Reef Fish Spawning Aggregations in Aceh, Sumatra: Local Knowledge of Occurrence and Status

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Reef Fish Spawning Aggregations (FSA) are critical in the life cycle of the fishes that use this reproductive strategy as sources of larvae, but are also highly vulnerable to over exploitation. With the exception of the Komodo (Pet et al. 2005) little if any research has been focused on FSAs in Indonesia. Interview surveys were conducted among fishing communities on the island of Weh in northern Aceh in order to determine the level of awareness of FSAs among fishers; which reef fish species form FSAs; sites of aggregation formation; seasonal patterns; and to assess fishing pressure on and status of FSAs. Results show that many fishers possess reliable knowledge of spawning areas, species and times. Possible FSAs were reported from a number of areas on Weh island inside and outside protected areas. Of the 47 species of fish mentioned by respondents, we conclude that six species are very likely to form spawning aggregations in marine waters of Weh island. All six species were mentioned by more than 10 fishers, and included *Bolbometopoton muricatum* (Scaridae: Bumpheaded parrotfish), *Cepahpholis miniata* (Serranidae: Coral grouper) *Variola louti* (Serranidae: Yellow Edged Lyretail), *Cheilinus undulatas* (Labridae: Napolean wrasse), *Thunnus albacares* (Yellow fin tuna) *and Caranx lugubris* (Carangidae: Black Jack Trevally). FSAs in Aceh were areas targeted by fishers, although many were inside existing marine protected areas where prohibitions on netting from boats are in place. The results from this study will be used to increase awareness among communities as well as managers and policy makers of reef fish spawning aggregations, their ecological significance and vulnerability, in order to design and implement suitable management responses. In particular the information is being used in the design of a network of marine protected areas for the region.

Key words: reef fish spawning aggregation, traditional knowledge, Indian Ocean, Aceh

Introduction

A Reef Fish Spawning Aggregation (FSA) is a phenomenon where one or several reef fish species gather at a specific time and site to spawn (Domeier and Colin 1997). During spawning aggregations fish densities are considerably higher than those found in the areas during non-reproductive times. In many situations the location and timing of spawning aggregations are predictable over the long term making them targets for fisheries (Sadovy and Domeier 2005). FSAs are critical in the life cycle of the fishes that use this reproductive strategy as sources of larvae, and while any single FSA usually does not seem to represent a large proportion of a species reproductive output, transient FSAs collectively can make up 100 percent of the reproductive potential. Fish may migrate over very large distances to an aggregation site (e.g. Bolden 2000), and the fertilized eggs and larvae FSAs produce may travel far before settling out of the plankton to mature. Thus a single FSA may have an impact on fish populations over an area spanning several hundred kilometres, and connectivity between fish populations that use FSAs as a reproductive strategy is to a large extent dependent on healthy FSAs. If this system is broken down the health of both fish populations and the entire coral reef ecosystem is compromised. There is increasing recognition of the vulnerability of FSAs to over exploitation, and there are many examples of where fishing has drastically reduced FSAs (e.g. Sala et al 2001, Aguilar-Perera 2006). A main threat is the growth in the market for live trade in reef fish which has expanded in south east Asia over the pst 10 years (Sadovy and Vincent 2002). Indonesia is a major supplier of live reef fish and this has resulted in considerable exploitation and targeting of fish spawning aggregations (Mous et al. 2000).

FSAs have been described and/or documented in many locations, including the Caribbean (e.g. Bolden 2000), South Pacific (e.g. Sadovy 2004), Micronesia (e.g. Johannes et al 1999), Australia (e.g. Samoilys 1997), the Seychelles (Robinson et al 2004), East Africa (Samoilys et al 2006) and Indonesia (Pet et al. 2005). These studies have found that aggregating fish tend to be of large species, mainly Labridae, Scaridae, Serranidae, Acanthuridae and Lutjanidae, that lay pelagic eggs, yet the timing and periodicity of spawning among species and the physical structures at the aggregation sites vary greatly (Claydon 2004). It appears very little research seems to have been focused on FSAs in South East Asia and while FSAs are known to occur there seems to be little but anecdotal evidence available beyond some detailed work in Komodo (Pet et al. 2005). There is also little information available on the implications of reef fish reproductive biology for overall reef heath and the reef resource dependent human societies. Consequently, FSAs have frequently not been considered in most aspects of coral reef and fisheries management in South East Asia.

