Geomorphometric Analysis of Nassau Grouper Spawning Aggregation Sites in Belize and the Cayman Islands

Shin Kobara and William D. Heyman
Texas A&M University

Spawning aggregations (SPAGs)

- Nassau grouper
  - The most well-studied reef fish species
  - declining
  - critically endangered species.

- The primary reason for decline
  - Over-fishing of its highly synchronized and site specific spawning aggregations.
  - They come back same place every year for spawning.

Aggregation type: Resident /Transient

Frequency	occur regularly; often daily	**occur infrequently; at specific times of the year**
Portion of reproductive effort	single aggregation constitutes minor portion of annual reproductive effort	**single aggregation constitutes major portion of annual reproductive effort**
Migration distance	migrate relatively short distance	**migrate relatively large distance**
Duration of aggregation	aggregation is ephemeral, lasting only a few hours or less	**aggregation persists for several days**
General size of aggregating species	species are relatively small to medium sized representatives of their respective families	**species are relatively large sized representatives of their respective families**
Type of food habits	species feed low on the food chain	**species feed high on the food chain**
Modes of spawning	only group spawning has been observed	**group and pair spawning have been observed**

Domeier and Colin 1997

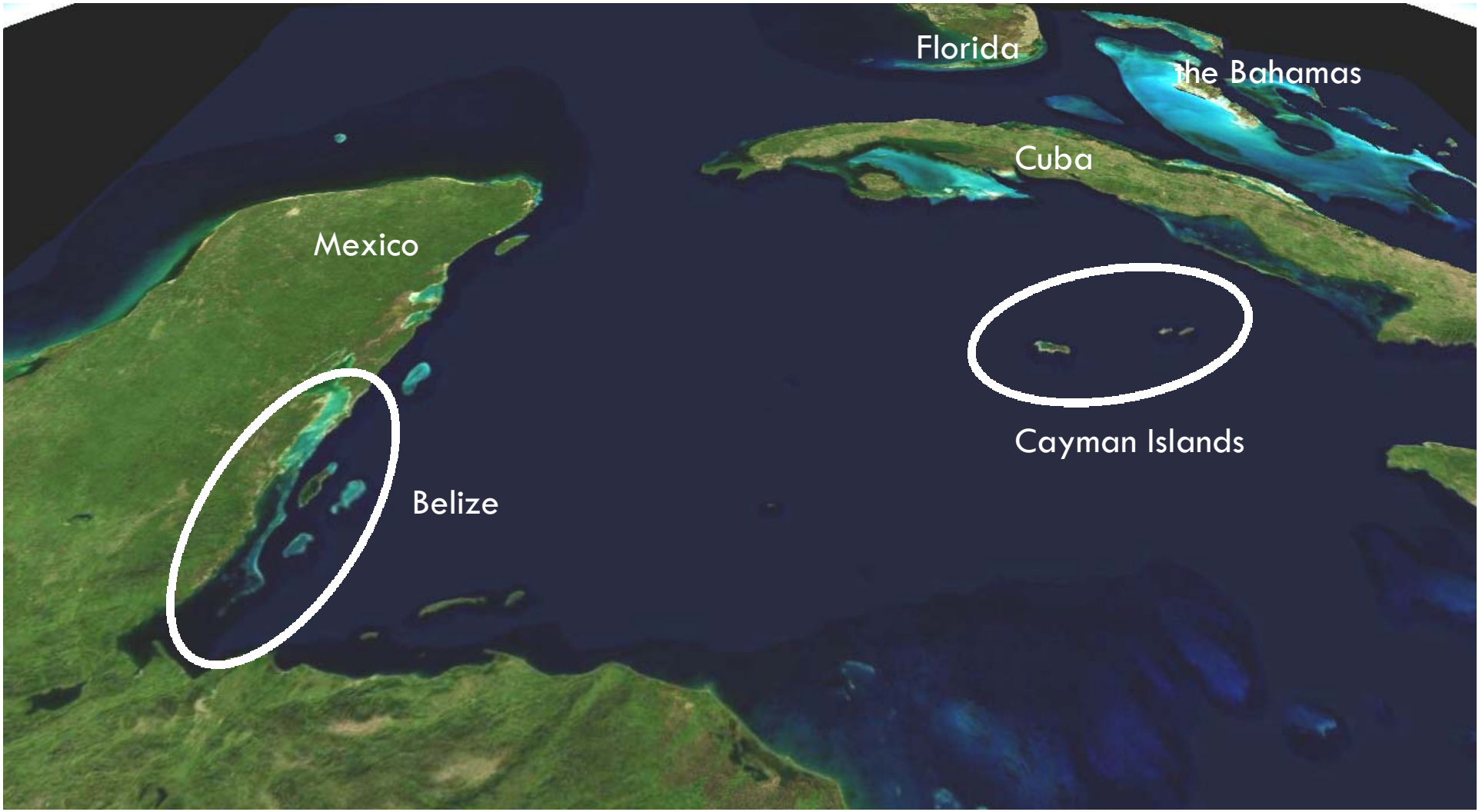
Spawning Type

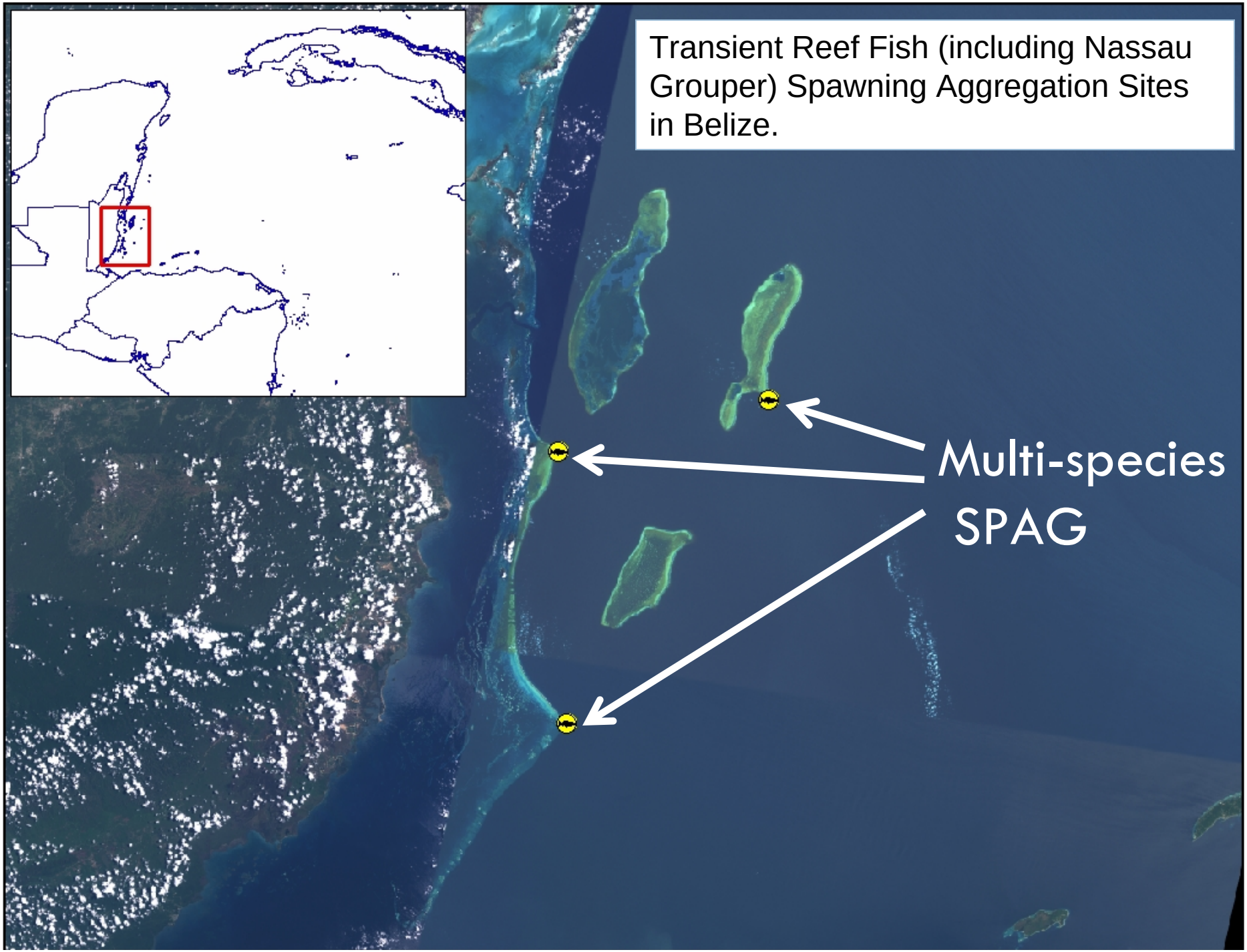
- Pair-Spawning (Red hind)

