



Scapics



Scapics



Scapics

SCRFA

SOCIETY FOR THE CONSERVATION
OF REEF FISH AGGREGATIONS

NEWSLETTER 12 • MAY 2009



CONTENTS

Words from the Chair

SCRFA Update

CARIBBEAN & ATLANTIC

Belize

Mexico

Senegal

United States

INDO-PACIFIC

Australia

United States

Perspectives

New Publications

BREAKING NEWS

Grey mackerel declines in
Northeastern Australia prompt
calls for action.

Minimum size for Nassau grouper
introduced in Belize to stop
declines.

Spawning aggregations as
“indicators” of reef fisheries
condition?

For more information,
see Newsletter

WORDS

from the chair

Y. Studovy de Mitcheson



What's new? The current status of spawning aggregations has been included in the recently published "Status of Coral Reefs of the World, 2008", (Wilkinson, 2008). Only a few known fish spawning aggregations are protected, whereas more than three quarters exhibit declining catches. In the Indo-Pacific, almost half of the known aggregations are either in decline or can no longer be found (possibly functionally extinct) and in the wider Caribbean (tropical western Atlantic), more than half of known aggregations have declined or are gone.

The Live Reef Food Fish Trade (LRFFT) and food security were discussed at the recent International Coral Reef Initiative (ICRI) meeting in Thailand; several key species in the trade are taken from aggregation sites. The recent meeting paved the way for further discussions at the next General Meeting in early 2010, and the United States Department of State is supporting a workshop on the LRFFT, expected to occur later this year. SCRFA will be involved in this workshop to help facilitate a better understanding of the Trade, impacts on spawning aggregations, and work towards sustainability of reef fish fisheries especially in relation to the Coral Triangle Initiative (CTI). The CTI aims to safeguard the marine and coastal biological resources for the sustainable growth and prosperity of current and future generations in the home of the highest diversity of marine life on Earth; Indonesia, Philippines, Malaysia, Papua New Guinea, Solomon Islands and Timor Leste.

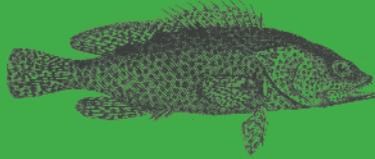
The SCRFA website is undergoing a total face lift, and our spawning site online database is being improved. I encourage you to take a look at the database, it has over 500 records which can be queried for many different parameters including species, location, lunar phase and habitat. Note that the database is now split into direct and indirect evidence and that these fields should be searched independently.

Martin Russell

Chair/CEO, SCRFA

SCRFA continues to focus on three core areas: education and outreach; long-term monitoring of focal aggregation sites associated with training, and emerging issues. In addition to fundamental research, we conduct training in survey techniques, give presentations, conduct workshops and seek opportunities for media exposure including television, newspaper and radio. A recent article on the live reef fish trade (LRFT) in the New York Times received widespread attention.

Our work is developing principally in Fiji, Palau and the Philippines, with a new project recently set up in the Bahamas and collaborations in the Seychelles and Mexico. In Palau, we continue to work with the Palau Conservation Society in developing a robust underwater monitoring protocol for an aggregation of three grouper species at Ebiil, an important protected area in the country. Preliminary data suggest that numbers of *Plectropomus areolatus* have declined substantially in recent years almost certainly due to poaching at the protected site and to overfishing in general; many of the reef fishes in this country are undergoing clear declines and we had the opportunity to present results to key Palauan delegates and governors responsible for Palauan resources. In Fiji, we concentrate on a grouper aggregation site in the island of Kadavu and will be tagging fish for the first time this year to determine their catchment area, as an aid to marine protected area (MPA) work led by the Fiji Locally Managed Marine Areas (widely known as FLMMA) project. We also work closely with staff at the Fiji Division of Fisheries Research and with the University of the South Pacific. In the Philippines, our focus is on the live reef food fish species that aggregate to spawn, in collaboration with WWF-Philippines and the Palawan Council for Sustainable Development.



