Reef Fish Spawning Aggregations in South Asia and the Andaman Sea: Preliminary Findings from Local Knowledge

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INTRODUCTION

Reef Fish Spawning Aggregations (FSA) are a phenomenon where reef fish species gather in large numbers at a specific time and site to spawn (for definitions see Domeier and Colin 1997). For coral reef fishes these sites are consistent over years. Spawning aggregations can be critical in the life cycle of the fishes that use this reproductive strategy. In particular, for those species that travel relatively large distances to aggregation sites and gather for a short period to spawn each year (termed "transient" spawning aggregations, Domeier and Colin 1997), such aggregations can represent 100 percent of the species' reproductive output.

Fish may migrate over very large distances (10s of km) to an aggregation site, as exemplified by the Nassau grouper in the Caribbean (Bolden 2000). In addition, the pelagic fertilised eggs and larvae from such aggregations may travel far before settling out of the plankton to mature. Thus a single spawning aggregation may have an impact on fish populations over an area spanning several hundred kilometres. If these aggregations break down, for example through persistent fishing of the aggregations, the species' population can decline dramatically to critically unsustainable levels (Sadovy 1999). Since many species from several families of reef fish spawn in aggregations careful management of this phenomenon is critical if the health of fish populations and hence

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the entire coral reef ecosystem is to be maintained (Sadovy and Domeier 2005). Accordingly, reef fish spawning aggregations are a central component to the coral reef resilience concept, as synthesised in *The Nature Conservancy's Reef Resilience (R2) Toolkit* (Domeier et al 2002, R2 2004). This Toolkit addresses methods for minimising stress to coral reefs in order to maximise their ability to resist or recover from coral bleaching caused by climate change (e.g. Obura 2005).

The character of spawning aggregations leaves them highly vulnerable to over exploitation, and there are many examples where fishing has drastically reduced spawning aggregations (e.g. Sala et al 2001, Aguilar-Perera 2006). In view of this, the 3rd IUCN World Conservation Congress adopted Recommendation 3.100 on "Reef-fish spawning aggregations" (IUCN 2004). The recommendation expresses the concern of IUCN's 1,072 member institutions about the increasing exploitation of reef-fish spawning aggregations in various parts of the world, and about the dramatic ecological and socio-economic effects that such exploitation can lead to. It further urges governments to establish sustainable management programmes for sustaining and protecting reef fish and their spawning aggregations, and also requests a number of organisations to take action to promote and facilitate the conservation and management of fish spawning aggregations, by raising awareness of the long term ecological, economic and societal values of spawning aggregations. The importance of this recommendation was further emphasised by the International Coral Reef Initiative (ICRI 2006).

Reef fish spawning aggregations have been described and/or documented in many locations, including the Caribbean (Sadovy 1999, Bolden 2000), South Pacific (Sadovy 2004), Micronesia (Johannes et al 1999), Australia (Samoilys 1997), the Seychelles (Robinson et al 2004), and East Africa (Samoilys et al 2006, Robinson et al, 2007). Studies have indicated some similarities between spawning aggregations. For example, aggregating fish tend to be of large species from the Serranidae, Lutjanidae, Siganidae, Labridae, Scaridae. The timing and behaviour of aggregations and the physical characteristics of the sites vary (Claydon 2004) and there is still much that we do not know or understand about this critical phenomenon (Domeier et al 2002).

Guidelines on the study of reef fish spawning aggregations have been prepared by Colin et al. (2003). However, it appears very little research has been focused on spawning aggregations in South Asia and the Andaman Sea, and while spawning aggregations are known to occur there seems to be little but anecdotal evidence available beyond some detailed work in Lamu atoll in the Maldives (Sluka 2001a,b,c). There is also little information available on the implications of reef fish reproductive biology for overall reef health as well as reef resource dependent human societies. Consequently, spawning aggregations have frequently not been considered in most aspects of coral reef and fisheries management in South Asia and the Andaman Sea.

Interview Survey in South Asia and the Andaman Sea

A project has been initiated by IUCN and CORDIO in collaboration with national and local institutions, aimed at gathering some of the first data on spawning aggregations in the South Asia and Andaman Sea region, with a view to providing information that can support further research on reef fish population dynamics and reef resilience, as well as strengthen management of coral reefs and reef resources.

The objectives of the study are to a) determine which reef fish species form spawning aggregations; b) determine the specific sites of aggregation formation; c) determine the seasonal patterns in spawning aggregations by species; d) determine the level of awareness of spawning aggregations and status of stocks of those species among fishers; e) sensitise fishers and marine resource personnel in south asia on reef fish spawning aggregations and their implications to conservation and sustainable fisheries; and f) provide recommendations for the protection and management of sites of spawning aggregations.

