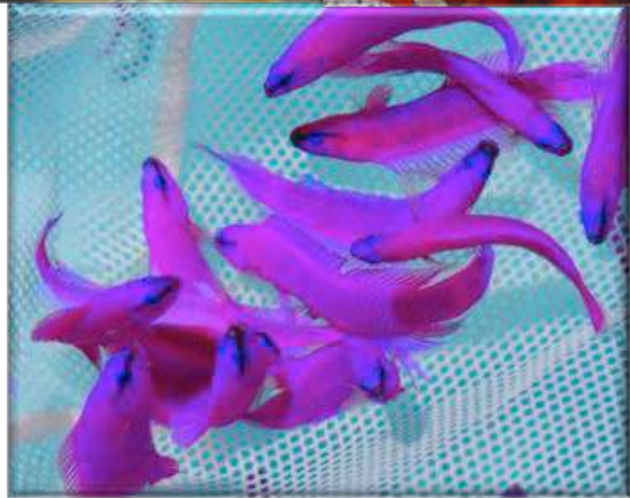
Collaborative Marine Ornamental Fish Propagation Efforts

Allan Marshall – The Florida Aquarium
Dr. Matt Wittenrich – University of Florida
Eric Cassiano – University of Florida

Marine Fishes

- Industry relies on wild-caught specimens
- Few bred at all
- Largely opportunistic
- Only few dozen commercially bred



Aquarium and Zoo Aquatic Collection Sustainability Committee

- AZA initiative
- Assess sustainability of current aquatic animal accession options
- Establish plan to improve existing and potential options
- Create a Sustainability Statement and Action Plan

Results

- Too many diverse species for a single solution
- Wild collection will remain the only viable option for many species (ensuring sustainable practices)
- Continue to develop captive breeding to reduce pressure on reef ecosystems

Rising Tide Conservation Initiative

Rising Tide
CONSERVATION

- SeaWorld Parks and Entertainment (2009)

- Research facilities, industry partners, public display aquaria

- Create a platform that promotes the dissemination of information on marine tropical fish aquaculture

- Rising Tide stakeholder
  - Explore production protocols for target species
  - Transfer protocols to related species

Challenges For Breeding Marine Fishes

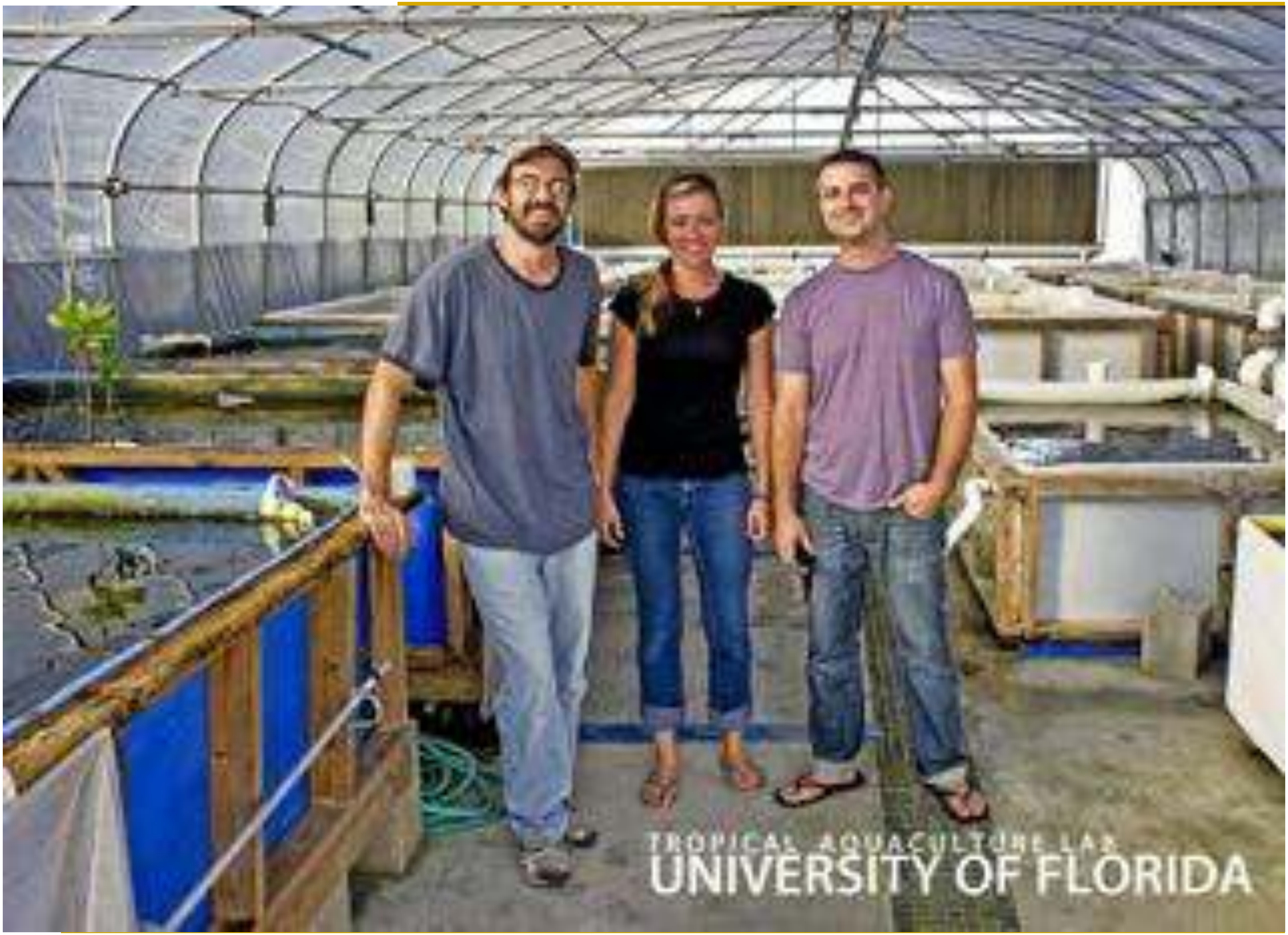
- General lack of research / knowledge
- Broodstock availability and performance
    - -Spawning and egg quality
    - -Nutritional requirements
- Incubation → hatching → first feeding
- Feeding environment / Live feeds
- Subsequent developmental stages
- Aquarium Resources

