



Newsletter No.27
December 2013



Welcome to the RAP Newsletter, providing feedback on the data you are collecting and keeping you informed about what is happening at the Research Division of the Department of Fisheries.

Bight redfish tagging study starts

The movement of Bight redfish (*Centroberyx gerrardi*) in southern oceanic waters is being investigated in a new tagging study by the Department of Fisheries. Bight redfish are a demersal species occupying the deeper continental shelf waters along the south and lower west coasts of WA, extending into South Australia.

In WA the species is often incorrectly referred to as 'nannygai', a closely related eastern states species.

Bight redfish live at depths from roughly 30 to over 300 metres. When released they have a remarkable ability to swim straight to the bottom, showing few signs of barotrauma. This is unusual for a species living at these depths, making them a good candidate for tagging.

1,500 Bight redfish will be tagged at various locations from Cape Naturaliste to east of Esperance. Boat fishers in the south are being asked to keep an eye out for the green dart tags, inscribed with a telephone 'hotline' number for reporting recaptures.

The newly commenced tagging study aims to identify fish movement patterns, which are an important consideration in managing any fishery. If it shows Bight redfish to be highly mobile along the lower west and south coast of WA, this suggests they should be managed as a single stock. On the other hand, if it shows there is little movement of tagged fish, this suggests localized depletion of stocks is possible. The implications of this are, for example, if the Bight redfish population near Esperance became depleted, one would not expect replenishment from the Albany population, so these stocks might have to be managed separately.



It is interesting to speculate on what the tagging study will reveal by considering the anatomy of Bight redfish. One clue is the tail (caudal) fin, which propels the fish through the water. The forked tail shape of the Bight redfish is often found on fish that swim constantly and over long distances – suggesting a mobile species. However, in contrast, the large head of the Bight redfish is typical of a more sedentary species.

Murdoch University fish biologist Dr Peter Coulson, who is studying Bight redfish biology, discounts significant along-shore movements: 'They don't strike me as a species capable of swimming large distances and appear more adept to hanging in caves or over lumps.' He points to preliminary age data showing different growth rates between fish from the Great Australian Bight and ones further west as evidence of lack of exchange between those areas. The tagging study will help resolve this mystery.

While along-shore movement seems unlikely, a study of fish spawning aggregations in the Cape-to-Cape region by Mike Mackie in the mid-2000s suggested Bight redfish undertake

regular inshore-offshore movements, perhaps related to spawning behavior. Under this hypothesis, the juveniles would eventually move offshore to complete their life cycle.

Dr Peter Coulson says the inshore-offshore hypothesis has support from preliminary age data: young fish are more commonly caught in relatively shallow water (around 30 m) compared to deepwater catches from places like the Albany Canyon, where older fish are more prevalent. Tagging will hopefully reveal evidence of inshore-offshore movements.

The tagging of Bight redfish is part of a broader research project assessing the health of demersal south coast fish stocks, funded by the State Natural Resource Management Office. The sustainability of the fisheries for pink snapper and blue morwong ('queen snapper'), as well as for Bight redfish, will be assessed. Fishers catching these species are asked to donate their 'frames' (fish skeletons with heads and guts intact) to assist the study. There are great prizes available, including a grand prize of a charter fishing trip for two to the Montebello Islands, donated by Monte Bello Island Safaris. For details see: www.fish.gov.au/frames

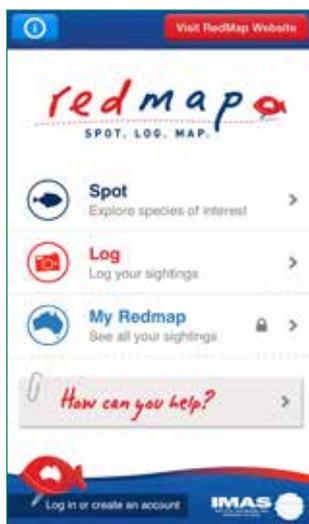
Report marine 'strangers' with the Redmap app

Redmap has launched a free phone application to assist reporting of unusual marine species with a few clicks on your phone. Complementing its website www.redmap.org.au, the app also contains information on species Redmap has highlighted in WA as being important to look out for and allows individuals to build their own map and catalogue of sightings.

Observations submitted to Redmap of unusual sightings help scientists track which marine species are shifting their usual range into new areas. These changes may be in response to changes in your local seas, including ocean warming.

