

# **Biology and Management of Spawning Aggregations - Lessons Learned and Panel Discussion: A Half-day Symposium Sponsored by the Society for the Conservation of Reef Fish Aggregations (SCRFA)**

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## **INTRODUCTION**

The objectives of the symposium were to use a selection of detailed case studies to explore experiences with management and management-related research over the last decade in order to extract lessons that could be used to increase the ability and success of managing reef fish spawning aggregations. The session was organised because of the recognition that the effective management and conservation of reef fish aggregations is still typically undeveloped in the region. Invited speakers were asked to describe their work and then to outline some of the key issues that had emerged. Using the lessons learned from these studies and experiences, combined with the panel discussion that followed the presentations, our aim was to identify steps that could be taken or provide recommendations to improve Fish Spawning Aggregation (FSA) management and science in the Gulf and Caribbean.

This document provides a brief overview of the symposium presentations and the issues raised during the ensuing panel discussion. We provide an outline of the principal points and lessons learned to date. This summary is divided into two sections:

- i) Presentations by principal topic – biology and management, and
- ii) Panel discussion.

Finally, we highlight what we feel to be the key outcomes from the session theme of “Lessons Learned”.

## **PRESENTATIONS**

### **Biology**

1. Defining Marine Protected Areas for Yellowfin, *Mycteroperca venenosa*, and Nassau Grouper, *Epinephelus striatus*, Spawning Aggregation Sites - Rick Nemeth, Elizabeth Kadison and Jeremiah Blondeau

*Need* — Technique for determining standardized and biologically meaningful boundaries for Fish Spawning Aggregation Sites (FSAS).

*Method* — Behavioral observations coupled with acoustic arrays to track fish enabled determination of FSAS boundaries, catchment area and connectivity between staging and spawning areas and the temporal components of spawning (months, lunar phase).

#### *Lessons learned*

- i) Aggregating species have three spatial use areas which all need to be considered for spatial management since they involve both spawning areas and areas nearby used between spawning months in each spawning season. The three spatial use areas are: catchment, staging and spawning arena based upon migration routes, local movements and residence times.
- ii) Quantification of residence times and movement patterns provide managers with information for MPA size requirements at different levels of risk according to both management needs and the conservation status of species under consideration (i.e. species of high conservation concern such as the Nassau grouper might need particularly conservative management action).
- iii) Species-specific differences in movement patterns were noted with management implications that go beyond the immediate spawning site; the widest ranging species, in this case the Nassau grouper, could be the default for

determining an area to protect multiple species especially given its current conservation status of endangered on the IUCN Red List.

2. Geomorphology of Grouper and Snapper Spawning Aggregation Sites in the Upper Florida Keys, USA – Arthur Gleason, Todd Kellison and Pamela Reid

*Need* — Identification of potential FSAS based on geomorphological characteristics to incorporate in MPA planning

*Method* — Multi-pronged approach using bathymetric charts, satellite imagery and GPS (Global Positioning System)/ fathometer benthic maps generated by divers.

*Lessons learned*

- i) Reef promontories are FSAS in Belize for some species but the presence of a promontory does not necessarily mean that there is an aggregation at the site.
- ii) In the Florida Keys, where promontories are generally lacking, another geomorphological feature, a pattern of outlier reefs, was found in proximity to all mapped FSAS. This association requires more research to assess its relevance.

3. Tracking Potential Larval Dispersal Patterns from Nassau Grouper Aggregation Sites: Evidence for Local Retention and the “Importance of Place” - Scott Heppell, B.X. Semmens, C.V. Pattengill-Semmens, P.G. Bush, B.C. Johnson, C.M. McCoy, C.Paris, J. Gibb and S.S. Heppell.

*Need* — To determine whether this FSAS occurs where it does because of larval dispersal patterns.

*Method* — Track movement of water mass present at the aggregation site during actual spawning using surface velocity profile drifters (satellite telephone with a GPS unit). The assumption is that the drifters meaningfully track the body of water containing fertilized eggs at least for the period of time considered.

