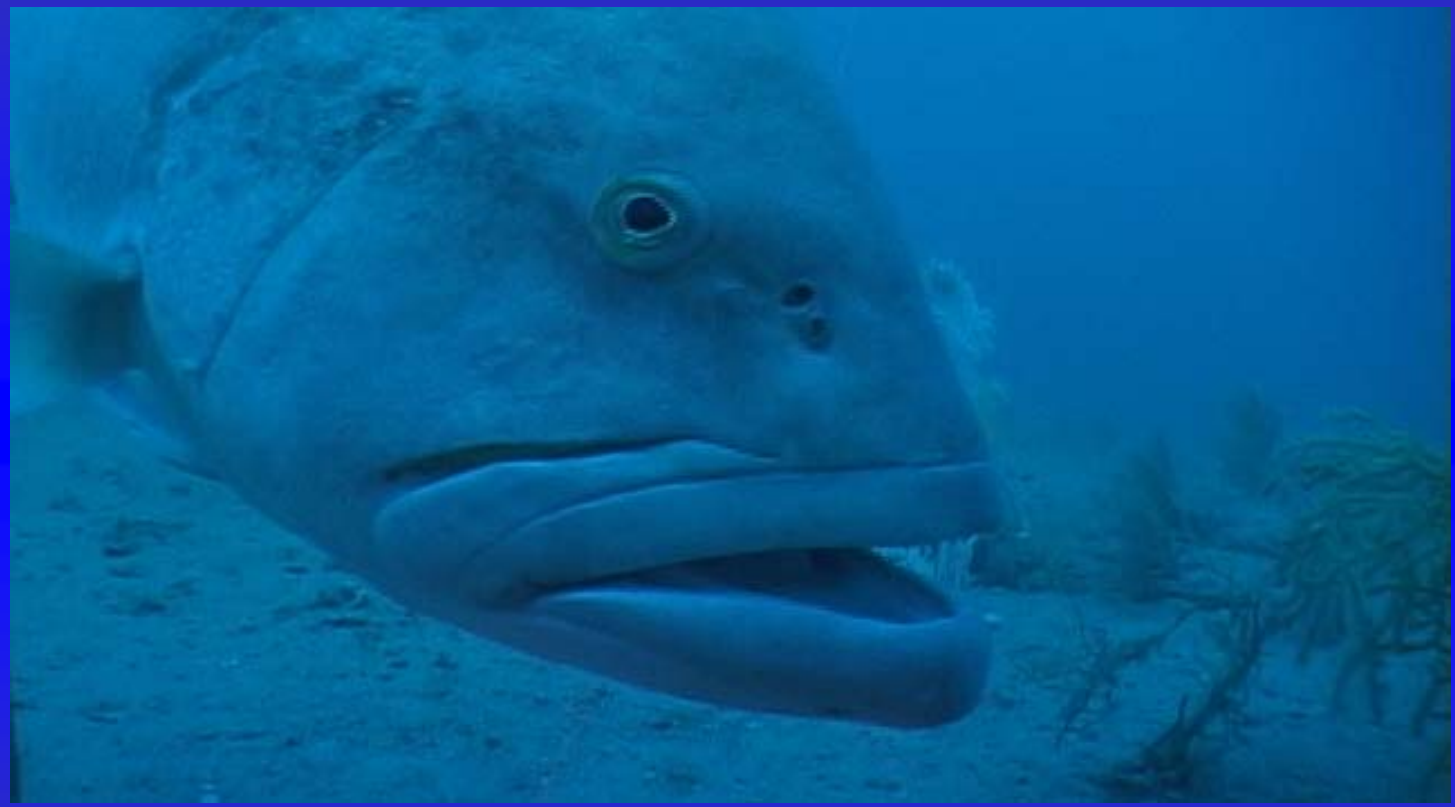
Northeast Gulf of Mexico
MARINE RESERVE PROGRAM



Principal Investigators:

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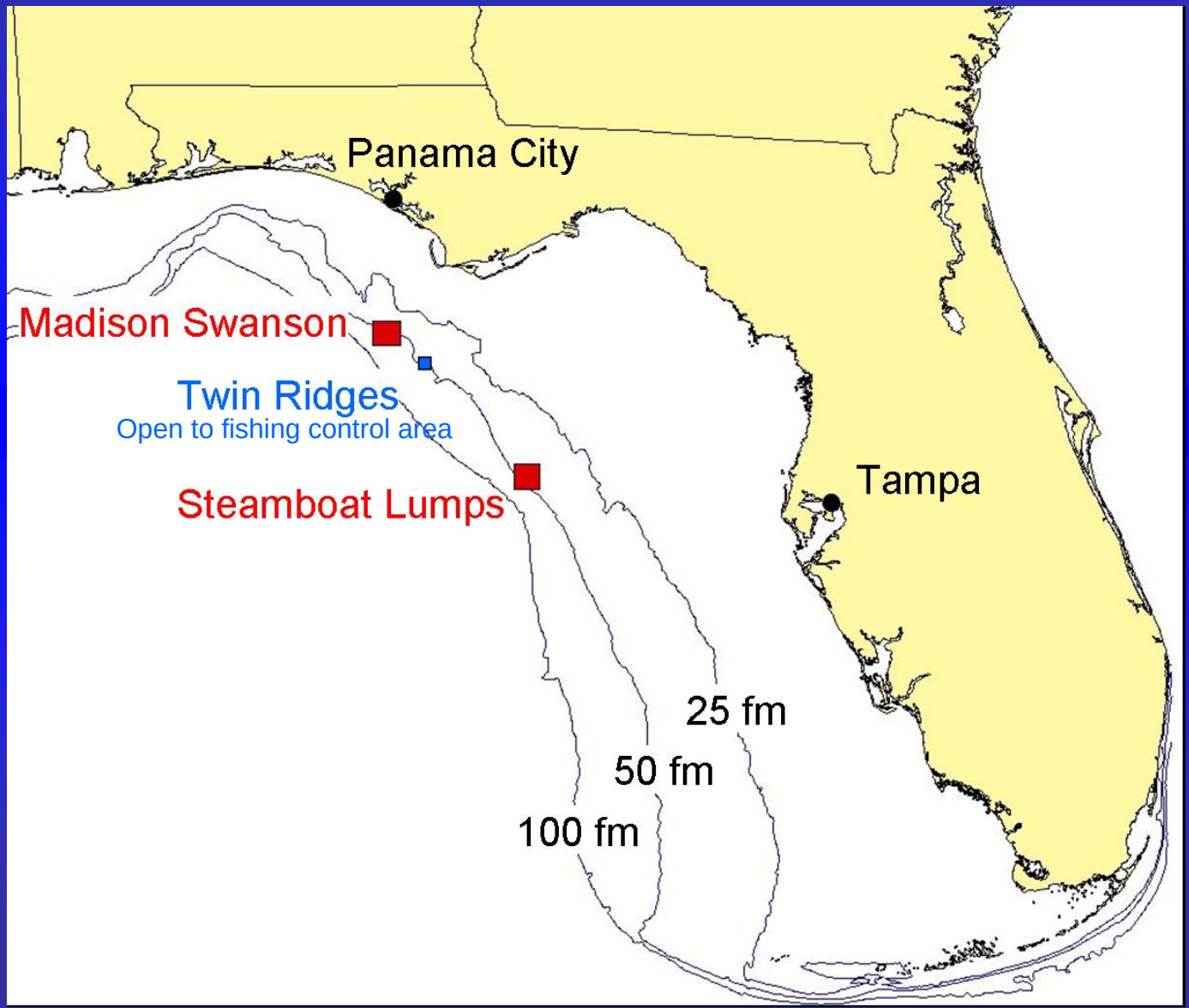
Pascagoula Laboratory

Andrew W. David
Panama City Laboratory

Madison-Swanson and Steamboat Lumps



RATIONALE

The marine reserves were designed to protect gag spawning aggregations and provide locations to assess the efficacy of marine reserves to protect (spawning) aggregations.

From: Gulf of Mexico Gag Grouper, SEDAR 10, 2006

OBJECTIVES

- Establish baseline estimates of fish abundance, especially for species of groupers and snappers.
- Describe significant habitat features in the Madison-Swanson and Steamboat Lumps MPAs.
- Analyze the relationship between habitat and species assemblages.
- Track changes in fish abundance and distribution within the MPAs during the closure period.

METHODS

- Stratify areas using multibeam bathymetry and acoustic backscatter imagery.
- Randomly select sites within each stratum (5 strata in Madison-Swanson, 5 in Steamboat Lumps).
- Conduct annual video surveys with seasonal uniformity to assess habitat and fish assemblages.
- Compare MPAs with adjacent open-to-fishing area as well as Gulf-wide SEAMAP survey.

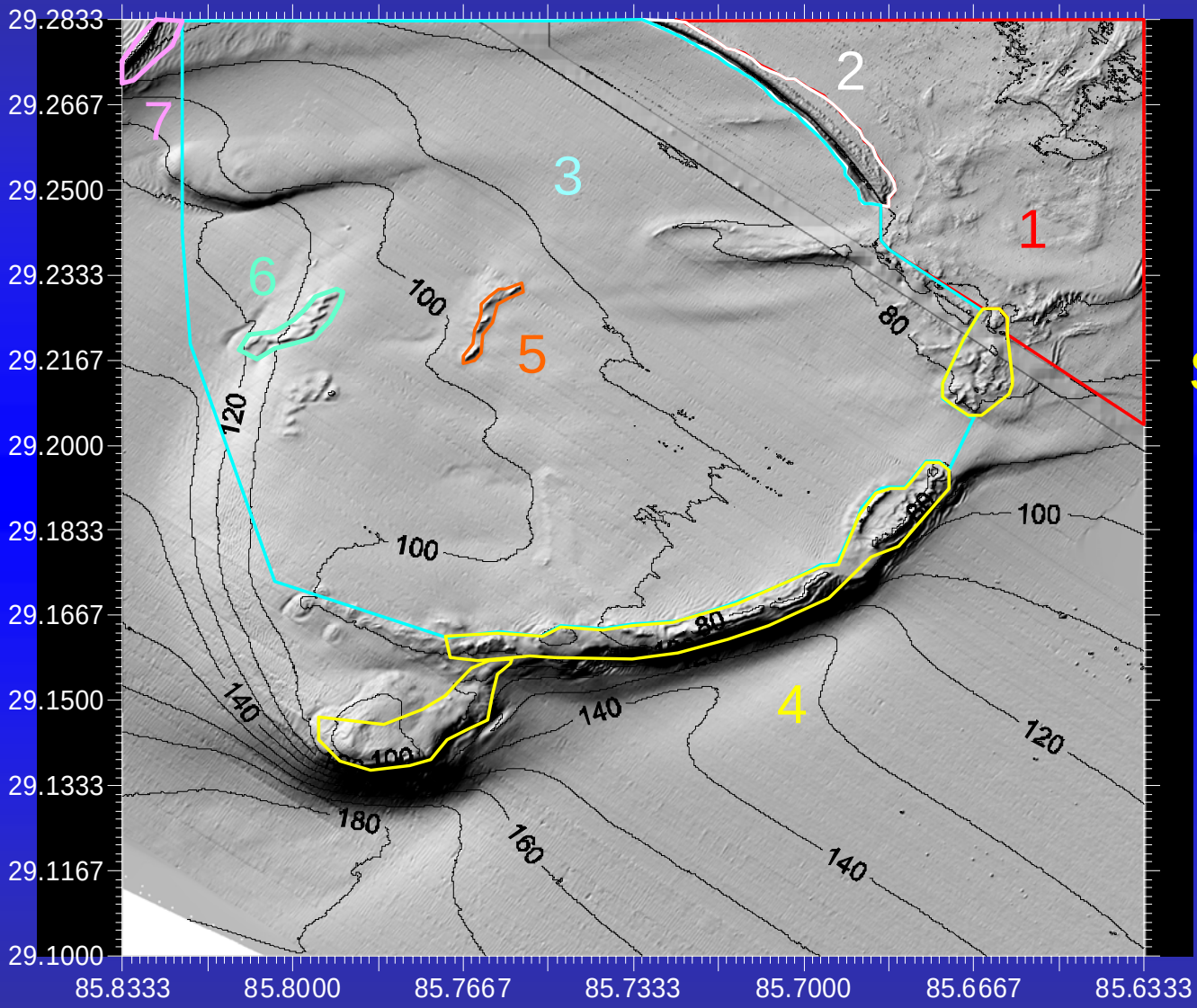
Camera Array

Four digital video cameras, 20 min of imagery analyzed

TAPE READING METHODS

- One camera randomly selected for tape reading. Views occluded by habitat or out of focus are excluded from random selection.
- 20 minute segment of imagery is read and all fish identified to lowest possible taxonomic level.
- Abundance values derived from maximum number of each species visible simultaneously.
- Habitat quantity (within ten classes) also determined.

