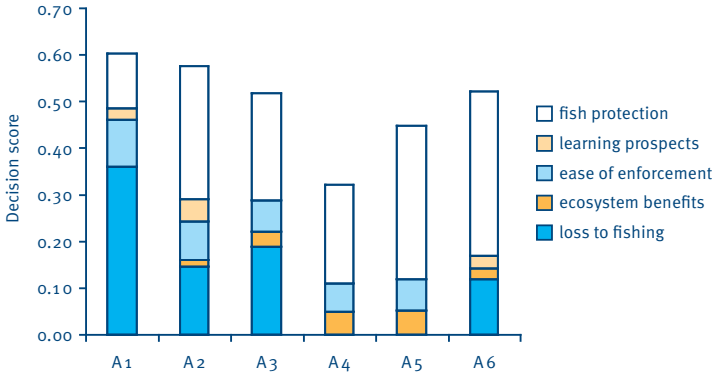
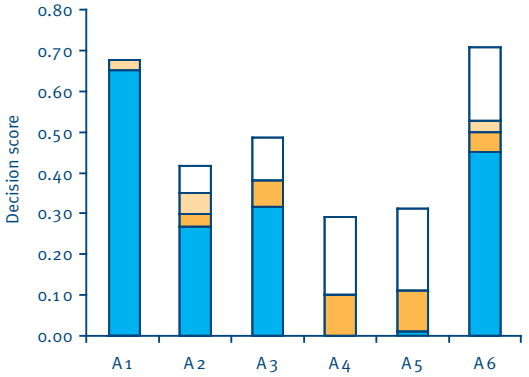
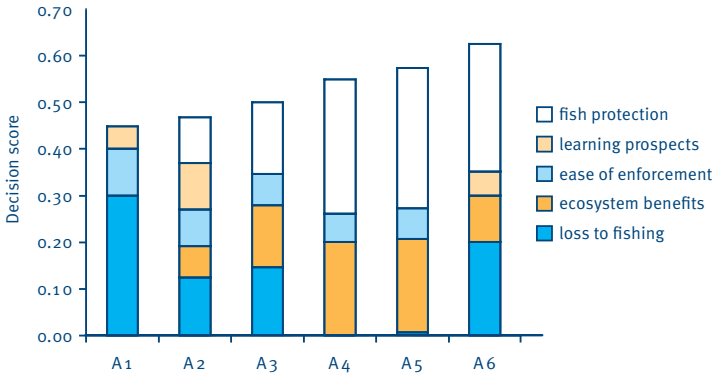


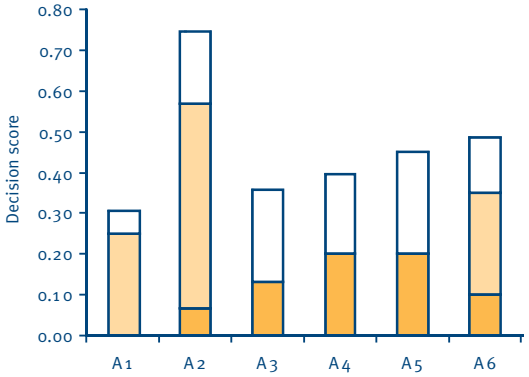
Shaun Hanson, commercial fisher (Queensland Seafood Industry Association).



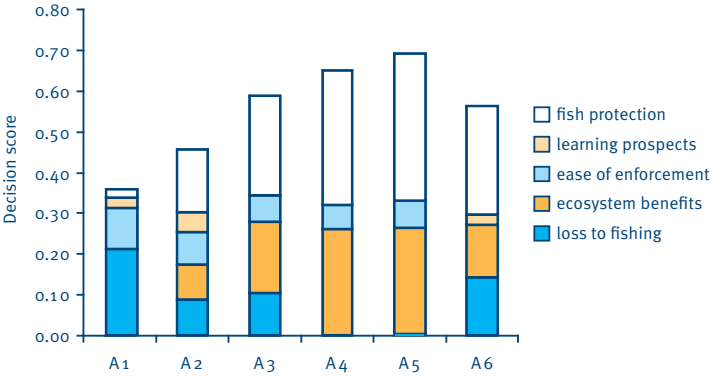
Bruce Stobo, charter operator.



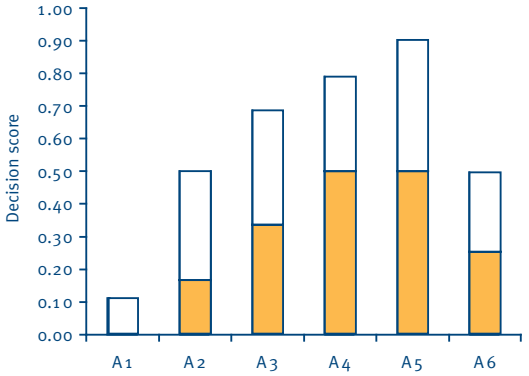
Anthony Roelofs, fisheries biologist, Queensland Primary Industries and Fisheries.