In addition, we are involved in a wide range of projects related to our core work (above) which build on specific outcomes or on needs identified. As one example, through a collaboration with the University of British Columbia, several post-graduate researchers conducted studies on the value of several important coastal resources. One of these studies identified the key importance that fish species that aggregate to spawn play in the overall coastal fisheries, further highlighting the need to manage them and consider the inclusion of aggregations in MPAs. In January we assisted the Fisheries Department in the Bahamas in setting up a fisher interview survey to determine the perceived current status and history of the Nassau grouper in the country and are working with the Caribbean Fishery Management Council on a region-wide overview of the status of the species, heavily affected by aggregation-fishing. We are collaborating with colleagues at Scripps on their work in Mexico to create interest and a higher profile for aggregations and will be working with the Seychelles Fishery Authority, among others, on Seychelles aggregations.

In relation to emerging issues, SCRFA is active in many other projects. These range from participation in film projects (most recently the LRFFT was addressed in 'the End of the Line' a film to be released in June, 2009, based on the book of the same name by Charles Clover), to consultation on project development and management issues. We are also working on more conceptual issues such as the possible usefulness of aggregations as 'indicators' of reef fish health and the question of aggregation protection *per se* when compared to other management options for fish species that aggregate to spawn. As part of our work in raising interest in aggregations, the plight of the Nassau grouper was selected as one of 12 marine species stories that appeared in a book produced by IUCN called "Adrift: Tales of Ocean Fragility". Written in a popular style this book has been distributed worldwide to help to improve awareness and understanding of important marine issues and has been very well received.

Although our major source of funding is the David and Lucile Packard Foundation, we also received support from the Kingfisher Foundation, the Ocean Foundation and the Caribbean Fishery Management Council for related projects. We continue to benefit from in-kind support through many of the institutions associated with our Board members.

Yvonne Sadovy de Mitcheson

yjsadovy@hku.hk

Belize

Nassau news from Belize – introduction of minimum size

In early April 2009 the Minister of Fisheries in Belize signed into law additional measures to help manage and protect the Nassau grouper (*Epinephelus striatus*). These include minimum and maximum size limits of 80cm and 120cm (20" and 30"), respectively, and a ban on spear fishing within all marine reserves. Furthermore, as a large proportion of fin fish catches are landed as fillets, the new regulations require that all Nassau grouper be landed whole, and that all other fish landed as fillets must have a 2.5cm by 5cm (1" by 2") skin patch.

In the last SCRFA newsletter (February 2008) I reported that despite the protection of 11 spawning aggregation sites and a four month closed season (Dec – March) introduced in 2003, the numbers of Nassau groupers at these sites have further declined. In view of this, the National Spawning Aggregation Working Group presented recommendations for additional management measures to the Fisheries Administrator in October 2007. These were received favourably,



but the Group was requested to consult with fishermen and fishing co-operatives on the proposed measures and to report the results to the Fisheries Department. The Group developed an informative poster, a Powerpoint presentation and a documentary film on the Nassau grouper and consulted widely within the fishing communities using these materials. In December 2008 the results, which showed support by the majority of fishermen for some proposed measures but not others, were shared with the Fisheries Administrator, who subsequently informed the Minister. The Working Group had also met with the Minister in July 2008 to discuss the urgent need for additional protective regulations for the Nassau grouper, and gave him copies of the educational material including a copy of the Nassau grouper DVD, so he was already aware of the proposed measures. With support for some of these measures given by the fishing community, the Minister requested that the necessary legislation be drafted as soon as possible. By January 2009 the draft legislation was completed, and during the period of January to March 2009, the Working Group broadcasted its Nassau grouper television and radio 'spots' and documentary film, keeping its concerns alive in the public eye.

This campaign culminated with the signing of the statutory instrument in early April 2009 and demonstrates the progressive management measures that Belize is instituting to protect and manage this top predator and endangered species of reef fish, through wide consultation and consensus.

Janet Gibson

Wildlife Conservation Society
jgibson@btl.net



Mexico

Grouper spawning aggregations in Alacranes Reef, Mexico

Grouper spawning aggregations are under investigation in Alacranes Reef, the largest reef platform in the southern Gulf of Mexico located 140 km off the northern coast of the Yucatan Peninsula, Mexico. Following a protocol that combines the local ecological knowledge of fishers through semi-structured interviews, and verification of reported sites in the field, through diving, the existence of grouper aggregations and sites are indicated on this reef. One example is a spawning aggregation of the “mero del Caribe” (Nassau grouper), *Epinephelus striatus*, listed as Endangered on the IUCN Red List (<http://www.iucnredlist.org/details/7862>). According to veteran fishers, Nassau grouper was commonly exploited (using skin diving and speargun) since the 1960s at its aggregations around the full moon of December, January and February at a northeastern site (windward, 20-30 m in depth) of the reef platform. Fishers reported that the aggregation used to consist of up to 4,000 fish, and that sometimes the aggregation entered the reef platform through channels in the reef crest and reached shallow areas (less than 10 m) where fishers were able to “hoop net” groupers from their boats in areas less than 2 m in depth.

