Fisheries Management in South Eleuthera, Bahamas: Can a Marine Reserve Help Save the 'Holy Trinity'?

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ABSTRACT

Agriculture and tourism once played major roles in supporting the economy of south Eleuthera. Unfortunately, unsustainable growing practices, changes in market demand, and downward trends in tourism have transformed south Eleuthera into one of the most economically depressed areas in the Bahamas. As such, local residents have increased their dependency on marine resources for income and subsistence, and empirical and anecdotal evidence suggests that stocks of queen conch, spiny lobster, and grouper – the 'holy trinity' – are experiencing increased fishing pressure. Evidence from shell middens and shoreline shell surveys on Cape Eleuthera indicate that the proportion of juvenile conch being harvested has increased, while fishers are visibly taking conch from a suspected nursery ground. As queen conch stocks decline, spiny lobster and several species of grouper are being targeted more heavily, especially those residing in patch reefs in the shallow bank environment. Surveys and directed interviews conducted in south Eleuthera revealed that local residents consume finfish, including grouper, as frequently as either queen conch or spiny lobster. In recognition of these pressures, a fully-protected marine reserve is proposed for south Eleuthera, and its boundaries are to encompass suspected conch nursery grounds and numerous patch reefs inhabited by spiny lobster and juvenile grouper. Although the establishment of this reserve is a crucial step towards maintaining local stocks of the 'holy trinity', efforts are also needed to spur sustainable economic growth in south Eleuthera. Without alternative sources of income and food for south Eleuthera communities, optimal benefits of the marine reserve cannot be feasibly obtained.

KEY WORDS: Marine reserve, south Eleuthera, Bahamas

Manejo de los Recursos Naturales Marinos en el Sur de Eleuthera: Puede Una Reserva Marina Salvar a la "Santa Trinidad"

La agricultura y el turismo jugaron una vez un importante papel en el desarrollo económico del sur de la isla de Eleuthera. Desdichadamente, el crecimiento de practicas insostenibles en el sector agrícola y tendencias decrecientes en el turismo han transformado a esta región insular en una de las económicamente más deprimidas del archipiélago. Estos cambios han llevado a intensificar su dependencia en la explotación de los recursos marinos como

medio de subsistencia. Consecuentemente, las actuales evidencias empíricas e históricas indican un decrecimiento de las reservas del reina caracol (strombus gigas), langosta, y el mero - los cuales son considerados localmente como la "Santa Trinidad". Por ejemplo, mediciones visuales han revelado consistentemente bajas en la densidad de la población del reina caracol, especialmente en las zonas usadas tradicionalmente para la pesca. Adicionalmente, evidencias de grupos de conchas desechadas (shell middens) indican un crecimiento en la proporción de las conchas juveniles actualmente cosechadas, mientras que las observaciones de los patrones de pesca muestran que muchas de estas poblaciones juveniles provienen directamente de viveros. Mientras las reservas del reina caracol disminuyen, varias especies de mero y langosta reciben considerablemente mas atención, específicamente aquellas poblaciones en zonas poco profundas y arrecifes próximos a la orilla. En entrevistas, los pobladores del sur de Eleuthera mencionan que varios tipos de pescado, incluyendo al mero, son consumidos con mas frecuencia en comparación con el reina caracol y la langosta, reflejando una probable disminución de estos. El planteamiento de una reserva marina protegida en el sur de Eleuthera abarca varios reservorios y numerosos arrecifes habitados por la langosta y el mero. Si bien este es un paso crucial para mantener la existencia locales de la "Santa Trinidad," también se necesita de otros esfuerzos que promuevan un desarrollo económico y diversificado que brinde a las comunidades del sur de Eleuthera otras alternativas para la generación de ingresos, y de esa manera reducir la presión y explotación de los recursos marinos.

PALABRAS CLAVES: Manejo de los recursos, Eleuthera, Bahamas

BACKGROUND

Natural resources have been the foundation of economic development on Eleuthera for hundreds of years. In the 19th and early 20th century, agriculture prospered on Eleuthera because of a favorable climate and red, lateritic soils that allowed large-scale production of crops such as pineapple, vegetables, and grains (Sealey 1994). In fact, Eleuthera was a major supplier of pineapple to the United States until Hawaii became a U.S. territory in 1900 (Sealey 1994). Unfortunately, changes in market demand, in combination with intensive growing practices reducing the land's ability to sustain agriculture at a commercial scale, eventually relegated agriculture to small-scale operations that only support local demands and subsistence living.

