

Test of Multi-species Spawning Aggregations

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ABSTRACT

Spawning aggregations are an essential phase in the life history of most commercially important finfish species of the Caribbean including snappers and groupers. These aggregations are under increasing threat from overfishing. This special symposium was designed to examine the ecology of spawning aggregations, the socio-economics of their exploitation, and examples of their effective management. Region-wide similarities in the ecology of aggregations and the threats to them may require consistency in monitoring approaches and management measures.

Belizean fishermen, national fisheries managers, and local and international conservation organizations recognized declines in the endangered Nassau grouper (*Epinephelus striatus*) and have conducted coordinated national monitoring efforts during 2001 – 2003. Data from these field surveys confirm that Nassau grouper stocks are depleted compared to historical records. These surveys also provided strong support for the hypothesis that multi-species spawning aggregations consistently occur at the shelf edge of windward facing reef promontories that jut into deep waters.

With new understanding from nation-wide surveys and unanimous support from conservationists and fishers alike, Belize enacted year-round fishing closures at 11 of these multi-species spawning aggregation sites within new Marine Reserves in November 2002, along with new closed season for Nassau grouper from January through March. This symposium has brought together over 50 aggregation fishers and a total of 450 scientists and managers from around the Caribbean Basin to address the issue of spawning aggregation monitoring and conservation at local and regional scales. The goal of the symposium was to foster shared regional efforts to conserve and manage spawning aggregations throughout the Gulf and Caribbean.

KEY WORDS: Multi-species spawning aggregations, conservation,

Conservación de las Agregaciones de Desove de Múltiples Especies

Las agregaciones de desove son una fase esencial en la historia de la vida de la especie de mayor importancia comercial en el Caribe incluyendo los pargos y meros. Estas agregaciones están bajo amenaza de aumento de la sobre pesca. Este simposio especial fue diseñado para examinar la ecología de agregaciones de desove, la socio-economía de su explotación, y para dar ejemplos de un manejo eficaz. A través de la región existen similitudes en la ecología de estas agregaciones y a las amenazas para estas están expuestas requieren consistencia en el tipo de monitoreo y en las

medidas de manejo.

Los pescadores de Belize, los encargados nacionales de las industrias pesqueras, y las organizaciones conservacionistas de índole local e internacional reconoce el declive en el mero de Nassau (*Epinephelus striatus*) una especie que esta puesta en la lista de las especies en peligro. Estas entidades han conducido esfuerzos de monitoreo nacionales coordinados durante 2001- 2003. Los datos de estos muestreos de campo confirman que el stock del mero de Nassau ha sido eliminado cuando se comparó a los expedientes históricos. Estos exámenes también proporcionaron fuerte apoyo a la hipótesis que dice agregaciones de desove de especies múltiple ocurren constantemente en el borde de la plataforma de los promontorios de barlovento del arrecife en ves que en las aguas profundas.

Con la nueva comprensión de muestreos a escala nacional y la ayuda unánime de conservacionistas y de los pescadores, Belice decretó un cierre total a lo largo de todo el año de la pesca en 11 de estas agregaciones de múltiples especies dentro del marco de las nuevas reservas marinas en Noviembre de 2002. Al mismo tiempo decreto una nueva época de veda para el mero de Nassau a partir de Enero y hasta Marzo. Este simposio ha reunido sobre 50 pescadores de las agregaciones y un total de 450 científicos y administradores de la región del Caribe para tratar la aplicación la supervisión y la conservación de las agregaciones en escalas locales y regionales. La meta del simposio era fomentar esfuerzos regionales compartidos para conservar y manejar las agregaciones de desove a través del Golfo de México y del Caribe.

INTRODUCTION

Fisheries globally are surpassing carrying capacities causing severe depletions; reef fish fisheries within the Gulf and Caribbean are no exception (FAO 1994, Jackson et al. 2001). Coral reefs throughout the world are also under duress and showing declines in diversity and live coral cover. Marine protected areas are now being used to mitigate habitat loss, and to assist in fishery management. In order to provide maximum benefits for fisheries and biodiversity protection however, these protected areas must be supported locally, be placed strategically, managed effectively, supported sustainably, and be linked by ocean currents into mutually replenishing networks.

For the sake of efficiency, marine protected areas, particularly in the tropics were multi-species fisheries dominate, should include critical life stages of many ecologically and commercially important species (Lindeman et al. 2000, Roberts et al. 2001). Spawning aggregations are crucial in the life history of most commercially important reef fishes. Many of the aggregations of snappers and groupers are transient in space and time (Domeier and Colin 1997), and collectively represent 100% of the annual reproductive output for these species (Shapiro 1987). Spawning aggregations serve as important "source sites" for reproduction. As such, gametes are released from these sites into ocean currents from which they can replenish other areas by recruitment. Source sites are particularly important for protection and should be included within marine reserve networks (Roberts 1997). Studies of the

marine connectivity between spawning aggregation sites nursery habitats by ocean currents has become an active area of research, and will help in designing marine protected areas networks that can be mutually replenishing (e.g. Colin 1995, Cowen et al. 2000, Lindeman et al. 2001). Two talks in this symposium (Kjerfve and Paris) will address this issue specifically.