FSA Interview Survey in Aceh, Sumatra

This project was initiated by IUCN and CORDIO in collaboration with WCS Indonesia and local institutions. The aim was to gather some of the first comprehensive data on FSAs in the Aceh 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 were 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 FSAs following the guidelines by Colin et al 2003. The survey covers key reef areas on ther island Weh located in northern Aceh, Sumatra, Indonesia. The interview surveys were conducted in October 2007.

Results and Discussion

A total of 60 fishers from 7 districts on Weh island were interviewed. Eighty eight per cent of fishers were aged between 20 and 50 years. Sixty one per cent of fishers had been fishing for between 5 and 15 years while 19% and 20% had been fishing for less than 5 years and more than 15 years respectively.

A range of different gears were used by fishers including speargun, handline, and gillnets (Fig 1). Gleaning for mollusc, sea cucumber and harvesting of lobster were also dominant fishery based activities of respondents. The dominant gear used by fishers from all districts was the handline, while spear gun and gillnet were less common. Beurawang situated on the west coast of Weh had the highest diversity of fishing activities by respondents. Ninety three percent of all respondents used either diesel or outboard motor boats for fishing while the remainder used outrigger canoes and other non-motorised vessels.

Forty seven species of fish were mentioned by fishers as forming possible spawning aggregations (Figure 2). It is likely that many species mentioned were observations from fishers of fish aggregations that may not necessarily be fish spawning aggregations. To delineate between those species mentioned as forming aggregations and those most likely to be exhibit spawning aggregations, we compared the information provided by fishers with information on species known to form fish aggregations in Indonesia, information given by respondents on timing and habitat characteristics and our knowledge of fisheries and reef fish populations of Weh island. We concluded that of the 47 species mentioned by respondents, six species of fish were very likely to form spawning aggregations in marine waters of Weh island (Figure 3). All six species were mentioned by more than 10 fishers, and included *Bolbometopoton muricatum* (Scaridae: Bumpheaded parrotfish), *Cepahpholis miniata* (Serranidae: Coral grouper) *Variola louti* (Serranidae: Yellow Edged Lyretail), *Cheilinus undulatas* (Labridae: Napolean wrasse), *Thunnus albacares* (Yellow fin tuna) *and Caranx lugubris* (Carangidae: Black Jack Trevally).

Spawning aggregations of the six species were reported to occur year round with the timing of fish spawning aggregations varying according to location (Table 1). There were no clear geographic patterns in the timing of aggregations, with aggregations on the west, south and east coast of Weh island occurring at different times according to

location and species (Table 1). In general, for a given site aggregations of *Cepahpholis miniata* (Serranidae: Coral grouper), *Variola louti* (Serranidae: Yellow Edged Lyretail), *Cheilinus undulatas* (Labridae: Napolean wrasse), *and Caranx lugubris* (Carangidae: Black Jack Trevally) were reported to occur during one season or time of the year. For *Caranx lugubris* this was predominantly reported as the west monsoon and transition periods. For *Cepahpholis miniata* (Serranidae: Coral grouper),*Variola louti* (Serranidae: Yellow Edged Lyretail), and *Cheilinus undulatas* (Labridae: Napolean wrasse) the timing occurred equally in west and east monsoon periods, depending on the location. For *Thunnus albacares* (Yellow fin tuna) and *Bolbometopoton muricatum* spawning was reported as occurring year round during east and west monsoons and transitions periods (Table 1).

Possible spawning aggregations of *Bolbometopoton muricatum* were identified on reef crest habitats located on the north-west coast of Weh island (Figure 3), with 3 of the 5 locations inside a local government marine protected area where netting from boats is prohibited *Cepahpholis miniata* aggregations were also known by fishers in this region in reef crest and outer slope habitats, but just outside the protected area boundaries. Two locations were nominated for spawning habitats for the Napolean wrasse, *Cheilinis undulatus* (Figure 3). Both were located on outer slope reef habitats and located in the north west and south east of Weh island, outside marine protected areas.