*Lessons learned*

- i) At this site, peak spawning occurs on the night of eddy formation, potentially helping to entrain larvae near the site. Is this a coincidence or an adaptation to retain eggs and larvae locally?
- ii) This possible oceanographic-based “importance of place” may have important implications for the long-term survival of the local population.

4. Spatial Ecology of a Remnant Nassau Grouper Stock on Cayman Brac, Cayman Islands – Brice Semmens, Phil Bush, Scott Heppell, Bradley Johnson, Croy McCoy, Christy Pattengill-Semmens and Selina Heppell.

*Need* — To determine whether protection of overfished historically known spawning sites will help recover overfished stocks

*Method* — Acoustical tagging and tracking of Nassau grouper on Cayman Brac, an island where heavy fishing pressure is believed to have either exhausted a previously fished aggregation or resulted in a shift in its location.

*Lessons learned*

- i) Nassau grouper on Cayman Brac continue to use the historic aggregation site at the eastern end of the island even though the number of individuals is much lower than on the neighboring island of Little Cayman.
- ii) Despite the large difference in aggregation sizes, the aggregating behavior as determined by diver observations appears virtually identical.
- iii) On both islands, the entire reproductively active population aggregated each season and spawning nights were the same.
- iv) These findings demonstrate the extreme vulnerability of local stocks to harvesting at aggregations. Long-term site fidelity of the aggregation was demonstrated but it is unclear whether site protection has helped the aggregation to recover as the number of fish present is very low.

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## Management

1. Management and Conservation of Spawning Aggregations; Lessons Learned and Future Perfect - Yvonne Sadovy de Mitcheson

*Method* — Use of standardized database to examine patterns of FSA geography, formation, and function, and impacts of fishery pressure on aggregating species. Also integration of experiences gained from fisher interview surveys used to determine presence of spawning aggregations.

*Implication* — Shifting baselines and misconceptions, or poor understanding, about how the marine environment works, what spawning aggregations are, and the impacts of overfishing can lead to distorted views about the marine environment and fisheries which can preclude appropriate management decisions and action.

### *Lessons learned*

- i) Shifting baselines can seriously affect perceptions, particularly among younger people, of how the unfished or lightly fished state should be relative to a current more heavily exploited fishery.
- ii) Interviews that seek to reconstruct past relative to present status can help to demonstrate the history of aggregation exploitation and identify marked changes over time thus providing a longer term perspective on the fishery.
- iii) A challenge for initiating management of aggregations is that high seasonal catches give an “illusion of plenty” i.e. that fish are plentiful, but aggregation catches may not reflect the true abundance status of the population because aggregations can continue to form in large numbers even as the population of fish declines markedly. Given the ease with which aggregations can be overfished, especially when exploited commercially, there is a need to move from targeting aggregations directly to protecting them.
- iv) The non-extractive value of aggregations through their role in generating young fish to supply catches between aggregation seasons needs to be better understood.

2. Seasonally-closed Spawning Aggregation Sites for Red Hind (*Epinephelus guttatus*): Bermuda’s Experience over 30 years (1974 - 2004) – Brian E. Luckhurst and Tammy Trott

*Method* — Historical time-series data on size-frequency distributions are valuable for monitoring the impact of management measures, particularly when data are taken from the same aggregation site under management over extended time periods.

### *Lessons learned*

- i) It is difficult to determine the effectiveness of management measures such as seasonal area closures without a long-term data collection program to assess changes.
- ii) The systematic data collection and monitoring in this study enabled the evaluation of long-term trends in the status of a population parameter (mean length) of fishes from a specific aggregation. The resulting significant increase in mean size over time suggested that the seasonal protection of the aggregation was having positive benefits for the population and affirmed the need to continue with the existing management program.