Site Stratification within Madison-Swanson

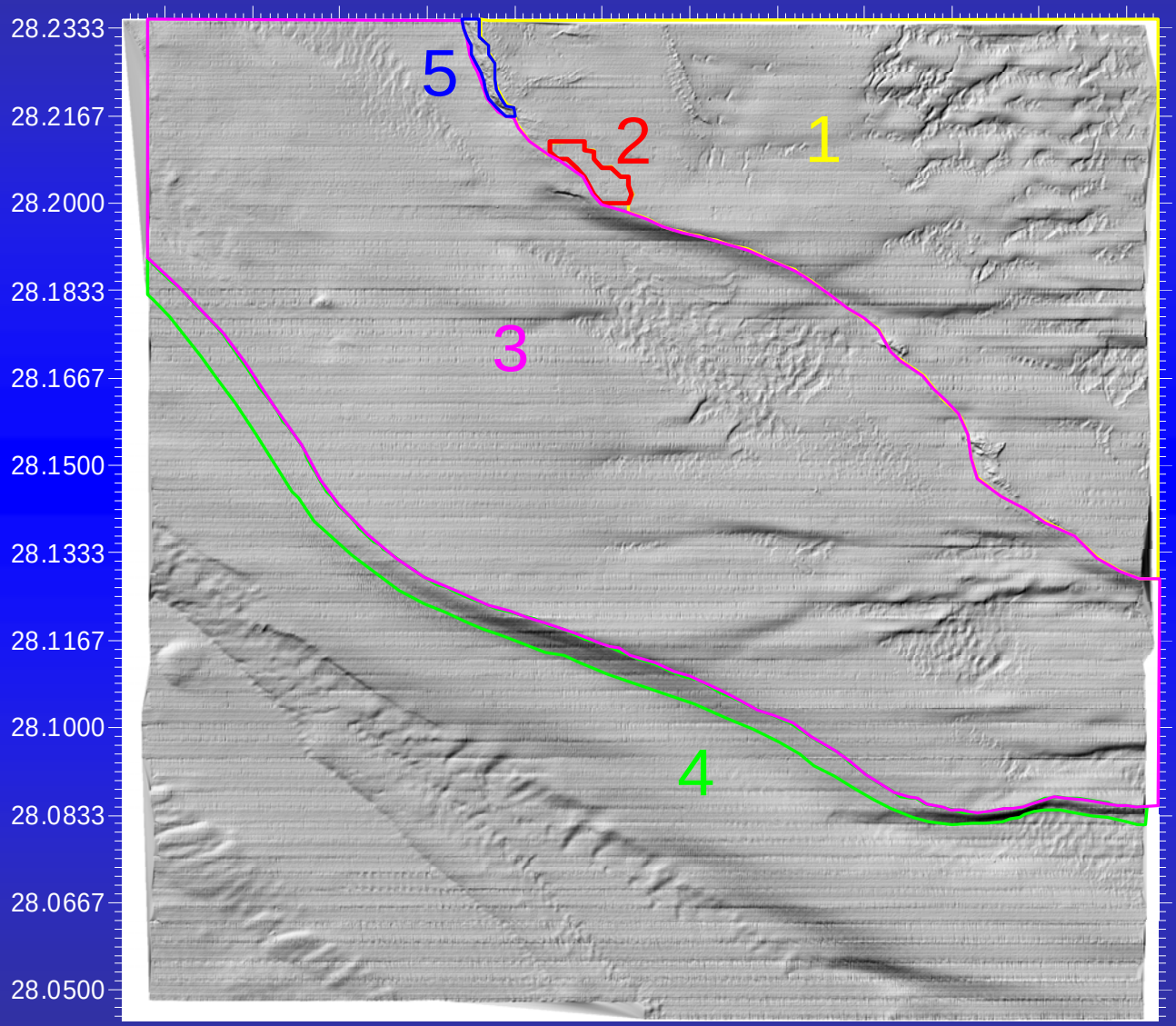


Total Area
394 km^2

Surveyed Area
266 km^2

Gag Habitat
59 km^2

Site Stratification within Steamboat Lumps MPA



North Latitude

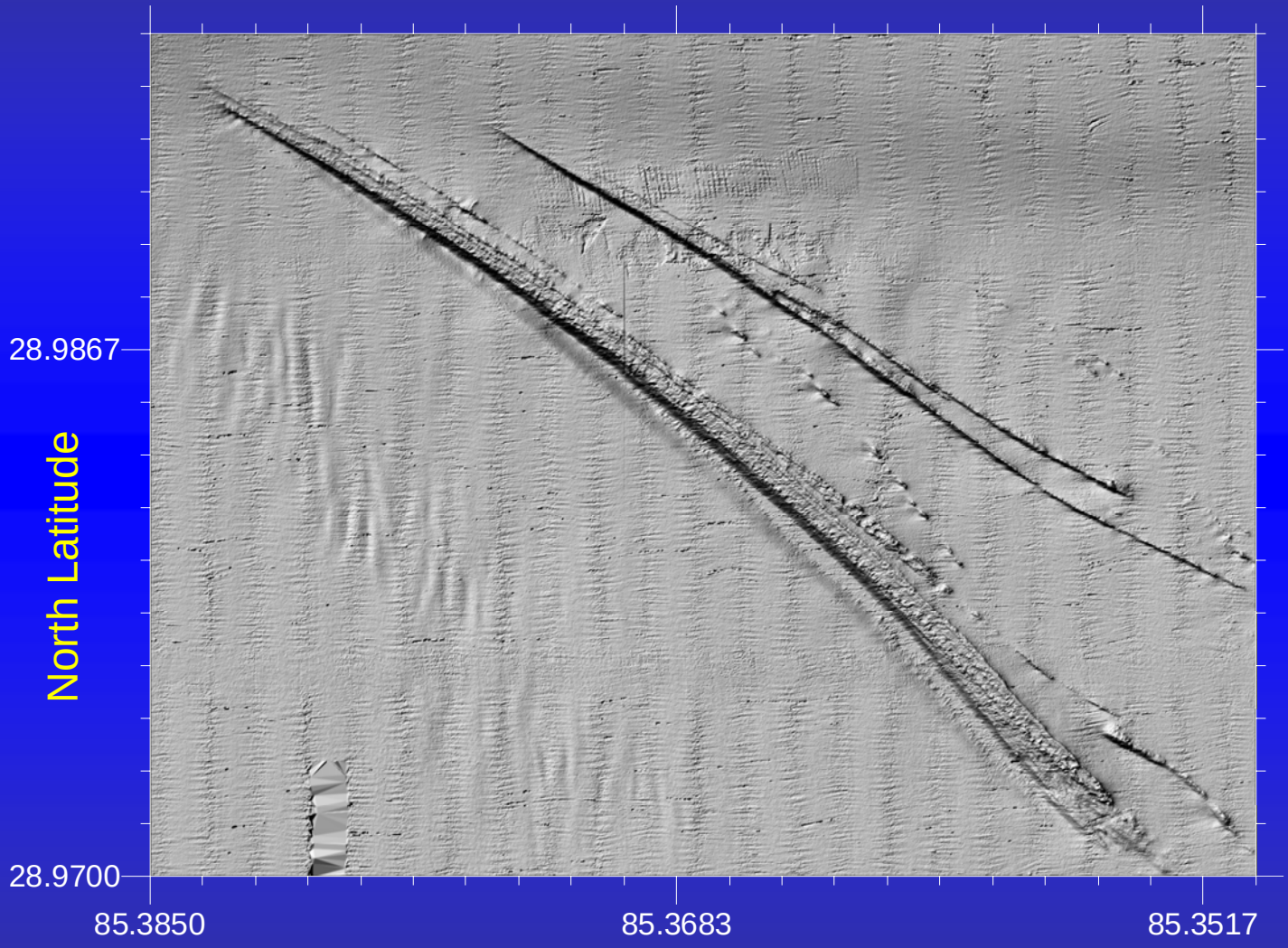
West Longitude

Total Area
356 km^2

Surveyed Area
216 km^2

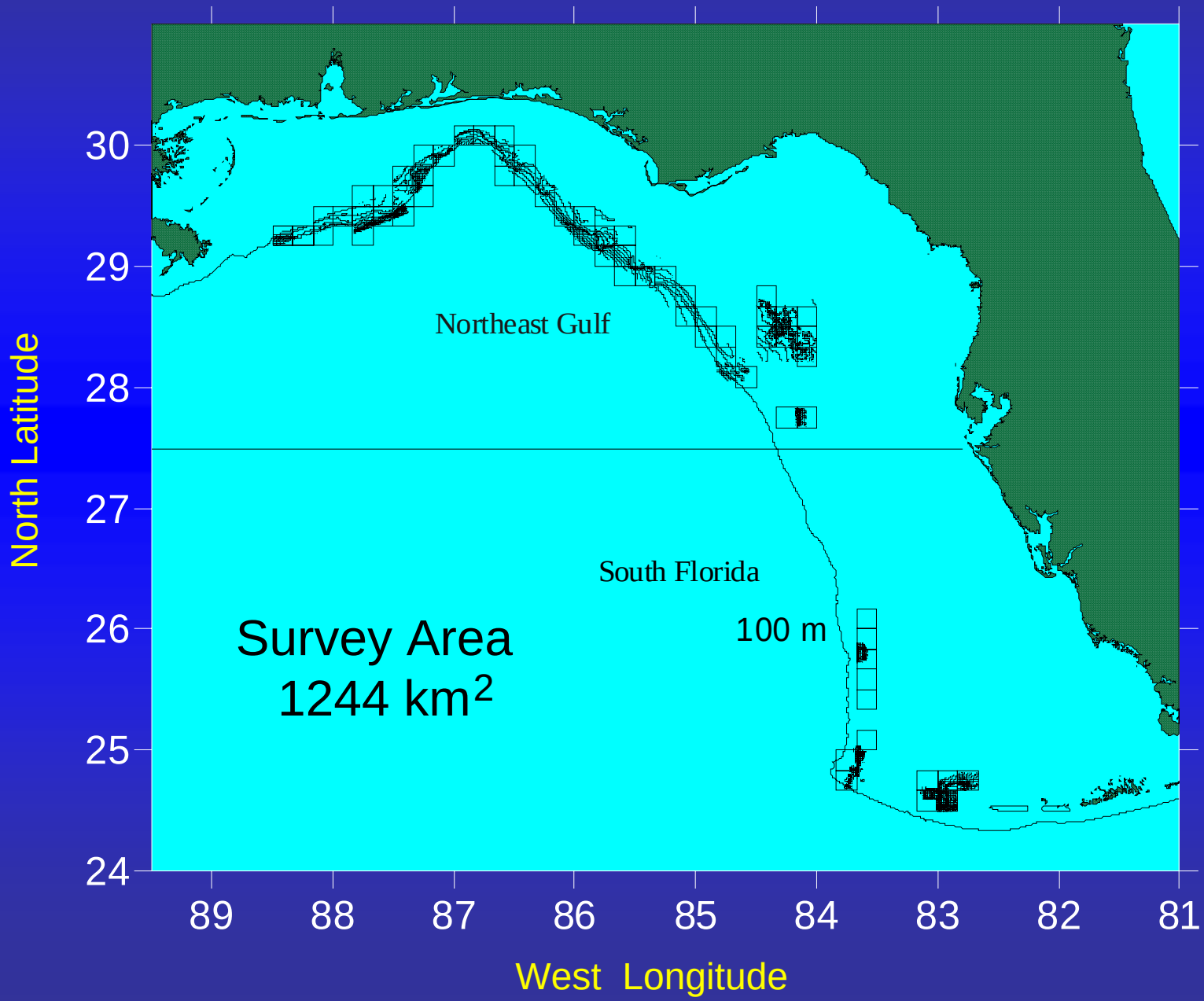
Gag Habitat
2 km^2

Twin Ridges Control Area

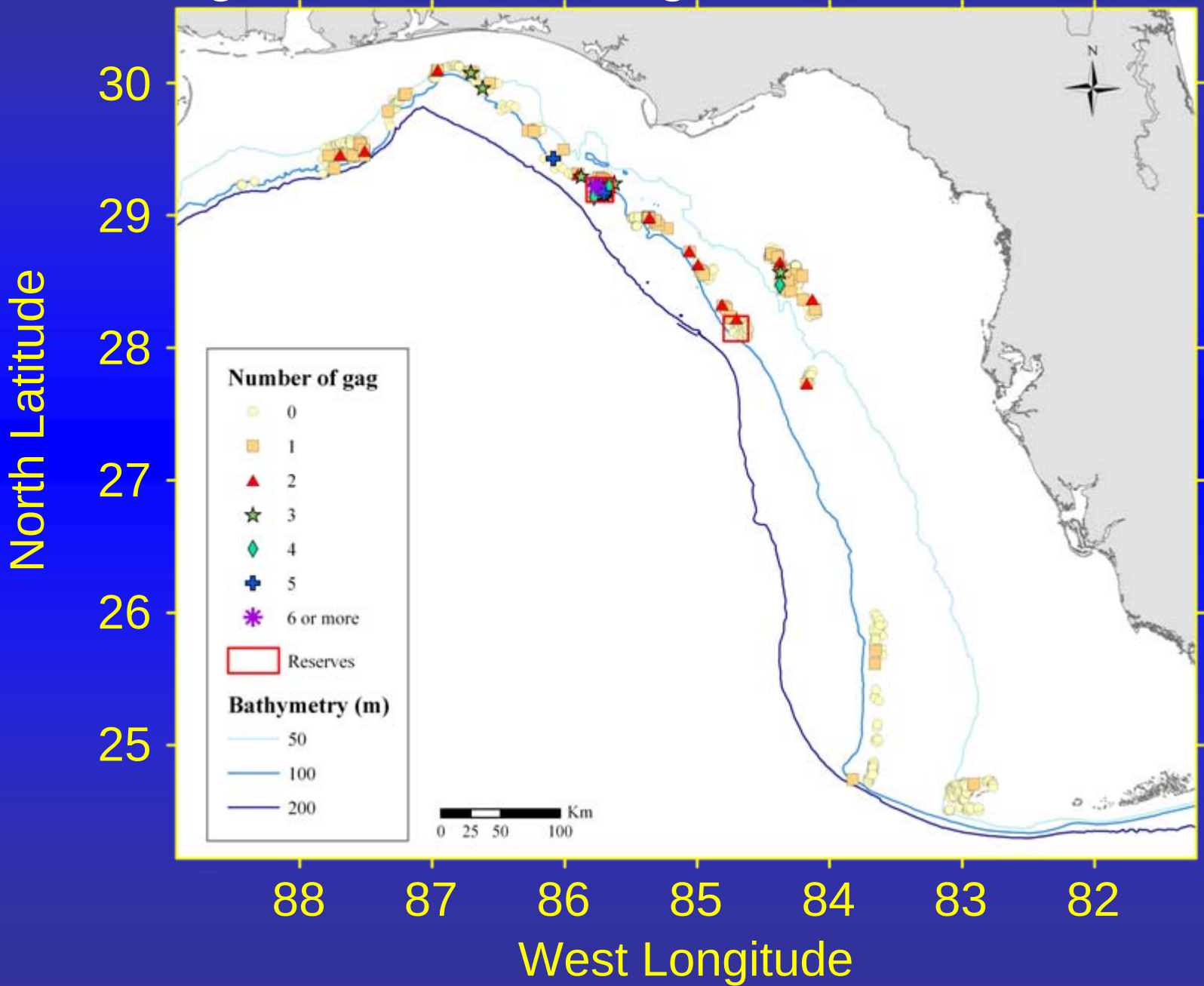


Gag Habitat
5 km^2

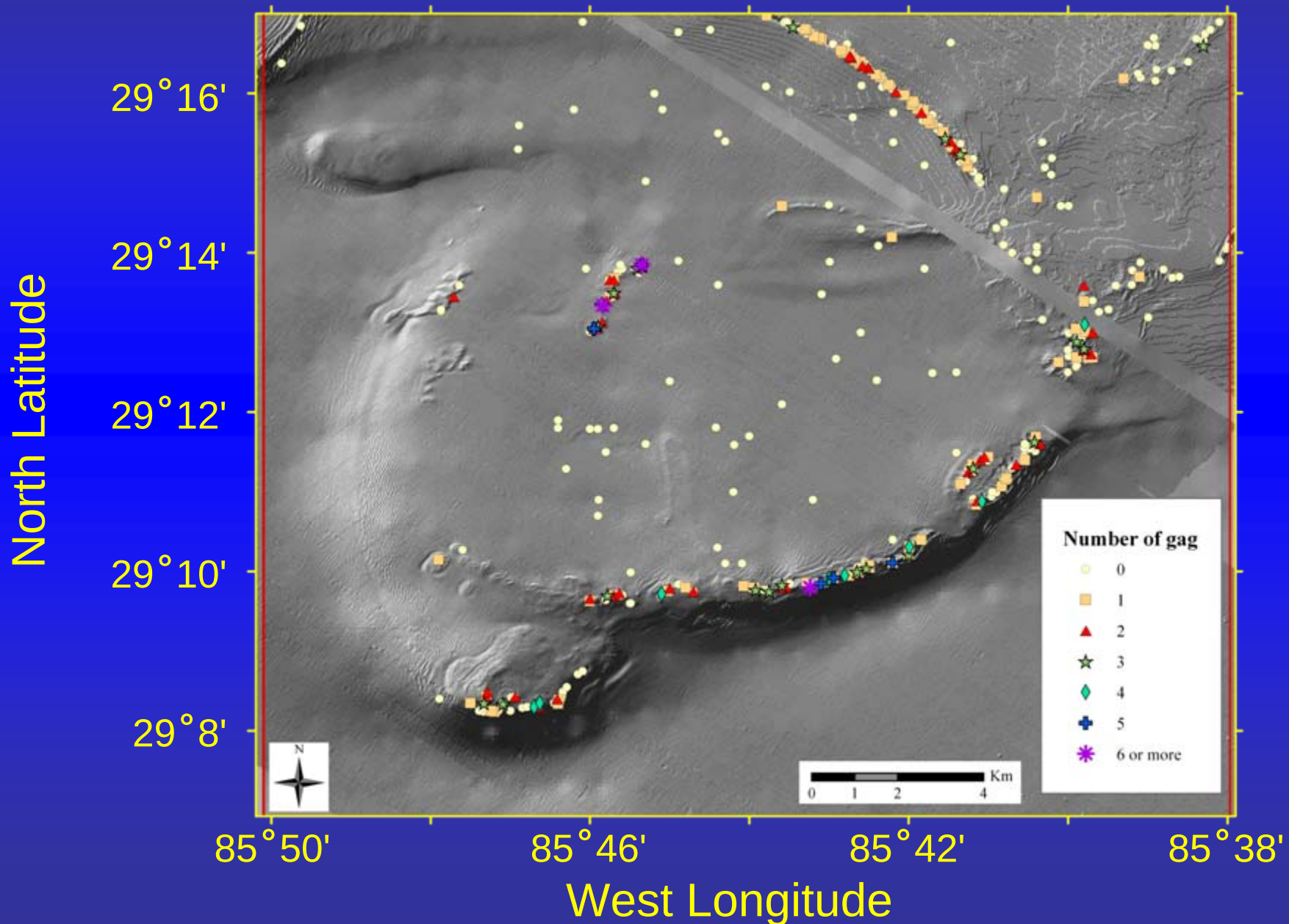
Eastern GOM SEAMAP sampling blocks



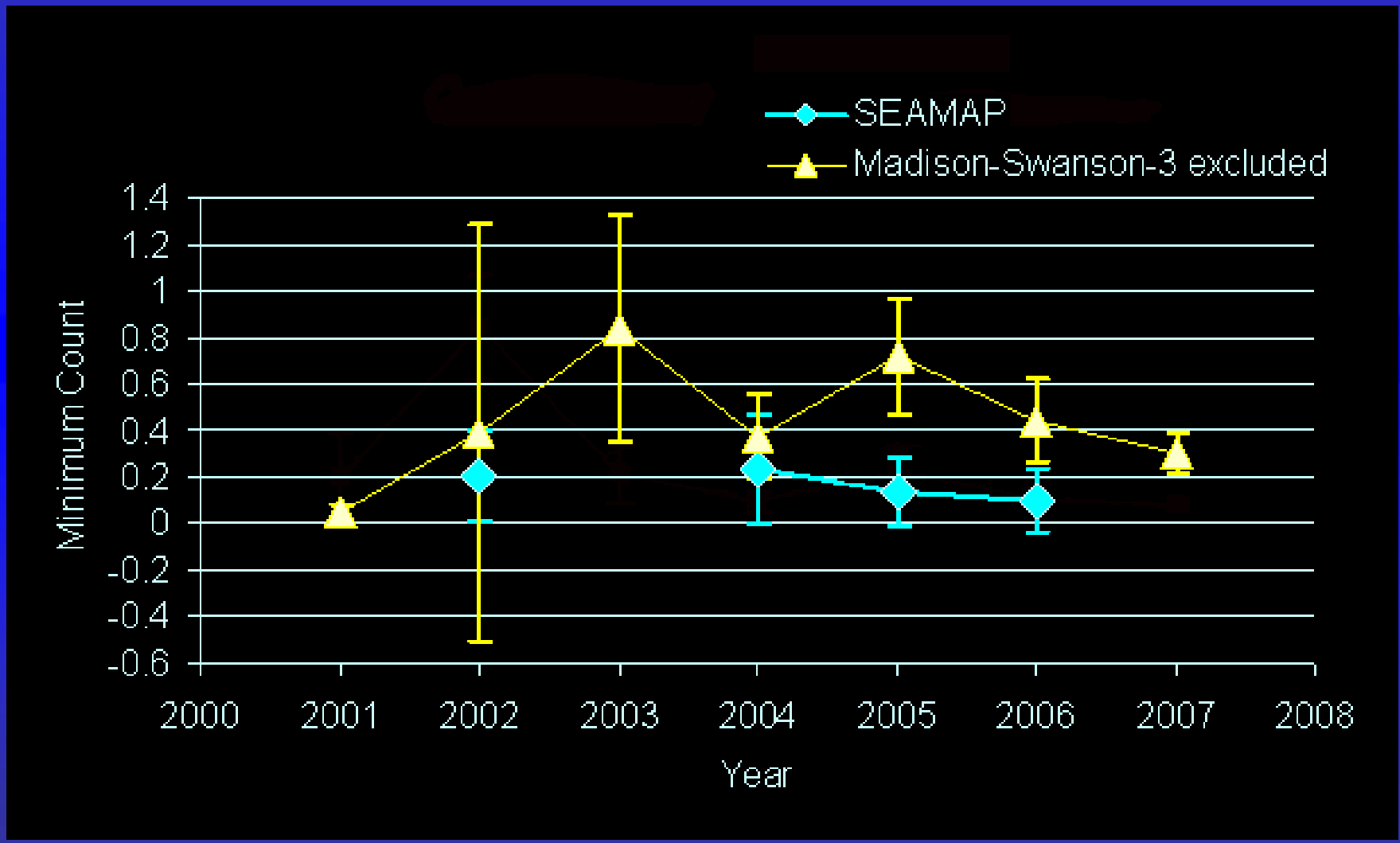
Gag Distribution along the west Florida shelf