The short duration abundances of fishes that appear at spawning aggregation sites have attracted fishermen to them. As these sites are discovered by fishers, anecdotal information about the timing and location of spawning aggregations have been passed by oral tradition. In some cases, this information is documented by researchers, and is slowly being revealed to biologists and managers (e.g. Claro and Lindeman 2003, Heyman 1996, Johannes 1978, Lindeman et al. 2000). But fishing pressure has caused the depletion of many of these sites throughout the Caribbean Basin, particularly for Nassau grouper (*Epinephelus striatus*) (Sadovy 1994). In Belize, declines have been sharp in recent years. Nassau grouper was harvested from a site at Caye Glory, reaching a peak in the late 1960s when two tons of fish per day were being removed from the area (Craig 1969). Recent surveys indicate that only 21 fish remained at the site (Paz and Grimshaw 2001) indicating dramatic declines. Several studies have documented declines in reef fish spawning aggregations in the Caribbean, particularly groupers, and highlighted the need for their protection (Auil-Marshalek 1994, Beets and Friedlander 1999, Coleman et al. 1996, Johannes 1997, Luckhurst 2002, Sadovy 1994, 1997, Sala et al. 2002).

Until recently, descriptions of spawning aggregations were generally focused on single species (e.g. Aguilar Perera 1994, Carter et al. 1994, Colin 1992, Smith 1992, White et al. 2002). However, recent studies in Belize, and other areas in the Caribbean are revealing what fishermen throughout the Caribbean may have known for generations. Many spawning aggregation sites are utilized by several different species for spawning throughout various times of the year. Studies in Belize have revealed, for example that one multi-species spawning site, Gladden Spit, harbors spawning aggregations of at least 26 different reef fish species (Heyman 1994; Heyman and Boucher, in prep. Heyman et al. 2001, Heyman et al. In prep.). Collaborative studies conducted with nine marine conservation and management organizations in Belize, and with the intimate involvement of fishers revealed at least 13 sites serve as multi-species spawning aggregations (Heyman and Requena 2002). The study further revealed that these aggregations were generally found at the shelf break (25 – 35 m) on windward facing reef promontories that jut into deep (> 500 m) water (Figure 1). This pattern was so robust as to allow prediction of new sites, using geo-referenced, remotely sensed Landsat TM images (Heyman and Boucher In prep.). This collaborative research process, including fishers, and the revealed patterns of the timing and locations of multi-species spawning aggregations, has led to the declaration of 11 new marine reserves in Belize (November 2002) that protect these areas, and a closed season for Nassau grouper from December through March. These patterns are beginning to be documented in other countries around the Caribbean, using similar techniques (e.g. Claro and Lindeman 2003, presentations in this symposium by Aguilar, Medina-Quej, Tuz-Sulub, and Whaylen). these areas,

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A recent Caribbean wide survey of marine protected areas in the Caribbean revealed that very few spawning aggregations had been specifically included in marine protected areas (Appeldoorn and Lindeman 2003). To date, few efforts have been made to bring fishermen actively into the process of research and conservation of fish spawning aggregations, and their inclusion in marine protected areas. This symposium invited 50 fishers from around the Caribbean Basin to participate, including two from Belize (Young and Cuevas) who will speak to the assembly in support of spawning aggregation protection and the involvement of fishers in this process. The Nature Conservancy, along with local conservation organizations in Belize, has promoted economic alternatives for spawning aggregation fishers, via training in SCUBA guiding, fly fish guiding. These alternatives are helping fishers wean themselves from extractive fishing on aggregations and have helped to build their support for marine protected areas declaration and management.

The symposium will be concluded with the words of the Hon. Minister of Fisheries from Belize, Daniel Silva, who will offer encouraging words for the future and draw participants into action.