3. Fishing, Management and Conservation of the Nassau grouper, *Epinephelus striatus*, in the Mexican Caribbean - Alfonso Aguilar, Carlos Gonzalez-Salas and Harold Villegas-Hernandez

*Method* — Nassau grouper is an important commercial species in Mexico but good fishery statistics are not available so the population status is unknown and management is thus difficult to implement.

*Lessons learned* — There needs to be a science-based management program incorporating MPA planning and conservation initiatives that involve all sectors of the fishing industry.

4. Cruzan Fisher’s Perspectives on the Performance of the Buck Island Reef National Monument (BIRNM) and the Red Hind Seasonal Closure – Constance Karras

*Method* — Surveys and interviews were used to determine fishers' perspectives, both biological and socio-economic, about the fishery management measures implemented in St. Croix in the BIRNM and during the red hind spawning season.

*Lessons learned*

- i) Effective management of fishery area closures requires the support and cooperation of fishers.
- ii) Their perceptions of the socio-economic impact of such closures are often firmly rooted in their ability to continue fishing as a livelihood as closures limit their access to the resource.
- iii) Economic analyses of actual or potential impacts of closures are needed.

5. Goliath Grouper *Epinephelus itajara* Fishery and its Aggregations on the Coast of Yucatan, Mexico – Luis Rodriguez-Gil and Carlos Reyes Sosa

*Method* — Analysis of fishery landings statistics from a fishery cooperative during the period 1988-1999.

*Lessons learned*

- i) Limited fishery data suggest that the Goliath grouper is overfished in Mexican waters and no fish have been reported landed since 2000.
- ii) There is a need to identify spawning aggregation sites and incorporate these locations into effective fishery management planning.
- iii) Training is to be implemented to help locate FSA sites and there is reportedly support by fishers for a fishing moratorium.

6. Using Lessons-learned from Six Years of Reef Fish Spawning Aggregation Site Validation, Collaboration and Outreach in St. Croix, USVI – Jeanne Brown

*Method* — A project running since 2002 involved a collaborative effort between fishery managers and fishers to evaluate and monitor FSA sites.

*Lessons learned*

- i) A high level of community participation early in the project showed promising results following conservation forums and aggregation research training. However, support eroded over time as contentious fishery issues arose which caused reduced participation and cooperation by fishers.
- ii) Examination of the factors contributing to the controversial atmosphere of spawning aggregation management is important to help shape future plans for conservation and management.
- iii) There is little point in gathering information and implementing rules if there is little or no follow up.

7. Adaptive Management of Fish Spawning Aggregations on the Great Barrier Reef, Australia – Relevant Lessons Learned– Martin Russell

*Method* — Seasonal spawning aggregation closures were introduced as a component of the overall management of the Great Barrier Reef Marine Park. The refinement of the times and locations for these closures is an ongoing process and community involvement is essential.

*Lessons learned*

- i) We know little about FSAs on the Great Barrier Reef, but have been able to implement complex management arrangements, e.g. seasonal closures, using limited information on the timing of spawning.
- ii) Refinement of the closures is difficult without dedicated research to gather key FSA data.
- iii) Stakeholders question the need to have closures given the suite of management measures in place such as TAC, size and possession limits. They have expressed concern about the socio-economic impact of these closures and more research is required to accurately determine species-specific spawning behaviors, locations and times to evaluate the efficacy of the existing regulations.

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**PANEL DISCUSSION – Selected Questions and Comments**

*Jeremy Jackson* — Why do scientists have to demonstrate over and over again that the same rules operate? We need to have a firm position and act from it. Research questions are interesting for managing details but the real issue is that aggregations are important, we know that, so do we need more research before acting to manage aggregations?

*Connie Karras* — There is a need for more socioeconomic evaluations, and more outreach to stakeholders to increase probability of success

*Bob Glazer* — How can we conserve and restore aggregations? Top down or bottom up? We don't have the people here at the meeting to listen to these presentations who can make some of the decisions to protect aggregations.