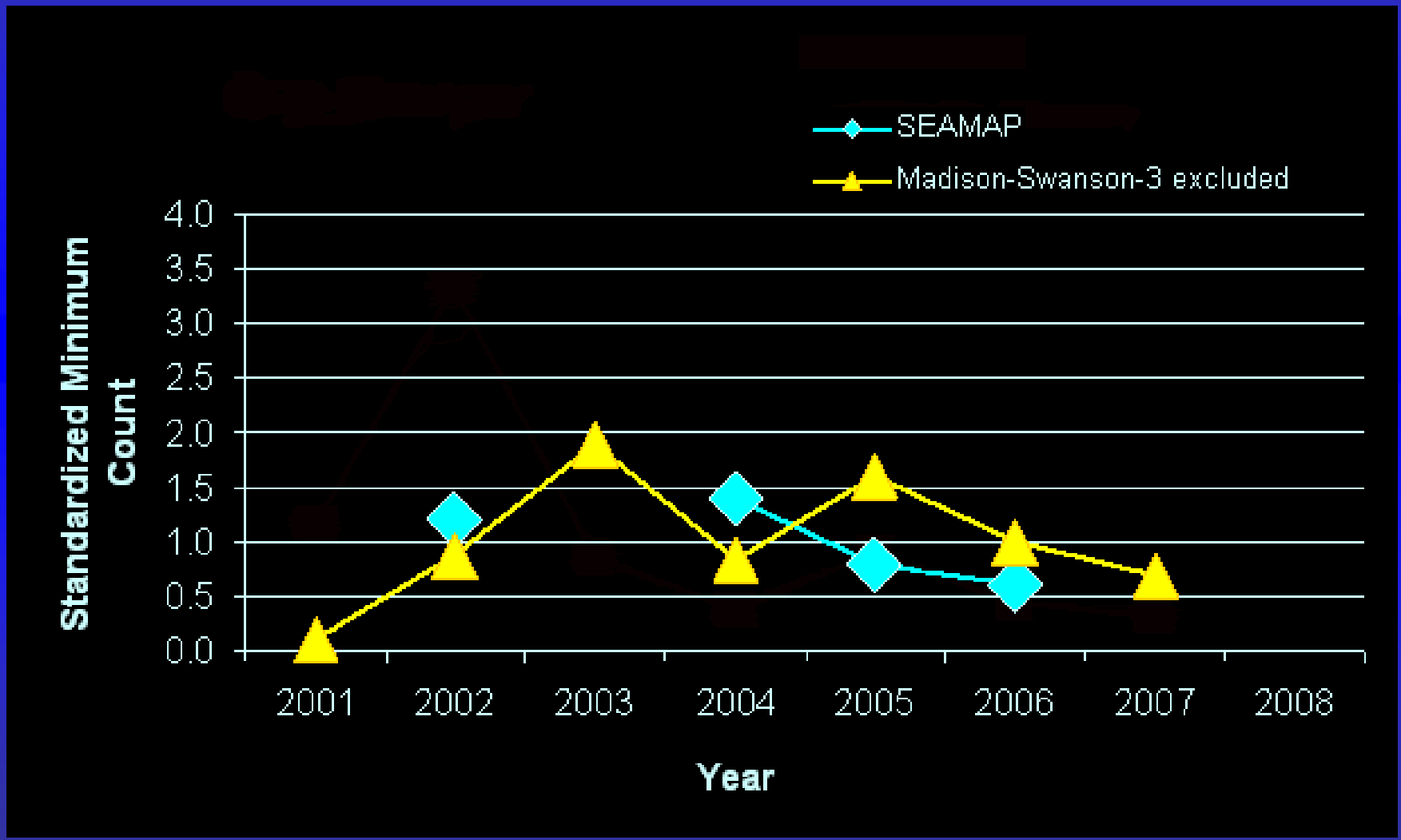
Gag Distribution within Madison-Swanson



GAG


SEAMAP
Madison-Swanson-3 excluded
Minimum Count
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

GAG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Madison-Swanson-3 excluded
Standardized Minimum Count
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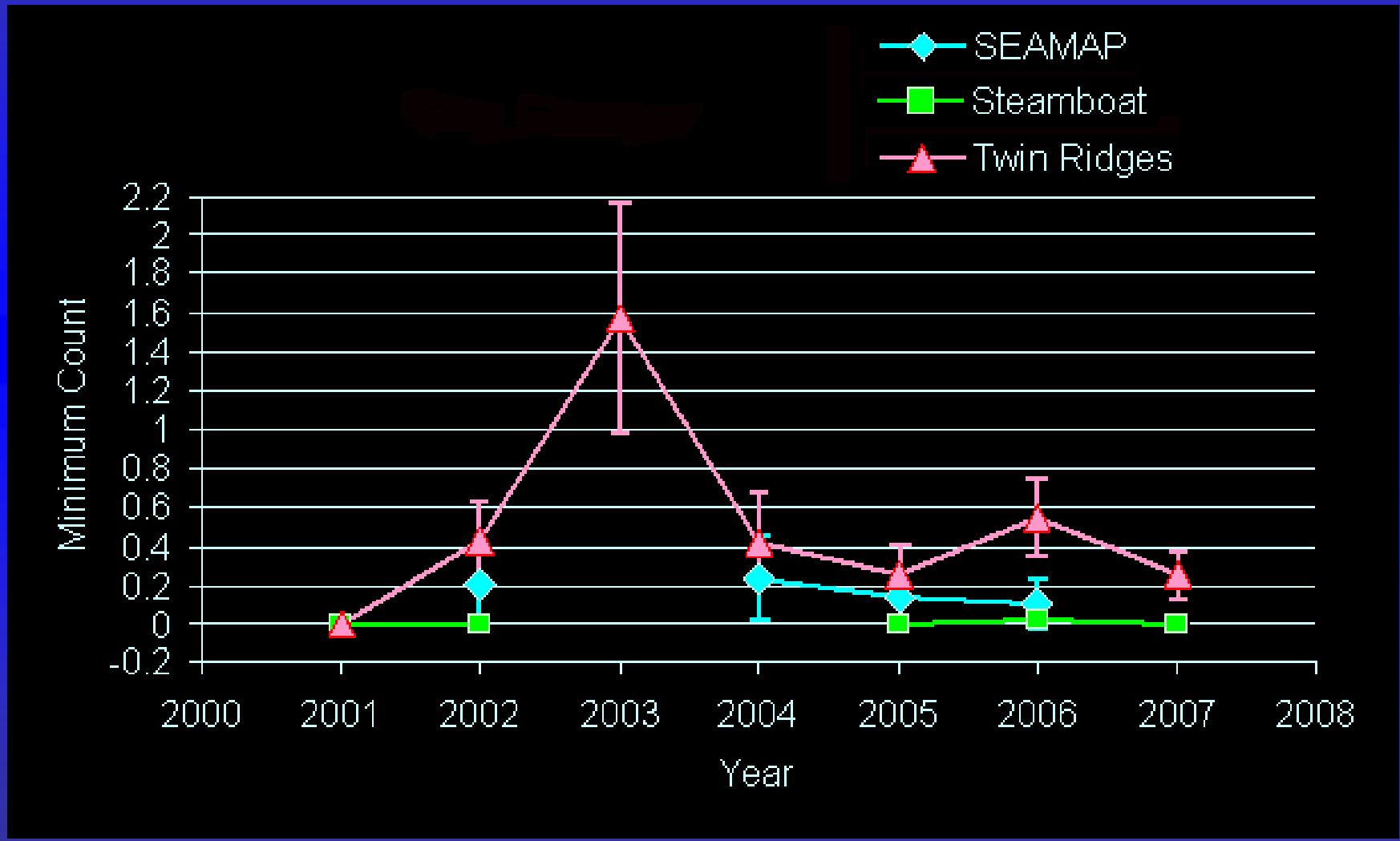
2001
2002
2003
2004
2005
2006
2007
2008
Year

GAG


SEAMAP
Steamboat
Twin Ridges
Minimum Count
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1.8
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1.4
1.2
1
0.8
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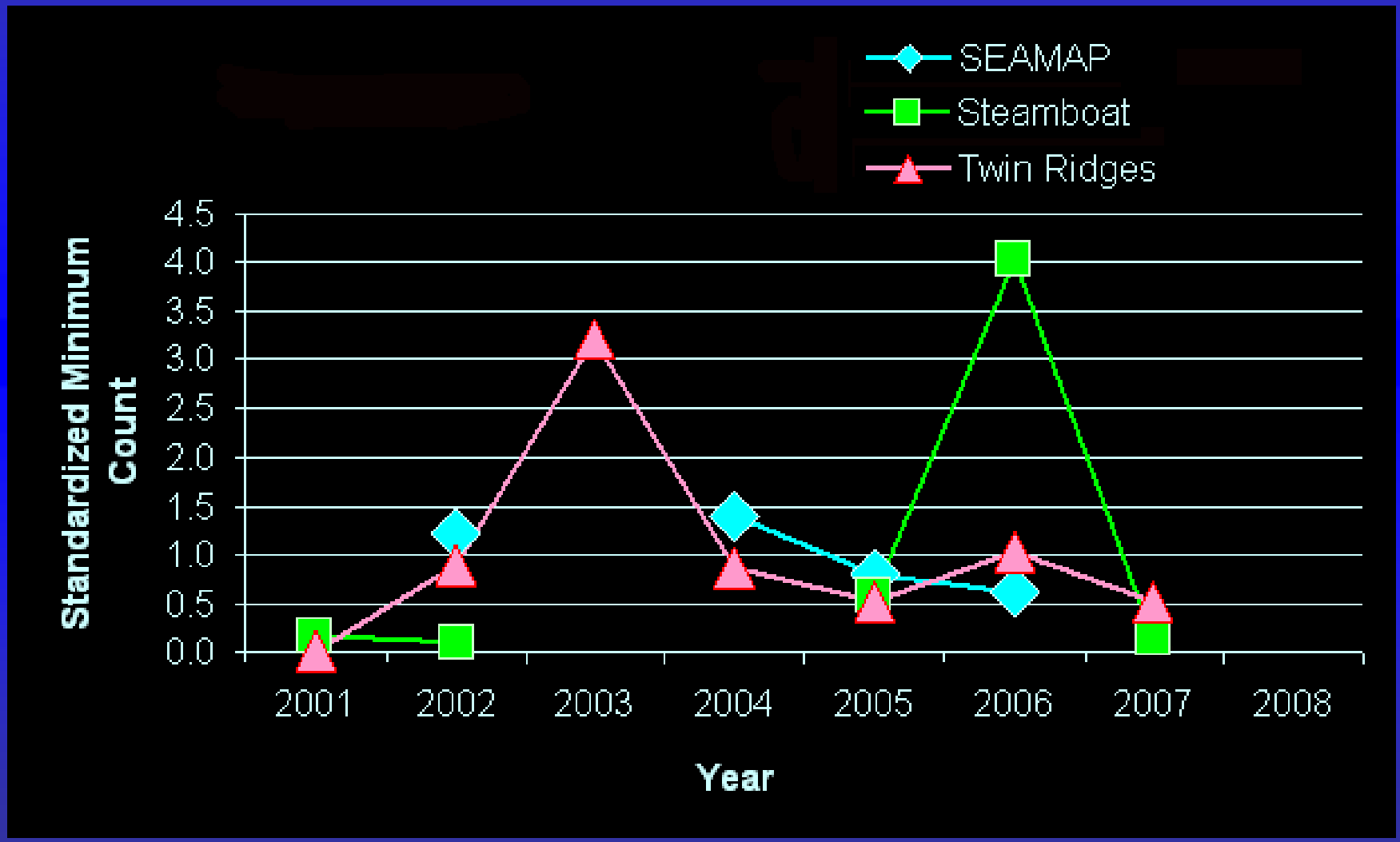
2001
2002
2003
2004
2005
2006
2007
2008
Year

GAG


SEAMAP
Steamboat
Twin Ridges
Standardized Minimum Count
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3.5
3.0
2.5
2.0
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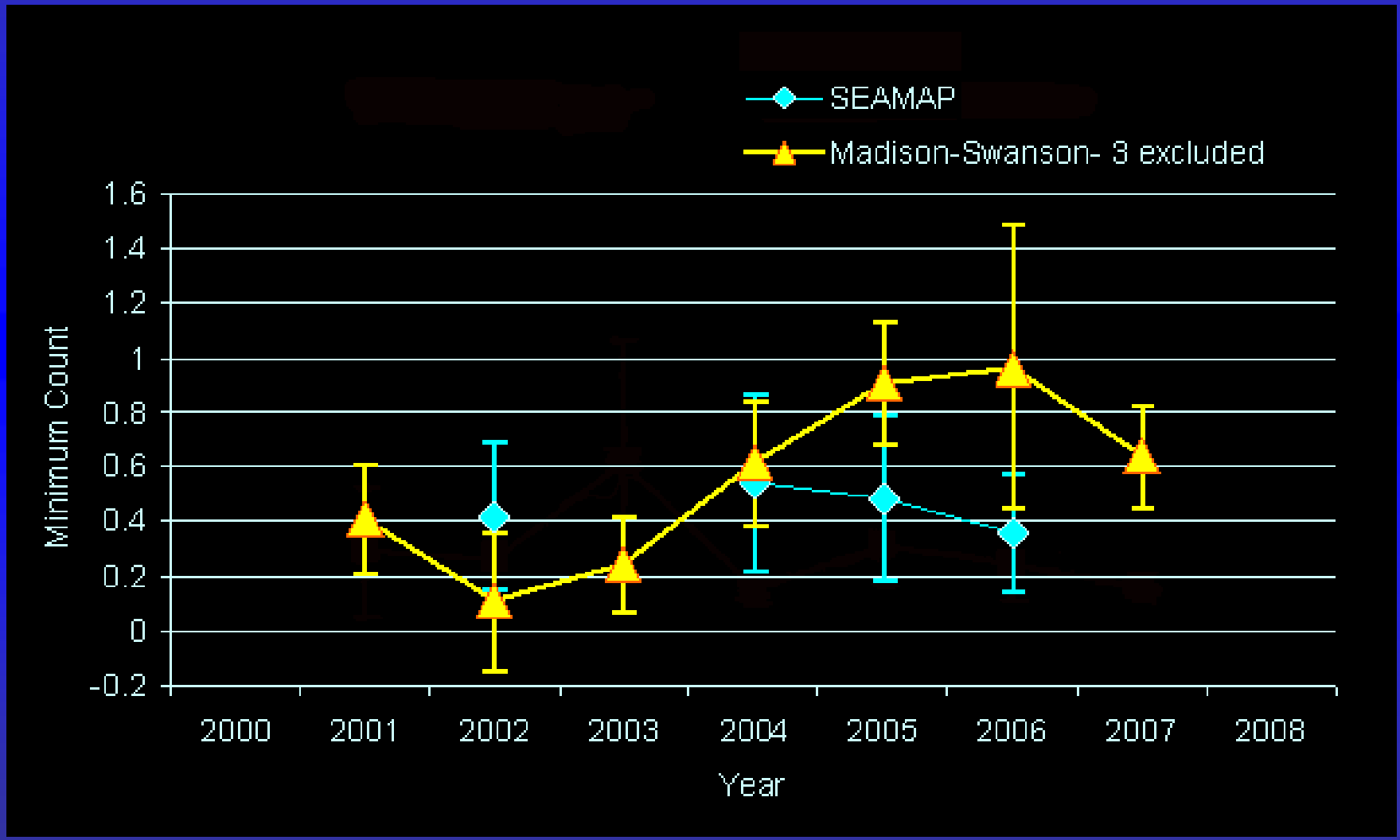
1.0
0.5
0.0
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED GROUPER


