COBIA (*Rachycentron canadum*)

Daniel Benetti, Ph.D.

ROSENSTIEL SCHOOL
OF MARINE & ATMOSPHERIC SCIENCE

Photo courtesy Snapperfarm, Inc.

Cobia (*Rachycentron canadum*)

SPECIES CRITERIA

1) Native /endemic to the region

2) Market demand and value

3) Technology developed/available from hatchery to market (close cycle)

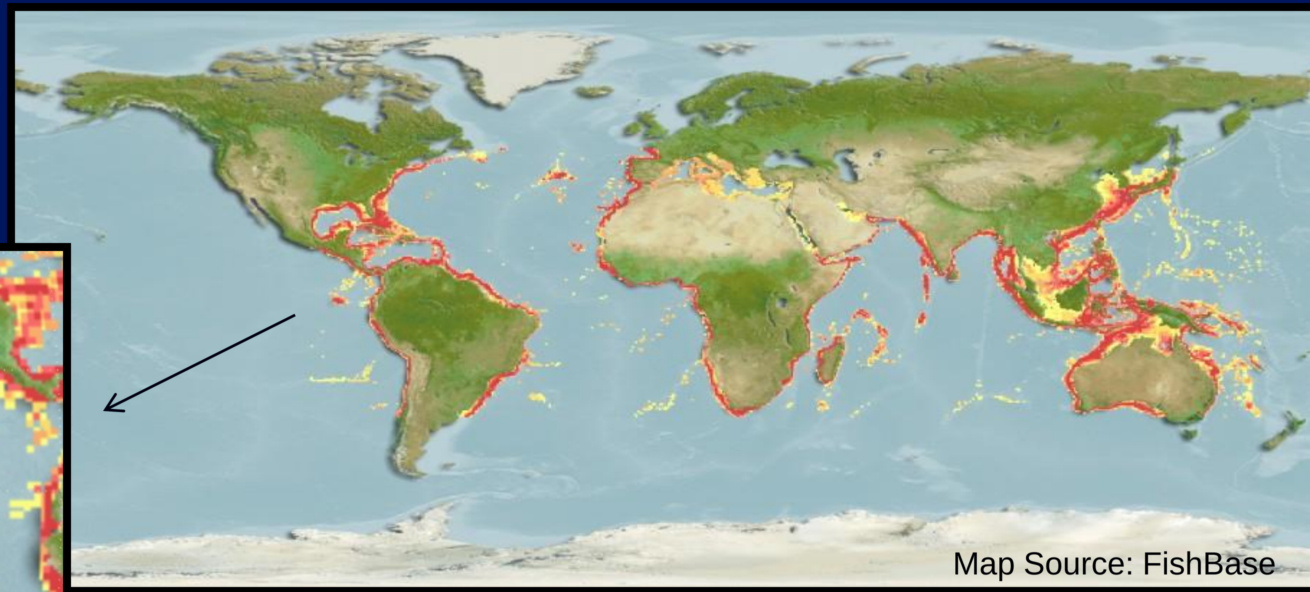
4) Aquaculture performance:
   - Growth
   - Survival
   - Feed conversion rate

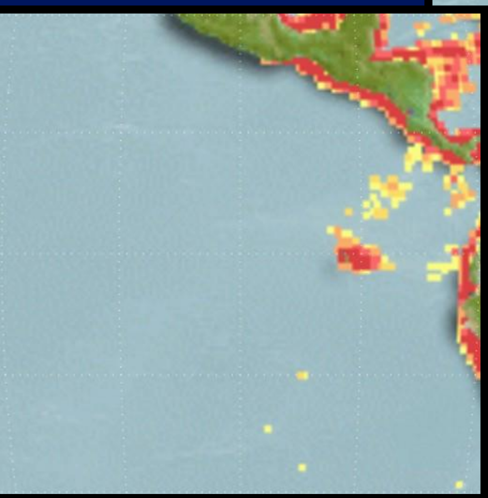
5) FEC (Feed Economic Conversion)
   price of feeds and of market fish

6) FCE (Feed Conversion Efficiency)
   ecological cost of producing farmed fish

7) Not competing with fisheries

COBIA DISTRIBUTION AND OCCURRENCE





Cobia (Rachycentron canadum) has been observed to occur in the Eastern Equatorial Pacific; É it is captured close to an island off the town of Iquique, Chile, approximately 200 km south of the Chile-Peru border (Fowler 1944: 502).

Widespread in the Indo-West Pacific, but absent from the eastern Pacific and from the Pacific Plate, except marginally. Collette, B.B, FAO (1999)

Range given by Herre (1953:287) as "all warm seas but Eastern Pacific." However, it is recorded from the coast of Chile (Iquique) by Fowler (1944:502). In: Briggs, J.C. 1960. Fishes of Worldwide (Circumtropical) Distribution *Copeia*, Vol. No. 3. (Sep. 26, 1960), pp. 171-180.

URL:
http://links.jstor.org/sici?sici=00458511%2819600926%293%3A1960%3A3%3C171%3AFOW%28D%3E2.0.CO%3B2-4
Copeia is published by American Society of Ichthyologists & Herpetologists.

More info | Plus d'info | Mais info FishBase

FAO areas where *Rachycentron canadum* occurs		
[n=11]		
FAO Area	Status	Note
Atlantic, Northwest	native	
Atlantic, Western Central	native	
Atlantic, Eastern Central	native	
Mediterranean and Black Sea	introduced	
Atlantic, Southwest	native	
Atlantic, Southeast	native	
Indian Ocean, Western	native	30° E - 80° E; 45° S - 30° N
Indian Ocean, Eastern	native	77°E - 150°E; 55°S - 24°N
Pacific, Northwest	native	
Pacific, Western Central	native	
Pacific, Eastern Central	native	
New FAO area	Back to Search	

Last modified by Eli, 17.11.05. (dd.mm.yy)

More info | Plus d'info | Mais info FishBase

Occurrence Record of *Rachycentron canadum*

Gazetteer

Main Ref:	IGFA, 2001 (Ref. 40637)	Museum: [IGFA]
Name used:	Rachycentron canadum	Sex:
Catalog No.:	IGFA 3542-12238	Picture:
Locality:	Pinas Bay, Panama	
Station:		Gazetteer:
Year:	1966	Date: 18/06/1966
Water depth:	- m	Salinity:
Altitude:	- m	Temperature: °C
Coordinates:		Accuracy:
Geog. area:		
Country:	591 - Panama	
Length:	cm	Range: -
Collector:		Identifier:
Gear:		

Entered:Greenfield,David - 18/03/2004 Back to Search

Update

Page created by: Eli, 10.08.05, last modified by Eli, 11.04.07

Highly migratory species
Not abundant throughout its distribution range
Non-invasive

FishBase Map link:

The computer generated native distribution map of cobia in the region shows 0.8-1.0 (80-100%) likelihood of occurrence. Check at:

http://fishbase.sinica.edu.tw/tools/aquamaps/receive.php#

www.fishbase.org/References/FBRefSummary.cfm?ID=10948&database=FB

Comparative Growth of Cobia and Snapper
45 DPH (Days Post Hatch) to harvest

At stocking (45 days post hatch)
Cobia = 5.5 g; 11.5 cm (4.5 in)
Snapper = 0.2 g; 2.0 cm (1.0 in)

At harvest (10-12 months post hatch)
Cobia = 4-6 kg (10-12 lb)
Snapper = 0.4-0.6 kg (1-1.5 lb)

UNIVERSITY OF MIAMI EXPERIMENTAL HATCHERY

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HATCHERY TECHNOLOGY
Semi-Intensive Larval Rearing of Cobia in Ponds