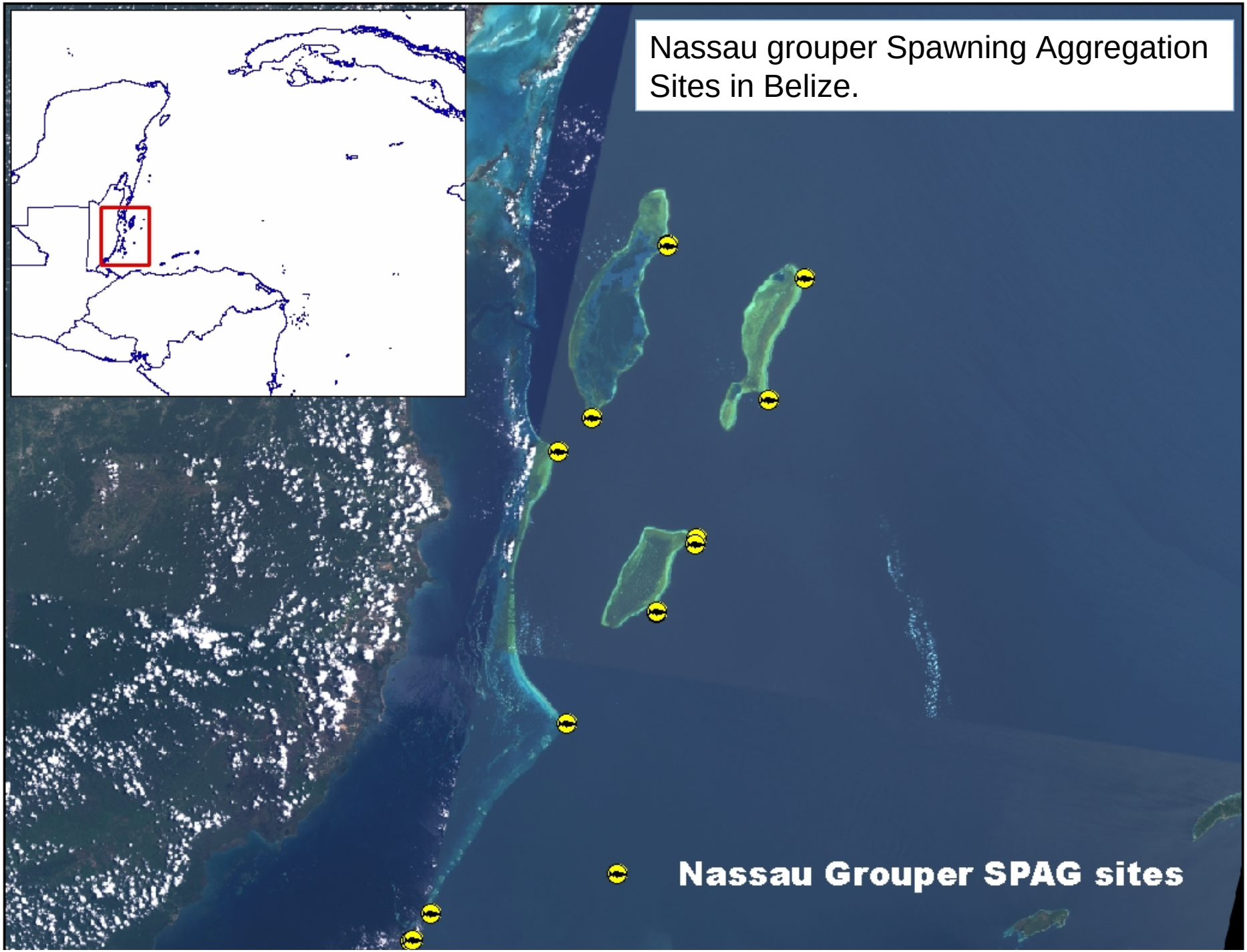
- Group Spawning (Cubera, Dog, Mutton Snappers)
  - Mass spawning is a form of group spawning
    - consists of the great majority to all of the individuals within an aggregation spawning simultaneously, as a single unit (Domeier and Colin, 1997).

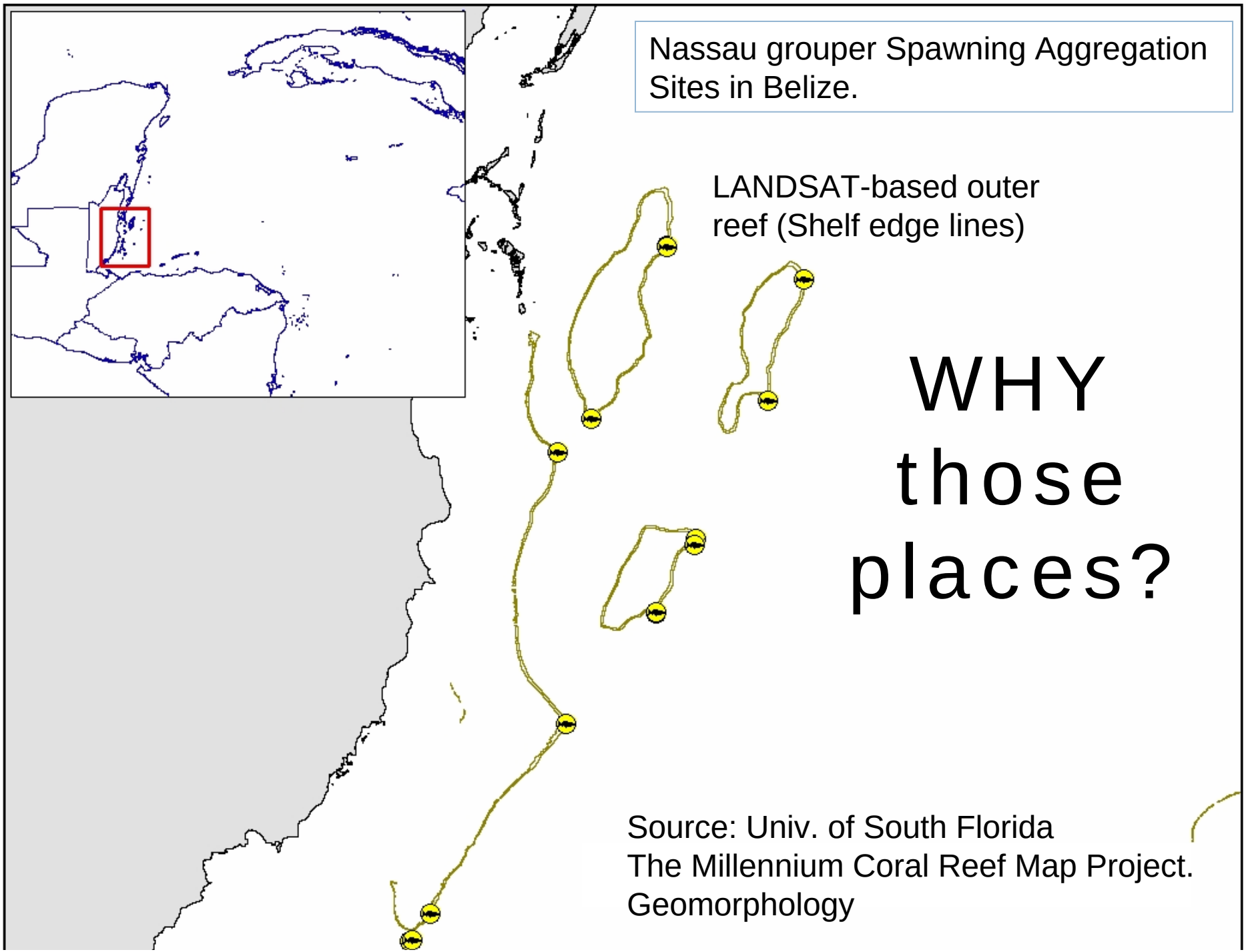
Nassau grouper is a transient reef fish and a group spawning species