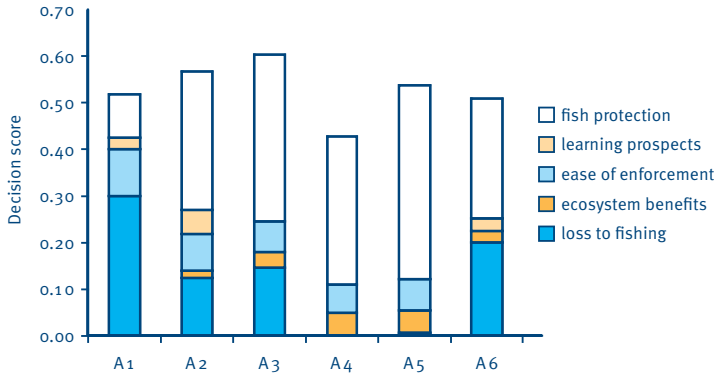
Andrew Tobin, Fishing and Fisheries Research Centre, James Cook University.



Martin Russell, Great Barrier Reef Marine Park Authority.



Eric Wolanski, School of Marine and Tropical Biology, James Cook University.



Stephanie Slade, senior fisheries management officer, Queensland Primary Industries and Fisheries.

Appendix 3: Key points from workshop discussions.

Throughout the workshop, participants were involved in discussions regarding the biology and spawning behaviour of key species in the coral reef fin fish fishery, the relative importance of species to each fishery sector, the merits of the alternative spawning closure regimes identified in Table 1 and research priorities identifying information that could contribute to future reviews of spawning closures. This section summarises the main points of discussion.

(i) Spawning behaviour of coral trout:

(a) Coral trout on the Great Barrier Reef (GBR) are known to form spawning aggregations; however, observed aggregations (of up to 300 fish) are not as large as spawning aggregations of other groupers in other parts of the world (e.g. Nassau grouper form aggregations of 10 000–20 000 fish in the Caribbean). The average number of coral trout on a GBR reef is approximately 2000 fish. It is not known whether fishing has impacted on the size and number of aggregations on the GBR and if so, to what extent.

(b) Coral trout on the GBR have been observed to pair-spawn; however; the relative importance of aggregation spawning and pair-spawning is unknown.

(c) Coral trout have been observed to form primary spawning aggregations and may also form secondary spawning aggregations on the same reef. It is likely that many reefs on the GBR support spawning aggregations of coral trout.

(d) As with all coral reef fin fish, recruitment of coral trout is highly variable. This variability is likely to be a major driver of coral trout abundance.

(ii) Known spawning behaviour of other coral reef fin fish:

(a) Knowledge of the spawning behaviour of coral reef fin fish species other than coral trout is significantly more limited; however, some information was presented to workshop participants showing temporal spawning behaviour.

(b) The removal of December from the spawning closure regime means that protection of those species known to spawn in December is reduced. Of significance, camouflage grouper (*Epinephelus polyphekadion*) and flowery cod (*E. fuscoguttatus*) are aggregating December spawners. These species are naturally less abundant than many other coral reef fin fish species, so constitute a lower relative proportion of the catch.

(c) Red throat emperor have been provided minimal protection under the former spawning closure regime; however, the stock assessment indicates that the stock is in good condition.

(iii) Catchability of coral reef fin fish during peak spawning periods:

(a) The effectiveness of spawning closures in protecting coral reef fin fish assumes that fish are more accessible during peak spawning times. Previous studies have not detected an increase in catchability during the months that coral trout are known to spawn on the GBR. In addition, a draft report from the Fishing and Fisheries Research Centre at James Cook University indicates that, for those species available to the fishery, there is no significant increase in the catch during October, November and December. This result from the draft report must be treated with caution however, as the analysis does not incorporate fishing effort during those months.

(iv) Species importance:

(a) Workshop participants rated coral trout as the most important species for consideration because of its role as an apex predator and its importance to fishery users, in particular the commercial fishing sector.

(b) Participants were informed that a positive relationship has been found between the abundance of coral trout on the GBR and the number of prey species.

(c) Participants were informed that outbreaks of crown of thorns starfish are less prevalent on reefs closed to fishing.

(v) Coral trout only closures:

(a) The likelihood of this strategy protecting coral trout is dependent upon the post-release survival of coral trout (it was acknowledged that coral trout would be captured and would have to be released) and the impact on spawning success in the presence of fishing activity during peak spawning times.

(b) In the case of the commercial sector, coral trout only closures may result in a reduction in fishing pressure during the closure periods as some commercial fishers are unlikely to target other species due to their low relative value.

(c) In the case of the recreational and charter fishing sectors, effort during the closure periods is likely to be relatively unaffected.