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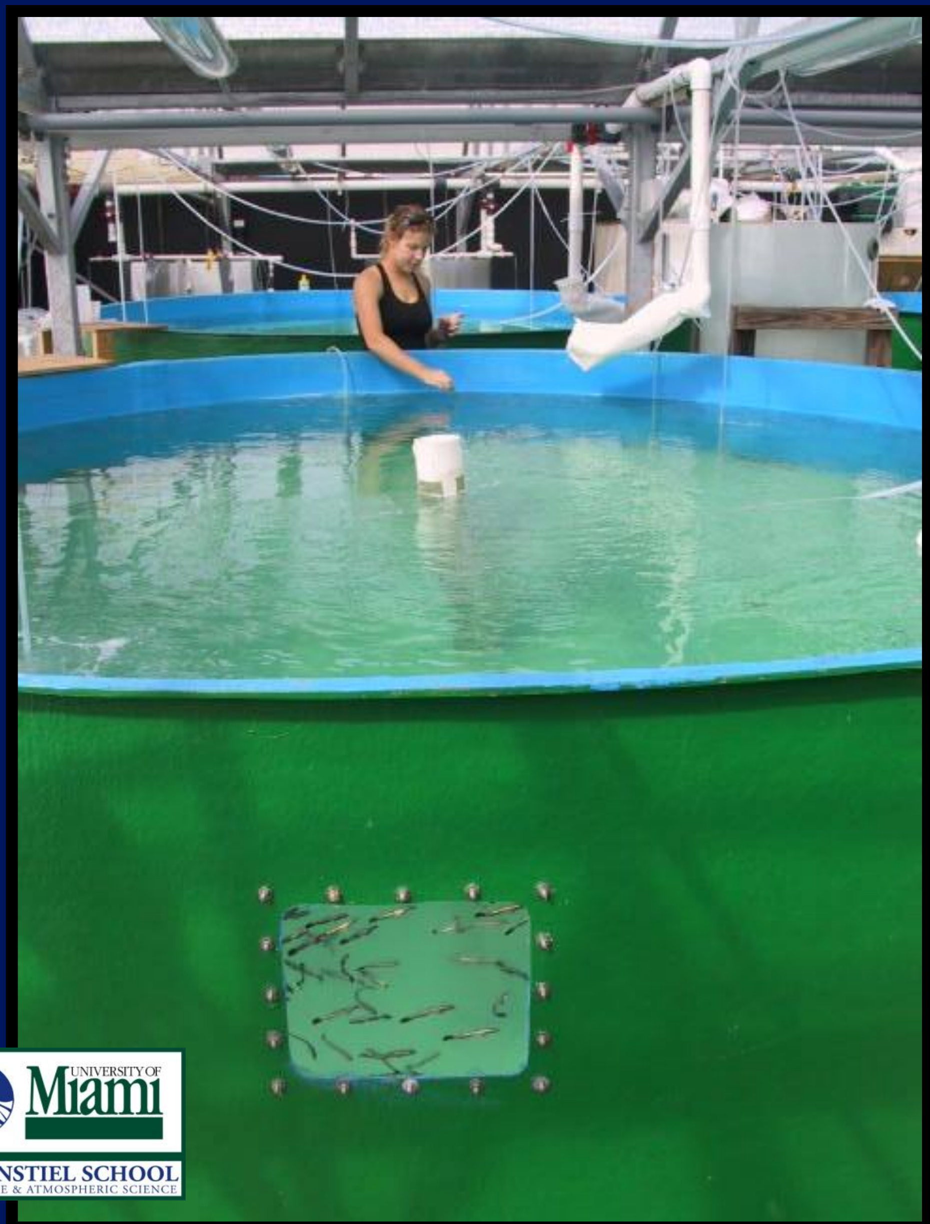
COBIA FINGERLING PRODUCTION - NURSERY/SHIPPING STAGE



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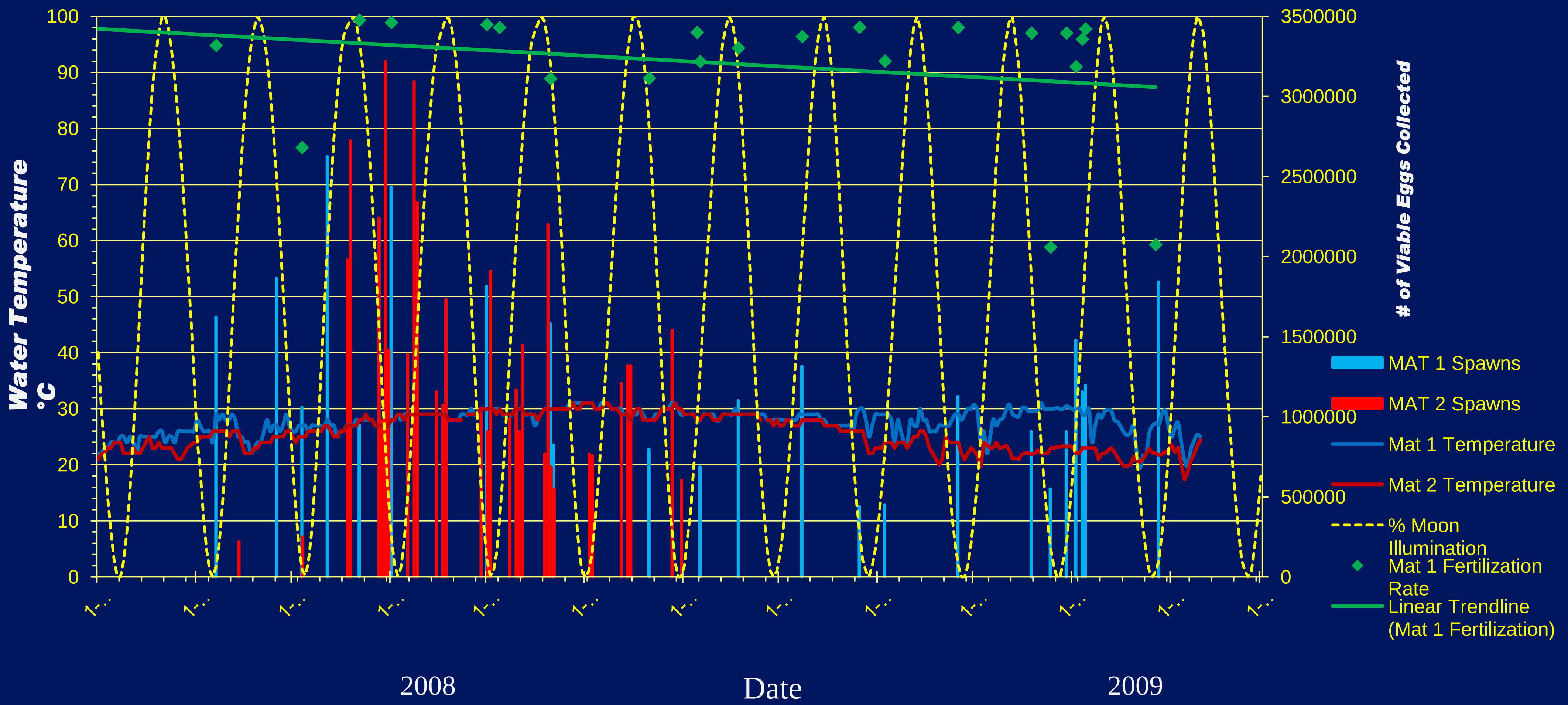
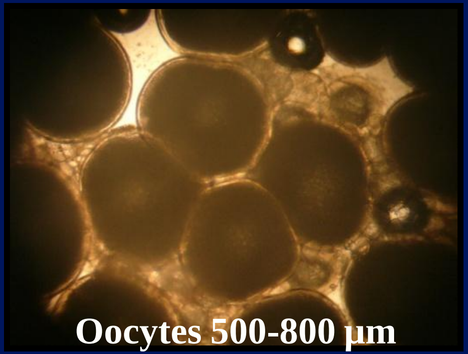
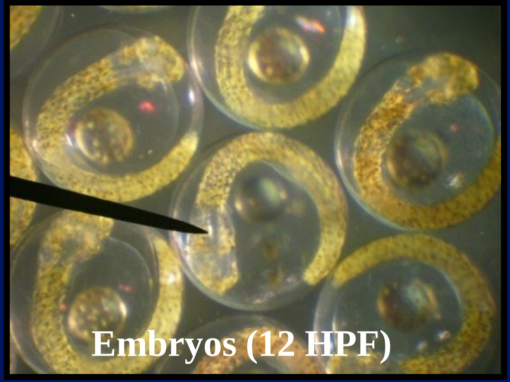
UMEH Cobia Spawning Events 2008 - 2009



HATCHERY TECHNOLOGY OF COBIA *Rachycentron canadum*

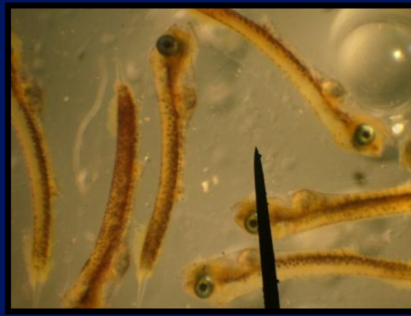

Oocytes 500-800 µm


Embryos (12 HPF)


Yolk-sac larvae - 1 day old


10 days old

1. Selective breeding
2. Probiotics
3. Improved nutrition
4. Prophylaxis
5. Diligent work


3 days old day larvae


20 days old post-larvae


45 days old (4.5 in)

COBIA MEETS MOST CRITERIA


RELIABLE FINGERLING PRODUCTION!
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Shipping and
Stocking Submerged Cages