*Dirk Zeller* — A bottom-up approach is necessary but where are the media? GCFI needs more outreach. Communication is necessary. Spawning aggregations are the top story of this meeting. Without good media coverage there is no chance to promote the outputs both regionally and globally.

*Ellen Peel* — Scientific information is the most persuasive tool for use by managers, communicators, and decision-makers to gain acceptance by stakeholders.

*Brian Luckhurst*: — Involvement of fishers is essential to provide an historical perspective to help understand changes that have occurred over time. Interpretation of fishery statistics without this input can be misleading. Fishers should participate in decision-making so that they have some "ownership". Political will is a critical but often overlooked element in the process. There is a need to analyze the political system and determine how to generate support in a timely fashion.

*Georgina Bustamante* — Using MPA networks like CaMPAM (Caribbean Marine Protected Areas Managers), how can managers play a role in connecting the scientists with the fishers/ stakeholders?

*Alejandro Acosta* — Traditional fishing practices are handed down from father to son – conservation messages should be taught in schools to re-program the next generation of fishers. Two-way communication and outreach is needed at all levels.

*Bob Glazer* — History is insightful. GCFI has always been a forum for the exchange of ideas between different sectors of the fishing industry. There is an outreach program that involves fishers throughout the region and provides them with a perspective on common fishery issues and problems. Fishers' involvement in all aspects of fishery management and conservation has become a recognized element in the success of such programs.

**Additional comments**

- i) Let fishers provide input in order to manage their resources. Pulse fishing on FSAS might be used to reduce annual fishing pressure- let fishers convince the fishing community of the need to act. Involvement in the whole process is the key including participation in scientific studies.
- ii) Scientists need to write in the language of the fishermen.
- iii) A number of key areas require more research attention to generate the data necessary to improve management.
- iv) Political will is essential. Therefore, scientists and managers need to actively provide politicians with information on the need to manage FSAs.

**SESSION SUMMARY**

It is unequivocal that exploited aggregations need either total protection from fishing or that fishing activity on them should be minimized through careful management. FSAs can be viewed as bank accounts from which we can derive "interest", and it is important to recognize FSAs as critical areas for management. The challenge is how to achieve effective management. Major changes in perspectives are needed to create an awareness of why aggregations are important for sustaining the fisheries of many aggregating species and why they need management even when they appear to be capable of producing large catches each year. Management depends first of all on an appreciation of the vulnerability and role of aggregations and their value as sources of regeneration of fish stocks. This calls for outreach at all levels, from the general public to the users in the fishing communities to politicians. Means of communication can range from school presentations to links with existing networks in the region and there is a clear need to engage considerably more with the media. The

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message needs to be consistent and easy to understand and it behooves scientists to communicate in ways that go well beyond the scientific community. It is suggested that the GCFI Board of Directors consider arranging media coverage of the next discussion on FSAs to help towards effective outreach.

There is already a strong scientific basis for management of spawning aggregations in general. However, improvements in management actions can be encouraged by fine-tuning relevant information locally (e.g. movement and seasonality of target fish species) and involving stakeholders at all stages of planning and implementation. The socio-economic implications of management need to be considered more carefully and economic analyses of different management options would be valuable. All stakeholders should be involved in a consultative process to enhance the probability of successful management. The combination of good science and strong stakeholder consensus is a powerful means of pushing for change and generating the necessary political will for action. It is essential that where there is not yet sufficient information for management decisions, such as on the timing and location of exploited sites, the connections between spawning and nearby staging areas, or the implications for reproduction of reduced aggregation numbers, then further focused studies are necessary. However, there already exists sufficient Caribbean and global evidence to be able to implement at least basic forms of management such as seasonal closures or spatial area protection, noting that MPAs are not the sole, or necessarily always the best, solution. Species of high conservation concern should be a particular focus for management and fishers should be involved as much as possible in the planning and execution of such studies. Any protective action should incorporate a long-term monitoring program to assess management effectiveness and provide for adaptive management as necessary.