THE FLORIDA AQUARIUM
CENTER FOR CONSERVATION

Challenges for Breeding Marine Fishes

- Brood Stock

Collaborative Effort

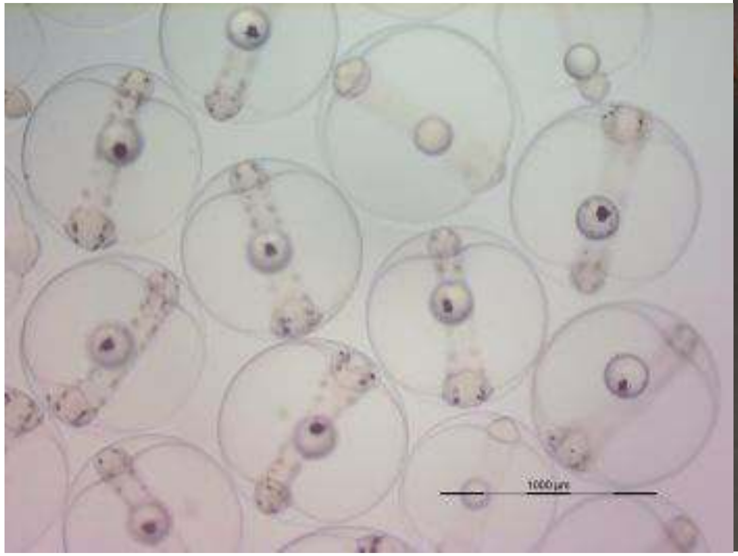

TROPICAL AQUACULTURE LAB
UNIVERSITY OF FLORIDA

Pelagic vs Demersal

- Of the ~ 60 species commercially raised 58 are demersal spawners
- Incubating pelagic eggs
- Pelagic larvae care