Study areas




Transient Reef Fish (including Nassau Grouper) Spawning Aggregation Sites in Belize.
Multi-species SPAG


Nassau grouper Spawning Aggregation Sites in Belize.
Nassau Grouper SPAG sites

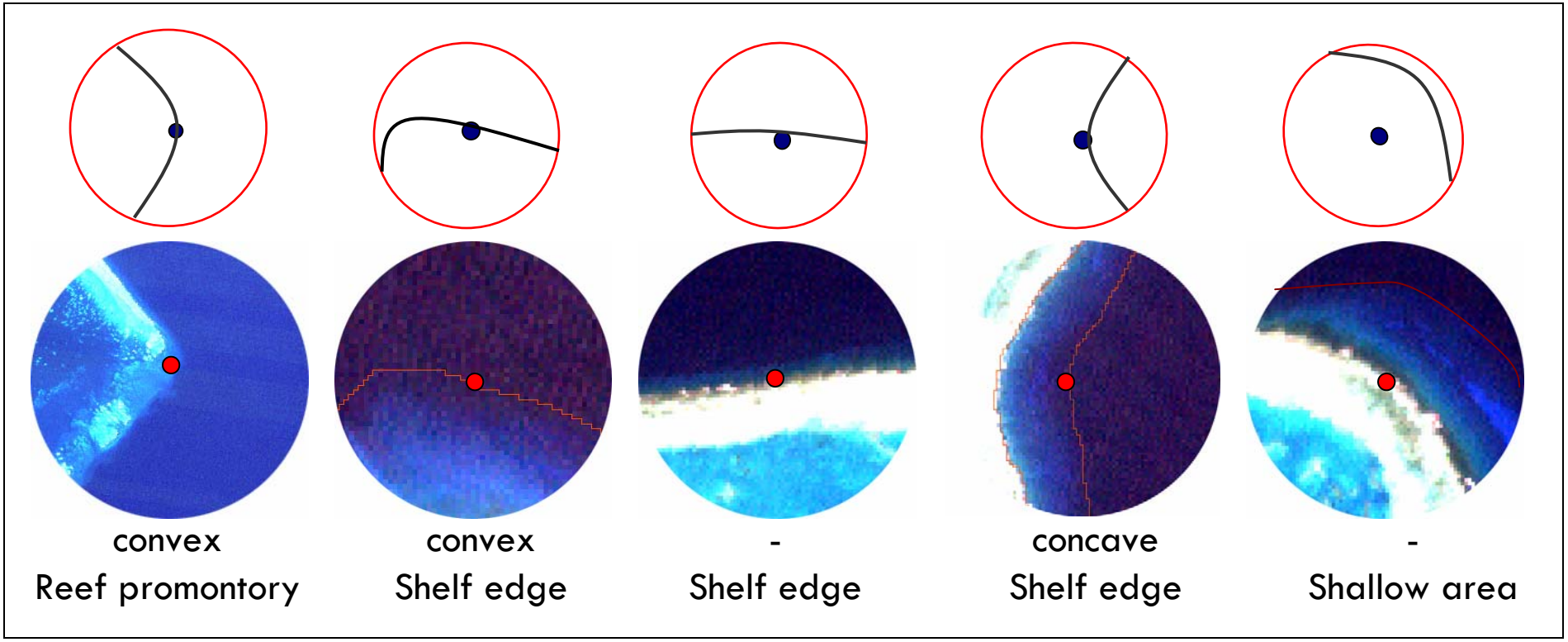

Nassau grouper Spawning Aggregation Sites in Belize.
LANDSAT-based outer reef (Shelf edge lines)
WHY those places?
Source: Univ. of South Florida
The Millennium Coral Reef Map Project.
Geomorphology

Only a limited understanding of the general location of SPAG sites

→ limits their inclusion in marine protected areas

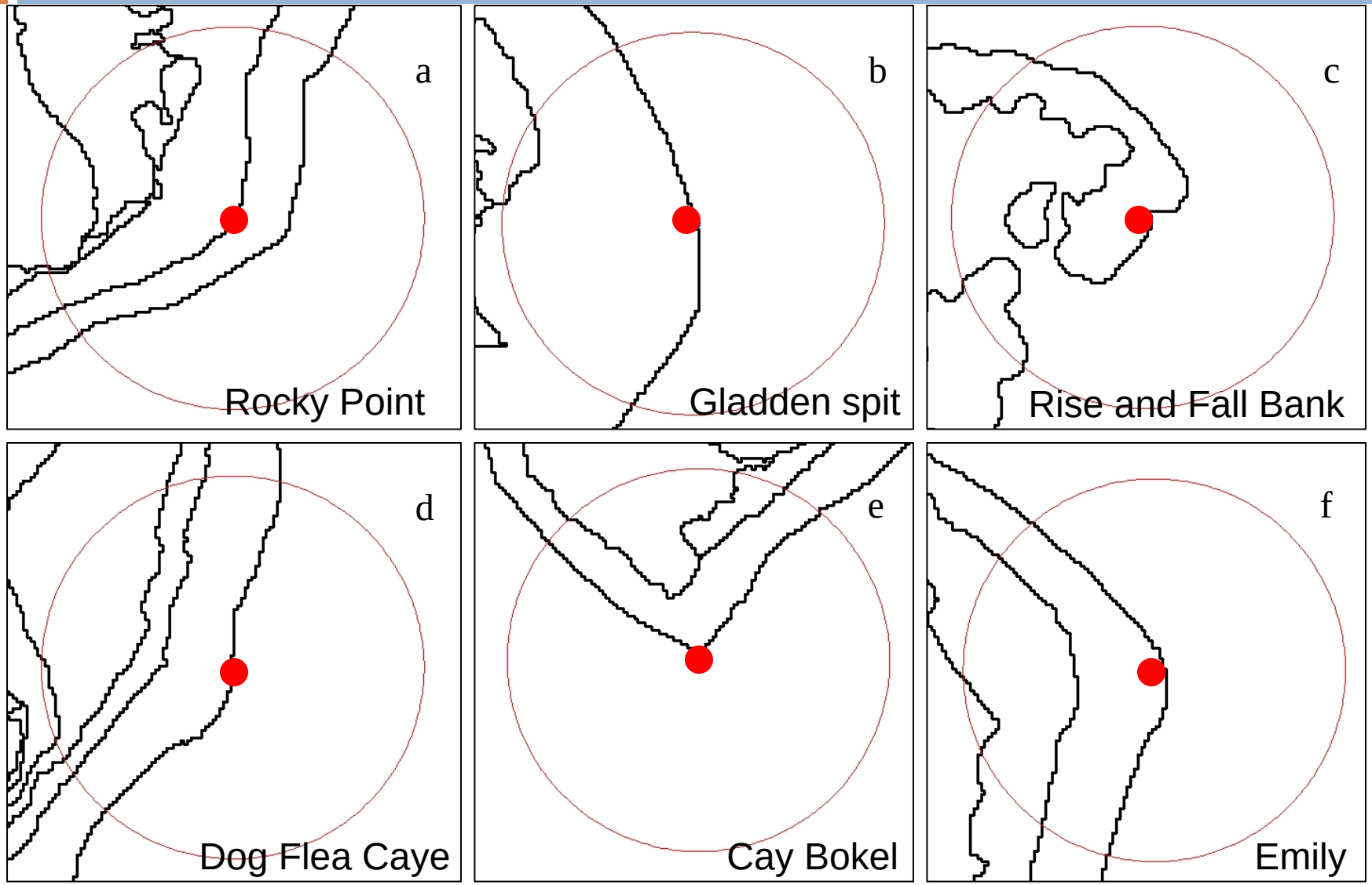
Need to understand geospatial characteristics