SEAMAP
Madison-Swanson- 3 excluded
Minimum Count
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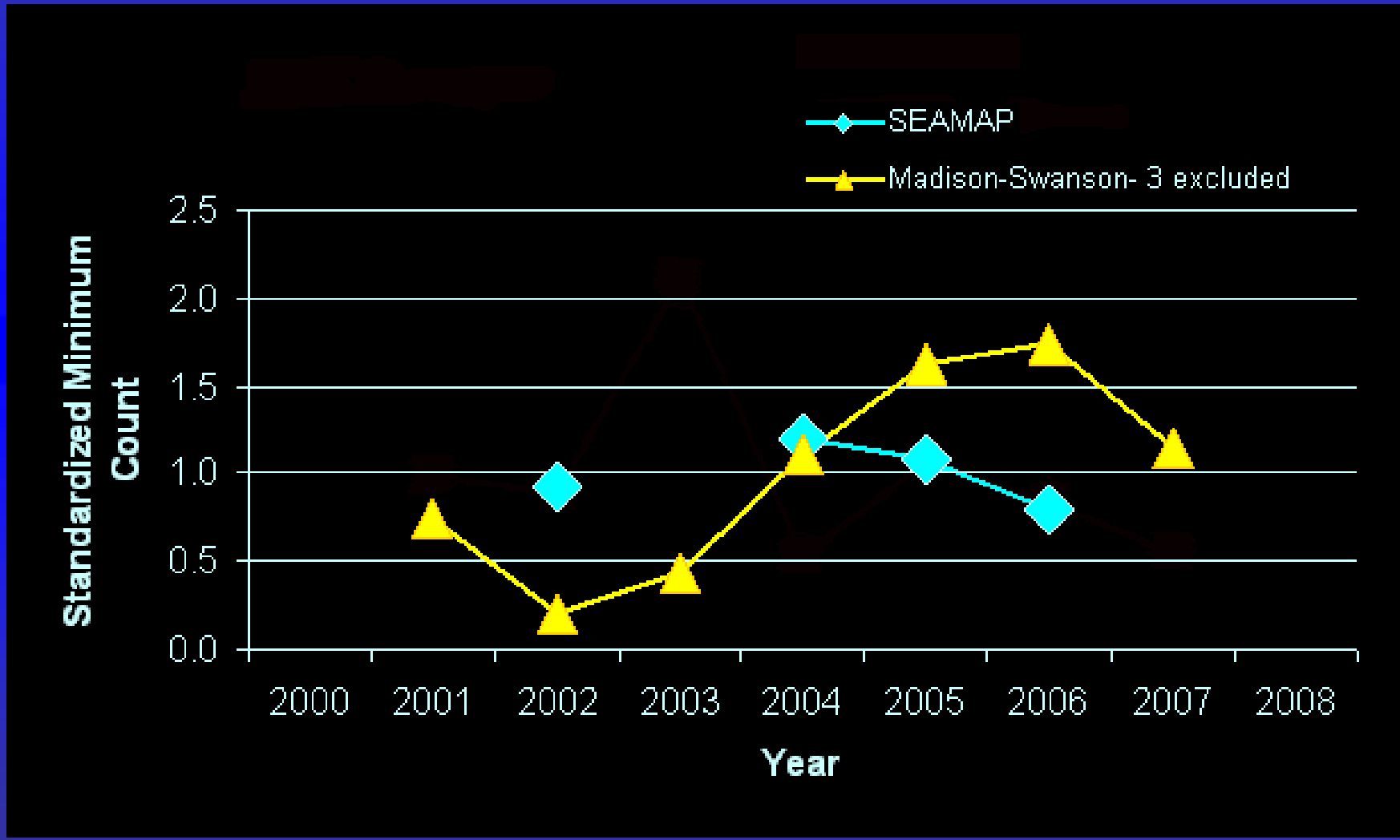
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED GROUPER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Madison-Swanson- 3 excluded
Standardized Minimum Count
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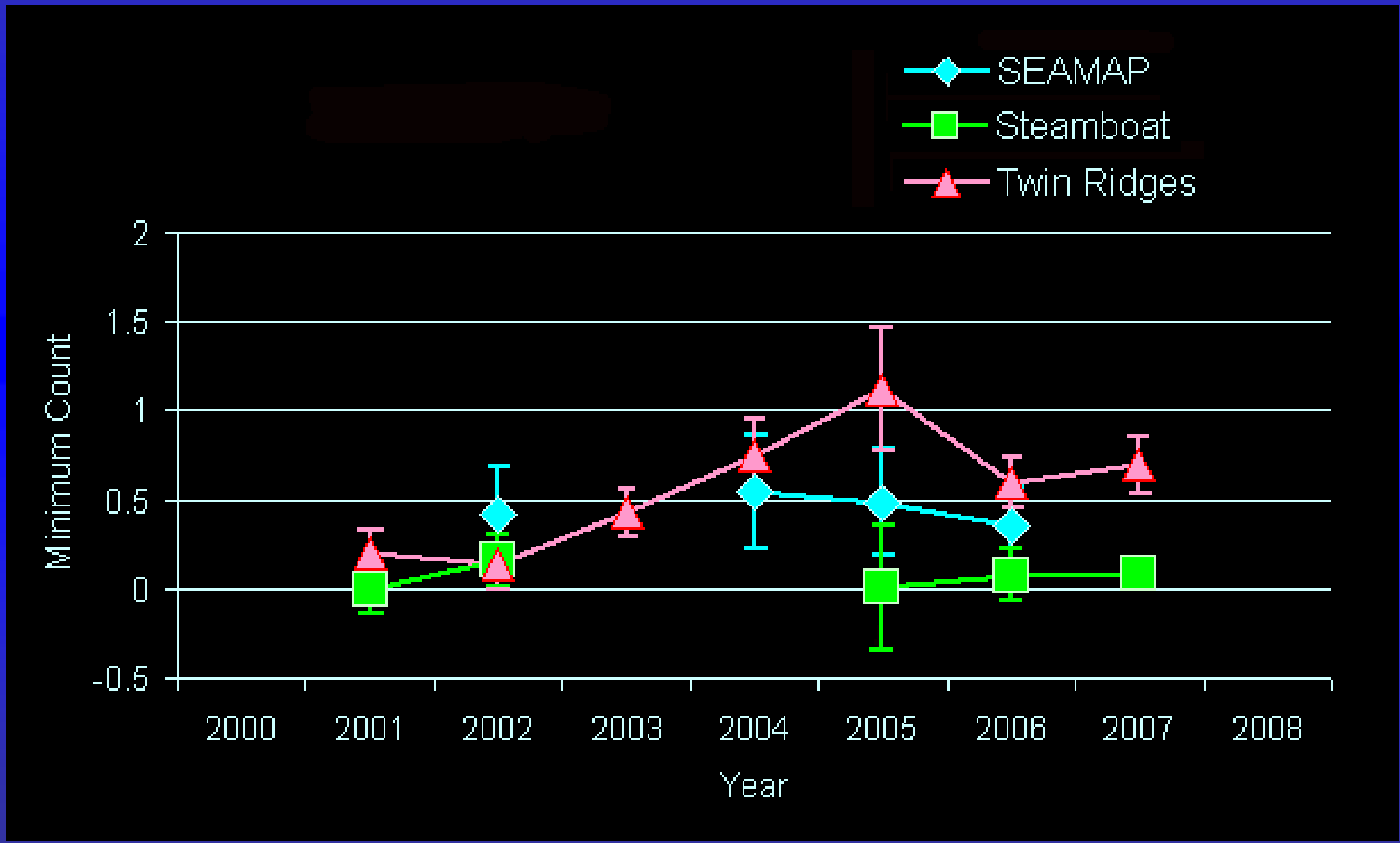
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED GROUPER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Steamboat
Twin Ridges
Minimum Count
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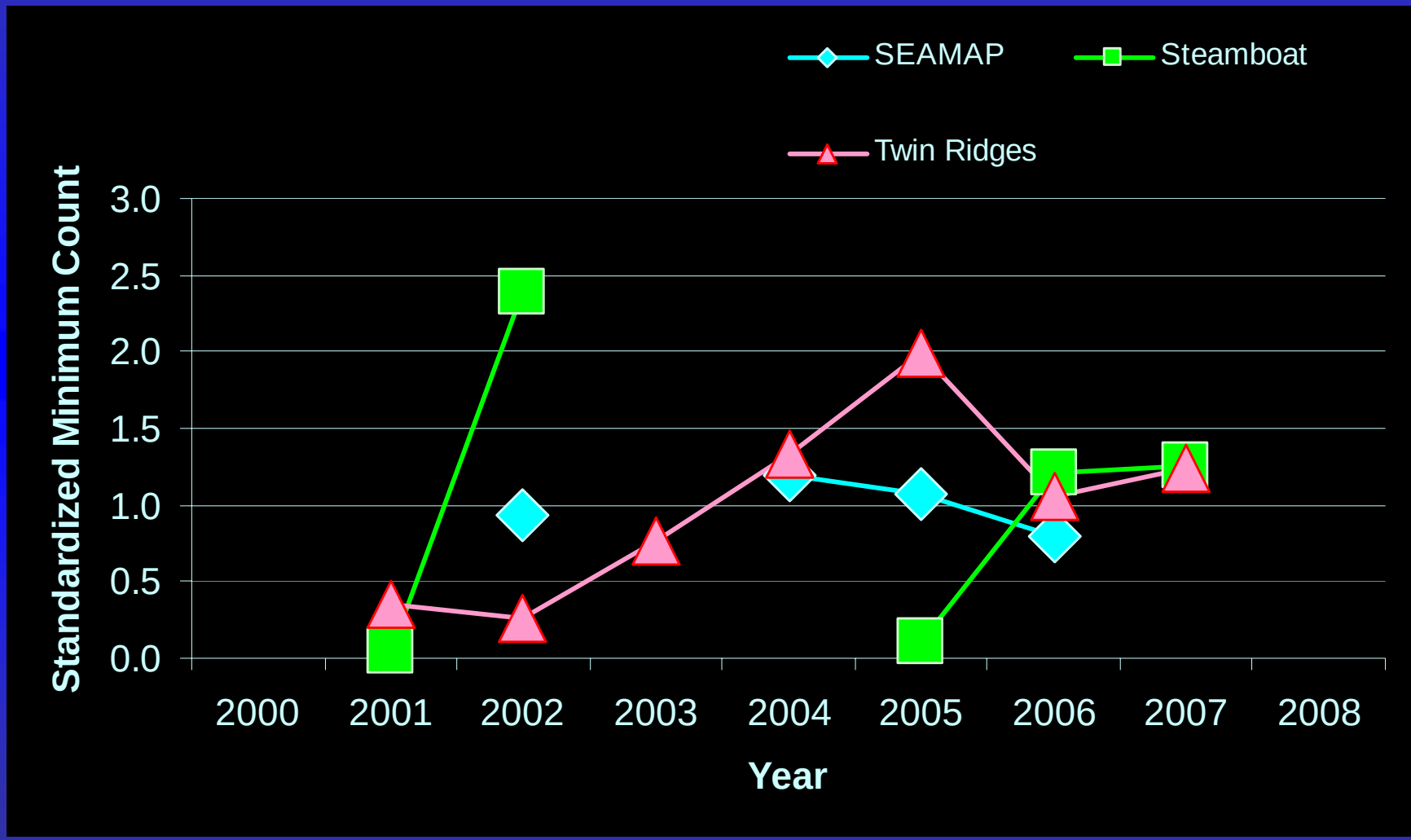
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED GROUPER


SEAMAP
Steamboat
Twin Ridges
Standardized Minimum Count
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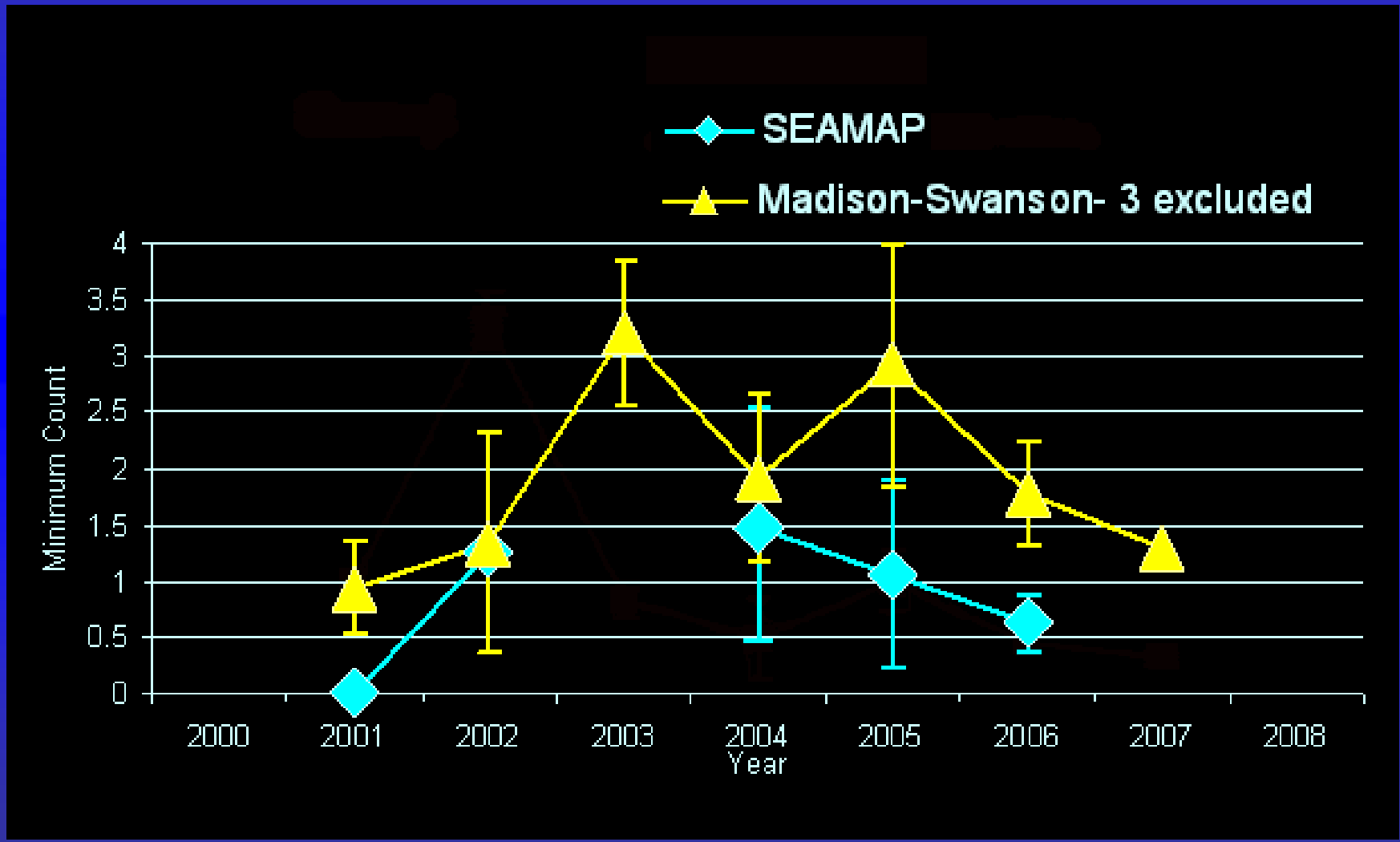
2.5
2.0
1.5
1.0
0.5
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

SCAMP


SEAMAP
Madison-Swanson- 3 excluded
Minimum Count
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3.5
3
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1
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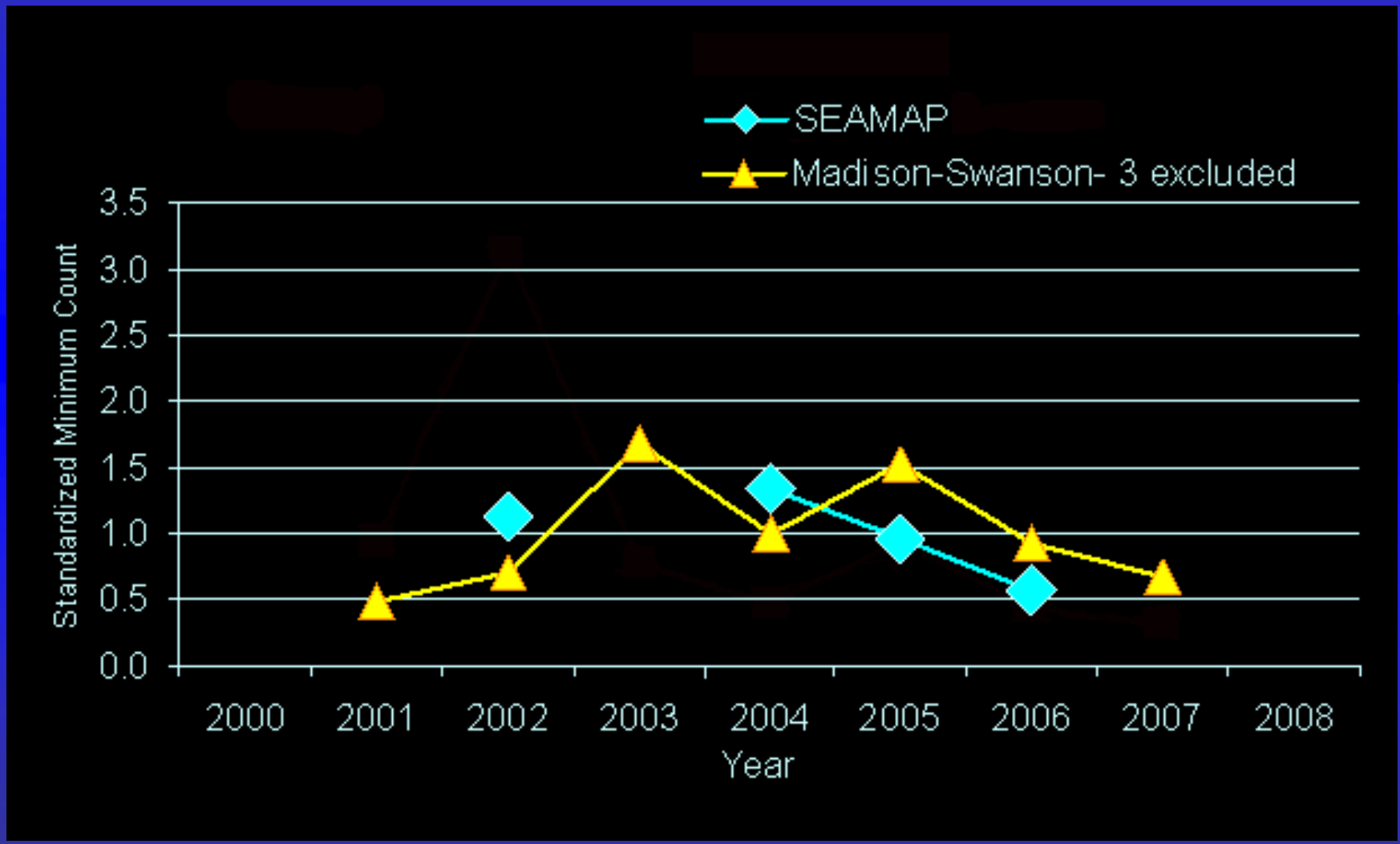
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