Challenges for Breeding Marine Fishes

- Collecting Pelagic Eggs/ Larvae



Ramon Villaverde
Paul Rinehart

- Egg collectors in the aquarium for 18 hours

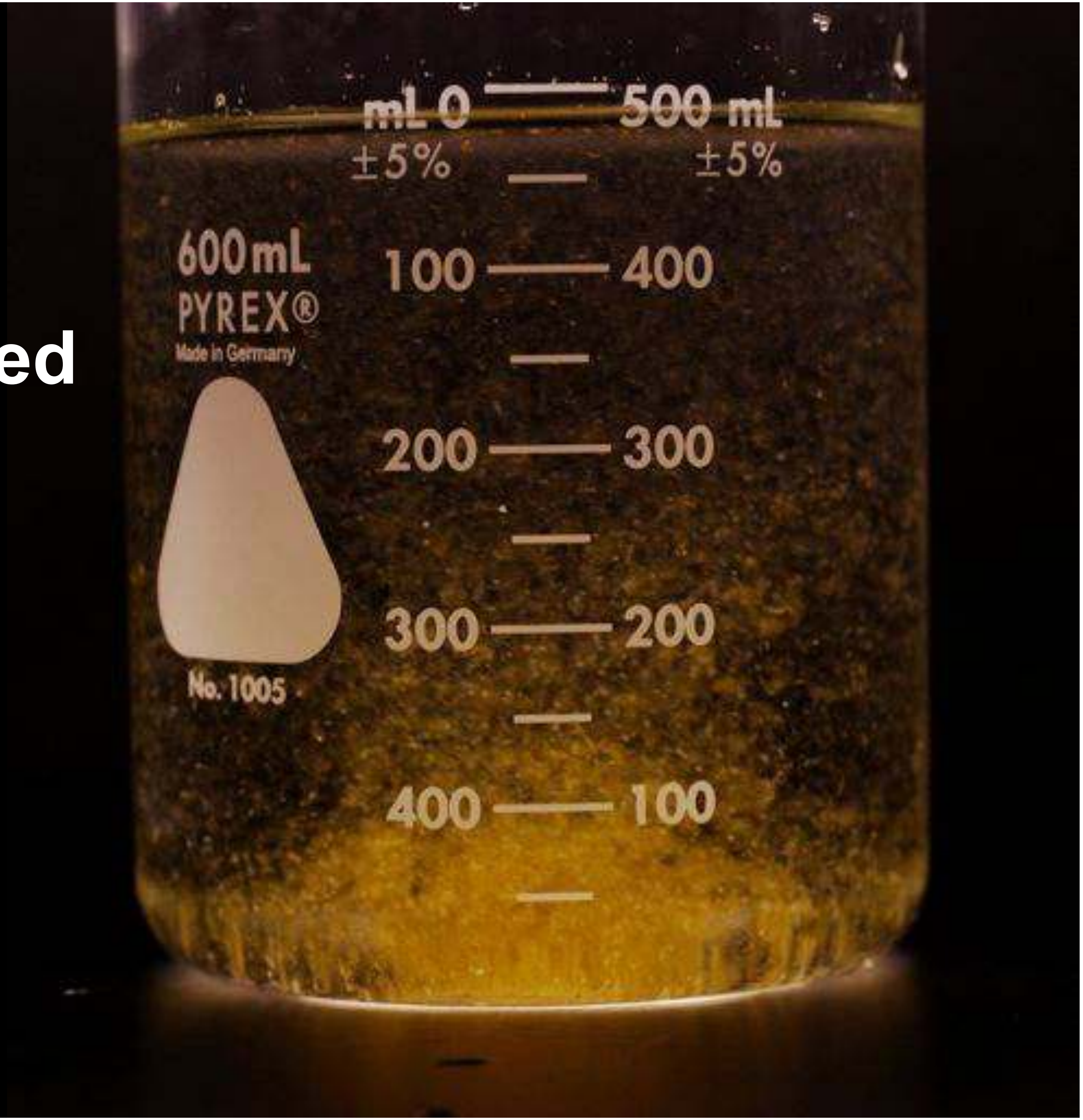

DIVER CHECK LIST
1) IS THE TANK FULL? ___ PSI
2) "O" RING IN PLACE?
ANY LEAKS?
3) DROP LINE IN PLACE?
4) SHEPHERDS HOOK IN PLACE?
5) WEIGHT BELT SUFFICIENT?

