SUSTAINABLE MARINE AQUACULTURE AND THE FUTURE OF SEAFOOD PRODUCTION

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Biscayne Bay Regional Restoration Coordination Team (BBRRCT)
Meeting Presentation
June 18, 2014

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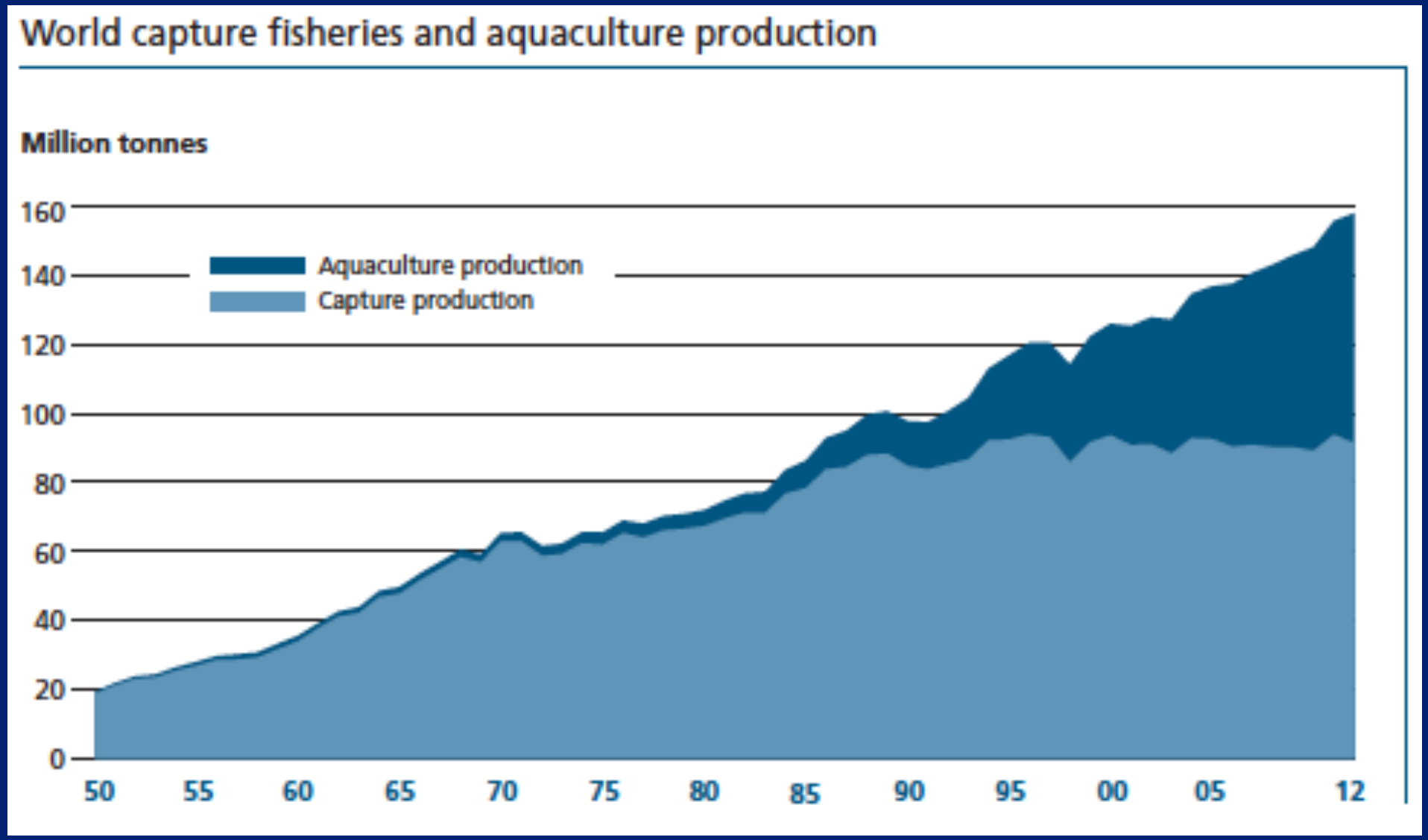
SUSTAINABLE DEVELOPMENT AND RATIONAL USE OF NATURAL, RENEWABLE RESOURCES

CURRENT STATUS AND TRENDS IN FISHERIES, AQUACULTURE AND HUMAN POPULATION

- Human population >7 billion and will top 9 billion in a few decades.
- Need to produce 60 – 70% more food than is produced on earth today.
- Need economically and environmentally sustainable way to produce more food.

CURRENT PRODUCTION



Source: FAO, 2014

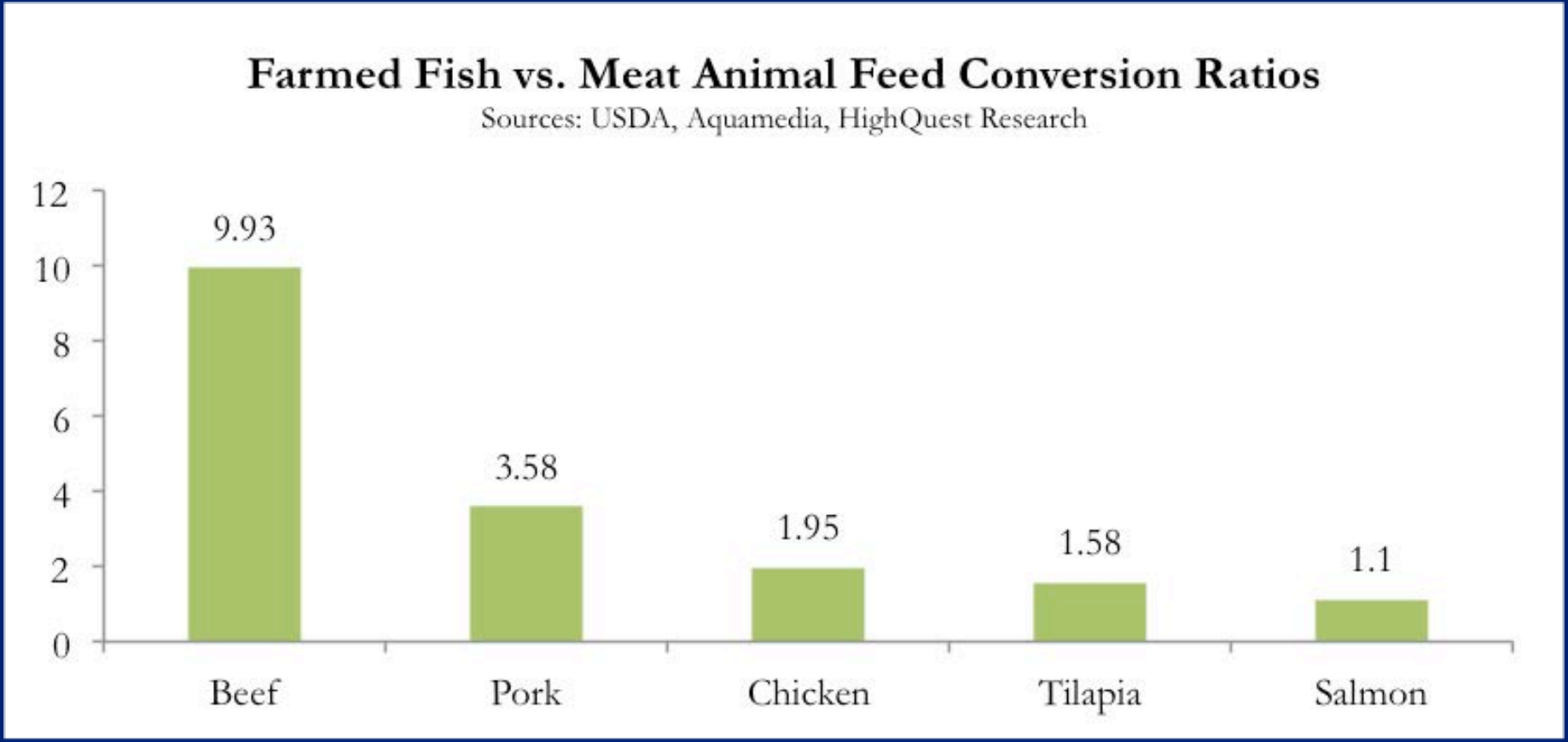
Where will we get our fish?

