

# Protecting Common Coral Trout (*Plectropomus leopardus*) Spawning Aggregations in the Great Barrier Reef Marine Park, Australia

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## ABSTRACT

Common Coral Trout (*Plectropomus leopardus*) aggregate to spawn on the Great Barrier Reef. The Great Barrier Reef Marine Park Authority, under consultation with the Society for the Conservation of Reef Fish Aggregations (SCRFA), has been assessing several key aggregation sites to help fill the information gaps on spawning site habitat, and timing for Common Coral Trout spawning in the Great Barrier Reef Marine Park.

In 2004, Commonwealth and State Government management arrangements were introduced to protect coral reef fin fish on the Great Barrier Reef. Common Coral Trout spawning aggregations have been afforded some protection; 33% of the Great Barrier Reef Marine Park is now closed to fishing, and three nine day closures to reef fish fishing occur over the new moons in October, November and December each year, coinciding with the peak spawning activity of the species.

This paper discusses Common Coral Trout spawning aggregations, their current management strategies and possible options for future management. In comparison two other species are discussed, the red throat emperor (*Lethrinus miniatus*) and the flowery cod (*Epinephelus fuscoguttatus*).

KEY WORDS: Coral trout, Great Barrier Reef, spawning .

## Protegiendo las Agregaciones de Desove de la Common Coral Trout (*Plectropomus leopardus*) en el Parque Marino de la Gran Barrera Arrecifal de Australia

De common coral trout se agrega par desovar en la gran barrera arrecifal. La Autoridad del Parque Marino de la Gran barrera arrecifal y la Sociedad para la conservacion de agregaciones de desove de peces de arrecife (SCRFA) han estado evaluando diferentes lugares claves de agregacions para complementar vacíos en la información acerca del tipo de hábitat y el tiempo del desove de Common Coral Trout en el Parque Marino de la Gran barrera arrecifal.

Ciertas medidas de manejo han sido introducidas para proteger agregaciones de desove de la Common Coral Trout; el 33% del gran parque marino ahora está cerrado a la pesca; y tres cierres de nueve días para la pesca de los peces de arrecife están en efecto durante la Luna Nueva en los meses de octubre, noviembre y diciembre cada año. Este papel discute las agravaciones de desove de agregaciones de la Common Coral Trout sus corrientes opciones de manejo y las opciones futuras de manejo.

PALABRAS CLAVES: La Common Coral Trout, agregaciones de desove, manejo.

## INTRODUCTION

The Great Barrier Reef Marine Park (GBRMP) is a multiple use marine protected area managed by the Great Barrier Reef Marine Park Authority (GBRMPA), a Commonwealth Statutory Authority. The GBRMP spans 345,400 km<sup>2</sup>, is 2300 km long, and contains 2900 reefs. Since 2004, about 33% of the entire GBRMP was closed to fishing.

Coral reef fishes are targeted by the Queensland Coral Reef Fin Fish (CRFF) fishery, which uses hook and line and speargun (recreational) throughout the GBRMP. The CRFF fishery is managed by the Queensland Department of Primary Industries and Fisheries (QDPI&F).

Research on fish spawning aggregations in the GBRMP, essential for adequate management of fisheries, has been minimal to date, compared to some areas such as the Caribbean. Research and monitoring by the GBRMPA

includes a long-term data set on two key spawning aggregation sites offshore Cairns, training of Marine Park Rangers to identify fish spawning aggregation sites of the common coral trout (*Plectropomus leopardus*), and collection of anecdotal information from fishers on the locations of spawning aggregation sites of a range of species across the GBRMP. Research conducted by various research organisations includes size, age and growth information, catch and effort data analysis and visual surveys of fish abundances for key target species of the CRFF fishery. This research, although limited in direct assessments of spawning aggregations, has provided valuable information for management decisions. Furthermore, a precautionary management approach has been taken to protect most reef fish exploited by the CRFF fishery.

## DISCUSSION

### Research

Research on spawning aggregations on the Great Barrier Reef (GBR) has been limited to date. Unfortunately, little interest has been shown by coral reef researchers or fishery managers on the GBR to investigate the biological and habitat characteristics of CRFF fishery key target species' spawning aggregations. This is mostly due to limited research funding, logistic problems with such a large area of possible locations of FSAS, and the need for other information (basic biology and stock assessments) to base management decisions upon. Nevertheless, some work has been done on the spawning behaviours of common coral trout, humphead Maori wrasse (*Cheilinus undulatus*), red throat emperor (*Lethrinus miniatus*), flowery cod (*Epinephelus fuscoguttatus*) and camouflage grouper (*Epinephelus polyphekadion*).