SCAMP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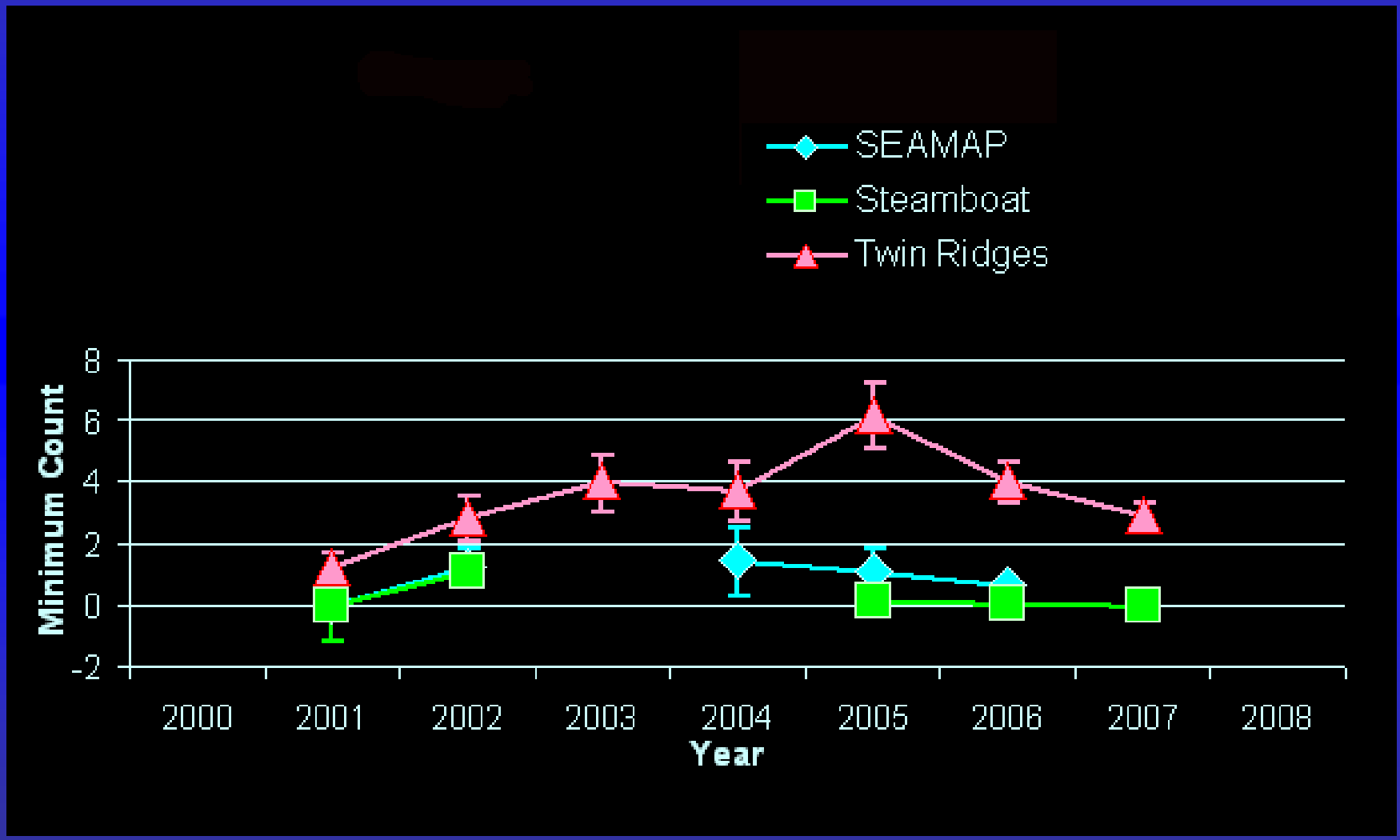
2008
Year

SCAMP


SEAMAP
Steamboat
Twin Ridges
Minimum Count
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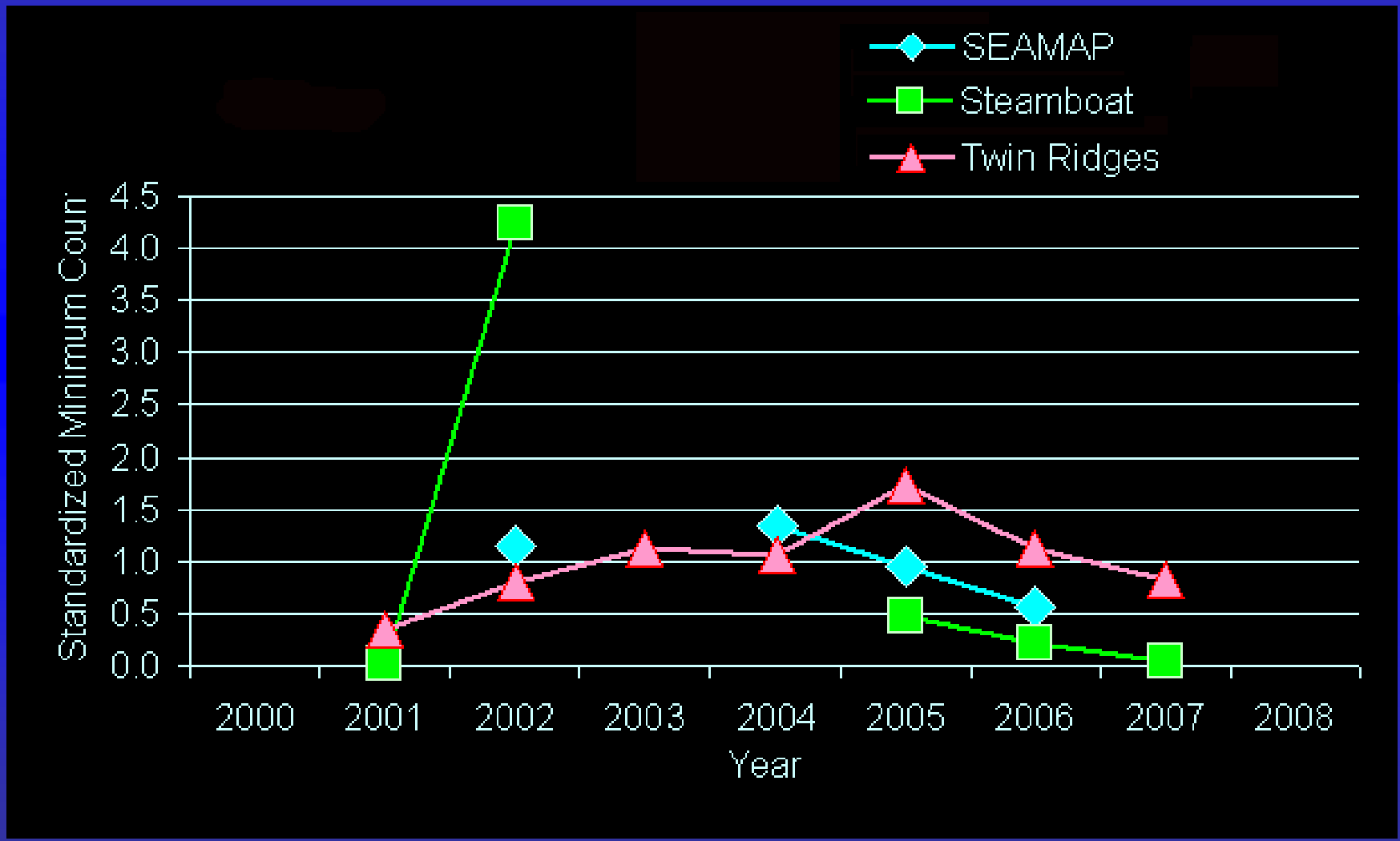
2001
2002
2003
2004
2005
2006
2007
2008
Year

SCAMP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Steamboat
Twin Ridges
Standardized Minimum Coun
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3.5
3.0
2.5
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1.5
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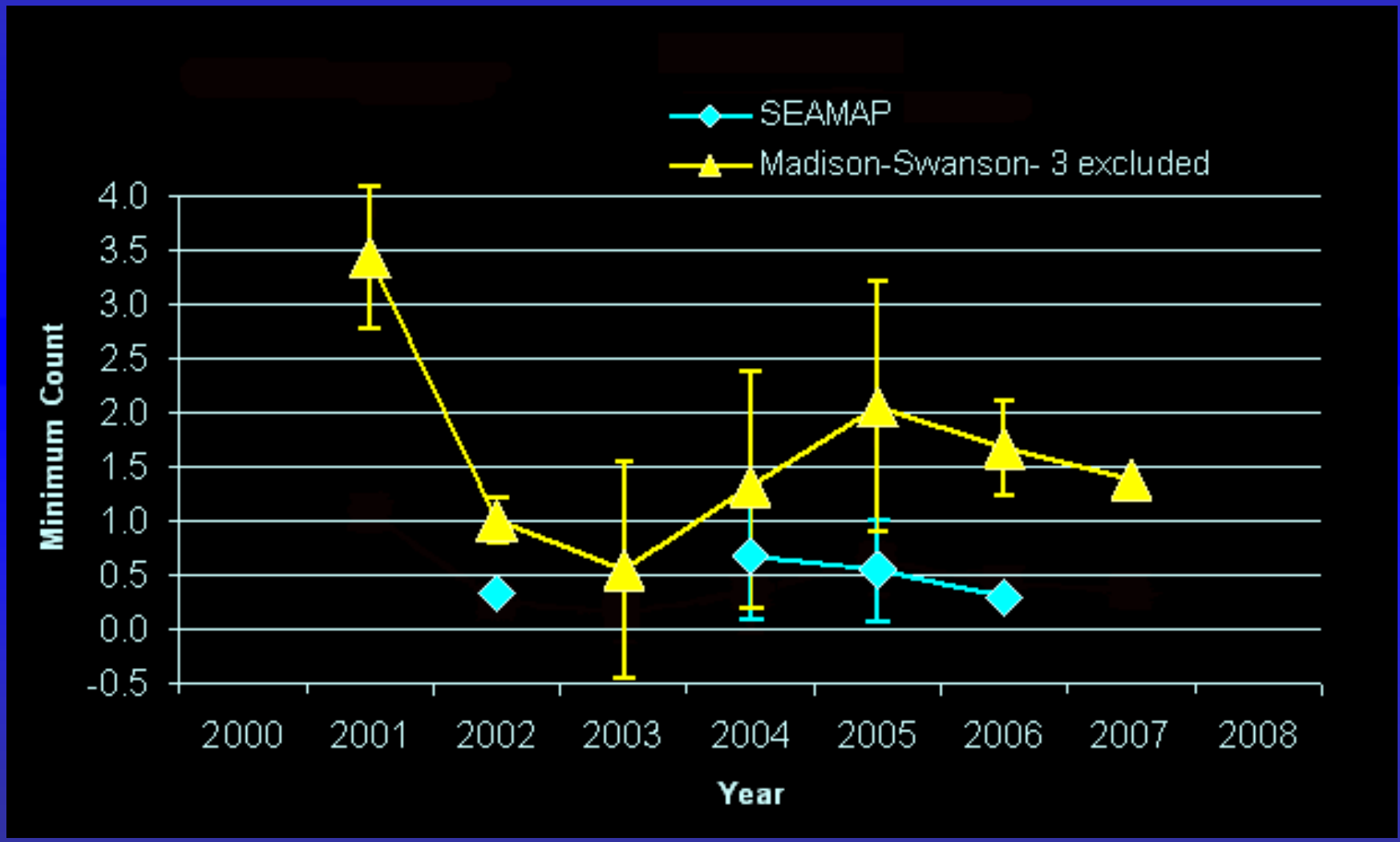
0.5
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED SNAPPER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Madison-Swanson- 3 excluded
Minimum Count
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3.0
2.5
2.0
1.5
1.0
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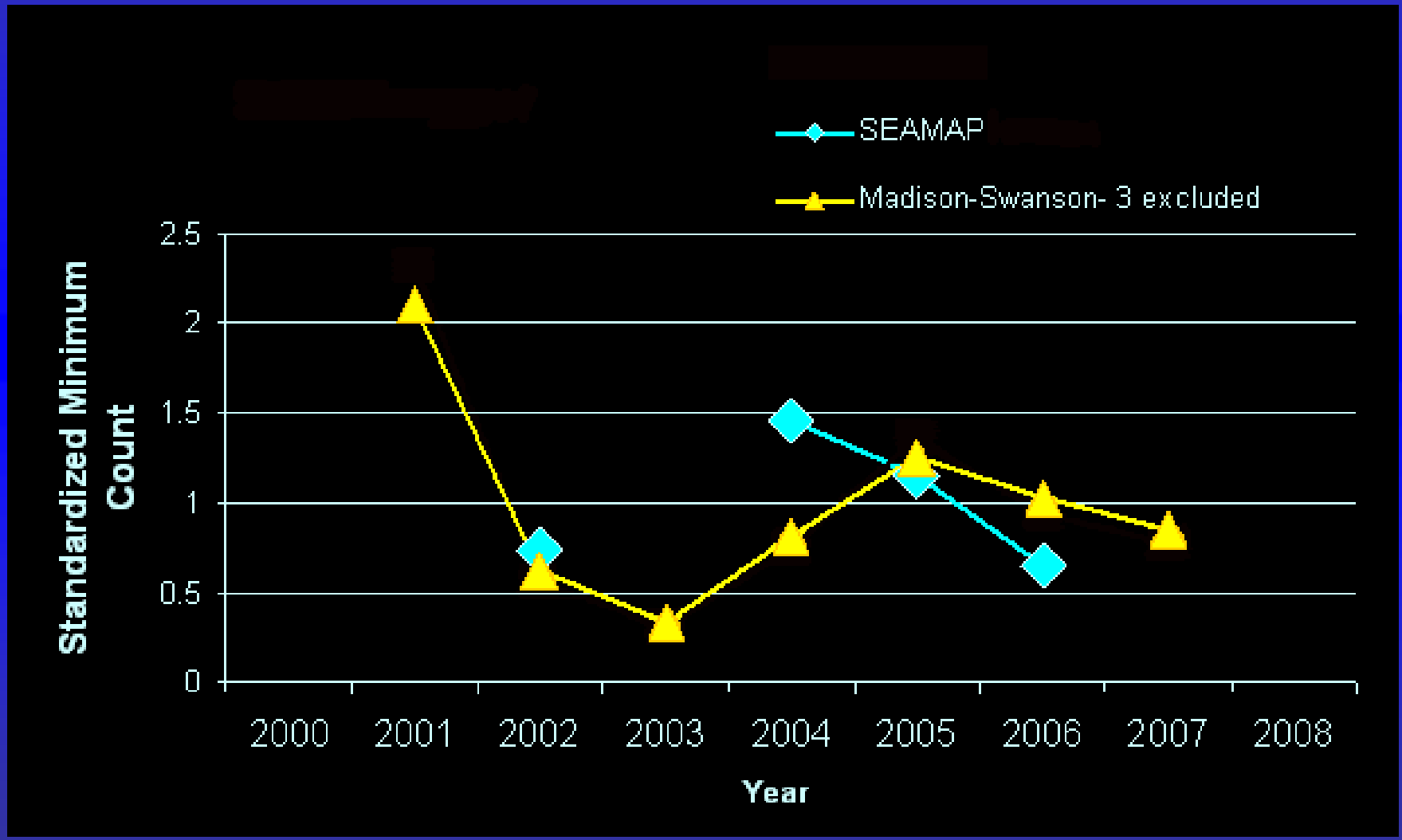
0.0
-0.5
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED SNAPPER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Madison-Swanson- 3 excluded
Standardized Minimum Count
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2000
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2005
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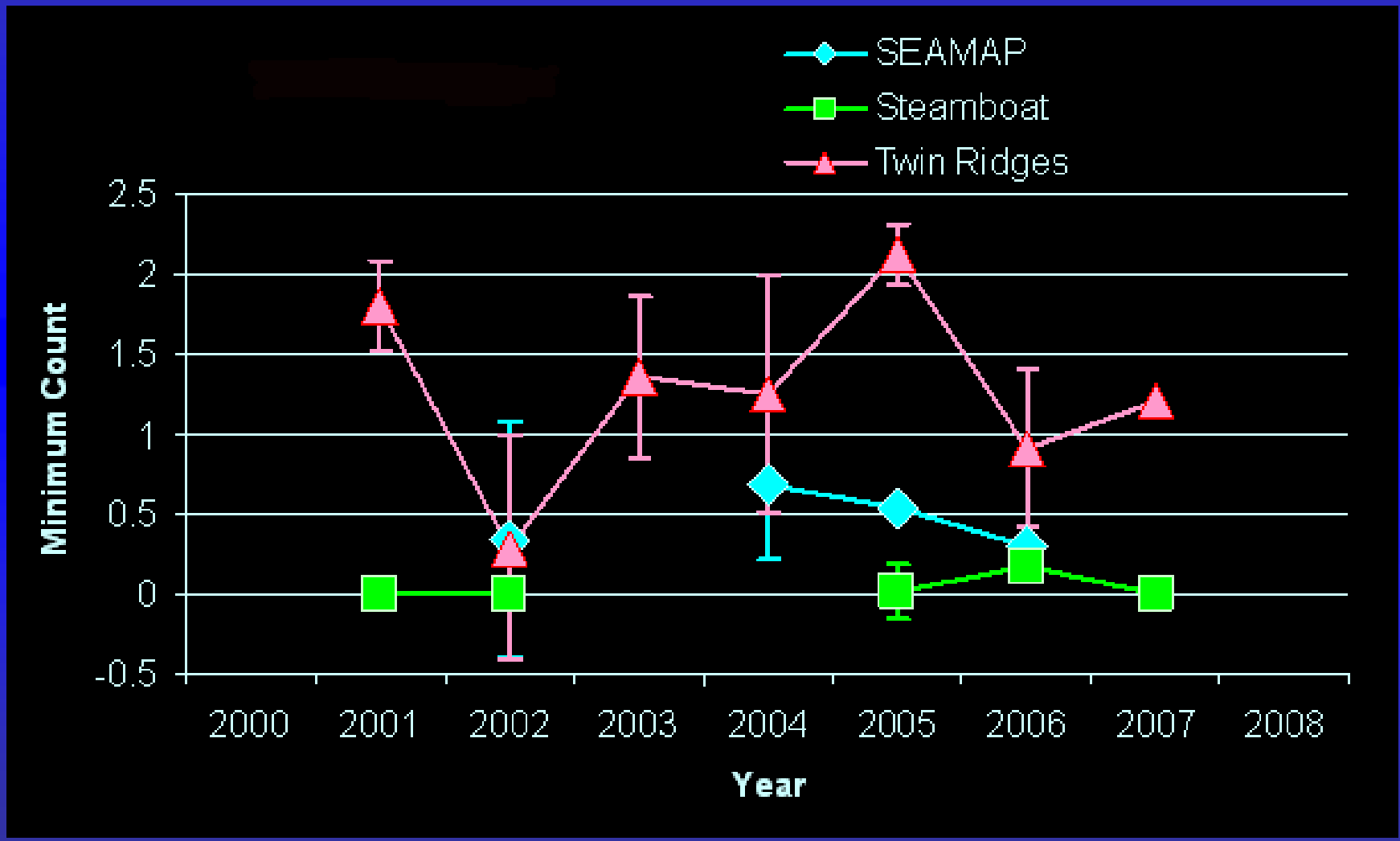
2007
2008
Year

