length (FL).

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 330014, common name or scientific name to find further information.
Eastern Sea Garfish

*(Hyporhamphus australis)*

**Exploitation Status**

**OVERFISHED**

Despite some encouraging signs in the 2007/08 age composition, the stock does not appear to be recovering and there is still a lack of older fish (2-6 years) in the population.

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<tr>
<th>Scientific Name</th>
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<tr>
<td><em>Hyporhamphus australis</em></td>
<td>eastern sea garfish</td>
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</tr>
</tbody>
</table>

**Background**

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 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 early spring (June-September) on the north coast. They produce relatively large eggs (~2.5 mm diameter) that are covered with filaments of 5 to 10 mm long that allow them to attach to floating or benthic vegetation. Batch fecundity increases linearly with fish length up to approximately 3500 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 distinctly seasonal, most catches being taken between December and May on the south coast and between March and June on the north coast. Reported annual commercial landings have declined from around 200 t in the early 1990s to less than 40 t in recent years. Recent landings have been dominated (95%) by fish less than 2 years old.
Additional Notes

- Landings continue to be at historical lows. The catch per unit effort appears to be increasing but it is not expected to be a reliable indicator of abundance for this species.
- Recent years have seen continued recruitment to the stock but the majority of these fish are not surviving beyond the first year class.
- The fishery continues to be closely monitored. A small improvement in the proportion of the catch greater than 2 years old in 2007/08 does not appear to have been sustained during 2008/09 (~92% less than 2 years old).
- The relatively low abundance of fish greater than 2 years of age in the population may have reduced spawning output and subsequent recruitment.
- There is a recreational bag limit of 20 eastern sea garfish.

Catch

Recreational Catch of Eastern Sea Garfish

The annual recreational harvest of eastern sea garfish in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
The length distribution of eastern sea garfish in NSW commercial landings has remained relatively stable since 2000, with the majority of fish being between 20 and 30 cm fork length (FL) during this period (fork length is measured from the tip of the upper jaw to the fork in the tail). No representative length composition data are available prior to the 1999/2000 year. In NSW, there is no minimum legal length for eastern sea garfish.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 234014, common name or scientific name to find further information.
Flounders
(Paralichthyidae and Pleuronectidae)

**EXPLOITATION STATUS** UNDEFINED
Species identification issues need to be resolved before stock status can be assessed.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td><em>Pseudorhombus jenynsii</em></td>
<td>smalltooth flounder</td>
<td></td>
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<tr>
<td><em>Pseudorhombus arsius</em></td>
<td>largetooth flounder</td>
<td></td>
</tr>
<tr>
<td><em>Pseudorhombus tenuirastrum</em></td>
<td>slender flounder</td>
<td></td>
</tr>
<tr>
<td><em>Pseudorhombus dupliciocellatus</em></td>
<td>three twinspot flounder</td>
<td></td>
</tr>
<tr>
<td><em>Ammotretis rostratus</em></td>
<td>longsnout flounder</td>
<td></td>
</tr>
<tr>
<td><em>Rhombosolea tapirina</em></td>
<td>greenback flounder</td>
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</tbody>
</table>

**Background**

Most marketable flounders caught in NSW waters are ‘left-eye’ flounders belonging to the family Paralichthyidae, a group generally known as sand flounders. They include the largetooth flounder (*Pseudorhombus arsius*), smalltooth flounder (*P. jenynsii*) and slender flounder (*P. tenuirastrum*). Landings may also include small numbers of the ‘right-eyed’ longsnout flounder (*Ammotretis rostratus*) and possibly greenback flounder (*Rhombosolea tapirina*) of the family Pleuronectidae. All these species are generally confined to large estuaries, bays and coastal waters.

Largetooth and smalltooth flounders are widespread around most of Australia, with the largetooth flounder also distributed through the Indo-west Pacific region. They are mostly found in estuaries, bays and near-shore ocean waters to depths of about 50 m, although occasional specimens are taken as deep as 100 m. The slender flounder seems to be confined to the continental shelf off eastern Australia and generally inhabits deeper water than the other sand flounders, being commonly found out to a depths of 100 m or more. A sixth sand flounder, the three twinspot flounder (*P. dupliciocellatus*), is sometimes encountered in prawn-trawl catches off northern NSW and may also be landed with the other species. The longsnout and greenback flounders are sometimes caught in southern NSW bays and harbours but are more common off southern Australia.
Identification of the different species of sand flounders is difficult, and all are reported as ‘flounder’. Almost all are landed from the Ocean Trawl Fisheries with small quantities (< 3 t) being reported from the estuary fisheries. Commercial landings were generally stable around 30 t per annum until 2004/05 but there has been a decline in landings to less than 20 t in recent years. Flounders are also caught by recreational fishers with an estimated total NSW catch at about 10 t - 20 t per annum.

**Additional Notes**

- Three species comprise the bulk of NSW landings - largemouth flounder (*Pseudorhombus arsius*) and smallmouth flounder (*P. jenynsii*) occur in estuaries, bays and near-coastal waters, while the slender flounder (*P. tenuirastrum*) occurs further offshore.
- All species are mainly harvested as by-product of trawling, and the two inshore species are frequently caught by recreational anglers.
- There is a minimum legal length of 25 cm total length for flounders and a combined recreational bag limit of 20 for all flounders and soles.

**Catch**

**Recreational Catch of Flounders**

The annual recreational harvest of flounders in NSW is likely to lie between 10 t and 20 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
The length distribution of largetooth flounder caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mainly of fish between 15 cm and 35 cm total length (TL). A minimum legal length of 25 cm TL was introduced in September 2007.

The length distribution of smalltooth flounder landed by NSW commercial fishers in 2005/06 was comprised mainly of fish between 22 cm and 30 cm TL. A minimum legal length of 25 cm TL was introduced in September 2007.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 460002, 37 460009, 37 460031, 37 461001 and 37 461003, common name or scientific name to find further information.
Frigate Mackerel

*(Auxis thazard)*

**EXPLOITATION STATUS**  UNDEFINED

A small pelagic species with low and fluctuating commercial landings. Recreational catch may be significant. Minimal information currently available.

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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
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<tbody>
<tr>
<td><em>Auxis thazard</em></td>
<td>frigate mackerel</td>
<td>Also known as leadenall.</td>
</tr>
</tbody>
</table>

**Background**

The frigate mackerel (*Auxis thazard*) is a small, pelagic, tuna-like member of the family Scombridae which includes tunas, mackerels, and bonitos. It is a highly migratory species with a worldwide distribution through all tropical and subtropical seas. In Australia, it is found around the whole of the mainland although it is more abundant in northern waters. The frigate mackerel is primarily an open water species preferring coastal seas, but it is known to enter sheltered bays and harbours e.g. it is occasionally caught in Sydney Harbour. It usually inhabits the top 50 m of the water column, but has been reported as deep as 200 m.

Frigate mackerel can be distinguished from other similar species of small, striped tunas such as the true bonitos (*Sarda* spp.), mackerel tuna (*Euthynnus affinis*) and skipjack tuna (*Katsuwonus pelamis*) by its very widely spaced dorsal fins - in these other species, the dorsal fins are very close together and often almost touching at their bases. Frigate mackerel grow to almost 60 cm fork length and a weight of nearly 4 kg but they are more commonly 25-40 cm and 0.3-1.3 kg. Because of their abundance, frigate mackerel are considered to be an important component of the food chain. Their primary food sources include small fish, squids, and planktonic larval crustaceans while in turn, frigate mackerel are preyed upon by larger fish such as tunas and billfish.

The NSW commercial fishery for frigate mackerel is very seasonal, with almost all the catch taken during summer. Most is taken by the Ocean Hauling Fishery but the reported landings are highly variable, ranging between about 2 and 20 t per annum since the year 2000. Because of their dark, oily flesh, frigate mackerel have low market acceptance and are commonly used for bait by both commercial and recreational fishers.
### Additional Notes

- Small species (< 3 kg) which occurs in coastal waters around all Australian states.
- Minimal biological information is currently available.
- Frigate mackerel are a conditional target species in the Ocean Hauling Fishery and are caught sporadically.
- Mainly utilised for bait by the commercial fishery.
- Recreational catch may be greater than commercial landings.

### Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab](http://www.marine.csiro.au/caab) and search for the species code (CAAB) 37 441009, common name or scientific name to find further information.

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**Historical Landings of Frigate Mackerel**

The annual recreational harvest of frigate mackerel in NSW is likely to be less than 20 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

![Graph showing historical landings of frigate mackerel](image)

Commercial landings (including available historical records) of frigate mackerel for NSW from 1993/94 to 2008/09 for all fishing methods. Financial years where commercial catch was reported by less than six fishermen were removed due to privacy concerns.
Gemfish
(Rexea solandri)

<table>
<thead>
<tr>
<th>EXPLOITATION STATUS</th>
<th>RECRUITMENT OVERFISHED</th>
</tr>
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<tbody>
<tr>
<td>Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment has been adopted.</td>
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</tbody>
</table>

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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>Rexea solandri</td>
<td>gemfish</td>
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</table>

Background

Genetic research determined that there are two stocks of gemfish in Australian waters. The eastern stock is distributed from Cape Moreton in southern Queensland to the west coast of Tasmania. The western stock extends from western Bass Strait to Geraldton in WA.

Females mature between 4 and 6 years of age (60-75 cm fork length (FL)) while males mature between the ages of 3 and 5 (50-70 cm FL). Females can live to a maximum of about 17 years and attain a maximum length of 116 cm and weight of 13 kg. Males are shorter lived with a maximum age of about 12 years, maximum length of about 106 cm and weight of about 8 kg.

Mature fish in the eastern stock migrate northwards along the continental slope to spawn off central and northern NSW during a short period in early to mid-August. The biology of the western stock of gemfish is thought to be similar to that of the eastern stock except that they appear to spawn in summer instead of winter.

The fishery for eastern gemfish began in the late 1970s, targeting the well-defined winter migration of mature fish along the continental slope from eastern Bass Strait to Port Stephens (latitudes 40°S-33°S) in depths of 350-450 m. Gemfish was the major harvest by trawlers operating from NSW ports during the period 1977-87, with annual catches peaking at more than 5000 t in the early 1980s. Total annual catches then fluctuated around 3-4000 t until 1987. In 1985 the South East Trawl Fishery (SETF), incorporating waters outside 3 nm and south of Barrenjoey Point (Broken Bay), was implemented by the Commonwealth Government. An annual Total Allowable Catch (TAC) of 3000 t was imposed for gemfish in 1988 but, with catches continuing to decline and concerns about recruitment, the TAC was progressively reduced to zero by 1993. Subsequent TACs were as high as 1000 t but since 2005 have been set at around 100 t to allow for gemfish caught incidentally while targeting other species.

Dropline fishers in the Ocean Trap and Line Fishery account for the majority of gemfish reported by NSW commercial fishers. Because of the overfished status of the gemfish stock, NSW commercial fishers are subject to a 50 kg trip limit for all fishing methods. Recreational fishers are subject to a bag limit of two gemfish per angler and a boat limit of ten gemfish.
Additional Notes

- Nomination of gemfish as a threatened species was unsuccessful in NSW but eastern gemfish were listed as “Endangered - Conservation Dependent” by the Commonwealth in early 2009.

- An updated assessment using the results from a trawl survey in 2008 estimated current spawning biomass to be about 16% of unexploited level (likely spawning biomass of 2000-3000 tonnes) - however concerns have been expressed about the use of a ‘hyperstable’ abundance index in the assessment.

- Despite the recruitment of a ‘stronger’ 2002 cohort to the mature population, there has been little improvement in the stock from the low level following the recruitment collapse.

- NSW commercial dropline fishery now has only a small number of operators, and trawl catches are very low (both are subject to a 50 kg trip limit). Landings by the charter boat fishery are likely to be significant (subject to a 10 fish per boat limit).

- The Commonwealth considers the eastern stock to be overfished. (Wilson et al., 2009)

- Length-based monitoring of NSW commercial catch is continuing at the Sydney Fish Market.

- There is a combined recreational bag limit of 5 hapuku, banded rockcod, bass groper, gemfish and blue-eye trevalla. Additional restrictions applying to gemfish include a bag limit of 2 fish and boat trip limit of 10 fish.

Catch

Recreational Catch of Gemfish

The annual recreational harvest of gemfish in NSW is likely to be less than 10 t. This estimate is based on the results of offsite and onsite surveys undertaken by I & I NSW.
Length Frequency of Gemfish

Growth Curves of Gemfish

The length distribution of gemfish landed by NSW commercial dropline fishers comprises mainly fish between 50 and 100 cm fork length (FL). There is no minimum legal length for gemfish in NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 439002, common name or scientific name to find further information.
Ghost Nipper
(*Trypaea australiensis*)

**Exploitation Status**

Moderately Fished

A significant level of exploitation is estimated in some areas of the species’ range, but the overall level of exploitation is likely to be low to moderate.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Trypaea australiensis</em></td>
<td>ghost nipper</td>
<td>Also known as pink nipper and yabby.</td>
</tr>
</tbody>
</table>

Background

A number of species of burrowing shrimps occur on intertidal sand and mud flats in NSW. The ghost nipper (*Trypaea australiensis*) occurs in estuaries between northern Queensland and central Victoria, and is commonly harvested for use as bait by recreational fishers. Large numbers are caught by individual fishers, and there is also a small commercial fishery which supplies bait shops. Ghost nippers are harvested from intertidal flats at low tide using a tubular pump, known as a 'yabby pump'. In certain areas harvest rates can be significant, especially during peak recreational fishing periods (such as the summer holiday period), however significant areas are also closed to the harvesting of bait. There are also sub-tidal populations of ghost nippers in many areas which are effectively protected from harvesting.

Ghost nippers dig complex burrow structures in soft but stable sediments, and feed on small particles of organic matter. The claw on one side of the animal is larger than that on the other side, and males generally have a much larger claw than females. Females carry fertilized ova in bunches under the abdomen, until they hatch into free swimming zoea larvae. Ghost nippers are thought to be a relatively fast growing species, with a life span of less than 4 years. Because they occur in large numbers and are active burrowers to a depth of 25 cm or more, ghost nippers are considered to be a very important component of the ecology of intertidal flats, affecting the distribution of particle sizes in the substrate and allowing oxygen penetration below the surface. Although numbers harvested are significant,
there is no accurate information available on the total recreational harvest. The commercial harvest is small (less than 5 t per year) and is significantly less than the harvest by recreational fishers. It is thought that the total harvest may have declined in recent years due to the increasing popularity of artificial baits and lures with recreational fishers.

**Additional Notes**

- Nippers are harvested mainly for bait by recreational fishers, and by commercial fishers in the Estuary General fishery (for sale to recreational fishers for use as bait).
- An annual commercial harvest of less than 5 t is reported; recreational landings are not accurately estimated.
- Anecdotal reports suggest there may have been a decline in total harvest in recent years as ‘soft plastic’ lures have become popular with anglers.
- Annual commercial landings have not been reported due to privacy considerations.
- A bag limit of 100 nippers was recently introduced in September 2007.

**Catch**

_Recreational Catch of Ghost Nipper_

The annual recreational harvest of ghost nipper in NSW is not accurately known but is likely to be many times greater than the commercial harvest.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 803004, common name or scientific name to find further information.
Ghostsharks (Chimaeriformes)

**Exploitation status: undefined**

Small numbers of individuals are harvested as bycatch in the Ocean Trawl Fishery mainly from the outer continental shelf and continental slope. There is a lack of information with which to assess stock status.

### Background

Chimaeriformes include three families of mainly deepwater chondrichthians (cartilaginous fishes), and all families are represented in NSW waters. The taxonomy of deepwater ghostsharks (Chimaeridae) in Australian and New Zealand waters has recently been clarified and the NSW fauna is now known to include at least nine species. There is one species of elephantfish (*Callorhinchus milii*; family Callorhinchidae), several species of shortnosed ghostsharks (*Chimaera* spp. and *Hydrolagus* spp.; family Chimaeridae), and two species of longnosed ghostsharks or spookfishes (*Rhinochimaera pacifica* and *Harriotta ralieghana*; family Rhinochimaeridae). However, despite their mainly deepwater habitat and unusual appearance, chimaeras have good eating qualities and small quantities of a variety of species are landed as incidental catches in the Ocean Trawl Fishery.

The elephantfish is the only shallow water species of the group, occurring around southern Australia and in New Zealand. Elephantfish can grow to at least 110 cm in length and about 9 kg in weight, and are occasionally caught off the far south coast of NSW. They are bottom feeders with plate-like teeth in both jaws used to crush shellfish and other invertebrate prey. The status of the elephantfish stock is currently being assessed.

### Scientific Name | Standard Name | Comment
---|---|---
*Callorhinchus milii* | elephantfish | Occasionally caught inshore south of Sydney.
*Hydrolagus ogilbyi* | Ogilby’s ghostshark | Caught on outer shelf and upper slope (120 to 400 m)
*Hydrolagus marmoratus* | marbled ghostshark | Small species infrequently caught off northern NSW in depths 550-1000 m
*Hydrolagus lemers* | blackfin ghostshark | Caught in upper slope depths (200 to 700 m)
*Chimaera fulva* | Southern chimaera | Frequently caught 780-1000 m.
*Chimaera macrospina* | longspine chimaera | Caught in midslope depths (435-1300 m).
*Harriotta ralieghana* | bigspine spookfish | Caught in midslope depths (700-900 m).
*Rhinochimaera pacifica* | pacific spookfish | Caught in midslope depths (760-1290 m).
*Chimaera obscura* | shortspine chimaera | Known only from four specimens caught in 1050 m depth off Tuncurry.
by the Commonwealth, as it forms a significant by-catch in the Southern and Eastern Scalefish and Shark Fishery, and there is a significant recreational catch in the southern states.

More commonly caught by NSW offshore trawlers, albeit in relatively small numbers, are several species of ghostsharks. Ogilby’s ghostshark (*Hydrolagus ogilbyi*) may be caught as shallow as 150 m but the other species inhabit continental slope depths between 500 and 1500 m. Some species of NSW ghostsharks grow to about 80 cm in length (not including the tail filament) and weigh up to 5 kg. All deepwater chimaeras have long filamentous tails making them weak swimmers and they are reported to feed mainly on small fish and invertebrates, including squids.

The females of all chimaeras are oviparous in that they lay single large eggs in leathery egg-cases; these eggs take up to a year to develop and hatch into a fully formed small shark. While the elephantfish breeds annually in shallow water, little is known of the breeding biology of deepwater chimaerids. However, like most deepwater sharks, ghostsharks are likely to have slow growth rates and very low fecundity, making them vulnerable to over fishing.

### Additional Notes

- It is likely that the abundance of these species has always been quite low off NSW.
- Most are deepwater sharks with typically low fecundity.
- Elephantfish is subject to catch limits in the Commonwealth Southern Shark Fishery (Total Allowable Catch of 94 t).
- Ghostsharks are a key secondary species in the Ocean Trawl Fishery.

### Catch

**Recreational Catch of Ghostsharks**

The annual recreational harvest of ghostsharks in NSW is likely to be less than one tonne.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Giant Mud Crab
(*Scylla serrata*)

**Exploitation Status**
Undefined

Significant commercial and recreational fisheries occur in NSW which is at the southernmost extent of the species’ range. Local biological information has not been analysed in detail.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Scylla serrata</em></td>
<td>giant mud crab</td>
<td>Also known as mangrove crab.</td>
</tr>
</tbody>
</table>

**Background**

The giant mud crab (*Scylla serrata*), along with most species of commercially harvested crabs in Australia, belongs to the family Portunidae. Species in this family are usually referred to as swimmer or paddle crabs, and are easily recognized by their broadly flattened back legs with paddle-like last segments. The giant mud crab or mangrove crab has a smooth carapace (back), is deep green in colour, and differs from other swimmer crabs by having very robust claws and 9 similarly-sized spines on each side of its carapace. It is the largest species of swimmer crab and can reach 28 cm in carapace width and 3 kg in weight but is more commonly 15-20 cm in width and 0.5-1.0 kg.

Giant mud crabs are widely distributed through the Indo-Pacific region and around the Indian Ocean to east Africa. In Australia, they are found from the Bega River in southern NSW north to the Gulf of Carpentaria and around to Broome in WA. Giant mud crabs are usually found in sheltered waters, particularly estuaries, tidal flats and mangrove areas, and can tolerate wide variations in temperature (12-35°C) and salinity (2-50‰). However, it has been found that their activity and feeding slows greatly in temperatures less than 20°C. During the day, giant mud crabs may live intertidally in burrows but most bury in the mud at subtidal levels. They forage at night for food, feeding mainly on molluscs, crustaceans and worms.

Giant mud crabs grow in a step-wise fashion through a succession of moults until they reach maturity after 18-24 months. The moult that marks the transition from a juvenile to a mature state is the final or terminal moult for most male and almost all female crabs. Most giant mud crabs do not grow further after this terminal moult, and death is thought to occur at a maximum of 4 years. However, it has been found that about 3% of females do moult (and...
breed) a second time. At maturity, the claws of male giant mud crabs increase in proportion to body size, comprising up to 40% of the body weight, making them prized for the meat content.

Female giant mud crabs carry between 2 and 5 million eggs and are thought to spawn only at sea. The young crabs hatch as zoea larvae which require marine conditions to develop properly. After a series of molts the zoea larvae metamorphose into ‘megalopa’ (the first stage resembling the adult crab form) which move inshore and molt into juvenile crabs.

The main fishery for giant mud crabs in Australia is in Queensland where 800-1000 t are harvested annually. In NSW, yearly landings are around 100-120 t. The commercial fishery is seasonal with the greatest harvest occurring in summer, peaking in February and March. Giant mud crabs are sold locally and interstate, with only a small percentage exported overseas.

Recreational catches of giant mud crabs are also significant, and in some areas outweigh the commercial catches. Crab pots are the primary means of capturing giant mud crabs by both commercial and recreational fishers. Recreational fishers also use hoop nets or dillies. Recreational fishers are limited to using one crab trap, and/or five hoop nets (‘dillies’ or ‘witches hats’) to target a bag limit of 5 crabs.

Female giant mud crabs are protected in Queensland, NT, and WA, but in NSW only females with eggs are protected although these are rarely caught by commercial or recreational fishers. Minimum size and maximum bag limits vary between states. The minimum legal size for giant mud crabs (male or female) in NSW is 8.5 cm carapace length.

**Additional Notes**

- NSW is at the southern extent of the species’ range and our fishery is likely to be dependent upon recruitment from further north.
- NSW commercial landings and catch rates were stable until 2007/08, but there was a significant decline in 2008/09 - the reasons for this decline are under investigation. The recreational catch is significant, but not well estimated.
- A joint research program is underway to study the association between environmental factors and mud crab landings, following significant declines in landings in the northern state’s fisheries.
- Monitoring of the size composition of commercial catches from the Clarence River and Wallis Lakes is continuing - no trends are apparent since 2003/04.
- There is a minimum legal length of 8.5 cm carapace length and a recreational bag limit of 5 giant mud crabs.

**Catch**

**Recreational Catch of Giant Mud Crab**

The annual recreational harvest of giant mud crab in NSW is likely to lie between 30 and 60 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Giant Mud Crab**

![Historical Landings of Giant Mud Crab](chart.png)

Commercial landings (including available historical records) of giant mud crab for NSW from 1978/79 to 2008/09 for all fishing methods.
The length distribution of giant mud crabs landed by NSW commercial fishers is comprised mainly of crabs between 9 and 14 cm carapace length (CL), and has been relatively stable in recent years. The minimum legal length of mud crabs in NSW is currently 8.5 cm CL.

Reported landings of giant mud crab by NSW commercial fisheries from 1997/98. * Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch rates of giant mud crab harvested using crab potting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

The length distribution of giant mud crabs landed by NSW commercial fishers is comprised mainly of crabs between 9 and 14 cm carapace length (CL), and has been relatively stable in recent years. The minimum legal length of mud crabs in NSW is currently 8.5 cm CL.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 911008, common name or scientific name to find further information.
Goatfish
(Mullidae)

**Exploitation Status**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Upeneichthys lineatus</em></td>
<td>bluestriped goatfish</td>
<td>More than 80% of NSW catch.</td>
</tr>
<tr>
<td><em>Parupeneus spilurus</em></td>
<td>blacksaddle goatfish</td>
<td></td>
</tr>
<tr>
<td><em>Upeneus tragula</em></td>
<td>bartail goatfish</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

At least three species of goatfishes, popularly known as red mullet or barbounia, are included in the NSW catch. It is estimated that 80% or more of the catch consists of the bluestriped goatfish (*Upeneichthys lineatus*), a small fish measuring mainly between 15 and 20 cm in length. Also landed are small numbers of the larger blacksaddled goatfish (*Parupeneus spilurus*) which can grow to more than 40 cm, and the slender bartailed goatfish (*Upeneus tragula*) which seldom exceeds 15 cm. The bartailed and blacksaddled goatfishes are tropical species with ranges extending to central NSW while the bluestriped goatfish is endemic to eastern Australia between southern Queensland and southern NSW.

Goatfishes typically inhabit inshore waters where they feed on soft sandy areas of seabed using strong barbels on the underside of their mouth to dig and to sense small prey. There have been no studies into the biology of any NSW species. Size composition data were collected during trawl surveys of king prawn and fish-trawling grounds by Fisheries Research Vessel *Kapala*, and some length data are available from commercial landings.

Annual landings of goatfish by NSW ocean trawlers are mostly between 20 and 30 t with most of the catch taken as by-product of prawn trawling. Red mullet are also landed in small quantities by the southern Queensland prawn-trawl fishery, and it is estimated that less than 1 t is taken annually by NSW recreational fishers. No stock assessment has been undertaken for any goatfish species in NSW and the species composition of the catch has not been accurately determined.
Additional Notes

- There are three species in this reporting group, though bluestriped goatfish (*Upeneichthys lineatus*) is most commonly landed.
- Bluestriped goatfish is a widely distributed inshore species.
- Size composition data from recent commercial catch monitoring of bluestriped goatfish was compared with data from research trawls and no trends were apparent.

Catch

Recreational Catch of Goatfish

The annual recreational harvest of goatfish in NSW is likely to be less than one tonne.

Historical Landings of Goatfish

Commercial landings (including available historical records) of goatfish for NSW from 1990/91 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Goatfish

Reported landings of goatfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Goatfish Harvested by Ocean Prawn Trawling in NSW

Catch rates of goatfish harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Length Frequency of Bluestriped Goatfish

The length distribution of bluestriped goatfish landed by NSW commercial fishers in recent years has shown a single mode, with the majority of fish being between 15 and 20 cm fork length (FL). Blue striped goatfish do not have a minimum legal length.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 355001, 37 355015, and 37 355014, common name or scientific name to find further information.
Goldspot Mullet

*(Liza argentea)*

**EXPLOITATION STATUS**

Moderately fished

Exploitation rates vary between estuaries, but state-wide the species is considered to be moderately fished.

**Background**

The goldspot mullet (*Liza argentea*) is an Australian endemic species found in both tropical and temperate waters. Its distribution extends from northern Queensland (including the Gulf of Carpentaria) around all southern states (except Tasmania) to about Perth in WA. It is principally an estuarine species being found in the upper reaches during its first year before inhabiting coastal lakes and shallow inshore waters. Both as juveniles and adults, this highly active fish feeds on filamentous algae and other weeds as well as benthic crustaceans.

The goldspot mullet is a schooling fish that can reach a length of 45 cm although it rarely exceeds 30 cm and 0.5 kg in weight. A recent study found that they can live for at least 17 years and that males and females have similar growth patterns until 2-3 years of age, after which males on average are smaller than females. Goldspot mullet spawn in inshore coastal waters, including the lower reaches of estuaries. They are capable of short to extended spawning periods (2 to 9 months) which vary in timing and duration depending on location. They reach maturity at a length of 16 to 23 cm fork length (FL).

In NSW, goldspot mullet are landed throughout the year with the highest catches between January and March. Over 90% of the annual 60-100 t catch is taken by the Estuary General Fishery and the remainder by the Ocean Hauling Fishery. Landings include very small numbers of fantail mullet (*Paramugil georgii*) which occur in estuaries and bays in southern QLD and NSW. Both species are sold whole or filleted for food, and for commercial bait. In some areas, recreational fishers also target goldspot mullet for food and bait.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Liza argentea</em></td>
<td>goldspot mullet</td>
<td>Formerly known as flat-tail mullet. Comprises the majority of landings.</td>
</tr>
<tr>
<td><em>Paramugil georgii</em></td>
<td>fantail mullet</td>
<td>Minor landings only.</td>
</tr>
</tbody>
</table>

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*Image © Bernard Yau*
**Additional Notes**

- Previously known as flat-tail mullet, goldspot mullet are mostly caught in haul nets, often mixed with other mullet species.
- Mortality estimates indicate that fishing mortality is similar to natural mortality in some estuaries, but harvests are low in other estuaries.
- There is a combined recreational bag limit of 20 for all mullet species.

**Catch**

*Recreational Catch of Goldspot Mullet*

The annual recreational harvest of goldspot mullet in NSW is likely to be less than 30 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Goldspot Mullet**

Commercial landings (including available historical records) of goldspot mullet for NSW from 1978/79 to 2008/09 for all fishing methods.

**Landings by Commercial Fishery of Goldspot Mullet**

- *Ocean Hauling*
- *Estuary General (Key Secondary Species)*

**Landings of goldspot mullet by NSW commercial fisheries from 1999/00. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.**

**Catch Per Unit Effort Information of Goldspot Mullet Harvested by Mesh-Netting in NSW**

Catch rates of goldspot mullet harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

**Length Frequency of Goldspot Mullet**

The length distribution of goldspot mullet landed by NSW commercial fishers shows a single mode, with the majority of fish being between 22 and 30 cm fork length (FL). There is no minimum legal length for goldspot mullet in NSW.
Age-length data with fitted growth curve for male goldspot mullet (Kendall, 2007). Lengths are presented as fork length (FL).

Age-length data with fitted growth curve for female goldspot mullet (Kendall, 2007). Lengths are presented as fork length (FL).

**Further Reading**


**Masters Thesis.**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 381004 and 37 381009, common name or scientific name to find further information.
Greentail Prawn

(*Metapenaeus bennettiae*)

**Exploitation Status:** Undefined

The species is similar to school prawns, but lives entirely within estuarine waters. No detailed assessment of stock status has been made.