The app is supported by an Australian Government Inspiring Australia grant; the New South Wales Environmental Trust; and the University of Tasmania.

Become a citizen scientist today and download the free app at the iTunes App Store or Google Play and Spot, Log, Map.

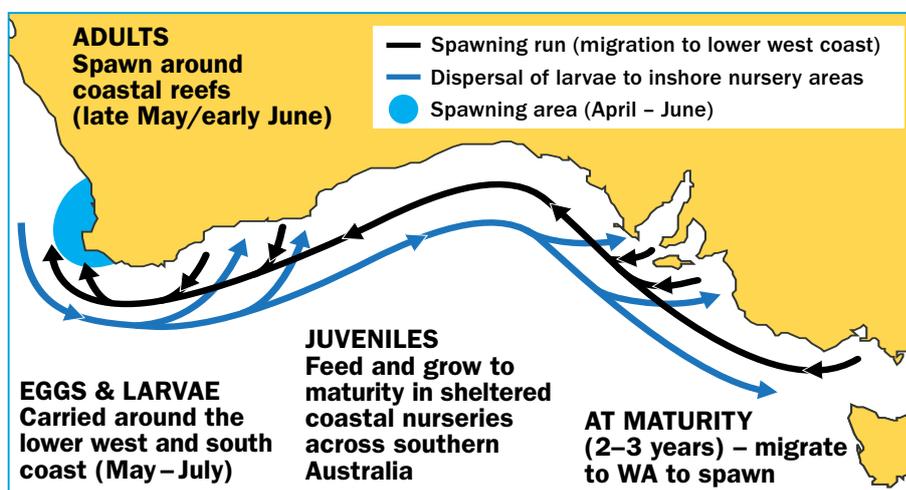


Results of nearshore finfish project unveiled

The Department of Fisheries recently released the results of a major research investigation into the status of nearshore finfish stocks in the West Coast Bioregion (which runs from Black Point, east of Augusta to the Zuytdorp Cliffs, north of Kalbarri) of WA. This three-year project collected new biological data on Australian herring (*Arripis georgianus*), tailor (*Pomatomus saltatrix*), southern school whiting (*Sillago bassensis*), King George whiting (*Sillaginodes punctata*) and southern garfish (*Hyporhamphus melanochir*). The stock status of these popular species was largely unknown prior to this study.

The status of each stock was assessed using a 'weight of evidence' approach – which incorporates all available historical and current information about the fish stocks, including past and present levels of fishing mortality, catch composition, catch rate trends, recruitment trends and the inherent vulnerability of the stock to exploitation due to biological characteristics.

The assessments, which were reviewed by an external expert reviewer, found that the risk status of tailor and whiting stocks is acceptable but that, due to a combination of changing environmental conditions and sustained fishing activity, the risk status of Australian herring is unacceptable.



Australian herring are endemic to southern Australia, occurring from Shark Bay (WA) southwards to Port Phillip Bay (Victoria). The breeding stock occurs primarily in the West Coast Bioregion (WCB). Herring larvae are carried south and east on ocean currents. Other areas, including the south coast of WA, South Australia and Victoria, contain immature/ pre-spawning herring, which migrate to the lower WCB prior

to spawning. Adult herring remain in the WCB after spawning (i.e. there is no return migration to the south coast). Due to this life cycle, catches of herring along the southern coast of Australia are dominated by juveniles and young adults, whereas catches in the WCB are comprised of a wider range of ages and sizes that is representative of the entire herring breeding stock.

Evidence of decline

The age and length structure of Australian herring in commercial and recreational catches was sampled in 2009 – 2011 and compared with historical samples collected since the 1970s. For many years, during and prior to the assessment, total national fishery landings (commercial and recreational) were comprised mainly of young fish, with 50 to 75 per cent of annual landings comprised of fish that are yet to spawn for the first time. Also it was found that

total landings in WA were mostly made up of (around 70 per cent) females.

The 2009 – 2011 herring catches were dominated by two and three-year old fish, despite a maximum age of 12 years for this species. It appears that the age and size composition of the herring population has become more truncated over time, i.e. the proportion of larger and older fish in the catch has declined. These findings suggest that the Australian herring stock has been heavily fished over the past two decades and

is now predominantly based on young fish entering the fishery each year.

The assessment found evidence of a substantial decline in herring stock abundance since the late 1990s and a steady increase in fishing mortality (or 'F' as scientists refer to it) over the same period. F is a measurement of the rate of removal of fish from a population by fishing.