Egg cleaning and separation

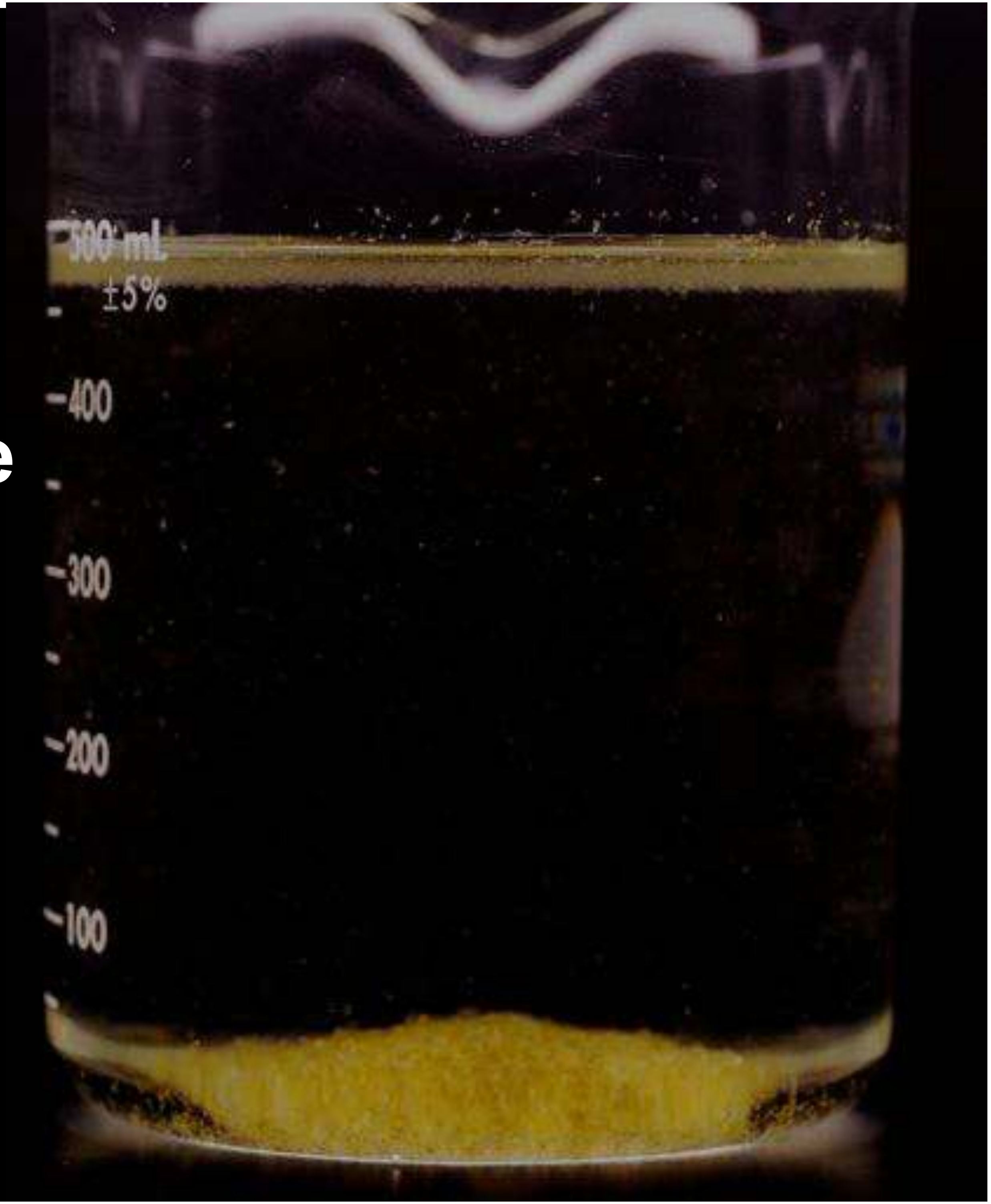

Eggs filtered through window screen

Screened material collected into another mesh sieve