Shape analysis

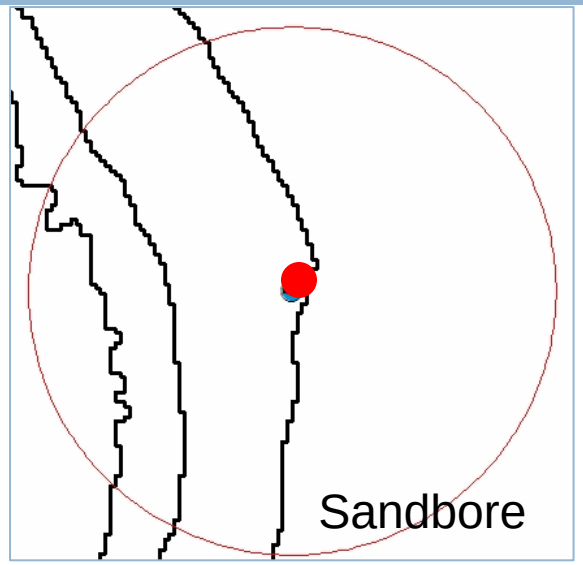


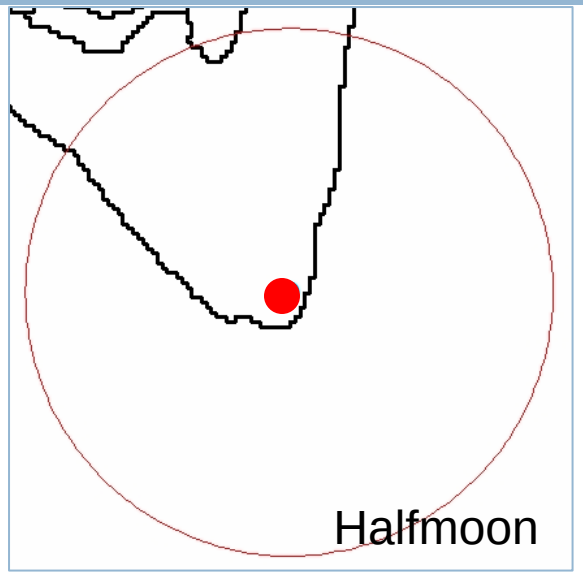
- Possible spawning aggregation sites.

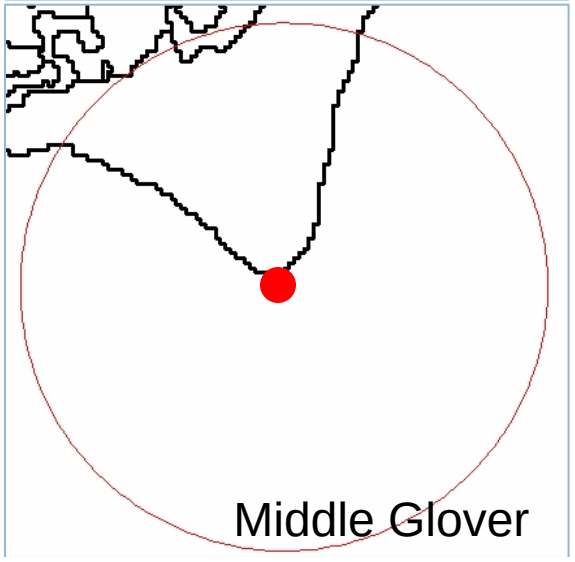
Belize


a
Rocky Point
b
Gladden spit
c
Rise and Fall Bank
d
Dog Flea Caye
e
Cay Bokel
f
Emily

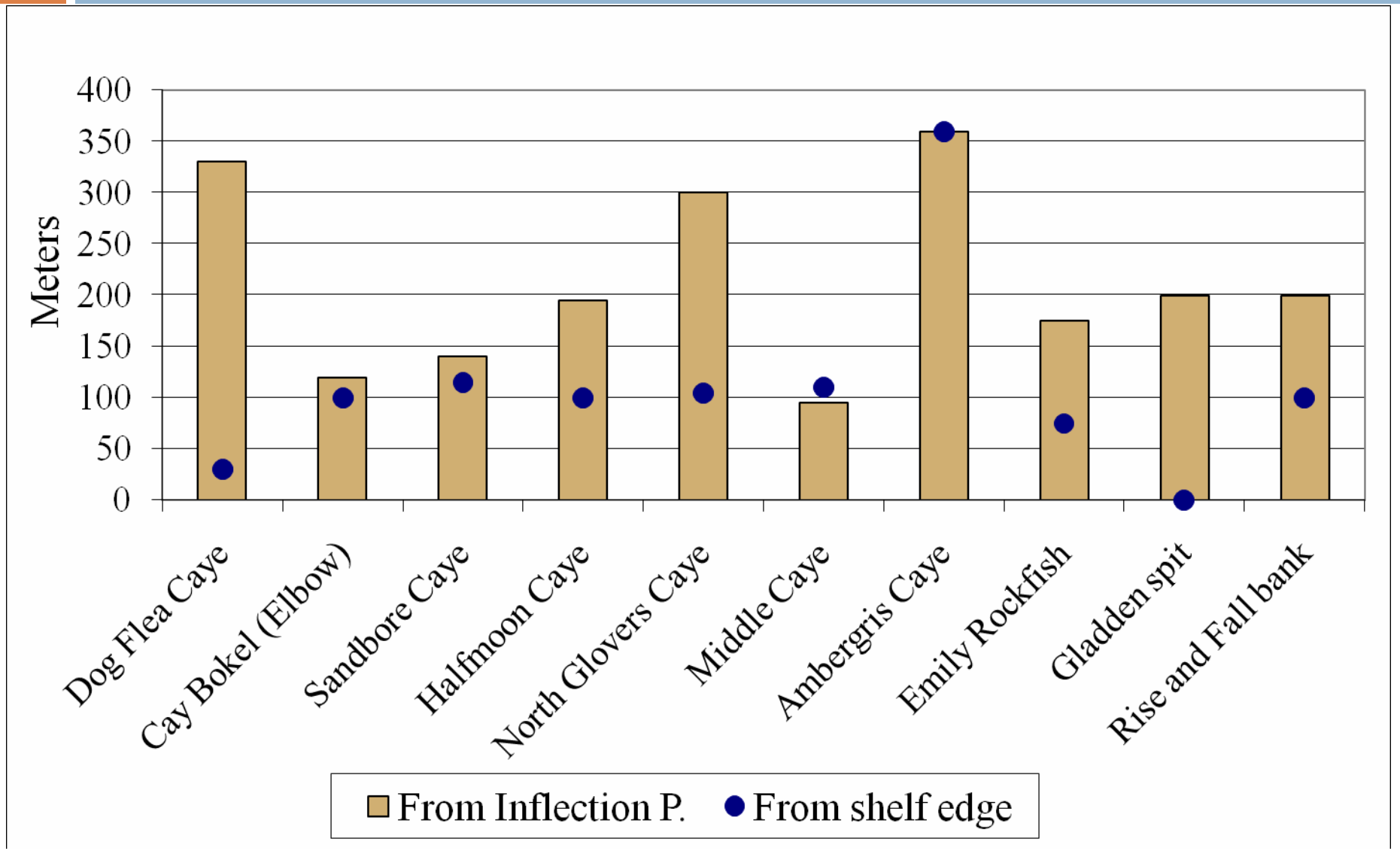
Belize (2)