The study is being carried out through interview surveys with fishers, who often are aware of and are fishing spawning aggregations (Johannes 1981), following the guidelines by Colin et al (2003). The survey covers most of the key coral reef areas in the region, including Lakshadweep, Gulf of Mannar and Andaman and Nicobar Islands in India, the Thailand Andaman Sea coast, reef areas in the West and South of Sri Lanka, Aceh in Indonesia, and the Maldives. The interview surveys were initiated around the region between March and August 2007, and are still ongoing (September 2007).

Preliminary Findings

Based on discussions with fishers on the northern Sumatra islands of *Weh and Aceh, Indonesia,* as well as ecological assessments in the area, three potential spawning habitats for Giant Trevally (*Caranx ignobilis*) have been identified. A detailed survey of fishers knowledge gained from household and field surveys is currently in progress to identify biological and resource use characteristics of these areas and further potential spawning aggregation sites in the region.

In the *Maldives* surveys have been carried out at Vaavu and Baa Atolls. Fishermen on Vaavu are aware of reef fish spawning aggregations and have identified sites and times for groupers (*Epinephelus fuscoguttatus, Plectropomus areolatus and P. pessuliferus*). One island in the atoll has an established grouper fishery that targets spawning aggregations on a regular basis. However, reportedly the fishing pressure on these sites has decreased over the years. Preliminary results from islands in Baa atoll indicate most fishermen either do not know about spawning aggregations or are hesitant to provide information. However, this does not include results from some of the islands with a local reef fishery. Field verification and characterisation of some of the sites has been planned.

Interviews in the Union Territory of *Lakshadweep, India*, conducted in some depth on Minicoy and Agatti islands and opportunistically at Kavaratti and Kadmath islands, indicate limited knowledge of reef fish spawning aggregations. The phenomenon of spawning aggregations is known and has been observed in some tuna baitfish (a number of species are used for tuna bait, including *Spratelloides gracilis, S. delicatulus*, and *Encrasicholina heteroloba*, as well as some Caesionidae, Apogonidae, Pomacentridae etc.), but fishers in the area had never heard of or seen reef fish spawning aggregations in larger fish such as groupers and snappers. However, many seemed to know the spawning seasons of pelagic species. This is reflective of the relatively low commercial importance of reef fish in the islands, where the hook and line tuna fishery is the main export earner. The reefs in the archipelago do exhibit many of the characteristics associated with reef fish spawning aggregations elsewhere, and further field surveys as well as more intense interview surveys are underway. In view of the concerns with respect to a growing export fishery targeting high value reef fish, knowledge and management of potential reef fish spawning aggregations is viewed as a high priority.

In the North Andaman region of the *Andaman and Nicobar Islands, India,* a first preliminary survey provided indications of spawning aggregations including several grouper spawning aggregations (largely *Plectropomus* spp.) in South Andaman. These aggregations are apparently fished for the lucrative export trade to South East Asia.

Surveys of nine villages in the *Gulf of Mannar, India* have reported no spawning aggregations in the shallow (0.5-3m) reef areas around the near shore islands. However, four possible fish spawning aggregations have been identified in areas further off shore, 5-10 miles out and at depths between 10 and 20m, with opinions of species, timings, including lunar phase shared among several fishers from different villages. Species reported included primarily the Lethrinidae, but also Siganidae, Lutjanidae, and Scaridae. The area is heavily fished with gillnets and hook and line, and higher catches are reported at the times of aggregation.

Interviews with 190 small-scale fishers in the southern part of *Phuket Island* and *Bulon Island,* *Thailand* provided some evidence of fish aggregations, although none of the respondents specifically mentioned spawning as a reason for fish aggregating, with some considering feeding the primary reason and others unable to provide an explanation. Sites were characterised as isolated underwater rock-outcrops or rock pinnacles on sandy bottom, and some located in channels between islands. Species observed aggregating included trevally (Carangidae) as well as certain serranids (*Epinephelus coioides* and *E. lanceolatus*), lethrinids (*Lethrinus lentjan*), and scombrids (*Rastralliger brachysoma* and *R. kanagurta*).

DISCUSSION

While several potential reef fish spawning aggregation sites have been identified through this study, the results are preliminary and unverified, and thus indicative only. It is clear that although many fishers are not immediately aware of spawning aggregations, others possess at least some knowledge of spawning areas, species and times. Further, as has been found in many other parts of the world, it appears that many aggregations are targeted by fishers in the area. The results are encouraging in the sense that they indicate functional spawning aggregations can still be found in the region.

In view of the intense fishing pressure in many parts of the region, particularly over the past two decades, it is expected that some aggregations have been diminished. As this trend is likely to continue, accurate and reliable information as well increased awareness among managers and policy makers of reef fish spawning aggregations, their ecological significance and vulnerability, are needed in order to design and implement suitable management responses.

Detailed and final results from the surveys will be published in national reports as well as a regional synthesis intended for presentation at the 11th International Coral Reef Symposium in 2008. Information on exact locations and timings of fish spawning aggregations will not be published in the public domain, but will be reported to the Society for the Conservation of Reef Fish Aggregations (SCRFA) database.

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