RED SNAPPER


SEAMAP
Steamboat
Twin Ridges
Minimum Count
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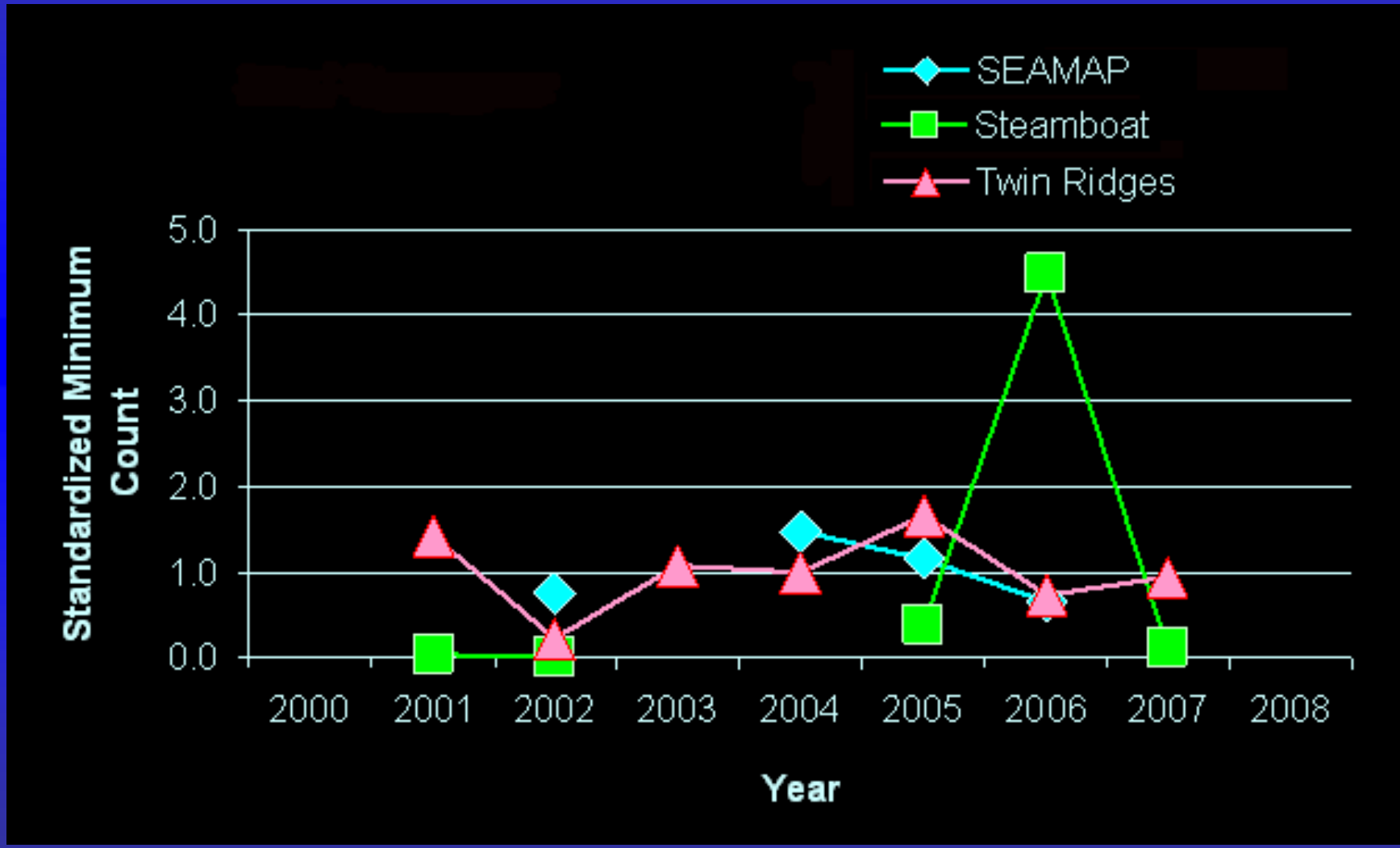
0
-0.5
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

RED SNAPPER


SEAMAP
Steamboat
Twin Ridges
Standardized Minimum Count
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3.0
2.0
1.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

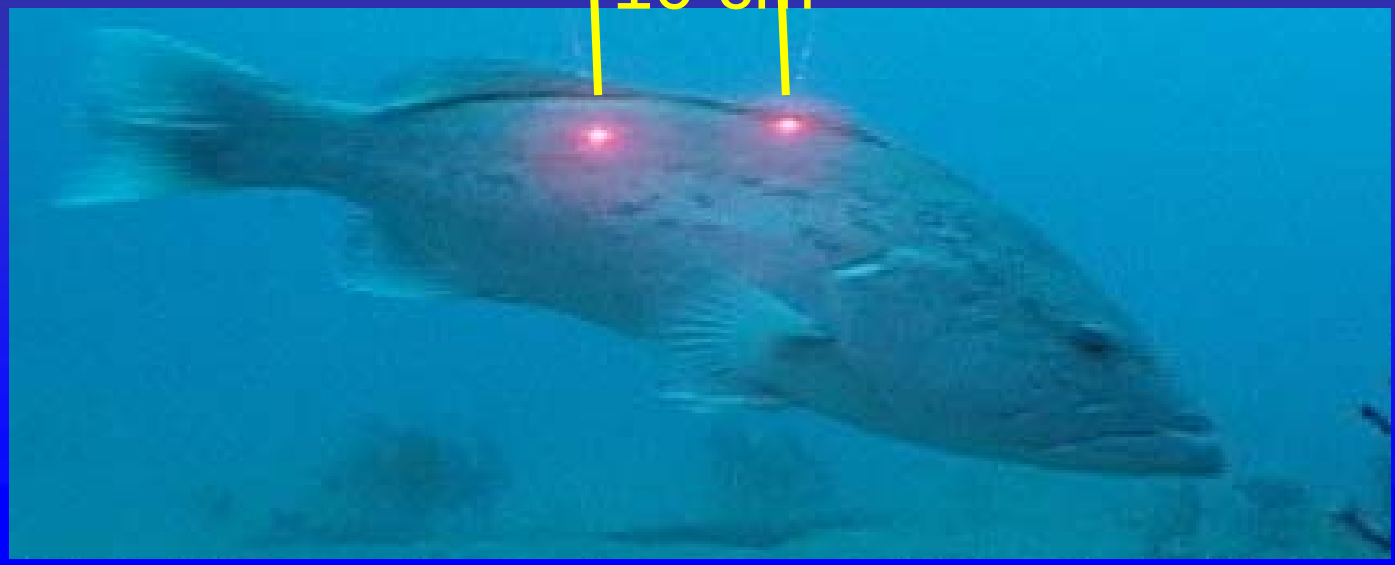
2001 - 2005 Trends in Population Indices

	Madison-Swanson	Steamboat Lumps	Twin Ridges	Eastern GOM
Gag	Increase	Level	Increase	Increase
Red Grouper	Increase	Level	Increase	Increase
Scamp	Increase	Level	Increase	Increase
Red Snapper	Increase	Level	Increase	Increase

2006 - 2007 Trends in Population Indices

	Madison-Swanson	Steamboat Lumps	Twin Ridges	Eastern GOM
Gag	Decrease	Level	Level	Decrease
Red Grouper	Decrease	Increase	Decrease	Decrease
Scamp	Decrease	Decrease	Decrease	Decrease
Red Snapper	Decrease	Level	Level	Decrease

Length of gag inside the MPAs



YEAR	N	MEAN	MIN	MAX	SE
2001	4	734.50	683	835	34.16
2003	40	653.63	238	933	21.54
2004	5	688.20	568	773	43.07
2005	58	708.88	542	960	12.48
2006	14	658.43	493	830	26.64
2007	2	713.00	688	738	25.00

SUMMARY

- Steamboat Lumps MPA does not contain significant grouper/snapper habitat. The ridge and fish pits area total 1.8 km^2.
- Grouper/snapper abundances were low and did not change over time within the Steamboat Lumps MPA.
- A general decrease in groupers and red snapper was observed in the Madison-Swanson MPA, Twin Ridges and along the eastern Gulf of Mexico shelf in 2006-2007.

SUMMARY

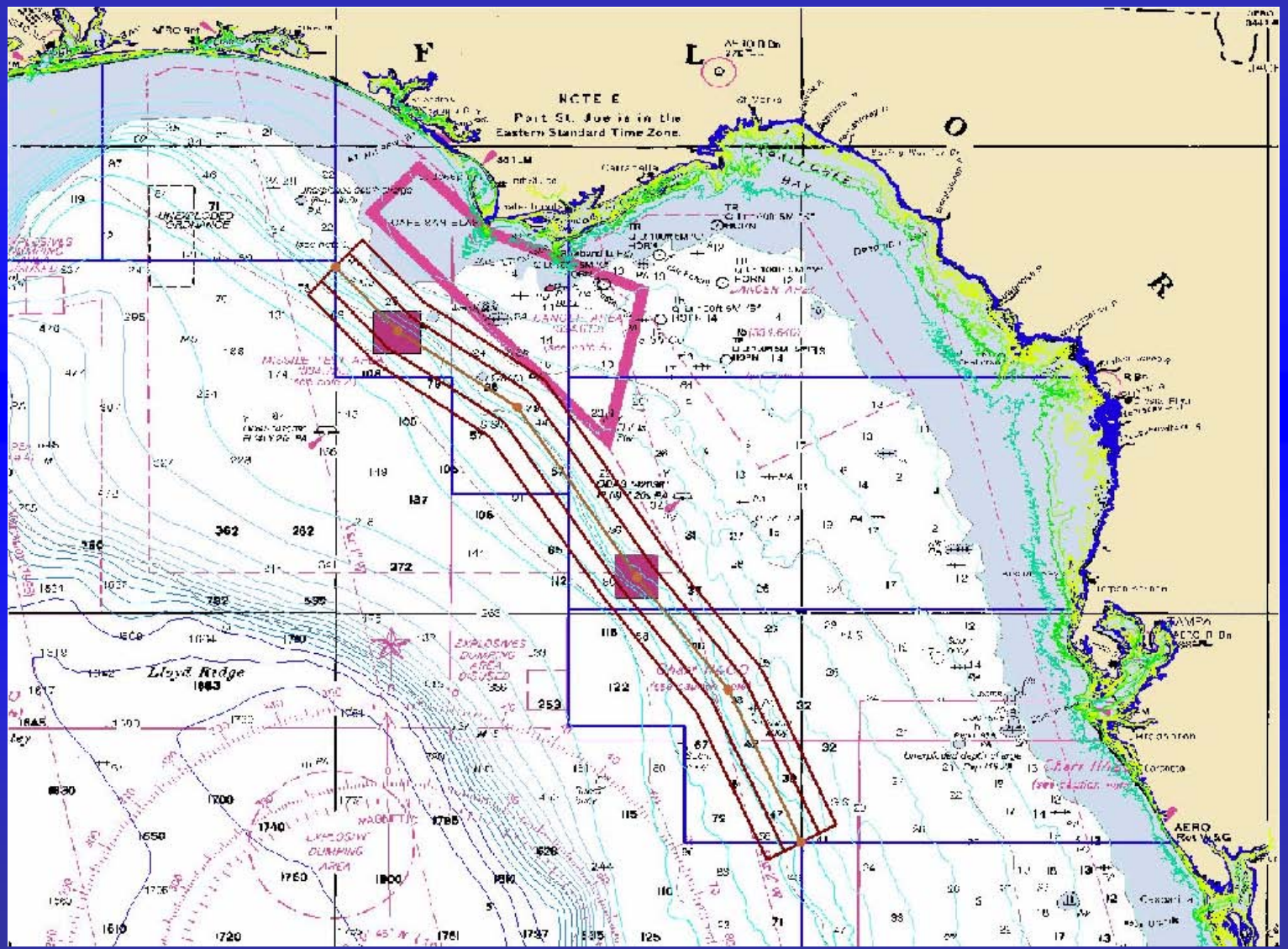
- Poaching occurs in both Madison-Swanson and Steamboat Lumps.
- Gag habitat within Madison-Swanson is only 5% of shelf-edge habitat sampled by SEAMAP survey.
- Gag habitat within Steamboat Lumps is only 0.1% of shelf-edge habitat sampled by SEAMAP survey.

ACKNOWLEDGEMENTS

- Funding provided by MARFIN (2001) and Coral Reef Conservation Program (2001-2007)
- R/V Caretta, R/V Gandy, NOAA Ship OREGON II
- Kevin Rademacher, Paul Felts, Brandi Noble, Stacey Harter, Marta Ribera, Chris Gardner, Chris Palmer, Linda Lombardi, John Brusher, and Bill Walling

Aerial Effort Survey

Aerial Survey of Fishing Activity



Quantifying Fishing Activity Within and Adjacent to NE Gulf of Mexico Marine Protected Areas

- Conducted by Steven G. Smith and Natalia Zurcher, University of Miami, Rosenstiel School of Marine and Atmospheric Science
- 3200 nm^2 along the outer continental shelf between Tampa and Panama City were surveyed each day from an aircraft flying at 1000 ft, georeferenced photos were taken of all vessels detected. MPAs were 6.9% of survey area.
- Flights were stratified by (i) spawning seasons of target species; (ii) commercial and recreational open/closed fishing seasons for red snapper and groupers; and, (iii) midweek and weekend/holiday time periods.
- 49 flights were made; 24 between January and April, 25 between May and September.