- **Eggs and debris moved into 600ml beaker for separation**

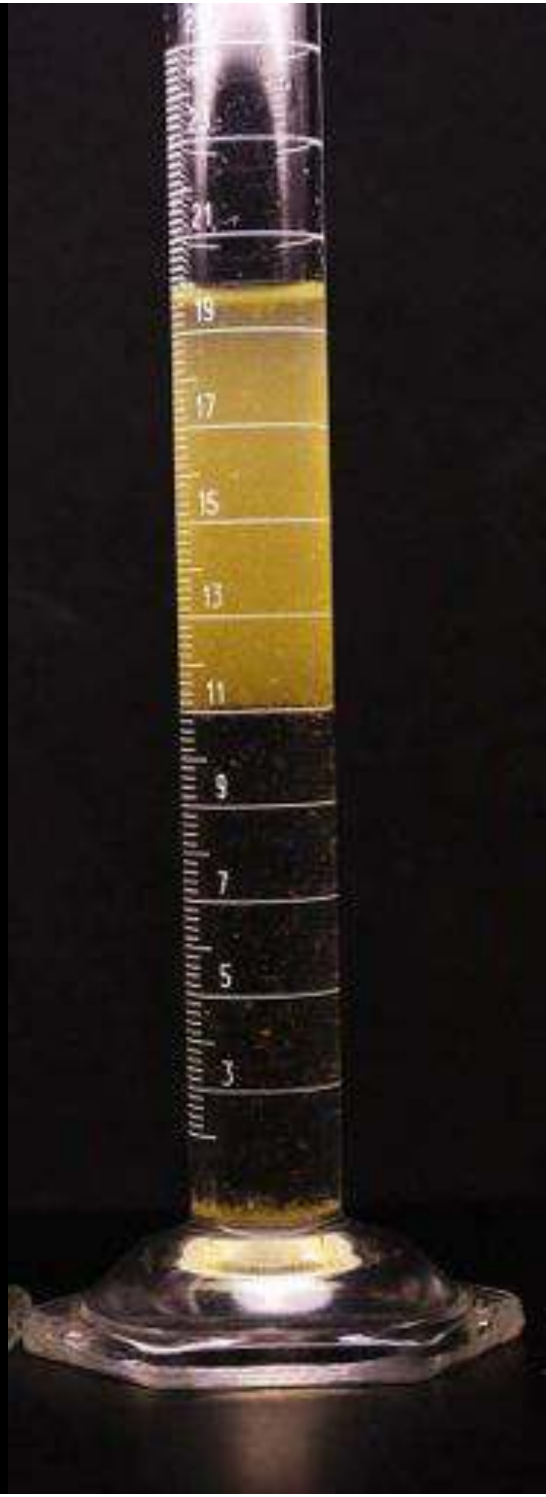


- **Approximate settlement time is 10 minutes**

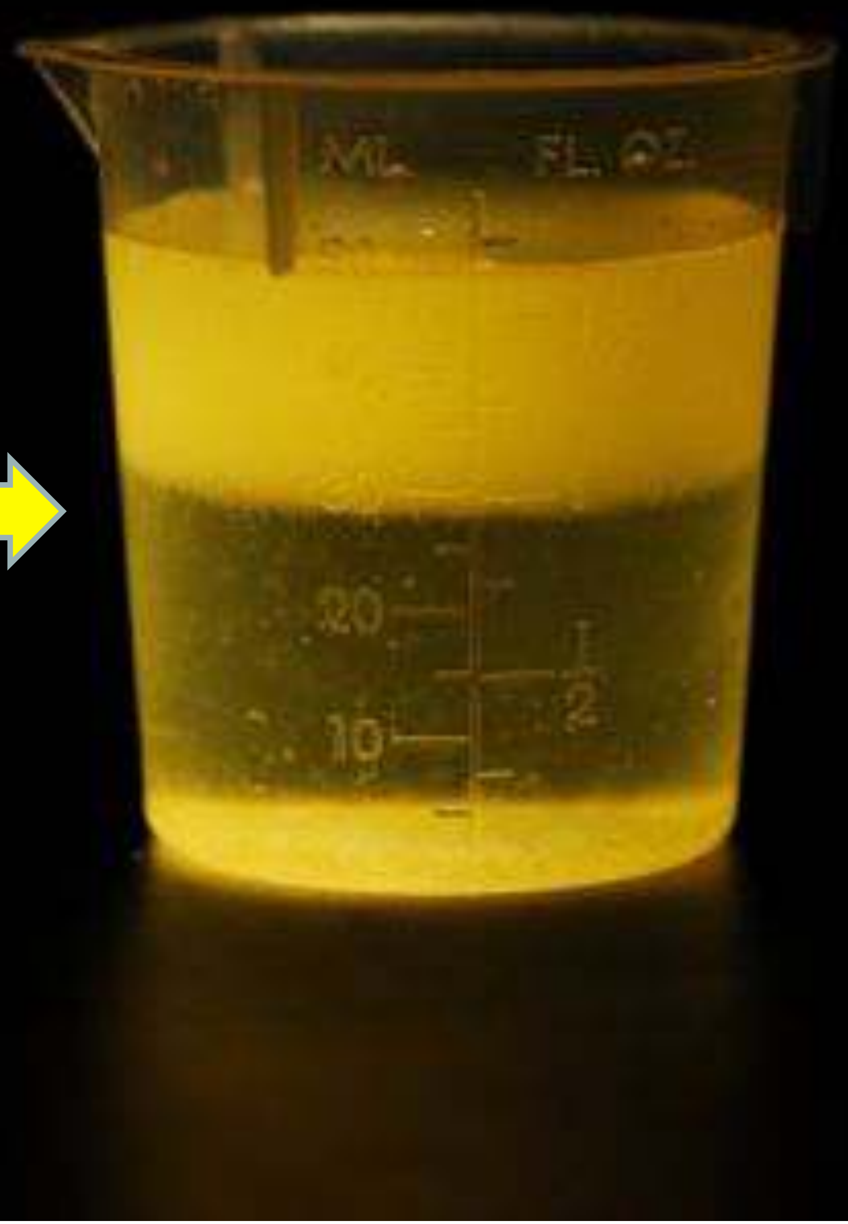