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<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Metapenaeus bennettiae</em></td>
<td>Greentail Prawn</td>
<td>Also known as the greasyback prawn.</td>
</tr>
</tbody>
</table>

**Background**

Previously known as greasyback prawn, the greentail prawn (*Metapenaeus bennettiae*) is found along eastern Australia between about Rockhampton in Queensland and the Gippsland Lakes in eastern Victoria. The greentail prawn is found in marine, estuarine and freshwater habitats. Juveniles have been found in rivers up to 35 km from the sea while larger juveniles are usually found in areas of the estuary nearer the coast in shallow mangrove areas. Adults are most common closer to the sea in coastal lakes, lagoons and shallow ocean waters out to depths of about 15 m, and generally moving out of the estuaries in times of flooding. They prefer mud substrates but are also found on sand. It is a relatively small prawn with females reaching a maximum length of ~13 cm; the average commercial size is less than 10 cm total length (TL) and around 8 g in weight.

Unlike other penaeid prawns which spawn offshore, the greentail prawn is able to complete its entire life cycle in shallow coastal lagoons. Both juveniles and adults are efficient osmoregulators which helps explain this unusual life cycle. Juveniles move downstream towards the estuaries as they grow and mature, and breeding occurs in the marine environment of estuaries or shallow coastal waters. Sexual maturity is reached about one year after hatching, when the male is around 1.6 cm carapace length (CL) or 7.7 cm TL, and females 2 cm CL (~10 cm TL). Spawning occurs during the summer, usually around the full moon.

The main fishery for greentail prawns is in the Brisbane River and Moreton Bay in southern Queensland where it is a significant component of the ‘bay prawn’ catch of more than 500 t. In NSW, the annual greentail prawn catch has recently fluctuated between 20 and 50 t with most being landed during early summer (October to January). Almost all the catch is taken using seine nets by Estuary General fishers in the Wallis Lake-Hunter region, with small quantities taken in the Estuary Prawn Trawl Fishery.
**Additional Notes**

- Greentail prawns are mainly taken by prawn seining in the Estuary General Fishery.
- The life history of this species is very similar to school prawns, but greentail prawns do not generally move from the estuary to ocean waters.
- Commercial landings fluctuate between years, probably in association with rainfall. Catch rates for prawn seining have been stable to increasing in recent years.
- Effort on this species is likely to have been reduced as a result of the implementation of Recreational Fishing Havens.
- There is a combined recreational bag limit of 10 litres for all prawns.

**Catch**

**Recreational Catch of Greentail Prawn**

The annual recreational harvest of greentail prawn in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Greentail Prawn**

Commercial landings (including available historical records) of greentail prawn for NSW from 1978/79 to 2008/09 for all fishing methods.

**Landings by Commercial Fishery of Greentail Prawn**

Reported landings of greentail prawn by NSW commercial fisheries from 1997/98. * Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

**Catch Per Unit Effort Information of Greentail Prawn by Prawn Seining in NSW**

Catch rates of greentail prawn harvested using prawn seining for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 711022, common name or scientific name to find further information.
Grey Morwong
(Nemadactylus douglasii)

**EXPLOITATION STATUS**

**OVERFISHED**

Long term declines are evident in both landings and catch rates, and the average size of harvested fish has also decreased substantially since the 1970s. The age composition of landings strongly suggests that fishing mortality is greater than natural mortality.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nemadactylus douglasii</td>
<td>grey morwong</td>
<td>Formerly known as rubberlip morwong and blue morwong. Sometimes marketed as deep sea bream.</td>
</tr>
</tbody>
</table>

**Background**

Grey morwong (Nemadactylus douglasii) are distributed along the south-eastern Australian coastline in continental shelf waters from Moreton Bay in Queensland to Wilsons’ Promontory in Victoria. They can also be found along the east coast of Tasmania to Storm Bay and are also present around the north island of New Zealand, where they are known as ‘porae’. The common name of this species in Australia has undergone a number of changes in the past, and it has variously been known as rubberlip, blue and grey morwong, and is often sold in retail outlets as ‘deep sea bream’.

The biology and life history characteristics of grey morwong in Australian waters have recently been studied. They are demersal fish commonly caught near reefs at depths of 10-100 m. Fish, crustaceans and invertebrates are the primary food items consumed by this species. The maximum length and weight of grey morwong is approximately 80 cm and 6 kg, but the majority of fish caught are between 25 and 35 cm fork length (FL) in length and 250 to 500 g in weight. Catches contain very few fish greater than 50 cm in length.

Grey morwong mature at 22 to 25 cm FL and spawning occurs between April and June. In common with other members of the family Cheilodactylidae, grey morwong probably have a pelagic ‘paperfish’ larval stage which may last for many months. After settlement to their demersal juvenile habitat, grey morwong reach
15cm FL after one year and 20 cm FL after two years. A recent study (Stewart and Hughes, 2009) found that growth of individual grey morwong was quite variable, but on average males appeared to grow faster than females. There was also some evidence for variation in recruitment strength from year to year. The oldest fish aged in this study was 22 years old, but few fish larger than 45 cm FL were available to be aged, so it is likely the longevity of grey morwong is much greater than this.

In NSW grey morwong are taken by trap fishers in the Ocean Trap and Line Fishery along the whole coast and by fish trawl south of Smokey Cape. Grey morwong are a significant catch by recreational fishers in ocean waters.

Additional Notes

- Long term decline in the average size of landed fish indicates the stock is depleted.
- Size at maturity is below the current legal size and the oldest fish sampled was aged 22 years - it is likely the maximum age is greater.
- The fishery is predominantly based upon age classes between 3 and 14 years old.
- The age composition indicates variable recruitment.
- The life-history characteristics of grey morwong may make them susceptible to overfishing. These characteristics include relatively slow growth rates, an extended pelagic larval phase and complex social interactions
- There are estimates of significant discarding of small grey morwong by fish trawlers in the early 1990s (Liggins, 1996).
- Length-based monitoring of commercial catches is continuing at the Sydney Fish Market.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 10 grey morwong.
- The recreational harvest of grey morwong has been estimated to be approximately 3 times the commercial harvest.

Catch

Recreational Catch of Grey Morwong

The annual recreational harvest of grey morwong in NSW is likely to lie between 130 and 210 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Grey Morwong

![Graph showing historical landings of grey morwong](image)

Commercial landings (including available historical records) of grey morwong for NSW from 1978/79 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Grey Morwong

![Graph showing landings by commercial fishery of grey morwong](image)

Reported landings of grey morwong by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
Catch rates of grey morwong harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Age-length data with fitted growth curve for grey morwong (Stewart and Hughes, 2008). Lengths are presented as fork length (FL).

The proportion of larger (>40 cm fork length (FL)) grey morwong in commercial landings declined between the 1970s and the 1990s and recent landings have mainly comprised fish between 25 and 40 cm FL. The minimum legal length of grey morwong in NSW was increased from 28 to 30 cm total length in September 2007.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 377002, common name or scientific name to find further information.
Gummy Shark

(*Mustelus antarcticus*)

**Exploitation Status**

FULLY FISHED

Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment was adopted.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Mustelus antarcticus</em></td>
<td>gummy shark</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The gummy shark (*Mustelus antarcticus*) is widely distributed in Australian waters, ranging from northern NSW around the southern coast, (including Tasmania) to Geraldton in WA. Gummy sharks are demersal and mainly found in continental shelf depths between 20 and 150 m; off NSW they have been recorded as deep as 450 m. Recent genetic and tagging studies determined that the NSW population was distinct from gummy sharks found along the southern Australian coast, although some overlap occurred off southern NSW. Female gummy sharks in southern Australian waters grow to at least 185 cm total length (TL) and 25 kg in weight while males reach almost 150 cm and 15 kg. In contrast, gummy sharks off central and northern NSW rarely exceed 100 cm in length. The difference in the size structures of the two stocks is shown by their sizes at maturity. About 50% of gummy sharks off southern Australia are mature when they are 110-120 cm in length whereas the length at 50% maturity for NSW sharks is 65-70 cm TL.

Gummy sharks are lecithotrophic viviparous in that the young develop internally from eggs. Large pregnant females have been found to carry as many as 57 pups but the smaller NSW females mostly have between 5 and 10 young. The pups are born in early summer at a size of around 30-35 cm and, although gestation lasts 11-12 months, most females breed only once every two years.

The main fishery for gummy sharks is by the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) in Bass Strait and off SA where there is an annual allowable catch of about 1800 t. The NSW catch is mostly less than 50 t per year and is mainly taken on the south coast by the Ocean Trap and Line Fishery; the remainder is byproduct of the Ocean Trawl Fishery. Gummy shark production in the SESSF is closely monitored but the relatively small production off NSW has not warranted targeted research.
Additional Notes

- The Commonwealth has completed extensive and detailed assessments of this species. The species is not considered overfished and there are no current concerns about the species in Australian waters.
- Relatively easily identified by commercial fishers.
- NSW commercial landings are relatively stable at 30 to 50 t per annum. Most (~90%) of the NSW catch is harvested south of Jervis Bay.

Catch

Recreational Catch of Gummy Shark

The annual recreational harvest of gummy shark in NSW is likely to be less than 10 t. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Commercial landings (including available historical records) of gummy shark for NSW from 1990/91 to 2008/09 for all fishing methods.

Catch rates of gummy shark harvested using all line fishing methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 017001, common name or scientific name to find further information.
**Hairtail and Frostfish**  
*(Trichiuridae)*

**Exploitation Status**: Undefined

No local biological information available for either species in this group, but growth and maturity have been studied for *Trichiurus lepturus* from the East China Sea, where it supports a major fishery.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Trichiurus lepturus</em></td>
<td>Largehead Hairtail</td>
<td></td>
</tr>
<tr>
<td><em>Lepidopus caudatus</em></td>
<td>Frostfish</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The largehead hairtail (*Trichiurus lepturus*) belongs to the family Trichiuridae which, worldwide, includes nine genera and about 30 species generally referred to as cutlassfishes or scabbardfishes. Off NSW, at least four species of trichiurids are found in deepwater, but the most well known member of the family to most people is the hairtail, found in shallow coastal waters and estuaries.

A cosmopolitan species, the largehead hairtail is subject to significant fisheries off many Asian countries, particularly China and Korea. The world catch reportedly now exceeds 1.5 million t annually. In eastern Australia, hairtail occasionally school in coastal bays and estuaries where they may be targeted by commercial fishers but in most years only a small incidental catch is taken by line or trawl. However, hairtail are important to NSW recreational anglers, particularly in the Hawkesbury River system.

The largehead hairtail prefers shallow coastal waters, with muddy substrates, and locally is known to frequent coastal embayments such as Broken Bay to the north of Sydney. It is uniformly silver with a long, ribbon-shaped body ending in a thin whip-like tail. Its body has no scales and its teeth are sharp and prominent.

The hairtail is commonly around 100 cm in length and about 2 kg in weight but reaches a maximum length of about 220 cm and weight of 3.5 kg.

Overseas studies have observed that adults feed at the surface during the day, and retreat to deeper waters at night. In contrast, juveniles and small adults tend to feed at night at the surface, and aggregate into schools at depths during the day. The adult hairtail diet consists mainly of fish with occasional squid and crustaceans, whereas juveniles mainly feed on planktonic crustaceans, euphausiids and small fish.

Reported landings in NSW generally range between 10 and 25 t with catches greatest during March-May. Production has mostly been from the Estuary General fishery, taken mainly by handline. In recent years however, the fish trawl sector has reported the majority of hairtail landings, mainly from the Newcastle-Port Stephens area. Recent annual landings have been very low (less than 3 t).

The frostfish or ribbonfish (*Lepidopus caudatus*) is a closely related species caught by trawlers operating in deepwater off NSW. It is a large fish reaching about 200 cm in length and weighing 3 kg and, although similar in appearance to the hairtail, can be distinguished by its small caudal
fin (tail). The frostfish migrates from the south along the NSW upper slope (300-600 m depth) during early winter on a spawning run and is occasionally trawled in very large numbers (individual catches can exceed 10 t). However, because of low market acceptance, significant quantities of frostfish are discarded at sea and only small quantities are marketed.

**Additional Notes**

- Annual commercial landings of *Trichiurus lepturus* exceeded 50 t in the early 1990s, and show an episodic availability pattern - recent landings have been very low.

- Important recreational species although very specialised recreational fishery in winter (very few anglers target hairtail).

- Caught in deep estuaries and offshore as bycatch through the use of live baits.

- Movements into estuaries are sporadic (along with many other characteristics of this species).

- NSW is at the southern end of their distribution. Note that catches in NSW are insignificant at a global scale.

- Recent research from Korea has described growth and size at maturity - preliminary analyses suggest some concern about overfishing of the stock in the Asian region.

- Southern frost fish, *Lepidopus caudatus*, is caught by trawling in deepwater, and a large proportion of the catch is discarded due to poor market acceptance.

- In NSW there is a recreational bag limit of 10 hairtail.

**Catch**

*Recreational Catch of Hairtail*

The annual recreational harvest of hairtail in NSW is variable and likely to be less than 10 t.

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**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 440004 and 37 440002, common name or scientific name to find further information.
Hammerhead Sharks

(*Sphyrna spp.*)

**EXPLOITATION STATUS**  **UNDEFINED**

Three species of hammerhead shark are harvested by the commercial line fishery and are also caught by the recreational gamefish fishery. Little information is available to specify exploitation status.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sphyrna zygaena</em></td>
<td>smooth hammerhead</td>
<td></td>
</tr>
<tr>
<td><em>Sphyrna lewini</em></td>
<td>scalloped hammerhead</td>
<td></td>
</tr>
<tr>
<td><em>Sphyrna mokarran</em></td>
<td>great hammerhead</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Three species of hammerhead sharks are found in NSW waters, the smooth hammerhead (*Sphyrna zygaena*), scalloped hammerhead (*S. lewini*) and great hammerhead (*S. mokarran*). The smooth hammerhead occurs south from Coffs Harbour, and is the most abundant of the three species in NSW waters. It occurs over the continental shelf, from the surface to at least 60 m depth.

Smooth hammerheads attain a maximum length of 350 cm, with males maturing at about 250 cm, and females at about 265 cm. It is likely that hammerhead sharks have at least a 2 year breeding cycle. All hammerheads give birth to free-swimming live young. Smooth hammerheads have 20 to 50 pups per litter, after a 10-11 month gestation. As the name suggests, smooth hammerheads have a very smooth, curved, leading profile to their hammer.

The Australian distribution of the scalloped hammerhead covers all northern waters, extending south to ~34ºS latitude on each coast (Sydney to Geographe Bay). Adult scalloped hammerheads inhabit deep waters adjacent to continental and insular shelves, in water depths ranging from the surface to at least 275 m. Juveniles are often found close inshore, often in large migratory schools. Adult females are rarely caught inshore. Scalloped hammerheads produce litters of 13 to 41 pups after a 9-10 month gestation. Pupping takes place between October and January in Australia.

The great hammerhead inhabits tropical and warm temperate waters. It is found on the continental shelf north of Sydney, from inshore to at least 80 m depth. It can grow to a length of 600 cm, though rarely more than 450 cm. Males mature at about 225 cm and females at about 210 cm. Litters of 6 to 33 pups are produced in summer in northern Australia. The great hammerhead is distinguished by a very tall first dorsal fin, a large 2nd dorsal fin and a non-curved leading edge to their hammer.
The scalloped hammerhead and the smooth hammerhead comprise the majority of NSW commercial and recreational catches. Total commercial hammerhead catch peaked in 1993/94 at 15.7 t. Annual commercial catches have averaged approximately 4 t in the last 5 years. Most hammerhead landings come from the Ocean Trap and Line Fishery, with smaller landings by the Ocean Trawl Fishery and occasionally by the Estuary General Fishery. Between the 1970s and 2001, the total catch of hammerhead sharks by recreational gamefishing and protective beach meshing remained at about 250 sharks per year. It was estimated that over 95% of the recreational gamefishing catches are tagged and released alive.

**Additional Notes**
- This subgroup of pelagic sharks is readily identifiable by all stakeholders - the three species can be differentiated by their teeth and a notch in the middle of the head but correct identification to species level by fishers may be problematic.
- Hammerhead sharks are a key secondary species in the Ocean Trap and Line Fishery. Reported landings have generally been less than 10 t in recent years.
- The current observer program in the line fishery is providing additional information on the composition of this group of species, however catches have been small.
- There is a recreational bag limit of one hammerhead shark.

**Catch**

*Recreational Catch of Hammerhead Sharks*

The annual recreational harvest of hammerhead sharks in NSW is likely to lie between 10 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Further Reading**


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### Historical Landings of Hammerhead Sharks

![Historical Landings of Hammerhead Sharks](chart)

Commercial landings (including available historical records) of hammerhead sharks for NSW from 1990/91 to 2008/09 for all fishing methods.


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 019004, 37 019001 and 37 019002, common name or scientific name to find further information.
Hapuku
(Polyprion oxygeneios)

**Exploitation Status**
*Undefined*

No detailed stock assessment available. NSW landings of this species are very small compared to landings in New Zealand and by Commonwealth fisheries.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>Polyprion oxygeneios</td>
<td>hapuku</td>
<td></td>
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</tbody>
</table>

**Background**

The hapuku or New Zealand groper (*Polyprion oxygeneios*) is a circum-global temperate species inhabiting waters around New Zealand, the southern half of Australia, southern Chile and a number of Southern Ocean islands. Small juvenile hapuku have a pelagic stage when they are associated with flotsam in surface waters and are rarely captured. At about 50 cm in length and (estimated) 3-4 years of age, they become demersal in habit. In New Zealand waters, they can be found in depths as shallow as 20 m but around Australia they mainly prefer continental slope depths of 200-500 m. Hapuku are large, long-lived fish with reports of specimens almost 180 cm in length and 80 kg in weight, and living longer than 60 years. New Zealand studies of hapuku found them to mature over a wide size range, with 50% maturity at 80-85 cm for males and 85-90 cm for females, corresponding to 10-13 years of age.

Hapuku are caught in small numbers along the whole NSW coast. Some are caught by trawlers but most are taken by deepwater dropliners in the Ocean Trap and Line Fishery when targeting blue-eye trevalla. Since 1997/98, hapuku catches have been recorded separately from the similar bass groper (*P. americanus*), and annual catches have remained fairly stable at around 5 to 10 t. This small catch contrasts with the New Zealand catch (combined for the two species of *Polyprion*) of more than 1500 t per year.
Additional Notes

- A deepwater demersal species with a prolonged pelagic phase that lasts 2-3 years (juveniles up to about 50 cm are found near the surface).
- Landings in NSW are small (<10 t) compared with landings from Commonwealth fisheries and New Zealand.
- Commonwealth fisheries harvest this species, but catches are not managed by quota, and no stock assessment is available.
- There is a combined recreational bag limit of 5 hapuku, banded rockcod, bass groper, gemfish and blue-eye trevalla. Additional restrictions apply to gemfish.

Catch

Recreational Catch of Hapuku

The annual recreational harvest of hapuku in NSW is likely to be less than 10 t.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 311006, common name or scientific name to find further information.
Jackass Morwong

*(Nemadactylus macropterus)*

**EXPLOITATION STATUS**

**OVERFISHED**

The commercial harvest is predominantly by trawlers in the Commonwealth Southern and Eastern Scalefish and Shark Fishery. Commonwealth assessment is based on a full population model which shows a very significant decline in biomass since the 1980s. The biomass has recently been estimated to be about 20% of the unexploited level.

<table>
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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td><em>Nemadactylus macropterus</em></td>
<td>jackass morwong</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The worldwide distribution of jackass morwong (*Nemadactylus macropterus*) includes waters of New Zealand, southern South America, southern Africa and some islands in the Atlantic and Indian oceans. Jackass morwong are distributed in Australian waters from Moreton Bay in Queensland to Perth in WA. They occur in depths to 450 m and, in Australian waters, are most abundant between 100 and 200 m.

Jackass morwong have a summer-autumn spawning period with larger, older females being more fecund. They have an extended pelagic post-larval stage known as a ‘paperfish’, which can be distributed up to 250 km offshore. After settlement they are demersal fish with juveniles inhabiting the shallow reefs of Bass Strait and Tasmania.

Sampling of jackass morwong along the southern and eastern shelf region of Tasmania showed that newly settled juveniles were about 10 - 13 cm fork length (FL). Maximum lengths observed were 43 cm FL for males and 46 cm FL for females. Growth of juveniles is rapid with fish attaining a size of about 26 cm at 3 years of age. After fish reach sexual maturity at 4 to 5 years of age, growth slows. A maximum age of 30 years for females and 41 years for males was recorded in this Tasmanian study, however few fish were older than 25 years.

From the 1950s to the 1970s annual landings of jackass morwong frequently exceeded 1500 t. There was a consistent decline in landings through the 1980s and 1990s, and by 2000 total annual landings were about 800 t, of which about 50 t were caught off NSW. Most jackass morwong are caught by trawlers in the Commonwealth South East Fishery, and the Commonwealth has developed a quantitative stock assessment, which considers stocks east and west of Bass Strait separately. In 2008 the eastern stock biomass was assessed as being at about 19% of the unexploited level,
and the stock was considered to be subject to overfishing (Wilson et al. 2009). However, there was some uncertainty about the veracity of a separate western stock (which was assessed as being at 68% of the unfished biomass) and there were also concerns about the completeness and accuracy of some of the recent data (e.g. discard rates had been very poorly estimated). The 2009 assessment addressed some of these uncertainties, and the eastern stock was assessed to have improved slightly, to 24% of unfished biomass. The stock of jackass morwong off eastern Australia is still considered to be very significantly depleted.

Additional Notes

- Small quantities are caught by trap fishers in southern NSW waters.
- Recent buyouts may reduce catch from Commonwealth operators as 8% of the jackass morwong quota was bought back.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 10 for jackass morwong in NSW.

Catch

Recreational Catch of Jackass Morwong

The annual recreational harvest of jackass morwong in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Jackass Morwong

Commercial landings (including available historical records) of jackass morwong for NSW from 1978/79 to 2008/09 for all fishing methods. Note that the small decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.
The length distribution of jackass morwong landed by NSW commercial fishers between 1970 and 1992 remained reasonably stable and comprised mainly fish between 25 and 40 cm fork length (FL). No recent length composition data are available for NSW catches. The minimum legal length for jackass morwong in NSW is 30 cm total length.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 377003, common name or scientific name to find further information.
John Dory  
(Zeus faber)

<table>
<thead>
<tr>
<th>EXPLOITATION STATUS</th>
<th>FULLY FISHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predominantly a Commonwealth fishery, exploitation status from Commonwealth stock assessment is 'uncertain' with respect to whether or not the stock is overfished. Given the long term relatively stable fishery in NSW, 'fully fished' is more appropriate for this jurisdiction.</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

John dory (*Zeus faber*) has a very wide distribution through temperate waters of most of the world’s oceans. Stock structure within this range is unclear. John dory occur from close inshore (including deeper estuarine waters) to a depth of about 400 m.

Reported landings of john dory by NSW ocean trawl fishers have fluctuated between 20 and 60 t per annum since the mid 1980s. John dory are taken by trawl fisheries in adjacent jurisdictions, most notably in the Commonwealth-managed trawl fisheries, where they are subject to a Total Allowable Catch.

The biology and life history of john dory are poorly documented. Spawning takes place off NSW in late summer and autumn at depths of 50 to 100 m, but fecundity has not been estimated. Recent ageing studies suggest john dory have a reasonably fast growth rate, maturing at 3 to 5 years of age (25 – 30 cm in length) and reaching an age of about 12 years at a length of 50 cm. However, john dory have been observed to grow to 70 cm in length and in excess of 3 kg in weight, so the maximum age is probably greater than 12 years. The considerable amounts of length composition data available for john dory since the 1960s suggest that the stock has remained relatively stable throughout this period.
Additional Notes

- John dory have a worldwide distribution, stock structure is not known. They are taken incidentally by trawl fishing in continental shelf waters, and in small quantities by recreational fishers.
- Recent annual landings in NSW are 20 - 30 t compared with Commonwealth landings of 70-80 t - down from total landings of 200 - 300 t in the 1970s and 1980s.
- Available length frequency data show no trends since the 1970s.
- Research indicates john dory live to a maximum of about 15 years and mature at about 3 - 5 years of age.
- Size composition monitoring of NSW commercial landings is occurring at the Sydney Fish Markets.

Catch

Recreational Catch of John Dory

The annual recreational harvest of John dory in NSW is likely to be less than 10 t. This estimate is based upon the results of the offshore recreational trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Historical Landings of John Dory

Commercial landings (including available historical records) of John dory for NSW from 1946/47 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.
The length distribution of John dory landed by NSW commercial fishers has been stable since the 1960s, and is comprised mainly of fish between 20 and 40 cm total length (TL). There is no minimum legal length for John dory in NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 264004, common name or scientific name to find further information.
Longtail Tuna  
(*Thunnus tonggol*)

### Exploitation Status
**Undefined**

A coastal tuna species for which the recreational fishery is probably more significant than the commercial fishery. There are few useful data with which to establish status.

<table>
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<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Thunnus tonggol</em></td>
<td>longtail tuna</td>
<td>Previously, but incorrectly called northern bluefin tuna.</td>
</tr>
</tbody>
</table>

**Background**

The longtail tuna (*Thunnus tonggol*) inhabits continental shelf and ocean waters in warm temperate and tropical regions of the Indo-west Pacific. It is a common species in Queensland waters but during the summer it can be found as far south as Twofold Bay in southern NSW. Previously called ‘northern bluefin tuna’ in Australia, the longtail tuna is a relatively small, slender species that grows to a weight of 36 kg and length of 136 cm; it is more commonly 80-90 cm and 10-15 kg. In comparison, the true ‘northern bluefin’ (*Thunnus orientalis*) can exceed 500 kg in weight and reach almost 300 cm in length.

The longtail tuna reaches maturity at lengths of around 60-70 cm, and spawning takes place during the summer months. The main diet of the longtail tuna consists of small pelagic and demersal fish, but also includes crustaceans and cephalopods.

Because of their rapid acceleration, longtail tuna are highly regarded as sports fish but their very dark flesh gives them a low market acceptance. Since about 2000 the NSW commercial catch has been less than 2 t per year, with most taken by the Ocean Trap and Line Fishery and very small amounts reported by the Ocean Hauling and Estuary General Fisheries.
Additional Notes

- The fishery mostly occurs off Queensland - data from the gamefish tagging program show 93% of longtail tuna have been tagged off Queensland and 7% off NSW.
- Growth parameters are summarised in Griffiths et al. (2009) for samples from Australia, Papua New Guinea and Japan.
- The sporadic nature of catches off NSW precludes the easy collection of additional data.
- There is a combined recreational bag limit of 5 fish under 90 cm total length (TL) and 2 fish over 90 cm TL for all tuna species.

Catch

Recreational Catch of Longtail Tuna

The annual recreational harvest of longtail tuna in NSW is likely to be less than one tonne.

Historical Landings of Longtail Tuna

Commercial landings (including available historical records) of longtail tuna for NSW from 1992/93 to 2008/09 for all fishing methods. Financial years where commercial catch is made up of less than six fishermen were removed due to privacy concerns.

Growth Curve of Longtail Tuna

Growth curve of longtail tuna using parameters from Griffiths et al. (2009). Lengths are presented as fork length (FL).

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 441013, common name or scientific name to find further information.

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Luderick

(*Girella tricuspidata*)

**Exploitation Status**  
FULLY FISHED

A moderately long-lived species with significant recreational and commercial harvests. Fishing mortality rate is estimated to be about the same as natural mortality rate.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Girella tricuspidata</em></td>
<td>luderick</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Luderick (*Girella tricuspidata*) occur from southern Queensland to Tasmania and SA and are also found in New Zealand. In NSW waters, luderick are found primarily within estuaries and around nearshore rocky reefs. Within estuaries, luderick are mainly found in association with “weedy” habitats such as seagrass beds and rocky reefs. They are primarily herbivorous, preferring certain species of green macroalgae, although other foods (particularly small invertebrates) also form part of their diet.

Spawning is thought to occur in surf zones near estuary entrances, typically during winter. The larvae enter estuaries and the small juveniles subsequently live in sheltered shallow water habitats (particularly seagrass beds and mangrove channels). Larger juveniles occur in slightly deeper waters, and are particularly common around estuarine and near coastal reefs. Luderick grow fairly slowly, taking approximately 5 years to reach 27 cm (fork length). They mature at around 25 cm and migrate to near-coastal waters prior to spawning. Adults may return to estuarine waters after spawning.

Luderick in the Estuary General Fishery are primarily caught in mesh nets and hauling nets during autumn and winter. Significant quantities of luderick are also taken on ocean beaches during autumn and winter by ocean haul fishers. A small number of luderick are salted and used for bait in the commercial rock lobster fishery. Luderick are an important recreational species, and are targeted using specialised techniques.
Addisonal Notes

- Luderick form the basis for a significant, highly targeted recreational fishery and they are also a significant component of commercial mesh net and hauling catches.
- Annual commercial landings have shown a slowly declining trend over the past decade, but catch rates for mesh netting have been relatively stable.
- Growth and maturity data have recently been analysed, and initial estimates of mortality rates suggest fishing is significant compared to the likely level of natural mortality.
- There is a minimum legal length of 27 cm and a recreational bag limit of 20 luderick.

Catch

Recreational Catch of Luderick

The annual recreational harvest of luderick in NSW is likely to lie between 270 and 550 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
The length distribution of luderick in NSW commercial landings was relatively stable from the 1970s to the 1980s, and comprised mainly fish between 22 and 35 cm fork length (FL). Commercial landings sampled during the 1990s contained a smaller proportion of luderick between 22 and 25 cm FL and a similar size has been found for luderick sampled in recent years. The minimum legal length for luderick in NSW is 25 cm total length (approximately 22 cm FL).

**Growth Curve of Luderick**

Growth curve for luderick using parameters from Gray et al. (2010) Lengths are presented as fork length (FL).

