Local knowledge of white-dotted grouper (*Epinephelus polystigma*) aggregations in Melanesia

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Introduction

In a recent assessment of all grouper species, a panel of experts concluded that 20 out of 160 grouper species are considered vulnerable or endangered under IUCN Red List criteria (Sadovy 2007). Aspects of grouper life history that appear to make this family particularly vulnerable to overfishing include slow population turnover (Coleman et al. 2000) and the spawning aggregation behaviour of many species (Johannes 1978). Indeed, 50% of the groupers listed as vulnerable or endangered on the IUCN Red List are known to form spawning aggregations. Spawning aggregations occur when mature fish travel to a specific location at a specific time for the purpose of reproduction (Domeier and Colin 1997). Some grouper species form spawning aggregations of hundreds or thousands of fish (Johannes et al. 1999; Rhodes and Sadovy 2002), and at these times the aggregating population is highly susceptibly to overfishing (Sadovy and Domeier 2005a).

Many grouper species in the Pacific are important to subsistence, artisanal and commercial fisheries (Wright and Richards 1985; Dalzell et al. 1996; Rhodes and Tupper 2007). Although both aggregating and non-aggregating groupers are fished, species that form aggregations often bear the brunt of fishing pressure. Grouper spawning aggregations can be rapidly depleted or totally eliminated when subjected to moderate to high levels of subsistence or commercial fishing (Hamilton and Kama 2004; Johannes 1997; Sadovy et al. 2003; Hamilton and Matawai 2006). In the Indo-Pacific, the live reef food fish trade (LRFFT) and night spearfishing are some of the main threats to grouper spawning aggregations (Sadovy and Vincent 2002; Hamilton et al. 2005).

At the global level, approximately 13% of all groupers are considered to be vulnerable or endangered, and a further 30% cannot currently be assessed as there are insufficient data on them (Sadovy 2007). Two recommendations made at the 2007 IUCN workshop on groupers were that 1) all larger data deficient species should be the immediate focus of more data gathering, especially in Southeast Asia and the Pacific Islands region, and 2) species that aggregate to spawn need more protection if aggregations are targeted (Sadovy 2007).

In this article we draw on local knowledge and field observations to provide a picture of the aggregating behaviour and status of the white-dotted grouper (*Epinephelus polystigma*) in Melanesia. *E. polystigma* was one of 48 species listed as data deficient in the recent IUCN Red List assessment of all groupers (Sadovy 2007)

E. polystigma is a medium-sized, rare grouper species that inhabits estuaries and mangrove habitats of Indonesia, the Philippines, Papua New Guinea and the Solomon Islands (Heemstra and Randall 1993). One of the only published accounts of this species is a short article that describes fishers' local knowledge of *E. polystigma* in Isabel Province, Solomon Islands (Johannes 2001). Isabel fishers state that *E. polystigma* is a lazy fish, that is exceptionally easy to approach and spear, and that it often aggregates in water "so shallow that the backs of fish protrude from the water as they rest on the bottom" (Johannes 2001). Isabel fishers also stated that the ease with which this species could be captured meant that it was now rare around areas inhabited by humans (Johannes 2001)

Most of the information on *E. polystigma* presented here was documented in 2003 and 2004 while we were conducting local knowledge surveys on reef fish aggregations in New Ireland and Manus provinces in Papua New Guinea[3] (Hamilton 2003a; Hamilton et al. 2004). These surveys were intended to quickly amass information on reef fish spawning aggregations. It was envisaged that the local knowledge on aggregation parameters that was documented (such as specific locations, species

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3. Information on *E. polystigma* aggregations in Roviana Lagoon presented here was documented by one of the authors (RH) while he was residing in Roviana Lagoon in 2000 and 2001.

composition and aggregation status) could provide a template of information for tailoring future research and conservation efforts in these provinces of Papua New Guinea.

Using local ecological knowledge for research and conservation

Local knowledge is an important component of the intellectual and cultural property of many indigenous societies (Carrier 1987; Foale 1998). From a rationalist viewpoint, local knowledge bases also hold a great deal of information valuable to conservation and science. This potential is increasingly recognised, and there exists a large body of literature advocating its documentation and integration with more quantitative types of research (Christie and White 1997; Johannes and Neis 2007). Interest in local ecological knowledge stems from a mosaic of disciplines, including agriculture (Walker et al. 1999), environmental impact assessment (Usher 2000), conservation (Warren 1997), toxicology (Huia and Xu 2000), and fisheries research and management (Ruddle 1996; Bergmann et al. 2004). As many authors have pointed out, the lack of a university degree does not mean that a person is not knowledgeable or that his or her knowledge is unimportant (Nordhoff 1930; Johannes 1981; Foale 1998).