Decant viable eggs into mesh sieve

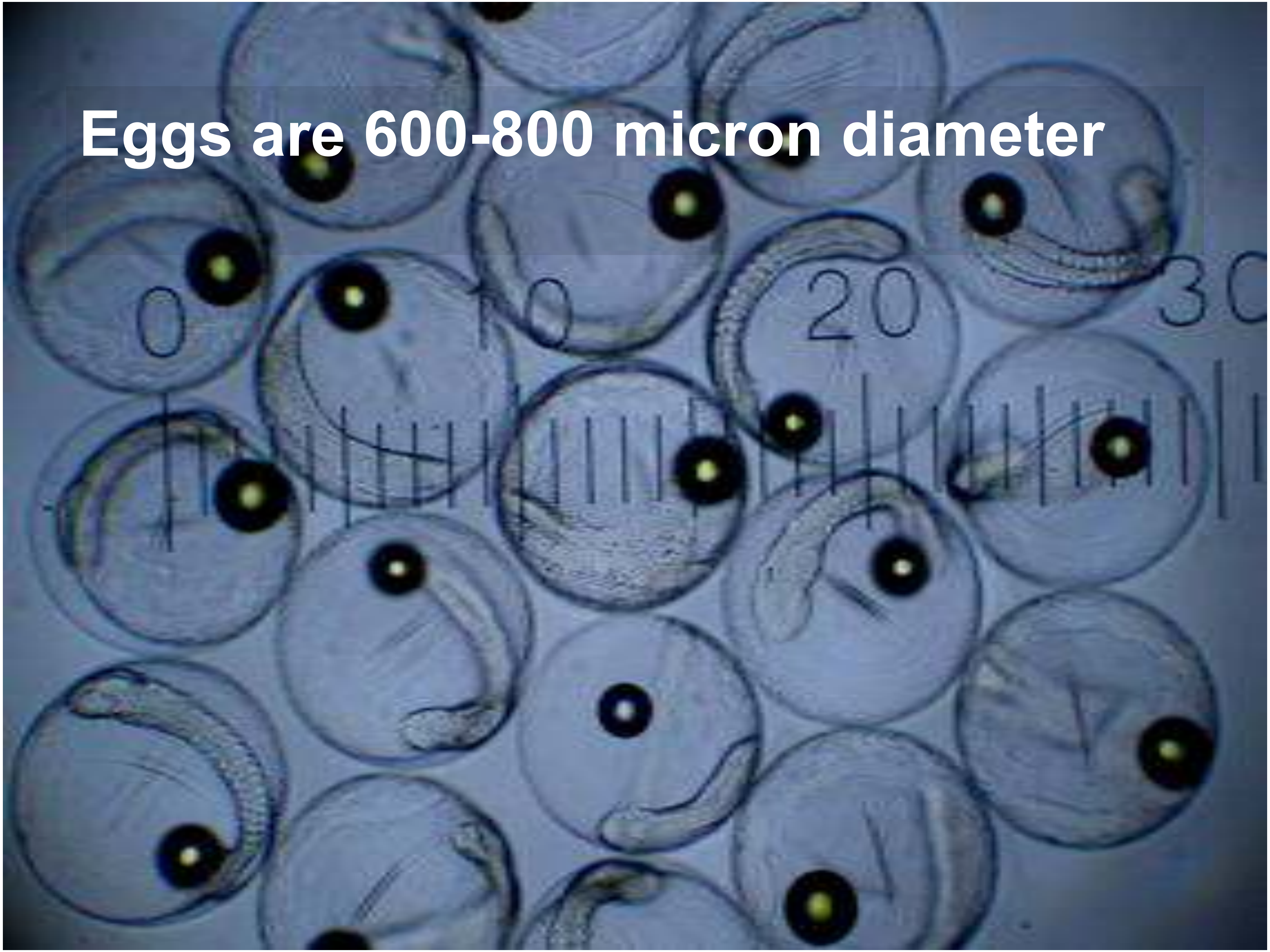
- **Eggs rinsed into a graduated cylinder or beaker for measurement**