In January, February and March 2009, field work was conducted to verify the reported aggregation. Unfortunately, bad weather prevented access to the aggregation site for verification in January. While bad weather prevailed in February and March, inspection of the site was possible on a few days but no Nassau Grouper aggregation was found. In January 2009, three Nassau groupers (not aggregated) were caught by fishers with speargun 12 km south from the aggregation site. While caught groupers were close to the adult size range, their gonads were not mature. Veteran fishers reported that few people have fished the aggregation in the last 15 years.

While it is premature to conclude that a Nassau grouper aggregation was once present and subsequently disappeared from Alacranes Reef, it is clear that the species no longer occupies a significant place in commercial catch. Rather, the red grouper, *Epinephelus morio* and black grouper, *Mycteroperca bonaci* are commonly taken.

Fishers also reported an aggregation of the “mero payaso” (red hind - see photo), *Epinephelus guttatus* at Alacranes Reef. The aggregation site was said to be located north of that indicated for the Nassau grouper. This red hind aggregation was verified by divers, and body sizes and gonad samples taken during January, February and March. According to fishers, other groupers aggregate to spawn in Alacranes Reef, including the Negrillo (black grouper), the Dztoz (tiger grouper), *M. tigris*, and the Guacamayo (yellowfin grouper), *M. venenosa*. Their aggregations were reported from the leeward side of the reef platform (14 km away) but were not validated.

Since 1994, Alacranes Reef has been a Natural Protected Area (National Park) but relatively little is known about grouper spawning aggregations in terms of species, sites and threats. Our work, funded by The Nature Conservancy’s Yucatan Coastal and Marine Programme and promoted by Fundación de la Universidad Autónoma de Yucatán, attempts to elucidate the aggregation characteristics for incorporation in the conservation and management programme of the Alacranes Reef National Park.

Alfonso Aguilar-Perera and

Armin Tuz-Sulub

Universidad Autónoma de Yucatán

alfaguilar@gmail.com



Fish Spawning Aggregations of Mexico: Workshop a great first step to aggregation management

Very little is known of fish spawning aggregations (FSAs) in Mexico although there are a number of reports and anecdotal accounts. The Nassau grouper has evidently declined markedly at one site in the Mexican Caribbean, Mahahual. Numerous species of sharks, rays, groupers, snappers, jacks, wrasses, parrotfishes, and croakers are known to form spawning aggregations in the Gulf of California (such as leopard groupers

Mycteroperca rosacea in the photos), and all or most of these are targeted by commercial, recreational, and artisanal fishers. Dramatic increases in fishing pressure in many areas of the Gulf have occurred over the past three decades resulting in marked declines in landings and catch-per-unit effort of many aggregating species.

Scientific information is needed on aggregating species in Mexico to evaluate the potential effectiveness and feasibility of different management options. These data will be critical for determining the size, locations, and timing of seasonal and area closures in the Gulf and other areas of Mexico and make meaningful recommendations to local and regional resource agencies and fisheries managers.

A workshop, held on October 28-30 2008 in La Paz, Mexico, brought together scientists, managers, fishers, conservation agencies, government agencies, and other stake-holders to: (1) review current issues related to the conservation and management of fish spawning aggregations in several regions of the world, (2) discuss the current status of FSAs and their fisheries in Mexico, and (3) develop a list of research and management priorities, based on experiences elsewhere, for Mexico. The workshop began with a full day research symposium that was the premier event for the Annual Meeting of Mexican Society of Ichthyologists.

The workshop helped to consolidate a network of interested and relevant agencies and individuals from all sectors (academic, government, NGOs, etc) dedicated to improving the science, fisheries management and conservation of FSAs in Mexico. Combined efforts can help to increase awareness and understanding of aggregations and advocate for effective policies and programmes. Outputs from the workshop will form the strategic direction for managing and researching FSAs in Mexico in the near future.