In the early to mid 20th century, tourism began to replace agriculture as a viable industry on Eleuthera. The tourism industry was founded on non-extractive and extractive properties of Eleuthera's natural resources. Pristine, secluded beaches and reefs abound with fish and healthy corals brought tourists in search of rest and recreation, while seafood and local agricultural products offered fresh, exotic food items for the foreign pallet. By the 1970s, tourism was well distributed along the 160 km expanse of Eleuthera, providing greater income for local residents, and a revitalized infrastructure and economy for the island.

Although economically prosperous, tourism also brought increased

pressure on Eleuthera's natural resources. Increased tourism on Eleuthera caused greater demands for fishery resources sought out for consumption, especially for members of the 'holy trinity' - queen conch, *Strombus gigas*, spiny lobster, *Panulirus argus*, and Nassau grouper, *Epinephelus striatus*. In addition, greater regional tourism on islands such as New Providence, and growing international demands for marine products likely contributed to increased fishing pressure on local stocks. Modifications to the coastline resulting from tourism development and increase human activity likely also had a negative impact on fisheries resources through the loss of critical habitats (Sealey 2003).

By the late 20th century, tourism in south Eleuthera began to fade, and currently all medium to large-scale resorts are closed. With the combined loss of large-scale tourism and agriculture, south Eleuthera has been transformed into one of the more economically depressed areas in the Bahamas (Rt. Hon. Perry G. Christie, Prime Minister of the Bahamas, 06 June 2003). As such, local residents have become more dependent on marine resources for subsistence, thus the relative importance of harvesting queen conch, spiny lobster, and finfish has increased.

DEPLETION OF MARINE RESOURCES

Empirical and anecdotal evidence indicates that stocks of queen conch, spiny lobster, and grouper around south Eleuthera are either threatened or experiencing increased fishing pressure.

Queen Conch

In the Bahamas, evidence suggests that queen conch stocks are overfished, and local populations are vulnerable to collapse (BREEF 2002). With a recent export ban on queen conch from the Dominican Republic, Haiti, and Honduras, three of the top exporters of queen conch in the Caribbean, pressures to harvest and export queen conch from the Bahamas will likely increase.

In south Eleuthera, queen conch stocks are showing signs of overfishing. One fishing practice that can increase the vulnerability of a population to collapse is the harvest of juveniles, resulting in growth overfishing (King 1997). Surveys of shell middens on Cape Eleuthera have shown that the proportion of juvenile conch being harvested is quite high (Clark et al. In Press). In addition, surveys of conch shells discarded on the shoreline in close proximity to a suspected queen conch nursery ground also show a high proportion of juveniles being harvested as well as the presence of a 'walk-in' fishery. Continued fishing for juveniles, especially in nursery grounds, can easily contribute to a continual decline in queen conch density and reduced potential for population recovery.

Spiny Lobster and Grouper

Both spiny lobster and grouper are high-priced resources in local, regional, and international markets. In the Bahamas, the harvest and sale of spiny lobster contributes greatly to the socio-economic development of many island communities (FAO 2000). Similarly, grouper is often in high demand.

Unfortunately, the behavior and dispersal patterns of both spiny lobster and grouper make them relatively easy to harvest, thus vulnerable to over-exploitation (Sadovy 1999). For instance, in the Bahamas, approximately 40 % of the annual catch of grouper is taken during spawning aggregations (Sadovy 1999).

In south Eleuthera, spiny lobster and grouper are frequently fished and consumed by local residents. Community surveys and semi-structured interviews conducted in the fall of 2002 examined perceived trends and the importance of marine resources in local communities. Surveys were administered to residents of settlements in south Eleuthera and comprised of closed-ended questions with limited answers, and open-ended questions used to generate qualitative information regarding the use of marine resources (Bunce et al. 2000).

Despite surveys indicating that queen conch is a staple food item in local communities, 53 % of respondents (n = 53) stated that they consumed finfish 2 - 3 times per week or more. In addition, over 70 % of respondents stated that the availability of spiny lobster has declined significantly in the past 10 - 20 years. Respondents also stated that the availability of spiny lobster and reef fish is equally important as the availability of queen conch.

MARINE RESERVE INITIATIVE

In 2000, the Bahamian government declared five areas of the Bahamas archipelago to be designated as no-take marine reserves (Dahlgren 2002). No-take reserves have been advocated as an effective 'low cost' fisheries management tool that can provide ecological and fishery benefits (Roberts and Polunin 1993, Roberts 1997, Murray et al. 1999). From a fisheries perspective, marine reserves can help conserve essential habitat and promote the buildup of biomass, which, in turn, may result in the spillover of adults into adjacent fishing grounds and the downstream export of larvae to more distant fished areas (Murray et al. 1999).

