THE BENEFITS OF A MARINE FISHERY RESERVE FOR NASSAU GROUPER *Epinephelus striatus* IN THE CENTRAL BAHAMAS

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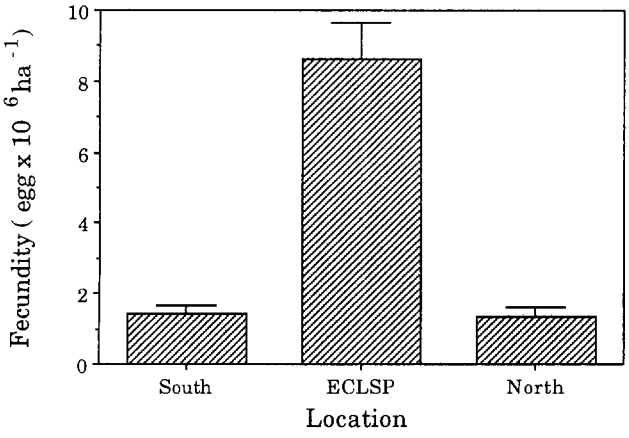

Fig. 2: Reproductive output (no. eggs ha^{-1}) of Nassau grouper north, inside, and south of the Exuma Cays Land and Sea Park (ECLSP). Error bars indicate 1 standard error.

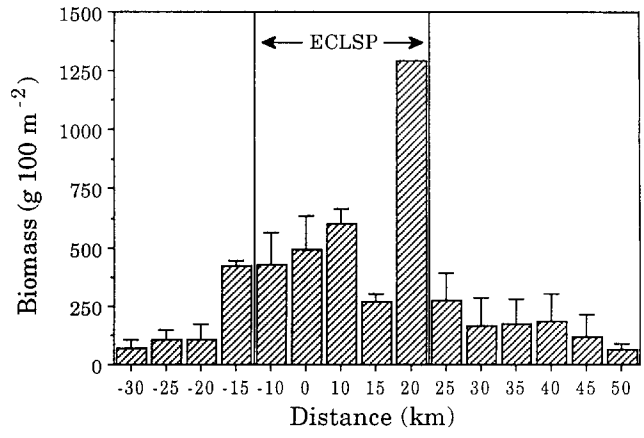

Fig. 3: Relationship between distance north (positive number) and south (negative number) of the ranger station and Nassau grouper biomass (g 100 m^{-2}). Error bars indicate 1 standard error. The boundaries of the Exuma Cays Land and Sea Park (ECLSP) are indicated by vertical lines.

to have very low Nassau grouper biomass. The habitat type of a transect was designated as the habitat constituting the majority of the transect. Smith (1988) also sampled farther north of the northern Exumas, which likely experiences more intense fishing pressure due to the proximity to more populated areas such as Nassau.

Smith (1988) showed that Nassau grouper occur almost exclusively in hard-bottom habitats with structural relief. The lack of a significant relationship between habitat and the abundance of Nassau grouper in the present study implies that it is unimportant which hard-bottom habitats are protected, but mainly that some preferred habitat of Nassau grouper is protected. This result only applies to the range of coral reef habitats studied. For example, we can make no statement about the importance of mangrove habitats to Nassau grouper abundance. It appears that Nassau grouper do not preferentially occupy either channel, fringing, or windward hard-bottom habitats, and can be abundant equally among these habitat types. Thus, it is more important to protect reefs from fishing than to protect the 'correct' type of reef. However, it should be clear that a wide range of habitats is still necessary to protect all life history stages. Algal covered clumps and patch reefs are important in the early life history of this species (<150 mm total length) (Eggleston 1995) and should be included in any reserve design. Patch reefs in the Exuma Cays had a greater abundance of smaller individuals, indicating ontogenetic movements offshore with increasing size (Ross and Moser 1995). The relationship between grouper abundance and habitat is a function of the scale and detail at which it is studied (Sluka 1995).

Direct evidence of biomass export through the spillover of adults was not collected in the study. However, by examining patterns in the spatial distribution of grouper biomass, this process can be inferred. Based upon theoretical evidence and tagging studies, it is hypothesized that the abundance of targeted species should increase directly outside of marine fishery reserve boundaries due to movement of adults (Russ et al. 1992; Attwood and Bennett 1994). For example, in a study by Attwood and Bennet (1994), 17.8% of tagged *Coracinus capensis* were recaptured a minimum of 25 km and a maximum of 1,044 km from the tagging site. Trap catches decreased gradually from the center of a marine reserve in Barbados (Rakitin and Kramer 1996). However, this pattern was not established for visual census or individual species data and sites sampled were located at a maximum distance of 4 km from the center of the reserve. The data from the present study support the hypothesis that Nassau grouper biomass was more similar to levels inside ECLSP immediately outside of park boundaries than in areas further away (Fig. 3).

In conclusion, the ECLSP is protecting the size, biomass, and reproductive output of Nassau grouper in the northern Exuma Cays. There was no evidence that habitat was an important consideration in the design of marine fishery reserves for adult Nassau grouper, within the range of coral reef habitats studied. However, there was evidence of ontogenetic migrations by this species. Analysis of spatial patterns of Nassau grouper biomass indicated that the ECLSP was exporting Nassau grouper biomass to the surrounding area through adult emigration.

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