Proceedings of the workshop were covered in several newspaper, magazine, and internet articles in Mexico and were therefore successful in communicating the relevance and importance of to the general public. The immediate success of the workshop was reflected in a follow-up meeting with the National Fisheries Commissioner Ramon Corral of CONAPESCA (Comisión Nacional de Acuicultura y Pesca), which resulted in a partnership between our group, CONAPESCA and NOS (Noroeste Sustentable) on one of the most important aggregation fisheries in the region, the Gulf Corvina (*Cynoscion othonopterus*).

SENEGAL

First reported grouper spawning aggregation in Senegal

West Africa

The information in this article was provided to the author by Cyril Calendini, a charter boat captain and fisherman in Dakar, Senegal. It is based largely on personal interviews of divers and fishermen who participated in the harvesting of groupers at the reported aggregation site.

A putative spawning aggregation of groupers was discovered by divers off the coast of Senegal in April 2008, several days after the full moon. Fishermen had observed the migration of several species of grouper southwards along the coast to this site. They saw groupers in water as shallow as 3 m and large numbers on the bottom in deeper water. Although there were no estimates of the numbers of groupers present at the possible aggregation site, it was described by divers as being like a “carpet of fish” covering the bottom. The groupers could apparently be approached by divers and pushed by hand with little reaction.

There were three different species of grouper identified at the site: dusky grouper (*Epinephelus marginatus*), white grouper (*E. aeneus*) and mottled grouper (*Mycteroperca rubra*). The divers estimated that dusky groupers were the most abundant and white groupers were abundant. The depth at the site was approximately 28 m and the water on the bottom was clear and cold (temp. 16° C), apparently below a thermocline.; water visibility above the thermocline was poor. The estimated size of the area where the groupers were aggregated was approximately 400 m long and 100 m wide. On the day that the divers discovered the aggregation, they speared a number of groupers at the site and noted that the aggregated fish did not move away. The following day, more boats went to the site and many more groupers were shot. Fishing effort reportedly escalated dramatically at the aggregation site over just a few days. It was estimated that spearfishermen killed over 1,200 fish in 5 days. It is believed that all of the fish speared were dusky grouper. A conservative estimate of the



Photo: Dusky grouper underwater.

Scapric

number of spearfishermen diving at the site was 150. The groupers apparently remained in the same area for this entire period. During this same period, the market price for grouper dropped dramatically as the market became flooded over a few days.

Estimates of the numbers of white and mottled groupers taken were not available. The mottled grouper apparently migrated after the other two species had arrived at the site. Mottled grouper were taken mostly by handlining with live bait rather than by spearfishing. A traditional “panga fishing” boat reportedly caught 300 mottled grouper in one day and there may have been up to 100 boats fishing at the peak of this aggregation. Although landings figures are not available, a simple extrapolation from the above information leads to the conclusion that the potential impact of uncontrolled fishing could quickly decimate the numbers at this site with unknown but, certainly deleterious, longer term impacts.

Brian E. Luckhurst, fishery officer, retired.

Umbria, Italy.

brian.luckhurst@gmail.com

Note from Editor: on the 2008 IUCN Red List *E. aeneus* is considered Near Threatened (<http://www.iucnredlist.org/details/132722>) and *E. marginatus* Endangered (<http://www.iucnredlist.org/details/7859>), in both cases due to overfishing.

Goliath

Grouper Aggregation and Spawning Research in SE Florida

The Florida Oceanographic Society conducted a preliminary Goliath grouper (*Epinephelus itajara*) monitoring project during the full moon of September near Jupiter, southeast Florida. The research focused on corroborating the reports of local divers that Goliath groupers were aggregating and possibly spawning at several locations on nearby off-shore reefs. Historically, the Jupiter area was known in the 1950s – 1970s as a spawning area but mangrove habitat loss in the nearby Lake Worth and Indian River lagoons and over-fishing were probably major factors that resulted in sharp declines in numbers of this species that ultimately led to protection by both the Federal government and the State of Florida in the early 1990s.