During the sampling period 2009 – 2011, the estimated F was more than two times higher than natural mortality (M) – see Figure 1 – which is well above the limit reference point used in the management of this species ($F_{\text{limit}} = 1.5 \times M$). The limit reference point indicates the point at which fishing should be reduced to allow stock to recover.

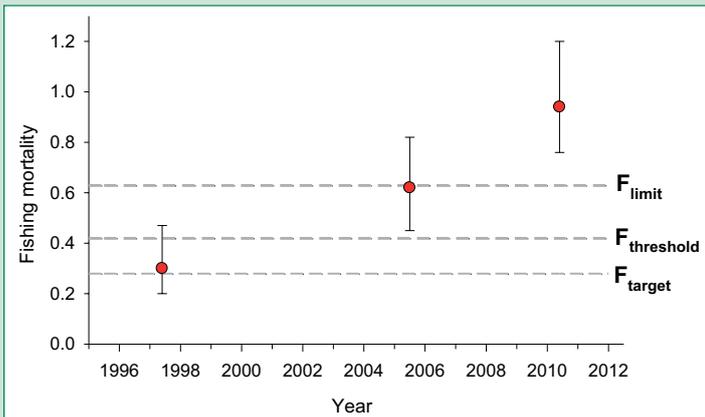


Figure 1. An increasing rate of fishing mortality (F) is impacting on the Australian herring stock, calculated from samples collected from fishers.

Table 1. Reference points for fishing mortality (F) related to natural mortality (M) used to assess the stock status of Australian herring.

Reference Point	Fishing Mortality
Target	$2/3 \times M$
Threshold	M
Limit	$1.5 \times M$

Table 2. General decision rules for fishery managers based on fishing mortality (F) levels.

F estimate	Decision rule related to fishing pressure
$F < F_{\text{target}}$	Fishing effort (and/or catches) may increase
$F_{\text{target}} < F < F_{\text{threshold}}$	Fishing effort (and/or catches) to remain constant
$F_{\text{threshold}} < F < F_{\text{limit}}$	Fishing effort (and/or catches) reduced, e.g. 10 – 50%
$F > F_{\text{limit}}$	Fishing effort (and/or catches) reduced, e.g. 50 – 100%

The assessment concluded that the herring stock level was inadequate and recommended a reduction of at least 50 per cent in the total catch of herring to ensure the sustainability of the stock.

An uncertain future for herring?

The assessment also found that there had been relatively low recruitment into herring stocks since 2000. The low recruitment may partly be a consequence of a declining breeding stock level due to overfishing in a period of environmental change that has been unfavourable for herring. These changes include fluctuations in the strength of the Leeuwin Current and ocean warming.

Since 2000, the Leeuwin Current has been steadily increasing in strength and coastal waters around south-west WA have been warming. These changes seem to have been unfavourable for successful spawning by herring. In 2011, extremely unusual oceanographic conditions occurred along the south-western coast of WA, including summer water temperatures greater than three degrees Celsius above average in some areas. Recruitment of juvenile herring in 2011 was among the lowest ever recorded.

Since the completion of the assessment (in 2011) ocean temperatures have continued to warm, reaching record high levels along the south coast in 2012 and 2013. It is uncertain as to how well herring will adapt to these changing environmental conditions.

Overall, the assessment identified a severe risk to the sustainability of the Australian herring stock. The combined pressures of fishing and environmental changes, such as ocean warming, have impacted on Australian herring to the extent that management action is now needed. The Department is working with WA's peak fishing bodies (Recfishwest and the Western Australian Fishing Industry Council) to formulate management responses to aid the recovery of the stock.

Management measures will be needed across both recreational and commercial sectors. In recent years, the total recreational catch has been approximately equal to the total commercial catch in WA. The majority (around 85 per cent) of commercial landings are in the South Coast Bioregion (between Black Point, east of Augusta, to the WA/SA border) and the majority (around 85 per cent) of recreational landings are in the West Coast Bioregion.

The stock assessment research reports for whiting, tailor and Australian herring are available on the Department's website at www.fish.wa.gov.au. The nearshore research was supported by State Natural Resource Management funding.

Groundbreaking study on eightbar grouper

The eightbar grouper (*Hyporthodus octofasciatus*) is a large deep-water demersal (bottom-dwelling) fish. A world-first study, investigating the life history characteristic of this species, by Department of Fisheries researchers, has revealed new information about this mysterious fish.