Local ecological knowledge contains baseline information on local ecologies, including information on the components of local ecosystems, and their temporal and spatial patterning. Fishers can provide critical information on inter-annual, seasonal, lunar, diel, tide- and habitat-related differences in behaviour and abundance of target species, and how these dictate fishing strategies (Johannes et al. 2000). These data are particularly relevant to marine biologists working in the Indo-Pacific region, where sources of more orthodox ecological information are normally unavailable. Fishers often know much more than biologists about the location of critical habitats such as spawning grounds (Johannes 1989), spawning behaviour (Hamilton 2005), nursery areas (Johannes and Ogburn 1999), and seabird aggregation sites (Nakashima 1993). Local fishers are also often the only people who know that during particular seasons certain otherwise unremarkable islets or coral sites become critical habitats, such as nesting beaches for sea turtles (e.g. Johannes 1981), rookeries for seabirds (e.g. Nakashima 1993) and egg-releasing beaches for land crabs (e.g. Foale 1999).

Fishers' local knowledge can also be critical in providing a perspective on the historical state of reef fish communities. In the Indo-Pacific area, coastal fisheries quantitative baseline studies are rarely available to marine biologists, but rich bodies of local ecological knowledge frequently exist, and if accessed correctly, can provide detailed insights into past abundances, size structure and spatial distribution of a particular fish stock. In situations where large-scale ecological changes have occurred within the lifespan of fishers, the knowledge of such changes can be extremely detailed (Johannes and Yeeting 2001; Hamilton 2003b; Dulvy and Polunin 2004). Finally, fishers' local knowledge is increasingly playing an important role in the demarcation of marine protected areas and ecoregional assessments, since both of these processes require a prior knowledge of the spatial and temporal distribution of marine species (Aswani and Hamilton 2004; Aswani and Lauer 2006; Smith and Hamilton 2006; Hinchley et al. 2007).

It is important to highlight that although local knowledge of marine environments can be of great practical value to scientists and conservationists, there are several cultural and methodological issues that need to be taken into account. In particular these include:

1. Local ecological knowledge needs to be documented and utilised in ways that are endorsed by the custodians of this information.

2. Anthropological methods such as interviewing and participant observation are required to accurately document this material.

3. Local knowledge is often stratified by gender, age and geographical location, and specific knowledge pertaining to specific families of fish is often restricted to expert fishers who specialise in targeting those species (Johannes et al. 2000).

4. Most local knowledge of marine ecologies is ultimately directed towards identifying patterns that maximise capture success. Thus, some details of fish biology that are important to a marine biologists studying reef fish ecology may well be irrelevant to a local knowledge base, since these biological parameters have no influence on subsistence practice (Hamilton and Walter 1999).

5. While local knowledge of recent changes in the abundance or size structure of local fish stocks will often be very accurate, local explanations for the mechanisms underlying these changes may not be compatible with scientific paradigms: "In some places declining yields may be attributed to sorcery or a failure to propitiate the gods." (Ruddle et al. 1992:262).

6. Fishers' knowledge, like scientists', is fallible, and this cultural information needs to be gathered systematically and treated with the same critical scrutiny that is applied by scientists to any other data set (Johannes et al. 2000).

Methods

Study sites

The local knowledge of *E. polystigma* reported on here was documented from New Ireland and Manus provinces in Papua New Guinea and Roviana Lagoon in the Western Province of the Solomon Islands (Fig. 1).