The one day initial monitoring resulted in 304 Goliath Grouper sightings spread out over five different, adjacent, reef locations. A total of 32 aggregations were counted. Note that aggregation is used to define the collective assembly - within each aggregation were multiple groupings which could be exhibiting different behaviours simultaneously. The largest single grouping consisted of 55 Goliath Groupers. Two-thirds of the sightings were made during the late afternoon with the remaining one-third observed during mid-morning dives. Twenty-eight percent of the Goliath Grouper were large adults with a total length of 180 to 240 cm. Fourteen percent of the groupings consisted of paired adults and 79% of the sightings had three or more Goliath Groupers.



Karen F. Christopher
www.seapix.com

Goliath grouper displaying the bicolor pattern thought to be associated with spawning behaviour

No direct spawning activity was observed but several indirect indicators of possible spawning behaviour were noted. These behaviours include colour changes, chasing, stacking (arrangement of Goliath Groupers wherein one hovers directly above another), and pairing. Eighty-five percent of the Goliath Groupers had a normal coloration pattern. Three percent displayed a bicolor phase with a pale head. Both completely dark and completely pale coloration patterns were also observed.

The Florida Oceanographic Society plans to conduct further monitoring in 2009 by optimizing the survey design to include monitoring during the full moon period in July, August, and September. Timing of the dives close to dusk will also be included in the 2009 monitoring efforts. The SCRFA manual was very valuable in designing the underwater survey form used by the divers. A full copy of the 2008 final report is available at the Florida Oceanographic Society's web site at www.floridaoceanographic.org.

Mike Phelan

Florida Oceanographic Society
fish_id@comcast.net.

Australia

Dispersal, connectivity and marine reserves on the Great Barrier Reef

Researchers from James Cook University in Australia are currently undertaking a reef fish tagging project within the Keppel Island group in the southern Great Barrier Reef Marine Park (GBRMP). The tag, release and recapture project is aimed at shedding light on fish movements within and between reefs, larval dispersal, population connectivity and export effects of no-take marine reserves.

Recreational fishers worked tag and release over 6,500 reef Park (green) zones (no-take Island group during late 2007 was carried out during the peak species in the southern GBR



Fish were captured using hook tagged, fin clipped for a DNA to the water. Additionally, bar-maculatus), long-fin grouper stripey snapper (*Lutjanus* with an enriched stable isotope

stable isotope functions as a trans-generational marker which is passed from female fish to their developing eggs. The marker is subsequently expressed as an unequivocal altered barium isotope signature in the otoliths of the offspring.

Beginning in April 2008, recruits of bar-cheek coral trout, long-fin grouper and stripey sea perch were collected from reefs in the area. Otoliths were removed from the recruit fish and scanned for the barium isotope marker using laser ablation inductively coupled plasma mass spectrometric (LA-ICPMS) analysis. When marked otoliths are detected, the natal reef of that fish can be identified and larval dispersal distances and directions calculated. DNA samples taken from the recruited fish are also being cross-validated with DNA samples from adult fish in a parentage analysis to complement the larval marking and recapture component of the study. Analysis of samples is currently underway; however preliminary results have been encouraging. Several barium tagged individuals have been detected within the samples scanned thus far and it is evident that there has been some dispersal of larvae from within no-take marine reserves to surrounding fished areas. Analysis of all otolith and genetic samples will be completed by late 2009. The larval dispersal data is being incorporated into a high resolution coupled bio-physical model for the southern GBR region.

A combination of underwater visual census (UVC) and recaptures of tagged adult fish is providing insights into rates of adult fish export (spill-over) from no-take marine reserves to surrounding fished areas. UVC was also used to quantify the size and number of fish involved in spawning aggregations and the relative number of tagged to untagged fish participating in the spawning aggregations. Data obtained on fish spawning aggregation sites will be entered into databases coordinated by the Great Barrier Reef Marine Park Authority and the Society for the Conservation of Reef Fish Aggregations (SCRFA). The adult fish movement component of the study should be completed by late 2009.

David Williamson

James Cook University, & ARC Centre of Excellence for Coral Reef Studies.
david.williamson@jcu.edu.au

with the research team to catch, fishes within Marine National marine reserves) of the Keppel and early 2008. The research spawning season for these region.

and line, measured, externally sample and quickly returned cheek coral trout (*Plectropomus* (*Epinephelus quoyanus*) and *carponotatus*) were injected barium chloride solution. The

The marker is subsequently expressed as an unequivocal altered barium isotope signature in the otoliths of the offspring.