- Fish consumption: increasing, world population growing
- Overfishing: The fraction of stocks fished within sustainable levels continues to decline
- Supply from capture fisheries remains nearly constant
  - Natural resources exhausted

- US imports 2/3 of seafood consumed, most of it farmed
- US produces 3% of total world aquaculture production
- US seafood trade deficit ~ $11 Billion /year and growing
- Increases in seafood supply *will not* come from wild fisheries

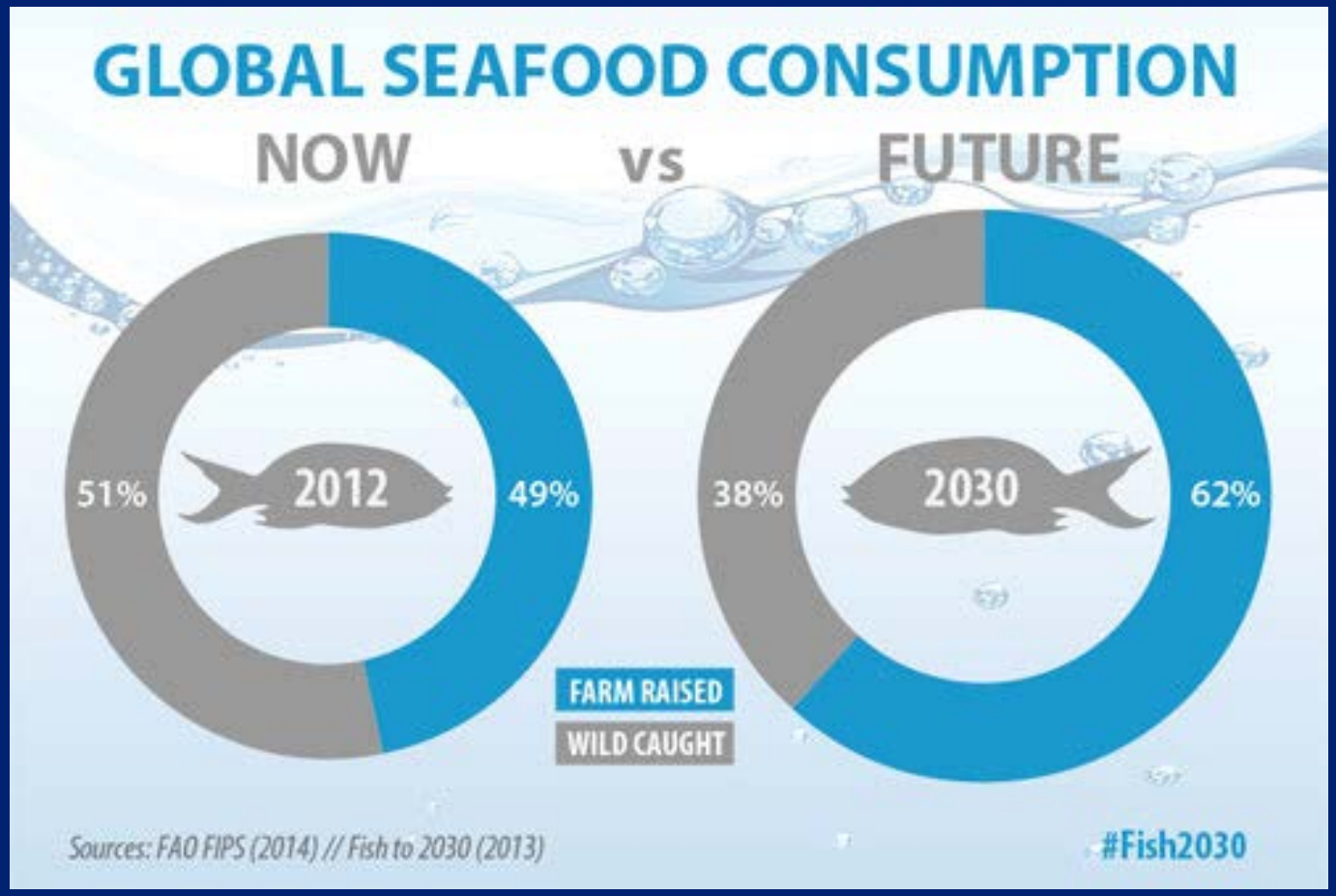
- Meanwhile…
  - World aquaculture production has been steadily increasing:
    - 10% per year over the last decade / more than doubled last 15 years
      - > 50% of seafood for human consumption…