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 361007, common name or scientific name to find further information.
Mackerel Tuna
(Euthynnus affinis)

EXPLOITATION STATUS  UNDEFINED

Small commercial fishery with low priority for assessment.Possibly more significant in the recreational fishery. Minimal information available.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>Euthynnus affinis</td>
<td>mackerel tuna</td>
<td></td>
</tr>
</tbody>
</table>

Background

The mackerel tuna (Euthynnus affinis), also known as the little tuna, belongs to the family Scombridae which includes the mackerels, tunas and bonitos. It is a widespread pelagic species found in the tropical waters of the Indo-Pacific. Although also inhabiting ocean waters, mackerel tuna prefer to stay close to the coast and juveniles are even found in bays and harbours. It is a highly migratory species and frequently forms large schools which are often mixed with other scombrid species. In Australia, mackerel tuna range from Cape Leeuwin, WA, around northern Australia and Queensland to the south coast of NSW.

Mackerel tuna is a small tuna with a distinctive dark-striped pattern on its back and 2-5 dark spots above the ventral fin. It can be distinguished from similar species with striped patterns by the spots and, in the case of frigate mackerel, the lack of space between the dorsal fins. Mackerel tuna can grow to 100 cm fork length (FL) and about 20 kg in weight but are more commonly around 60 cm and 3 kg. They feed on small fish, particularly clupeids (herrings, pilchards) and silversides, as well as on squids, crustaceans and zooplankton. Their predators include billfish and sharks.

In NSW and Queensland, mackerel tuna are usually caught on lines by fishers targeting mackerel (Scomberomorus spp.) and larger tunas. Annually, 10-20 t of mackerel tuna are landed for sale in NSW with almost all the catch taken by the Ocean Trap and Line Fishery. However, it has dark flesh which deteriorates quickly resulting in poor marketability. Despite this, mackerel tuna are popular with recreational fishers as a light-tackle gamefish.
Additional Notes

- A highly migratory small tuna species that occurs throughout the Indo-West Pacific region - NSW is at the southern extremity of its range.
- There is minimal information available on this species from fisheries in NSW waters.
- Commercial landings are low (10 to 20 t recently).
- Species may be significant in recreational catches, but accurate catch estimates are not available.

Catch

Recreational Catch of Mackerel Tuna

The annual recreational harvest of mackerel tuna in NSW is likely to be less than 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I&I NSW.

Historical Landings of Mackerel Tuna

Commercial landings (including available historical records) of mackerel tuna for NSW from 1990/91 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Mackerel Tuna

Reported landings of mackerel tuna by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 441010, common name or scientific name to find further information.
Mahi Mahi
(Coryphaena hippurus)

**EXPLOITATION STATUS**
**UNDEFINED**

Mainly targeted by recreational fishers, mahi mahi are likely to have high growth and mortality rates, but there is a lack of local information with which to assess stock status.

**SCIENTIFIC NAME**
**Coryphaena hippurus**

**STANDARD NAME**
**mahi mahi**

**COMMENT**
Also known as common dolphinfish.

---

**Background**

Mahi mahi (*Coryphaena hippurus*) are a tropical oceanic species found in the Atlantic, Indian and Pacific oceans. In Australian waters they can be found off WA, NT, and from Queensland to Montague Island in NSW.

This pelagic species is limited in habitat by sea surface temperatures of 19-20°C and extensions of distribution occur with seasonal variations in water temperature. Mahi mahi are also known to associate strongly with floating objects and are highly sought by recreational fishers around Fish Aggregation Devices (FADs). In NSW, significantly more mahi mahi were observed around offshore FADs than inshore FADs in summer and autumn. These fish are considered to be highly migratory although detailed information on migration routes and stock structure are not available for the east coast of Australia.

Studies elsewhere suggest the species grows rapidly with fish reaching 1 kg after 6 months and 10 kg after 1 year, with an estimated maximum size of 200 cm total length (TL) and weight of 25 kg. They also mature at about 6 months of age and females are believed to reach maturity at a smaller size than males.

Mahi mahi are highly fecund, producing 58,000 – 1.5 million eggs per female, with an exponential increase in egg number with increasing fish length. They can also spawn frequently once mature. There is general agreement in the literature that this species is short lived (maximum 4 years old), with most dying before they reach 2 years of age.

A study on the diets of mahi mahi caught in NSW waters showed that they predominantly feed on larval or small juvenile fish and invertebrates. Many of these prey species are associated with drifting clumps of algae. Mahi mahi also serve as the prey items of large tuna, sharks, marlin, sailfish and swordfish.

All of the mahi mahi harvested by commercial fishers in NSW are taken in the Ocean Trap and Line Fishery, however the recreational catch of this species is greater than the commercial catch. November to April are the months of primary commercial harvest of mahi mahi. This summer/autumn peak period is most likely due to their strong association with water temperature.
**Additional Notes**

- Mahi mahi is a minor commercial species taken by line fishing off NSW with annual landings generally less than 10 t and fluctuating catch rates.

- Mahi mahi is more important as a recreational species with significant catches by the charter boat sector (estimated to be 5 times the commercial fishery). Offshore boat anglers and some spearfishers also target mahi mahi around Fish Aggregating Devices (FADS).

- In the Atlantic mahi mahi grow rapidly and have a high total mortality rate (Oxenford, 1999).

- Since September 2007 there has been a minimum legal length of 60 cm total length (TL) and a recreational bag limit of 10 with only one fish over 110 cm TL for mahi mahi.

**Catch**

**Recreational Catch of Mahi Mahi**

The annual recreational harvest of mahi mahi in NSW is likely to be around 100 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Mahi Mahi**

![Graph showing historical landings of mahi mahi](image)

Commercial landings (including available historical records) of mahi mahi for NSW from 1990/91 to 2008/09 for all fishing methods.

Please visit the CSIRO website, [http://www.marine.csiro.au/caab](http://www.marine.csiro.au/caab) and search for the species code (CAAB) 37 338001, common name or scientific name to find further information.

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Mako Sharks

(Isurus spp.)

**EXPLOITATION STATUS** UNDEFINED

Relatively small catches occur in NSW - the majority of the catch is the shortfin mako, which has a global distribution. Mako sharks are an important target species in the recreational gamefish fishery.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Isurus oxyrinchus</em></td>
<td>shortfin mako</td>
<td>Oceanic and pelagic, occasionally caught close inshore.</td>
</tr>
<tr>
<td><em>Isurus paucus</em></td>
<td>longfin mako</td>
<td>Rarely reported in catches but could be understated due to mis-identification.</td>
</tr>
</tbody>
</table>

**Background**

The shortfin mako (*Isurus oxyrinchus*) and longfin mako (*I. paucus*) are both caught off NSW. The shortfin mako is widespread in Australian waters, and is found along the entire NSW coast. It is oceanic and pelagic, and occurs from the surface to depths of at least 650 m. The longfin mako is a more tropical species and has only been rarely reported in Australia, but has been recorded off central NSW.

Mako sharks are seldom found in waters below 16 °C. The shortfin mako reaches a maximum length of 395 cm, with both sexes growing at similar rates for the first 7 years. Thereafter, the male growth rate declines. Males mature at about 195 cm and females at 280 cm. Shortfin makos are oophagous, where the embryos feed off a succession of eggs ovulated by the female. Litters of 12 to 16 pups have been recorded off NSW, where birth takes place in early summer.

Due to the very small number of specimens examined, very little is known about the biology of the longfin mako. From Atlantic fisheries the maximum length is reported as 417 cm, with size at maturity of 205-228 cm for males and 245 cm for females. Reproduction is also oophagous, with litters of 2 to 8 young, and size at birth between 97 and 120 cm. This species has relatively longer pectoral fins (equal to headlength), and softer flesh, which makes it of lesser commercial value.

Pelagic fisheries target mako sharks for their meat and fins across the globe. NSW commercial catches of mako sharks are generally less than 5 t and almost entirely derived from the Ocean Trap and Line Fishery. The Commonwealth Eastern Tuna and Billfish Fishery catches a higher number of mako sharks, both off NSW and on the high seas. Mako sharks are also an important target species of the recreational gamefish fishery.
Additional Notes

- Commonly caught in the Commonwealth Eastern Tuna and Billfish Fishery - catches have been recently reduced by changes in gear selectivity.
- Local catch and catch rate data are also available from studies of recreational fisheries (Murphy et al., 2002; Lowry and Murphy, 2003; Park, 2007).
- There is a recreational bag limit of one mako shark.

Catch

Recreational Catch of Mako Sharks

The annual recreational harvest of mako sharks in NSW is likely to lie between 30 and 140 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 010001 and 37 010002, common name or scientific name to find further information.

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Mantis Shrimps (Stomatopoda)

**EXPLOITATION STATUS** | **UNDEFINED**
--- | ---
Species identification issues need to be resolved. Very small quantities are landed and it is unlikely an exploitation status could be specified.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomatopoda-undifferentiated</td>
<td>mantis shrimps (family code)</td>
<td></td>
</tr>
<tr>
<td><em>Erugosquilla grahami</em></td>
<td>[a mantis shrimp]</td>
<td></td>
</tr>
<tr>
<td><em>Harpiosquilla harpax</em></td>
<td>[a mantis shrimp]</td>
<td></td>
</tr>
<tr>
<td><em>Oratosquilla oratoria</em></td>
<td>[a mantis shrimp]</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

There are at least 450 species of stomatopods or mantis shrimp worldwide including almost 150 in Australian waters. Mantis shrimp are generally found in shallow marine waters, but some species have been found deeper than 1000 m.

Mantis shrimp are found singly or in pairs hiding in holes and self-excavated burrows in coral reefs, rocks, and soft substrates. Females lay eggs within their burrows and guard them until they hatch. Once hatched the larvae are planktonic. Within a few weeks the larvae settle to the bottom to build their own burrows. Some species of mantis shrimp may grow to a length of 55 cm.

Mantis shrimp actively hunt their prey with an enlarged second pair of legs, which resemble the front legs of the preying mantis insect. They can be broadly grouped into ‘spearmers’ which use their front claws to spear prey such as worms, other shrimp and fish, or ‘smashers’ which use their front claws to club their prey. They feed mainly on shelled animals such as crabs and snails. All mantis shrimp lie in
ambush, strike at passing prey and, when successful, drag their prey into their burrow or hole. Some tropical species of mantis shrimp use fluorescent signalling to lure prey.

Very small quantities of mantis shrimp are marketed annually in NSW, mainly from the Estuary Prawn Trawl Fishery. The recreational catch of mantis shrimp is insignificant.

Additional Notes

- Species are subject to problems with identification.
- Possibly several families represented in what are extremely small commercial landings.
- Much of the commercial catch came from Port Jackson (which no longer supports commercial fisheries).
- Recent reported landings have been very small (< 100 kg) - annual landings have not been reported due to privacy considerations.
- Mantis shrimp are a byproduct species in the Estuary Prawn Trawl Fishery.

Catch

Recreational Catch of Mantis Shrimps

The annual recreational harvest of mantis shrimp in NSW is likely to be insignificant.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 051000, 28 051032, 28 051036 and 28 051048, common name or scientific name to find further information.
Mirror Dory
(Zenopsis nebulosus)

EXPLOITATION STATUS
FULLY FISHED

Predominantly a Commonwealth fishery, with seasonal landings of mature fish by NSW trawlers north of Sydney during the winter months. Commonwealth status of ‘not overfished’ is consistent with ‘fully fished’, which is more appropriate for the NSW fishery.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zenopsis nebulosus</td>
<td>mirror dory</td>
<td></td>
</tr>
</tbody>
</table>

Background

Mirror dory (Zenopsis nebulosus) occur at depths of 50 to 600 m around southern Australia from northern NSW to central WA. They are caught by trawling in outer continental shelf and upper slope waters. The majority of landings come from depths between 300 and 600 m during the winter months when the fish aggregate for spawning along the NSW upper slope.

The mirror dory is a laterally compressed oval-shaped fish with a smooth silvery skin. They have a single row of spiny-edged scutes along the belly, and enlarged plates at the bases of the dorsal and anal fins. Large fish provide thick fillets of good quality flesh, and the species is regarded as a good table fish. Mirror dory have a large telescopic mouth and are predatory on smaller fish, crustaceans, and cephalopods.

Mirror dory larger than about 30 cm are marketed, and most of the catch consists of mature fish between 40 and 60 cm total length (TL) and weighing between 1.0 and 2.5 kg. Mirror dory reach a maximum age of about 12 years and weight of 3 kg, but most fish in landed catches are between 4 and 10 years of age. Females reach maturity at about 35cm TL (4 to 5 years of age). In NSW, mirror dory spawn over a protracted period throughout winter, from May to September. The eggs are large (2-3 mm diameter) and it is likely the species is a serial spawner. The larval development and early life history stages are not well known.

Most of the Australian mirror dory catch of 400-600 t comes from the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) which has an annual total...
allowable catch of about 600 t. In winter, NSW trawlers land up to 100 t per annum from the upper slope between Sydney and Port Stephens. Standardised catch rates in the SESSF have been stable in recent years which, combined with limited age composition data, indicates that mirror dory stocks are probably not overfished.

Additional Notes
- Only present in the NSW fishery on an intermittent basis during the winter months.
- Ageing studies indicated mirror dory were relatively fast growing and reach a maximum age of about 12 years, with the bulk of NSW catches likely to be fish of 4 to 8 years of age.
- Available data do not suggest any significant concerns with the stock.

Catch

Recreational Catch of Mirror Dory
The annual recreational harvest of mirror dory in NSW is likely to be less than one tonne.

Historical Landings of Mirror Dory

Commercial landings (including available historical records) of mirror dory for NSW from 1976/77 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 264003, common name or scientific name to find further information.
Mulloway
(Argyrosomus japonicus)

EXPLOITATION STATUS
OVERFISHED

Age composition of samples from commercial catches was indicative of an overfished stock, and the spawning potential ratio was estimated to be below the recommended threshold.

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<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argyrosomus japonicus</td>
<td>mulloway</td>
<td>Also known as ‘jewfish’. Previously called Argyrosomus hololepidotus.</td>
</tr>
</tbody>
</table>

Background

Mulloway (Argyrosomus japonicus) is a nearshore coastal (<100 m depth) species that also occurs in estuaries. In Australia, mulloway are distributed along the eastern, southern and western seaboard from the Burnett River in Queensland to North West Cape in WA. Mulloway also occur in the north-western Pacific and through the Indian Ocean as far west as Africa.

There is limited information available on the stock structure of mulloway. Genetic-based studies have been done only in Australia and the conclusions from these studies are limited as they were based on samples comprising very few individual fish from only a few locations. Some electrophoresis-based evidence showed that a separate sub-population of mulloway occurs in WA compared to the southern (SA and Victoria) and eastern (NSW and Queensland) seaboard, and that there may be additional population sub-structuring between fish in SA and NSW. However, preliminary data based on mitochondrial DNA (mtDNA) analysis did not appear to support this. No other genetic studies have been reported for the species and therefore the degree of genetic division among populations from different seaboard and oceans is not well known.

Small (<30 cm total length (TL)) juveniles are found in estuaries and nearshore coastal environments. Sub-adult and adult mulloway occur in estuarine and ocean waters. In estuaries, larger juveniles and sub-adult fish (>40 cm TL) appear to be more abundant in the lower reaches where salinities are nearer to seawater. Large individuals are caught around the mouths of estuaries, in surf zones and around rocky reefs and ridges in offshore waters.

Crustaceans accounted for between 14% and 81% of the reported diet of juveniles. The importance of crustaceans in the diet of mulloway appears to decrease with increasing fish size, with fish and squid being of greater relative importance in the diet of larger mulloway.
Mulloway grow to a large size and are relatively long lived. In South African waters the maximum length was recorded at 181 cm TL, weight of 75 kg and age of 42 years. In a recent NSW study the largest mulloway sampled was 165 cm TL (approximately 35 kg) and fish were aged to a maximum of 24 years. In NSW, size at 50% maturity for males was estimated at 51 cm (2+ years of age) and for females at 68 cm (3+ years of age). Mulloway are known to spawn in summer in Australian waters.

In NSW, significant catches of mulloway are taken by the Estuary General, Ocean Hauling and Ocean Trap and Line fisheries. Mulloway is also a very significant species in the recreational fishery, and catches by this sector are much larger than commercial landings. Better data on the size/age composition of recreational catches would improve the assessment.

**Additional Notes**

- Commercial landings remain low but catch rates have been more or less stable for the past decade.
- No accurate information on current recreational catches is available. Determining the size composition of recreational catches is considered a high priority.
- Age composition of commercial landings in the early 2000’s was indicative of a heavily fished stock (98% < 5 years old).
- Fishing mortality is estimated to be much greater than natural mortality.
- The minimum legal length (45 cm TL) is much smaller than the size at sexual maturity (~70 cm TL) for females. Review of the MLL should occur as part of any recovery program.
- Spawning potential ratio for mulloway (between 5% and 20%) is well below the recommended threshold of 25%.
- There has been confusion over the correct scientific name for mulloway, which has been referred to as *A. hololepidotus*. Griffiths and Heemstra (1995) conclude that Australian mulloway are correctly known as *A. japonicus*.
- There is a minimum legal length of 45 cm TL and a recreational bag limit of 5 mulloway with only 2 fish greater than 70 cm TL.

**Catch**

**Recreational Catch of Mulloway**

The annual recreational harvest of mulloway in NSW is likely to lie between 100 and 500 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Mulloway**

![Image showing historical landings of mulloway](image)

**Commercial landings (including available historical records) of mulloway for NSW from 1944/45 to 2008/09 for all fishing methods.**

**Landings by Commercial Fishery of Mulloway**

![Image showing landings by commercial fishery](image)

**Reported landings of mulloway by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.**
The length distribution of commercial landings of mulloway reflects changes in the minimum legal length (MLL) through time. There was no MLL prior to 1978/79 when a MLL of 38 cm total length (TL) was imposed, and this was increased to 45 cm TL in 1992/93. Since the mid 1990s the majority of mulloway in commercial landings have been between 45 and 60 cm TL.

Catch rates of mulloway harvested using handlines for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Age-length data with fitted growth curve for mulloway (Silberschneider and Gray, 2009). Lengths are presented as total length (TL).

The length distribution of commercial landings of mulloway reflects changes in the minimum legal length (MLL) through time. There was no MLL prior to 1978/79 when a MLL of 38 cm total length (TL) was imposed, and this was increased to 45 cm TL in 1992/93. Since the mid 1990s the majority of mulloway in commercial landings have been between 45 and 60 cm TL.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 354001, common name or scientific name to find further information.


Ocean Jacket
(Nelusetta ayraudi)

EXPLOITATION STATUS  FULLY FISHED
The abundance of ocean jackets appears to have increased significantly since 1999/2000. Status of all other leatherjacket species is undefined.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
</table>
| Nelusetta ayraudi | ocean jacket | Constitutes the majority of the leatherjacket catch. Previously known as chinaman leatherjacket.

Background
A number of leatherjacket species are taken by commercial and recreational fisheries operating in NSW waters. In recent years, however, leatherjacket landings have been dominated by ocean jackets (Nelusetta ayraudi). Other species of leatherjacket which are significant in landings are the yellowfin (Meuschenia trachylepis), velvet (M. scaber), sixspine (M. freycineti) and fanbelly (Monacanthus chinensis). The status of all these species is undefined, due to a lack of biological and fishery data.

Ocean jackets are distributed in southern Australian waters from Cape Moreton in Queensland to North West Cape in WA (including Tasmania). They can be found in waters from 2 m to 200 m in depth. Juveniles of this species occur close to shore in bays and estuaries and have been caught in seagrass, over sand and rocky reefs. Research from the Great Australian Bight suggests that this species schools in size classes with larger fish occurring in deeper water.

The diet of ocean jackets has been recorded as consisting of fish, invertebrates and salps. Recent NSW research has shown that both male and female ocean jackets mature at about 35 cm total length (TL), at about 2 to 3 years of age. They are a relatively fast growing and short lived species, with a maximum observed age of 6 years.

Analysis of historical steam trawl catch and effort data for 1918-23, 1937-43 and 1952-57 from the Australian South East Fishery showed that leatherjackets (assumed to be mostly ocean jackets) were very abundant in the early years of the fishery and then declined in abundance in later years. NSW trap fishers annually landed up to 1000 t of leatherjackets during the 1950s, however this level of harvesting appeared to be unsustainable.
**Additional Notes**

- Ocean jackets are a short lived species (up to 6 years) and grow to 70 cm. 50% of the species is mature (L50) at 35 cm TL.
- The age structure of commercial landings of ocean jackets during 2003/04 was dominated (~85%) by 2-3 year old fish.
- A number of secondary species are known to be important in landings, but there is a lack of biological and fishery data.
- There is a recreational bag limit of 20 leatherjackets.

**Catch**

*Recreational Catch of Leatherjackets*

The annual recreational harvest of leatherjackets in NSW (all species combined) is likely to lie between 110 and 180 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Historical Landings of All Species of Leatherjackets*

Commercial landings (including available historical records) of all species of leatherjackets for NSW from 1944/45 to 2008/09 for all fishing methods.

*Landings by Commercial Fishery of All Species of Leatherjackets*

- Ocean Trap and Line (Primary Species)
- Ocean Prawn Trawl (Key Secondary Species)
- Ocean Trawl
- Estuary General

Reported landings of all species of leatherjackets by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

*Catch Per Unit Effort Information of All Species of Leatherjackets Harvested by Fish Trapping in NSW*

Catch rates of all species of leatherjackets harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
The length distribution of ocean jacket landed by NSW commercial fishers in recent years comprised mainly fish between 30 and 50 cm total length (TL). There is no minimum legal length for leatherjackets in NSW.

**Length Frequency of Ocean Jacket**

The length distribution of ocean jacket landed by NSW commercial fishers in recent years comprised mainly fish between 30 and 50 cm total length (TL). There is no minimum legal length for leatherjackets in NSW.

**Growth Curve of Ocean Jacket**

Age-length data with fitted growth curve for ocean jacket (Miller, 2007). Lengths are presented as total length (TL).

**Further Reading**


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 465006, 37 465005, 37 465036, 37 465009 and 37 465059, common name or scientific name to find further information.
Ocean Perch

(*Helicolenus* spp.)

**Exploitation Status**

Fully Fished

Two relatively long-lived species comprise the majority of the catch of this group. Significant in both the Ocean Trawl and Ocean Trap and Line Fisheries but most of the catch comes from the Commonwealth South East Trawl fishery. Status in NSW is consistent with the Commonwealth status of ‘not overfished’.

### Scientific Name

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Helicolenus barathri</em></td>
<td>bigeye ocean perch</td>
<td>Also known as offshore ocean perch.</td>
</tr>
<tr>
<td><em>Helicolenus percoides</em></td>
<td>reef ocean perch</td>
<td>Also known as inshore ocean perch.</td>
</tr>
</tbody>
</table>

### Background

Five species of ocean perches (family Sebastidae) are found offshore along the NSW coast but two species comprise the bulk of the landings. The reef ocean perch (*Helicolenus percoides*) is distributed across the continental shelf and onto the upper slope in depths between about 80 and 350 m while the bigeye ocean perch (*H. barathri*) is an upper-slope species found in 250-800 m. The deepsea ocean perch (*Trachyscorpia capensis*) occurs mostly in mid-slope depths greater than 800 m and, because there is little fishing at such depths off NSW, few deepsea ocean perch are caught locally. Two similar species (*Neosebastes incisipinnis* and *N. scorpænoides*) are smaller fish which occur closer inshore, and are sometimes caught incidentally by trawl fishers.

The two species of *Helicolenus* found off NSW are very similar in appearance. However, the ‘inshore’ reef ocean perch tends to be orange in colour with small dark spots on the head and more defined darker vertical bands on the body, compared to the ‘offshore’ bigeye ocean perch which has a more overall pink-red colouration with greenish flecks on the scales. The reef ocean perch seldom exceeds 30 cm in length and is commonly 20-25 cm, whereas the bigeye ocean perch can reach more than 40 cm in length (1.5 kg) and live for 60 years. Most catches of bigeye ocean perch now comprise fish in the 25-35 cm range which are less than 15 years of age.
Ocean perch are lecithotrophic viviparous, meaning that egg fertilization and larval development occur inside the female fish. The larvae are released when they reach about 1 mm in length. The ocean perch breeding season extends from June to November and a single female can produce between 150,000 to 200,000 larvae per season. Ocean perch are ambush predators, rising quickly from the ocean floor to capture prey. Main food sources for ocean perch are royal red prawns, squid and smaller fish.

Ocean perch inhabit reef and areas of flat, hard seabed. Commercial catches are primarily taken by trawl although the quantity taken by line fishing methods is increasing. The two species of Helicolenus are important trawl fish around south-east Australia and the annual total allowable catch (TAC) for ocean perch (combined for the two species) in the Commonwealth managed Southern and Eastern Scalefish and Shark Fishery is around 500 t; the actual bigeye ocean perch catch is about 250 t and the catch of reef ocean perch, mostly taken south of NSW, is around 50-100 t. Because of its generally small size, relatively large quantities of reef ocean perch are discarded.

NSW landings are comparatively small, ranging between 15 and 30 t per annum since 2000. Most of the landings are reported by Ocean Trap and Line and Ocean Trawl Fisheries, and comprise mainly bigeye ocean perch.

Additional Notes

- Two main species in this group: the inshore form (Helicolenus percoideis) and the offshore form (H. barathri).
- NSW has a small line fishery, which targets the offshore species, though both species are sometimes harvested in the trawl fishery north of Sydney.
- Stock appears relatively stable after an initial fish-down – possibly due to existence of ‘refuges’ (reefs which are not able to be trawled).
- Monitoring of the size composition of NSW dropline catches is continuing at the Sydney Fish Markets.

Catch

Recreational Catch of Ocean Perch

The annual recreational harvest of ocean perch in NSW is likely to be less than 10 t. This estimate is based upon the results of the offshore trailer boat survey (Steffe et al. 1996) and onsite surveys undertaken by I & I NSW.

Historical Landings of Ocean Perch

Commercial landings (including available historical records) of ocean perch for NSW from 1976/77 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Ocean Perch

Reported landings of ocean perch by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
The length distribution of bigeye ocean perch (H. barathri) landed by NSW commercial fishers was relatively stable from the late 1980s to the early 1990s, and comprised mainly fish between 20 and 40 cm fork length (FL). The majority of fish measured during this period were caught in demersal trawl nets. A smaller number of ocean perch were measured during the late 1990s and recently (2005 to 2009) - these fish were mostly caught on droplines and were larger, between 30 and 40 cm FL. There is no minimum legal length for ocean perch in NSW.

**Further Reading**


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 287093, 37 287001, 37 287005, 37 287019 and 37 287046, common name or scientific name to find further information.
Ocean Trawl Squid (Teuthida)

**EXPLOITATION STATUS** UNDEFINED

Status of Gould’s or arrow squid (Nototodarus gouldi) has not been assessed in NSW. The main fishery is in Commonwealth waters - although a formal assessment has not been conducted the stock is considered to be ‘not overfished’ due to relatively low recent annual landings of this species which is considered to be an annual stock.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nototodarus gouldi</td>
<td>Gould’s squid</td>
<td>Also known as arrow squid and seine-boat squid. Important component of fish trawl catch off southern and central NSW.</td>
</tr>
<tr>
<td>Uroteuthis (Photololigo) spp.</td>
<td>slender squid</td>
<td>Also known as pencil squid. Important incidental catch of prawn trawling off northern NSW.</td>
</tr>
<tr>
<td>Uroteuthis (Photololigo) etheridgei</td>
<td>broad squid</td>
<td>Minor component of ocean prawn trawl catch.</td>
</tr>
<tr>
<td>Uroteuthis (Loliolus) noctiluca</td>
<td>bottle squid</td>
<td>Only a very minor component of landings from ocean waters near estuaries.</td>
</tr>
</tbody>
</table>

**Background**

New South Wales ocean trawlers catch several species of squid which, apart from southern calamari, have not been clearly defined in monthly catch returns. Landings mainly comprise Gould’s squid (Nototodarus gouldi) and an undescribed species, slender squid (Uroteuthis sp.). Broad squid (U. etheridgei) is sometimes present in catches from ocean waters and small quantities of the small bottle squid (U. noctiluca) may also be landed from school prawn grounds adjacent to estuaries. Gould’s squid has relatively low market acceptance (< $3 per kg) but broad squid and slender squid are more valuable ($5 - $10 per kg) and are often included with southern calamari landings.

Gould’s squid is distributed around the south of Australia from southern Queensland to about Geraldton in WA, and also occurs around the northern half of New Zealand, where the species supports a large fishery (approximately 10 thousand tonnes per year). They range in depth from shallow coastal bays to depths of over 500 m on the upper continental slope, but are most abundant between about 50 and 400 m. Gould’s squid have a typical cephalopod life cycle, living for about one year before breeding and dying. In southern waters, most males are mature at 20-25 cm mantle length (ML) and females around 30 cm, although males can attain 35 cm (1.2 kg) and females 40 cm (1.6 kg). North of about Montague Island, maturity of Gould’s squid occurs at smaller sizes than off southern Australia, and few are caught larger than about 25 cm ML.
Small quantities of Gould’s squid are landed by the NSW Ocean Trawl Fishery, mainly off the central coast. Much larger quantities of Gould’s squid are taken by trawlers and squid jig vessels operating in Commonwealth fisheries around southern Australia. These fisheries land one to two thousand tonnes per year, and although there is no formal stock assessment available, the status of these fisheries is considered to be ‘not overfished’ (Wilson et al. 2009).

Slender squid is a tropical shallow water species with distribution extending down Australia’s east coast to about Sydney in depths to about 100 m. Broad squid mainly inhabit estuaries and bays but, along with the slender squid, small numbers are also caught regularly on inshore ocean prawn grounds. Biological information is available for the broad squid but there is no detailed information available for the slender squid. However, data from Fisheries Research Vessel Kapala inshore trawl surveys showed that most slender squid were between 15 and 30 cm ML with some larger specimens almost 40 cm ML. Most slender squid off NSW matured at sizes greater than 20 cm ML.

The NSW catch of ‘arrow’ and ‘unspecified’ squid reported by the Ocean Fish Trawl sector (5-10 t per annum) probably consists mainly of Gould’s squid. The ‘squid’ landings reported by Ocean Prawn Trawlers (10-20 t) mainly comprise a mix of pencil squid and southern calamari. Onboard observer studies and fishermen’s co-op monitoring are needed to better quantify the species composition of ocean trawl squid catches.