- Approximately 4,000 eggs per ml
- 120,000 eggs



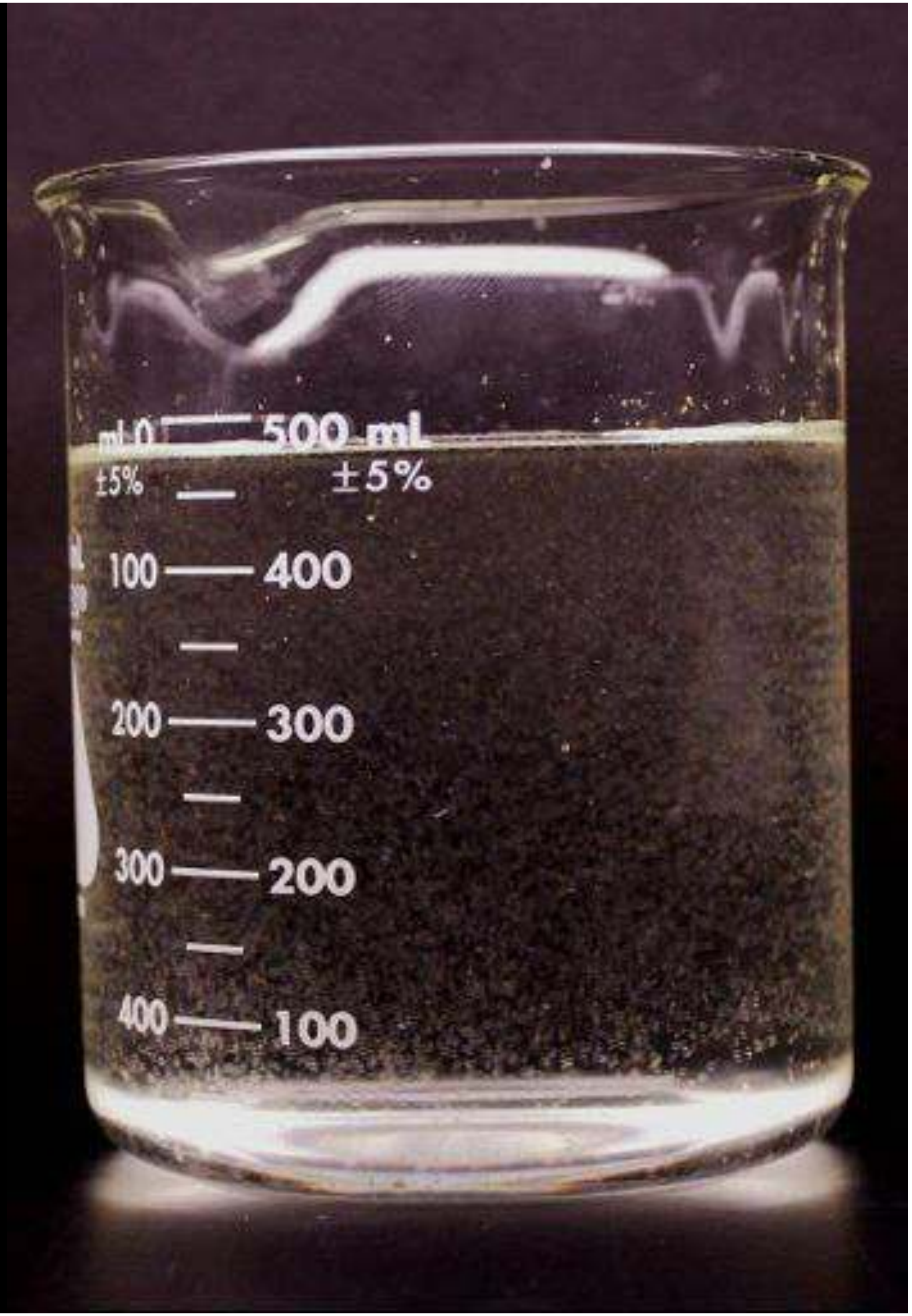
Eggs are 600-800 micron diameter



Packing and shipment

- System water filtered through 1µm sock filter
- Oxygenated for 5 minutes with pure oxygen