Efficient Production of Animal Protein



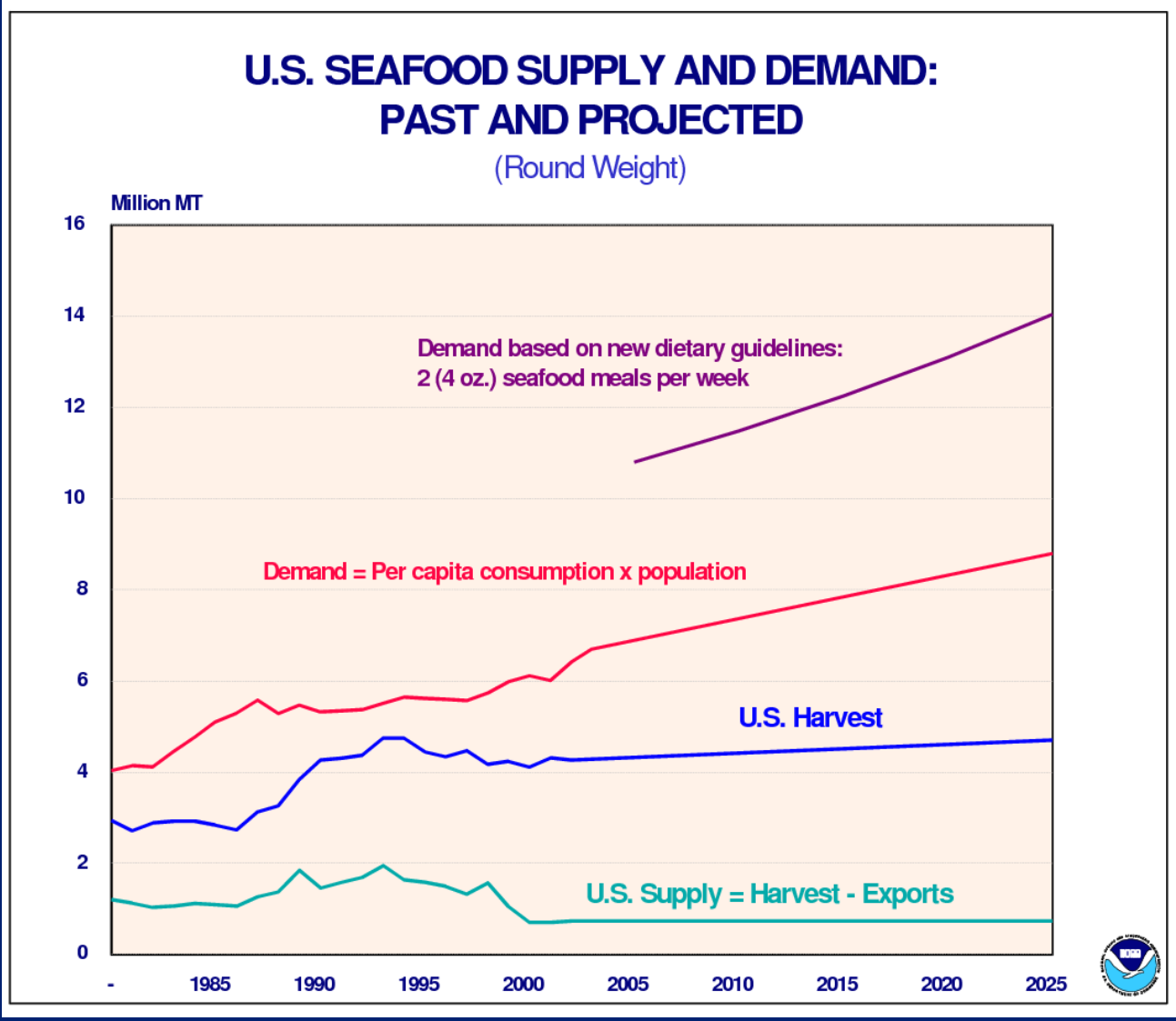
AQUACULTURE'S PRODUCTION EFFICIENCY

The Future of Seafood



US Seafood Industry

- ~$11 Billion / Year Seafood Trade Deficit

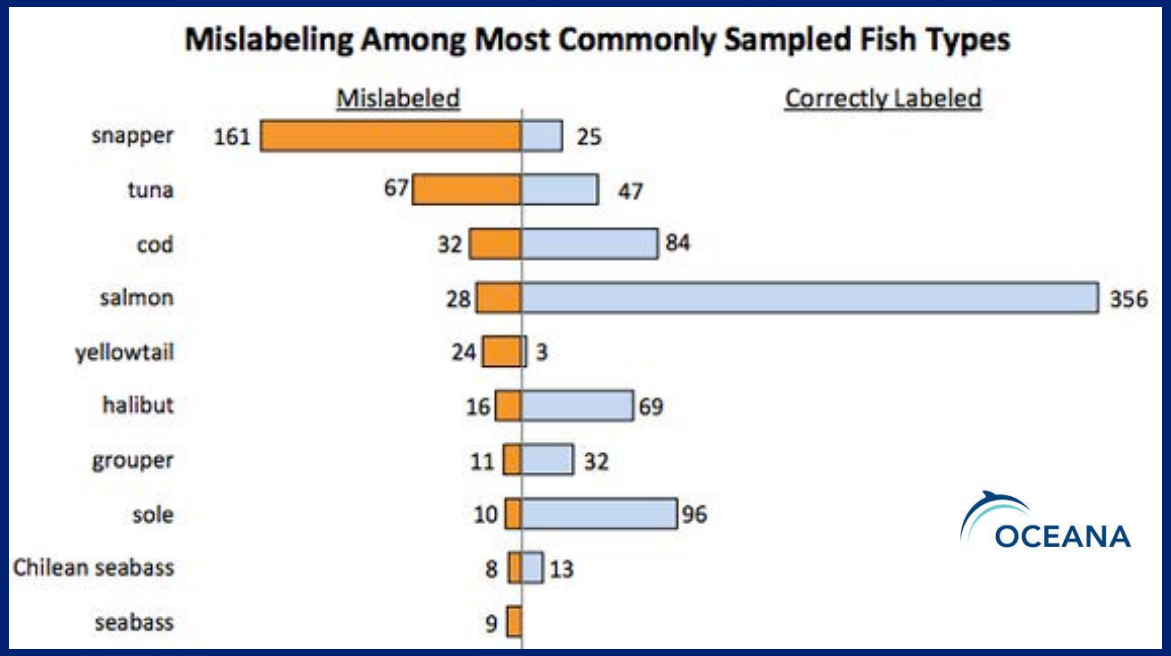


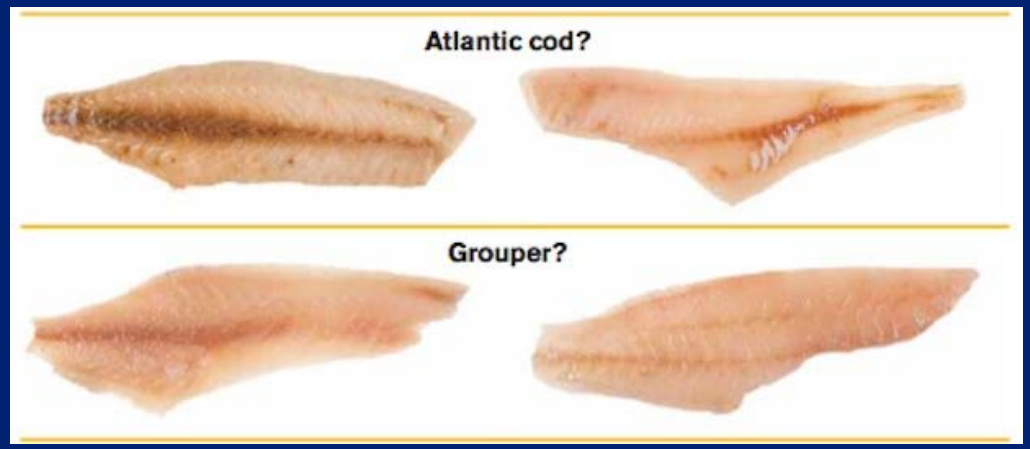
Do we know what we're eating?

- 33% of fish on sale in the US is not the species it is sold as
- 80% of the red snapper sold in the US is not red snapper
- 25% of cod and haddock sold in the UK is neither of these
- 7 out of 8 "wild salmon" sold in gourmet shops in NY are farmed and the other one was a farmed escapee

THE BASA PHENOMENON (All over the world…)

Seafood Mislabeling





10 MYTHS ABOUT US AQUACULTURE

10. The US doesn't need aquaculture
9. Aquaculture uses more wild fish than it produces
8. Farmed fish isn't safe to eat
7. Farmed fish are contaminated
6. Farmed salmon is full of "color-added" dyes
5. Farmed fish are full of harmful antibiotics
4. Fish waste from net pens hams the ecosystem
3. Aquaculture causes diseases in wild fish
2. Farmed salmon is full of sea lice
1. Farmed fish and shellfish doesn't taste as good

Source: NOAA - http://www.nmfs.noaa.gov/aquaculture/homepage_stories/10myths.html

UNIVERSITY OF MIAMI EXPERIMENTAL HATCHERY

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SPECIES CURRENTLY AT UMEH

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Almaco/yellowtail jack, huayaipe, kahala, Kona Kampachi® (*Seriola rivoliana*)

Mutton Snapper (*Lutjanus analis*)

Pacific red snapper (*Lutjanus peru*)

Yellowfin Tuna (*Thunnus albacares*)