**Additional Notes**

- Trawl landings off southern and central NSW are dominated by Goulds squid, but small proportions of morphologically similar species are likely to be present in catches including pencil or slender squid and bottle squid.
- Gould’s squid is a fast growing species, which lives for a maximum of about 1 year.
- Small catches of Gould’s squid are sometimes discarded because of low market price.
- Since 2000, landings have declined with declining trawling effort, but catch rates have remained reasonably stable.
- There is a combined recreational bag limit of 20 squid and cuttlefish.

**Catch**

*Recreational Catch of Ocean Trawl Squid*

The annual recreational harvest of ocean trawl squid in NSW is likely to be less than one tonne.

**Historical Landings of Ocean Trawl Squid**

Commercial landings (including available historical records) of ocean trawl squid for NSW from 1984/85 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

**Landings by Commercial Fishery of Ocean Trawl Squid**

Reported landings of ocean trawl squid by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 23 636004, 23 617901 and 23 617010, common name or scientific name to find further information.
Octopus

(*Octopus* spp.)

**Exploitation Status:** **Undefined**

Lack of fishery information on the species harvested precludes resource assessment at this time.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Octopus australis</em></td>
<td>southern octopus</td>
<td>The most common species harvested (around 70-80% of the landings).</td>
</tr>
<tr>
<td><em>Octopus maorum</em></td>
<td>Maori octopus</td>
<td>A minor species that is sometimes caught in waters off southern NSW. Also known as <em>Pinnoctopus cordiformis</em>.</td>
</tr>
<tr>
<td><em>Octopus pallidus</em></td>
<td>pale octopus</td>
<td>A minor species that is sometimes caught in waters off southern NSW.</td>
</tr>
<tr>
<td><em>Octopus tetricus</em></td>
<td>gloomy octopus</td>
<td>A minor species (~10% landings), mainly from central and northern NSW.</td>
</tr>
</tbody>
</table>

**Background**

Several genera and species of octopus are found in NSW waters. The southern octopus (*Octopus australis*) is found in coastal waters and bays on Australia’s east coast from central Queensland to southern NSW and is the most abundant species in NSW catches. It is a relatively small species with the arm-span of adults around 40 cm. The southern octopus lives on sand or mud substrates in depths between 3 and 140 m. Also commonly found along Australia’s east coast is the gloomy octopus (*Octopus tetricus*), a relatively large species with an arm-span that can reach 2 m. It is also a shallow water species inhabiting the southern Queensland and NSW coasts, mainly in seagrass beds and coastal reefs; small numbers are also caught regularly by trawlers in depths out to about 70 m.

The pale octopus (*Octopus pallidus*) has an arm-span reaching 60 cm. It is found around southeastern Australia from about Newcastle in the north to Ceduna in SA, and also around Tasmania. It inhabits a wide depth range from shallow sandy bays (in the south) to at least 275 m.

The largest Australian octopus is the Maori octopus (*Octopus maorum*) with an extended arm span of over 3 m. It is mainly a southern species ranging from central NSW to southern WA, and around Tasmania; it is also found in New Zealand. The Maori octopus commonly inhabits inshore coastal rocky reefs, seaweed and seagrass beds but is also found in offshore waters to a maximum depth of about 550 m.
During the day, most octopus hide in lairs or bury in the seabed. They emerge at night to feed, preying mainly on shellfish and crustaceans. Captured prey are first injected with poison which causes paralysis, before being consumed. Large species, such as the Maori octopus, are known to enter lobster traps and consume or remove rock lobsters.

Most octopus species live for 12-18 months and breed only once during their life. To reproduce, male octopus inseminate females using a modified third arm or hectocotylus. With this arm, sperm packets are deposited directly into the females’ mantle cavity and are ready to fertilize the eggs when they are released. Females lay eggs in rock crevices or attach them to sheltered hard surfaces. After hatching, the young of some species are planktonic and travel on ocean currents before settling on the bottom. The young of other species settle on the bottom immediately after hatching.

In Australia, octopus are mostly marketed for human consumption but some are used for bait. Commercial landings of octopus in NSW occur throughout the year but vary seasonally. Catches are greatest between January and May, with a peak in March. By far the largest quantities are harvested by the Ocean Trawl Fishery with smaller quantities landed by the Estuary Prawn Trawl and Ocean Trap and Line Fisheries. It is estimated that about 70-80% of the NSW octopus landings comprise southern octopus, mainly from northern NSW, with gloomy octopus another 10-20% of the commercial catch.

Commercial landings of all octopus species combined have been around 400 t per annum, but declined to less than 200 t in recent years, associated with reduced fishing effort by ocean prawn trawlers. Having a short lifecycle, octopus, like most cephalopods, are less susceptible to fishing pressure than most fish. However, there have been no biological studies or stock assessments of NSW octopus species and long-term effects of harvest are unknown.

**Additional Notes**

- In total, nine species of octopus were sampled in landings at the Sydney Fish Market by Nottage et al. (2007).
- The most common species in landings were *O. australis* (80% of landings) and *O. tetricus* (~10% of landings, central and northern NSW). *O. pallidus* and *O. maorum* were also commonly caught off southern NSW.
- There is a recreational bag limit of 10 octopus.

**Catch**

*Recreational Catch of Octopus*

The annual recreational harvest of octopus in NSW is not accurately known, but is likely to be less than 10 t.

**Historical Landings of Octopus**

![Graph showing historical landings of octopus](image-url)

Commercial landings (including available historical records) of octopus for NSW from 1979/80 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 23 659001, 23 659003, 23 659004 and 23 659006, common name or scientific name to find further information.
Pearl Perch

*(Glaucosoma scapulare)*

**EXPLOITATION STATUS**  UNDEFINED

Pearl perch are predominantly harvested in Queensland. Biological research on this species has recently been completed in NSW, but results of current research in Queensland are needed before an exploitation status can be specified.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Glaucosoma scapulare</em></td>
<td>pearl perch</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Pearl perch (*Glaucosoma scapulare*) occur in coastal and continental shelf waters (depths 10 to 150 m) between Rockhampton in Queensland and Sydney in NSW. They are generally found close to submerged reefs, rock ledges or rough bottom. They seem to prefer places of high water movement in shallow water, yet seek the protection of isolated reefs in gutters and channels in deeper waters. Although individual fish are sometimes observed, most are seen in small groups or schools. This species can sometimes be a midwater feeder moving well up from the bottom to take bait during the night, however most pearl perch are caught near the bottom during the day.

Pearl perch can reach a maximum length of about 70 cm fork length (FL) but sizes of 30-50 cm FL are more common. The largest reported weight for this species is 7.3 kg taken from the 35 fathom reefs east of Moreton Bay in July 1991.

Pearl perch are highly regarded as a table fish and command a high market price. The species is targeted by recreational fishers in ocean waters off northern NSW.
Additional Notes

- Pearl perch occur off northern NSW and southern Queensland. They are a significant species in the recreational/charter boat fishery - it is likely that recreational landings are greater than the commercial catch off NSW.
- NSW commercial landings have been relatively stable at 10 - 15 t for the past decade, and catch rates have shown a recent increase.
- Research in NSW aged pearl perch to a maximum of 18 years, but the majority of fish sampled were less than 6 years old. No reproductively active fish were found in NSW.
- There is a minimum legal length of 30 cm total length and a recreational bag limit of 5 pearl perch.

Catch

Recreational Catch of Pearl Perch

The annual recreational harvest of pearl perch in NSW is likely to be less than 30 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Pearl Perch

Catch rates of pearl perch harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
The length distribution of pearl perch landed by NSW commercial fishers during 2004 to 2007 was comprised mainly of fish between 25 and 45 cm fork length (FL). A minimum legal length of 30 cm total length (approximately 29 cm FL) was introduced for pearl perch in NSW in September 2007.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 320003, common name or scientific name to find further information.
Pipi

(Donax (Plebidonax) deltoides)

EXPLOITATION STATUS: UNCERTAIN

Landings have declined markedly since 2005 and there is considerable concern amongst commercial fishers that catch rates have dropped to uneconomic levels, despite the reasonably high prices received. There is insufficient information to allow specification of an exploitation status.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donax (Plebidonax) deltoides</td>
<td>pipi</td>
<td>The same species is known as eugarie in Queensland and Goolwa cockle in South Australia.</td>
</tr>
</tbody>
</table>

Background

The pipi (Donax (Plebidonax) deltoides) occurs on surf beaches from southern Queensland southwards to Eyre Peninsula in SA. They are found in the surf zone, i.e. intertidal and shallow subtidal waters along high energy beach coastlines. Whilst pipis are harvested within the Estuary General Fishery, they are not normally found in estuaries. Like most bivalve molluscs, pipis filter feed by extracting microscopic matter (particularly phytoplankton) from the water.

In NSW, pipis grow rapidly and reach sexual maturity at about 3.7 cm shell length within the first 10 to 12 months of life. Pipis appear to be capable of spawning all year round, giving rise to ‘cohorts’ of recruitment of small pipis (less than 1 cm shell length) onto beaches. However, not all recruited cohorts become established in the population. Pipis grow to more than 6 cm shell length and are believed to live for up to 4 or 5 years.

There was a considerable peak in landings of pipis in 1996/97 before several events of human sickness following consumption of pipis caused this part of the fishery to be closed periodically during 1997 and 1998. The pipis were contaminated by algal blooms occurring off some beaches in summer. Access to this part of the fishery has subsequently been limited to fishers who operate in accordance with an approved biotoxin management program. Under the program, fishers test the water regularly for the presence of algae and cease harvesting if concentrations are above threshold levels.

Pipis are collected exclusively by hand in the Estuary General Fishery, by endorsement holders. Apart from human consumption in soups and chowders, pipis are also sold as bait for recreational fishers. Considerable quantities are also collected by recreational fishers for use as bait.
Additional Notes

- Commercial landings have declined from more than 500 t in 2004/05 to less than 100 t in recent years, despite a very significant increase in price over this period.
- The commercial harvest may no longer be greater than the recreational harvest, although no data are available on trends in the latter.
- The unit for measuring commercial catch rates was reviewed in 2009 and found to be appropriate – catch per unit effort has declined even though effort had apparently been reasonably stable over the past decade.
- Some monitoring of size composition of catches from selected beaches has been continued at the Sydney Fish Market but catches have been sporadic. Monitoring of the size composition does not appear to provide useful information on stock status.
- There is a combined recreational bag limit of 50 cockles, mussels and pipis.

Catch

Recreational Catch of Pipi

The annual recreational harvest of pipi in NSW is likely to lie between 20 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW. Additional information is available from Murray-Jones and Steffe (2000).

Historical Landings of Pipi

Commercial landings (including available historical records) of pipi for NSW from 1984/85 to 2008/09 for all fishing methods.
The length distribution of pipis landed by NSW commercial fishers from Stockton Beach is comprised mainly of pipis between 5 and 8 cm shell length (SL). There is no minimum legal length for pipis in NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 23 359001, common name or scientific name to find further information.
Red Gurnard and Latchets (Triglidae)

**EXPLOITATION STATUS**  UNDEFINED

Red gurnard is the primary species landed in NSW waters. There is little local information to assess status.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelidonichthys kumu</td>
<td>red gurnard</td>
<td>Majority of the NSW landings.</td>
</tr>
<tr>
<td>Pterygotrigla andertoni</td>
<td>painted latchet</td>
<td>Deepwater species; minor landings only in NSW.</td>
</tr>
<tr>
<td>Pterygotrigla polyommata</td>
<td>latchet</td>
<td>Minor landings in NSW. Sometimes called sharpbeak gurnard.</td>
</tr>
</tbody>
</table>

**Background**

The gurnard family (Triglidae) comprise about 120 species worldwide with more than 30 species found in Australian waters. Gurnards are benthic fish found primarily in depths less than 200 m. Off NSW, several species of small butterfly gurnards (*Lepidotrigla* spp.) are a major component of trawl-bycatch. However, there are three species of gurnards in NSW waters that grow large enough to be marketed. The red gurnard (*Chelidonichthys kumu*) occurs mainly in deeper estuarine and inner continental shelf waters in depths less than 100 m around most of Australia. Red gurnard are also found through much of the tropical and temperate waters of the Indo-Pacific region, including New Zealand. Latchet (*Pterygotrigla polyommata*) are a more temperate species, occurring off all southern Australian states but generally inhabiting deeper waters, from 100 to 400 m. The painted latchet (*Pterygotrigla andertoni*) is found mainly on the upper slope between 200 and 400 m depth, and is distributed around southern Australia and other areas of the southwest Pacific, including New Zealand.

Red gurnard grow to about 55 cm in length and almost 2 kg in weight, while the two species of latchet seldom reach 50 cm in length. There is no biological information on red gurnard or latchet in Australia, but New Zealand studies of red gurnard found that they reached around 23 cm fork length (FL) after 2-3 years and could live for 15 years.

Historically in NSW, the names for red gurnard and latchet were confused and reported catches were often ascribed to the wrong species. Consequently, landings of all three species were combined for catch statistics. A new catch reporting system introduced in July 2009 requires catches of the three species to be reported separately.
The NSW catch of red gurnard and latchets is taken almost totally by the fish-trawl sector of the Ocean Trawl Fishery, with recent landings remaining relatively stable at around 25 to 30 t per annum. Significant quantities of mainly latchet are also taken in the Southern and Eastern Scalefish and Shark Fishery from grounds south of Sydney. The recreational catch of red gurnard and latchet is estimated to be less than 10 t per annum.

**Additional Notes**

- Monitoring of the size composition of NSW commercial landings of red gurnard was recommenced in 2008/09 at the Sydney Fish Markets.
- Landings by NSW trawl fishery are low (< 50 t), and catch rates are low but reasonably stable (however changes may be masked by the combination of past catch data for three species).
- These species are also harvested by Commonwealth fisheries (latchet - 80 tonnes per annum, red gurnard - 100 tonnes per annum) but are not managed by catch quota, therefore major assessment projects have not been undertaken and few biological data have been collected.
- Species aggregate at certain times of the year, and sometimes large catches can be taken.
- Red gurnard are also taken incidentally by recreational fishers in both estuarine and ocean waters.

**Catch**

*Recreational Catch of Red Gurnard and Latchets*

The annual recreational harvest of red gurnard and latchets in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 288001, 37 288005 and 37 288006, common name or scientific name to find further information.
Red Morwong  
(*Cheilodactylus fuscus*)

**EXPLOITATION STATUS**  
UNDEFINED

Few data are available to assist in determining exploitation status. Very small by-catch from commercial trap fishing - the major harvest is by recreational spear fishing.

### SCIENTIFIC NAME  
*Cheilodactylus fuscus*  
### STANDARD NAME  
Red Morwong

---

**Background**

The red morwong (*Cheilodactylus fuscus*) is confined to the east coast of Australia, from southern Queensland to Bass Strait, with the western-most record being Queenscliff, Victoria. It is also found off northeastern New Zealand. Red morwong prefer shallow water, rarely any deeper than 30 metres, and electronic tracking studies have shown them to be quite territorial with relatively small home ranges. Red morwong are a gregarious species and individuals remain affiliated with the one aggregation at a fixed location for years. This species does not form part of a significant commercial fishery, but as one of the largest resident species (maximum length 65 cm fork length (FL), and weight of 3.5 kg), it is a primary target species for spearfishers in southeast Australian waters.

Ageing of red morwong from NSW showed that they grow rapidly, reaching a length of about 30 cm FL after 5 years. They can reach ages in excess of 30 years, but the majority of fish sampled were aged less than 15 years. Little is known about the reproductive biology of red morwong.

The vulnerability of this species to spearing, their limited home range and the tendency for aggregations to structure local populations in relatively shallow water all provide the opportunity for even marginal increases in mortality rates to have significant impact on local populations. Spearfishers constitute only a small percentage of recreational effort, but their catch is highly selective for the larger target species resulting in a reduction in the abundance and modal size-distribution of...
popular target species. There is evidence that spearing is responsible for the localised depletion of morwong populations in New Zealand. A better understanding of the activities of spearfishers in relation to the harvest of red morwong should be regarded as a priority for the future assessment of this species.

**Additional Notes**

- Red morwong are more abundant in NSW waters than banded morwong.
- There is a small commercial catch in NSW, about 3 t annually. Recreational spear fishing is probably the main harvest sector, but quantitative data have not been collected.
- The species is relatively long lived, to a maximum of about 40 years of age.
- Red morwong have a defined home range, which suggests they may be vulnerable to localised depletions.
- Red morwong have a minimum legal length of 25 cm TL and a bag limit of 5 in NSW.

**Catch**

**Recreational Catch of Red Morwong**

The annual recreational harvest of red morwong in NSW is not accurately known but is thought to be less than 10 t.

**Historical Landings of Red Morwong**

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Landings (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95/96</td>
<td>1</td>
</tr>
<tr>
<td>96/97</td>
<td>2</td>
</tr>
<tr>
<td>97/98</td>
<td>3</td>
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<td>98/99</td>
<td>4</td>
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<td>99/00</td>
<td>5</td>
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<td>00/01</td>
<td>6</td>
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<tr>
<td>01/02</td>
<td>7</td>
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<td>02/03</td>
<td>8</td>
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<td>03/04</td>
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<td>05/06</td>
<td>11</td>
</tr>
<tr>
<td>06/07</td>
<td>12</td>
</tr>
<tr>
<td>07/08</td>
<td>13</td>
</tr>
</tbody>
</table>

**Commercial landings (including available historical records) of red morwong for NSW from 1990/91 to 2008/09 for all fishing methods.**

**Landings by Commercial Fishery of Red Morwong**

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Ocean Trap and Line</th>
<th>Estuary General</th>
</tr>
</thead>
<tbody>
<tr>
<td>97/98</td>
<td>1</td>
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<tr>
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<td>02/03</td>
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<td>6</td>
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<td>03/04</td>
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<td>04/05</td>
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<td>05/06</td>
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<td>06/07</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>07/08</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

Reported landings of red morwong by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 335001, common name or scientific name to find further information.
Redfish

(*Centroberyx affinis*)

**Exploitation Status**
Predominantly a Commonwealth fishery. The population is growth overfished and is very much depleted, but a full population model has not been successfully developed. The Commonwealth status has moved from 'Growth Overfished' to 'Uncertain', reflecting the lack of a good assessment of the extent of biomass depletion, but 'Growth Overfished' has been retained as it best describes the status of the stock in NSW.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Centroberyx affinis</em></td>
<td>Redfish</td>
<td>Also known as nannygai.</td>
</tr>
</tbody>
</table>

**Background**
Redfish (*Centroberyx affinis*) occur in continental shelf and upper slope waters (depths from 10 to 500 m) from northern NSW to eastern Bass Strait. Juvenile fish occur in the deeper bays and estuaries and over reefs in inshore waters. Redfish is a strongly schooling species, generally occurring in association with hard bottom types and other structures (e.g. shipwrecks).

Redfish are mostly caught in the Commonwealth fisheries, where recent landings have been around 200 t - despite the Total Allowable Catch being about 800 t. Recent landings from NSW-managed commercial fisheries are less than 50 t. Smaller quantities of redfish are taken by recreational fishers off NSW.

Redfish are slow growing and long-lived fish, which may reach a maximum age of about 30 years and 1 kg in weight. Most aspects of the species' biology have been studied and are reasonably well understood. A long time series of monitoring data is available for Commonwealth fisheries and research trawls, and some data are available on the size composition of catches by NSW trawlers in recent years.

Reasonably detailed stock assessments conducted as part of the Commonwealth process indicate that the redfish stock is significantly growth overfished (i.e. on average, fish are caught at too small a size to maximise the yield in weight). The most recent Commonwealth assessment is uncertain as to whether the redfish stock is overfished, however all the main indicators suggest that the stock remains significantly depleted.
Additional Notes

- A schooling species predominantly taken by the Commonwealth trawl fishery. In NSW redfish are taken by the ocean trawl, ocean trap and line, and recreational sectors.

- Redfish is a long-lived (30+ yrs) schooling species and is vulnerable to trawl fishing.

- Discarding of small fish was a serious problem prior to 2005. Gear changes to reduce discarding have been introduced, however in recent years the modal length of redfish in landed catches was just 17 cm fork length (FL).

- Monitoring of the size composition of redfish landed by NSW commercial fishers was recommenced in 2009 and is continuing.

Catch

Recreational Catch of Redfish

The annual recreational harvest of redfish in NSW is likely to lie between 20 and 40 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Redfish

Commercial landings (including available historical records) of redfish for NSW from 1946/47 to 2008/09 for all fishing methods. Note that the decline in reported catch during the late 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 258003, common name or scientific name to find further information.
River Eels

*(Anguilla spp.)*

**Exploitation Status: Lightly to fully fished**

Stock status varies between catchments, with some areas being lightly fished and other areas subject to significant fishing effort. Overall catch rate is relatively stable, with a decline in commercial fishing effort since the late 1990s.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anguilla reinhardtii</em></td>
<td>Longfinned eel</td>
<td>Primary target of the commercial fishery</td>
</tr>
<tr>
<td><em>Anguilla australis</em></td>
<td>Shortfinned eel</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

There are two species of ‘river eel’: the longfinned river eel (*Anguilla reinhardtii*) and the shortfinned river eel (*A. australis*). Both species occur along the entire NSW coast, but longfinned eels are the primary target of the commercial fishery. Within Australia, the shortfinned river eel has a more southerly distribution (approximately between Brisbane and Tasmania) than the longfinned river eel (between Cape York and Tasmania). Both species are also found at Lord Howe Island and Norfolk Island as well as in New Caledonia and New Zealand. Longfinned eels are also found in New Guinea and the Solomon Islands. In NSW waters, both species occur in estuaries and in most freshwaters east of the Great Dividing Range, with the longfinned river eel preferring riverine and estuarine habitats while the shortfinned river eel is more likely to be found in still or slow flowing fresh waters. River eels are the top carnivores in upper catchment waters, feeding on crustaceans, molluscs, terrestrial and aquatic insects, and in the case of larger individuals, fish (including other eels) and small waterfowl.

Spawning occurs in deep ocean waters (believed to be in the Coral Sea), typically during winter. River eels pass through two distinct larval stages: the leaf-like ‘leptocephalus’ larva and the un-pigmented, eel-shaped post-larvae known as ‘glass eel’ or ‘elver’. After a long larval period (almost one year) the elvers enter estuaries and freshwaters. In the process, they quickly develop into fully pigmented sub-adults or ‘yellow eels’, which are the focus of the commercial fishery. River eels are less affected by in-stream barriers than are most finfish, and are able to ascend most dams and weirs provided suitably damp conditions are available. River eels appear to grow slowly, taking about 20 to 50 years to reach sexual maturity. In general, females grow to a much larger size than males. Mature eels migrate downstream (with the assistance of floodwaters) before swimming up to 3000 km to reach the spawning area. Maximum length is about 165 cm for longfinned river eels and about 110 cm for shortfinned river eels. Adults are presumed to die after spawning.

River eel landings were first recorded separately in 1969. Recorded landings remained low (less than 100 t per year) until 1991. During this period most of the landings were recorded from the Clarence River. The primary market was for locally smoked eel meat or frozen fillets exported to Europe. Prices for both
markets were relatively low. In the early 1990s, a high value market developed for live eels for export to China. Fishing effort in the estuaries increased substantially and permits were issued for harvesting from impoundments in 1991.

Peaks in eel fishing activity vary between catchments. In the Clarence River eel trapping is generally a winter activity. Commercial eel fishing in the Hawkesbury River, however, peaks earlier in the year, and is possibly market driven to supply the high export demand for the Chinese New Year.

Eels are taken almost exclusively in eel traps. Most of the catch is exported live to China and a very small proportion of the catch is sold as whole fish through the Sydney Fish Market.

Additional Notes

- River eels represent an economically valuable fishery, with precautionary management strategies in place because of the complex life history of these long lived species.
- With the exception of some impoundments where fishing occurs under permit, commercial fishing is not allowed in freshwater (where the majority of female eels occur).
- Commercial landings fluctuate over time, and have declined over the past decade - but analysis is confounded by a reduction in fishing effort and the possible effects of the drought. After declining in the 1990s, recent commercial catch rates are relatively stable.
- Recreational landings are not accurately known, and may be significant in some catchments near population centres.
- There is a minimum legal length of 58 cm and recreational bag limit of 10 longfinned eels and a minimum legal length of 30 cm and recreational bag limit of 10 shortfinned eels.

Catch

Recreational Catch of River Eels

The annual recreational harvest of river eels in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of River Eels

Landings by Commercial Fishery of River Eels

Reported landings of river eels by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy. Catches from impoundments are excluded from this figure.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 056001 and 37 056002, common name or scientific name to find further information.
River Garfish

(Hyporhamphhus regularis ardelio)

**EXPLOITATION STATUS**
FULLY FISHED

Study of catches from three estuaries suggested fishing mortality was approximately equal to natural mortality. Status may vary from estuary to estuary but, state-wide, the species should be considered to be fully fished.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyporhamphhus regularis ardelio</td>
<td>river garfish</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

River garfish (*Hyporhamphhus regularis ardelio*) belong to the family Hemiramphidae (commonly known as garfishes). They are found in coastal lakes and estuaries and sometimes freshwaters between Gladstone in Queensland and the Gippsland Lakes in Victoria. Typical of all garfishes, they are 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.

River garfish are multiple batch spawners between July and December in NSW estuaries. They produce relatively large eggs (~2.5 mm diameter) that are covered with filaments of 5 to 10 mm long that allow them to attach to floating or benthic vegetation. Batch fecundity increases linearly with fish length up to approximately 2300 eggs. River garfish mature at approximately 16 cm fork length and about 1 year of age. They have been reported to attain approximately 29 cm fork length and 7 years of age. Females grow faster and attain larger sizes than males. The sex ratios in commercial landings are strongly biased towards females.

The fishery for river garfish in NSW is almost exclusively within the Estuary General Fishery. River garfish are caught using the method of bullringing and are generally between 18 and 27 cm fork length and 1 to 5 years old. Bullringing nets are essentially boat-based mesh nets that are fished in shallow water. The commercial fishery for river garfish is distinctly seasonal and peaks during the winter months. The most important estuaries for commercial landings of river garfish in NSW are Lake Illawarra, Wallis Lake, Tuggerah Lakes and Port Stephens. Commercial landings of river garfish declined after 2000; however this appears to have been due to a reduction in fishing effort. Landings and catch rates both increased in 2008/09.
Additional Notes

- Commercial landings of river garfish are significant for a number of NSW estuaries, and the species is also significant in recreational catches.
- The commercial catch has declined over the past decade, however fishing effort has also declined and catch rates have remained stable.
- Fishing mortality in three estuaries during the early 2000’s was approximately equal to natural mortality (Stewart et al., 2005) and the age composition of catches was stable over the 2 years of the study. The reproductive potential was assessed to be approximately 40% of unfished levels.
- River garfish are subject to a recreational bag limit of 50.

Catch

Recreational Catch of River Garfish

The annual recreational harvest of river garfish in NSW is likely to be less than 20 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of River Garfish

Commercial landings (including available historical records) of river garfish for NSW from 1984/85 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of River Garfish

Reported landings of river garfish by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of River Garfish Harvested by Mesh-Netting and Bullrigging in NSW

Catch rates of river garfish harvested using mesh-netting and bullrigging for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Length Frequency of River Garfish

The length distribution of river garfish landed by NSW commercial fishers between 2001 and 2004 comprised mainly fish between 20 and 25 cm fork length (FL). There is no minimum legal length for river garfish in NSW.
Age-length data with fitted growth curve for male river garfish (Stewart and Hughes, 2007). Lengths are presented as fork length (FL).

Age-length data with fitted growth curve for female river garfish (Stewart and Hughes, 2007). Lengths are presented as fork length (FL).

**Further Reading**


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 234012, common name or scientific name to find further information.
Rock Blackfish

*(Girella elevata)*

**EXPLOITATION STATUS**

**UNDEFINED**

A coastal rocky foreshore species fished by recreational line and spear fishers. Almost no biological or fishery data are currently available for this species however a biological study is underway.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
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<tbody>
<tr>
<td><em>Girella elevata</em></td>
<td>rock blackfish</td>
<td>Also called black drummer.</td>
</tr>
<tr>
<td><em>Kyphosus sydneyanus</em></td>
<td>silver drummer</td>
<td></td>
</tr>
</tbody>
</table>

Background

Rock blackfish (*Girella elevata*) occur from southern Queensland to eastern Tasmania and also around Lord Howe Island and New Zealand. They are closely related to luderick (*Girella tricuspidata*) and look similar, but do not have the vertical dark bars characteristic of luderick. Juvenile rock blackfish are light grey-brown in colour and commonly occur in rock pools in the intertidal zone. Adult rock blackfish are a uniform dark blue-black in colour and live in the wave surge zones around rocky headlands and offshore islands, generally where there is a lot of environmental structure such as caves and crevices.

Rock blackfish are powerful swimmers, and are sought by recreational fishers because of their fighting ability and good eating qualities. They are omnivorous, and eat a wide range of species including crabs, cunjevoi and algae. Rock blackfish can grow to a maximum size of about 65 cm in length and 9 kg in weight, however fish greater than 3 kg are considered rare. It is possible that the stock has been significantly depleted by fishing, but there is very little biological or fishery data on which to base an assessment. A PhD study of the biology of and fishery for rock blackfish commenced in 2010.
The silver drummer (*Kyphosus sydneyanus*) occurs in similar habitats in southern Australian waters, and grows to a much larger size than rock blackfish (up to 75 cm in length and 15 kg in weight). Although superficially similar, as its name implies the silver drummer is much lighter in colour, and is easy to distinguish from rock blackfish by the number of spines in the dorsal fin (11, as opposed to 13 in the rock blackfish). The silver drummer has poor eating qualities, and is not highly sought by commercial or recreational fishers.

In NSW rock blackfish are subject to a minimum legal length of 30 cm and a bag limit of 10 per person. There is no reported commercial catch, and no reliable estimate of current recreational landings.

**Additional Notes**

- Related to luderick and reported to grow to about 7 - 9 kg in weight - targeted by line and spear fishing in ocean waters near rocky headlands.
- No commercial catch reported, and no reliable estimates of recreational catch are available.
- There are concerns that rock blackfish may be subject to significant localised depletion.
- A bag limit of 10 fish and minimum legal length of 30 cm apply to NSW recreational fishers.

