Marine Geomorphology as a Determinant for Essential Life Habitat: An Ecosystem Management Approach to Planning for Marine Reserve Networks

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Building a marine reserve network in Belize based on spatio-temporal patterns of reef fish reproduction

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THE GROUPEPER FISHERY OF CAY GLORY, BRITISH HONDURAS

Alan K. Craig
1969
Caye Glory
1968

Harvest: 2 tons/day

(Craig, 1969)
Grouper spawning aggregation

Predictable but transient aggregation for purpose of reproduction
Reef Fish
Life Cycle

eggs
larvae
juveniles
adults
spawning aggregation
Caye Glory
2001

Harvest:
9 fish
Belize Fish Export

Pounds

Whole Fish
Fish Filet
Consistent with global fisheries declines
Traditional fisheries management approaches proven ineffective

Marine reserves networks proposed
Global extent of marine protected areas

But where should new reserves be placed?

“critical life habitats”

An example from Belize
Caye Glory
Reef
Promontory
Spawning Site
Gladden Spit
Reef
Promontory
Spawning Site

Reef Crest
Shelf Edge

Spawning Aggregation Site
Cubera snapper

Photo by Douglas Seifert
Nassau grouper
Dog snappers spawning: every month of the year

Photo by Douglas Seifert
Gladden Spit serves as a multi-species spawning aggregation site.

21 species from 9 families spawning throughout the year.
Gladden Spit:
Oasis for reproduction

- Permit, crevalle, yellow jack, horse-eye
- Black and Yellowfin Grouper
- Yellow-eye snapper, queen silk snapper, blackfin snapper
- Black jacks, other groupers “Jul”
Nassau grouper at Gladden Spit

Number of fish

Date

Day

21-Jan-03 28-Jan-03 4-Feb-03 11-Feb-03 18-Feb-03 25-Feb-03 4-Mar-03 11-Mar-03 18-Mar-03 25-Mar-03 1-Apr-03 8-Apr-03 15-Apr-03 22-Apr-03 29-Apr-03 6-May-03 13-May-03

0 50 100 150 200 250 300

○ = Full Moon

= Full Moon

= Full Moon

= Full Moon

= Full Moon

= Full Moon

= Full Moon

= Full Moon
Cubera Snapper at Gladden Spit

- Date in 2003
- Number of fish

○ = Full Moon
Yearly

Maximum Number of Fish

Mean Monthly Temperature (°C)

1998 1999 2000 2001 2002 2003
Where else do spawning aggregations occur?

National study at reef promontories involving fishers
Hypothesis: Transient, multi-species reef fish spawning aggregations occur at:

- Reef promontories (inflections on the reef)
- Shelf edge
- 30 – 50 m depth
- Top of dropoff into deep waters (> 500 m)
- Windward facing
Evaluated hypothesis using:

- Underwater visual counts
- Reef mapping - see Kobara, next talk
Lighthouse Reef Atoll
Half Moon Caye

Halfmoon Caye spawning site
Half Moon Caye

Aerial photo  Landsat image
Half Moon Caye’s Reef - East Wall

20 species spawning
Glover’s Reef Atoll
Northeast Point
and
Middle Caye

Glover’s Reef spawning sites
Glover’s Reef – Northeast Point

Multi-species spawning site
Glover’s Reef – Middle Caye
Predicting new sites
Predicted spawning aggregation site

South Point Lighthouse Reef Atoll

Landsat TM

Predicted spawning aggregation site
18 species spawning
Reef promontories as Marine Oases

Breeding

Feeding

Photo by Douglas Seifert
Fisheries Minister declared

1. 11 new year-round, no-take reserves at multi-species SPAGs

2. Closed season for Nassau grouper (December-March)

November 2002