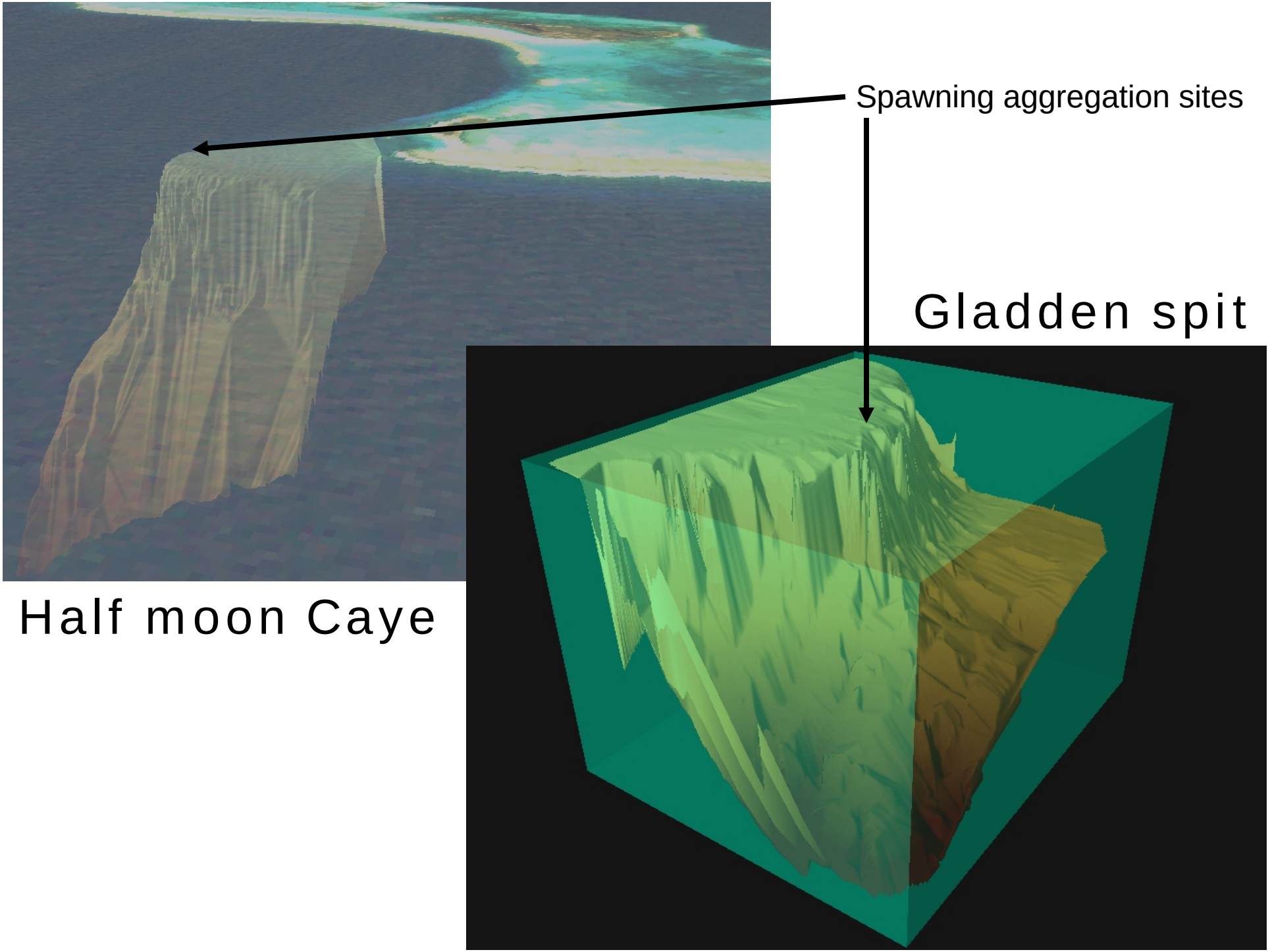






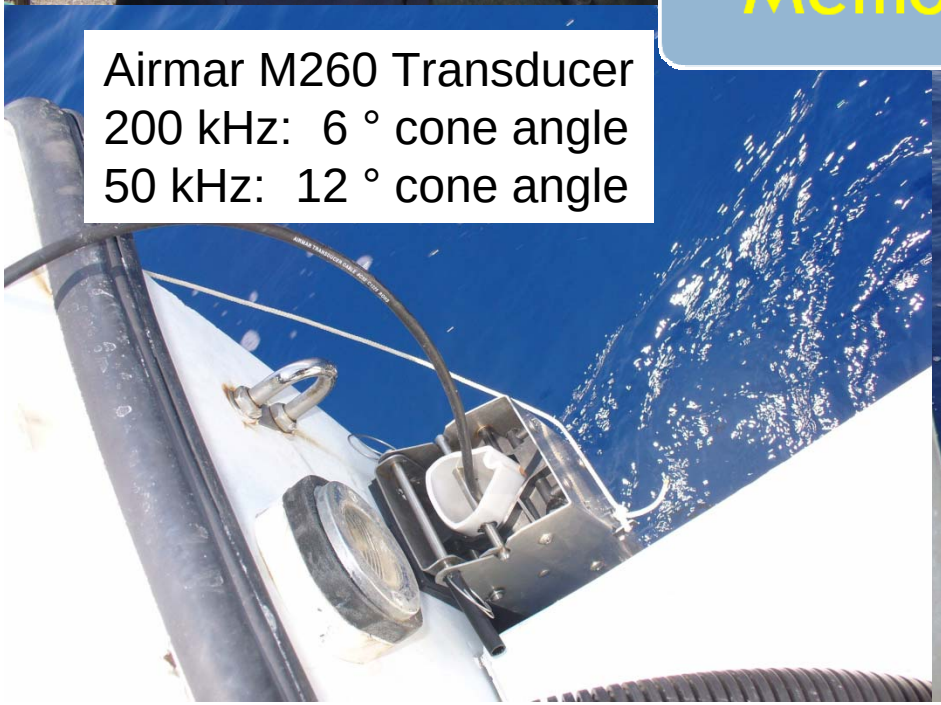
Distances toward SPAG sites

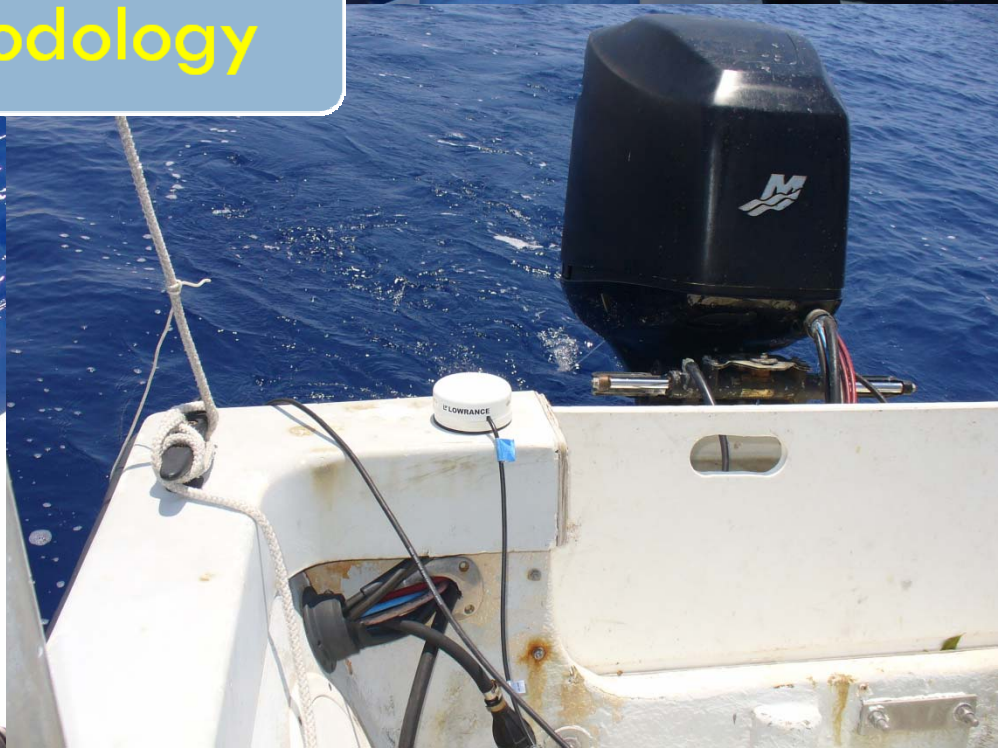



Spawning aggregation sites
Gladden spit
Half moon Caye

Methodology