AQUACULTURE DEVELOPMENT CYCLE

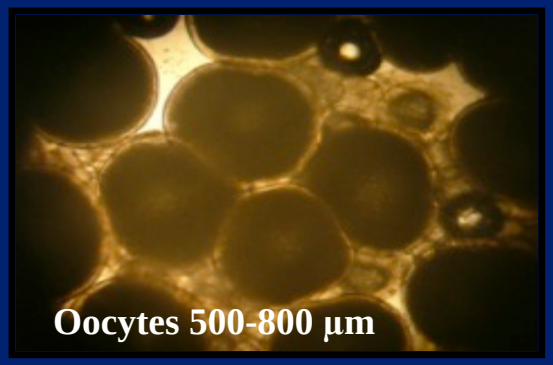
LEADS TO INDUSTRY PARTNERSHIPS:

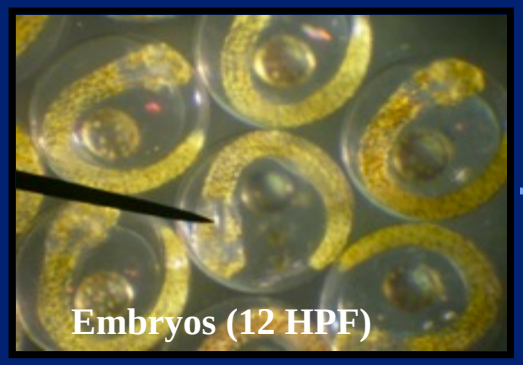
openblue

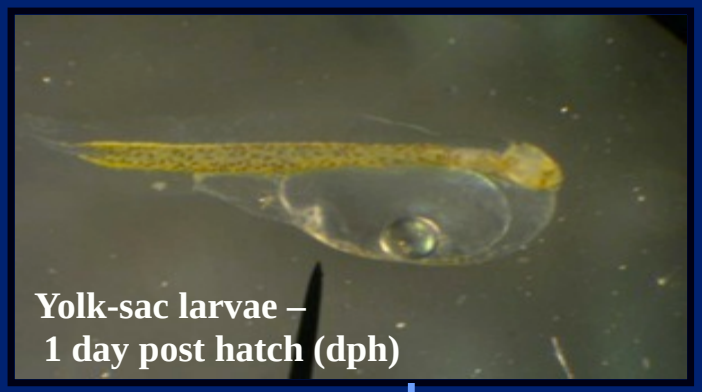
MARICULTURE MARTEC

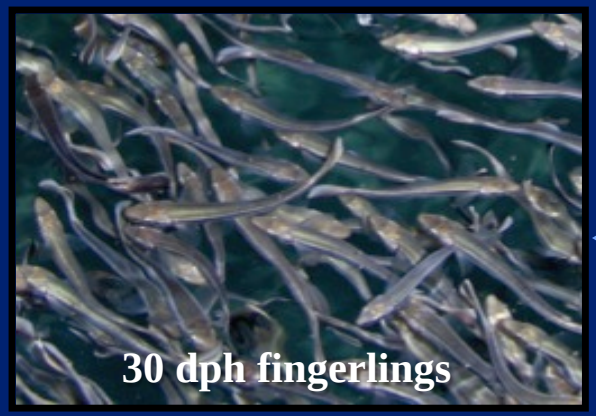
Earth Ocean FARMS

COBIA (*Rachycentron canadum*)



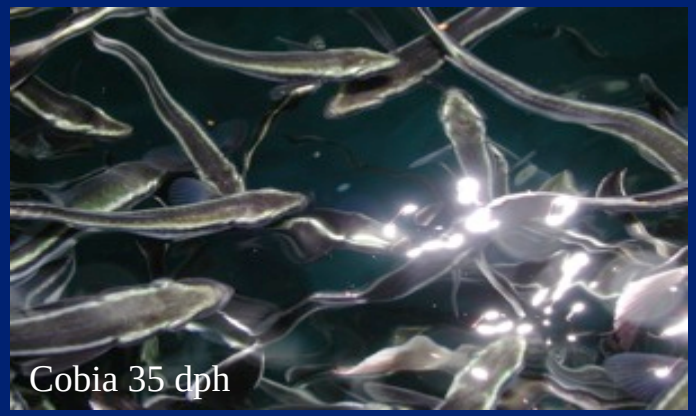






Broodstock Collection

Intensive Larviculture



Cobia 35 dph

Mahi-mahi larvae 1 dph

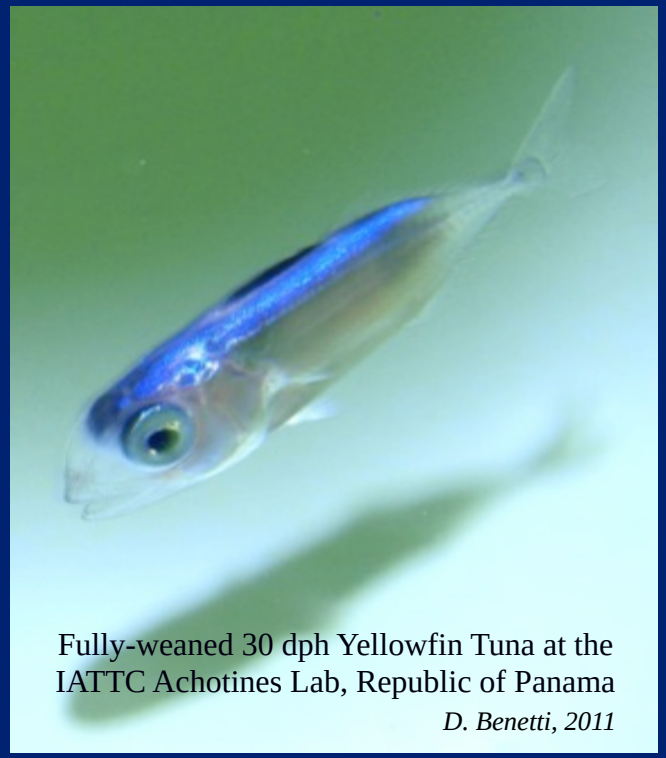
Yellowfin Tuna larvae 7 dph

End Products of Larviculture

25 dph Cobia Fingerling *G.Partridge, 2010*

Goggle eye (18 dph)

Fully-weaned 34 dph Mahi-Mahi *J. Stieglitz, 2012*



Fully-weaned 30 dph Yellowfin Tuna at the IATTC Achotines Lab, Republic of Panama *D. Benetti, 2011*

COMMERCIAL-SCALE PRODUCTION OF JUVENILES IS CRUCIAL!