AUSTRALIA

Grey Mackerel

line fishery failed in World Heritage Waters of Far North Queensland



In 2006 this newsletter reported that a pre-spawning aggregation of grey or broad-barred mackerel (*Scomberomorus semifasciatus*) was being targeted by commercial offshore netters in sheltered, inshore World Heritage Area waters of the Great Barrier Reef Marine Park (GBRMP) in Far North Queensland (FNQ).

In 2007, the May issue reported calls by local commercial line and recreational fishers for an emergency closure of the netting on sustainability grounds because of an apparent sudden drop in size of schools and very poor catches.

During the 2008 season, the use of echo sounders by the leading commercial line fisher failed to locate any schools of grey mackerel for the first time ever. Commercial line catches fell from 500 - 800 large fish per season prior to 2004 to under 40 fish per fisher. The net boats did not return that year and the lead fisher was forced out



of the fishery and sold his mackerel fishing licence back to government. A documented case study is available on the website of Fishers For Conservation, http://www.ffc.org.au/Grey_Mackerel.html.

Local commercial line and charter fishers have also noted a big drop in catches of other large inshore species and consider that the big net boats, using up to 1.2 km of hydraulically hauled monofilament nets, are just too efficient for a coastline where the longest river in the area is only 120 km in length, the watershed of the coastal catchment often falls within 7 km of the coast and mangrove systems are relatively small. These fishers are concerned that other inshore species, which also do not have any spawning closures, are suffering a similar fate to the more visible grey mackerel schools.

The Federal Government carried out a review of Queensland's fishery management, published online in November 2008, see: <http://www.environment.gov.au/coasts/fisheries/qld/east-coast-finfish/index.html>. This review notes: p 66, "A serious lack of validated and species-specific data on the fishery catch means there

is very limited knowledge of the sustainable levels of catch for most species. the Panel has concerns over the level of precaution being adopted ... and, p72: "depletions are not always obvious when fishery "assessments" are based on aggregate (species) data, as they have been ... Yet in schooling species with local residency and/or those that form seasonal spawning aggregations, the risk of localised depletion is high (e.g. grey mackerel).

The international fishery consultancy company, Poseidon ARM Pty Ltd, undertook a scoping study last October of the processes for establishing management arrangements for the inshore grey mackerel fishery, using the best available evidence. Their report, available at www.consult-poseidon.com/reports.asp;

(Report 13), notes that in this case, "management authorities ... are required by law to apply the Precautionary Principle ..."

In March 2009 the Queensland government introduced a series of measures "in order to take a sufficiently precautionary approach to this fishery". These include a single total allowable catch for the entire east coast of Queensland, despite at least two separate stocks having been identified during 2008. A second measure is a minimum size limit of 60 cm, despite size at first breeding being 75 cm.

Local fishers in FNQ consider that the measures introduced will be ineffective in securing a precautionary approach and, based on their history of observations, have serious concerns for the sustainability of the fishery. They are calling authorities to commission an independent participatory risk analysis of inshore fishery of the World Heritage waters of the GBRMP as a lead-in to the adoption of further, more effective, precautionary measures.

For the full story on our campaign to save stocks of grey mackerel see: www.ffc.org.au/Grey_Mackerel.html

David C. Cook

Network for Sustainable Fishing in Far North Queensland,
Mossman Boat and Fishing Club
davecook@bigpond.com

USA

The Gulf Corvina

A thriving fishery on a fishing aggregation in the Upper-Gulf of California

The Gulf Corvina (Sciaenidae: *Cynoscion othonopterus*) is endemic to the Gulf of California and every year migrates to the Upper Gulf region to spawn in the delta of the Colorado river estuary at which time it is heavily exploited. The fishery of this species is being studied to develop a sustainable fishery and to understand the impact of the fishery on the population, and its reproduction, as well as on the ecology and biology of the species.