(d) Ease of enforcement is likely to be reduced under a coral trout only closure option due to fishing effort associated with other species.

(vi) Providing an exemption to spawning closures for the extended charter fishing sector:

(a) This alternative would involve identifying and exempting 'extended' charter operators from a spawning closure regime in exchange for those operators sitting out an alternative time period that would have less impact on their business operations.

(b) The charter fishing participant informed the workshop that it is likely that approximately 15 operations would qualify for such an exemption.

(c) This strategy was opposed by a number of workshop participants (predominantly those from other fishery sectors) on the grounds that it was not seen to address issues of equity.

(vi) Hydrodynamic processes:

(a) The GBR cannot be treated as a uniform system—some reefs are source reefs (for recruits) and some are sink reefs. Areas around the Swains reefs, off Bowen and off Cairns, are self-seeding.

(b) Research is currently underway to quantify the self-seeding capacity of coral trout on reefs in the Great Keppel area.

(viii) Regional management:

(a) Spawning closures to date have applied across the entire GBR in the months that coral trout are known to spawn; however, they have not taken into account the latitudinal variation in spawning.

(b) Participants from the scientific community and the commercial fishing sector noted that coral trout spawn earlier in the north (September–October) than they do on the southern GBR (November–December). This trend has been demonstrated through observations of 'ripe' fish and timing of recruitment in northern and southern reefs.

(c) A north–south split in spawning closures would be unlikely to provide additional protection to any other coral reef fin fish.

(d) Regional management may ease the impact on the marketing sector as it would result in a more continuous supply of product if, for example, the entire fishery were only closed for one month.

(e) Regional management may present some social impacts from commercial fishing boats moving between ports to avoid closure periods. There is likely to be less movement of recreational and charter fishers.

(ix) Opportunities for learning:

(a) Participants identified the following information gaps in relation to spawning of coral reef fin fish:

(i) The relationship between spawning closures (and other management arrangements including zoning) and recruitment of coral reef fin fish (i.e. what is the flow-on effect of the closures to coral reef fin fish stocks?).

(ii) Seasonal variability in spawning (both temporal and spatial variability).

(iii) Spawning behaviour: How many fish aggregate? How long do they stay at the aggregation site? How often do they aggregate? Are they more accessible to fishing during peak spawning periods? (i.e. does catchability increase?) Does fishing disrupt spawning? Are fish that are not normally available to the fishery vulnerable to capture during spawning times? Some of these questions could be answered using acoustic telemetry.

(iv) What is the relative importance of other species of coral reef fin fish in the catch of non-commercial fishers? This could be used to target further biological research for other key species.

(x) Additional comments from Professor Yvonne Sadovy:

Professor Sadovy joined the workshop for a short time during day 1 and in conversation with the fishery manager on day 2 provided the following observations:

(a) The assumption at the workshop appears to be that the other management controls currently in effect (i.e. non-spawning aggregation measures including minimum legal size, possession limits etc) are appropriate and already effective for the species. However, the quota and bag limits are not biologically based, the minimum size limit is probably too small for the species given its longevity (long-lived species should be allowed several years to reproduce to give them a reasonable chance for effective reproduction according to life history theory), and the number of spawning aggregations in the protected 33% area of

the GBR is unknown. The relative importance of each management measure for protection is unknown so the spawning aggregation protection cannot be evaluated independently. Moreover, it is not clear how effective the minimum size enforcement is likely to be given recent changes undermining the ability to enforce minimum size regulation. It is not clear, therefore, that the key fishery species are sufficiently protected in the absence of spawning season closures.

(b) Due consideration should be given to the potential impact on a fishery of fishing on aggregated fishes. Possible impacts could be on social structure in the case of sex-changing species, or disturbance of the mating system that can be highly structured and form for short periods each year in relation to spawning. A precautionary approach is needed given these unknowns.

(c) High mortality of live ripe fish for the live fish trade is a problem for some traders in other countries who avoid trading gravid females that can be readily stressed.

(d) The experience with Scott and Elford reefs has shown that fished aggregations decline and that protecting spawning aggregations can lead to increased numbers in the aggregations.

(e) Given that only a few spawning site locations are actually known and also given that it is possible that not all coral trout spawn in aggregations, the most effective way to protect reproductively active/spawning fish is by seasonal protection. This also means that it is not necessary to know the locations of spawning aggregations.

(f) Adaptive management would suggest that any changes to the current management regime should be gradual and the outcomes monitored and assessed over several years before further changes to management are made. Given that last year 2 × 9-day closures replaced 3 × 9-day closures, this change should be monitored for several years with all else staying the same to evaluate the possible outcomes of the shift in closure regime.

(g) Loss of December protection (last year) has substantially reduced protection for two Epinephelus species. This could be an issue in future if pressure to exploit them increases; this is a possibility from the live reef fish sector since these species are among the most important in the fishery. We know that such aggregations in other countries have been rapidly overfished for live fish.