**Catch**

*Recreational Catch of Rock Blackfish*

The annual recreational harvest of rock blackfish in NSW is not accurately known.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 361006 and 37 361001, common name or scientific name to find further information.
Royal Red Prawn
(*Haliporoides sibogae*)

**Exploitation Status**  
**Lightly Fished**

The limited targeting of this species and the recent decline in landings is associated with the low market price received for this species.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Haliporoides sibogae</em></td>
<td>Royal Red Prawn</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The royal red prawn (*Haliporoides sibogae*) is a deepwater species recorded from both the east and west coasts of Australia. In the west it ranges from about Perth northwards across the North West Shelf to Indonesia. The eastern population extends from south east Queensland to waters east of Bass Strait. The two populations are probably distinct with the eastern form currently recognised as a subspecies (*H. sibogae australiensis*).

The royal red prawn is a demersal species inhabiting soft substrates along the upper continental shelf. Off NSW, it has been found in depths between 230 and 825 m but is most abundant in 400-550 m. Females grow larger than males, having a maximum carapace length (CL) of almost 5 cm and weighing more than 40 g; males reach a maximum of about 3.5 cm. Unlike the annual life-cycle and 1 - 2 year life-span of most shallow-water prawns, female royal red prawns may live 3 - 4 years. Males become sexually mature at a CL of around 2.6 cm and most breed only once; in contrast, females reach sexual maturity at a CL of around 3.1 cm and may breed several times throughout their life. Royal red prawn eggs are blue and mature females are characterized by the conspicuous blue ovary running through the body to the tail. Off NSW, there are two breeding seasons each year, one around March-April and the other in July-August. Royal red prawns are benthic feeders on micro-molluscs, crustaceans, and worms, and are an important food source for many benthic fish species.

Currently, the only significant commercial fishery for royal red prawns in Australia is off NSW and is shared between the Southern and Eastern Scalefish and Shark Fishery (SESSF) and the NSW Ocean Trawl Fishery. The fishery began off Wollongong in the late 1970s, and trawlers from Wollongong, Sydney, Newcastle and Port Stephens have regularly targeted royal red prawns since. In past years, royal red prawns were occasionally fished by vessels from Coffs Harbour and the Clarence River in the north, and Ulladulla and Bermagui in the south. For a brief period in the 1980s, trawlers worked for royal red prawns off southern Queensland. The fishery is market-driven with frequent lack of demand and low wholesale prices resulting in a relatively lightly fished stock.
Endorsed trawlers from the central NSW ports normally use a single royal red prawn trawl net while northern trawlers retain their standard triple-rig gear used for eastern king prawns. Royal red prawns can be caught during both day and night although daytime catch rates are generally higher. There is an annual total allowable catch of 374 t for royal red prawns in the SESSF (2007) but catches since 2000 have been less than 250 t. Annual landings by NSW ocean prawn trawl vessels from waters north of Sydney were around 200 t between 1997 and 2003 but have since dropped to very low levels as demand has lessened. There have been no quantitative stock assessments of the royal red prawn stock in the SESSF or NSW Ocean Trawl Fishery but royal red prawns are believed to be lightly fished.

Additional Notes
- There has been a significant decline in targeting of royal red prawns since 2002/03 - recently only sporadic fishing has occurred.
- Catch rates were stable prior to 2007/08.
- The Commonwealth assessment considers royal red prawns to be ‘not overfished’.

Catch

Recreational Catch of Royal Red Prawn
There is no recreational harvest of royal red prawns in NSW.

Historical Landings of Royal Red Prawn

Landings by Commercial Fishery of Royal Red Prawn

Catch Per Unit Effort Information of Royal Red Prawn Harvested by Royal Red Prawn Trawling in NSW

Reported landings of royal red prawn by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch rates of royal red prawn harvested using royal red prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Status of Fisheries Resources in NSW, 2008/09

Growth Curves of Royal Red Prawn

Growth curves of royal red prawn using parameters from Baelde (1994). Lengths are presented as carapace length (CL).

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 714005, common name or scientific name to find further information.
Sand Mullet
*(Myxus elongatus)*

**EXPLOITATION STATUS**
*UNDEFINED*

This species has minor commercial and recreational importance. Biological data (growth rates and size at maturity) are available, but information on length or age composition of catches is lacking.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Myxus elongatus</em></td>
<td>sand mullet</td>
<td></td>
</tr>
</tbody>
</table>

## Background

Sand mullet (*Myxus elongatus*) occur in estuarine and coastal waters from Queensland to South Australia, and in the waters of Lord Howe and Norfolk Island. Sand mullet have a more pointed snout than sea mullet (*Mugil cephalus*) and can also be distinguished by the presence of a black spot on the pectoral fin base. Sand mullet also have a gold blotch on the upper opercle similar to gold spot mullet (*Liza argentea*) and can be easily distinguished from this species by the number of soft rays in the anal fin - sand mullet have nine rays whereas gold spot mullet have 10 rays.

Sand mullet reach a maximum age of about 12 years at a length of about 40 cm fork length (FL) and weight of 1 kg, but catches are mostly comprised of smaller fish, 25 to 30 cm FL. They posses a single row of small teeth in the upper jaw, which suggests a more carnivorous diet than most other mullet species, and they are frequently taken by anglers using worms or other flesh baits. Female sand mullet mature at about 3 years of age and 25 cm FL, and fish with developing gonads are found near estuary mouths between November and March. Spawning is thought to occur during mid to late summer in ocean waters, although females in spawning condition (with hydrated ova) have yet to be observed.

Sand mullet are mainly taken by the Estuary General Fishery and historic landings averaged 20 to 50 t per annum until the 1990s when landings increased to approximately 150 t. Recently, landings have declined to around 100 t. In NSW sand mullet are not subject to a minimum legal length, but are included in the bag limit of 20 for all mullet species combined. Anglers are also allowed to take up to 20 ‘poddy’ mullet (small fish, less than 15 cm in length, all species combined) for use as live bait.
Additional Notes

- Commercial landings of sand mullet are around about 100 tonnes per annum - there is possible confusion with other species (sea mullet) in commercial catch records. Recreational catches are probably significant, but are not accurately estimated.
- The species is harvested by recreational fishers as juveniles (‘poddy’ mullet used for bait) and also as adults.

Catch

Recreational Catch of Sand Mullet

The annual recreational harvest of sand mullet in NSW is likely to be less than 10 t.

Historical Landings of Sand Mullet

Commercial landings (including available historical records) of sand mullet for NSW from 1997/98 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Sand Mullet

Reported landings of sand mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 381003, common name or scientific name to find further information.
**Sand Whiting**

*(Sillago ciliata)*

<table>
<thead>
<tr>
<th>EXPLOITATION STATUS</th>
<th>FULLY FISHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand whiting are targeted by recreational anglers and commercial fishers throughout their range. Commercial landings and catch rates are stable.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sillago ciliata</em></td>
<td>sand whiting</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

The sand whiting (*Sillago ciliata*) occurs along the entire eastern coastline of Australia, from Cape York (Queensland) to Victoria and eastern Tasmania. It is also found in New Caledonia and Papua New Guinea. In NSW waters, sand whiting are found in estuaries and coastal waters off ocean beaches. Within estuaries, the favoured habitat is bare sandy substrate. Sand whiting eat bottom dwelling invertebrates, particularly polychaete worms, crustaceans and molluscs taken by fossicking though the sand.

Spawning occurs in the lower reaches of estuaries and in coastal waters near river mouths during summer. Larvae then enter estuaries, with the small juveniles preferring shallow water (particularly along sandy shores, but also in and around seagrasses and mangroves). Sand whiting grow reasonably quickly, taking about 2 years to reach 25 cm fork length (FL) after which growth slows. They mature at around 24 cm FL (males) and 26 cm FL (females). Maximum length is about 50 cm (total length). After spawning, adults may either enter estuarine waters or remain along ocean beaches.

The majority of sand whiting are taken in the Estuary General Fishery using hauling and mesh nets. Sand whiting are caught throughout the year but landings peak during the summers. Sand whiting is a very popular species amongst recreational fishers, and the recreational catch is estimated to be 2 to 3 times greater than the commercial catch.
Additional Notes

- Significant amounts of biological and monitoring data are now available for sand whiting.
- The size composition of the commercial catch has been relatively stable since the 1960s.
- There is a minimum legal length of 27 cm total length for sand whiting and a combined recreational bag limit of 20 whiting.

Catch

Recreational Catch of Sand Whiting

The annual recreational harvest of sand whiting in NSW is likely to lie between 230 and 460 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Landings by Commercial Fishery of Sand Whiting

Reported landings of sand whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Historical Landings of Sand Whiting

Commercial landings (including available historical records) of sand whiting for NSW from 1952/53 to 2008/09 for all fishing methods.

Catch Per Unit Effort Information of Sand Whiting Harvested by Mesh-Netting in NSW

Catch rates of sand whiting harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
The length distribution of sand whiting in NSW commercial landings was relatively stable from the 1960s to the 1990s, and comprised mainly fish between 25 and 35 cm fork length (FL). Most of the catches sampled were taken with hauling nets. Commercial landings sampled during recent years included more samples from mesh net catches, and showed an increased proportion of larger (>30 cm FL) whiting. The minimum legal length for sand whiting in NSW is 27 cm total length (approximately 25 cm FL).

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 330010, common name or scientific name to find further information.
Sawsharks
(*Pristiophorus* spp.)

**EXPLOITATION STATUS**

**UNDEFINED**

Little information is available to assess stock status. Biological information from local populations should be collected.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pristiophorus cirratus</em></td>
<td>common sawshark</td>
<td>The majority of NSW catch.</td>
</tr>
<tr>
<td><em>Pristiophorus nudipinnis</em></td>
<td>southern sawshark</td>
<td>Occurs from southern NSW to central SA.</td>
</tr>
</tbody>
</table>

**Background**

Sawsharks (family *Pristiophoridae*) are relatively small sharks (< 150 cm total length (TL)) characterised by a narrow blade-shaped snout with numerous slender, sharp spines along its margins. Sawsharks should not be confused with the large tropical sawfishes which also possess a long saw-like snout; sawfishes live in shallow seas, estuaries and rivers, and can grow to seven metres in length.

Of the three Australian sawshark species, two are distributed around southern Australia, and the third is found in deepwater off northern Queensland. The common sawshark (*Pristiophorus cirratus*) is the main species caught in NSW waters. It is found mainly in outer shelf and upper slope depths (40-630 m), and its known distribution is from northern NSW (Coffs Harbour) to Jurien Bay (WA), including Tasmania. The southern sawshark *P. nudipinnis* occurs from central NSW to Eyre (WA) in the Great Australian Bight, in depths to at least 110 m.

Biological data collected off NSW for the common sawshark showed that males matured at about 80 cm TL while the largest measured was 112 cm TL weighing about 2.7 kg. Females matured at about 90 cm and grew to a maximum of about 125 cm (~3.5 kg).

Sawsharks are viviparous (trophodermic – the developing young receive some nutrients through the mother’s uterine epithelium) and give birth to fully developed young after a gestation period of at least 12 months. Common sawsharks generally give birth to about 11 pups (range 6 to 22) which vary in size between 35 and 38 cm TL. Southern sawsharks also average about 11 pups (range 7 to 14) but they are smaller (30 to 35 cm TL).

Sawsharks are a minor component of the Commonwealth managed Southern Shark Fishery, where their status is considered to be ‘uncertain’ - landings by Commonwealth fishers in 2008 were about 250 t.

The small NSW catch is taken almost totally by trawling. Sawsharks are only occasionally taken by recreational fishers.
**Additional Notes**

- *P. cirratus* is the main species taken off NSW - annual landings have fluctuated between 10 and 30 t in recent years.
- This group should not be confused with the sawfish family (Pristidae).
- The Commonwealth has imposed a total allowable catch (312 t in 2008) on sawsharks taken in the Southern Shark Fishery.
- Sexed length frequency data are available from *Kapala* ( Fisheries Research Vessel) data, but there are no useful size composition data from the commercial fishery.

**Catch**

*Recreational Catch of Sawsharks*

The annual recreational harvest of sawsharks in NSW is likely to be less than one tonne.

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**Historical Landings of Sawsharks**

Commercial landings (including available historical records) of sawsharks for NSW from 1990/91 to 2008/09 for all fishing methods.

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**Catch Per Unit Effort Information of Sawsharks Harvested by Fish Trawling in NSW**

Catch rates of sawsharks harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Length Frequency of Sawsharks

The length distribution of sawsharks caught during trawl surveys by the Fisheries Research Vessel Kapala was comprised mainly of sharks between 40 and 120 cm total length (TL - including the length of the ‘saw’). There is no minimum legal length for sawsharks in NSW.

Further Reading


Last, P.R. and J.D. Stevens (1994). Sharks and Rays of Australia. Melbourne, CSIRO.


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 023003, 37 023002 and 37 023001, common name or scientific name to find further information.
School Prawn

*(Metapenaeus macleayi)*

**Exploitation Status:**

FULLY FISHED

Research results and modelling have established that environmental factors (river flows) generally have a major influence on landings of school prawns. These findings have resulted in the species’ current status of fully fished however research is continuing on the optimum size at first capture.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td><em>Metapenaeus macleayi</em></td>
<td>school prawn</td>
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</tbody>
</table>

**Background**

The school prawn (*Metapenaeus macleayi*) occurs along the east coast of Australia, between southern Queensland and eastern Victoria. Throughout this range, school prawns inhabit both estuaries (mostly as juveniles and sub-adults) and inshore ocean waters (as adults). Within estuaries, they prefer soft muddy substrates and areas of seagrass, and can be found well upstream into brackish to fresh waters. School prawns eat a variety of small invertebrates and detritus.

School prawns spawn in nearshore ocean waters off NSW between February and May. After a larval stage of about 2 to 3 weeks, the post-larval prawns enter estuaries and move upstream. By the following spring, the now adolescent prawns return downstream and emigrate to sea to mature and spawn. School prawns grow to a total length of 13 cm (males) and 16 cm (females) and generally live for 12 to 18 months, spawning only once. Rainfall and the associated river discharge are thought to be important cues in the life cycle of school prawns, in that significant freshwater discharge appears to facilitate downstream migration, gonad maturation and spawning success. School prawns may undertake oceanic migrations of up to 100 km.

School prawns are harvested mainly in estuaries by the Estuary Prawn Trawl Fishery (otter trawling) and by numerous methods in the Estuary General Fishery (set pocket nets, running nets, hauling and seine nets). They are also targeted in ocean waters by ocean prawn trawlers after periods of high rainfall or flooding.

There is a valuable domestic market for larger school prawns for human consumption, and substantial quantities, especially from the Clarence and Hawkesbury Rivers, are also sold for use as bait for recreational fishing.
Additional Notes

- Commercial landings of this short lived (< 2 years) species fluctuate between 500 and 1000 t, dependent on rainfall levels.
- Stock status may vary between different estuaries, as each probably represents a separate population.
- Landings and catch rates in the estuary prawn trawl fishery are variable but stable (no long term trend).
- A research project which studied growth and mortality rates of school prawns in the Clarence and Hunter Rivers is in the final stages of analysis.
- Abundance is not high enough for ocean fishery to be commercially viable in years of low river discharge, but there are peaks in ocean production in flood years. Concerns have been raised about the decline in landings from the ocean sector.
- There is a combined recreational bag limit of 10 litres for all prawns.

Catch

Recreational Catch of School Prawn

The annual recreational harvest of school prawn in NSW is likely to be less than 30 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of School Prawn

Catch rates of school prawn harvested using estuarine prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Further Reading


Growth Curves of School Prawn - Clarence River

Growth curves for school prawn in the Clarence River using parameters from Montgomery (in press). Lengths are presented as carapace length (CL).

Growth Curves of School Prawn - Hunter River

Growth curves for school prawn in the Hunter River using parameters from Montgomery (in press). Lengths are presented as carapace length (CL).


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 28 711029, common name or scientific name to find further information.
Sea Mullet
(Mugil cephalus)

EXPLOITATION STATUS  FULLY FISHED
A long history of stable landings and catch rates is evident for both the estuary and ocean fisheries.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mugil cephalus</td>
<td>sea mullet</td>
<td>Also known as bully mullet.</td>
</tr>
</tbody>
</table>

Background

The sea mullet (Mugil cephalus) occurs around much of the Australian coastline, as well as in many temperate and subtropical areas worldwide. In NSW waters, sea mullet are found primarily in estuaries and inshore waters, although they also occur in the freshwater reaches of coastal rivers. Within estuaries, sea mullet are found in association with shallow weed beds and bare substrates. They mostly eat microscopic plants (e.g. blue-green algae, filamentous green algae and diatoms), macroalgae (e.g. the green sea lettuce Ulva spp.) and detritus, and often ingest large amounts of substrate in the process.

Spawning occurs at sea, from autumn to early winter. The larvae enter estuaries and the small juveniles subsequently live in sheltered shallow water habitats. Many sea mullet travel into freshwaters, where they may reside for long periods, particularly if denied passage back to the estuary. Sea mullet grow quite quickly, taking about 4 years to reach 35 cm in length. Maximum length is approximately 60 cm but few fish greater than 50 cm are caught. Between late summer and early winter, adult sea mullet (two or more years of age) leave estuaries in large schools that then travel northward along the open coastline on their way to spawning grounds. This behaviour appears to be triggered by strong westerly winds and falling water temperatures. Shorter migrations by so-called ‘hard-gut’ (sub-adult) mullet also occur periodically, possibly in response to heavy flooding.

Sea mullet comprise the largest catch by weight of all species taken in commercial fisheries in NSW. The majority of the sea mullet harvest from NSW estuaries is sold as whole fish, but a significant quantity of the female roe (eggs) is exported to markets in South-East Asia and the Middle East. Sea mullet are not a significant recreational species, but are targeted by a small number of specialist anglers.
**Additional Notes**

- Reasonably fast growing, short-lived species, well distributed along the coast in all significant estuaries. The stock is also shared with Queensland.
- Monitoring of ocean haul catches for size/age composition is continuing in both NSW and Queensland.
- Recent catch rates in both the estuarine and ocean fisheries in NSW give no cause for concern about the current status of the stock.
- Bad weather during autumn 2009 resulted in poor catches during the ocean hauling season.
- In NSW there is a minimum legal length of 30 cm total length for sea mullet and a recreational bag limit of 20 mullet.

**Catch**

*Recreational Catch of Sea Mullet*

The annual recreational harvest of sea mullet in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

*Commercial landings (including available historical records) of sea mullet for NSW from 1944/45 to 2008/09 for all fishing methods. During 2008/09 landings by the ocean hauling fishery were significantly lower than in previous years due to very bad weather along the north coast of NSW during the short autumn spawning season.*

**Landings by Commercial Fishery of Sea Mullet**

*Reported landings of sea mullet by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.*

**Catch Per Unit Effort Information of Sea Mullet Harvested by Mesh-Netting in NSW**

*Catch rates of sea mullet harvested using mesh-netting for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.*
Growth curve for sea mullet using parameters from Smith and Deguara (2002). Lengths are presented as fork length (FL).

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 381002, common name or scientific name to find further information.
Sea Urchins (Echinoidea)

**EXPOITATION STATUS** | **UNDEFINED**
---|---
A large amount of biological information is available for these three species, but there is insufficient useful monitoring data to allow exploitation status to be decided. Confusion over common names needs to be addressed.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrostephanus rodgersii</td>
<td>purple sea urchin</td>
<td>Also known as longspine sea urchin. Majority of the commercial catch.</td>
</tr>
<tr>
<td>Heliocidaris tuberculata</td>
<td>red sea urchin</td>
<td>Also known as black sea urchin. Also important in commercial landings.</td>
</tr>
<tr>
<td>Heliocidaris erythrogramma</td>
<td>green sea urchin</td>
<td>Also known as purple sea urchin. Very small landings.</td>
</tr>
</tbody>
</table>

**Background**

Three species of sea urchin are harvested by commercial fishers in New South Wales. All are harvested for their roe, which commands a high market price when in a well developed condition; fishing is therefore concentrated on periods when the roe is developing, prior to spawning. The fishery remains relatively small with few divers participating, due to the limited domestic market and the high cost of processing the product.

Purple sea urchin (*Centrostephanus rodgersii*) is an abundant species in shallow rocky reef habitats along the NSW coast, and occurs from Coffs Harbour to eastern Victoria and north-eastern Tasmania. Purple sea urchins grow to a maximum test diameter of about 10 cm, and are profusely covered with thin tubular spines up to 7 cm in length. They shelter in crevices during the day, and move up to 10 metres in surrounding habitat to feed during the night. Purple sea urchins mature at a test diameter of about 5 cm when they are about 4 years of age, and individuals may live for more than 10 years. Purple sea urchins are the main species harvested commercially in NSW, with annual landings of 40 to 70 t.

Two other species of sea urchin also occur in intertidal and subtidal areas of rocky coastlines. The green sea urchin (*Heliocidaris erythrogramma*) is widely distributed around southern Australia, from southern Queensland to Shark Bay in Western Australia, including Tasmania, while the red sea urchin (*H. tuberculata*) is found from southern Queensland to the south coast of NSW. These
species are smaller than the purple sea urchin, and generally have a smaller test diameter (6 to 9 cm) and shorter spines (maximum of 3 cm in length). The spines of the green sea urchin are thin and sharply pointed, while those of the red sea urchin are thicker with blunt red-coloured tips. Red sea urchins are harvested in significant amounts in NSW (5 to 15 t per annum). The catch of green sea urchins is quite low (less than 500 kg per year).

Because sea urchins can occur in dense concentrations, they have the ability to locally overgraze algal habitats, creating large areas of ‘barrens’. It has been found that moving urchins from barrens to areas with better algal cover can increase the yield of roe. In conjunction with the turban shell fishery, the commercial fishery for sea urchin is subject to a significant number of area closures, designed to provide areas of refugia against which the effects of fishing in the open areas can be evaluated.

Additional Notes

- Two species provide the bulk of landings in NSW with purple sea urchins making up the majority. There is some confusion over common names because the names do not reflect the apparent colour of the animal.
- Urchins are harvested by commercial fishers only for roe – quality varies; and only the market-preferred stage receives any interest from buyers. Processing is a labour-intensive operation and markets are limited.
- Recreational fishers are subject to a bag limit of 10 urchins (all species combined) - recreational catches are not known, but are thought to be small.
- Since 2002 red sea urchins have been subject to a Total Allowable Commercial Catch (TACC) limit of 60 t per annum managed as Individual Transferable Quota (ITQ).
- Research surveys estimated the harvestable biomass of red and purple sea urchins to be 1195 t and 55,000 t respectively (Worthington & Blount, 2003), suggesting sustainable yields at 5% harvest rate of 60 t and 2750 t respectively.

Catch

Recreational Catch of Sea Urchins

The annual recreational harvest of sea urchins in NSW is likely to be less than 5 t.

Historical Landings of Sea Urchins

[Graph showing historical landings of sea urchins for NSW from 1999 to 2009 for all fishing methods.]

Commercial landings (including available historical records) of sea urchins for NSW from 1999 to 2009 for all fishing methods.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 25 211001, 25 247001 and 25 247002 common name or scientific name to find further information.
Shovelnose Rays  
(Rajiformes)

**EXPLOITATION STATUS**  
**UNDEFINED**

Eastern shovelnose ray is by far the most significant species in the catch of this group – research underway should improve biological knowledge for this species.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aptychotrema rostrata</em></td>
<td>eastern shovelnose ray</td>
<td>Constitutes the majority of the catch of this group.</td>
</tr>
<tr>
<td><em>Rhynchobatus australiae</em></td>
<td>whitespotted guitarfish</td>
<td>There are minor landings of this species from northern NSW.</td>
</tr>
<tr>
<td><em>Trygonorrhina fasciata</em></td>
<td>eastern fiddler ray</td>
<td>The small catches of this species are often discarded.</td>
</tr>
<tr>
<td><em>Glaucostegus typus</em></td>
<td>giant shovelnose ray</td>
<td>Caught infrequently.</td>
</tr>
<tr>
<td><em>Rhina ancylostoma</em></td>
<td>shark ray</td>
<td>Caught infrequently.</td>
</tr>
</tbody>
</table>

### Background

Between 100 and 150 t of ‘fiddler’ rays are landed annually in NSW. The bulk of the catch (estimated 75%) consists of the eastern shovelnose ray (*Aptychotrema rostrata*), with smaller quantities (~ 20%) of the eastern fiddler ray (*Trygonorrhina fasciata*) and occasional landings of the large whitespotted guitarfish (*Rhynchobatus australiae*), the giant shovelnose ray (*Glaucostegus typus*) and the shark ray (*Rhina ancylostoma*).

The shovelnose and fiddler rays are endemic to the southern Queensland and NSW coasts (between latitudes 27° and 36° S) while the guitarfish ranges from northern NSW through the tropics to southern Japan. All species mainly inhabit inshore smooth sandy substrates in depths less than 100 m and almost all the catch is taken by trawlers.

Eastern shovelnose rays grow to a maximum length of about 100 cm and weight of about 4 kg while fiddler rays reach 120 cm and about 10 kg. The whitespotted guitarfish can attain 300 cm in length and weigh more than 200 kg.

The biology of the eastern shovelnose ray in Moreton Bay has been studied. Both sexes matured at around 60 cm in length, and the females were found to breed annually with large specimens giving birth in the summer to as many as 18 young. New-born young are about 20 cm long. There is little biological information available for the fiddler ray (likely to have a similar reproductive cycle to the shovelnose ray) or the whitespotted guitarfish.
The commercial catch is taken almost totally by the Ocean Trawl Fishery. Significant numbers of shovelnosed rays are also taken by recreational anglers. The commercial landings have been relatively stable at around 100 to 150 t since the mid 1990s when ‘fiddler/banjo shark’ and ‘shovelnose/sand shark’ were first given separate species categories on commercial catch recording forms.

The stock status of all species is uncertain and the species composition of the catch needs to be more accurately determined. New catch reporting forms introduced in July 2009 require catches of all species to be separately recorded. No stock assessment is available for shovelnosed or fiddler rays in NSW waters. Length frequency data are available for the common species from Fisheries Research Vessel Kapala trawl surveys of inshore grounds in the 1990s.

Additional Notes

• The majority of the commercial catch is eastern shovelnose ray mainly from ocean prawn trawling and ocean fish trawling. Shovelnose rays are also taken in significant quantities by recreational fishers.

• Preliminary indications are that the stock of eastern shovelnose rays is more or less stable, but mortality rates are yet to be estimated.

• Female shovelnose rays have up to 18 embryos and move into shallower waters over the summer months to give birth (they are not susceptible to the trawl fishery during this stage but are taken by recreational fishers).

• These species are difficult to monitor after landing because fishers head and fin them. Onboard identification of the different species is straightforward because they have distinct morphologies.

Catch

Recreational Catch of Shovelnose Rays

The annual recreational harvest of shovelnose rays in NSW is likely to lie between 20 and 50 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 027009, 37 026001, 37 027006 and 37 026002, common name or scientific name to find further information. Please note that common names have been adopted from Last and Stevens (2010) and may differ to those contained on the CAAB website.

Catch Per Unit Effort Information of Shovelnose Rays Harvested by Fish Trawling in NSW

Catch rates of shovelnose rays harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Length Frequency of *Eastern Shovelnose Ray*

The length distribution of eastern shovelnose ray caught during trawl surveys by the Fisheries Research Vessel *Kapala* was comprised mainly of rays between 20 and 100 cm total length (TL). There is no minimum legal length for shovelnose rays in NSW.
Silver Sweep

*(Scorpis lineolatus)*

**EXPLOITATION STATUS**

FULLY FISHED

A long lived species which may be susceptible to localised depletion. Fully fished in localised areas such as Wollongong but maybe moderately fished state-wide.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
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<tbody>
<tr>
<td><em>Scorpis lineolatus</em></td>
<td>silver sweep</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Silver sweep (*Scorpis lineolatus*) are most abundant in NSW waters but also occur in southern Queensland, Victoria and Tasmania. Adults and juveniles are associated with coastal and estuarine reefs. Silver sweep mature at approximately 17 cm fork length at an age of 2 to 3 years and spawn during winter in NSW. Growth slows substantially following sexual maturity and silver sweep exhibit significant longevity, with a maximum estimated age of 54 years. A recent study estimated that more than 50% of silver sweep landed in NSW were greater than 15 years old. The longevity and slow growth of this species may make it particularly vulnerable to over-harvesting.

In NSW, more than 80% of commercial landings of silver sweep are by fish traps in the Ocean Trap and Line Fishery, with the remaining catch taken by purse seine nets in the Ocean Hauling Fishery. Trap landings are highest during spring and summer months, whereas purse seine landings tend to be higher during autumn.

Silver sweep are caught in significant numbers by recreational fishers angling from rock platforms and boats in coastal waters.
Additional Notes

- Silver sweep is a long-lived inshore rocky reef species taken commercially by purse-seine and trap fishers, and is a common recreational catch.
- Research (Stewart and Hughes, 2005) found silver sweep can live for more than 50 years; however they mature at a small size and early age (17 cm FL and 2-3 years).
- The age structure of samples obtained in 2003 and 2005/06 was indicative of a stock under relatively low fishing pressure, however silver sweep may be susceptible to localised depletion.
- Catch rates of the purse seine fishery (centred on the Wollongong area) have declined over the past decade; catch rates for fish trapping, after a decline in the late 1990’s, have recently returned to previous levels.

Catch

Recreational catch of Silver Sweep

The annual recreational harvest of silver sweep in NSW is likely to lie between 30 and 60 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Silver Sweep

Commercial landings (including available historical records) of silver sweep for NSW from 1990/91 to 2008/09 for all fishing methods.
The length distribution of commercial landings of silver sweep comprised mainly of fish between 20 and 30 cm fork length (FL). There is no minimum legal length for sweep in NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/CAAB/](http://www.marine.csiro.au/CAAB/) and search for the species code (CAAB) 37 361009, common name or scientific name to find further information.
Silver Trevally
(*Pseudocaranx georgianus*)

**Exploitation Status**

Growth Overfished

Minimum legal length (MLL) of 30 cm total length was implemented in September 2007 but recent size composition data indicate silver trevally should still be considered ‘growth overfished.’ Status should be reviewed after the impact of the MLL implementation has been fully assessed.

**Scientific Name**

*Pseudocaranx georgianus*

**Standard Name**

Silver trevally

**Comment**

Was recently known as *P. dentex*.