One of the five proposed reserves is designated for south Eleuthera in an area traditionally fished by local residents (Figure 1). Initial discussions regarding the boundaries of the proposed reserve included waters extending from Powell Point north to the Schooner Cays, east to a channel marker used for navigation through oolitic sand banks, and then south to Cow Point (Figure 1). These boundaries were partially based on observations of high conch densities near the Schooner Cays (Stoner et al. 1998), however recent evidence suggests that adult densities in this area are now quite low (Dahlgren 2002, Danylchuk unpublished data). Based on on-going habitat and population surveys off Cape Eleuthera, in combination with input from local fishers and residents at a Marine Reserve Management Workshop in April 2003, the proposed boundaries have been modified to incorporate areas critical for the recruitment of queen conch, spiny lobster, and finfish, especially grouper, from juvenile to adult stages. Revised boundaries extend eastward towards Poison Point, encompassing a greater proportion of shallow bank environment adjacent to several mangrove creeks along the shoreline (Figure 1).

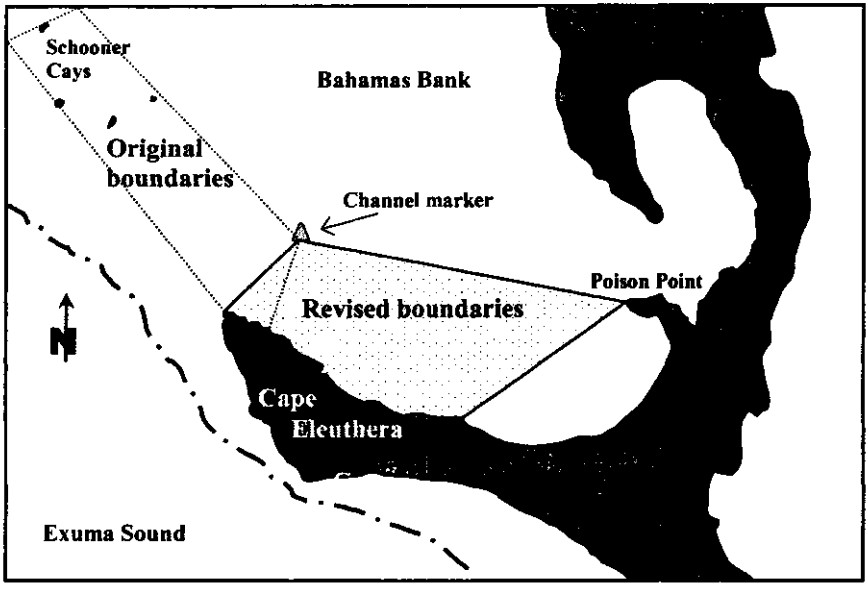

Figure 1. Original and revised boundaries of a marine reserve proposed for south Eleuthera, Bahamas. Stars indicate the location of settlements whose residents fish in the proposed area.

POTENTIAL ECOLOGICAL BENEFITS

With the revised boundaries, there is greater potential for the proposed reserve to be effective in protecting and potentially enhancing populations of queen conch, spiny lobster, and grouper.

Queen Conch

Revised boundaries of the marine reserve near Cape Eleuthera include suspected nursery grounds for queen conch (Clark et al. In press). Protecting nursery grounds for queen conch should allow for an overall increase in density and dispersal from juvenile habitat (Danylchuk et al. 2001), potentially leading to movement of adults to areas outside the reserve. The direction of dispersal for queen conch can depend on the adjacency of habitat preferred by successive life stages (Danylchuk et al. 2001, Danylchuk, unpublished data), thus spillover of adults requires the inclusion of habitat corridors that promote movement from inside to outside protected areas. Greater densities of queen conch within marine reserves (Stoner and Ray 1996, Posada et al 2000, Danylchuk et al. 2001) may also increase the encounter rate among individuals and ultimately promote reproduction (Stoner and Ray-Culp 2000). Given that queen conch have a relatively short larval life stage (14 - 35 days, Davis 1994) and that current patterns of surface waters in Exuma Sound are relatively self-contained (Colin 1995), an increase in reproduction may result in the down-stream export of larvae and ultimately support self-recruitment of local conch

stocks (Colin 1995).