Octavio Aburto

The Colorado river once reached the sea at the northern-most Gulf of California, but today only a remnant reaches the delta in very wet years. However, the habitat conditions and food available in this region are still plentiful, and a number of species come each year to reproduce in large numbers. This species is extremely important because its arrival in the Upper-Gulf (UG) coincides with Lent, a time of major consumption of fish in Mexico. The Corvina fishery thrived until the 1950s, but then disappeared for several decades before reappearing in the early 1990s. Today the annual production ranges between 1,500 tons and 4,500 tons, and this enormous amount of fish is collected over a period of just a few days during the months of February, March and April. Because of the behaviour of the species, fishermen only have a small time window to find and catch fish. Traditional knowledge indicates that the adults start arriving just after the quarter moon phase. Around that time, the aggregations move around the Gulf of the Santa Clara region before traveling north to enter the Colorado River delta. Spawning takes place in the river estuary right before the strongest tides and closer to full and new moons. Soon after, within a matter of hours, all the fish leave the region with the tide. This process is repeated for three months.

Researchers from the Center for Marine Biodiversity and Conservation (CMBC) at the Scripps Institution of Oceanography are working with Alto Golfo Sustentable (AGS), a consortium of NGOs, government and local fishermen, to study the species and collectively propose alternatives to improve the Gulf Corvina fishery. The government implemented new regulations in 2007, including a fishing season, a total landings quota, restricted fishing areas, and fishing gear restrictions. Although enforcement is implemented with some level of effectiveness, much work remains to create a sustainable fishery.

This year we are collecting and analyzing samples to determine the spawning cycle, batch fecundity, and population structure, and to fill in remaining gaps in general life history. We are interviewing fisherman to better understand the socio-economic aspects of the fishery and to increase public awareness on the value of generating information to improve management. We are also monitoring other components of the fishery, including daily landings, market prices, and the entire economic structure of the fishery. Landings information is provided by the government, and, together with the local fish buyers, we aim to estimate total fishing effort.

Gustavo A. Paredes, Brad Erisman, Octavio Aburto-Oropeza
CMBC-Scripps
berisman@mail.ucsd.edu

PERSPECTIVES

Can spawning aggregations be used as indicators of reef fisheries?

Of the wide range of coastal fisheries associated with coral reefs around the world, many exploited species that are valuable and vulnerable to fishing are known to form spawning aggregations. These aggregations have supported traditional fisheries in many areas. Increasingly, certain spawning aggregations are exploited for commercial gain to the extent that some species have been placed at risk and some fisheries compromised. The state of spawning aggregations would appear to be promising candidates as indicators of reef fish condition by indicating (a) pressures on fishery resources caused by human activities (fishing), (b) environmental state (aggregation condition relevant to some baseline), and (c) (societal) response by the degree to which they are managed effectively. There are a number of pros and cons to consider in assessing the usefulness of aggregations as indicators:

PROS

1. Attracts attention to specific sites and is a good way to stimulate discussion of issues.
2. As an indicator, aggregations are simple to understand and explain.
3. Aggregations are at the more vulnerable end of the spectrum in being easy to overfish as well being characteristic of the biology of many of the more vulnerable and valuable fish species.
4. Use of either catch or underwater visual census (UVC) data (although whichever is selected should be consistent over time and conducted according to standard protocols) can give indication of changes over time.
5. Many key species of commercial importance aggregate.
6. An interest and focus on aggregations before too heavy exploitation is desirable, especially in the Pacific.
7. It is widely accepted that declining aggregations is a problem.
8. There is existing monitoring and expertise to assess aggregations.
9. Aggregations address Ecosystem Based Management and conservation objectives.

CONS

1. Using aggregations as indicators inevitably attracts attention to them – the best protected aggregations are the ones that are little known or unknown.
2. UVC surveys of aggregations probably need to be expert surveys – sites are often difficult to dive, timing and methods are simple in concept but challenging in practice. Also dive surveys are expensive.
3. In most countries there are no baselines of aggregation status or condition and in Pacific in many countries little is understood about them.
4. Aggregations as an indicator are not applicable where aggregations not targeted or not likely to be targeted .
5. There can be natural inter-annual variability in fish number aggregating such that long-term datasets might be necessary – it is the trend that is important rather than the absolute number of fish.
6. It is not clear how comparable data on aggregations would be across countries because of different social and cultural contexts when establishing baselines on differing natural conditions regionally.
7. Cannot distinguish declines due to aggregation fishing from those due to other causes such as overfishing on the species. However, it appears to be the case that losses of aggregations can be a major factor in declines in fisheries of species with this habit.
8. Potential problem of hyperstability i.e. aggregations can suddenly collapse (Sadovy and Domeier 2005).