**Background**

Recent research determined that the silver trevally in south-eastern Australian and northern New Zealand waters is distinct from the larger tropical form (*Pseudocaranx dentex*) and the old name (*P. georgianus*) has been restored. Silver trevally occur in estuarine and coastal waters of southern Australian states ranging from about Coffs Harbour in NSW to about Perth in WA. Most of the Australian commercial catch is taken in NSW and eastern Victoria. Silver trevally is a schooling species, inhabiting mainly sandy substrates and feeding on benthic invertebrates, including worms and molluscs, and also on benthic and planktonic crustaceans.

Silver trevally mature between 18 and 24 cm fork length (FL), at 2 - 4 years of age. Females have moderate fecundity (50,000–200,000 eggs) and spawn during an extended period from spring to autumn. Larvae occur in coastal waters throughout this period, and may enter estuaries before settling out as juveniles. Fish less than 10 cm in length were found in samples from Botany Bay between December and August, however the life history of juvenile trevally is poorly known.

Silver trevally is a relatively long lived, slow growing species, attaining a maximum age in excess of 25 years. In NSW coastal waters trevally reach a maximum size of about 65 cm FL and weight of about 4 kg. Since the 1980s, the average size of silver trevally in catches has declined considerably and in recent years fish greater than about 35 cm in length (or 0.75 kg in weight) have been very poorly represented in catches. Commercial catches are dominated by young fish, less than about five years of age.

Commercial landings of silver trevally increased significantly to more than 1000 t per annum during the early 1980s. Annual landings then steadily declined to less than 500 t in the late 1990s. Commercial landings have been around 200 to 300 t for the past decade. The bulk of the commercial catch of silver trevally is taken in ocean waters by otter trawling. Smaller quantities are taken by fish trapping.
Commercial catches of silver trevally from estuarine waters have declined significantly following the declaration of a Recreational Fishing Haven in Botany Bay in 2002. In recent years, buy-outs of trawling licences associated with the implementation of Marine Parks have resulted in a further decline in landings of silver trevally. Most trevally are sold fresh at the Sydney and Melbourne fish markets where the species receives moderate prices depending on the size grade and quality of handling after capture.

Significant catches of silver trevally are taken by recreational fishers in both estuarine and ocean waters. In the mid 1990s the annual catch of silver trevally from ocean waters by recreational fishers was estimated to be between 150 and 210 t; however it is thought that recent catches have been lower.

Additional Notes

- A minimum legal length (MLL) of 30 cm total length was implemented in September 2007, however this regulation does not apply to fish caught under Commonwealth jurisdiction.
- The implementation of the zoning plan for the Batemans Marine Park off the NSW south coast in 2007 resulted in the closure to trawling of significant areas where silver trevally were previously targeted. A number of trawl licences were also bought out during the implementation of this Marine Park.
- NSW landings in 2007/08 were 133 t, and size composition monitoring is continuing at the Sydney Fish Market following the implementation of the MLL.
- There was a large reduction in the Commonwealth Total Allowable Catch (TAC) for silver trevally from 270 t in 2006 to 146 t in 2007, but only 67 t was landed in 2007. For 2008 the TAC was increased again to 296 t and landings were 112 t.
- The Commonwealth status of ‘not overfished’ was based on an analysis of catch rate data – that the stock may be considered ‘growth overfished’ is not considered relevant to the assessment (Wilson et al. 2009).
- There is a minimum legal length of 30 cm total length for silver trevally and a recreational bag limit of 20 for all trevallies.

Catch

Recreational Catch of Silver Trevally

The annual recreational harvest of silver trevally in NSW is likely to lie between 100 and 210 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Silver Trevally

Commercial landings (including available historical records) of silver trevally for NSW from 1944/45 to 2008/09 for all fishing methods. Note that the decline in reported catch during the late 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Landings by Commercial Fishery of Silver Trevally

Reported landings of silver trevally by NSW commercial fisheries from 1997/98. * Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.
Catch rates of silver trevally harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

The proportion of larger (> 30 cm fork length (FL)) silver trevally landed by NSW commercial fishers has declined between 1980 and 2000, and recent catches have comprised mainly fish between 20 and 30 cm FL. In September 2007 a minimum legal length of 30 cm total length (equivalent to 25 cm FL) was introduced for silver trevally in NSW.
Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 337062, common name or scientific name to find further information.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Snapper
(*Pagrus auratus*)

**EXPLOITATION STATUS**
GROWTH OVERFISHED

Commercial landings and catch rates have improved since the minimum legal length was increased in 2001, but recent analyses indicate the stock remains growth overfished.

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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tr>
<td><em>Pagrus auratus</em></td>
<td>snapper</td>
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</table>

**Background**

Snapper (*Pagrus auratus*) is distributed in the Indo-Pacific region from Japan and the Philippines to India and Indonesia, and New Zealand. In Australia, snapper occur in waters south from Hinchinbrook Island in Queensland to Barrow Island in WA and are occasionally found off the north coast of Tasmania.

Juveniles can be found around inlets, bays and other shallow, sheltered marine waters, often over mud and seagrass. Adults can be found near reefs, over mud and sand substrates and offshore to the edge of the continental shelf, across a depth range of 5-200 m. Some level of genetic sub-structuring is thought to exist for snapper in southern and western Australia, however snapper on the east coast (NSW and Queensland) are thought to constitute one stock.

Snapper spawn repeatedly during the spawning season i.e. they are serial spawners, with the number of eggs increasing exponentially with length. The length at which 50% of female snapper reach sexual maturity is 24 cm fork length (FL) and 2 - 3 years of age.

Over 95% of snapper harvested from the NSW commercial sector are taken by the Ocean Trap and Line Fishery. Since the mid-1980s, the commercial harvest of snapper has decreased from around 750 t to around 200 to 300 t in recent years. The main harvest season for snapper in the commercial sector is winter-spring. Significant quantities of snapper are also taken by recreational fishers.

Considerable research has been carried out on the growth of snapper and the results indicate a relatively long lived species with a highly variable growth rate. In NSW, snapper reach a maximum length of about 80 cm FL and weight of about 10 kg. They can live for more than 25 years, but the majority of fish in landings are less than 5 years of age. Growth rates of individual fish are apparently quite variable - a 30 cm FL fish can be between 2 and 8 years of age, while 5 year old snapper were found to be from about 25 cm to more than 50 cm in length. Very large and representative size and age composition samples are available for snapper from the mid 1980s to the most recent year, and analyses suggest that currently the fishing mortality rate is probably about three times the rate of natural mortality.
There is evidence of some improvement in the condition of the snapper stock off NSW since 2001 when the minimum legal length (MLL) was increased from 28 cm to 30 cm total length. However, recent analyses (Stewart and Hughes, 2008) conclude that the stock is heavily fished with a large proportion of landings being within a few cm of the legal minimum length. From a ‘yield-per-recruit’ perspective the stock remains growth overfished, but other fishery and economic factors need to be taken into account in any consideration of a further increase in MLL.

**Additional Notes**

- NSW commercial landings have increased over the past 5 years to 320 t, but are still well below the levels of the 1970s and 1980s (600 to 800 t).
- Catch rates of the NSW trap fishery have almost doubled since the 2001 increase in MLL.
- The average length of snapper in commercial landings has increased by 2 cm since the increase in MLL, but recent size composition data indicate the population remains growth overfished.
- Sampling in 2008/09 showed an increased proportion of fish aged greater than 4 years in commercial catches, but 3 and 4 year old fish are still the main age classes in the commercial catch.
- The NSW recreational catch may be of a similar order of magnitude to the commercial catch, with reports of increased catches using soft plastic lures.
- Recent NSW research has estimated the length at 50% maturity of female snapper to be 24 cm FL, which is less than the current MLL (30 cm total length (TL), approximately 25 cm FL).
- The Queensland assessment (Allen et al., 2006) has been externally reviewed following stakeholder concerns and the findings that the stock may be at 20-30% of the unfished state were confirmed.
- There is a recreational bag limit of 10 snapper in NSW and 5 in Queensland. The MLL of snapper is 30 cm TL in NSW and 35 cm TL in Queensland.

**Catch**

**Recreational Catch of Snapper**

The annual recreational harvest of snapper in NSW is likely to lie between 180 and 250 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Snapper**

![Graph showing historical landings of snapper](image)

**Landings by Commercial Fishery of Snapper**

![Bar chart showing landings by commercial fishery](image)

**Reported landings of snapper by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.**
**Catch Per Unit Effort Information of Snapper Harvested by Fish Trapping in NSW**

Catch rates of snapper harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

**Length Frequency of Snapper**

The length distribution of NSW commercial landings of snapper is comprised mainly of fish between 25 and 40 cm fork length (FL). In 2001 the minimum legal length (MLL) of snapper was increased from 28 to 30 cm total length, however the majority of fish in commercial landings in recent years are still within a few centimetres of the MLL, and the proportion of large (>40 cm FL) snapper in landings remains very low.

**Growth Curve of Snapper**

Age-length data with fitted growth curve for snapper in NSW (internal data). Lengths are presented as fork length (FL).
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 353001, common name or scientific name to find further information.
Soles
(Soleidae and Cynoglossidae)

**Background**

Soles marketed in NSW belong to the families Soleidae (true soles) and Cynoglossidae (tongue soles). The catch consists mainly of the lemon tongue sole (*Paraplagusia bilineata*) and the black sole (*Brachirus nigra*) with very small quantities of the manyband sole (*Zebrias scalaris*).

The lemon tongue sole is found around northern Australia, extending south in NSW to about Sydney. It inhabits shallow estuaries, tidal rivers and inshore coastal waters to a maximum depth of about 30 m, and prefers mud and sand substrates. The maximum-recorded length is 33 cm.

Both the black sole and manyband sole are endemic to eastern Australia, ranging from southern Queensland to eastern Bass Strait and southern Victoria. They are primarily found inshore in depths less than 50 m preferring muddy or sandy seabeds, particularly in estuaries and shallow coastal bays. Black soles grow to about 35 cm while the manyband sole is a small species reaching only about 20 cm.

All three species spawn pelagic eggs. As for flounders, the pelagic larvae of soles are initially symmetrical like other fish but during development the body plan changes so that both eyes become located on the one side. Both eyes of soles (Soleidae) become located on the right side of the head, while the eyes of tongue soles (Cynoglossidae) are on the left side. The young soles then settle flat on the seabed with the eyed-side, which becomes pigmented and dark coloured, facing upwards. The under-side of soles is pale and unpigmented.

In NSW, small commercial catches of sole (~ 10 t per annum) are landed throughout the year from both estuaries and oceans as a byproduct of trawling. About 80% of the landings come from the ocean prawn trawls with almost all the remainder from ocean fish trawls. A minimum legal length (MLL) of 25 cm total length (TL) introduced in September 2007 reduced the quantities of sole landed in subsequent years and the MLL was removed in September 2010. Soles are not commonly caught by recreational

<table>
<thead>
<tr>
<th>EXPLOITATION STATUS</th>
<th>UNDEFINED</th>
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Two species are significant in commercial catches, but little biological information and only limited size composition data are available.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td><em>Paraplagusia bilineata</em></td>
<td>lemon tongue-sole</td>
<td>Common in prawn trawl catches.</td>
</tr>
<tr>
<td><em>Brachirus nigra</em></td>
<td>black sole</td>
<td>Caught mostly by fish trawl.</td>
</tr>
<tr>
<td><em>Zebrias scalaris</em></td>
<td>manyband sole</td>
<td>Few landed.</td>
</tr>
</tbody>
</table>

---

*Brachirus nigra* Image © Bernard Yau
fishers.

**Additional Notes**

- Black (*Brachirus nigra*) and lemon tongue (*Paraplagusia bilineata*) soles are the most common species marketed.
- These species are an incidental catch of both fish and prawn trawling. They are rarely taken by recreational fishers.
- There is a combined recreational bag limit of 20 for all flounders and soles. The minimum legal length of 25 cm TL introduced for soles in September 2007 was removed in September 2010.

**Catch**

*Recreational Catch of Soles*

**Historical Landings of Soles**

Commercial landings (including available historical records) of soles for NSW from 1990/91 to 2008/09 for all fishing methods. Note that a minimum legal length of 25 cm TL was introduced in NSW in September 2007, and revoked in September 2010.

**Landings by Commercial Fishery of Soles**

Reported landings of soles by NSW commercial fisheries from 1997/98. *Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.*

**Length Frequency of Black Sole**

The length distribution of black sole landed by NSW commercial fishers during 2005/06 was comprised mainly of fish between 15 and 30 cm total length (TL). A minimum legal length of 25 cm TL was introduced in NSW for all flounder and sole species in September 2007, but the minimum legal length for sole species was removed in September 2010.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 463001, 37 462017 and 37 462010, common name or scientific name to find further information.
Southern Calamari
(*Sepioteuthis australis*)

**Exploitation Status**

**Undefined**

Significant commercial and recreational landings. The biology of the species has not been studied in NSW, but in southern Australia calamari are known to be short-lived and fast growing.

### Scientific Name

*Sepioteuthis australis*

### Common Name

Southern calamari

### Comment

*Sepioteuthis australis* Image © Bernard Yau

**Background**

Southern calamari (*Sepioteuthis australis*) are found in estuarine and near-shore coastal waters around southern Australia (including Tasmania) from about Brisbane, Queensland to Perth, WA; they are also found off northern New Zealand. The species is an important fishery resource off NSW, Tasmania, and SA.

Southern calamari are reported to be relatively fast growing, short-lived squid, with a maximum age of about 1 year. Males can reach 50 cm mantle length (ML) and females 40 cm ML in South Australian waters. Large calamari in NSW catches measure around 30-35 cm ML and weigh about 1 kg.

The biology of the species has been extensively studied off southern Australia where it was found that sexual maturity was attained at about 7-8 months of age and 15-20 cm ML. Females mate with a number of males and store the sperm before spawning in relatively shallow (3 - 5 m) depths mainly during the summer months. They produce multiple batches of eggs (numbering up to several hundred) which are attached to seagrass, macro-algae, hard reef and even sandy substrates.

NSW landings of southern calamari have been recorded separately since 1990. Most are caught by ocean trawlers and landings have been relatively stable at around 60 to 80 t per annum, except for a period in the late 1990s when landings exceeded 100 t per annum. Recreational anglers in NSW also take significant quantities of southern calamari in estuaries and near shore ocean waters.

The species is a significant catch in fish trawls in the Sydney to Port Stephens area of NSW and extensive length-frequency and biological data are available from the Fisheries Research Vessel *Kapala* surveys. However, there has been no formal stock assessment for southern calamari in NSW.
Additional Notes

- A short lived species which is a very important component of commercial and recreational catches. Recent recreational catches are not well estimated.
- Commercial landings and catch-rates are reasonably stable, but do fluctuate (probably as a result of recruitment variability).
- Trawl gears can retain small sizes (<10 cm mantle length) but the majority of the catch is comprised of calamari larger than 10 cm mantle length.
- Local information on growth and mortality rates would assist assessment.
- There is a combined recreational bag limit of 20 for all squid and cuttlefish.

Catch

Recreational Catch of Southern Calamari

The annual recreational harvest of southern calamari in NSW is likely to lie between 10 and 40 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Southern Calamari

![Graph showing Historical Landings of Southern Calamari](image)

Commercial Landings (including available historical records) of southern calamari for NSW from 1990/91 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 23 617005, common name or scientific name to find further information.

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Southern Maori Wrasse

(Ophthalmolepis lineolatus)

**EXPLOITATION STATUS**

MODERATELY FISHED

Mainly a recreational species, but also a small targeted commercial fishery. Fishing mortality is estimated to be about half the natural mortality rate.

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<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
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<tr>
<td>Ophthalmolepis lineolatus</td>
<td>southern maori wrasse</td>
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**Background**

The southern maori wrasse (Ophthalmolepis lineolatus) is a small endemic labrid commonly found on the temperate coastal rocky reefs of southern Australia from southern Queensland to southern Western Australia. Maori wrasse are carnivorous and are more frequently found in reef habitats dominated by sponges than in kelp forest or urchin-grazed barrens. Adult maori wrasse are also more abundant with increasing depth down to 20m where they may form loose aggregations, but can be found as deep as 60 m.

Like other members of the family Labridae they are protogynous hermaphrodites. They are sexually dimorphic with males and females differing in size and colour. Juveniles mature as females at approximately 18 cm total length (TL) and 2 years of age. Females change to the terminal phase male at a length of approximately 30 cm and about 5 years of age. The peak reproductive season is from January to March.

Maori wrasse grow quickly, attaining approximately 28 cm total length after 5 years, with growth slowing thereafter. They can reach 45 cm in length and have been aged up to 14 years.

Maori wrasse are important to the recreational fishery in NSW and ranked within the top 10 species by number retained during both years of a survey of offshore trailerboat fishers (Steffe et al., 1996). They are not considered an important commercial species with reported landings averaging around 2.5 tonnes per year from line fishing methods.
Additional Notes

- Maori wrasse is estimated to be among the top 10 species in recreational landings in NSW. There is also a small commercial harvest (less than 5 t annually).

- Significant biological data are available for this species (Morton, 2007; Stewart and Hughes, 2008), together with some commercial and recreational length frequency data.

- Maori wrasses mature first as females at about 18 cm TL, and change sex to males between 27 and 34 cm TL.

- Maori wrasses are not subject to a minimum legal length or any specific bag limit in NSW waters.

Catch

Recreational Catch of Southern Maori Wrasse

The annual recreational harvest of southern maori wrasse in NSW is likely to lie between 20 and 30 t. This estimate is based upon the results of the offshore trailer boat recreational survey (Steffe et al. 2003) undertaken by I & I NSW.

Historical Landings of Southern Maori Wrasse

Commercial landings (including available historical records) of southern maori wrasse for NSW from 1993/94 to 2008/09 for all fishing methods.

Growth Curve of Southern Maori Wrasse

Growth curve of southern maori wrasse using parameters from Stewart and Hughes (2008). Lengths are presented as total length (TL).
### Length Frequency of Southern Maori Wrasse - Commercial Fishery

The length distribution of southern maori wrasse landed by NSW commercial fishers in 2004/05 was comprised mainly of fish between 25 and 35 cm total length (TL). There is no minimum legal length for southern maori wrasse in NSW.

### Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 384040, common name or scientific name to find further information.
Spanish Mackerel
(Scomberomorus commerson)

EXPLOITATION STATUS  FULLY FISHED
Majority of the commercial harvest occurs in Queensland waters and status from the Queensland assessment has been adopted.

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<th>SCIENTIFIC NAME</th>
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<tr>
<td>Scomberomorus commerson</td>
<td>Spanish mackerel</td>
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</table>

Background
Spanish mackerel are distributed in the waters of the Indo-Pacific from the Red Sea and South Africa to southeast Asia, north to China and Japan, and south to Australia. They are also found in the eastern Mediterranean Sea. In Australian waters, they are distributed from Geographe Bay in WA around northern and eastern Australia to St Helens in Tasmania. Within this geographical distribution, Spanish mackerel can be found from the edge of the continental shelf to shallow coastal waters. Adults are associated with coral reefs, rocky shoals and current lines on outer reef areas and offshore. Small juveniles up to 10 cm fork length (FL) occur in creeks, estuaries and sheltered mud flats during the early wet season in north Queensland.

Sampling of Spanish mackerel in WA showed that 50% of females reached sexual maturity at about 79 cm, while 50% of males reached sexual maturity at 63 cm. Females can be categorised as serial or partial spawners with fish showing a peak in reproductive activity between August and January in WA, and during the spring/summer months in Queensland. They are highly fecund - large females produce more than 1 million eggs. In Queensland waters, Spanish mackerel can reach 240 cm FL and a maximum weight of 70 kg with females growing to a larger size than males. Initial growth is rapid with fish reaching 100 cm in the first few years of life. The oldest males and females sampled from catches by the Queensland commercial fishery were 10 (127 cm FL, 19 kg) and 14 years (155 cm FL, 35 kg) respectively.

Migrations of Spanish mackerel extend along the entire east coast of Queensland although permanently resident populations also seem to exist. Resident fish disperse from reefs after spawning whilst migrating fish can move up to 1000 nautical miles to the south (into NSW waters). The use of parasites to distinguish between stocks suggested that there may be six separate stocks of Spanish mackerel across northern Australia, however, the use of isozyme, allozyme and mitochondrial DNA genetic analysis failed to find any significant differences. The diet of Spanish mackerel consists of small fish like anchovies, clupeids and carangids, as well as squid and prawns.
**Additional Notes**

- NSW commercial landings are small (< 10 t) compared with Queensland (200 - 600 t).
- There are significant recreational landings of Spanish mackerel, especially in Queensland.
- A length-based stock assessment conducted in 2008 by Queensland Fisheries concluded that the stock was at about maximum sustainable yield level, with exploitable biomass estimated to be 35-60% of the unfished level.
- There is a minimum legal length of 75 cm total length for Spanish mackerel and a combined recreational bag limit of 5 for all Spanish and spotted mackerel.

**Catch**

*Recreational Catch of Spanish Mackerel*

The annual recreational harvest of Spanish mackerel in NSW is likely to lie between 10 and 100 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Spanish Mackerel**

Commercial landings (including available historical records) of Spanish mackerel for NSW from 1978/79 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 441007, common name or scientific name to find further information.
Spanner Crab
(\textit{Ranina ranina})

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|}
\hline
\textbf{Exploitation Status} & \textbf{Fully Fished} \\
\hline
Joint fishery-independent monitoring between NSW and Queensland occurs for this shared stock, and status has been determined from the Queensland assessment. \\
\hline
\end{tabular}
\end{table}

\textbf{Scientific Name} \hspace{1cm} \textbf{Common Name} \hspace{1cm} \textbf{Comment}

\begin{itemize}
\item \textit{Ranina ranina} \hspace{1cm} spanner crab
\end{itemize}

\textbf{Background}

Spanner crabs (\textit{Ranina ranina}) are distributed throughout the Indo-Pacific region in coastal waters, to a depth of 70 m, on sandy substrates in which they bury. On the east coast of Australia, spanner crabs are distributed from Yeppoon in Queensland to Nowra in NSW and, on the west coast, from Quinn rocks (north of Perth) to the Houtman Abrolhos and Geraldton in WA.

Spanner crabs mature and spawn between October and February, and large females are able to produce two batches of eggs each season with each batch averaging around 120,000 eggs. Female crabs mature at about 2 years of age which is equivalent to 7-7.5 cm carapace length, (CL) or about 150 g in weight.

Spanner crabs are opportunistic feeders with their diet consisting of urchins, bivalve molluscs, crustaceans, polychaete worms, and fish. Growth estimates for spanner crabs sampled in NSW suggest that males reach a maximum size of 14 cm CL and females reach a maximum size > 11 cm CL. Growth to these maximum lengths is thought to take approximately 10 years. Sampling of spanner crabs in both NSW and Queensland has indicated that the commercial catch consists predominantly of males.

Virtually all spanner crabs are caught in the Ocean Trap and Line Fishery by specifically endorsed fishers using spanner crab nets (also known as dillies).
**Additional Notes**

- Shared stock with Queensland, where the majority of the fishery (~90%) exists.
- There are no concerning trends evident in catch rates of legal-sized crabs from Queensland, but the fishery dependant catch rates from NSW have declined since 2003/04.
- Both jurisdictions have regulations that prohibit the harvesting of berried crabs (females carrying maturing ova).
- In NSW there is a minimum legal length of 9.3 cm carapace length and a recreational bag limit of 10 spanner crabs.

**Catch**

*Recreational Catch of Spanner Crab*

The annual recreational harvest of spanner crab in NSW is likely to be less than one tonne.

**Historical Landings of Spanner Crab**

[Graph showing historical landings of spanner crab from 1984/85 to 2008/09 for all fishing methods.]

*Commercial landings (including available historical records) of spanner crab for NSW from 1984/85 to 2008/09 for all fishing methods.*

**Landings by Commercial Fishery of Spanner Crab**

[Graph showing landings by commercial fishery of spanner crab from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.]

**Catch Per Unit Effort Information of Spanner Crab Harvested by Spanner Crab Trapping in NSW**

[Graph showing catch per unit effort information of spanner crab harvested by spanner crab trapping in NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.]

Catch rates of spanner crab harvested using spanner crab trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 28 865001, common name or scientific name to find further information.
Spotted Mackerel
(*Scomberomorus munroi*)

**Exploitation Status**
Fully fished

Predominantly harvested in Queensland, where assessment indicates that current recreational and commercial catch approximates the maximum sustainable yield. Status is consistent with the Queensland assessment.

**Scientific Name**
*Scomberomorus munroi*

**Standard Name**
Spotted mackerel

**Background**

Spotted mackerel (*Scomberomorus munroi*) are endemic to the Australasian region and are distributed around northern Australia from Wollongong in NSW to Rottnest Island in WA.

A tagging study on spotted mackerel released in NSW and Queensland showed that approximately 39% of fish moved over 100 km with the greatest movement being 1100 km (fish at liberty for 228 days). Of those fish that moved at least 100 km, more were recaptured in northern Queensland during winter and early spring while more were recaptured in southern Queensland in summer. Due to the seasonality and direction of movements, it is suggested that the east coast spotted mackerel comprise of a single stock undertaking seasonal migrations.

Female spotted mackerel sampled in northern Queensland were in spawning condition from August to October while males were in advanced stages of gonad development for most of the year. Spawning occurs in offshore waters in an area believed to be between Mackay and waters south of Townsville. The size at which 50% of spotted mackerel reach sexual maturity is 45-50 cm fork length (FL) for females and 40-45 cm FL for males. After spawning, pelagic eggs and larvae may then be dispersed southward by the East Australian Current.

In samples of spotted mackerel taken from Queensland waters, males were aged up to 7 years and females were aged up to 5 years. The maximum sizes of fish measured from that study were 75 cm FL for males and 86 cm FL for females, and the results indicated that females were significantly larger than males for any given age. Spotted mackerel grow quickly for the first three years of life, after which growth slows.

Spotted mackerel feed almost exclusively on pelagic species such as anchovies, pilchards and herring. Spotted mackerel spawn in northern Queensland waters from late winter to early spring and this coincides with reduced feeding activity. After spawning, the fish migrate to southern Queensland and this migration is associated with increased feeding.
**Additional Notes**

- A similar (but smaller) species to Spanish mackerel which is seasonally available in northern NSW waters. NSW commercial landings are 20 - 30 tonnes per annum (t.p.a) - catch rates are relatively stable.

- Assessment of the Queensland fishery in 2004 concluded the stock was ‘fully fished’ with commercial landings of 60-120 t and a recreational catch of about 150 t (Begg et al., 2005). The Queensland fishery is quota managed (120 t.p.a).

- NSW recreational fishery is opportunistic, but the species is highly sought after when the fish are available in NSW waters.

- In NSW there is a minimum legal length of 60 cm total length for spotted mackerel and a combined recreational bag limit of 5 for all Spanish and spotted mackerel.

**Catch**

*Recreational Catch of Spotted Mackerel*

The annual recreational harvest of spotted mackerel in NSW is likely to lie between 10 and 100 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Spotted Mackerel**

Commercial landings (including available historical records) of spotted mackerel for NSW from 1990/91 to 2008/09 for all fishing methods.

**Catch Per Unit Effort Information of Spotted Mackerel Harvested by All Line Methods in NSW**

Catch rates of spotted mackerel harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 441015, common name or scientific name to find further information.
Stout Whiting

(*Sillago robusta*)

**Exploitation Status** Moderately Fished

A small, fast growing species caught by trawling in ocean waters. The stock is shared with Queensland and the status has been adopted from the Queensland assessment.

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<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
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<tr>
<td><em>Sillago robusta</em></td>
<td>Stout Whiting</td>
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</table>

**Background**

Stout whiting (*Sillago robusta*) is a sub-tropical species that occurs in ocean waters to a depth of 70 m around northern Australia from WA to northern NSW. Stout whiting off southern Queensland and northern NSW are thought to belong to a single 'eastern' Australian stock.

Both eastern school whiting (*S. flindersi*) and stout whiting are taken by trawling in inshore ocean waters, and the two species may occur in the same trawl catch off northern NSW. Historically both species were reported by fishers as 'school whiting' and catches of each species were estimated according to latitude where the catch was taken. Since July 2009, fishers have been required to report the two species separately.

NSW trawlers generally discarded stout whiting until an export market developed in the 1970s. Landings increased to around 300 t in the mid-late 1980s, declined to very low levels in the mid 1990s, and rose again to around 500 t in the late 1990s. The decline in landings around 2000 was apparently associated with the introduction of bycatch reduction devices into the prawn trawl fishery, but catches have recently increased from this level. It is likely that trawlers targeting prawns have continued to discard significant quantities of stout whiting throughout this period.

Stout whiting are not taken in significant quantities by any other commercial or recreational fisheries in NSW. A targeted trawl fishery for stout whiting off southern Queensland has seen declining effort and catch since the mid 1990s. Recent landings have been around 500 - 1000 t annually, from a maximum of 5 vessels participating in the fishery. Stout whiting are also taken as a bycatch of prawn trawling off Queensland, but the bulk of these catches are discarded at sea. The annual discarded catch was estimated to be around 4000 t during the 1990s, however annual discards are estimated to have declined to around 1500 t recently.

There has been considerable research into the biology of stout whiting off southern Queensland. The species reaches a maximum age of eight years and length of 23 cm fork length (FL), although the bulk of catches is comprised of fish from 1 – 2 years of age and 14 to 18 cm FL. Sexual maturity is reached...
at about 2 years of age, at about 15 cm FL. Information on the distribution and size composition of stout whiting off NSW is available from research trawls conducted by Fisheries Research Vessel Kapala.

Additional Notes

• This is a short-lived species with no significant recreational fishery.

• The stock is shared with Queensland, whose few operators are managed with catch quotas (currently 1250 t).

• Recent research has provided growth rate and size at maturity estimates for the NSW area.

• Some limited information is available on the size composition of NSW commercial landings, and a recent research project at I & I NSW studied growth and reproductive biology of stout whiting from northern NSW.

• There is no minimum legal length for stout whiting which are included in a combined recreational bag limit of 20 for all whiting.

Catch

Recreational Catch of Stout Whiting

The annual recreational harvest of stout whiting in NSW is likely to be less than one tonne.