High larviculture survival rates in Cobia: 15 - 35%

Consistent and reliable production

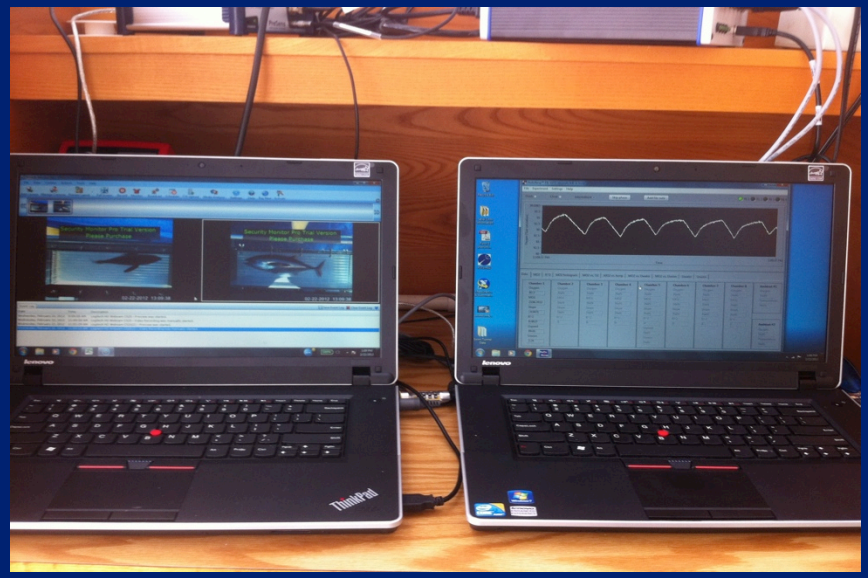
UMEH Nutrition Research

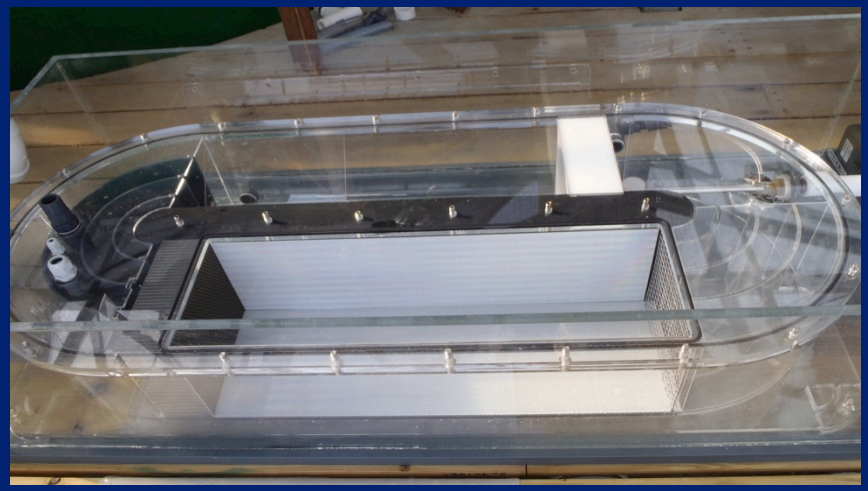
- Growth performance studies on various size fish:
  - Maximizing Fish Meal Replacement with Soybean Meal and Non-GMO Soybean Meal
  - Nutrient Requirements
- Digestibility of proteins, amino acids, lipids, and energy
- Formulating and Developing Diets
- Reducing Food Conversion Ratios (FCRs) through optimized feeding regimes

Developing Species-Specific Feeds: Testing Ingredients and Diets

Optimizing Production Technologies Through Physiological and Bioenergetics Research

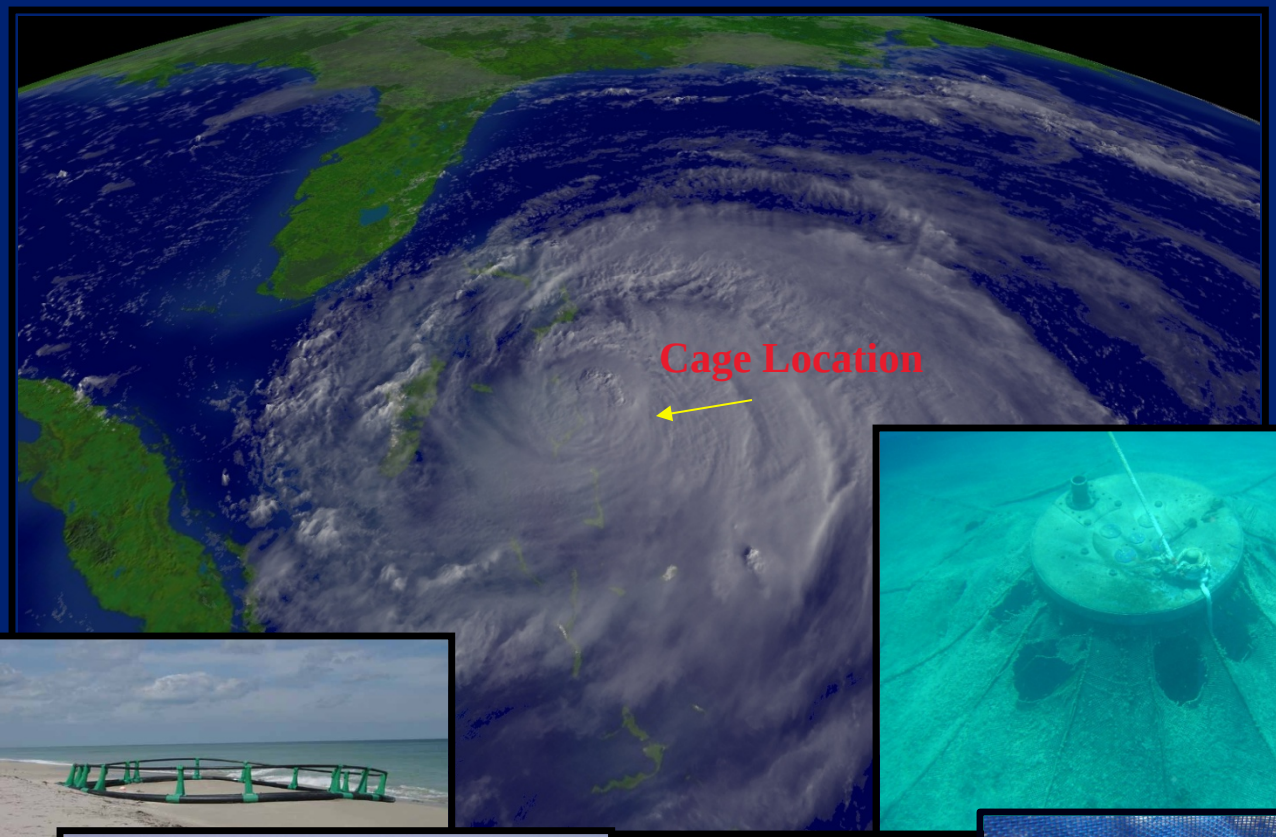
- Ability to determine optimal culture conditions throughout species lifecycle:
  - Different physiological demands at different life stages
- Improved economic and ecological efficiencies
  - Key to sustainability