San Juan, Puerto Rico

Rock Sound, South Eleuthera, Bahamas

Fajardo, Puerto Rico

Stocking Submerged Cages

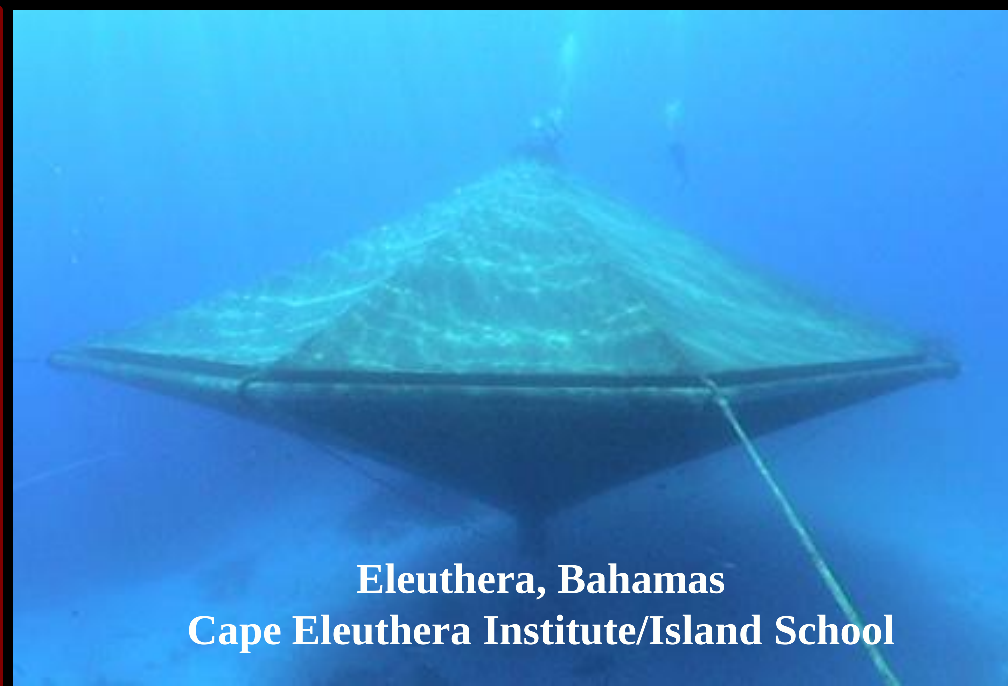
Snapperfarm's boats

Shipping and Stocking Gravity Cages (Marine Farms Belize)

U.S. and the Bahamas: submerged open ocean cages

Culebra, Puerto Rico
Snapperfarm, Inc.

Culebra, Puerto Rico
Snapperfarm, Inc.



Eleuthera, Bahamas
Cape Eleuthera Institute/Island School

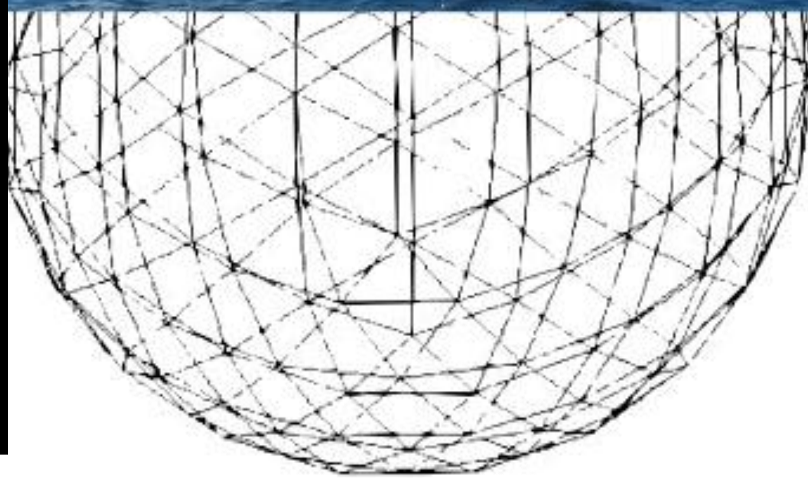

Eleuthera, Bahamas


Culebra, Puerto Rico

Ocean Farm Technologies, Inc.
Snapperfarm, Inc.

The Aquapod is a totally submersible secure predator proof system.

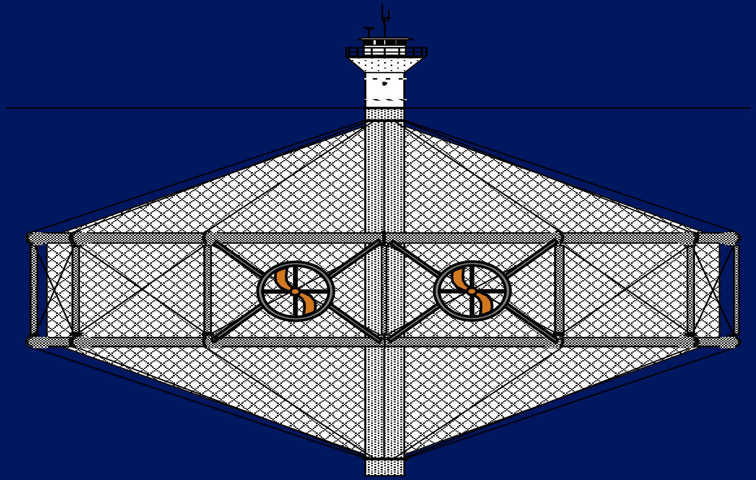
New Aquapod and SeaStation models can be exposed to the surface for cleaning and servicing.

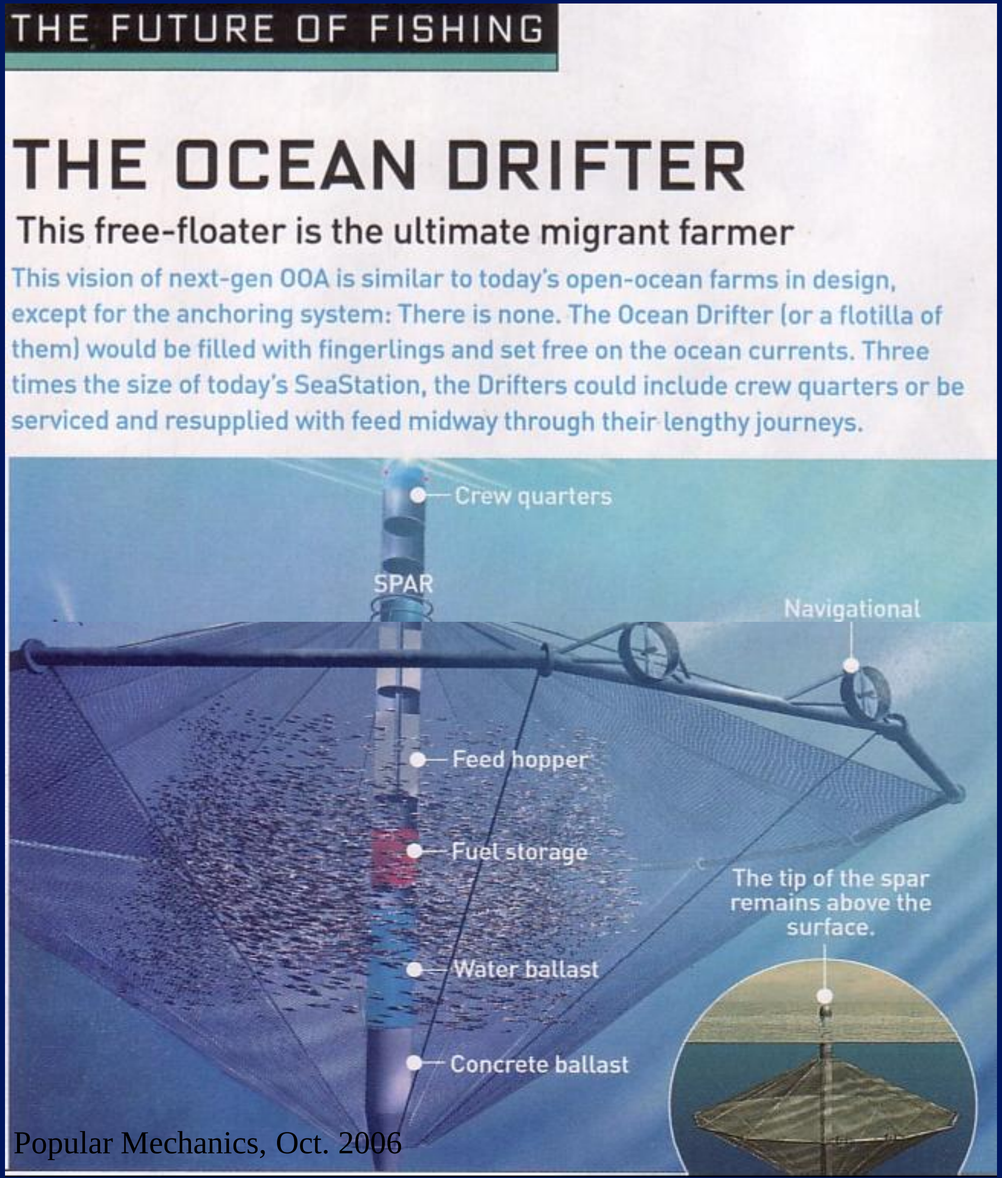


Advancing and automating open ocean containment systems

Cleaning and selective harvest

New Systems Designs: The future?