Community liaison and interviewing procedure

In each region where local knowledge surveys were conducted, we attempted to cover as wide a geographical area as possible, focusing on communities known to be heavily dependent on marine resources. The authors' knowledge of a region, word of mouth, and any available unpublished or published literature were used to determine where we placed our main efforts. In each region, the surveys lasted for approximately two weeks. Upon arrival we asked to speak to community leaders, and would introduce ourselves and explain our agenda. Typically, they would then call a group of available expert fishers together, under a tree or by the beach. We then introduced ourselves and gave an introductory talk on the life cycle of aggregating fishes, over viewing among other things, aggregating behaviour, spawning, pelagic larval stages of fish, and sex reversal. We then pointed out that although biologists knew a lot about fish biology, we knew nothing about where or when spawning aggregations occurred on reefs in the region we were now in, which is why we wanted to ask local fishers for their help. We ended by clearly stating that the information we were collecting was part of a preliminary assessment of spawning aggregations that we were making in their region, and specific details on locations of sites and other sensitive local knowledge would remain confidential.

These introductory talks frequently generated a great deal of interest, and served as a very effective way of initiating conversations on reef fish aggregation sites. Fishers often enthusiastically shared their own observations and asked numerous questions on spawning aggregations. Reef fish guide books and posters showing the main target species of the LRFFT were used as visual aids, so that fishers could show us what species aggregated on their reefs. Importantly, these introductory talks also served as a quick way of assessing the level of local knowledge of spawning aggregations in the area visited. If we drew completely blank stares from all fishers at the completion of a talk and further inquires confirmed that no such aggregations were known to occur on surrounding reefs, then we moved onto the next location fairly quickly. On the other hand, when we discovered an area that had a wealth of knowledge about reef fish aggregations, we often asked to

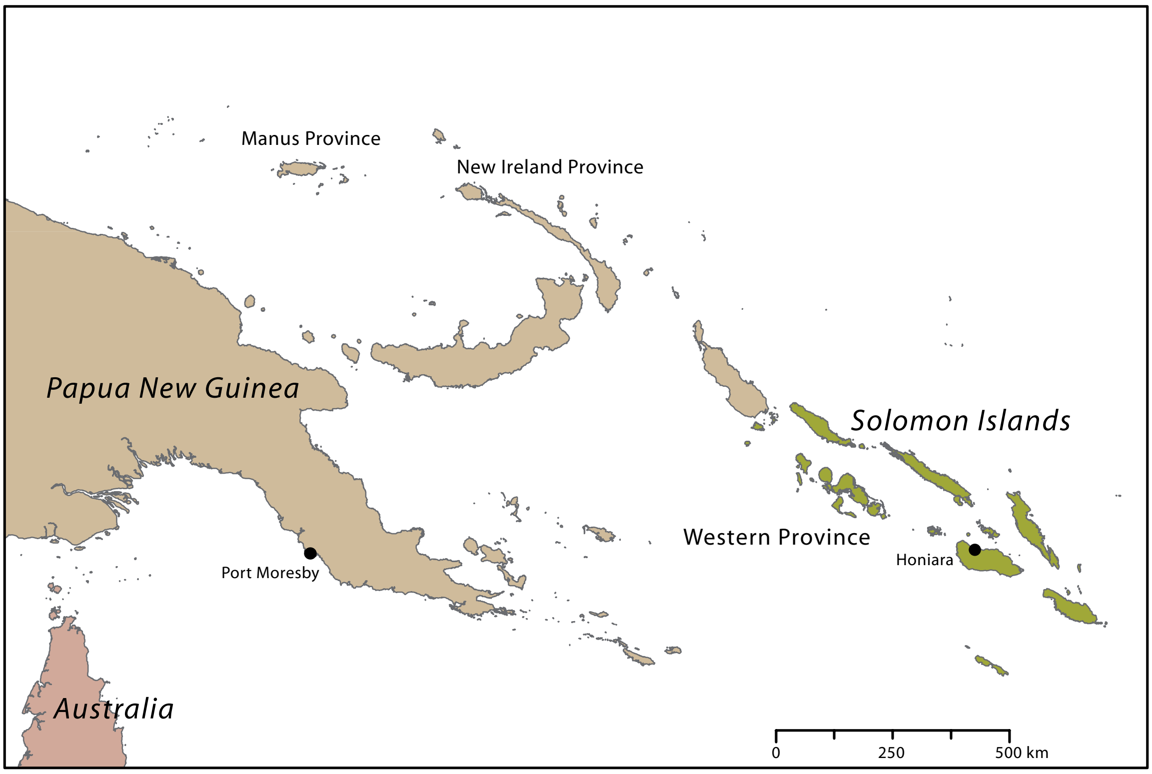

Figure 1. Manus and New Ireland provinces in Papua New Guinea, and Western Province in the Solomon Islands.

stay for a few nights so that we could get to know the fishers and learn as much as possible. In these instances we also asked local experts to take us to known aggregation sites, so that we could observe aggregation habitats and collect GPS coordinates on aggregation boundaries.