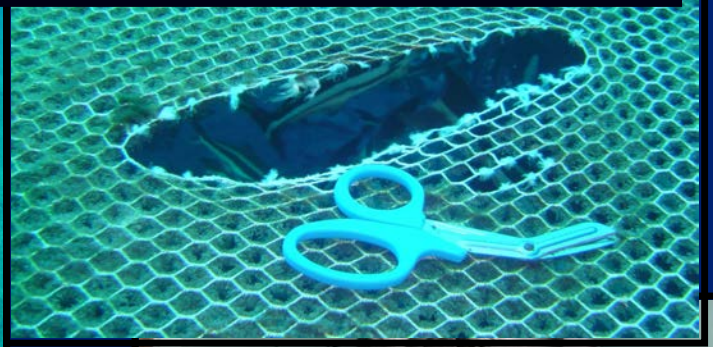




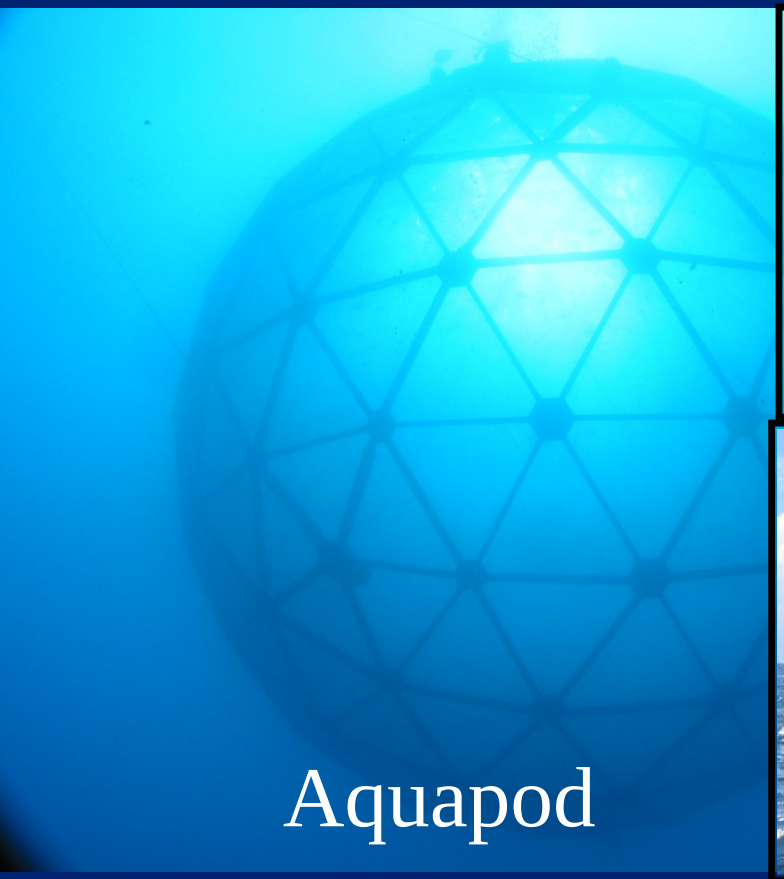
Growout Systems: Land-based tank/ponds, tradition net pens, or submersible cages

PROBLEMS: storms, predators, escapements, diseases, red tides, mechanical & human failures, etc.