Spiny Lobster and Grouper

Although the revised boundaries of the proposed marine reserve off Cape Eleuthera do not encompass deeper coral reef areas commonly inhabited by adult spiny lobster and grouper (Eggleston and Lipcius 1992), they do encompass extensive shallow flats (< 5 m) containing numerous, frequently fished patch reefs that are known to be transitional habitat for juveniles (Stewart 1989, Eggleston and Lipcius 1992). Larger juvenile spiny lobsters are gregarious and inhabit crevices in shallow patch reefs (Eggleston and Lipcius 1992). Similarly groupers spend several years as juveniles and tend to occupy more near-shore habitats compared to adults and are generally associated with patch reefs (Stewart 1989, Eggleston 1995).

Preliminary surveys inside the boundaries of the proposed reserve show that patch reefs are frequently inhabited by juvenile spiny lobster, Nassau grouper (< 250 mm TL), and other finfish that are consumed by residents in local communities (Danylchuk, unpublished data). Anecdotal observations of harvesting patterns indicate that fishers are using traps, hook and line, and spear to collect spiny lobster and finfish from patch reefs in this area. Fishing often occurs in these inshore waters when poor weather prohibits traveling into deeper, areas offshore. Going offshore to fish may also be cost-prohibitive for some individuals, especially given the state of the local economy.

Offering protection for areas containing shallow patch reefs may minimize fishing pressure on juvenile spiny lobster and grouper, and potentially reduce growth overfishing (King 1996, Sadovy 1999, Sluka et al. 1999). Although the current focus of management for groupers is the protection of spawning aggregations, protection of juvenile life stages is also important since juveniles are ultimately recruited into the breeding segment of the population (Sadovy 1999). In the Bahamas, there is a minimum size limit prohibiting the harvest of grouper under 1.36 kg or 3 lbs (Bahamas Department of Fisheries 1986) which should offer some protection for juveniles, however the institutional capacity to enforce such regulations, especially in remote locations like south Eleuthera, is currently quite limited.

SOCIO-ECONOMIC CONSIDERATIONS

Although the proposed marine reserve may lead to the conservation of queen conch, spiny lobster, and Nassau grouper, support from the local community is essential if the full potential of the reserve is to be realized (Salm et al. 2000). Given that the effectiveness of regulations controlling the use of resources is strongly dependent on economic conditions (Hanna 2001), the current depressed state of south Eleuthera may negatively affect the way the proposed reserve is perceived. Few economic alternatives to fishing are currently available for local residents, and although the long-term benefits of the reserve are generally understood, immediate and tangible incentives that may act as compensation for being displaced from fishing grounds do not exist.

The Bahamian government has been working to promote sustainable economic growth and diversification in south Eleuthera, however there will be

an asynchrony between the rate of economic growth and the proposed establishment of the reserve in July 2004 (P. Dustan, personal communication). In combination with a limited capacity to enforce fisheries regulations, this asynchrony may limit the effectiveness of the reserve since the need to extract resources for subsistence will remain strong.

CONCLUSION

Without tangible incentives, especially for local fishers of south Eleuthera who will be the first to feel the impact of area restrictions, little faith with be given to the potential fishery benefits of the proposed marine reserve. Tangible incentives could include other forms of fishery enhancement projects, such as the deployment of artificial 'fishing' reefs or the development of low-cost sustainable aquaculture that may allow fishers to remain in an industry they are familiar with. Small-scale, sustainable tourism could also provide tangible incentives in the form of jobs, and perhaps refocus attention to the non-extractive properties of the marine resources in south Eleuthera. Regardless of the form of incentives, additional attention needs to be paid towards providing sustainable economic alternatives that will not simultaneously have detrimental effects on the local environment if the proposed marine reserve in south Eleuthera is to be effective at saving the 'holy trinity'.

ACKNOWLEDGEMENTS

I gratefully acknowledge the key financial and logistical support of The Cape Eleuthera Institute and The Cape Eleuthera Island School. Thank you to the many students of The Island School who assisted with data collection on the local fishery, and to the staff for continually offering their guidance and enthusiasm. Thank you to The Bahamas Department of Fisheries for inviting me to the Marine Reserve Management Workshop in 2003, and to Bill Alevizon, Phil Dustan, Michelle Duval, and Jim Porter for their insights into the marine reserve initiative. Thanks also to Murray Rudd, Ben Freeman, and Sascha Clark who provided many useful comments on an earlier version of this paper. Lastly, I would like to thank the residents of south Eleuthera for their continued support and interest in this work. This manuscript is publication CEI-002 of the Cape Eleuthera Institute.

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