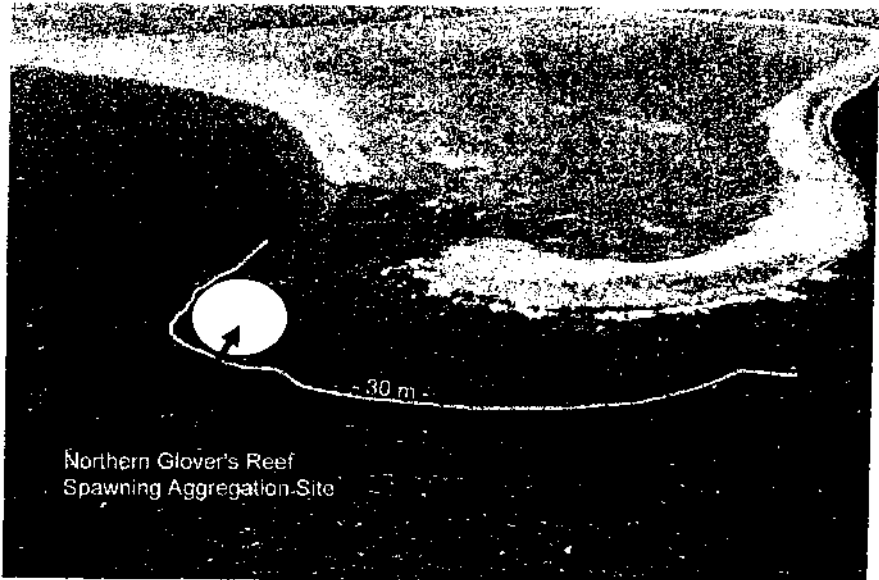


Figure 1. Multi-species spawning aggregation site at northern Glover's Reef Atoll in Belize as described in Sala et al. 2002.

SYMPOSIUM CONTENT

Aguilar, A. - Detection of Fishing Effects on a Nassau Grouper Spawning Aggregation from Southern Quintana Roo, Mexico

Luckhurst, B.E. - Current Status of Conservation and Management of Reef Fish Spawning Aggregations in the Caribbean

Medina-Quej, A. et al. - A Preliminary Survey of the Nassau Grouper (*Epinephelus striatus*) Spawning Aggregation at "El Blanquizal" in the South Coast of Quintana Roo, Mexico

Young, C. and E. Cuevas - Fishermen perspective on spawning aggregation management

Kjerfve, B. et al. - Connectivity of spawning aggregations in the inner Gulf of Honduras

Paris, C.B. et al. - Modeling Larval Transport from Snapper Spawning Aggregations (Lutjanidae) in Cuba

Rhodes, K.I. - Hong Kong Live Reef fish Trade

Tuz-Sulub, A. et al. - Preliminary Characterization of the Space Distribution of Several Species of Groupers (Epinephelinae: Epinephelini) in a Spawning Site in the Campeche Bank, Yucatan, Mexico

Whytlen, L. et al. - Observations of a Nassau Grouper (*Epinephelus striatus*) Spawning Aggregation Site in Little Cayman, Including Multi-species Spawning Information

Silva, D. - Minister of Fisheries for Belize - Closing Remarks - Political will for management

SYMPOSIUM RESULTS

The symposium provided an opportunity for fishers and managers from around the region to learn about and discuss the physical and ecological dynamics, and the need for management of spawning aggregation sites. Talks on connectivity by Paris and Kjerfve indicated that distant sites around the Caribbean are linked by oceanic currents. Talks by Heyman, Tuz-Sulub, Medina-Quej, and Whytlen underlined that many aggregation sites serve for multiple species. The talk by Belizean aggregation fishers, Young and Cuevas clearly demonstrated understanding of present and past conditions and the need to manage these sites. Leadership from the fishing community in management, and the development of economic alternatives for displaced fishers was a key element of success in Belize. Luckhurst's talk offered a regional look at the bleak status of aggregations around the region. Finally, Hon. Minister Dan Silva offered a note of urgency and action to the session, by announcing the imminent and sweeping legislation for the protection of Nassau

grouper and spawning aggregation sites. He signed the legislation two days after the completion of this Gulf and Caribbean Fisheries Institute Meeting.

DISCUSSION AND RECOMMENDATIONS

Discussions during and after the meetings lead to a series of recommendations as follows:

- i) Reduce or eliminate fishing mortality at vulnerable SPAG sites. A sense of urgency should be invoked for management /conservation action,
- ii) Incorporate known SPAG sites into planning programs for Marine Protected Areas (MPAs) to provide permanent protection for SPAG sites,.
- iii) Develop and implement monitoring programs involving scientists and user groups within the community and using standard protocols to evaluate the effect of management and conservation measures,
- iv) Develop community-based management programs for SPAG sites to the fullest extent possible. Full participation in the management process by all of the user groups affected by management measures will greatly increase the probability of success,
- v) Provide viable economic alternatives to those user groups who are displaced from SPAG sites as a result of management action, and
- vi) Regional networks of protected areas should be designed using principles of connectivity.

In lively discussions following the symposium, participants began work on an implementation plan for this regional strategy, strongly urging the use of electronic media and the Internet to disseminate information about SPAGs. A draft regional policy statement was developed and is online at http://www.gcfi.org/55th_gcfi.htm. Notes from the meeting and a downloadable spawning aggregations monitoring protocol for the Caribbean (Heyman et al. 2002) is available at: <http://nature.org/initiatives/marine/work/art9363.html> and comprehensive monitoring protocol (Colin et al. 2002) is also available at www.scrfa.org. It was further urged that veteran SPAG fishermen play an increasing role in data collection and conservation process, given their understanding of the ecology and historical perspective on changes in conditions. It was agreed that more tests of the applicability of remote sensing to predict the location of SPAGs in the region are called for. A regional network of marine protected areas, that protect important multi-species spawning aggregations, could contribute to regional fisheries management and help to conserve biodiversity.

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