Are GBR Shark Populations Really Collapsing?

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A recent publication by Robbins *et al.* (2006) purports to have found a widespread and dramatic decline in shark populations on the Great Barrier Reef due to fishing mortality. This report has attracted considerable media attention and seems likely to become the basis for further restrictions on reef activities. There are, however, a number of serious doubts regarding the methods and conclusions of this study.

The study was based primarily on a series of 80 underwater visual censuses of 21 reefs on the northern and central Great Barrier Reef plus 17 additional ones at the Cocos (Keeling) Islands in the Indian Ocean. Each census was made by divers swimming along a 400 M transect parallel to the reef crest and counting sharks seen in the area up to 10m on either side . Two species were surveyed, the whitetip reef shark (*Triaenodon obesus*) and the gray reef shark (*Carcharhinus amblyrhynchos*).

The GBR reefs included 2 reefs where entry is normally prohibited, 6 where entry is permitted but no fishing, 6 where limited fishing (*i.e.* trolling for pelagic species adjacent to the reef but not demersal fishing on the reef itself) is permitted and 7 reefs where both recreational and commercial fishing is permitted. Nineteen surveys were conducted in each of the first three reef categories and 23 in the last one.

The key findings were that on the GBR shark numbers on open fishing zone reefs were reduced by 97% for gray reef sharks and 80% for whitetip reef sharks. Abundances on limited-fishing reefs were close to those of open-fishing reefs and those on no-take reefs, where boats may anchor but fishing is not permitted were also heavily depleted and similar to the legally fished zones.

The study concluded that:

- "These results indicate that not only are reef shark populations heavily depleted on fished reefs but also that there is a dramatic difference in the effectiveness of no-entry zones and no-take zones."

- The findings were "sufficient to warrant ''Critically Endangered'' status under IUCN Red List (A3d) criteria for this study area, for both species."

- "Crucially, the apparent failure of no-take zones to protect sharks makes it clear that the mere legal prohibition of fishing in marine protected areas is inadequate; such prohibitions must be part of statutory or community-based enforcement regimes that achieve nearly universal compliance from reef users. Our data suggest that for coral-reef sharks, immediate and substantial reductions in shark fishing will be required for their ongoing collapse to be reversed."

At first glance these findings, though alarming, would seemingly appear well founded. However, there are a number of important reasons to seriously question them. In the first instance is the irrefutable fact that the GBR is subject to only very low fishing pressure. The small population of the region, distances of reefs from population centres and prevailing weather conditions, plus stringent restrictions on fishing result in a total harvest of less than 1% of that widely accepted as sustainable for coral reef fisheries (Starck 2005). There is also no dedicated shark fishery on the GBR and the subject species are only taken incidental to fishing for other fishes. In addition most sharks that are so caught are simply released.

On a recent (November 2006) cruise along the outer barrier reef from Cairns nearly to the tip of Cape York I saw not a single fishing vessel in a week of travel along some 650 Km of reef . In all only one

tourist cruise vessel and two other private yachts were seen. Reef sharks were common wherever we fished or dived. Such conditions are typical of numerous other trips I have made on the northern third of the GBR.

No boats over vast areas is not difficult to verify and it does not require sophisticated analysis to determine that no boats means no fishing. Government in fact possesses detailed long term information on the presence and distribution of boats on the GBR in the form of daily Coast watch reports. The reality of a very low level of any human activity over most of the GBR can be easily and accurately verified.

The extensive Effect of Line Fishing survey (Mapstone *et al.* 2004) found that even for the most heavily targeted species there was little or no significant difference in numbers between reefs open to fishing or closed to it on other reefs in the same study areas as the shark study. This was interpreted as indicating a low level of fishing pressure.

Populations of grey and whitetip reef sharks have remained robust in many Indo-Pacific island areas despite subsistence fishing at a much higher level than that to which the GBR is subjected. The Cocos Keeling Is. where this study found healthy shark populations comparable to the no entry zones on the GBR is a case in point. Although the study cited the Cocos reefs as being "pristine" and "under minimal exploitation" it is in fact subject to considerably more intense fishing pressure than is either of the two GBR areas surveyed. In the Cocos Is. there is a resident population of almost 600 persons for whom fishing is the main source of animal protein. A recent fisheries management paper for the Cocos Is. (Anon. 2005) states that "…evidence suggests that finfish stocks in the lagoon have been depleted." It also listed sharks as high value food species.