Three spawning sites for *Variola louti* were also in the north west region of Weh island with 1 site inside a marine protected area. Habitats for this species included reef crest and outer slope habitats (Figure 3). An additional location was recorded on the southern coast of Weh island. The most common species reported to form spawning aggregations was *Caranx lugubris* (Carangidae: Black Jack Trevally). Sites at 10 locations on the north west, east and south east coasts of Weh island were reported in reef crest, outer slope and drop off habitats (Figure 3). Four of the sites (Ie Muelee, Ujung Kareung, Ujung Reuteuk, Batee Dua) are located within marine protected areas on the east coast of Weh island managed by traditional customary law known as Panglima Laot, where netting from boats is banned. Another site at Ujung Pulau Rubiah on the north-west coast is located with the government tourism reserve and also located within the boundaries of Panglima Laot customary laws. One site was located within a sandy lagoon at Limbo Gapang on the northwest coast, while another was reported on reef crest habitat at Gua Sarang on the west coast (Figure 3). Both are outside the boundaries of the government tourism reserve.

Aggregations of *Thunnus albacares* (Yellow fin tuna) were reported on the east and south-east coasts of Weh Island, clustered on a promontory south of Ujung Suekee. These reported aggregations were located on reef crest and outer slope coral and sand habitats. It is not clear if these aggregations are spawning or schooling populations.

Recommendations

- Field surveys are required to verify the location and timing of the most commonly identified fish spawning areas on Weh island.

- Conduct workshops with Panglima Laot (traditional community fishery leaders) and government agencies to identify targeted marine regulations (eg. seasonal closures, gear restrictions) that protect fish spawning aggregations from exploitation by artisanal and commercial fisheries.

- Fish spawning areas to be included in the design of a network of MPAs for northern Aceh islands.

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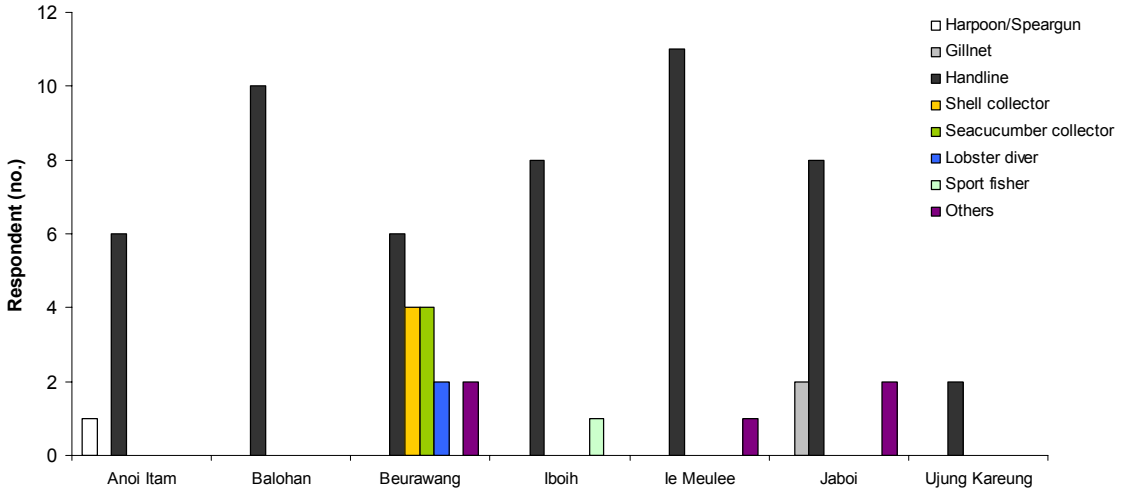

Figure 1. Fishing gears used by interview respondents from Weh island, Aceh, Sumatra.