As with other fish living in deep continental slope waters, and the

majority of groupers in general, the eightbar grouper is long-lived (with a possible lifespan of 50 years or more) and slow-growing (to 1.5m in length and weighing up to 65kg). These factors make the inherent vulnerability of this species relatively high. However, the good news from the research is that current levels of fishing for the eightbar grouper in the State's south-

west waters are not risking the fish stock's sustainability.

Study of this fascinating creature's life cycle was made possible by recreational and commercial fishers, who donated hundreds of fish frames for scientists to examine.

In recent years the eightbar grouper has become increasingly popular with

recreational fishers, who target it using high-tech equipment such as powerful echo sounders and electric reels. However, it generally takes three hours by boat to get to where it lives – 200 to 600 m deep in underwater terrain such as the Perth Canyon. To get vision of the grouper and other species in this very deep water, researchers used high-tech baited cameras.

In WA, the range of the eightbar grouper stretches 3,500 kilometers from the Kimberley to the south coast – the biggest distribution known for any demersal scalefish in WA.

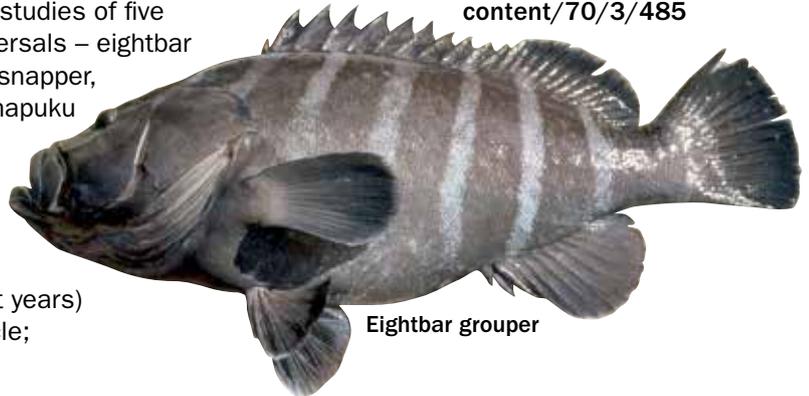
Despite also living in southern temperate zones, the research revealed that the eightbar grouper only spawns in northern tropical waters. It is very uncommon for a species not to spawn over such a large part of its

distributional range, but scientists found no evidence of spawning south of about 30° S in WA – which is just south of Leeman. The southern population probably relies on eggs and larvae that drift south, so there is a very high importance in conserving the spawning stock hundreds of kilometres away in northern tropical waters.

Some of the most significant findings from ongoing studies of five offshore demersals – eightbar grouper, ruby snapper, bass groper, hapuku and blue-eye trevalla – are the unique pelagic-juvenile stage (of up to eight years) in their lifecycle;

late maturation (e.g. 12 to 14 years for bass grouper); and their long lives (more than 50 years), which indicates a higher vulnerability at low levels of fishing. These have implications for managing stocks of these species at a sustainable level.

For the full study published in the ICES Journal of Marine Science, please see <http://icesjms.oxfordjournals.org/content/70/3/485>



Eightbar grouper

Recreational fishers and Shark Bay snapper egg surveys



Earlier this year, volunteer recreational fishers were again helping scientists from the Department of Fisheries with pink snapper research in Shark Bay. Daily egg production method (DEPM) surveys to assess the size of snapper stocks in the three inner gulf areas – the Eastern Gulf, Denham Sound and the Freycinet Estuary – have been carried out since 1997.

These egg surveys are scheduled to take place around the new moon in the middle of the snapper spawning season in each area. They involve plankton surveys (to collect samples of snapper eggs) and fishing (to collect samples of spawning fish).

Two separate groups of dedicated volunteers, some of whom have been assisting us for more than 16 years, took part in surveys in Denham Sound (in July) and in the Freycinet Estuary (in September). Results from this work will be analysed and, in combination with data from a DEPM survey carried out in the Eastern Gulf in 2012, included in updated stock assessments of the three snapper stocks early next year. The results will be presented in 2014 to a community working group which meets every three years to discuss snapper research and management.



Department of Fisheries staff and volunteers processing biological samples of pink snapper in Denham (top) and at the end of the day on the beach at Nanga (bottom).

Thank you for your ongoing support and happy fishing!

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Merry Christmas!



Fish for the future