Individuals or groups of knowledgeable fishers who were willing to be interviewed in detail were asked a wide range of questions on reef fish aggregations that occurred within their fishing grounds.[4] The questions laid out in the Society for the Conservation of Reef Fish Aggregations (SCRFA) questionnaire (http://www.scrfa.org/scrfa/studying/introduction.htm) formed the template of the questions covered. Interviews were conducted in Tok Pisin and Solomon Islands Pijin.

Results

Local knowledge of E. polystigma *aggregations in New Ireland Province, Papua New Guinea*

Aggregation 1

When conducting interviews with fishers in New Ireland province we were provided information on the location and timing of a large and recently discovered nocturnal grouper aggregation (Hamilton et al. 2004). This species, known locally as *avou* (later identified as *E. polystigma*) is reported to be common in river mouths and brackish mangrove regions around the island. Fishers report that the species is solitary and wary by day, and they regard the fish as "sneaky" due to its habit of "stealing" crabs knocked from mangrove roots by banded archerfish (*Toxotes jaculatrix*).

The aggregation site was first discovered in early 2003 by local fishers hunting for mud crabs. The finding was made at night during low tide, with fishers reporting large numbers of loosely dispersed *E. polystigma* sleeping in very shallow water among mangrove roots and on shallow sandy and rocky substrate at the mouth of a large remote estuarine bay. Fishers reported that the fish were in ankle-deep water and that catch rates were about 50 fish hr^{-1} from a small area (>5000 m^2). Fish were captured by simply using a bush knife to cut the sleeping fish in half.

The fishers who discovered this aggregation noted that the night on which they discovered it coincided with peak aggregations of squaretail coralgrouper (*Plectropomus areolatus*) that are known to form in this region. Fishers presumed that *E. polystigma* aggregations might also display a predictable lunar aggregation pattern. Fishers reported that over the previous year they had returned to this site on a near monthly basis at various lunar stages, and they were in agreement that *E. polystigma* aggregations occur each month approximately a week prior to the new moon. Fishers were unable to state whether captured fish from these aggregations were running ripe.

Exploitation of this recently discovered nocturnal aggregation appears to be growing as

Figure 2.
A sleeping *E. polystigma* lying on its side in very shallow water.

Figure 3.
A sleeping *E. polystigma* in slightly deeper water resting on its belly.

4. These local knowledge surveys produced a wealth of information on a great number of species that are not dealt with in this paper. For detailed findings of these surveys refer to Hamilton 2003; Hamilton et al. 2004 and Hamilton et al. 2005.

fishers from nearby villages learn of its location and timing, although fishing has been limited to subsistence use. It is noteworthy that the aggregation is not targeted every month as fishing is limited to aggregation periods that coincide with low nocturnal tides. Fishers have not yet investigated the aggregation boundaries, since all the fish required for subsistence can easily be collected within the limited aggregation area initially discovered.

Field observations

At 10 p.m. on 19 January 2004, three days prior to new moon, we accompanied a local fishing party to the recently discovered *E. polystigma* aggregation site during low tide. We immediately located several *E. polystigma* sleeping on the sand and mud against stones or mangrove roots in 10–20 cm of water. Larger fish that were in very shallow water were lying on their sides, presumably to keep their gills irrigated, while fish in slightly deeper water often had their bellies resting on the bottom (Figs 2 and 3). An identification of the species was made from the first fish speared (Fig. 4).

Over the next 50 minutes we sighted approximately 30 individuals and captured 18 in an area of approximately 4000 m^2 (Fig. 5). Fish were located by flashlight and speared with a handheld spear.

Fish were patchily distributed in small clumps over a fairly large area. At times we walked for several minutes without seeing a single fish; other times we observed 5–6 individuals in an area of ± 100 m^2. We never observed two individuals in close proximity to one another. Larger *E. polystigma* remained motionless regardless of the amount of disturbance we made and even the repeated flash of a camera did not disturb them. In contrast, smaller individuals had pronounced swollen bellies, were much more skittish and more numerous than big fish, and would often dart away before they could be speared. No *E. polystigma* were seen in water deeper than 20 cm, and no other fish species were observed.