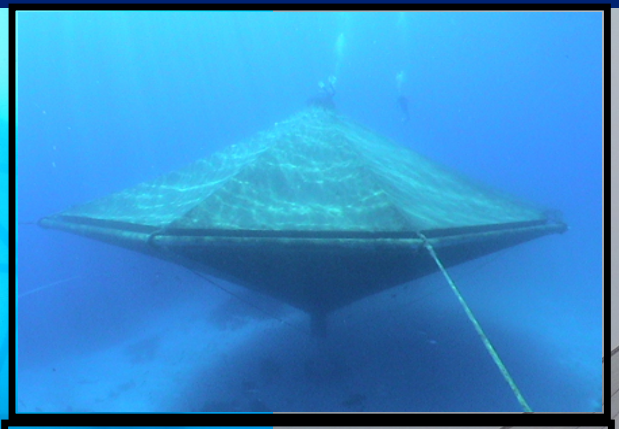


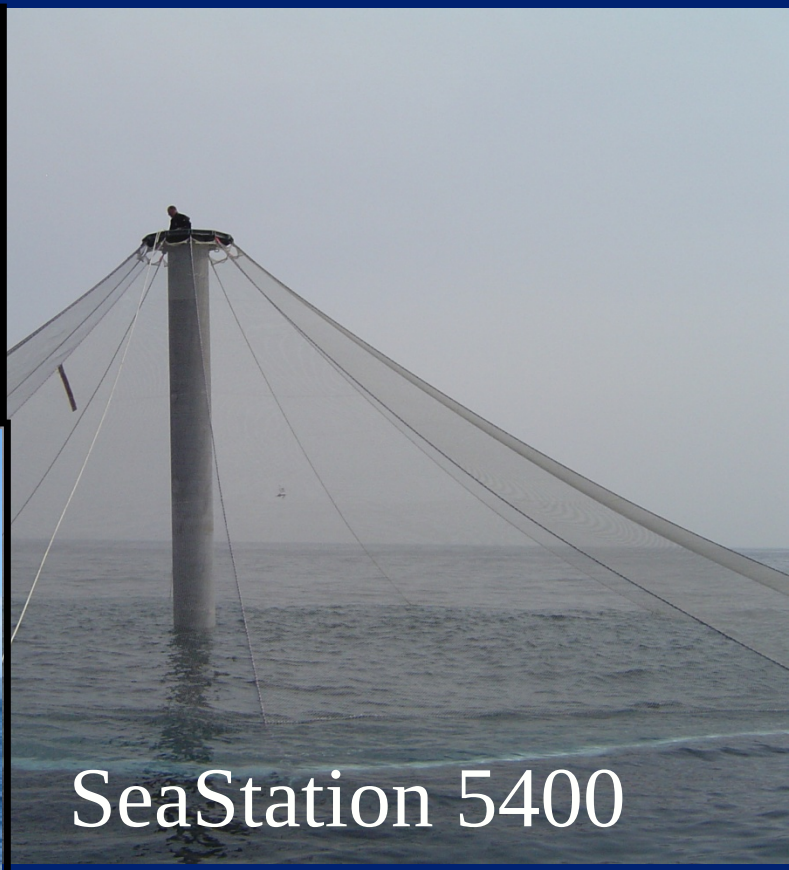


Offshore Aquaculture



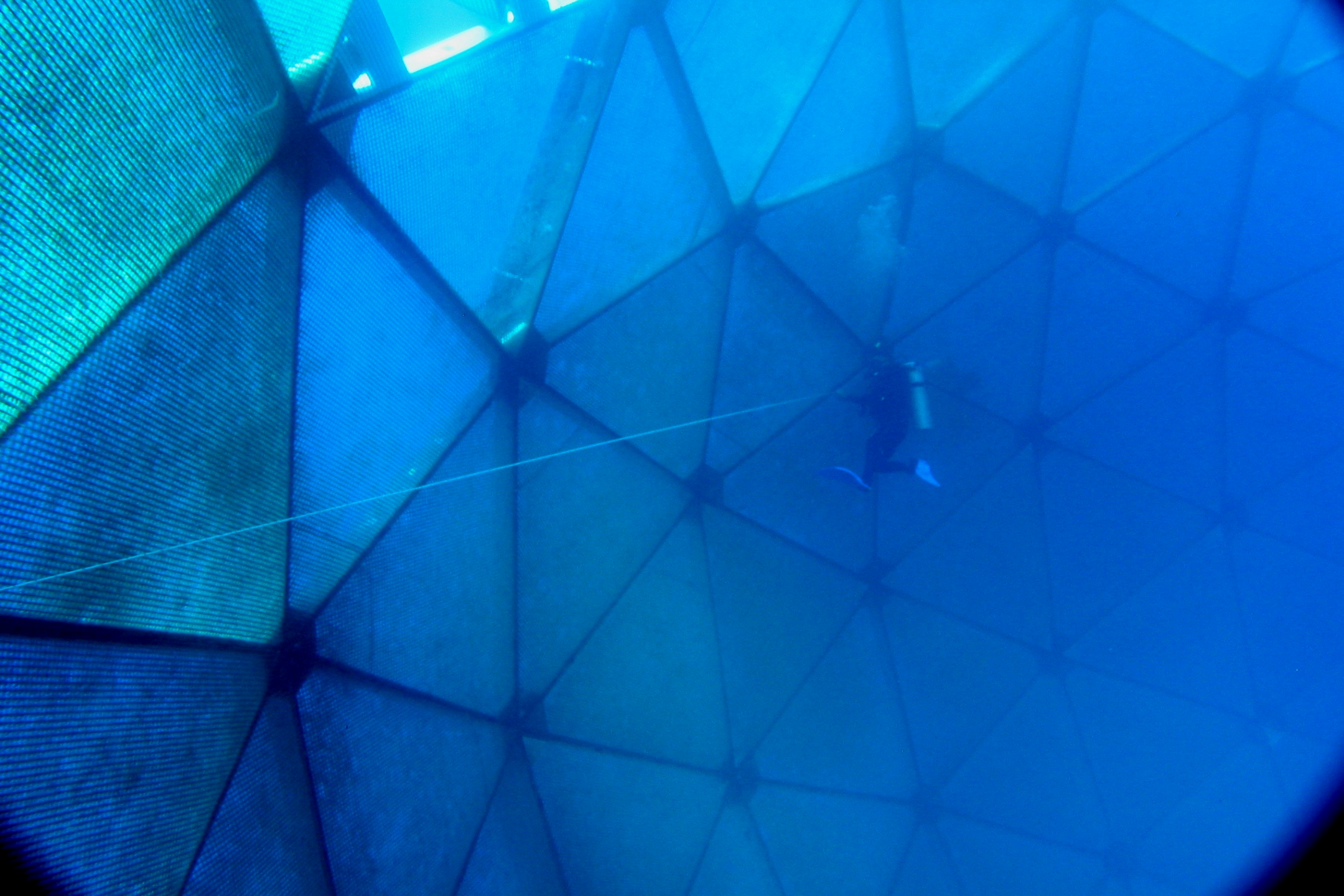
Aquapod





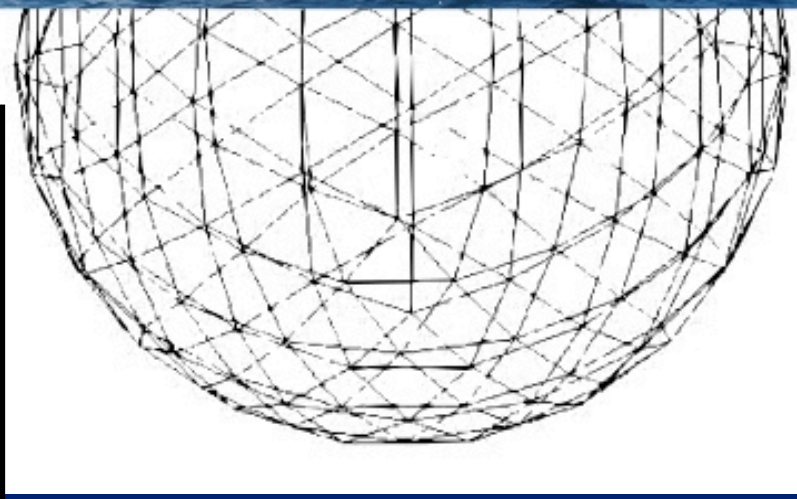
SeaStation 5400

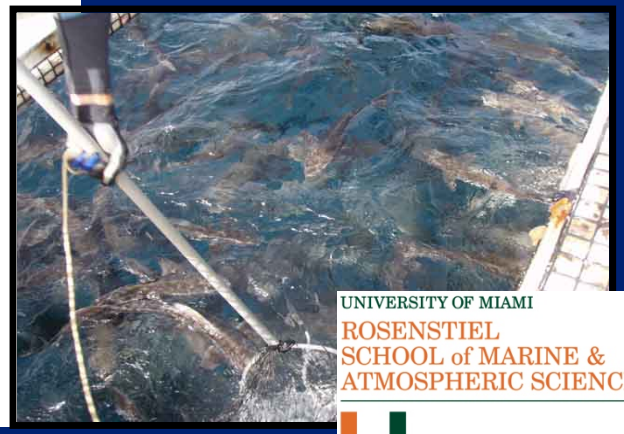
- Oceans cover 2/3 of the Earth
- World’s waterways and oceans are underutilized resources



Advancements in Open Ocean Aquaculture

- Automating open ocean containment systems
- Cleaning and selective harvest
- Remote monitoring





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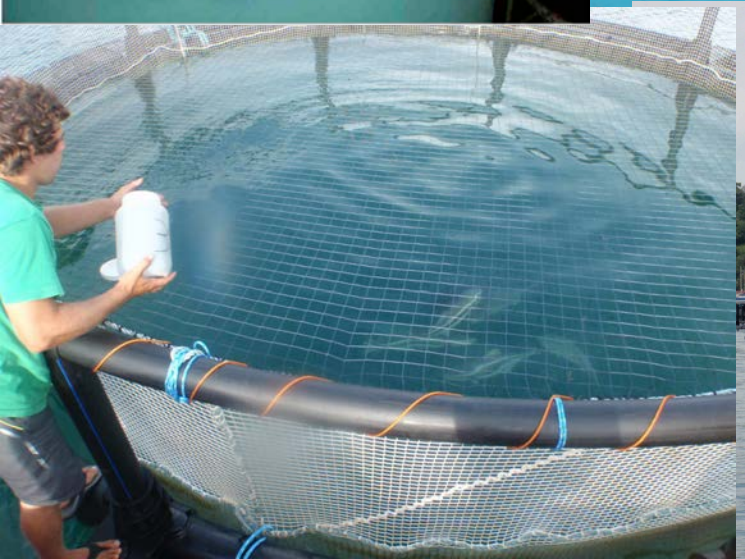
MODERN SURFACE SYSTEMS ARE FLEXIBLE, CONFORM TO WAVES

Collaborative Research With Industry Partners: Open Blue Sea Farms, Republic of Panama

COBIA (*Rachycentron canadum*)

Hatchery and Nursery



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OPEN BLUE SEA FARMS, REPUBLIC OF PANAMA

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HARVESTING COBIA IN PANAMA

openblue

HIGH QUALITY PRODUCT

openblue

COSTA RICA
MARTEC MARICULTURE
PACIFIC RED SNAPPER
(*Lutjanus guttatus*)

Earth Ocean Farms, Mexico

Earth Ocean
FARMS

RECIRCULATING AQUCULTURE SYSTEMS (RAS) FOR MARINE FISH PRODUCTION

- Technological feasibility proven
- Next step is commercial viability

COBIA DEL DESIERTO DE ATACAMA

Aquaculture is a reality and it's here to stay

- It's not *whether, if* or *when*
- Already represents > 50% of total global seafood production.

It's how and where it will be expanded:

- Traditional or new technology?
- Inland (RAS) / Coastal / Offshore?
- US or Abroad?

✓KEY IS TO IMPROVE ECOLOGICAL AND ECONOMICAL EFFICIENCIES SO IT CAN BE ENVIRONMENTALLY SUSTAINBALE AND PROFITABLE

FISH FARMS TO PRODUCE NEARLY TWO THIRDS OF GLOBAL FOOD FISH SUPPLY IN 2030

Source: World Bank, FAO, IFPRI (2014)

“Marine Harvest (salmon) has best quarter in history”

“Shrimp shortage boosts record prices and profits”

“Aquaculture production surpassed beef production in 2013”

“Aquaculture produces more than 50% of seafood for human consumption”

Sources: FAO, 2013; Seafood Source, August 21, 2013

ALL INDICATORS POINT TO EXCELLENT OPPORTUNITIES IN THE NEXT DECADES:

DEMAND, MARKET, ENGINEERING, TECHNOLOGIES, ETC.

THE OUTLOOK IS ABSOLUTELY BRIGHT

HOW WE CAN GROW THE AQUACULTURE INDUSTRY IN THE UNITED STATES?