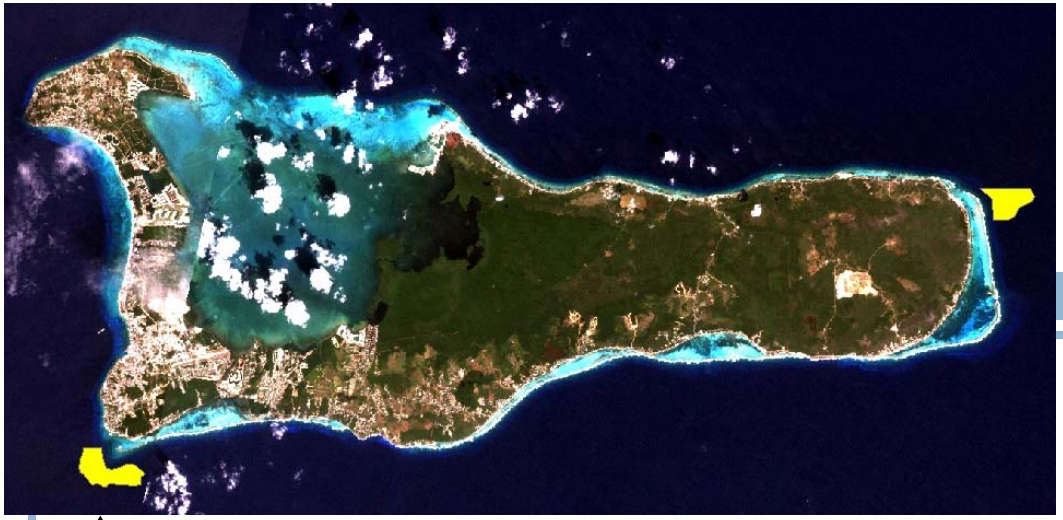
Airmar M260 Transducer
200 kHz: 6 ° cone angle
50 kHz: 12 ° cone angle





The Cayman Islands

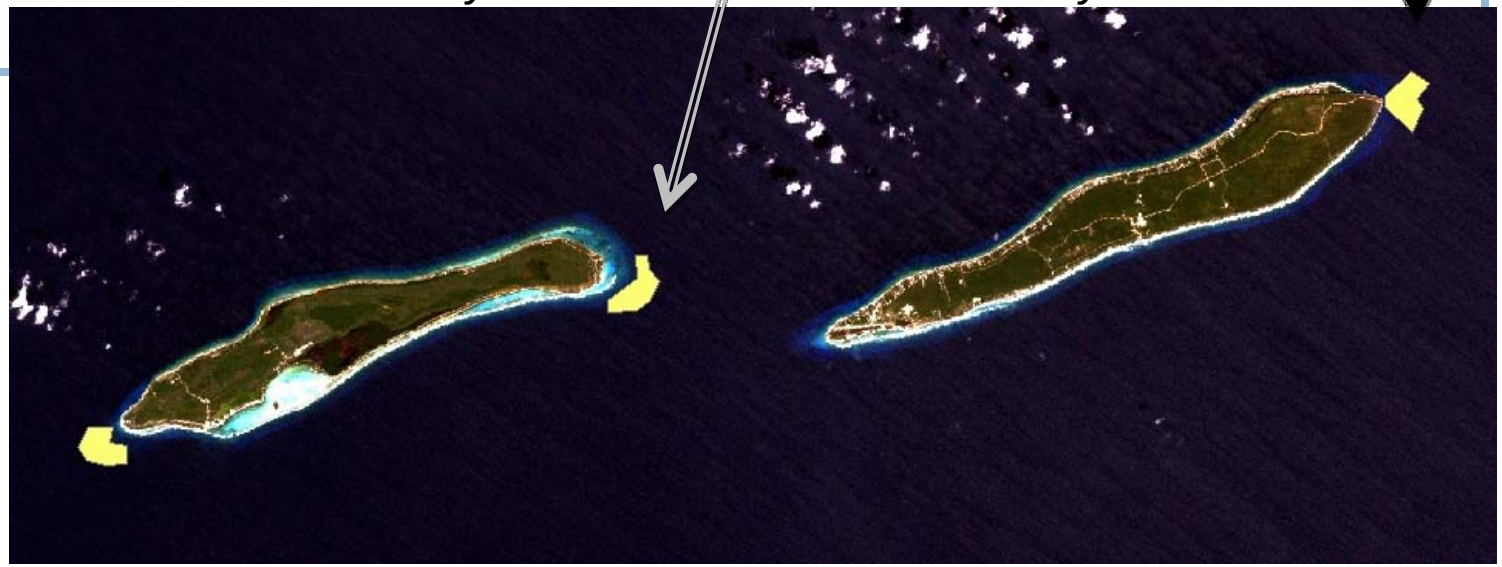
All groupers SPAG sites are currently protected