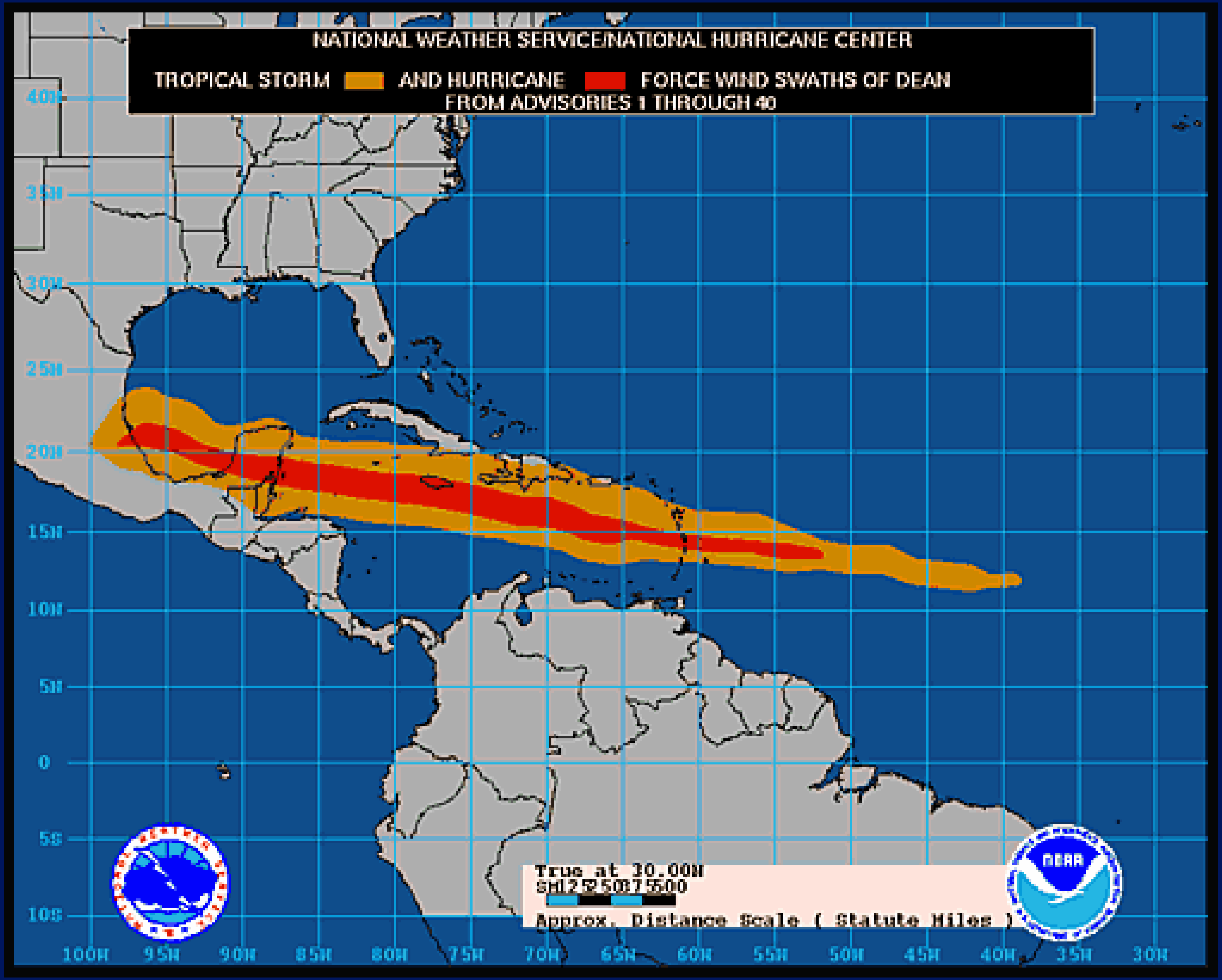




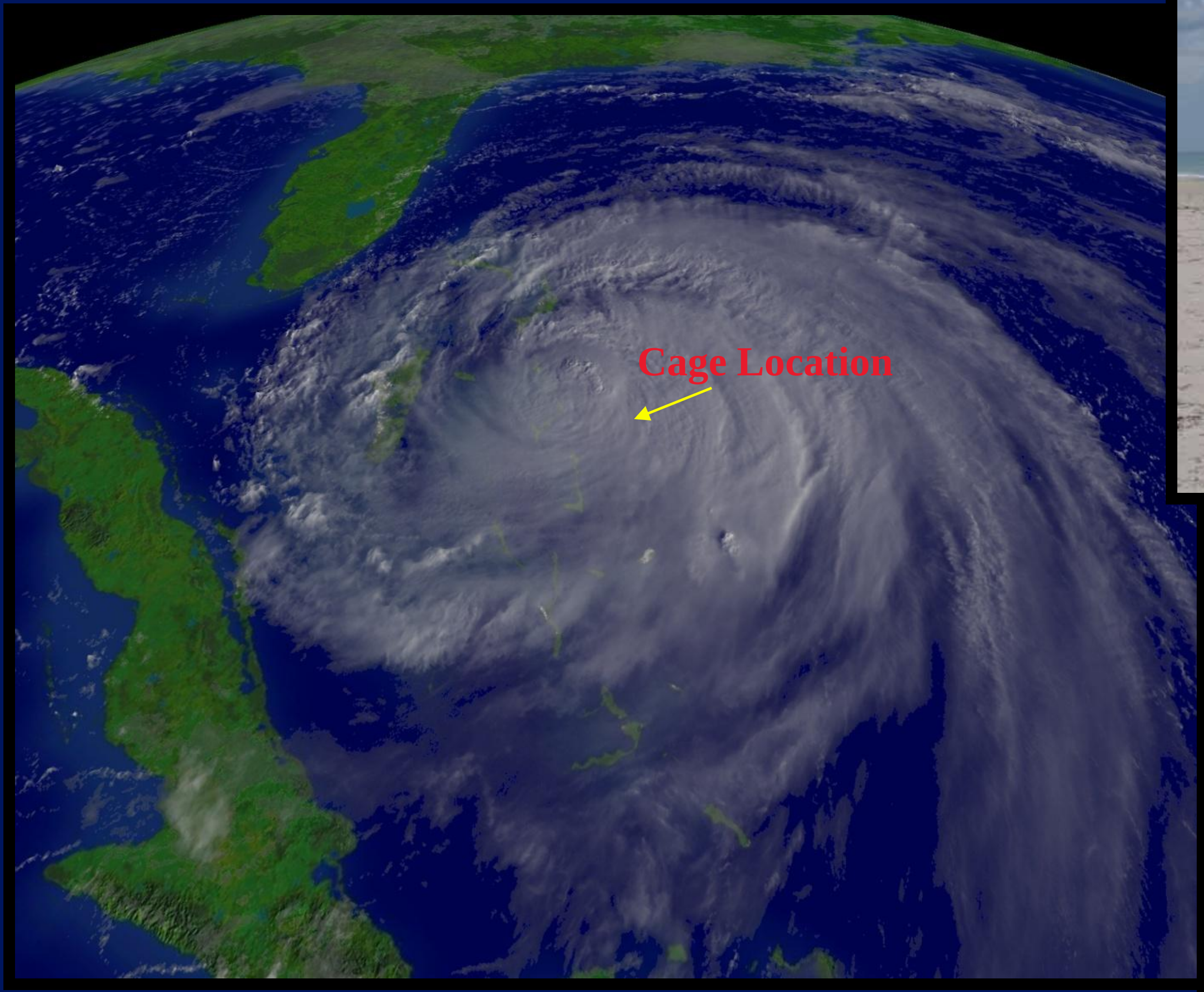
Popular Mechanics, Oct. 2006

Ocean Drifter (MIT Sea Grant/NOAA/Snapperfarm/OFT/UM)