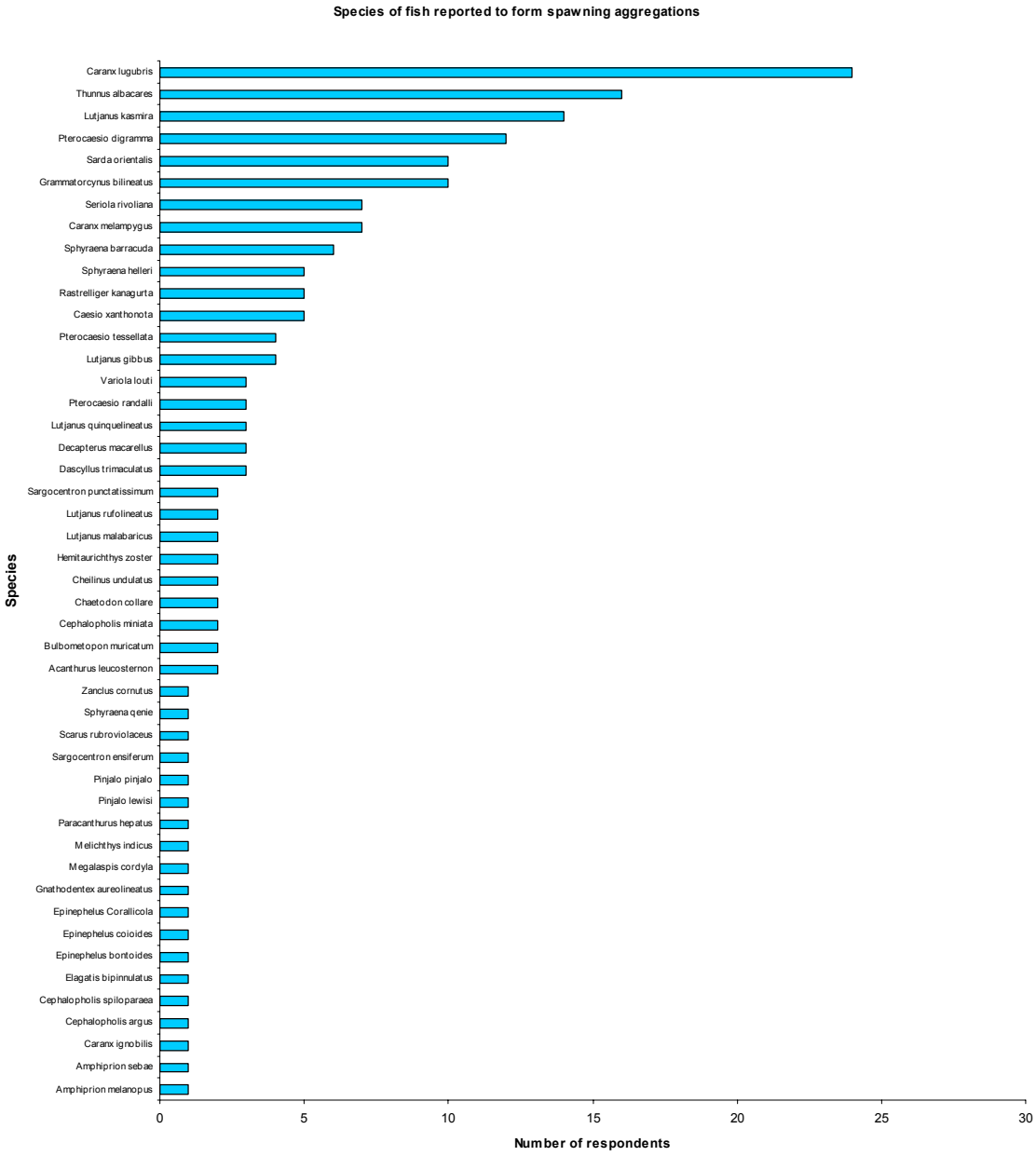

Figure 2. The number of respondents that reported fish species that form (spawning) aggregations on from Weh island, Aceh, Sumatra.