Key research questions for spawning aggregations on the GBR include:

- i) How far and over what time frame do common coral trout move to and from spawning aggregation sites
- ii) When and where do other key target species aggregate to spawn, and
- iii) What distances do these species move to and from an aggregation site?

It is anticipated that these questions will be investigated soon.

### Fisheries Management

Many coral reef fishes may form spawning aggregations on the GBR (Russell 2001). A key target species in the CRFF fishery that is known to form spawning aggregations on the GBR is the common coral trout. Common coral trout are known to move to and from spawning aggregations on the reefs they inhabit, rather than moving large distances between reefs (Davies 2000). Therefore, common coral trout are considered to form resident spawning aggregations on a reef-wide scale, but transient spawning aggregations on an individual reef scale. More information is needed on the movement of common coral trout to spawning aggregations; distances travelled and the possibility of using corridors between inter-connected reefs. Despite a lack of specific information, the best available information is used for management. New measures have been adopted recently. In 2004, the *Queensland Fisheries (Coral Reef Fin Fish) Management Plan 2003* introduced a package of fisheries management tools, including a commercial total allowable catch (TAC), revised size limits, revised recreational bag limits and spawning season closures.

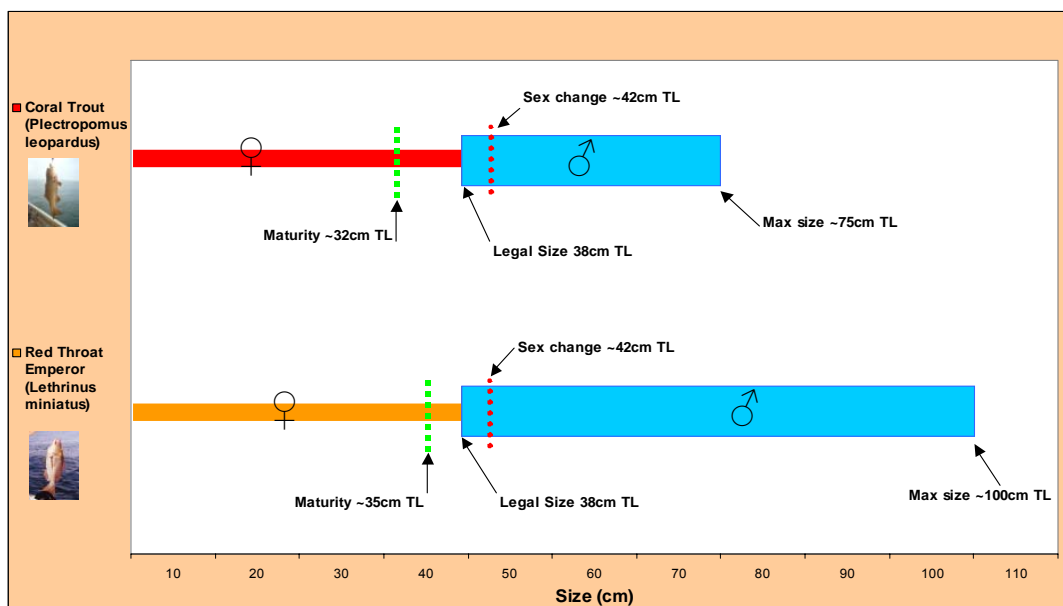
The commercial TAC of 1,350 ton of coral trout (*Plectropomus spp.*) is currently set at the level of catch taken by the commercial fishing sector in 1996, which is thought to represent full exploitation of the fish stocks

across the GBR. Researchers are currently developing a catch quota model involving complex effort dynamics associated with an extensive system of no-take areas and a significant recreational take, that can provide a framework for setting appropriate TACs and evaluating their impacts on the fishery ([www.reef.crc.org.au](http://www.reef.crc.org.au)).