Historical Landings of Stout Whiting

Landings by Commercial Fishery of Stout Whiting

Reported landings of stout whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Stout Whiting Harvested by Ocean Prawn Trawling in NSW

Catch rates of stout whiting harvested using ocean prawn trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Growth Curve of Stout Whiting

Age-length data with fitted growth curve of stout whiting (internal data). Lengths are presented as fork length (FL).
The length distribution of stout whiting from NSW commercial landings in 2000/01 was comprised mainly of fish between 10 and 20 cm fork length (FL). There is no minimum legal length for stout whiting in NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 330005, common name or scientific name to find further information.
Striped Grunter (Terapontidae)

**Exploitation Status:** Undefined

Striped grunter are small estuary/inshore fish caught as byproduct in estuarine and inshore ocean fisheries. Little biological information is available.

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<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Pelates sexlineatus</em></td>
<td>eastern striped grunter</td>
<td>Also known as striped trumpeter.</td>
</tr>
<tr>
<td><em>Pelates quadrilineatus</em></td>
<td>fourline striped grunter</td>
<td>Also known as striped trumpeter.</td>
</tr>
<tr>
<td><em>Terapon jarbua</em></td>
<td>crescent grunter</td>
<td>Also known as crescent perch.</td>
</tr>
<tr>
<td><em>Terapon theraps</em></td>
<td>largescale grunter</td>
<td>Also known as banded grunter.</td>
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**Background**

Striped grunter (more commonly known as trumpeter) are relatively small shallow water fishes belonging to the family Terapontidae. This family includes 30 Australian species which mostly inhabit freshwater or estuaries; only nine species are marine. To avoid confusion with the larger and more commercially important southern trumpeters (e.g. the Tasmanian ‘striped trumpeter’, *Latris lineata*), all members of the Terapontidae are now referred to as grunter.

Up to five tonnes per year of striped grunters have been reported from NSW estuaries, mostly from the Estuary General Fishery (~ 80%) but also with small amounts from the Estuary Prawn Trawl Fishery. Similarly small quantities of ‘trumpeter’ are reported from the Ocean Trawl Fishery but, as the species composition is unverified, landings from ocean fisheries are not currently included.

The main species in the estuarine catch is the eastern striped grunter (*Pelates sexlineatus*) which is found between southern Queensland and Jervis Bay on the NSW south coast. The striped grunter is a small schooling fish that grows to about 20 cm in length and inhabits large estuaries, bays and inshore coastal waters to about 30 m depth. It frequents large reef areas but is also commonly found on smooth trawling and hauling grounds. Very little is known about the biology of eastern striped grunter.
At least three other tropical members of the family are known from northern NSW: fourline striped grunter (R. quadrilineatus), crescent grunter (Terapon jarbua) and largescale grunter (T. theraps). These species are similar in size and appearance to the eastern striped grunter and may occur in small quantities in catches from northern NSW.

Significant numbers of striped grunters are caught by recreational fishers, but due to their small size they are frequently discarded.

Additional Notes
- Colloquial name for both estuary and ocean species is ‘trumpeter’.

Catch
Recreational Catch of Striped Grunters
The annual recreational harvest of striped grunter in NSW is likely to be less than 10 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 321005, 37 321001, 37 321002 and 37 321003, common name or scientific name to find further information.
Striped Marlin  
(*Kajikia audax*)

### EXPLOITATION STATUS
**UNDEFINED**

Status is yet to be determined but will be consistent with the assessment of the south-west Pacific stock by the Scientific Committee of the Central and Western Pacific Fisheries Commission.

<table>
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<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Kajikia audax</em></td>
<td>striped marlin</td>
<td>Previously known as <em>Tetrapturus audax</em>.</td>
</tr>
</tbody>
</table>

### Background

Striped marlin (*Kajikia audax*) is a highly migratory pelagic species distributed throughout warm-temperate to tropical waters of the Indian and Pacific Oceans. The stock structure of striped marlin is uncertain although there are thought to be separate stocks in the south-west, north-west, east and south-central regions of the Pacific Ocean, as indicated by genetic research, tagging studies and the locations of identified spawning grounds. The south-west Pacific Ocean (SWPO) stock of striped marlin spawn predominately during November and December each year in waters warmer than 24°C between 15-30°S from the east coast of Australia to Fiji and as far east as French Polynesia. Mature striped marlin move south during summer months to feed in cooler temperate waters off the NSW coast and northern New Zealand. Striped marlin are opportunistic carnivores that predominately consume small pelagic finfish and squid.

Striped marlin grow rapidly during their first two years of life, with about 70-75% of their maximum body length reached during this time. Male and female striped marlin grow at similar rates although females tend to grow slightly larger than males. Striped marlin can reach ages of at least 10 years and grow to lengths greater than 250cm (lower jaw-to-fork length) and can attain a maximum weight of about 240 kg. Females mature between 1.5 and 2.5 years of age whilst males mature between 1 and 2 years of age. Striped marlin are multiple batch spawners with females shedding eggs every 1-2 days over 4-41 events per spawning season. An average sized female of about 100 kg is able to produce up to about 120 million eggs annually.

Striped marlin spend most of their time in surface waters above the thermocline, making them vulnerable to surface fisheries. They are caught mostly by commercial longline and recreational fisheries throughout their range. Commercial longline catches from the south-west Pacific Ocean have varied between 2000 and 4000 t since the 1960s, with large catches prior to that time peaking at about 12 000 t. Annual catches of the Commonwealth-managed Eastern Tuna and Billfish Fishery (ETBF) were 359 t in 2007, 425 t in 2008 and 361 t in 2009.

Striped marlin is a popular gamefish and is caught commonly during NSW recreational gamefish competitions. Harvest of striped marlin by NSW recreational fisheries is estimated to be less than 10% of the ETBF catch. Additionally, more than 1000 striped
marlin are tagged and released annually by recreational fisheries on the east coast of Australia, with the majority of these from NSW offshore waters. Over 80% of striped marlin caught by competition-based recreational fisheries in NSW are tagged and released. Post-release mortality of recreationally-tagged billfish range from 0-35% as estimated from tagging studies with post-release survival found to be higher when circle hooks were used. Competition-based recreational fisheries have altered their fishing rules to reflect this research with a mandatory rule in place within gamefishing clubs that enforces the use of circle hooks when using natural baits to target marlin.

There has been some conflict over access to the striped marlin resource between the domestic longline and recreational fisheries, particularly on the south coast of NSW. These conflicts have been partially alleviated by a reduction in longline fishing effort and reduced fishing by longliners at times and in areas where there are high concentrations of gamefish vessels, particularly during recreational fishing tournaments.

**Additional Notes**
- Commercial exploitation off eastern Australia since 2006 has ranged from 10-14% of the total commercial catch of striped marlin in the Western and Central Pacific Fisheries Commission Statistical Area.
- Commonwealth status of striped marlin is uncertain based on an assessment done in the SWPO in 2006 (Langley et al., 2006). Once status from other jurisdictions is better documented, then this should be adopted for NSW.
- Local catch and catch rate information available (Murphy et al., 2002; Lowry & Murphy, 2003; Park, 2007)
- A bag limit of 1 for each marlin species (striped, black and blue) applies to NSW recreational fishers. Commercial fishers operating under NSW jurisdiction are prohibited from landing any species of marlin.

**Catch**

**Recreational Catch of Striped Marlin**
The annual recreational harvest of striped marlin in NSW is likely to lie between 5 and 45 t. This estimate is based upon the results of onsite surveys undertaken by I & I NSW.

**Growth Curve of Striped Marlin**

Growth curve for striped marlin using parameters from Kopf (2010). Lengths are presented as fork length (FL).

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 444002, common name or scientific name to find further information.
Tailor

(Pomatomus saltatrix)

**Exploitation Status**

**Fully Fished**

Significant recreational and commercial harvests in Queensland and NSW. Queensland assessment in 2004 indicated that the stock was close to the biomass at maximum sustainable yield (Bmsy) reference point.

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<tr>
<th>Scientific Name</th>
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<tr>
<td>Pomatomus saltatrix</td>
<td>tailor</td>
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</table>

**Background**

Tailor (Pomatomus saltatrix) occur in estuarine and close inshore waters along the Atlantic coasts of North and South America (where they are known as ‘bluefish’), western and southern Africa (where they are known as ‘elf’), and throughout the Mediterranean. In Australia, tailor occur from southern Queensland to eastern Bass Strait, and in southern Western Australia. Tailor form large schools in surface waters close to shore and are voracious predators. They are a very popular species with recreational fishers, and the catch by recreational fishers is estimated to be many times larger than the catch by commercial fishers.

Although reported to live for greater than 10 years and weigh more than 10 kg, the majority of tailor landed by both recreational and commercial fishers off south-eastern Australia are 2 to 4 years of age, between 30 and 50 cm in length and 0.5 to 1.5 kg in weight. The growth of tailor has been the subject of many studies throughout the species’ world wide range, and there is considerable variation between the different stocks. Tailor in South Africa and North America grow faster and to a greater size than in Australia.

In NSW, juvenile tailor occur in estuaries and large coastal bays, and older fish are commonly found in surf zones of beaches and around rocky headlands. Mature fish migrate north along the coast to spawn during late winter and spring off northern NSW and southern Queensland. The regular seasonal occurrence of large schools of pre-spawning fish in the surf zone has led to significant targeted recreational fisheries on the islands off southern Queensland (such as Stradbroke and Fraser Islands).

Because of their inshore schooling behaviour and predatory nature, tailor are susceptible to very high exploitation rates, and some stocks have been overfished and are subject to stringent management regulations to promote recovery of the stock. An assessment in 2004 of the eastern Australian tailor stock by researchers from the Queensland Department of Primary Industries and Fisheries concluded that the...
stock was heavily fished and remained relatively productive, but more protection of spawning fish would be beneficial. The assessment recommended an increase in the minimum legal length of tailor from 30 to 40 cm total length (TL), and an initial increase from 30 to 35 cm is due to be implemented in Queensland in March 2010. The minimum legal length in NSW is 30 cm TL.

**Additional Notes**

- Tailor is an important recreational species along the east coast (and also in WA).
- NSW recreational catch was estimated to be about 250 t in 2000/01; commercial catches are subject to trip limit regulations, with landings currently about 50 t.
- Queensland has an estimated recreational catch of 300 t and an annual commercial quota of 120 t.
- A full stock assessment model was developed by QDPI&F in 2004 - assessed as fully fished, with stock at about the level which would sustain optimum yield. This assessment is currently being updated.
- Catches mostly contain 2 - 4 year old fish (30 to 50 cm in length), but the species is reported to attain a maximum size of 15 kg and length of about 1 m.
- The minimum legal length in NSW is 30 cm TL and there is a bag limit of 20 tailor per angler per day.

**Catch**

*Recreational Catch of Tailor*

The annual recreational harvest of tailor in NSW is not accurately known and can be subject to significant fluctuations between years, but is thought to be in the range of 150 to 300 t.
The length distribution of tailor landed by NSW commercial fishers is comprised mainly of fish between 28 and 45 cm fork length (FL). The minimum legal length for tailor in NSW is 30 cm total length (which equates to about 27 cm FL). Note that prior to 1993 tailor were not subject to a minimum legal length.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 334002, common name or scientific name to find further information.
**Tarwhine**

*(Rhabdosargus sarba)*

**Exploitation Status:** Fully Fished

The age composition of commercial landings indicates that fishing mortality is similar to natural mortality.

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<th>Scientific Name</th>
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<tr>
<td><em>Rhabdosargus sarba</em></td>
<td>Tarwhine</td>
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</table>

**Background**

The tarwhine (*Rhabdosargus sarba*) belongs to the family Sparidae which also includes snapper (*Pagrus auratus*) and yellowfin bream (*Acanthopagrus australis*). It was originally described (named) from the Red Sea, but it is now believed that the Indian Ocean form (including WA) differs from the West Pacific form and therefore may need to be re-named. The tarwhine found off eastern Australia ranges from southern NSW, through the tropical West Pacific, to Japan. It is an inshore species found in estuaries and on coastal reefs out to depths of about 70 m.

The tarwhine is often confused with yellowfin and black bream. Distinguishing features of the tarwhine include obvious yellow or gold lines on a silver body and a more rounded head shape. A yellow marking is found above the pelvic base and on each scale. The head is rounded when compared to the more pointed head of a bream. Also above the lateral line on the tarwhine are 6 - 7 scale rows whereas on bream there are only four.

In NSW, tarwhine attain a maximum size of about 40 cm fork length (FL) or 45 cm total length, and weigh up to 1.4 kg. In commercial catches, tarwhine are typically 17-20 cm FL but recreational catches generally comprise larger fish in the 20-30 cm range (0.2-0.5 kg). They mature between 16 and 21 cm FL at 2 to 3 years of age, but after reaching about 24 cm at age 5 years, their growth rate slows. Spawning takes place in coastal reef areas, sheltered bays and lower estuaries in winter with the peak activity in July. Main food sources for tarwhine include molluscs and other bottom dwelling invertebrates such as crustaceans and worms.
Annual NSW commercial landings have fluctuated between 30 and 80 t during the past decade. The bulk of the landings come from the Estuary General Fishery, caught mainly by hauling net and mesh net. Smaller amounts (20-25% of landings) are taken in the ocean by Ocean Trawl, Ocean Hauling, and Ocean Trap and Line Fisheries. Tarwhine are commonly taken as byproduct with yellowfin bream, and catches peak in the autumn - winter months.

**Additional Notes**

- Tarwhine comprise a significant incidental catch of commercial and recreational fisheries in estuarine and near-shore ocean waters.
- Fish mature at about 19 cm FL (23 cm TL), slightly larger than the minimum legal length of 20 cm total length (Hughes et al., 2008).
- Fishing mortality has been estimated to be similar to natural mortality.
- Mesh-netting catch rates are stable apart from a peak in 1999/00.
- There is a minimum legal length of 20 cm total length for tarwhine and a combined recreational bag limit of 20 for all bream and tarwhine.

**Catch**

*Recreational Catch of Tarwhine*

The annual recreational harvest of tarwhine in NSW is likely to lie between 130 and 210 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Growth Curve of Tarwhine

Length Frequency of Tarwhine

Tarwhine landed by NSW commercial fishers in the 1980s and 1990s were mostly between 17 and 20 cm fork length (FL), and a recent research project has found this continues to be the case (Stewart and Hughes, 2008). The minimum legal length for tarwhine in NSW is 20 cm total length (which equates to approximately 17 cm FL).

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 353013, common name or scientific name to find further information.
Teraglin

(*Atractoscion aequidens*)

**EXPLOITATION STATUS**  
FULLY FISHED

Commercial catch data suggest a long-term decline in this stock, although the species appears to be fairly quick growing and may be subject to large variations in recruitment strength. There is concern that the stock may actually be ‘overfished’ but that insufficient information is available to support this determination.

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<th>SCIENTIFIC NAME</th>
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<tr>
<td><em>Atractoscion aequidens</em></td>
<td>teraglin</td>
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</tbody>
</table>

**Background**

Teraglin (*Atractoscion aequidens*) occur around southern Africa from Angola to South Africa and, in Australia from southern Queensland to Montague Island in NSW. Juvenile fish can be found in inshore waters, including deeper estuaries, while schools of adult fish can be found at depths of 20-80 m over gravel or broken reef substrates.

There is very little information available on the biology of this species in Australian waters, however some biological information is available for teraglin from South Africa. In South African waters, teraglin reach a maximum length of around 130 cm and a maximum weight of around 18 kg, spawn during spring and the diet of teraglin mainly consists of pilchards and anchovies. Growth was similar for males and females, and slowed at the onset of sexual maturity. The size at which 50% of teraglin mature in South African waters was reported to be about 90 cm fork length (FL, equivalent to about 5 years of age) while 100% maturity was recorded at around 93 cm FL (about 6 years of age).

In NSW, teraglin are reported to grow to more than 100 cm FL and 10 kg in weight, but the majority of fish landed are 40 to 70 cm FL and 1 to 3 kg in weight. Study of growth and reproductive biology of teraglin in Australia is currently underway.

The majority of commercial landings of teraglin are made by line fishers in the Ocean Trap and Line Fishery, and significant numbers are taken by recreational fishers. The largest catches are made off northern and central NSW and they are, in general, quite sporadic.
**Additional Notes**

- Teraglin is a schooling species, which is very susceptible to line fishing methods.

- Recent commercial landings have been less than 20 t, compared with 50 - 100 t prior to the 1970s.

- Recreational landings are likely to be greater than the commercial catch.

- Sampling in 2006/07 showed the commercial catch to be comprised mostly of young fish less than 3 years of age, with small numbers of older fish up to 10 years of age.

- Length-based monitoring of commercial catches is continuing, along with further sampling to study age composition and size at maturity.

- There is a minimum legal length of 38 cm total length and a recreational bag limit of 5 teraglin.

**Catch**

**Recreational Catch of Teraglin**

The annual recreational harvest of teraglin in NSW is likely to lie between 70 and 110 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Teraglin**

Commercial landings (including available historical records) of teraglin for NSW from 1947/48 to 2008/09 for all fishing methods.
The length distribution of teraglin landed since the 1970s by NSW commercial fishers has comprised mainly of fish between 40 and 70 cm fork length (FL). Catches in recent years have shown a higher proportion of fish in the 40 to 50 cm FL size classes. The minimum legal length for teraglin in NSW is currently 38 cm total length (TL).

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 354020, common name or scientific name to find further information.
Tiger Flathead
*(Platycephalus richardsoni)*

**EXPLOITATION STATUS**

**FULLY FISHED**

Predominantly a Commonwealth fishery, although significant landings are made by NSW trawlers north of Sydney. Exploitation status was adopted from the Commonwealth where a quantitative stock assessment has been developed.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Platycephalus richardsoni</em></td>
<td>tiger flathead</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Tiger flathead (*Platycephalus richardsoni*), occur in ocean waters from northern NSW to Tasmania, at depths of 40 to 300 m. They can easily be confused with a similar species, the ‘toothy’ or ‘gold-spot’ flathead (*P. aurimaculatus*), which is common in the southern part of the range, especially in eastern Bass Strait. Trawling for fish off NSW originally concentrated on targeting tiger flathead, and the species remains significant in recent trawl landings despite being overfished in the 1950s and 1960s.

In NSW, tiger flathead are not taken in significant quantities by any other commercial fisheries, however over 20 t are estimated to be taken annually by recreational and charter boat fishers. Tiger flathead is included in the ‘flathead’ Total Allowable Catch for the Commonwealth Southern and Eastern Scalefish and Shark Fishery, which in 2008 was set at about 2850 t.

The biology and population dynamics of tiger flathead have been studied in detail since the species was first fished over 80 years ago. Growth rates and general biology have been well documented, and there is a reasonable level of monitoring information available for Commonwealth catches. Information is also available from monitoring of the size composition of catches taken under NSW jurisdiction in the early 1990s and for some recent years.

Tiger flathead is a moderately long lived species reaching a maximum age of about 15 years. Females grow larger (60 cm fork length, FL) than males (50 cm FL). Tiger flathead mature at 3 to 5 years of age (approximately 30 to 35 cm FL) and they have an extended spawning period from spring to autumn. Mature females may produce up to 2.5 million eggs. Little is known about the early life history of tiger flathead.
Additional Notes

- NSW landings declined from 200 t in 2006/07 to about 120 t in 2007/08 in association with a large decline in reported fishing effort, however catch rates remained relatively high and landings returned to about 200 t in 2008/09.
- Size composition monitoring of NSW commercial landings was recommenced in 2008.
- Commonwealth has a robust assessment that indicates the species is not overfished and is not subject to overfishing (current catch is close to the long term sustainable yield).
- Some recent biological information on growth and mortality rates is available from studies conducted in the Sydney/Newcastle area.
- There is a minimum legal length of 33 cm total length for tiger flathead and a combined recreational bag limit of 20 for all flathead (including only 10 dusky flathead).

Catch

Recreational Catch of Tiger Flathead

The annual recreational harvest of tiger flathead in NSW is likely to lie between 20 and 60 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Tiger Flathead

Commercial landings (including available historical records) of tiger flathead for NSW from 1946/47 to 2008/09 for all fishing methods. Note that the decline in reported catch during the 1990s was due to changes in catch recording requirements for fishers with both NSW and Commonwealth licences.

Catch rates of tiger flathead harvested using fish trawling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Growth Curves of Tiger Flathead

Growth curve of tiger flathead using parameters from Cui et al. (2005). Lengths are presented as total length (TL).
The length distribution of tiger flathead landed by NSW commercial fishers has been very stable since the 1990s, and comprises mainly fish between 33 and 50 cm fork length (FL). The minimum legal length of tiger flathead in NSW is 33 cm total length (approximately 32 cm FL).

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 296001, common name or scientific name to find further information.
Tiger Shark
(*Galeocerdo cuvier*)

**EXPLOITATION STATUS**  UNDEFINED

Tiger sharks are an important target species in the recreational club-based gamefish fishery. Commercial catches off NSW are likely to be smaller than recreational catches.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Galeocerdo cuvier</em></td>
<td>tiger shark</td>
<td>Found along NSW coast, mainly in summer.</td>
</tr>
</tbody>
</table>

**Background**

The tiger shark (*Galeocerdo cuvier*) is found in tropical and warmer temperate waters of all the world’s oceans. Its Australian distribution includes all northern Australia, extending south to Perth in the west and Bass Strait in the east. Tiger sharks are found from close inshore to well off the continental shelf, with a depth distribution ranging from the surface to 850 m. Satellite telemetry work has found individual tiger sharks are capable of undertaking long migrations. One individual was found to swim from an Australian coral reef directly to Papua New Guinea, then into the Gulf of Carpentaria before being caught in a net 3 months later.

At birth, tiger sharks are 50 to 75 cm in length. Males mature at about 300 cm and females between 287 and 330 cm. Both males and females grow at similar rates, and may reach a total length of 600 cm, and a weight of about 1000 kg. Tiger sharks are lecithotrophic viviparous where the young develop internally from eggs. Litter sizes of tiger sharks vary from 10 to 80, with an average litter size of 35. Breeding and pupping both occur every two years, usually in summer.

A huge variety of dietary items can be found in the stomachs of tiger sharks. Fishes and reptiles (turtles and sea snakes) dominate, with mammals (primarily cetaceans) and dugongs also commonly found.

NSW commercial fisheries land small numbers of tiger sharks, with annual catches ranging between 1 and 6 t. Catches come mostly from the Ocean Trap and Line Fishery, with the Ocean Trawl Fishery contributing only a minor proportion of the catch. Tiger sharks are often released alive due to poor market demand.

The catch of tiger sharks by recreational fishers is probably greater than the commercial catch. Tiger sharks are a favoured target species for some gamefishers, with an estimated 10 t being landed annually. Catches of tiger sharks are correlated with water temperature, as the species moves south with warmer waters.
Additional Notes

- Tiger sharks are an important target species in the recreational gamefish fishery and a key secondary species in the Ocean Trap and Line Fishery.
- Poor eating qualities result in low commercial landings (recently less than 5 t per annum). The fins are also apparently of comparatively low value.
- Historical NSW recreational gamefish catch information and biological data are available (Chan, 2001).
- Additional biological information is available for tiger sharks (Heithaus, 2001; Randall, 1992; Simpfendorfer, 1992; Stevens, 1984).
- There is a recreational bag limit of one tiger shark.

Catch

Recreational Catch of Tiger Shark

The annual recreational harvest of tiger shark in NSW is approximately 10 t. This estimate is based upon data collected by Chan (2001).

Further Reading


Simpfendorfer CA, Goodreid AB, McAuley RB (2001) Size, sex and geographic variation in the diet of the tiger shark, Galeocerdo cuvier, from Western Australian waters. Environmental Biology of Fishes 61:37-46


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 296001, common name or scientific name to find further information.
Tilefish

*(Branchiostegus spp.)*

<table>
<thead>
<tr>
<th>EXPLOITATION STATUS</th>
<th>UNDEFINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>An incidental catch of fish trawling, tilefish apparently have a restricted distribution off NSW. Commercial landings and size composition data are available, and a biological study is underway.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Branchiostegus wardi</em></td>
<td>pink tilefish</td>
<td>The major component of tilefish landings.</td>
</tr>
<tr>
<td><em>Branchiostegus serratus</em></td>
<td>Australian barred tilefish</td>
<td>Small quantities landed.</td>
</tr>
</tbody>
</table>

**Background**

Two species of tilefish inhabit NSW waters - the pink tilefish, *(Branchiostegus wardi)* and the less commonly caught barred tilefish *(B. serratus)*. They mainly inhabit depths between about 50 and 200 m although the barred tilefish has been caught as deep as 350 m. Both have a relatively restricted distribution along the east coast of Australia, between Noosa Heads in southern Queensland and eastern Bass Strait. The pink tilefish has also been reported from New Caledonia.

The pink tilefish is mainly plain pink on the body, grading to pink/white on the belly and has a colourful caudal fin bearing two broad yellow stripes in the centre, a dark triangular patch on the lower part of the fin and yellow and grey on the upper part of the fin. The barred tilefish is more silver/white in body colour and has about 15-16 dark vertical bands prominent on the upper body.

Pink tilefish prefer mud or sandy substrates, and they are reported to live in burrows. Tilefish feed on molluscs, worms, squid, crab and small fish. Tilefish larvae are pelagic with distinct patterns of spines along the head and on their scales. These spines are shed when the larvae develop into benthic juveniles. Pink tilefish grow to about 50 cm maximum length. The majority of small fish (< 40 cm) are female while male fish dominate the larger size classes.

Almost all the NSW tilefish catch is landed by fish and prawn trawlers working off Newcastle-Port Stephens and is comprised mostly of pink tilefish. The annual catch has reached 11 t but is mostly less than 5 t. Tilefish are marketed as fresh fish, mainly in the Sydney Fish Markets. Little has been published in relation to the biology of the species; a study is currently underway investigating the growth and reproductive biology of pink tilefish.
Additional Notes

- Pink tilefish *Branchiostegus wardi* is the main species taken - distribution is from southern Queensland to eastern Bass Strait, but significant landings only occur in the Newcastle/Nelson Bay area off central NSW.

- The environmental assessment for the Ocean Trawl Fishery assigned a moderately-high risk for pink tilefish.

- Tilefish are bottom dwelling fish that eat crustaceans and small fish species. Growth and reproductive biology are currently being studied.

- Tilefish have been traditionally reported as ‘moonfish’, and there has been confusion in the catch records with the oceanic moonfish (opah) *Lampris guttatus*. Recent reported landings of tilefish have apparently been less than the amount marketed through the Sydney Fish Markets.

- Taken only by trawling - commercial catch is low (recently less than 2 t) and fluctuates between years. Landings since 2005/06 have been lower than expected, and the reasons for this are being investigated.

Catch

**Recreational Catch of Tilefish**

The annual recreational harvest of tilefish in NSW is likely to be less than one tonne.

**Historical Landings of Tilefish**

*Commercial landings (including available historical records) of tilefish for NSW from 1990/91 to 2008/09 for all fishing methods. Note that the landings since 2005/06 may have been greater than indicated due to issues with the correct common name.*
The length distribution of pink tilefish landed by NSW commercial fishers is comprised mainly of fish between 25 and 50 cm total length (TL). There is no minimum legal length for pink tilefish in NSW.

Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 331006 and 37 331005, common name or scientific name to find further information.
Trumpeter Whiting

*(Sillago maculata)*

**EXPLOITATION STATUS**
UNDEFINED

Small commercial and recreational landings, mainly from a few estuaries. Biological studies of growth and maturity have recently been completed, but estimates of mortality rates from size and age composition data are lacking.

<table>
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<tr>
<th>SCIENTIFIC NAME</th>
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<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>Sillago maculata</td>
<td>trumpeter whiting</td>
<td>Also known as winter whiting.</td>
</tr>
</tbody>
</table>

**Background**

Trumpeter whiting (*Sillago maculata*) are distributed along the east coast of Australia. They favour silty or muddy substrates in estuaries and coastal embayments. Juvenile trumpeter whiting are found in estuarine seagrasses and shallow habitats, while adults are common in deeper estuarine waters down to depths of 30 m.

Trumpeter whiting grow to about 30 cm fork length (FL) and a weight of about 260 g. They reach a maximum age of about 12 years, mature at a length of about 15 cm FL and typically spawn within estuaries during spring and summer.

Trumpeter whiting forage for burrowing or benthic animals and eat mainly polychaete worms, crustaceans (amphipods, shrimps, crabs), bivalve molluscs and a variety of other benthic animals and small fish.

Trumpeter whiting are caught commercially by hauling and seine nets in shallow water (Estuary General Fishery) and by otter trawl in slightly deeper water (Estuary Prawn Trawl Fishery).

The recreational catch of trumpeter whiting is significant and is probably around the same order of magnitude as commercial landings.
Additional Notes

- The recreational catch is probably of a similar order of magnitude as commercial landings.
- Fish mature between 1-3 years old and live to a maximum of 12 years.
- Species is subject to highly variable recruitment, which means that estimates of mortality will also be variable.
- There is a combined recreational bag limit of 20 for all whiting.

Catch

Recreational Catch of Trumpeter Whiting

The annual recreational harvest of trumpeter whiting in NSW is likely to lie between 10 and 30 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Trumpeter Whiting

Commercial landings (including available historical records) of trumpeter whiting for NSW from 1954/55 to 2008/09 for all fishing methods.

Landings by Commercial Fishery of Trumpeter Whiting

Reported landings of trumpeter whiting by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Catch Per Unit Effort Information of Trumpeter Whiting Harvested by Hauling in NSW

Catch rates of trumpeter whiting harvested using hauling for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Growth Curve of Trumpeter Whiting

Growth curves of trumpeter whiting using parameters from Kendall and Gray (2009). Lengths are presented as fork length (FL).
The length distribution of trumpeter whiting in NSW commercial landings was relatively stable between the 1970s and the 1990s, and was comprised mainly of fish between 18 and 25 cm fork length (FL). There is no minimum legal length for trumpeter whiting in NSW.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 330015, common name or scientific name to find further information.
Turban Shells
(*Turbo* spp.)