Hurricane Dean Path and Cobia Farms in the Region
August 2007

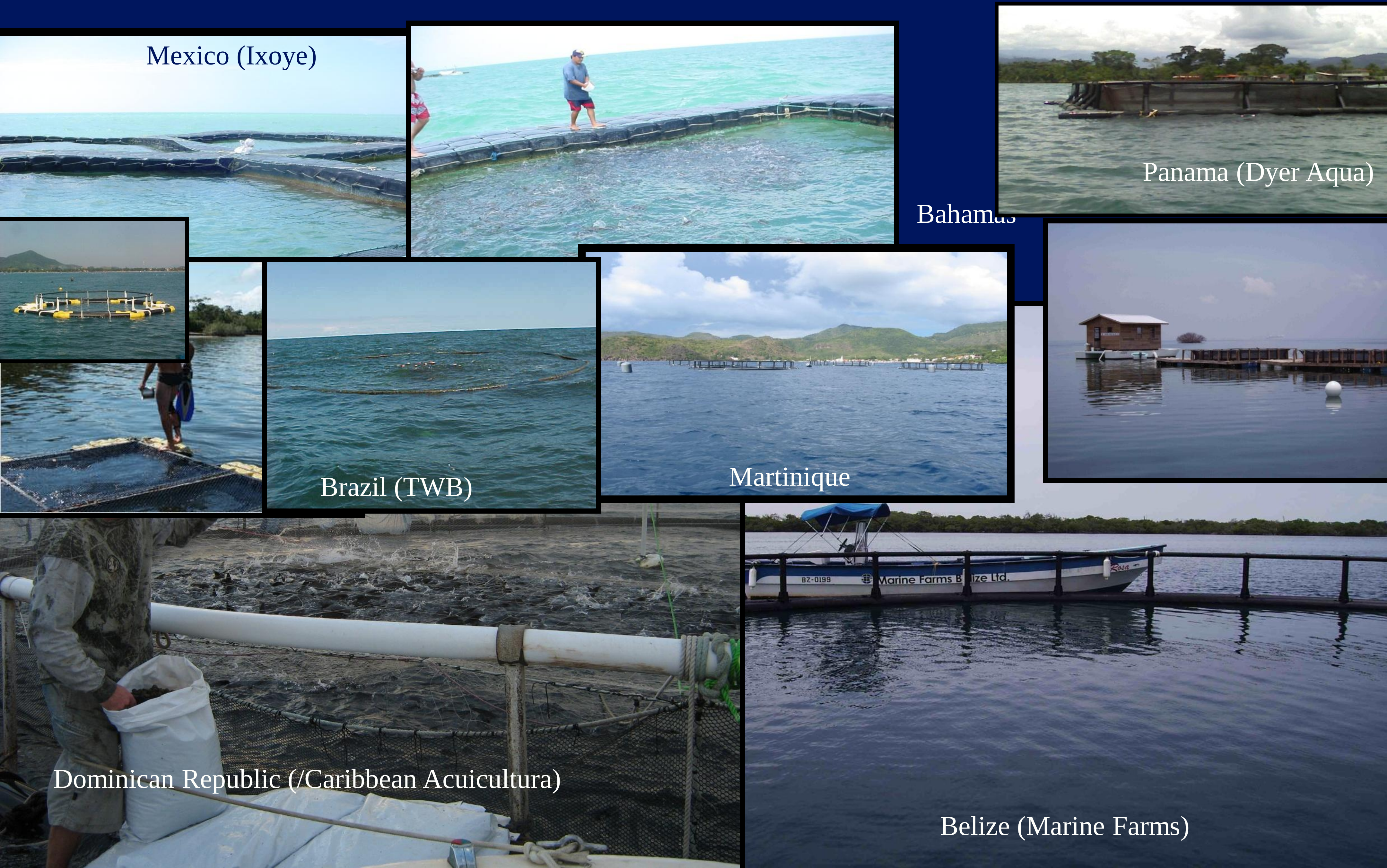


High Tech Submerged or Traditional Gravity, Floating Cages?



Hurricane Frances, 2004, South Eleuthera, Bahamas

Cobia Cage Culture Operations in Latin America and Caribbean



HDEP cages that are large, flexible, and ‘conform’ to wave

New cage culture operations in Latin America

Marine Farms Belize - Cobia

Aquapargos Costa Rica - Snapper

Other important developments with cobia: Pristine Ocean, Farallon and Open Blue Sea Farms in Panama; Aqualider and TWB in Brazil; Ocean Farms in Ecuador (also Seriola and snapper)

Site Selection/Environmental Monitoring

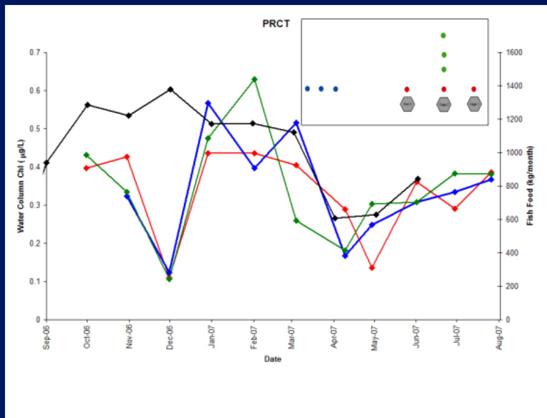
Main goal is to determine assimilation (carrying or environmental) capacity and develop environmental modeling for site

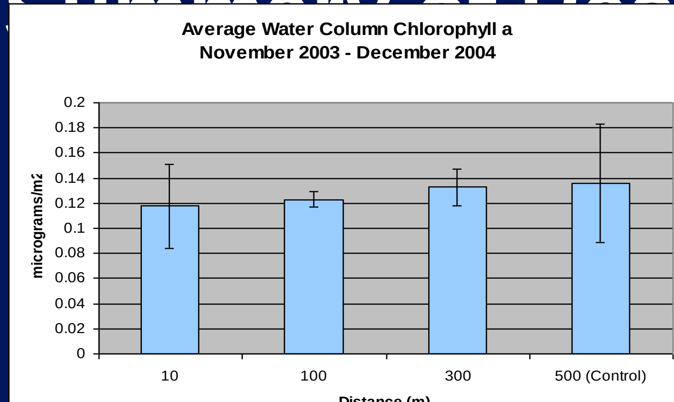
1st step is to determine baseline environmental parameters

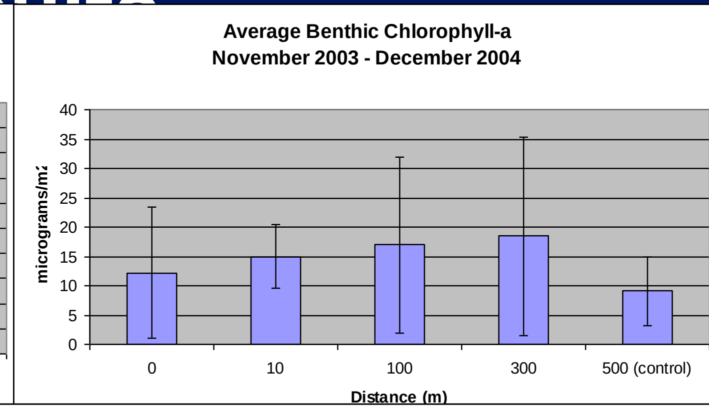
- **Physical factors**
  - Bathymetry (depth profile)
  - Bottom type (preferred sandy)
  - Wind velocity/direction/fetch
  - Currents and tides
  - Wave height (max/min/average)
  - Air and water temperature
  - Turbidity
- **Biological factors**
  - Fouling
  - Chlorophyll
  - Productivity
  - HABs
  - Assemblage
  - Benthic studies (biol. shifts/indic.)
  - Interactions w/ predators (+/-)
- **Chemical factors**
  - Total suspended solids
  - Ammonia
  - Nitrite
  - Nitrate
  - Phosphate
  - Dissolved oxygen
  - Organic matter
  - Nitrogen
- **Socio-economic factors**
  - Acceptance of project (govmt/community)
  - Partnership local Fishermen Associations
- **Educational factors**
  - Elementary / High School / Technical Level Curricula

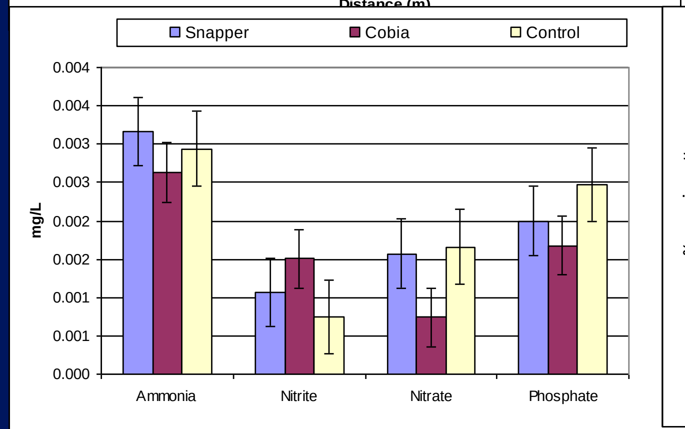
Environmental Monitoring 2003-2008

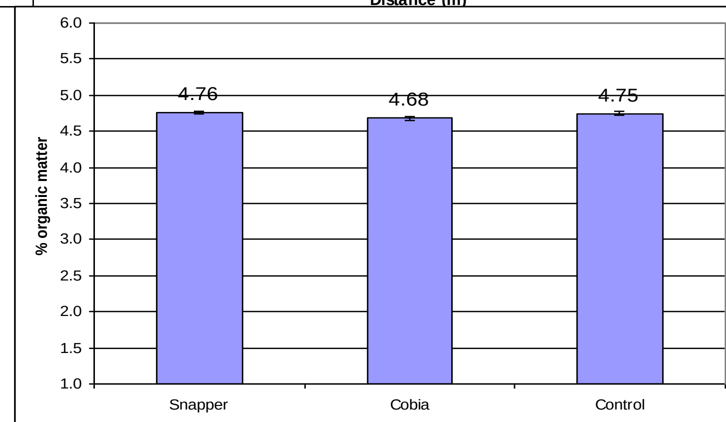
Summary of Results











Chlorophyll-a, dissolved nutrients, organic matter in sediments:

No significant or cumulative impacts found in the water column and at the bottom

Alston et al. 2005; 2006; Collins, J. 2006 (thesis); Benetti et al. 2006 (World Aquaculture); Brand et al. (MS in prep.)