Trawler (comm)


Longliner (comm)


Bandit (comm)

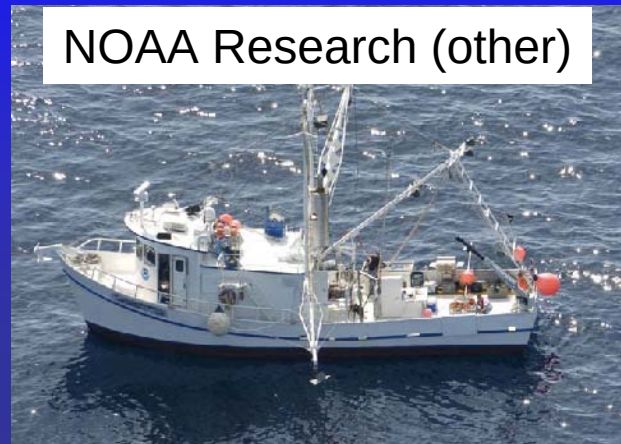

Headboat (rec)


Recreational


Sailboat (other)


USCG Cutter (other)
U.S. COAST GUARD


Freighter (other)


NOAA Research (other)

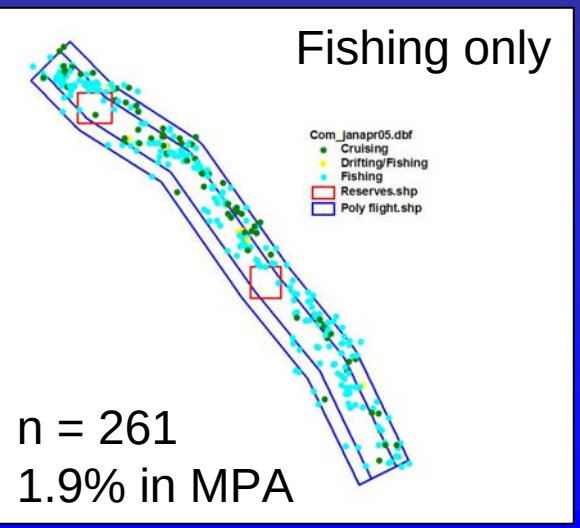
Quantifying Fishing Activity Within and Adjacent to NE Gulf of Mexico Marine Protected Areas

- 457 vessels detected in January through April
  74.6% were commercial vessels, 11.8% were recreational, 13.6% were others.
- 537 vessels detected in May through September
  58.5% were commercial vessels, 34.8% were recreational, 6.7% were others.
- 74.5 - 76.5% of commercial vessels seen were fishing.
- 67.9 - 70.4% of recreational vessels seen were fishing.
- Majority of “other” vessels were freighters (72-79%).
- Data was collected for scientific purposes only, no enforcement actions resulted from this survey.

January – April - 24 flights

Commercial

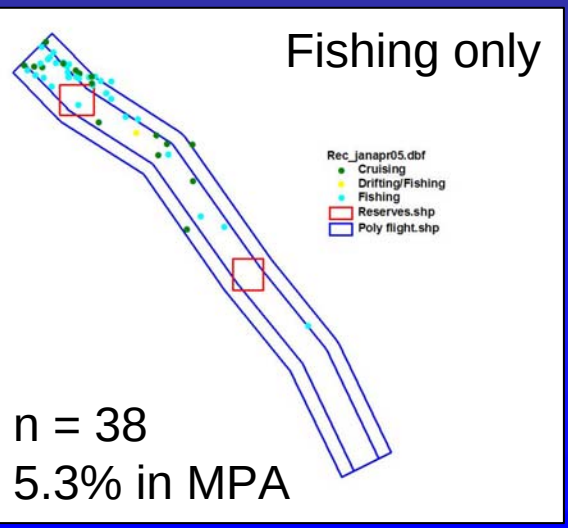
Fishing only



n = 261
1.9% in MPA

Recreational

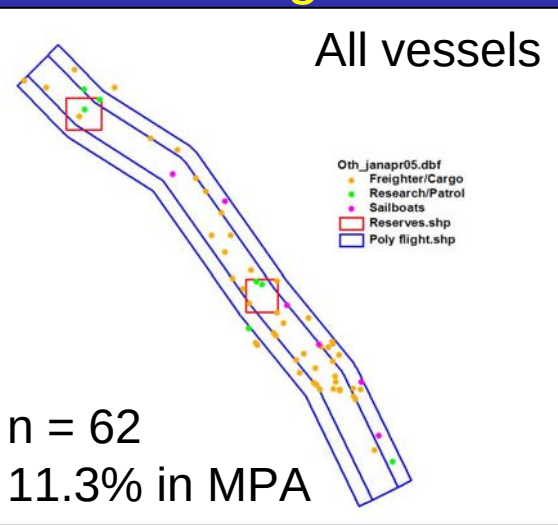
Fishing only



n = 38
5.3% in MPA

Non-Fishing Vessels

All vessels

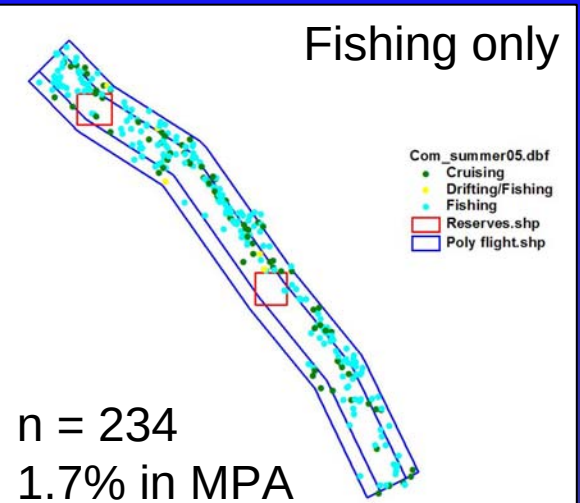


n = 62
11.3% in MPA

May – September - 25 flights

Commercial

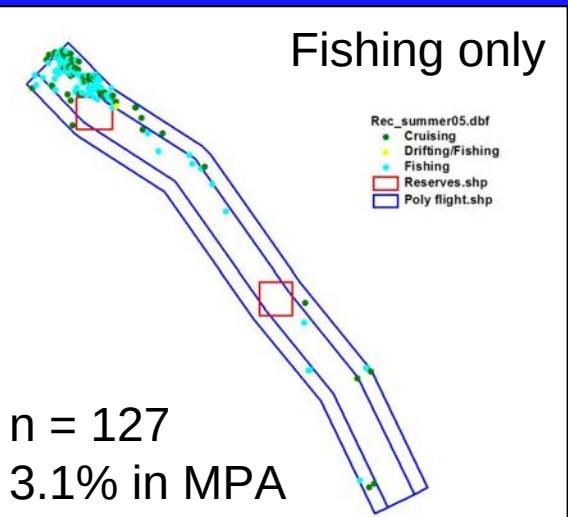
Fishing only



n = 234
1.7% in MPA

Recreational

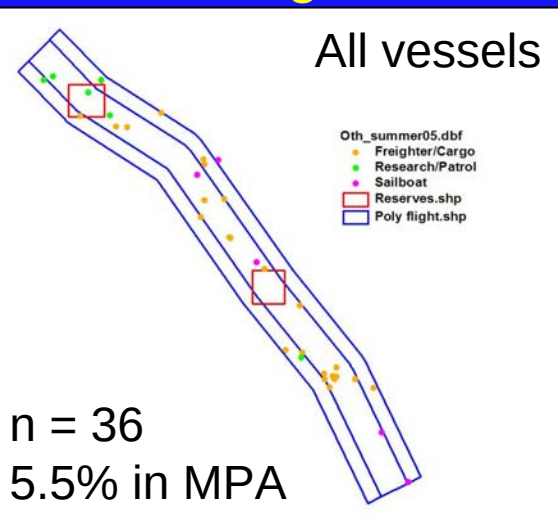
Fishing only



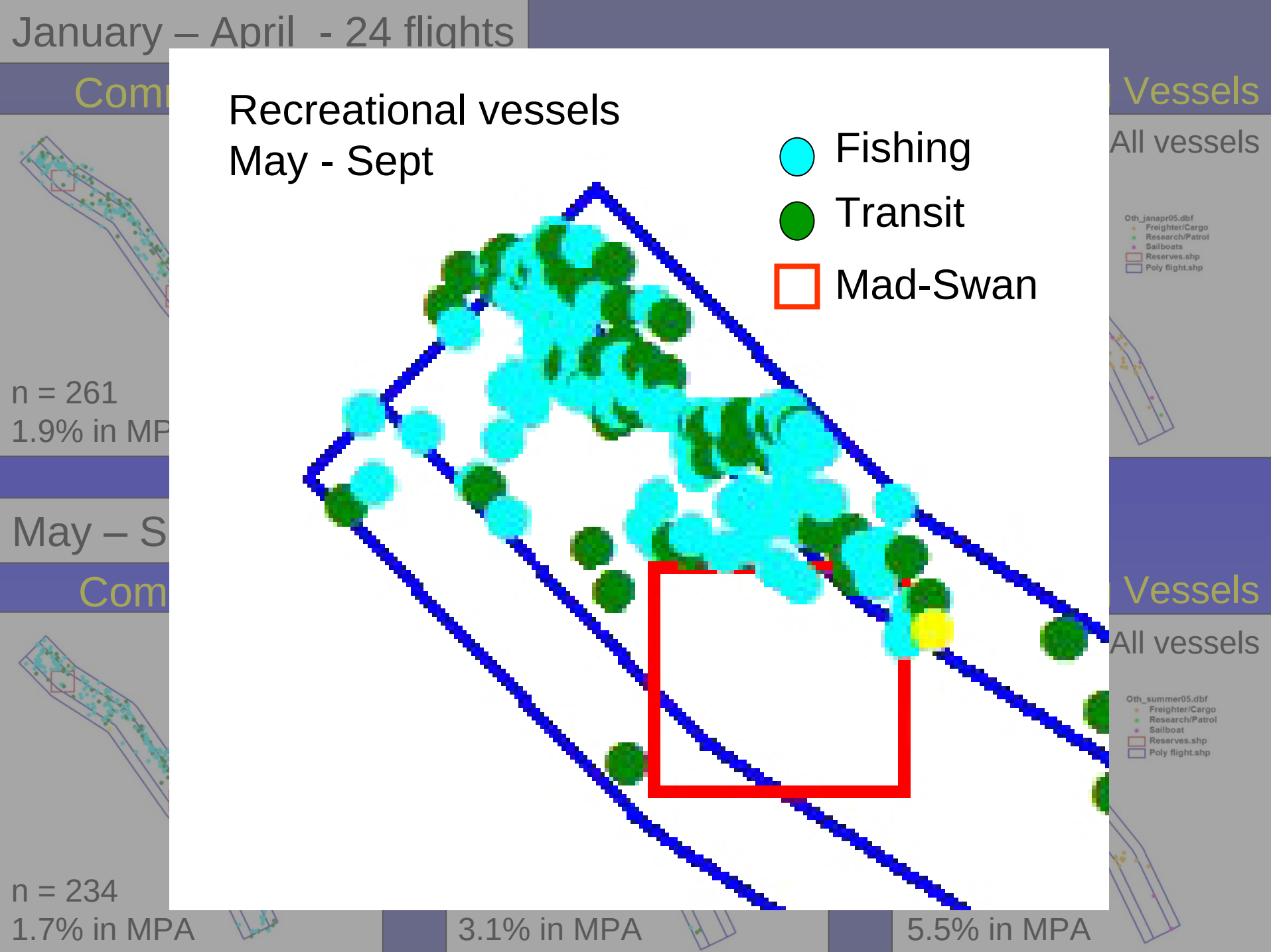
n = 127
3.1% in MPA

Non-Fishing Vessels

All vessels



n = 36
5.5% in MPA


January – April - 24 flights
Vessels
All vessels
n = 261
1.9% in MP
May – S
Vessels
All vessels
n = 234
1.7% in MPA
3.1% in MPA
5.5% in MPA
Recreational vessels
May - Sept
Fishing
Transit
Mad-Swan

GMFMC Questions

1) How do you define a successful MPA, and what criteria do you use to measure success?

A successful MPA is one which achieves its goals. In this case, the goals were “to protect gag spawning aggregations and provide locations to assess the efficacy of marine reserves to protect (spawning) aggregations.” (From: Gulf of Mexico Gag Grouper, SEDAR 10, 2006). Using these criteria, the Madison-Swanson MPA has had mixed results. After several years of increase, gag abundance within Madison-Swanson has declined since 2005. A similar decline from 2004-2006 has also been observed along the west Florida shelf. The two MPAs have not provided consistent protection to gag.

2) Have you seen any change in the male to female gag ratio, both within the reserves and within the general gag population that might be attributable to the reserves? How do you attribute the change to any areas outside the reserve?

Our survey uses non-destructive sampling and therefore we do not have reliable estimates of gag sex ratios. Sex determination based upon underwater visual observations are notoriously unreliable and therefore, we cannot address this question. However, it should be noted Gag populations are driven by episodically high year classes which can skew sex ratios.

3) Have you seen any changes in abundance, size or distribution of gag outside the reserves that can be attributed to the reserves? If so, how is it attributed to the reserves and not other regulatory actions that have changed over the past 7 years?

The index of abundance for gag along the west Florida shelf has decreased since 2004. We have no evidence of a spillover effect. However, the aerial survey of fishing boats shows a concentration of fishing activity just outside the Madison-Swanson border.

4) Are there any measurable impacts of marine reserves that can be incorporated into stock assessments? If so, how do you measure the impacts?

5) Do you feel that marine reserves are an effective way to control fishing mortality on a stock?

6) Is there any evidence that marine reserves increase yields? Outside the reserve and for the total stock?

These questions are beyond the scope of our research. However, they have been addressed by several authors. See Halpern, 2003 for a review. The general consensus is MPAs can be effective management tools provided the protected areas are large enough and enforcement levels prevent significant poaching.

7) Do you feel that MPAs can have large scale (i.e., stock-wide) benefits, or are the benefits primarily localized to the immediate area in and near the MPA location?

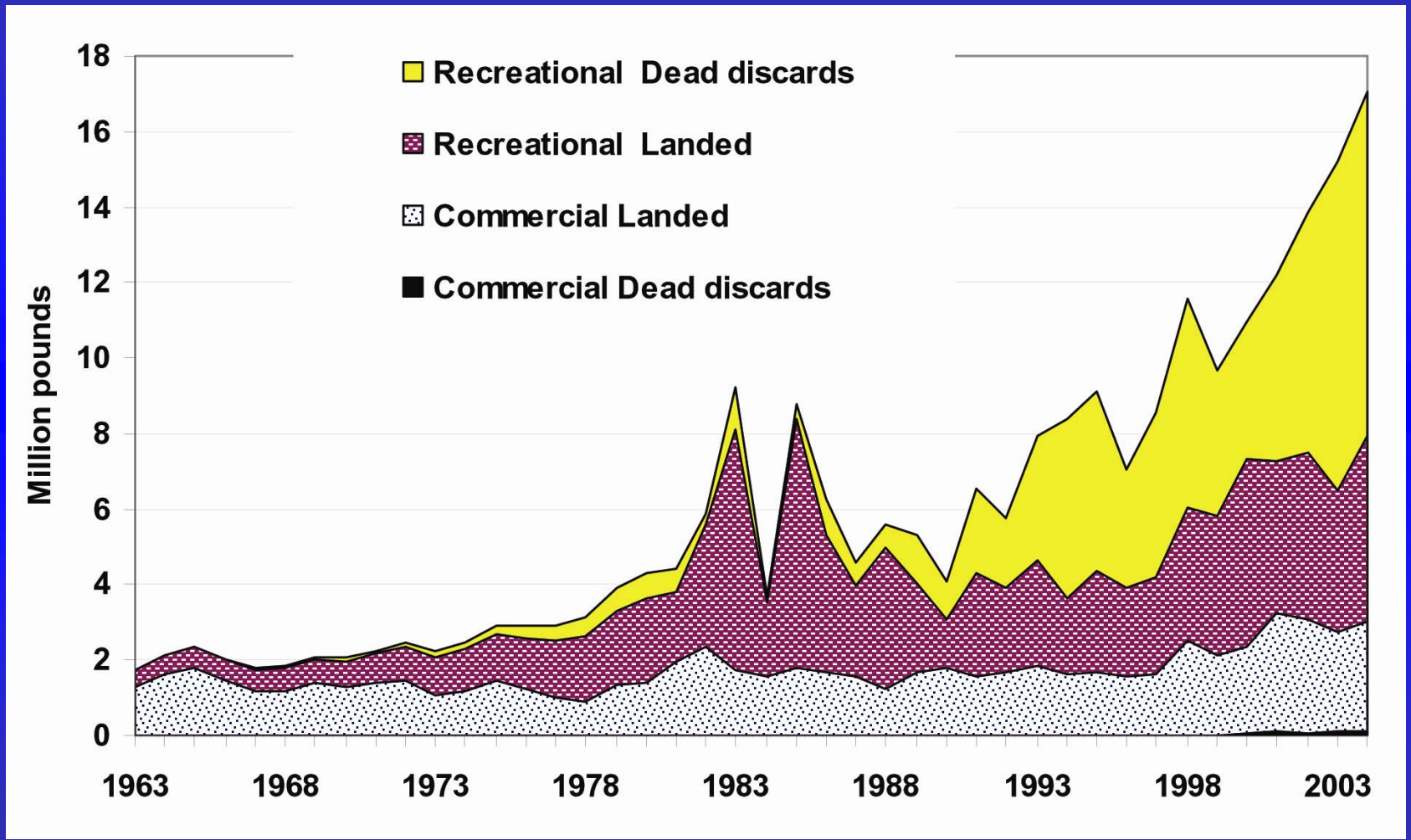
MPAs can have large scale benefits, particularly for species with strong site fidelity to well defined habitat types. Coupling these characteristics with a hermaphroditic life history which exposes individuals to fishing pressure for several years before sufficient numbers of both sexes are present in the population and preference for depths at which release mortality is very high due to barotraumas adds to the potential benefits of areal closures. There are caveats however, and the strongest one assumes the closed areas are of sufficient size to protect enough individuals to maintain genetic diversity and produce enough propagules to populate the stock's range.

8) Do you think poaching in Madison-Swanson adversely affected the results and, if so in which years was that a big problem?

Yes. The aerial survey indicated 2% of commercial fishing vessels and 3%-5% of recreational boats were fishing within MPAs. We have spent >100 days at sea since January 2001 in and near the NEGOM MPAs. During this time we saw gradual increases in poaching during the first three years then a sharp decline after some high profile enforcement actions. In the last two years, poaching has again been on the increase. During 2007 we witnessed more poaching than in any previous year. It should be pointed out that fishing on a spawning aggregation can quickly remove a large number of gag from the MPAs and as aggressive males are often the first fish caught, even minor levels of poaching can preclude spawning activity in a large number of grouper.