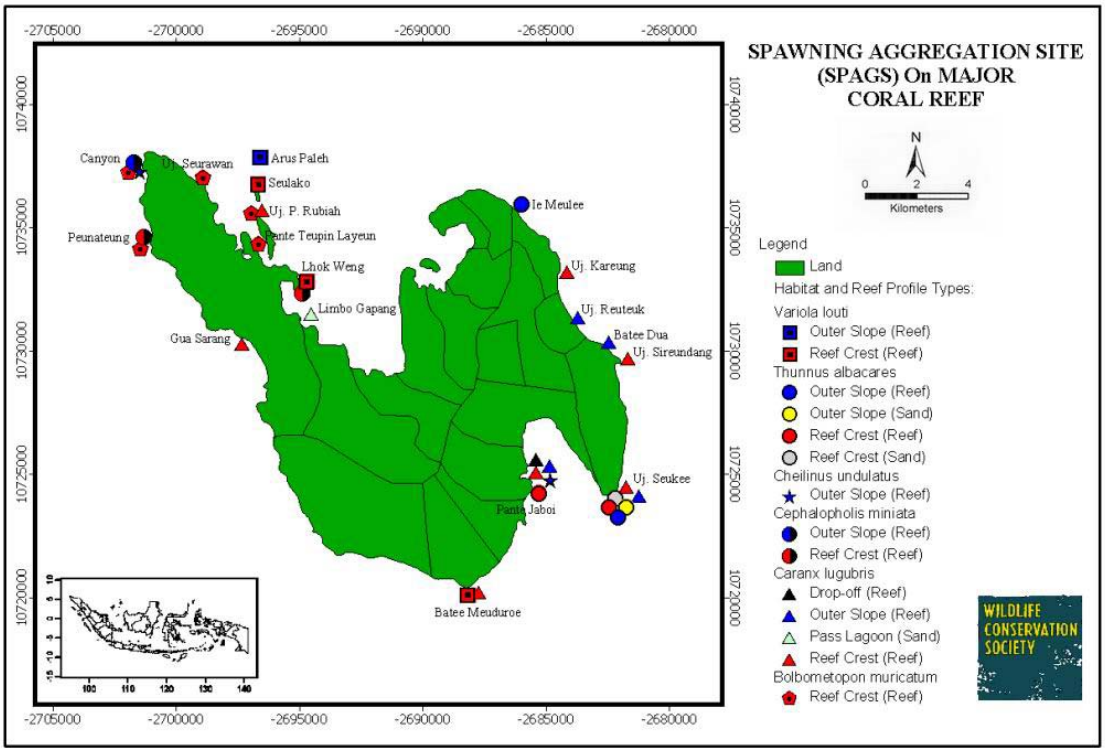

Figure 3. Locations and habitat types of six species of fish most commonly reported to form spawning aggregations in marine waters of Weh island, Aceh, Sumatra.

Table 1. List of fish species, site locations, habitat and spawning season for fish spawning aggregations on Weh island, Aceh, Sumatra.

No	Family	Spesies	Site name	Habitat	Reef profile	Season
1	**Carangidae**	**Caranx lugubris**	Batee Dua	Reef	Outer slope	West monsoon
			Batee Meuduroe	Reef	Reef crest	All season
			Ujung Sireundang	Reef	Reef crest	West monsoon
			Gua Sarang	Reef	Reef crest	West monsoon
			Limbo Gapang	Sand	Pass (Lagoon)	Transition period
			Pante Jaboi	Reef	Reef crest, Drop-off, Outer slope	All season
			Ujung Pulau Rubiah	Reef	Reef crest	East monsoon and Transition period
			Ujung Kareung	Reef	Reef crest	West monsoon
			Ujung Reuteuk	Reef	Outer slope	West monsoon
			Ujung Seukee	Reef	Reef crest and Outer slope	All season
2	**Scombridae**	**Thunnus albacares**	Pante Ie Meulee	Reef	Outer slope	All season
			Pante Jaboi	Reef	Reef crest	All season
			Ujung Seukee	Reef and Sand	Reef crest and Outer slope	All season
3	**Serranidae**	**Variola louti**	Arus Paleh	Reef	Outer slope	East monsoon
			Batee Meuduroe	Reef	Reef crest	East monsoon
			Lhok Weng	Reef	Reef crest	West monsoon
			Seulako	Reef	Reef crest	West monsoon
4	**Labridae**	**Cheilinus undulatus**	Pante Aneuk Seukee	Reef	Outer slope	East monsoon
			Pante Jaboi	Reef	Outer slope	West monsoon
5	**Serranidae**	**Cephalopholis miniata**	Lhok Weng	Reef	Reef crest	West monsoon
			Pante Aneuk Seukee	Reef	Outer slope	East monsoon
			Peunateung	Reef	Reef crest	West monsoon
6	**Scaridae**	**Bolbometopon muricatur**	Pante Aneuk Seukee (Can	Reef	Reef crest	Transition period
			Pante Teupin Layeun	Reef	Reef crest	Transition period
			Peunateung	Reef	Reef crest	All season
			Ujung Pulau Rubiah	Reef	Reef crest	All season
			Ujung Seurawan	Reef	Reef crest	All season

Season	**Month**
East monsoon	December - March
West monsoon	June - September
Transition period (E	April - May
Transition period (W	October - November

Pass is lagoon