Figure 4.

A very recently captured male *E. polystigma*. Small yellow (sometimes white) dots covering most of the body can be seen on the caudal and dorsal soft fin rays in this specimen, hence the name white-spotted grouper.

Figure 5.

Two local fishermen holding up their catch. The fisherman on the left is holding the handheld spear used to capture the fish.

Sex specific size structure and sex ratio

The 18 *E. polystigma* sampled were measured (nearest mm, total length) and sexed macroscopically. Fish were not weighed at capture. All individuals were ripe and were easily sexed in the field. Ripe ovaries were dark orange with a mass of oocytes clearly visible when cut transversely. Males were running ripe with a white compact testes and extractable milt. All male gonads were substantially smaller than those of females (Fig. 6).

Male and female *E. polystigma* had a pronounced bimodal size distribution, with no overlap in the size range of the sexes (Fig. 7). Females outnumbered males 2:1 in this sample. Given that all small (presumably female) individuals were more skittish and harder to capture than large (presumably male) fish, females were probably under represented in this sample.

Aggregation 2

Information on another *E. polystigma* aggregation in New Ireland was documented by one of the authors (TP) in 2006 and 2007. This *E. polystigma* aggregation occurs along the mangrove-lined edges of a seaward facing channel in the Tigak Islands. Aggregations are known to occur prior to the new moon in most months of the year. Aggregated *E. polystigma* are captured with gill nets, handheld spears and spearguns.

Highest catches are made by fishers using spearguns and underwater flashlights at night. Fishers report that this species is rarely caught on a fishing line. Interviewees state that the location and periodicity of this aggregation has been known to a limited number of fishers for decades, but historically, fishing this aggregation was only for subsistence purposes. Support for this claim comes from extensive surveys of artisanal fisheries in the Tigak Islands in the early 1980s. No *E. polystigma* was recorded in the artisanal catches from the Tigak Islands in the early 1980s (Wright et al. 1983). In the late 1980s, underwater spearfishing (day and night) became common throughout the Tigak Islands (Hamilton et al. 2005), and it may be that this practice led to many more fishers discovering and subsequently exploiting this aggregation site.

Currently, fishers from six nearby communities exploit this aggregation site for the specific purpose of selling *E. polystigma* in Kavieng. On several oc-

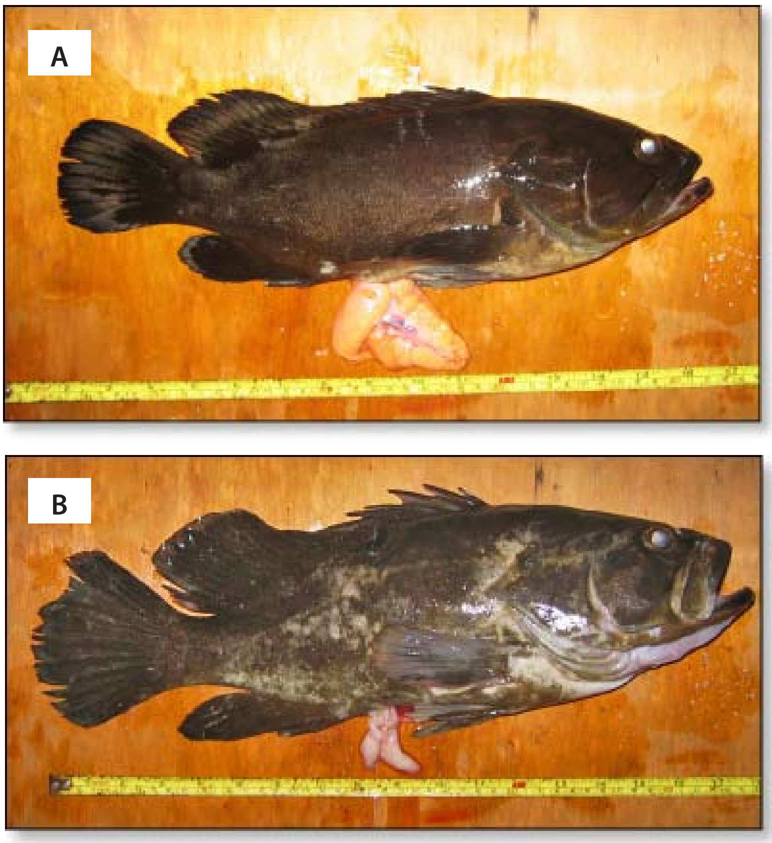

Figure 6. Top: Gonads of a ripe 305-mm female;
Bottom: Gonads of a ripe 475-mm male.