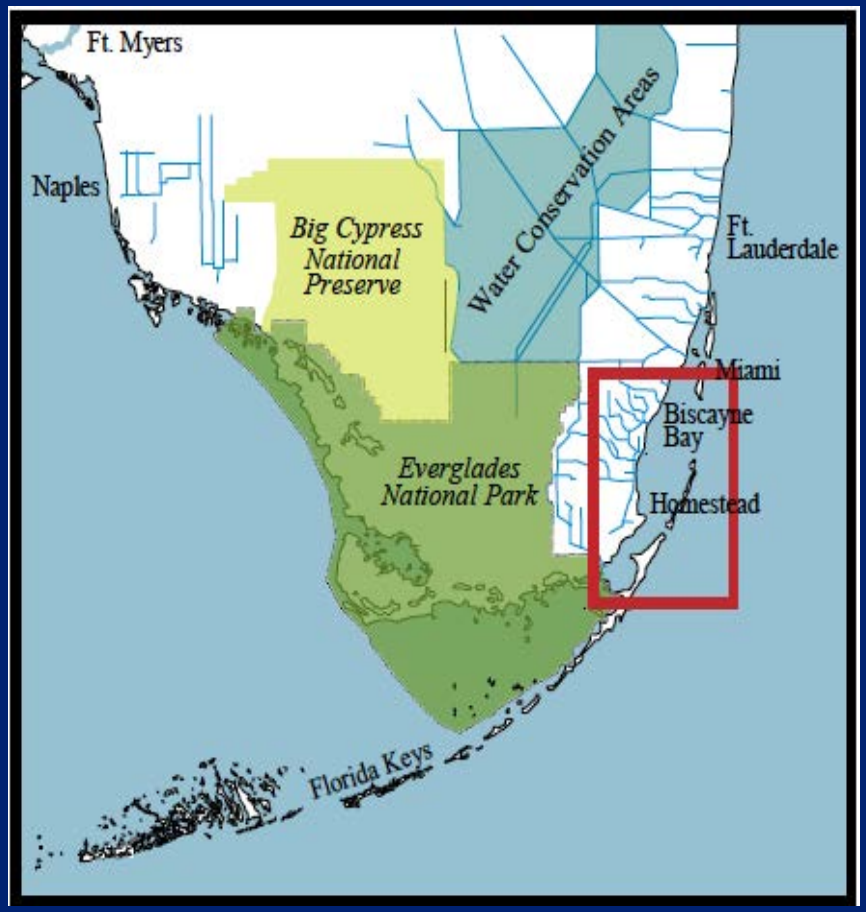
What Is Inhibiting The Domestic Aquaculture Industry and How Can We Fix It?

- **Treat Aquaculture Industry as the Agriculture Industry**
  - Must be an understanding and acceptance that the start-up of an aquaculture operation should be no different than any other agricultural operation.
- **Multidisciplinary research**
  - Needed to increase production efficiency, economic viability, and long-term sustainability of operations.
- **Development of clear regulatory and permitting pathways for the aquaculture industry by government agencies.**
- **The US is the most productive agriculture economy in the world.**
  - **Terrestrial agriculture producers generate trade surplus of >$32 billion.**
  - **Current seafood trade deficit of nearly $11 billion.**

Source: Max Holtzman, USDA

How Does This Apply to South Florida?

- Restoration of Biscayne Bay
  - Coastal Wetlands Project
  - Oyster Reef Restoration
  - Stock Enhancement



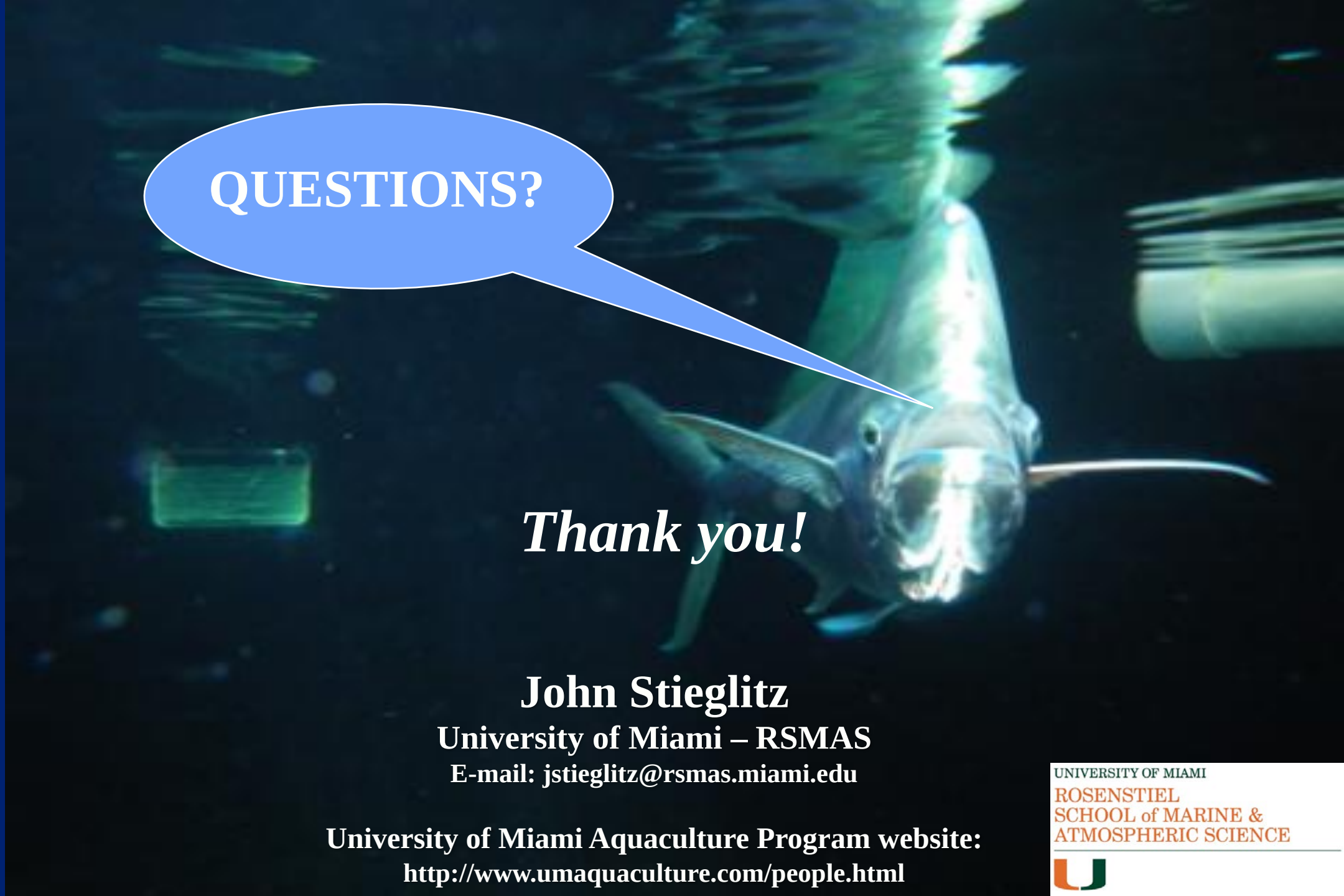
South Florida Aquaculture

Opportunities:

- Land-based marine finfish culture
  - Recirculating Aquaculture Systems (RAS)
- Aquaponics
  - Combine aquaculture (fish production) and hydroponics (plant production in water)
- Ornamentals
  - Warm, stable climate and proximity to international airports

Economic Benefits:

- Jobs
- Efficient use of agricultural lands
- High value products



Thank you!

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University of Miami Aquaculture Program website:
http://www.umaquaculture.com/people.html

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