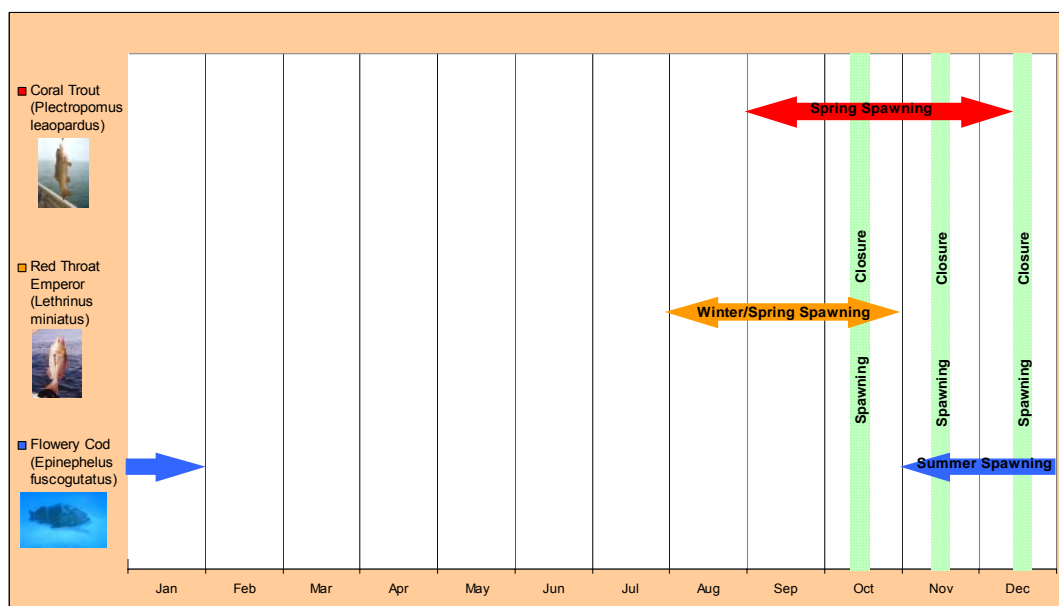
The recreational bag limit for coral trout is currently set at seven fish in possession per person. The biologically precautionary minimum legal size limit on take of common coral trout is 38 cm TL. The size limit is set based on information about size at maturity, which is about 32 cm, and size at sex change from female to male, which occurs at about 42 cm (Figure 1) (Mapstone *et al.* 2004). Even though the size limit is set to ensure most fish spawn at least once before recruiting to the fishery, this does not prevent the take of larger older male fish, which may cause skewed sex ratios and sperm limitation in the stock. Figure 1 also provides a comparison with red throat emperor (*Lethrinus miniatus*), a key target species of the CRFF fishery. As with common coral trout, the size limit for red throat emperor is set at about the correct level considering the size at maturity, and the size at sex change.

To protect the main spawning time for most CRFF fishery species, three nine-day spawning season closures occur over the new moons in October, November, and December each year. These closures cover all CRFF fishery species, and possession of any CRFF fishery species is prohibited during these times. The seasonal spawning closures are based on the peak spawning time for common coral trout, being the new moon phases of the spring/summer months on the GBR. Common coral trout was chosen as an indicator species because more information was available in this species than other species targeted in the CRFF fishery (Figure 2). Studies of the spawning behaviour of common coral trout on the GBR indicate that for several days either side of the Spring new moons they aggregate to spawn (at dusk) (Samoilys and Squire 1994, Samoilys 1997, Zeller 1998). A precautionary management approach was taken by including all CRFF fishery species in these closures, because of the limited information on the spawning behaviours of species other than common coral trout, and to facilitate compliance and enforcement. Placing a seasonal closure on only one CRFF fishery species or species group may not adequately protect those species, and is also difficult to enforce.

There is some anecdotal information on catch rates and spawning aggregations from fishers with a historic background in the CRFF fishery. Some fishers speak of large catches of certain species at particular locations and times in the past. However, this is not overly apparent in the commercial fishing logbook records. This could be due to inaccurate logbook reporting of catch and effort, non-reef specific logbook reporting, and species misidentification. It is likely that some fishers actively fish spawning aggregations on the GBR, whilst others are not aware of the locations and may accidentally fish them at times.



**Figure 1.** Common coral trout and red throat emperor maximum length, size at maturity, size at sex change and legal size limit. The blue shaded areas depict the size of fish available to the CRFF fishery.



**Figure 2.** Spawning seasons for common coral trout, red throat emperor and flowery cod. The current spawning season closures are shown in green diagonal hatched areas..

Currently, there are discussions to determine the most appropriate spawning aggregation protection strategies for CRFF fishery species. The three nine-day closures offer some protection for most targeted species during peak spawning times on the GBR. However, in comparison, the closures are not effective for red throat emperor, given their peak spawning times are from August to October each year. Furthermore, recent information on flowery cod, another target species of the CRFF fishery, also indicates that current spawning season closures offer little protection to this species, since its spawning time is from November to January (Figure 2). A solution can lie in modifying the spawning season closures times as more information is obtained on the spawning behaviours of the full range of target species in the CRFF fishery.