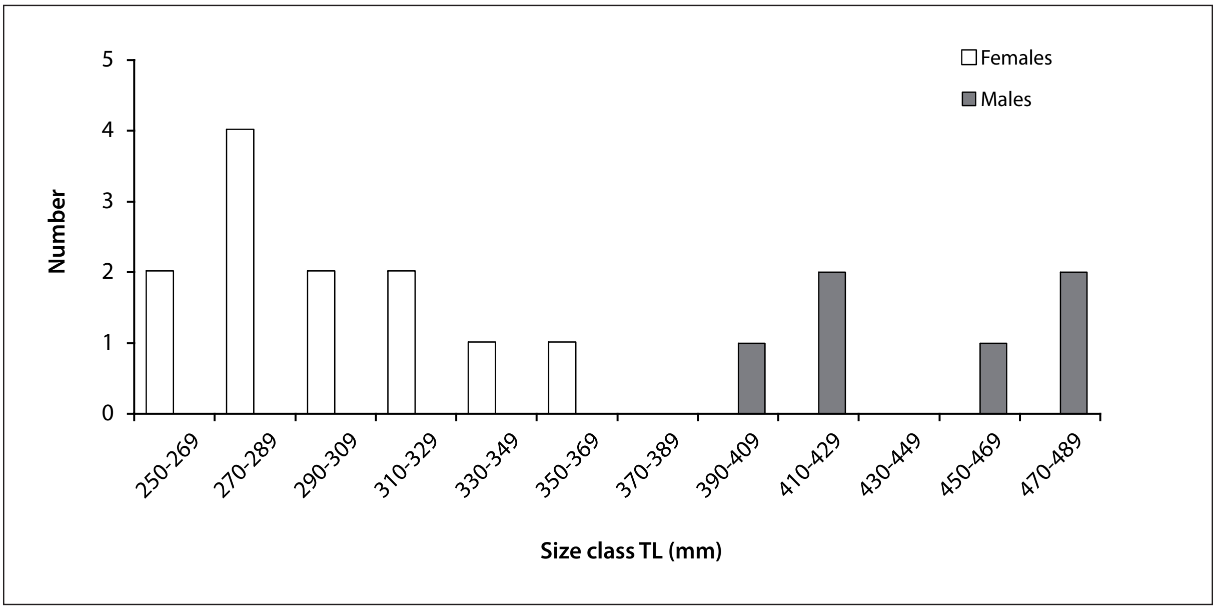

Figure 7. Size frequency distribution of *E. polystigma* in 20 mm size classes (n=18).

casions in 2006 and 2007, one of the authors (TP) observed catches of *E. polystigma* in excess of 50 individuals (that were captured from this aggregation site) being sold to local fish buyers in Kavieng. Interviews with local fishers in 2007 revealed that catch rates at this *E. polystigma* aggregation site were in decline. The attractive prices currently being offered for all grouper species in Kavieng appears to be driving heavy exploitation of this and other grouper spawning aggregation sites in the Tigak Islands.

Local knowledge of E. polystigma *aggregations in Manus Province, Papua New Guinea*

In Manus we documented local knowledge of two *E. polystigma* aggregations: one that appears to already have been seriously overfished, and the other, which appears stable. Information on the first of these aggregations was documented in 2003 when Pomat Powayai, a Manus fisheries officer, told one of the authors (RH) about large aggregations of two estuarine cod species that formed monthly in a shallow estuarine bay near his village over a five-day period prior to a new moon. Females of both aggregating species are known to be gravid at this time (Hamilton 2003a). In 2003, Powayai identified one of these aggregating estuary cod as *Epinephelus coioides*. The other fish was said to be absent from available coral reef fish identification books and, thus, not identified. In January 2004, we again interviewed Powayai about these aggregations and showed him digital photos of *E. polystigma* captured in Kavieng. He confirmed that *E. polystigma* was the other cod that aggregates in the estuarine bay near his village. This Manus aggregation of *E. coioides* and *E. polystigma* was discovered in the 1970s, and initial catch rates of these two species were said to exceed 200 fish per night. Fishing pressure has had a marked impact on these aggregations, with current catch rates being several magnitudes lower than original catch rates (Hamilton 2003a), and continuing to decline (Pomat Powayai pers. comm. January 2004).