**Exploitation Status**  UNDEFINED

Very little information available to establish an exploitation status.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
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<tbody>
<tr>
<td><em>Turbo torquatus</em></td>
<td>Sydney turban shell</td>
<td></td>
</tr>
<tr>
<td><em>Turbo militaris</em></td>
<td>Military turban shell</td>
<td>Also known as <em>T. imperialis</em>.</td>
</tr>
<tr>
<td><em>Turbo undulatus</em></td>
<td>Green turban shell</td>
<td></td>
</tr>
</tbody>
</table>

**Background**

Turban shells are large marine gastropods (snails) that occur in intertidal and shallow subtidal rocky shores of NSW ocean waters. They are opportunistic feeders, eating a variety of foliose and encrusting algae. Turban shells have been found to spawn twice a year, although spawning may be asynchronous among individual females and between localities. Growth and mortality rates have not been subject to detailed study, although for the Sydney turban shell (*Turbo torquatus*) the available data suggest that females may live longer and grow larger than males.

The two larger turban shell species, the Sydney turban shell and the military turban shell (*T. militaris*) grow to a maximum size of about 10 - 11 cm shell width, and are harvested mainly by licensed commercial divers using surface-supplied compressed air (hookah). Sydney turban shells occur in suitable habitats along the length of the NSW coast and have a relatively rounded apex on the shell, while military turban shells occur north of about Wollongong and have a distinctly pointed apex on the shell. There is some uncertainty about the correct scientific name for the military turban shell, with some researchers preferring *T. imperialis*.

A smaller species, the green turban shell (*T. undulatus*) grows to a maximum size of about 6 cm shell width, and occurs in intertidal zones on rocky shores from southern Queensland to Western Australia, including Tasmania. It is likely that this species is more commonly harvested by recreational fishers.

Commercial landings of turban shells are low and the number of divers involved in harvesting turban shells is small and variable from year to year. In conjunction with the sea urchin fishery, the commercial fishery for turban shells is subject to a significant number of area
closures, designed to provide areas of refugia against which the effects of fishing in the open areas can be evaluated. Additionally, both commercial and recreational fishers are subject to fishing closures within the series of Marine Parks and Aquatic Reserves which exist along the NSW coastline.

**Additional Notes**
- Two species provide the majority of the harvest (*Turbo torquatus* and *T. militaris*) – both are subject to a 75 mm minimum legal length (shell width).
- A third species, *T. undulatus*, is smaller and less commonly harvested.
- A small commercial fishery recently, about 6 t annual yield.
- Recreational fishery has not been estimated.
- There is a recreational bag limit of 20 individual turban shells per fisher per day (all species combined).

**Catch**

**Recreational Catch of Turban Shells**

The annual recreational harvest of turban shells in NSW has not been estimated, but is likely to be of a similar magnitude as the commercial harvest.

**Further Reading**


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 24 045003, 24 045002, and 24 045004, common name or scientific name to find further information.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry and Investment NSW or the user’s independent adviser.
Whaler Sharks

*(Carcharhinus spp.)*

**EXPLOITATION STATUS**  
**UNDEFINED**

A complex of species that are very difficult to identify (particularly as juveniles). Insufficient information is available to determine status for any of the whaler shark species.

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>STANDARD NAME</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td><em>Carcharhinus brachyurus</em></td>
<td>bronze whaler</td>
<td>Generally south of Coffs Harbour.</td>
</tr>
<tr>
<td><em>Carcharhinus brevipinna</em></td>
<td>spinner shark</td>
<td>Generally north of Jervis Bay.</td>
</tr>
<tr>
<td><em>Carcharhinus falciformis</em></td>
<td>silky shark</td>
<td>Generally north of Sydney.</td>
</tr>
<tr>
<td><em>Carcharhinus leucas</em></td>
<td>bull shark</td>
<td>Nearshore, estuaries and rivers from Sydney north, more common on North Coast.</td>
</tr>
<tr>
<td><em>Carcharhinus limbatus</em></td>
<td>common blacktip</td>
<td>Caught north of Bermagui.</td>
</tr>
<tr>
<td><em>Carcharhinus obscurus</em></td>
<td>dusky whaler</td>
<td>Mainly caught inshore.</td>
</tr>
<tr>
<td><em>Carcharhinus plumbeus</em></td>
<td>sandbar shark</td>
<td>Generally from Coffs Harbour north in water warmer than 23°C.</td>
</tr>
</tbody>
</table>

**Background**

Seven species of whaler sharks have been recorded in catches off NSW. The bronze whaler (*Carcharhinus brachyurus*) is found on the inshore continental shelf, usually in depths shallower than 100 m. Its Australian distribution extends southward from Coffs Harbour in NSW to southern WA. Bronze whalers reach a length of 300 cm, with males maturing at 235 cm, and females at 245 cm. Litter sizes of bronze whalers range from 7 to 20 pups.

Both the spinner shark (*C. brevipinna*) and common blacktip shark (*C. limbatus*) occur on the continental shelf from nearshore to depths of 75 m, although the common blacktip occasionally may be caught far offshore. These two species are found from southern NSW northward around northern Australia to WA. In tropical waters, the common blacktip is externally indistinguishable from the Australian blacktip shark (*C. tilstoni*), however this species is infrequently found in NSW. Maximum length of the spinner shark is 280 cm, while the blacktip shark reaches 250 cm. For the spinner shark both sexes mature at 190-200 cm, while maturity in the blacktip shark varies with location. Males can mature at 135-180 cm and females between 120 and 190 cm. Litter sizes vary from 3 to 15 pups in the spinner shark, and 1 to 10 (usually 4 to 7) pups in the common blacktip shark. For both species, gestation period is 10-12 months and females breed every 2 years. There is a late summer fishery on juvenile spinner sharks in Stockton Bight off Newcastle, NSW.
The silky shark (*C. falciformis*) is oceanic but most abundant along the edge of the continental shelf, and can be found from the surface down to depths of 500 m. Silky sharks occur in waters north from Sydney, across northern Australia, and south to Lancelin in WA. Maximum length is 330 cm, with both sexes mature between 200 and 210 cm. The silky shark produces litter sizes between 2 and 15 pups after an unknown gestation.

The bull shark (*C. leucas*) is a coastal, estuarine and riverine shark. In the marine environment it occurs near the bottom, from the surf zone to depths of at least 150 m. It is found in tropical and warm temperate seas around northern Australia between Sydney and Perth. Bull sharks reach a length of 340 cm, and both sexes mature at 220-230cm. Litter sizes range from 1 to 13 pups. Females normally give birth in the lower reaches of estuaries, and the juvenile sharks may remain in the river for up to 5 years.

The dusky whaler (*C. obscurus*) is a widespread species, distributed around the entire Australian coast (although rare off southern Tasmania). It is found on the continental shelf, from the surf zone to adjacent oceanic waters. The dusky whaler inhabits depths ranging from the surface down to at least 400 m. Maximum length is 365 cm, with males maturing at 265-280 cm and females at 295-310 cm. Litter sizes range from 3 to 14 pups (average 10). Adults and adolescent dusky whalers appear to move inshore during summer in WA waters, however the occurrence of similar movement patterns has not been examined on the east coast.

The sandbar shark (*C. plumbeus*) prefers water warmer than 23°C. Its distribution extends around northern Australia from Coffs Harbour in NSW to Esperance in WA. The sandbar shark is found on the continental shelf and adjacent deep water from the intertidal region to depths of 280 m. This species is normally found closely associated with the substrate. It grows to a maximum length of 240 cm. Males mature at 130-180cm and females mature at 145-185 cm. Only 3 to 8 pups are produced every second year, with multiple males fathering a single litter.

Individual statistics are not available for each of these species from NSW catch records, as a large proportion of sharks have been reported in the 'sharks unspecified' category. The Ocean Trap and Line Fishery lands 68% of the annual catch of whaler sharks, with Estuary General and Ocean Trawl Fisheries also contributing catches. Whaler sharks are the largest NSW commercial shark catch, with an average of 165 t landed per year between 1997/98 and 2005/06. The 2006/07 catch was considerably higher, at 425 t due to an increase in targeted fishing off the north coast of NSW. This fishery has prompted the development of specific management rules for shark fishing, and a requirement for fishers to more accurately report catches by species for the 'whaler shark' group. Many of the species landed in the NSW commercial fishery are also landed by fisheries in adjoining jurisdictions, and by recreational fisheries in NSW.

**Additional Notes**

- Onboard observer studies suggest five species make up the majority of the catch by commercial line fishers.
- NSW recreational gamefish catch information is available, including identification of landed sharks to species level (Chan, 2001).
- There is a recreational bag limit of one whaler shark.

**Catch**

*Recreational Catch of Whaler Sharks*

The annual recreational harvest of whaler sharks in NSW is likely to lie between 40 and 160 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Reported landings of whaler sharks by NSW commercial fisheries from 1997/98. Fisheries which contribute less than 2.5% of the landings are excluded for clarity and privacy.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 018001, 37 018023, 37 018008, 37 018021, 37 018039, 37 018003 and 37 018007, common name or scientific name to find further information.
Whitebait - Sandy Sprat

*(Hyperlophus vittatus)*

**Exploitation Status**: Undefined

Commercial landings average about 100 t per annum and size composition monitoring has been conducted on catches, but there is little local biological information available and mortality rates have not been estimated.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Standard Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Hyperlophus vittatus</em></td>
<td>sandy sprat</td>
<td>Constitutes the majority of the catch.</td>
</tr>
<tr>
<td><em>Engraulis australis</em></td>
<td>Australian anchovy</td>
<td>Small quantities landed.</td>
</tr>
<tr>
<td><em>Sardinops sagax</em></td>
<td>Australian sardine</td>
<td>Small quantities landed. Also known as pilchard.</td>
</tr>
<tr>
<td><em>Spratelloides robustus</em></td>
<td>blue sprat</td>
<td>Small quantities landed.</td>
</tr>
</tbody>
</table>

**Background**

In NSW, catches reported as ‘whitebait’ by commercial fishers can include a number of species, however the vast majority of the catch is comprised of sandy sprats, *(Hyperlophus vittatus)*. Other species sometimes included in catches of whitebait are Australian anchovy *(Engraulis australis)*, Australian sardine *(Sardinops sagax)* and blue sprats *(Spratelloides robustus)*. The majority of the whitebait catch is taken from ocean waters, however in some years significant landings of whitebait are reported from estuarine waters. Most of the commercial catch of whitebait is taken with small-meshed hauling nets.

Sandy sprats are a small, short lived species, reaching a maximum size of about 10 cm and 4 years of age. However, the majority of fish in commercial catches are 5 to 8 cm in length and 1 to 3 years of age. They occur in estuarine and inshore waters around southern Australia, from southern Queensland to southern WA, and significant fisheries exist in some areas, however little is known of the stock structure of sandy sprats throughout this range.

Sandy sprats are multiple batch spawners, but estimated batch fecundity is low to medium (743 to 5600 hydrated oocytes per batch). In SA female sandy sprats mature at 5.8 to 7.5 cm fork length, when they are 1 to 2 years of age, and spawning occurs in spring and summer. In NSW spawning may occur later as larvae have been caught in April/May.
Additional Notes

- Sandy sprat constitutes the majority of the catch (> 95%) so assessment should focus on this species.
- Research in South Australia indicates sandy sprats are fast growth/high mortality species, therefore not likely to be a major concern for overfishing.
- This reporting group also includes ‘nanata’ which is a generic name for small juvenile fish used by commercial fishers in NSW and the Sydney Fish Market - sampling has shown nanata to be comprised mainly of juvenile *H. vittatus*, with small numbers of other clupeid species.
- There is a recreational bag limit of 50 for whitebait/sandy sprat - but they are rarely caught by recreational fishers.

Catch

Recreational Catch of Whitebait - Sandy Sprat

The annual recreational harvest of whitebait - sandy sprat in NSW is likely to be less than one tonne.

Historical Landings of Whitebait - Sandy Sprat

Landings (including available historical records) of whitebait - sandy sprat for NSW from 1990/91 to 2008/09 for all fishing methods.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 085005, 37 086001, 37 085002 and 37 085003, common name or scientific name to find further information.
Wobbegong Sharks  
(*Orectolobus* spp.)

**Background**

At least ten species of wobbegongs are known from Australian waters with three species occurring along the NSW coast. The ornate wobbegong (*Orectolobus ornatus*) is distributed from Port Douglas in North Queensland to Sydney in the south. The spotted wobbegong (*O. maculatus*) is found from about Gladstone in central Queensland to Lakes Entrance in Victoria, and may also occur west of Bass Strait, but these records are uncertain. The third species is the gulf wobbegong (*O. halei*), which ranges around the south of the continent from southern Queensland to southern WA.

The three species are typically found in shallow inshore waters on coral and rocky reefs along the coast and around offshore islands. They usually inhabit depths less than 50 m although have been recorded to 220 m. Occasional captures, mainly of spotted wobbegongs, are made on sandy trawl grounds to depths of 100 m. The diet of wobbegongs comprises various fishes including small sharks and rays, octopus and occasionally invertebrates.

The ornate wobbegong is a small species, maturing at about 80 cm and attaining a maximum length of about 110 cm. The spotted wobbegong is reported to reach about 300 cm in length, but seldom exceeds 160 cm in NSW with a size at maturity of around 115-120 cm. Gulf wobbegong reaches at least 210 cm in NSW, and reportedly grows to almost 300 cm. The size at maturity for gulf wobbegong is between 161 and 187 cm. Wobbegongs are lecithotrophic viviparous, where the young develop in the uterus from eggs before being born at about 20 cm in length. The number of young varies with the size of the sharks with ornate wobbegongs having up to 18 pups, (averaging 9), spotted wobbegongs up to

**Exploitation Status**: undefined

The available catch data are not sufficiently accurate to use for determining stock status for any of the three species which occur off NSW. From July 2009 more detailed reporting is required on commercial catch return forms.

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<td><em>Orectolobus maculatus</em></td>
<td>spotted wobbegong</td>
<td></td>
</tr>
<tr>
<td><em>Orectolobus halei</em></td>
<td>gulf wobbegong</td>
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*Image © Bernard Yau*
37 pups, and gulf wobbegong as many as 53 pups. Although gestation for all species is 10 - 11 months, they breed only once every three years making their apparent high fecundity (for sharks) much lower in practice.

The Ocean Trap and Line Fishery accounts for 80% of the commercial harvest of wobbegong sharks in NSW with most caught by various line-fishing methods. In the 15 years after 1990, annual NSW wobbegong landings declined from about 120 t to about 60 t. Recent management in the form of trip limits has seen a further decline in commercial landings.

Additional Notes
- Three species of wobbegong now recognised in the NSW catch but better information is required on the proportion of the three species in catches.
- There are important biodiversity and conservation issues associated with this group of species.
- Biological information for all three species is available from Huveneers (2007).
- Additional management measures have been introduced for wobbegong sharks taken in the Ocean Trap and Line Fishery - a trip limit of 6 carcases and a minimum length of 130cm now apply.
- Wobbegong sharks are no longer permitted to be retained by recreational fishers.
- Changes to the structure of the industry are probably responsible for some of the patterns in the catches (decreasing) and catch rates (increasing).

Catch
Recreational Catch of Wobbegong Sharks
Prior to 2007, the annual recreational harvest of wobbegong sharks in NSW was likely to lie between 10 and 50 t. This estimate was based upon the results of the offshore National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW. Note that a recreational bag limit of zero was introduced for wobbegong sharks in September 2007 and they are no longer permitted to be retained by recreational fishers.
Catch rates of wobbegong sharks harvested using all line fishing methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 013001, 37 013003 and 37 013020, common name or scientific name to find further information.
Yellowfin Bream
(*Acanthopagrus australis*)

**EXPLOITATION STATUS**  
**FULLY FISHED**

The yellowfin bream has a long history of stability of both the length composition and commercial catch rate data. The species is the basis of very significant recreational and commercial fisheries in NSW.

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<td><em>Acanthopagrus australis</em></td>
<td>yellowfin bream</td>
<td>Majority of landings.</td>
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**Background**

Yellowfin bream (*Acanthopagrus australis*) are endemic to Australia and occur from Townsville in Queensland to the Gippsland lakes in Victoria. In NSW waters, yellowfin bream are found primarily within estuaries and along nearshore beaches and rocky reefs, although they also occur within the lower freshwater reaches of coastal rivers. Within estuaries, yellowfin bream are found in association with all types of habitat, including seagrass beds, mangroves, bare substrates and rocky reefs. They eat a wide variety of foods, including small fish, molluscs, crustaceans and worms.

Spawning occurs in inshore waters near estuary entrances during winter. The larvae enter estuaries and the small juveniles subsequently live in sheltered shallow water habitats (particularly seagrass beds and mangrove channels). Larger juveniles occur in slightly deeper waters, and are particularly common around estuarine and near shore coastal reefs. Yellowfin bream grow slowly, taking about 5 years to reach 23 cm fork length (FL). They mature at around 22 cm and appear to undertake extensive pre-spawning migrations. Maximum length is about 55 cm FL and maximum weight about 3.7 kg. Adults may return to estuarine waters after spawning.

The majority of bream taken in the Estuary General Fishery are caught in mesh and hauling nets with a smaller number taken in fish traps. The highest commercial catches of bream occur in autumn and winter. Yellowfin bream are also taken in very large quantities by recreational fishers and recreational landings are estimated to be about double commercial landings.

Reported commercial landings of bream declined during the 1990s. This decline was at least partly attributable to phasing out the use of pound (figure six) nets in Port Stephens and adjoining coastal waters. There was also a decline in the amount of fishing effort reported in estuaries during this time. Commercial
landings have stabilised in recent years, and the age and length compositions of catches have remained relatively stable, indicating no declines in older fish.

Black bream (A. butcheri) is a similar species to yellowfin bream and is found in estuarine waters on the NSW coast south of Myall Lakes. They are almost exclusively found in estuarine waters, and generally only enter ocean waters after periods of flood. Black bream are often reported as yellowfin bream during catch reporting, as distinguishing the species by visual examination can be very difficult. The differentiation between the species is made more difficult through a significant percentage of hybrids that exist as a result of the two species interbreeding.

**Additional Notes**

- Length frequency has been stable since the 1950s and the age distribution of commercial catches in the early 1990s was mainly 3-8 year old fish (Gray et al., 2000).

- There is a minimum legal length of 25 cm total length (approximately 22.5 cm FL) for yellowfin and black bream and a combined recreational bag limit of 20 for all bream and tarwhine.

**Catch**

**Recreational Catch of Yellowfin Bream**

The annual recreational harvest of yellowfin bream in NSW is likely to lie between 820 and 1070 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Catch rates of yellowfin bream harvested using fish trapping for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.

The length distribution of NSW commercial landings of yellowfin bream has been reasonably stable since the 1950s. Prior to the 1950s, the minimum legal length (MLL) for bream in NSW was 9 inches (approximately 22 cm total length (TL) or 19 cm fork length (FL)), but since the 1960s the MLL has been 25 cm TL (approximately 22.5 cm FL).
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/, and search for the species code (CAAB) 37 353004 and 37 353003, common name or scientific name to find further information about the species.
Yellowfin Tuna

*(Thunnus albacares)*

**Exploitation Status**: Fully Fished

Mainly a Commonwealth fishery off eastern Australia, with some uncertainty about the degree of overlap with the much larger western and central Pacific stock. Status has been adopted consistent with the Commonwealth assessment - ‘not overfished’, but there is some concern about high rates of fishing in the western and central Pacific.

### Background

Yellowfin tuna (*Thunnus albacares*) are distributed throughout the warm-temperate and tropical waters of all oceans living in temperatures between 15 and 31°C. They are a highly migratory, pelagic species that prefer open oceanic waters although they are occasionally caught in deep bays and harbours. Yellowfin tuna form large schools, primarily by size, which are often associated with floating debris such as logs. In the central Pacific, the larger fish frequently school with dolphins and it was this behaviour that lead to high dolphin mortality during the early years of the purse seine fishery for yellowfin tuna; subsequent changes in fishing procedures have greatly reduced the dolphin mortality. It is a highly migratory species that regularly travels long distances and genetic studies have found that yellowfin tuna from all oceans share a common gene pool.

Yellowfin tuna are fast growing fish, with females reaching 5 kg by the end of their first year and maturity after about 2 years at 25 kg. Maximum size is in excess of 200 cm (fork length, FL) and 175 kg, but on the east coast of Australia, yellowfin are commonly 50 to 190 cm in length and 4 to 100 kg in weight. Spawning occurs through most of the year in water temperatures greater than 26°C, with females shedding eggs every 1-2 days over a period of several months; during a single spawning season, an individual can produce up to 1,500,000 eggs. Yellowfin tuna are opportunistic carnivores, feeding on small fish, crustaceans and squids.

Worldwide, about one million tonnes of yellowfin tuna are harvested annually making it one of the most important fishery resources of the world. The total Australian catch is comparatively small (~ 2000 t per annum) and although yellowfin tuna are found around the whole Australian coast, most of the catch is taken off NSW and Queensland in the Commonwealth managed East Coast Tuna and Billfish Fishery. Yellowfin tuna is an excellent eating fish that is sold frozen, canned, fresh, and smoked, and is highly valued for sashimi.
In recent years, the NSW yellowfin tuna catch has been less than ten tonnes per year, with almost all taken by line-fishing methods in the Ocean Trap and Line Fishery. The species is also a popular gamefish and it is likely that the recreational fishery lands far more yellowfin tuna than the commercial fishery.

**Additional Notes**

- NSW commercial landings are very small (< 10 t) compared with Commonwealth Eastern Tuna and Billfish Fishery (approximately 2,000 t per annum).
- Recreational landings off NSW are significant but not accurately estimated - likely to be between 50 and 350 t.
- Commonwealth assessment processes for the Eastern Tuna and Billfish Fishery consider this species to be not overfished (40-50% of unfished biomass), but there is some concern that current levels of fishing may be reducing the stock if recent levels of recruitment are ‘average’.
- Some catch and catch rate information is available for the recreational fishery (Lowry and Murphy, 2003; Murphy et al., 2002; Park, 2007; Williams, 2002).
- There is a combined recreational bag limit of 5 fish under 90 cm total length (TL) and 2 fish over 90 cm TL for all tuna species.

**Catch**

**Recreational Catch of Yellowfin Tuna**

The annual recreational harvest of yellowfin tuna in NSW is likely to lie between 50 and 350 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.
Further Reading


Please visit the CSIRO website, http://www.marine.csiro.au/caab/ and search for the species code (CAAB) 37 441002, common name or scientific name to find further information.
Yellowtail Kingfish
(Seriola lalandi)

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<td>Catch rates of commercial line fishers have improved since the 1990s. Size composition data indicate the stock remains growth overfished.</td>
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<th>STANDARD NAME</th>
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<tr>
<td>Seriola lalandi</td>
<td>yellowtail kingfish</td>
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</table>

Background

Yellowtail kingfish (Seriola lalandi) are distributed throughout temperate waters of the Pacific and Indian oceans. In Australian waters they are distributed from southern Queensland to central WA, including the east coast of Tasmania, and around Lord Howe and Norfolk islands.

Kingfish are spring-summer spawners with pelagic eggs that are about 1.4 mm in diameter. Larval kingfish hatch within 2-3 days at 4 mm in length. Schools of juvenile kingfish can be found in offshore waters around the continental shelf and solitary or small groups of adults can be found near rocky shores, reefs and islands. While it is reported that adults can reach about 190 cm in total length (TL) and can weigh up to 70 kg, it is thought that fish of this size are rare. Maximum age is thought to be in excess of 21 years. Kingfish are opportunistic daytime feeders with fish, squid and crustaceans forming a large part of their diet. Tagging programs have shown widespread movements of kingfish from NSW to New Zealand (and vice versa) and many large scale movements (> 500 km) along the NSW coast.

The estimated size at which 50% of females and males are sexually mature is around 83 cm and 47 cm FL respectively. For males, this size at maturity occurs at an age of less than 1 year old. Growth is rapid, being nearly linear between 1 and 11 years old, with fish reaching the 65 cm minimum legal length (MLL) at around 2-3 years of age.

Kingfish is an important commercial and recreational species with the recreational harvest being comparable to the commercial harvest. The Ocean Trap and Line Fishery contributes about 99% of the total catch in the commercial sector. The commercial harvest of kingfish decreased from around 600 t in the mid-late 1980s to around 100 t in the late 1990s. A 60 cm MLL was imposed for kingfish in NSW waters in 1990, and kingfish traps were banned in 1996. The peak period of capture is December to May with line methods being the main capture method.

In September 2007 the MLL for yellowtail kingfish in NSW was increased from 60cm to 65cm TL.
Additional Notes

- Length-based monitoring of commercial catches shows little change in the size composition of recent landings, except that caused by the change from 60 to 65 cm in the minimum legal length.
- Indications are that the fishing mortality rate remains relatively high.
- Commercial landings have fluctuated between 85 and 160 t in recent years and are still below the 200 tonnes per annum average taken through the 1960s-1970s, prior to the introduction of kingfish traps. Commercial catch rates have improved over the past decade.
- The recreational catch is probably larger than commercial landings but few recent data are available. Estimation of recreational landings is a high priority.
- The minimum legal length was increased from 60 to 65 cm total length in September 2007 and there is a recreational bag limit of 5 yellowtail kingfish.

Catch

Recreational Catch of Yellowtail Kingfish

The annual recreational harvest of yellowtail kingfish in NSW is likely to lie between 120 and 340 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

Historical Landings of Yellowtail Kingfish

Catch Per Unit Effort Information of Yellowtail Kingfish Harvested by all Lining Methods in NSW

Catch rates of yellowtail kingfish harvested using all line methods for NSW. Two indicators are provided: (1) median catch rate (lower solid line); and (2) 90th percentile of the catch rate (upper dashed line). Note that catch rates are not a robust indicator of abundance in many cases. Caution should be applied when interpreting these results.
Length Frequency of Yellowtail Kingfish

- 1974/75–1989/90
- 1997/98–2000/01
- 2007/08–2008/09

The length distribution of NSW commercial landings of yellowtail kingfish mainly comprises fish between 50 and 100 cm fork length (FL). A minimum legal length (MLL) of 60 cm total length (TL) (approximately 52 cm FL) was introduced in 1990, and the size distribution of kingfish greater than this length has remained relatively stable since that time. The MLL for yellowtail kingfish in NSW was increased to 65 cm TL in September 2007.

Growth Curve of Yellowtail Kingfish

Age-length data with fitted growth curve for yellowtail kingfish (Stewart et al., 2001). Lengths are presented as fork length (FL).

Further Reading


Please visit the CSIRO website, [http://www.marine.csiro.au/CAAB/](http://www.marine.csiro.au/CAAB/) and search for the species code (CAAB) 37 337006, common name or scientific name to find further information.
Yellowtail Scad

*(Trachurus novaezelandiae)*

**EXPLOITATION STATUS**

*FULLY FISHED*

A relatively long-lived small pelagic species which is significant in commercial and recreational catches, exploited throughout its range.

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<tr>
<td><em>Trachurus novaezelandiae</em></td>
<td>yellowtail scad</td>
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</table>

**Background**

Yellowtail scad (*Trachurus novaezelandiae*) occur around southern Australia from Queensland to WA, and off New Zealand. The species inhabits coastal waters and the lower reaches of estuaries. Adults are frequently associated with rocky reefs, while juveniles commonly occur over shallow, soft substrate and around structures such as wharves.

In NSW waters, yellowtail scad grow to a maximum length of about 33 cm and age of 15 years, while in New Zealand, the species reaches 40 cm and an age of 28 years. NSW yellowtail scad mature at approximately three years old and 20-22 cm fork length, and spawning occurs in summer and autumn.

In NSW, yellowtail scad are mainly caught by the Ocean Hauling Fishery in purse seine nets. Smaller quantities are also taken in bait nets (which are modified hauling nets) and general purpose hauling nets. Small quantities are also landed by trawlers but much of the trawl-caught yellowtail scad is discarded. Catches are taken throughout the year, with slightly higher catches in summer and autumn. Yellowtail scad is a very significant species in recreational catches, and is often caught for use as bait by both recreational and commercial fishers.

Since about 1997, the reported landed catch of yellowtail scad has been between 300 and 500 t per annum. Most is sold for human consumption but there is an increasing demand for the use of yellowtail scad as bait in other commercial and recreational fishing activities, particularly as live bait for tuna.
**Additional Notes**

- This species is the basis of targeted purse seine, bait-for-own-use and recreational fisheries in estuarine and near coastal waters off NSW.

- Yellowtail scad are also harvested under permit by Commonwealth fishers for use as bait in the tuna longline fishery.

- Length- and age-based monitoring of commercial catches was conducted from 2001 to 2008 at the Sydney Fish Market (note that monitoring data are mainly representative of the oceanic purse seine fishery.

- Yellowtail scad are relatively long-lived for a small pelagic species and have been aged to >15 years old.

- Length and age data from commercial monitoring have recently been analysed - the results show the fishery is based mainly on 3 to 10 year old fish and suggest the passage through the stock of a number of ‘stronger’ year classes.

- Only a minor species in the Commonwealth sector.

**Catch**

*Recreational Catch of Yellowtail Scad*

The annual recreational harvest of yellowtail scad in NSW is likely to lie between 40 and 60 t. This estimate is based upon the results of the offsite National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) and onsite surveys undertaken by I & I NSW.

**Historical Landings of Yellowtail Scad**

*Commercial landings (including available historical records) of yellowtail scad for NSW from 1969/70 to 2008/09 for all fishing methods.*
The length distribution of yellowtail scad landed by NSW commercial purse seine fishers has remained relatively stable in recent years and shows two modes - a smaller mode at 12 to 18 cm fork length (FL) and the main mode between 20 and 30 cm FL. There is no minimum legal length for yellowtail scad in NSW.

Further Reading


Stewart, J. and D.J. Ferrell (2001). *Age, growth, and commercial landings of yellowtail scad (Trachurus novaerzelandiae) and blue mackerel (Scomber australasicus) off the coast of New South Wales, Australia*, New Zealand, *Journal of Marine and Freshwater Research* 35 (3): 541-551.

Stewart, J., D.J. Ferrell and N.L. Andrew (1998). *Ageing Yellowtail (Trachurus novaerzelandiae) and Blue Mackerel (Scomber australasicus) in New South Wales, Final report to Fisheries Research and Development Corporation - Project 95/151*, Cronulla, NSW Fisheries.


Please visit the CSIRO website, [http://www.marine.csiro.au/caab/](http://www.marine.csiro.au/caab/) and search for the species code (CAAB) 37 337003, common name or scientific name to find further information.

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