Feeding trials with juvenile cobia using commercial diets at UM Hatchery

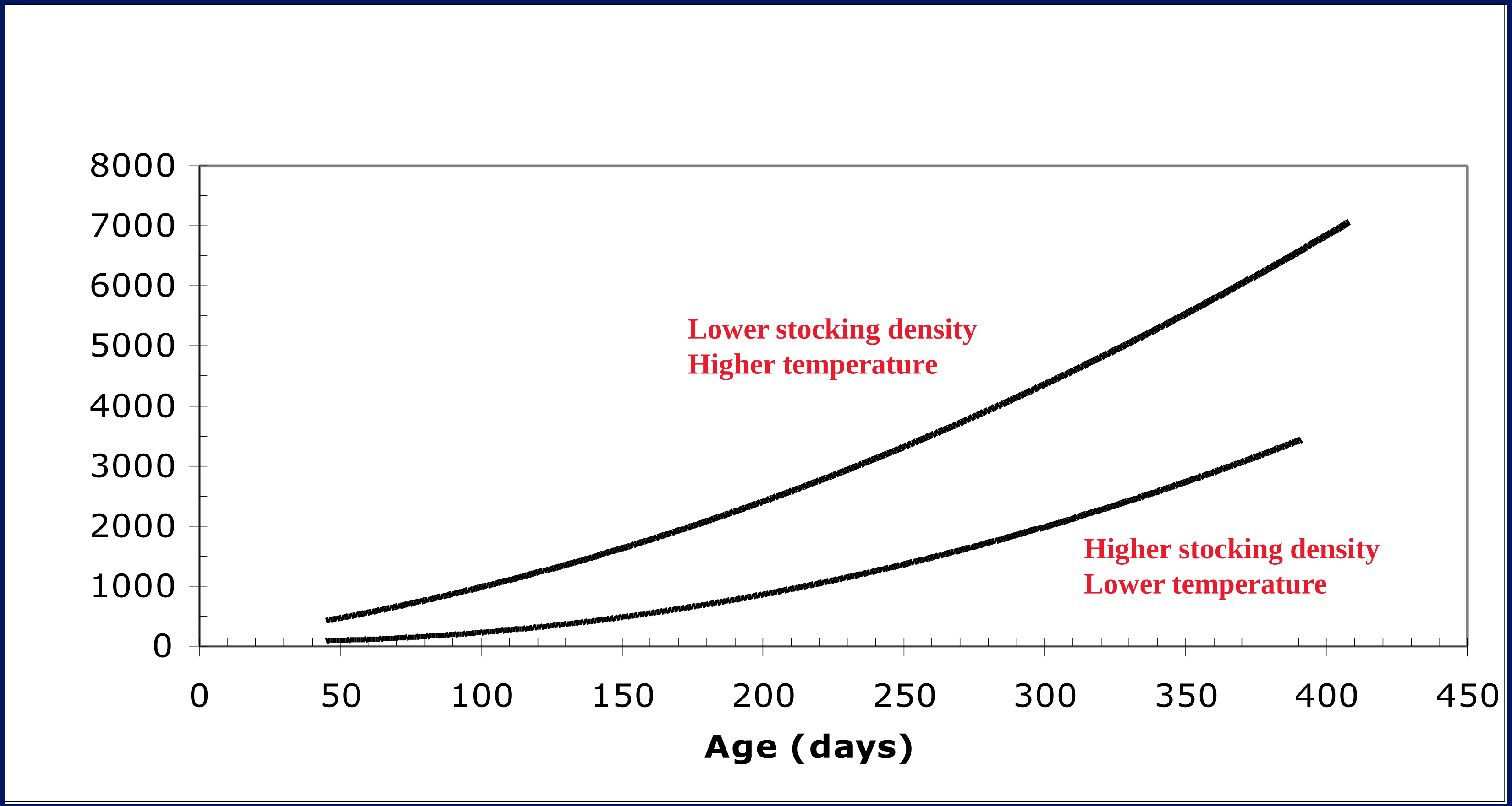
Stocking density = 30 fish/10 m^3 (10 kg/m^3)

Biweekly sampling

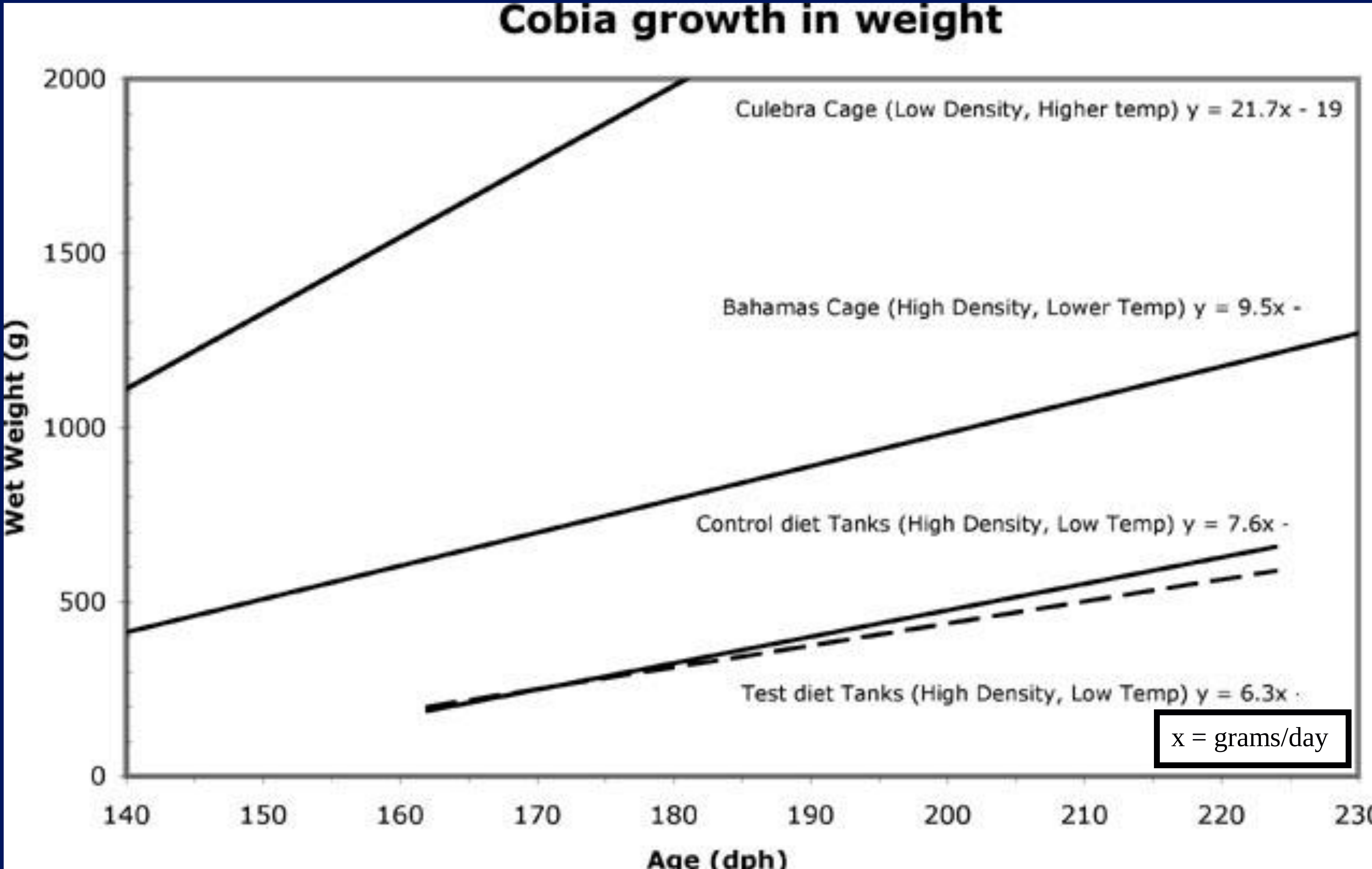
	Control Diet Higher Protein/FM/FO/energy/fat	Test Diet Lower Protein/FM/FO/energy/fat
Crude Protein (%)	50% (100% FM)	46% (35% FM)
Crude Fat (%)	18%	7%
Calories from protein and fat (cal/g)	4.5	3.2
Energy of feed	39% higher	
Initial weight mean (g)	187.1	198.6
Final weight mean (g)	658.6	588.6
Absolute growth (g)	**471.4**	**390.0**
Absolute growth rate (g/day)	**21% greater**	
Relative growth	**29% greater**	
Feed given (g)	**17% less**	
Energy intake	16% higher	
FCR	**1.01**	**1.47**
Price of feed per kg	**32% higher**	
FEC – Feed Economic Conversion	**9% less**	
FCE - Feed Conversion Efficiency (FM)	**2.1**	**0.7**
FCE (by FO – S.A. 5%)	**3.6**	**1.4**
FCE (by fish oil – Norway 12%)	**1.5**	**0.6**
Taste	No perceived differences	Both tasted great sashimi/fried/broiled
Omega-3	Being analyzed	Being analyzed

(Denlinger, B. 2007 and Denlinger et al. MS)

GROWTH RATES OF COBIA CULTURED IN OPEN OCEAN CAGES IN PUERTO RICO AND THE BAHAMAS



Growth rates of juvenile cobia (150 - 2000 grams) in cages and tanks



HARVESTING/PROCESSING/SHIPPING

Snapperfarm, Inc.