In 2004 we documented local knowledge of another *E. polystigma* aggregation, located on the south coast of Manus (Hamilton et al. 2004). In this region of Manus *E. polystigma* is known as *kali moniol*. This *E. polystigma* aggregation site occurs on very shallow, muddy inner reef areas that are in close proximity to mangroves. *E. polystigma* is said to only ever be present at this site on the first and second day of the new moon in every month of the year. Fishers believe that *E. polystigma* aggregate for the purpose of spawning, based on the fact that all captured females are gravid and captured males are always running ripe. Fishers we interviewed were unable to give us an estimate of aggregation numbers, stating that the extremely poor visibility of this site limited their ability to estimate the size of aggregations. However the aggregation area appears to be small, with fishers estimating that the total aggregation area was less than 10,000 m^2. Daytime speargun fishing appears to be the main method used to exploit this aggregation, although fishers who were interviewed stated that this fish will also take a baited hook.

Our main informant on this aggregation was an expert spear fisherman who is renowned in his village for his local knowledge. He has consistently targeted this aggregation site for over a decade, and had an interesting method to enhance his chances of capturing this species from the aggregation site. He reported that the very dark colour of this species combined with the muddy substrate and very poor visibility at the aggregation site made it difficult to spot *E. polystigma*, which are typically lying motionless on the mud. He stated that when he first started spearfishing at this site he would often only see *E. polystigma* when he had disturbed them and they were darting away. To enhance capture rates, he sinks coconut fronds within the aggregation area several days prior to the known aggregation period. When he returns during an aggregation period, *E. polystigma* are often sheltering under the coconut leaves, with their eyes clearly visible. They are much easier to spear as they are reluctant to flee from the shelter provided by the coconut frond.

This particular aggregation site appears to be stable, with the spear fisherman who regularly exploits this site stating that the maximum number of *E. polystigma* he caught in a single trip was approximately 15, and that his maximum catch had not declined in the 10 years he has been fishing this site. It appears however that fishing on this aggregation site is limited, as only a few individuals knew of the location and timing of this aggregation, and even those spear fishers that were aware of it often did not target this area due to the very poor visibility.

Local knowledge of **E. polystigma** *aggregations in Roviana Lagoon, Solomon Islands*

In mid-2000, the late Robert Johannes asked one of the authors (RH) to interview fishers in Roviana Lagoon about their knowledge of the behaviour and status of *E. polystigma* populations in this region. At the time, RH was residing in Nusabanga village, Roviana Lagoon and was completely unaware of this species, having never seen it in local catches. However interviews with several older fishers revealed detailed information on past *E. polystigma* fisheries in this region. Known as *kobili* in the Roviana language, *E. polystigma* is reported to have once been very abundant in the shallow inner lagoon areas directly surrounding Nusabanga village, and easily captured at night. In the 1950s when the island of Nusabanga was settled, fishers reportedly caught over 50 *E. polystigma* in a night. *E. polystigma* were speared in very shallow water, using burning coconut fronds and later flashlights as a source of light. Interviews did not reveal any information on the reproductive state of captured *E. polystigma* or the best lunar times to capture this fish.

The very close proximity of Nusabanga village to *E. polystigma* fishing grounds had rapid negative effects on this population, with older fishers reporting that *E. polystigma* catch rates quickly declined and had completely disappeared from inner lagoon areas around Nusabanga by the early 1970s. Indeed, an experienced Nusabanga fisher in his early thirties who came across and speared two *E. polystigma* in 1998 had to ask his father to identify these fish, having never seen this species before. Over the uninterrupted 12-month period that RH resided in Nusabanga village (August 2000–July 2001), only once did he examine two *E. polystigma*. A Nusabanga fisher speared both specimens at night on 28 November 2000 (two days after the new moon) in shallow water in the inner lagoon adjacent to Nusabanga village. These two *E. polystigma* were 510 mm and 470 mm long (1.6 kg and 1.35 kg total weight), and could not be sexed macroscopically because they had no obvious gonad development.