### Marine Protected Area Management

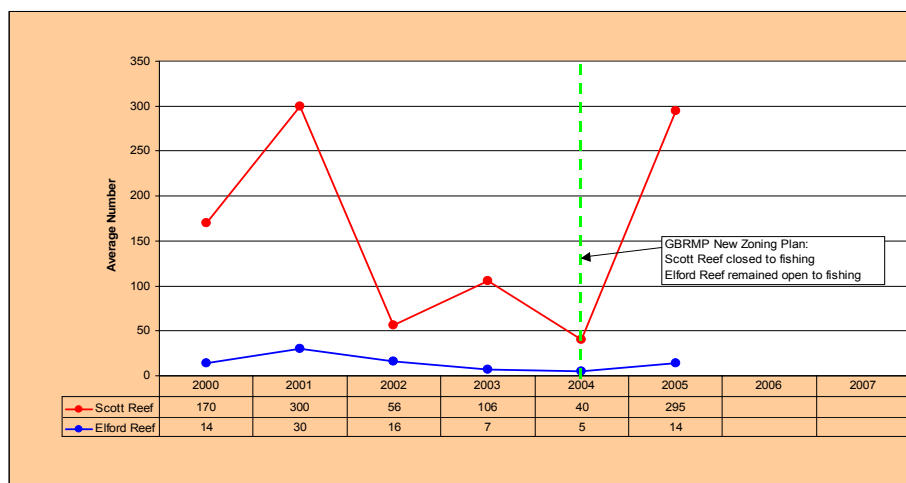
Because the CRFF fishery operates in a World Heritage marine protected area, a higher level of conservation based legislative requirements are in place under the *Great Barrier Reef Marine Park Act 1975*. The Australian Government recently introduced an unprecedented conservation initiative to better protect the GBRMP. The GBRMP was rezoned in July 2004, resulting in an increase of no-fishing areas from 4.5% to 33%. The rezoning was designed to protect representative examples of the biodiversity of the GBRMP; closures cover all habitat types described in 70 different bioregions. The amount of reef area, the area predominantly used by the CRFF fishery to target common coral trout, now closed to fishing is now about 30%.

The GBRMPA is aware of several hundred fish spawning aggregation sites throughout the GBRMP. However, most of these sites are anecdotal, and only a few of these sites have been validated using in-water visual surveys or catch sampling. The validated sites were considered in the rezoning of the GBRMP, and the anecdotal sites were considered only for supporting

ecosystem information. Considering it is likely that common coral trout form aggregations on most reefs on the GBR, the 30% protection of all reef habitats gives confidence that many spawning aggregation sites for this species are afforded some protection from fishing. However, this is not the case for other CRFF fishery species that may move large distances to spawning aggregations sites yet to be identified, and therefore some of these sites may not be protected from fishing.

Two key spawning aggregation sites for common coral trout at Scott Reef and Elford Reef, offshore Cairns, have been monitored over the past 15 years (Samoilys *et al.*, unpublished). These two sites have been fished at varying levels over this time. Under the new zoning of the GBRMP, Scott Reef has been zoned as a Marine National Park (green zone), which prohibits fishing, and Elford Reef has been zoned as a Conservation Park (yellow zone), which allows limited line fishing. This has created a very valuable and unique research and monitoring opportunity to document the changes in numbers of common coral trout visiting the aggregation sites on these two reefs over time as a result of the rezoning. Preliminary site assessments one year after the rezoning of Scott Reef as a green zone have shown the numbers of common coral trout visiting the spawning aggregation site has increased. In contrast, the numbers of common coral trout visiting the Elford Reef spawning aggregation site have remained relatively constant (Figure 3). However, it is too soon after the rezoning to determine if the rezoning has affected the number of fish visiting these spawning aggregation sites.

Spawning aggregation site habitat descriptions and identification criteria checklists for common coral trout are currently being developed by the GBRMP through in-water assessments and workshops. Also, spawning aggregation site assessors were trained during 2000 to 2003. However, trained staff have moved on to other positions within and outside the Government sectors, making site assessments difficult to organise.



**Figure 3.** Common coral trout numbers at Scott Reef and Elford Reef spawning aggregation sites during October new moon, 2000 to 2005.

### CONCLUSION

The management measures on the GBR are unique, in that, a precautionary approach has been taken, to a certain extent, to ensure the long-term sustainability of the reef fish resources. This is a preferable situation than many examples from around the world of the introduction of management measures, such as spawning season closures, after it has been found that spawning aggregations were in decline.

There will always be uncertainty in biological information and spawning behaviour of most reef fishes. However, the current fisheries and marine protected area management arrangements provide a strong certainty that at least common coral trout stocks on the GBR are being managed on an ecologically sustainable basis. Common coral trout are protected through no-take areas and input/output controls on the CRFF fishery, and their spawning aggregations, a vulnerable life history component, are protected through seasonal spawning closures.

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