In contrast Gribble *et al.* (2005), in an assessment of the Queensland east coast shark fishery, estimated a total GBR area shark harvest for 2003 of 1253t. They also reported that about 94% of this can be attributed to net fishing and only 6% to line fishing. It should be noted that net fishing is inshore and only line fishing takes place on the mid-shelf and outer reefs where the Robbins *et al.* study was conducted. It should be further noted that most line fishing (and presumably shark catches by line) also takes place inshore. At most, one might expect that fishing mortality of the study species on the GBR may amount to a few hundred individuals per year for the entire region. Even at the lowest population levels in the areas open to fishing estimated by this study such a minimal level of mortality would be lost in the noise level of fluctuations in natural mortality.

A further difficulty with the study findings arises from the geographic distribution of survey sites. Grey reef sharks in particular are far more abundant on the outer barrier reefs where both of the no entry reefs are situated. Conversely only 5 sites of the other categories of reef were on the outer barrier while 11 were on mid-shelf reefs where they are less common and 3 were around the shore of a moderately large continental island (Lizard I.) a habitat where both species are naturally even less abundant.

To compound the uncertainty only aggregate data for all surveys for each reef category is presented and no information is provided as to where on a reef the actual surveys were made. This can be critically important as actual abundance of sharks can vary greatly between different reef situations. Generally the outer edge of an outer barrier reef has much higher population density of both species than does the inside edge of the same reef and abundance in passes at the end of reefs can be highly variable.

Finally and most important of all is that the survey method used is inappropriate for these species. Grey reef sharks in particular are highly opportunistic roving predators. On reefs where divers have previously been rare or absent they are initially attracted to the appearance of a diver or divers and come in to investigate. It is not unusual to be able to see a half dozen or more at one time under such conditions and they may even approach as close as two to three meters. If repeated dives are made fewer are seen and they approach less closely. After a few days diving only scattered individuals are seen.

In areas subject to occasional or frequent diving not many sharks are normally seen and most of those sighted do not come within the 10 M radius required to be counted by the survey method described in the study. Seeing few or even none however, does not mean that they are not present. Their acoustical and visual senses permit them to be aware of a diver well beyond our limit of visibility. Spear a struggling fish and often several will quickly appear, especially if one is on the outside edge of an outer barrier reef. On a number of occasions I have used marlin carcasses to attract sharks when anchored inside various reefs on the outer barrier. These included two of the reefs in this study. On most occasions sharks began to appear in numbers within a half-hour or less of putting out the bait. As there was only little current the scent could only have attracted them from an area of a few Ha. down current by the time a dozen or more would be present. Grey reef sharks were always attracted first and in largest numbers although in normal diving on the same reefs only occasional scattered individuals would be seen.

Assessing the populations of reef sharks is difficult and visual counts along a 10m radius of a transect swum by a diver is subject to a large upward bias where resident sharks are unused to divers and are actually attracted to investigate an unfamiliar stimulus. Conversely they have a tendency to avoid or at least not approach to within 10m where they are familiar with divers. Aerial surveys by helicopter in calm weather would yield more reliable results. Use of a standardized baiting method to attract sharks would also help to provide a better comparison between areas, even though density per ha. estimates would not be possible.

Any spear or line fisherman familiar with the GBR can verify that reef sharks remain abundant on the GBR. Estimates of abundance made by academics should be treated with caution.

For example, a widely cited NSW Fisheries survey in 1995-96 (Harris and Gehrke, 1997) reported that: “A telling indication of the condition of rivers in the Murray region was the fact that, despite intensive fishing with the most efficient types of sampling gear for a total of 220 person-days over a two-year period in twenty randomly chosen Murray-region sites, not a single Murray cod or freshwater catfish was caught.” Yet the national Recreational Fishing Survey (Henry and Lyle 2003), conducted for 12 months in 2001 and 2002, estimated that during the survey period recreational fishers caught 483,284 Murray cod of which 374,932 were released and 108,352 weighing 144,222 Kg were kept. An obvious conclusion is that the inability of biologists to find an organism may have more to do with their lack of relevant skills than with the abundance of that organism.

Saving the Barrier Reef from alleged threats has become the basis of a multimillion dollar mini-industry involving hundreds of administrators, researchers, enforcers and environmental campaigners. Any suggestion that a threat may not be as serious as claimed is never greeted with hopeful interest. If it can not be ignored, effort is directed toward discrediting or dismissing such a suggestion rather than to fairly assessing it.

The impoverishment of reef sharks alleged by Robbins et al. (2006) is an especially serious claim in that it implies the effective or even actual extinction of the major apex reef predators of the reef community. If the findings and recommendations of this study are correct the only effective protection would require either the banning of all fishing or a major expansion of no entry zones to cover much of the entire GBR as well as acceptance of a significant ecological degradation of the remaining open areas. Before such action is contemplated, confirmation of the reality of the threat is warranted. The aerial and baiting surveys that I suggest above would provide quick and powerful confirmation or refutation of the order of magnitude differences in abundance claimed between no entry and other areas. Such a reality check is strongly needed.

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