HARVESTING

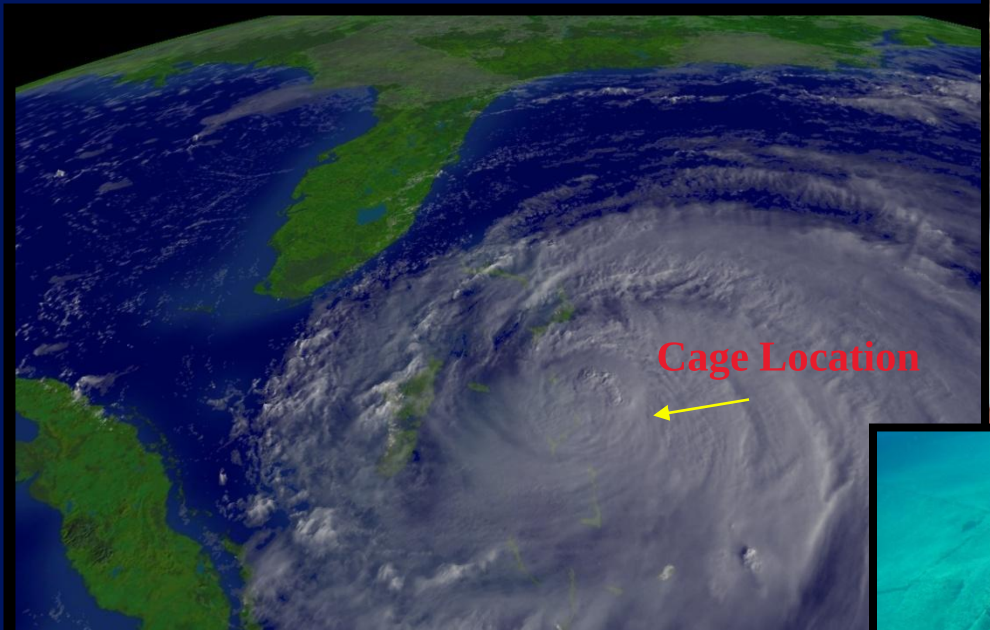
… FOR A HIGH-END MARKET

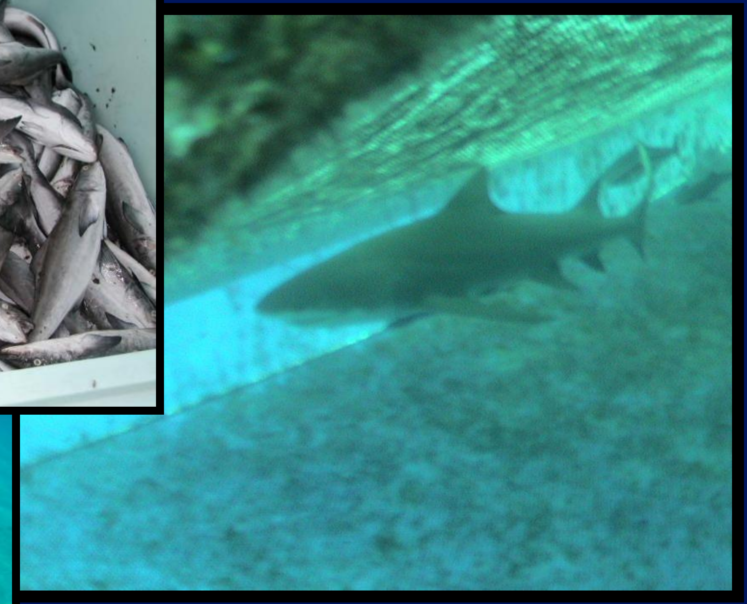
Sushi (sugi), sashimi, carpaccio, ceviche; grilled, blackened, putanesca, bbq, deep fried, etc…






Potential problems: storms, predators, escapements, diseases, red tides, HABs, etc.





MAJOR CONTENTIOUS ISSUES: WHAT ARE WE DOING ABOUT IT

Feeds, diseases, pollution and escapements/genetics

FEEDS: Improving quality, conversion, economic and ecological efficiencies, < fish meal

DISEASES: Probiotics and vaccines, improved management, water quality, prophylaxis

POLLLUTION: exposed areas, > depth and currents, > assimilation, > environment

ESCAPEMENETS/GENETICS: Native species, > systems engineering, management

Researchers, industry, government, regulators and organizations (NOAA, FAO, IFFO, WWF, etc.) are strongly committed to improve sustainability and eco-efficiency not only because of environmental concerns but also for economic/business common sense

NEED TO DEVELOP STANDARDS

Estimated cobia production in the Americas 2008

COUNTRY	HATCHERY	PRODUCTION (# fingerlings)	GROWOUT (tons)	SYSTEM (cage type)
UNITED STATES	Yes	400,000	100	Submerged[1,2]
BELIZE	No [3]	N/A	300	Gravity
DOMICAN REPUBLIC	No [3]	N/A	100	Gravity
MEXICO	Yes	100,000	100	Gravity
MARTINIQUE	No	N/A	100	Gravity
BAHAMAS	Yes [4]	N/A	< 50	Submerged / Gravity
PANAMA	No [3]	N/A	< 50	Gravity
BRAZIL	Yes [4]	20,000	< 10	Gravity/Semi-submerged[5]
TOTAL		520,000	< 800	

1 SeaStation 3000

2 Aquapod

3 Hatcheries under construction

4 First year operating

5 RefaMed

CONCLUSIONS / SUMMARY

- Aquaculture of cobia (high-value marine fish) can produce high yields with no significant or cumulative environmental footprint

- Highest yield with least impact than other human productive activities

- Objective is to produce "high-value" carnivorous fish to high-end market

- "High-value" = high quality and price but also rich in omega-3 fatty acids (EPA and DHA) essential for human health / nutrition – not just a luxury

- Addressing contentious issues: native species (no GMO's); probiotics; FDA approved chemicals/drugs; exposed sites open ocean; efficient feeds, low FCR, reduce use of fish meal; no drugs, chemicals, ATB's, hormones, pigments - all natural, "organic"…

CONCLUSIONS / SUMMARY

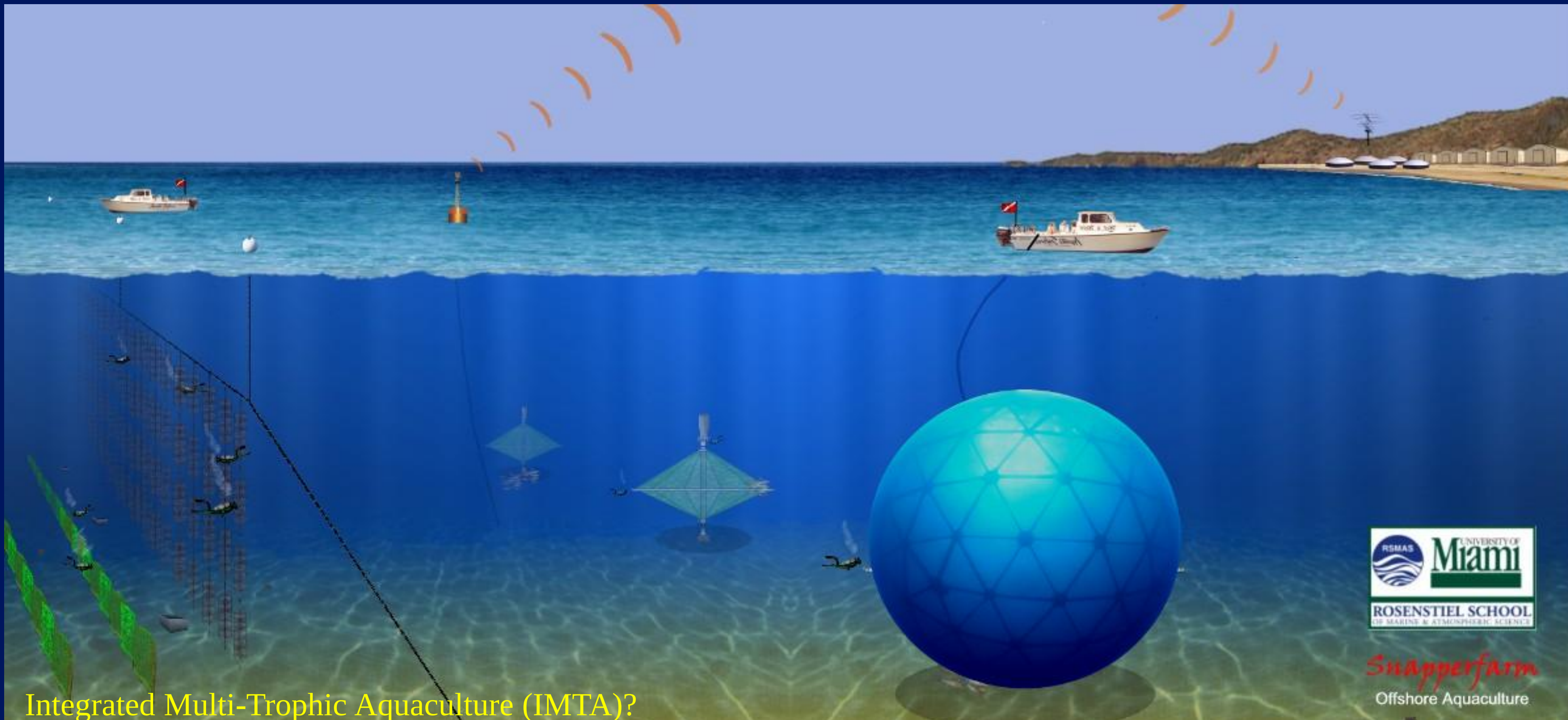
- Properly sited and managed, aquaculture of high-value marine fish can produce high yields with no significant or cumulative environmental impact

- Continue environmental monitoring with improved methods to ensure sustainability and determine threshold/carrying capacity of different areas/sites (clusters)

CONCLUSIONS / SUMMARY / (cont.)