Discussion

Information documented in the New Ireland and Manus local knowledge surveys and that obtained by interviewing elderly Roviana fishermen has enabled us to fill in some of the data gaps pertaining to the ecology of *E. polystigma* and its susceptibility to fishing. Local knowledge indicates that this species is normally solitary, with aggregations only occurring at specific sites in the days leading up to and including the new moon. Aggregations are reported to occur in every month of the year, and form in very shallow water in close proximity to mangroves. Manus local knowledge of this species indicates that aggregating *E. polystigma* have ripe gonads, an assertion that is supported from our field observations in New Ireland.

The lunar periodicity with which aggregations form, and the fact that aggregated females are gravid, provides indirect evidence for reproductive activity at or near the known aggregation sites. Although we have not been able to prove that these aggregations definitely represent spawning aggregations (Colin et al. 2003)[5], all available evidences indicates these periodic *E. polystigma* aggregations are occurring for the purpose of spawning, a behaviour trait that is characteristic of this family. Interestingly, local

5. Unequivocal evidence of spawning requires observing actual spawning or demonstrating the presence of hydrated eggs or post-ovulatory follicles in the ovaries of aggregating females (Colin et al. 2003).

knowledge relating to the lunar periodicity and annual seasonality with which *E. polystigma* aggregations form is identical to local knowledge of squaretail coral trout (*Plectropomus areolatus*) aggregations. Many local fishers throughout Melanesia know that spawning aggregation of *P. areolatus* occur prior to the new moon in every month of the year, assertions that have been validated through underwater monitoring programmes at multiple spawning aggregation sites in Melanesia (Smith and Hamilton 2006).

The pronounced bimodality and female bias sex ratio observed in the New Ireland sample of *E. polystigma* suggests the possibility of monandric protogynous hermaphrodism (adult female to male sex change), a sexual mode of development that typifies the serranids (Sadovy 1996). However, the sample size presented here is very small, and bimodal size-frequency distributions and female-biased sex ratios are non-specific features that that may have many causes, only one of which is protogyny (Sadovy and Shapiro 1987). In some cases presumed protogynous species have been shown to be gonochoristic (sexes separate throughout life) upon histological examination (Sadovy and Domeier 2005b; Hamilton et al. 2007). A conclusive diagnosis of the sexual pattern of *E. polystigma* will require histological examination of gonads from representatives of all size classes of this species (Sadovy and Shapiro 1987).

Despite the uncertainty concerning aggregation function and the sexual ontogeny of this species, one thing is absolutely clear: the remarkable ease with which these aggregations can be exploited makes the species highly susceptible to overfishing. Moreover, the larger size and placid nature of males creates a scenario for selective fishing that could easily skew the sex ratio for the aggregation, resulting in reductions in reproductive output (Koenig et al. 1996).

For example, subsistence fishing alone appears to have essentially wiped out an *E. polystigma* aggregation in Roviana Lagoon as early as the 1970s, and in Manus a historically large aggregation site for *E. polystigma* and *E. coincides* has been significantly overfished by subsistence fishers in several decades. These findings concur with Johannes (2001), who reports that in Isabel Province in the Solomon Islands, this species is rare in those mangrove and estuarine areas in close proximity to human settlements. Finally, it seems highly unlikely that the recent artisanal exploitation of one of the two known *E. polystigma* aggregations in New Ireland is sustainable.

Our synthesis of Melanesians' local ecological knowledge of *E. polystigma* permits some preliminary conclusions about this fish. It appears that *E. polystigma* meets many of the IUCN Red List criteria that make this fish family, as a whole, particularly vulnerable to fishing. It forms aggregations at predicable times and locations that are extremely easy to overfish, it is exploited throughout much of its range, its populations are in decline, and it has a limited geographical range. Clearly, further studies of this species are needed, including a detailed analysis of its reproductive biology, spatial distribution, spawning season and sexual pattern. Until that time, special management is warranted that should include restricting known aggregations from fishing. Perhaps, more importantly, local village leaders and fishers should be made aware of the species' vulnerability through aggregation fishing through a sharing of information on declines of aggregations and populations elsewhere.

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