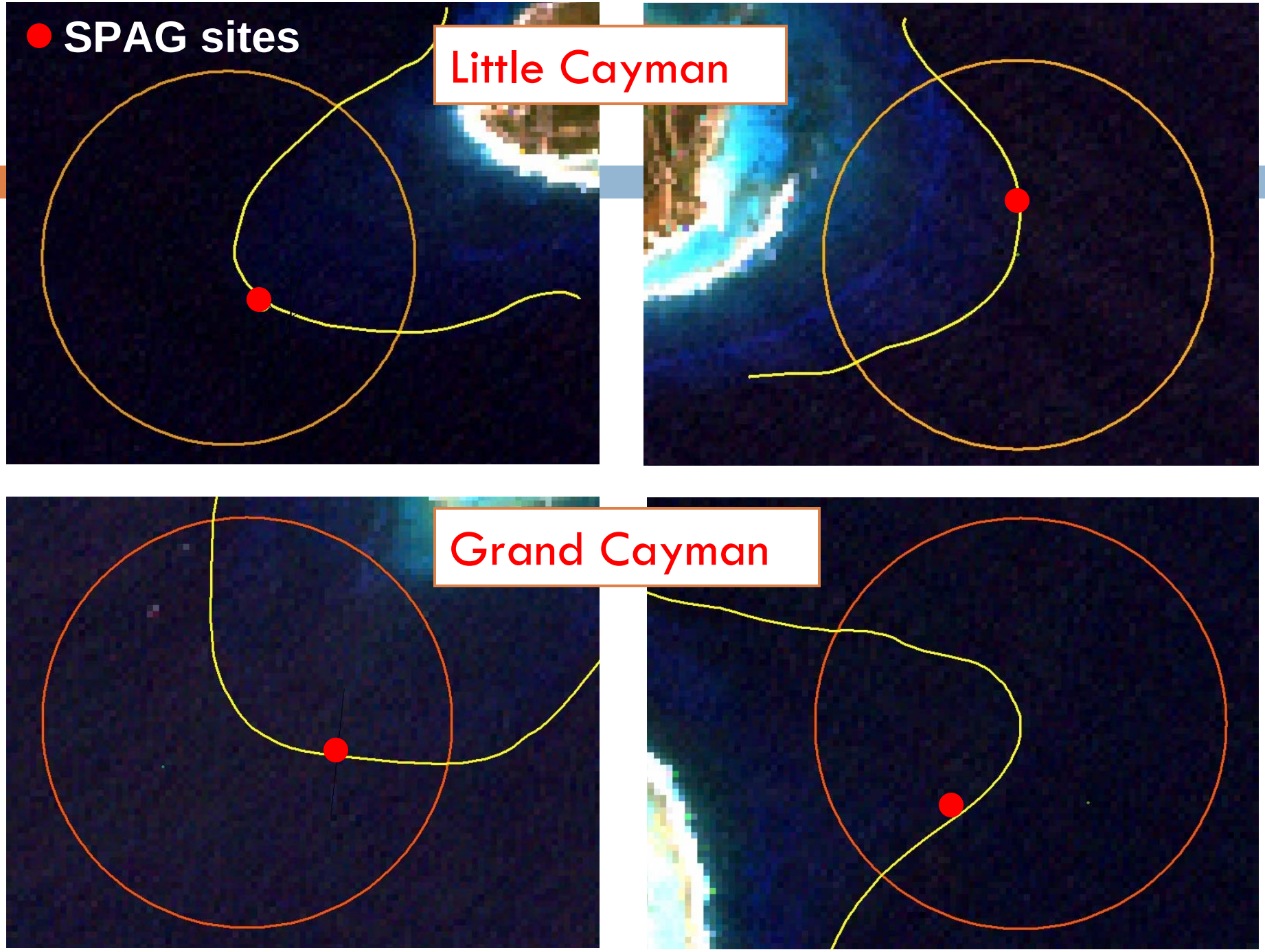


Grand Cayman

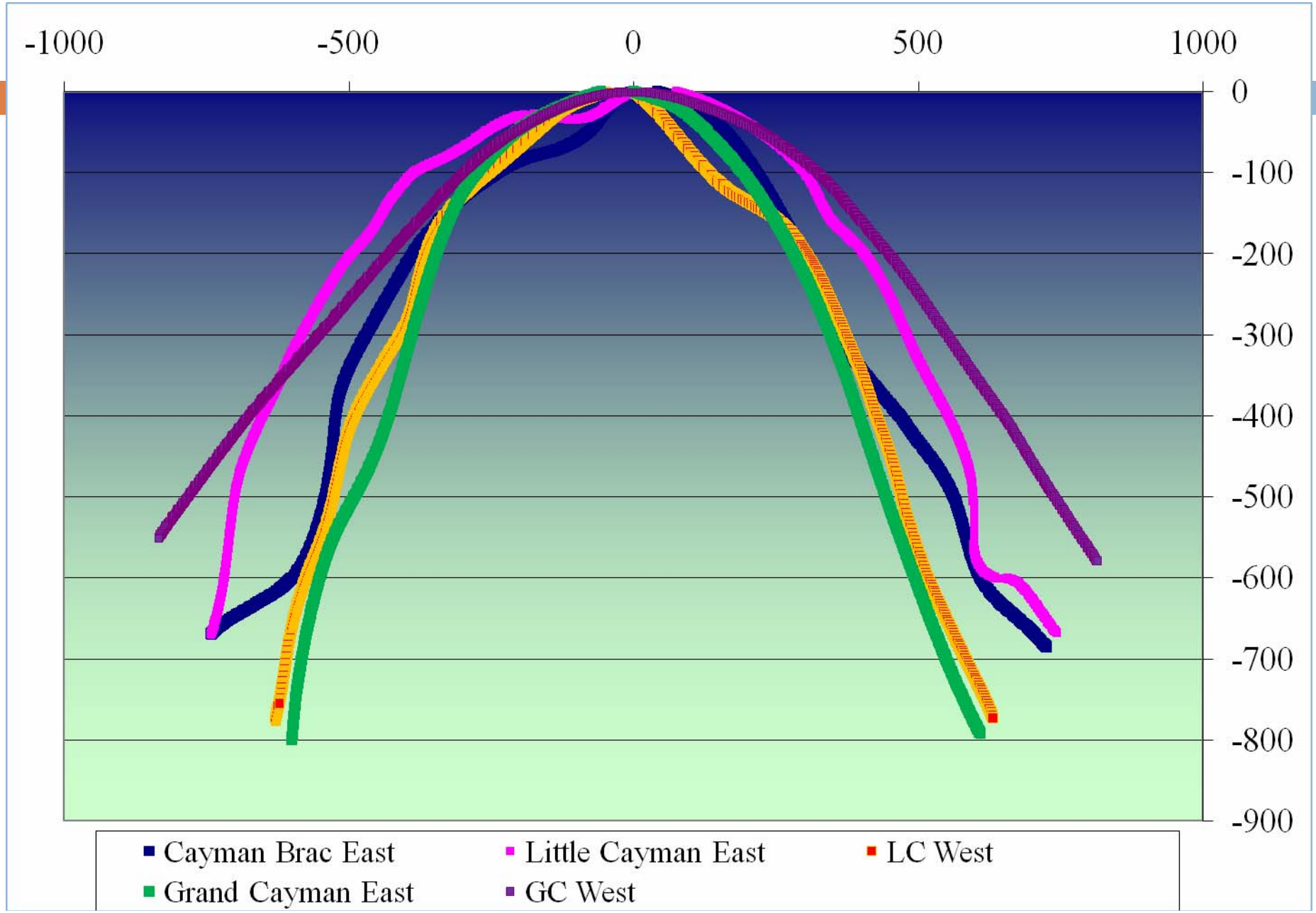
Little Cayman

Cayman Brac

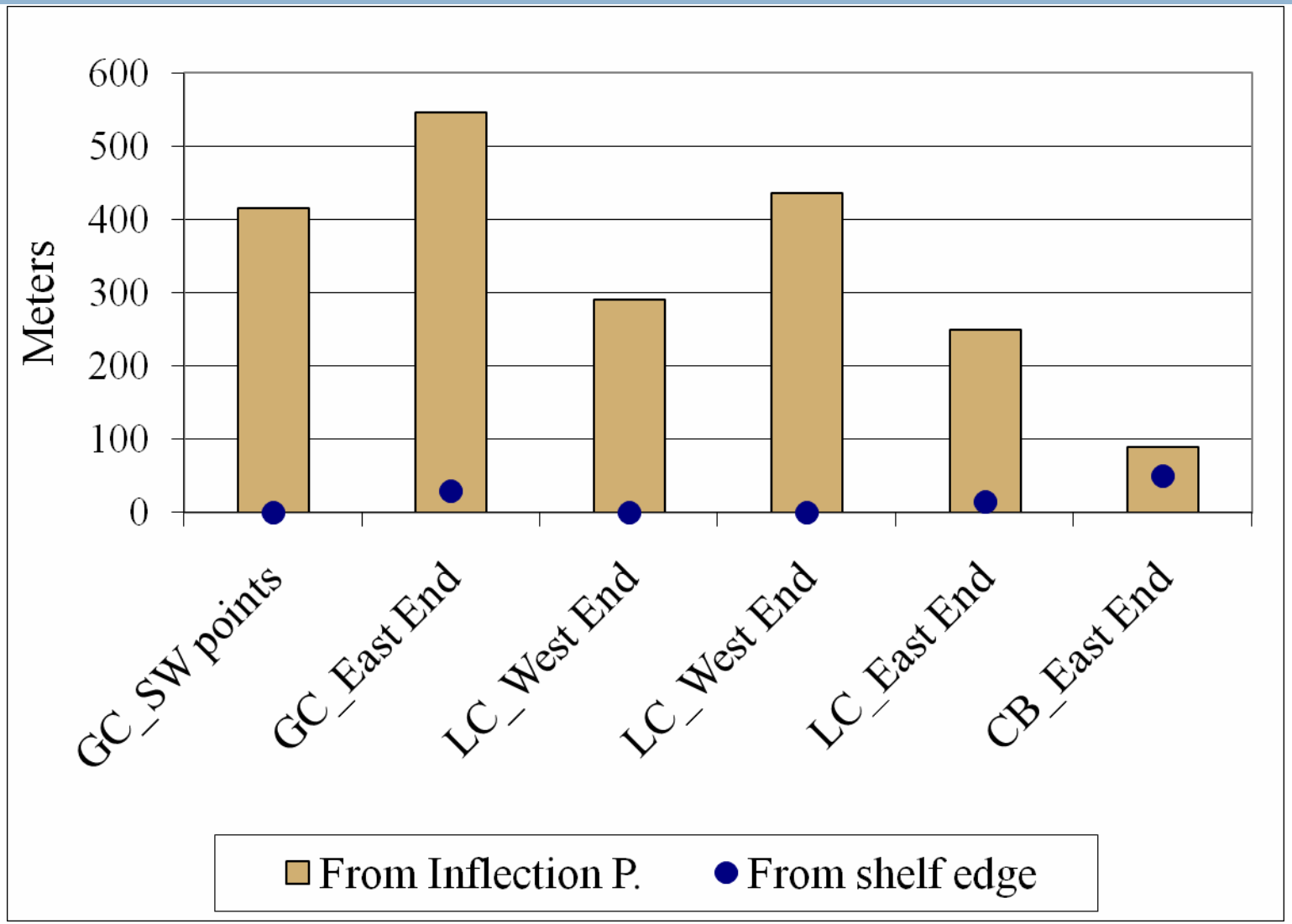



SPAG sites
Little Cayman
Grand Cayman

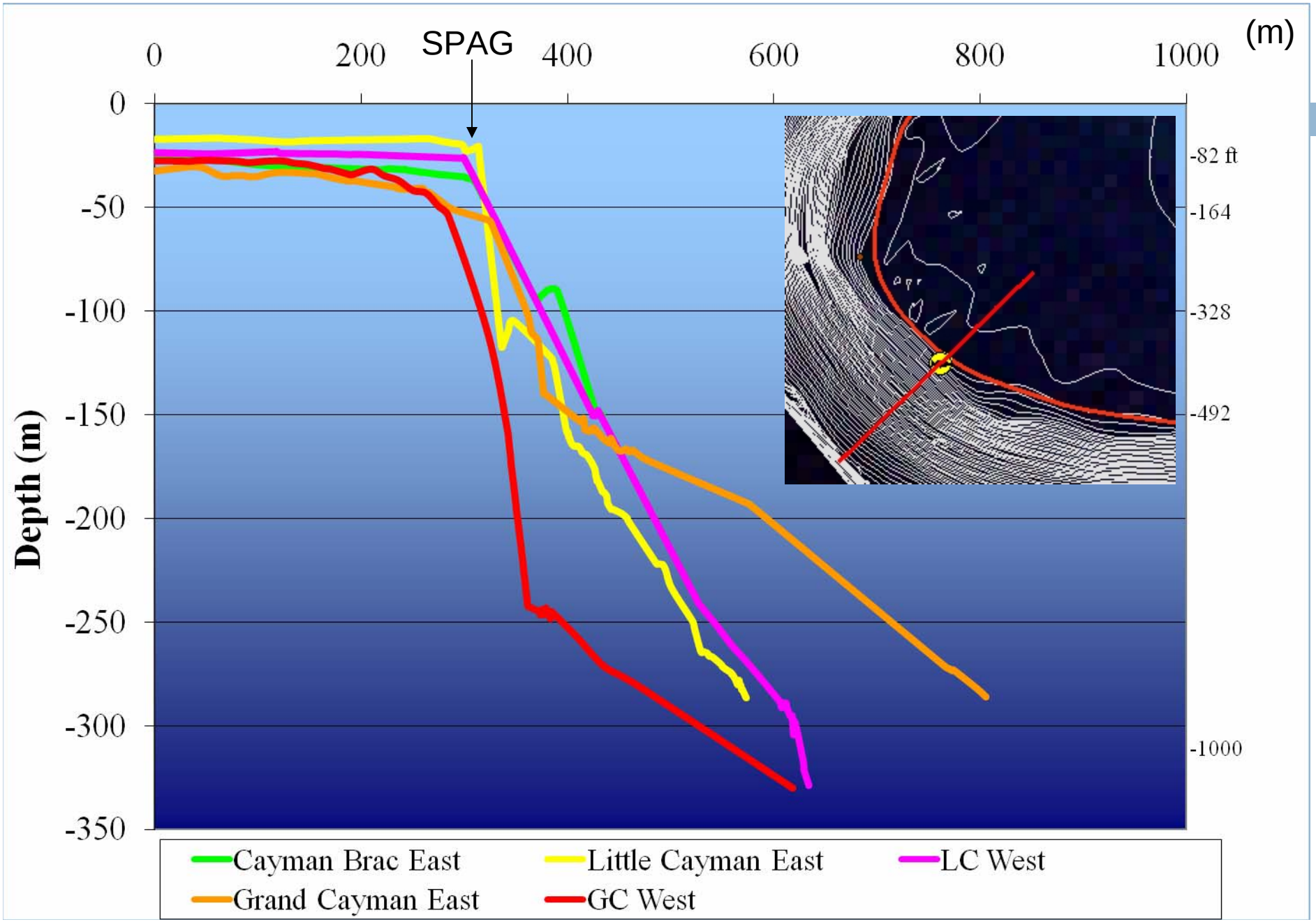
Horizontal curves of shelf-edges



Distances from SPAG sites



Vertical profiles at SPAG sites



Grand Cayman SPAG Sites

Summary

- All spawning aggregation sites in Belize & the Cayman Islands were located
  - within 120 m from the satellite-based shelf edges
  - and 550 m of turning points in the shelf break.

- With one exception (Rise and Fall Bank, Belize), all 14 Nassau grouper SPAG sites were located near inflection points of convex-shaped seaward extending reefs.

Summary

- All Nassau grouper SPAG sites in the Cayman Islands were located on the steep drop offs.

Geomorphometric conditions of SPAG sites in Cayman

- Bottom depth at SPAG sites is 25–45m (80–150 ft)
- Convex-shape (reef promontory)
- Steep drop-off
- Proximity to deep water

Next step

- **Is there any place that has similar Geomorphometric feature in the Cayman Islands?**
  - **YES.** → the west end of the Cayman Brac
    - Spawning aggregation is not confirmed yet.
    - But the department of the environment has already designed the designated area for no fishing for Nassau groupers in 2003 and during every alternate year after and only line fishing is permitted in open season by Caymanians.

Acknowledgment

- Department of Environment, the Cayman Islands
- Department of Fisheries, Belize

- Thank you
- Questions?