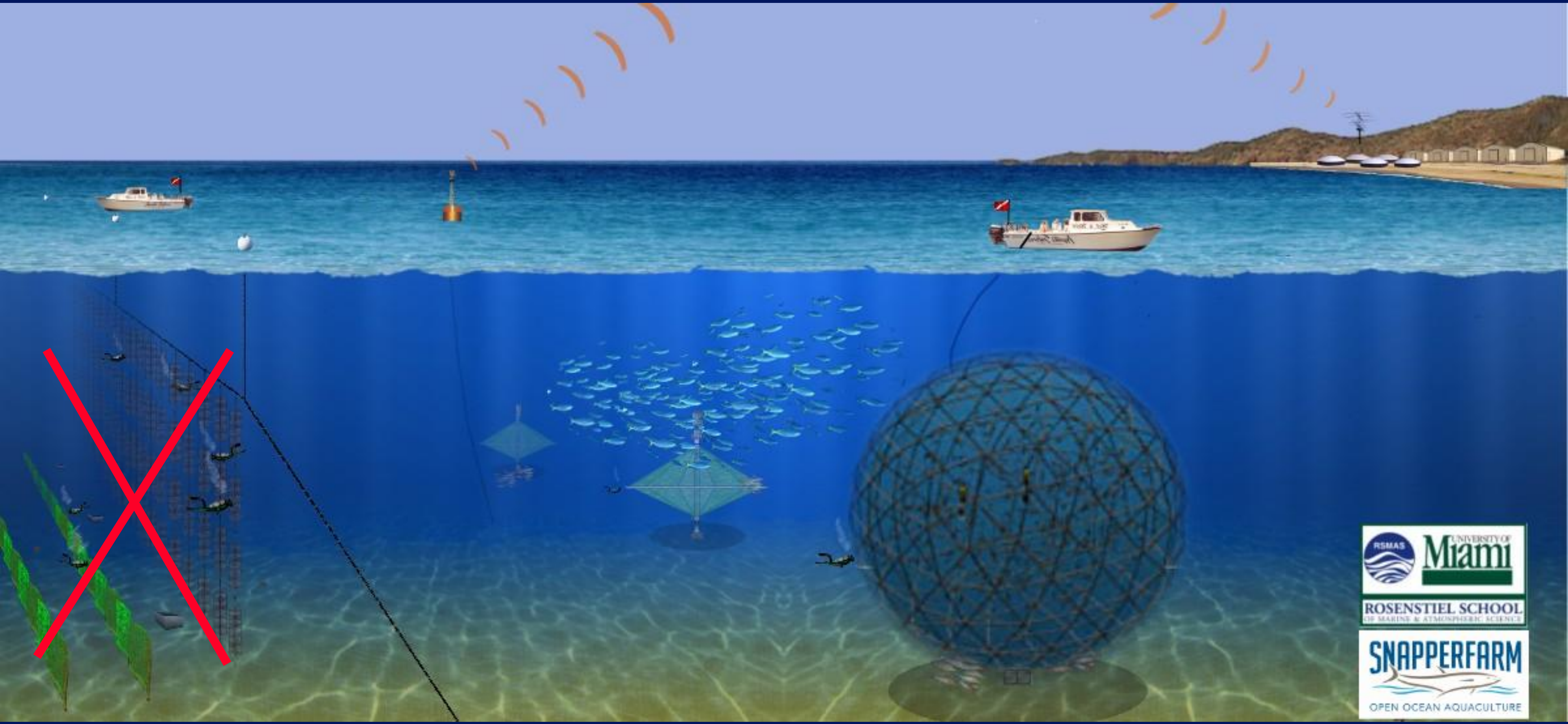
- Expansion of cobia aquaculture is a certainty: demand/production will continue to grow
- Industry development will bring enormous social, economic and technological benefits
- Decision to develop local aquaculture industry or keep importing seafood is <u>political</u>
- It will be difficult / expensive to operate offshore systems relative to traditional systems
- Oil platforms/rigs infrastructure offer potential as hatchery and growout operations
- Recirculating systems offer potential: technological feasibility in place but economic viability still uncertain (growth rates?)
- Advanced technology is being used in the US with much progress (hatchery/growout)
- Addressing and resolving al issues except regulatory/permitting process
- Asian, Latin American/Caribbean countries have available infrastructure/access expertise and…
- It’s happening just like predicted and anticipated.

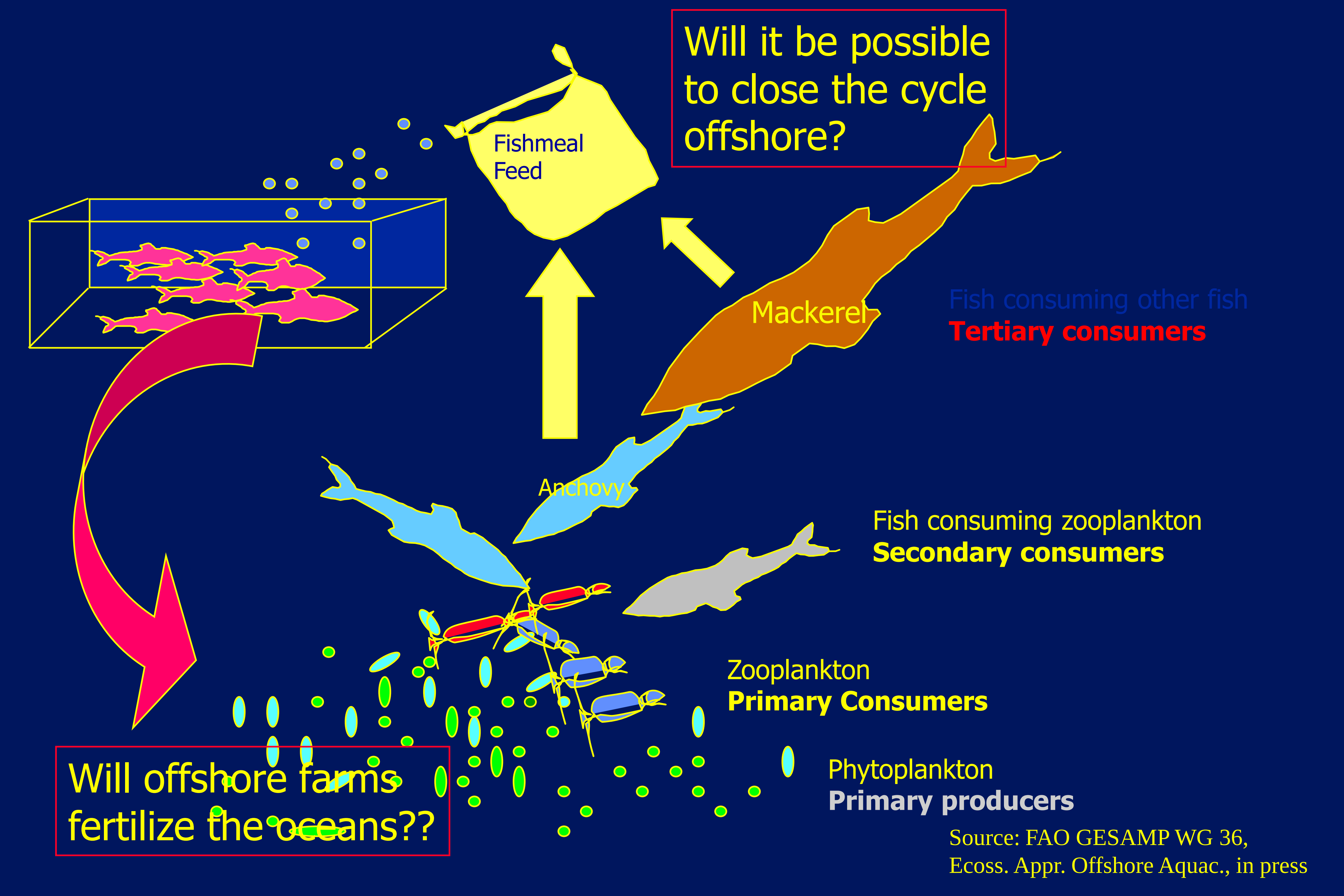
OPEN OCEAN AQUAFARM - A REALITY
THE FUTURE OF SEAFOOD PRODUCTION



www.snapperfarm.com www.rsmas.miami.edu/groups/aquaculture -

ENVIRONMENTALLY SUSTAINABLE, ECONOMICALLY VIABLE, SOCIALLY RESPONSIBLE, CARBON SINKING OPERATIONS





Will it be possible to close the cycle offshore?
Fishmeal Feed
Mackerel
Fish consuming other fish
Tertiary consumers
Anchovy
Fish consuming zooplankton
Secondary consumers
Zooplankton
Primary Consumers
Phytoplankton
Primary producers
Will offshore farms fertilize the oceans??
Source: FAO GESAMP WG 36, Ecoss. Appr. Offshore Aquac., in press

THANKS!


RSMAS
UNIVERSITY OF Miami
ROSENSTIEL SCHOOL
OF MARINE & ATMOSPHERIC SCIENCE
Snapperfarm, Inc.
Sea Grant
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA
Florida Department of Agriculture and Consumer Services
Division of Aquaculture