I would welcome feedback on the idea of spawning aggregations as indicators of coastal reef fish & fisheries condition.

Yvonne Sadovy de Mitcheson

scrfa@hku.hk

Reference: Sadovy Y.J. and Domeier M.L. (2005) Are aggregation-fisheries sustainable? Reef fisheries as a case study. Coral Reef 24:254-262.

NEW PUBLICATIONS

- Aburto-Oropeza O. & P.M. Hull (2008) A probable spawning aggregation of the leather bass *Dermatolepis dermatolepis* (Boulenger) in the Revillagigedo Archipelago, México. *Journal of Fish Biology*, 73: 288–295
- Begossi A. & R.A.M. Silvano (2008) Ecology and ethnoecology of dusky grouper [garoupa, *Epinephelus marginatus* (Lowe, 1834)] along the coast of Brazil. *Journal of Ethnobiology and Ethnomedicine*, 4:20 doi:10.1186/1746-4269-4-20
- Bradbury I.R., B.J. Laurel, D. Robichaud, G.A. Rose (2008) Discrete spatial dynamics in a marine broadcast spawner: Re-evaluating scales of connectivity and habitat associations in Atlantic cod (*Gadus morhua* L.) in coastal Newfoundland. *Fisheries Research*, 91 (2-3): 299-309
- Claro, R., et al., (2009) Historical analysis of Cuban commercial fishing effort and the effects of management interventions on important reef fishes from 1960–2005. *Fish. Res.*, doi:10.1016/j.fishres.2009.04.004
- Clement G., R. Wells, C.M. Gallagher (2008) Industry management within the New Zealand quota management system: the Orange Roughy Management Company. FAO FISHERIES TECHNICAL PAPER, <ftp://ftp.fao.org/docrep/fao/010/a1497e/a1497e25.pdf>
- Ganias K. (2008) Ephemeral spawning aggregations in the Mediterranean sardine, *Sardina pilchardus* : a comparison with other multiple-spawning clupeoids. *Marine Biology*, 155:293–301
- Gerhardinger L.C., E.A.S. Godoy, P.J.S. Jones (2008) Local ecological knowledge and the management of marine protected areas in Brazil. *Ocean and Coastal Management*, 52(3-4):154-165
- Graham R.T., R Carcamo, KL Rhodes, CM Roberts (2008) Historical and contemporary evidence of a mutton snapper (*Lutjanus analis* Cuvier, 1828) spawning aggregation fishery in decline. *Coral Reefs*, 27:311–319
- Heyman W.D. & B Kjerfve (2008) Characterization of transient multi species reef fish spawning aggregation at Gladden Spit. Belize. *Bulletin of Marine Science*, 27:311–319
- Hopkins A., HG Frontani, J Bruno (2008) Managing coral reef fisheries. eearth.org
- Loher L. & AC Seitz (2008) Characterization of active spawning season and depth for eastern Pacific halibut (*Hippoglossus stenolepis*), and evidence of probable skipped spawning. *J. Northw. Atl. Fish. Sci*, 41: 23–36
- Mellin C., S Andréfouët, M Kulbicki, M Dalleau (2008) Remote sensing and fish–habitat relationships in coral reef ecosystems: Review and pathways for multi-scale hierarchical research. *Marine Pollution Bulletin*, 58(1): 11-19
- Parsons M.J., RD McCauley, MC Mackie, P Siwabessy (2009) Localization of individual mullet (*Argyrosomus japonicus*) within a spawning aggregation and their behaviour throughout a diel spawning period. *ICES Journal of Marine Science*, 66, doi:10.1093/icesjms/fsp016
- Phelan M.J., NA Gribble, RN Garrett (2008) Fishery biology and management of *Protonibea diacanthus* (Sciaenidae) aggregations in far Northern Cape York Peninsula waters. *Continental Shelf Research* 28(16): 2143-2151
- Samoilys M. (2009) Sex on the reef: breeding fish at risk. *SWARA* (1): 32-33
- Wilkinson C. (2008) Status of coral reef of the world 2008. Global coral reef monitoring network and reef and rainforest research centre, Townsville, Australia. 296pp.
- Wielgus J., E. Sala, L.R. Gerber (2008) Assessing the ecological and economic benefits of a no take marine reserve. *Ecological Economics* 67(1): 32-40