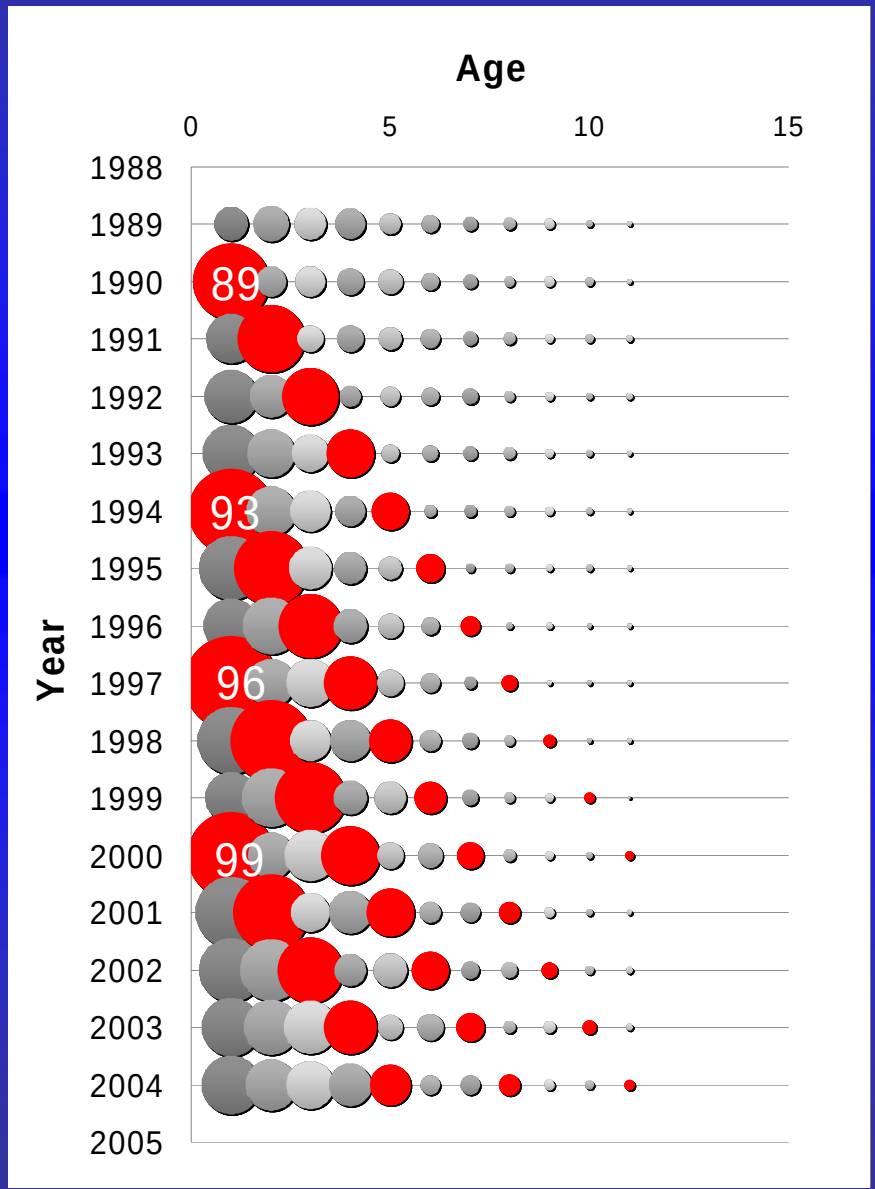
SEDAR Review

Gulf of Mexico gag landings and dead discards by the commercial and recreational fisheries in pounds gutted weight.

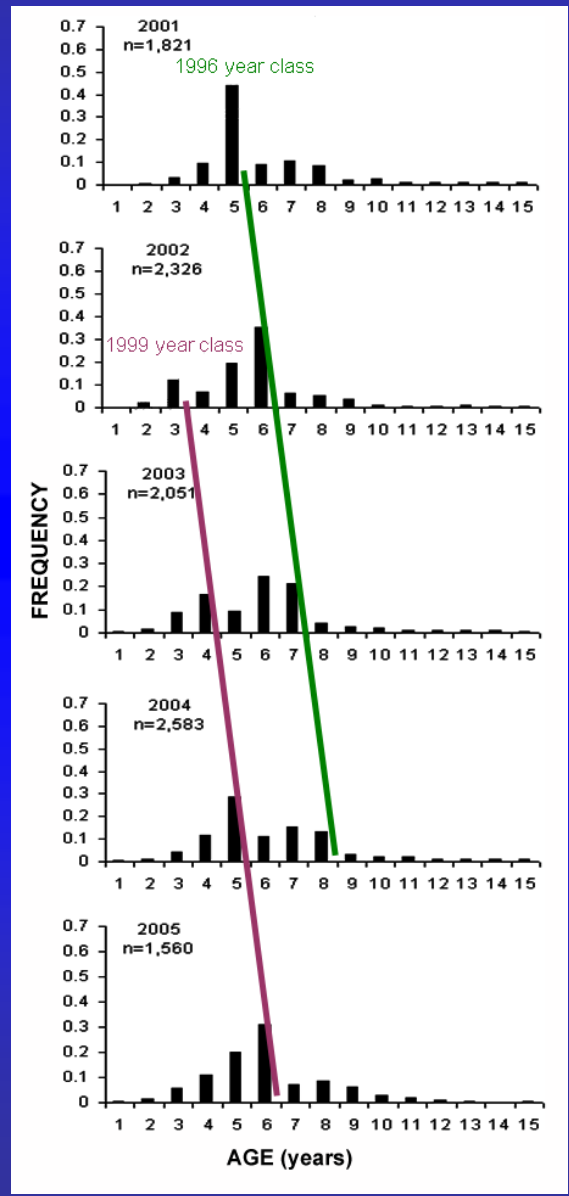


From: SEDAR 10 Advisory Report, page 9, figure 2

Gag populations driven by episodic large year classes

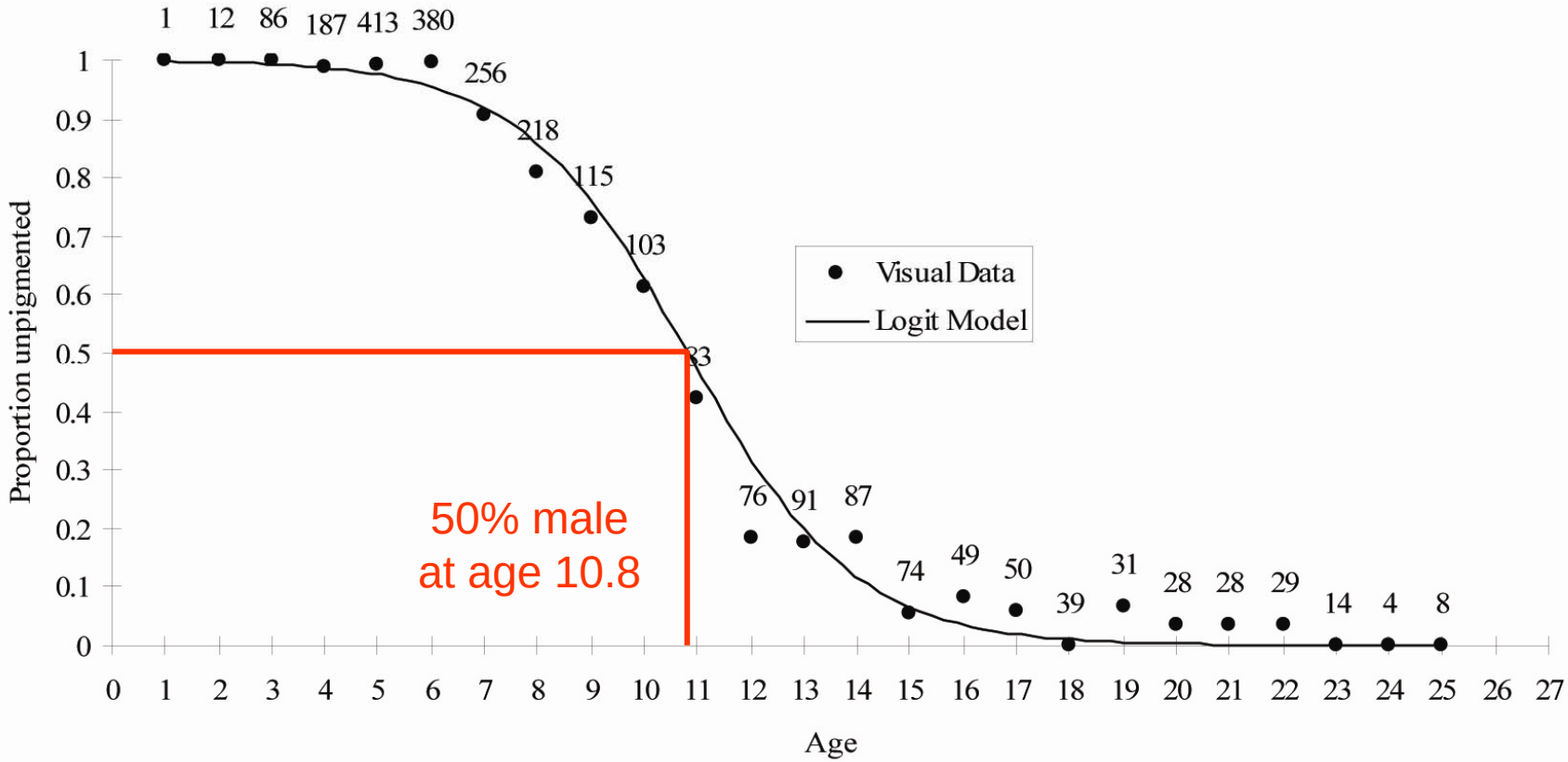


Model results, SEDAR 10

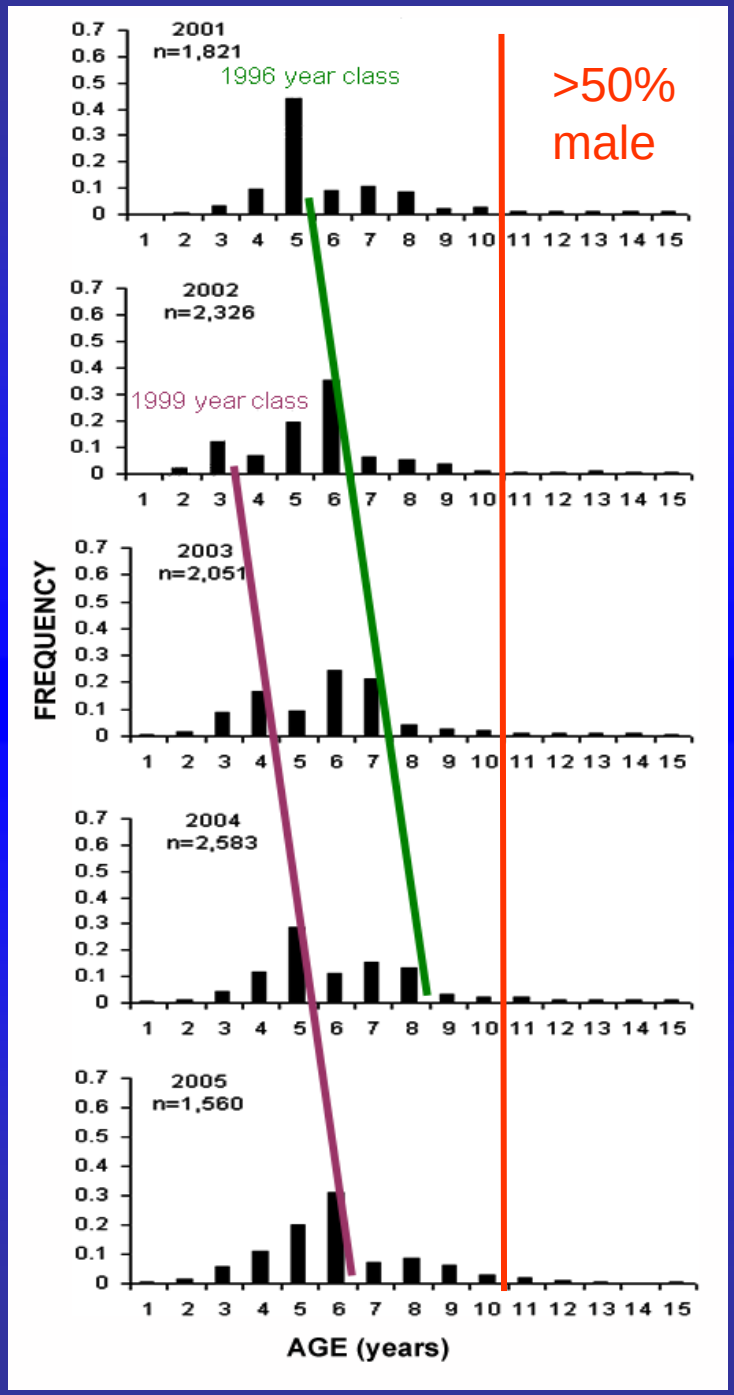


Otolith results, PC Lab

Gag sex ratio by age

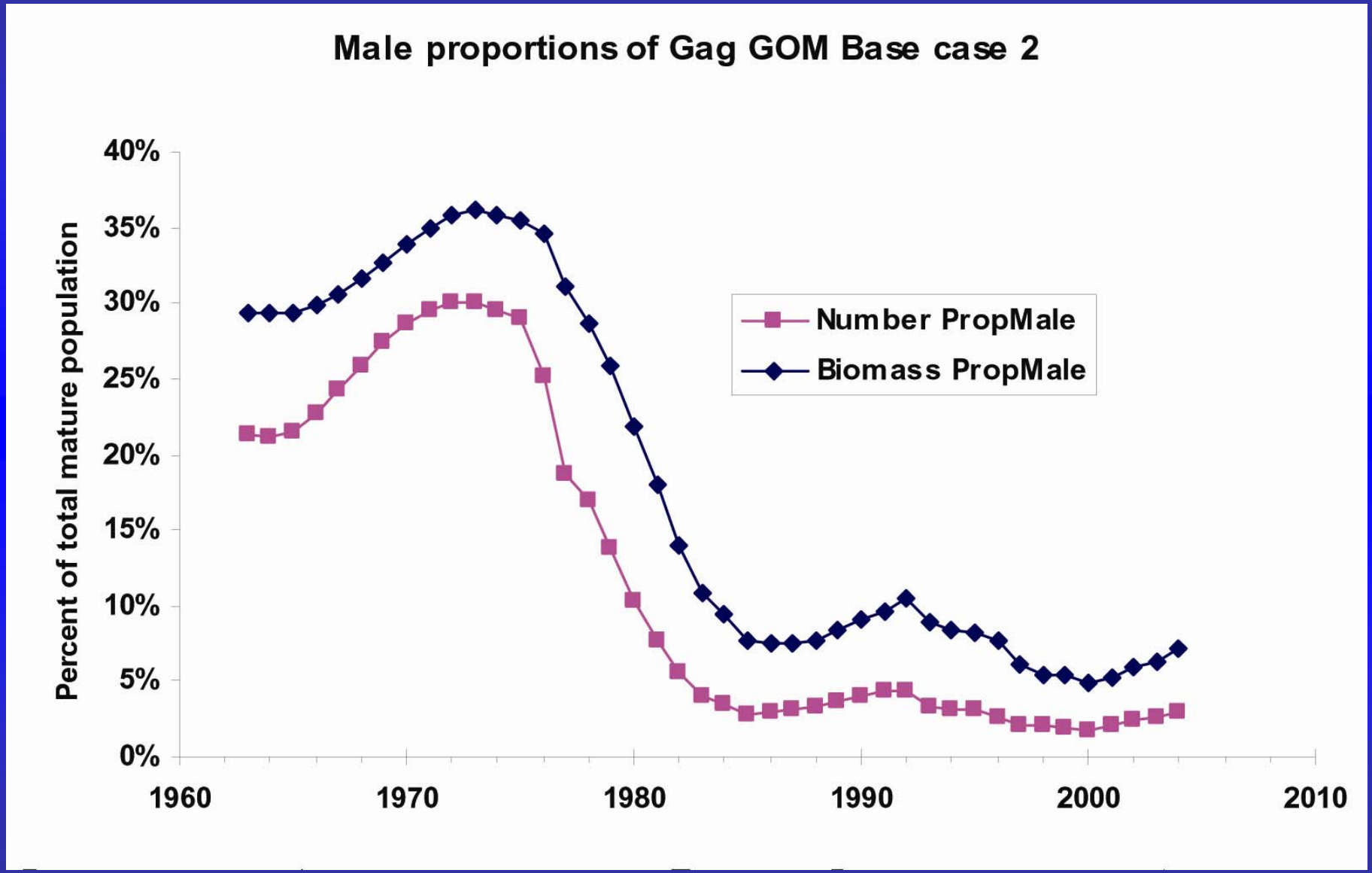


From: SEDAR 10, Data Workshop, Gag reproduction, page 25, figure 12



Percentage of males is very small due to age of transition from female to male and age structure of population. Recruitment of large year classes to fishery can shift sex ratio towards females as all young fish in these year classes enter the fishery as females.

Gag percentage male by year



From: SEDAR 10 SAR2 Section III 3.2, page 28, figure 7