- **Eggs mixed into suspension**

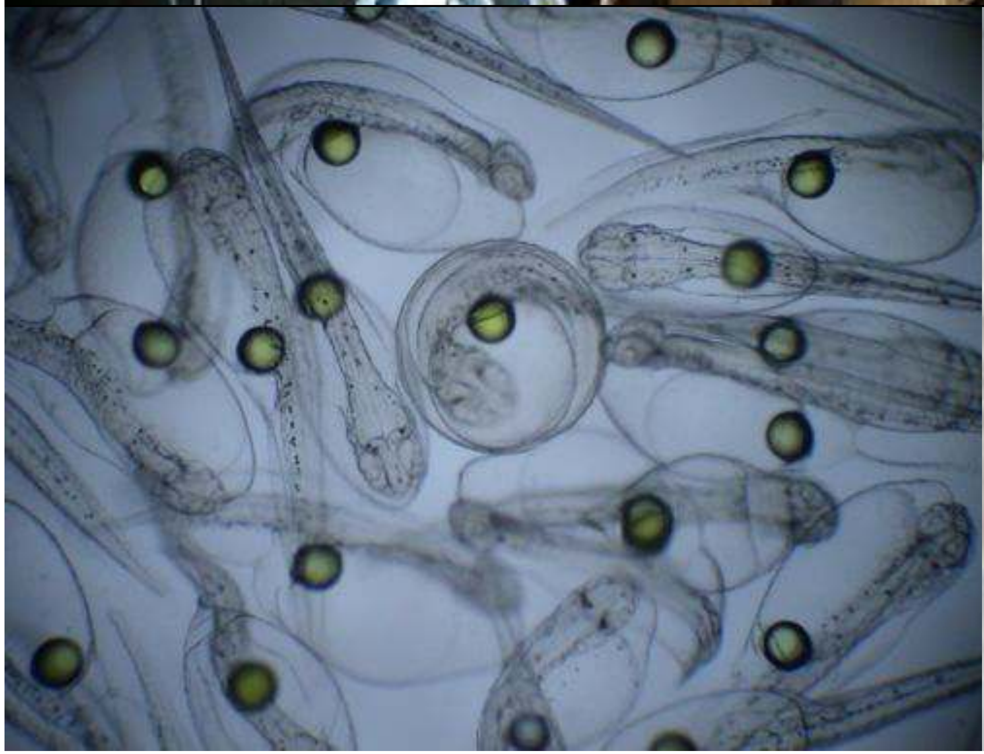


- **Measure 1.5gal of water per bag**
- **Approx 2.5ml of eggs per bag**

Bags are closed with no air

- Water parameters
- Egg/water volume/bag

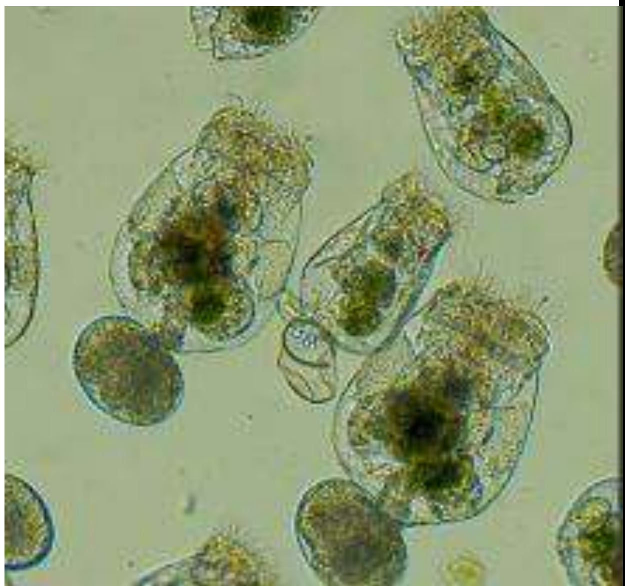

MLWITTENRICH

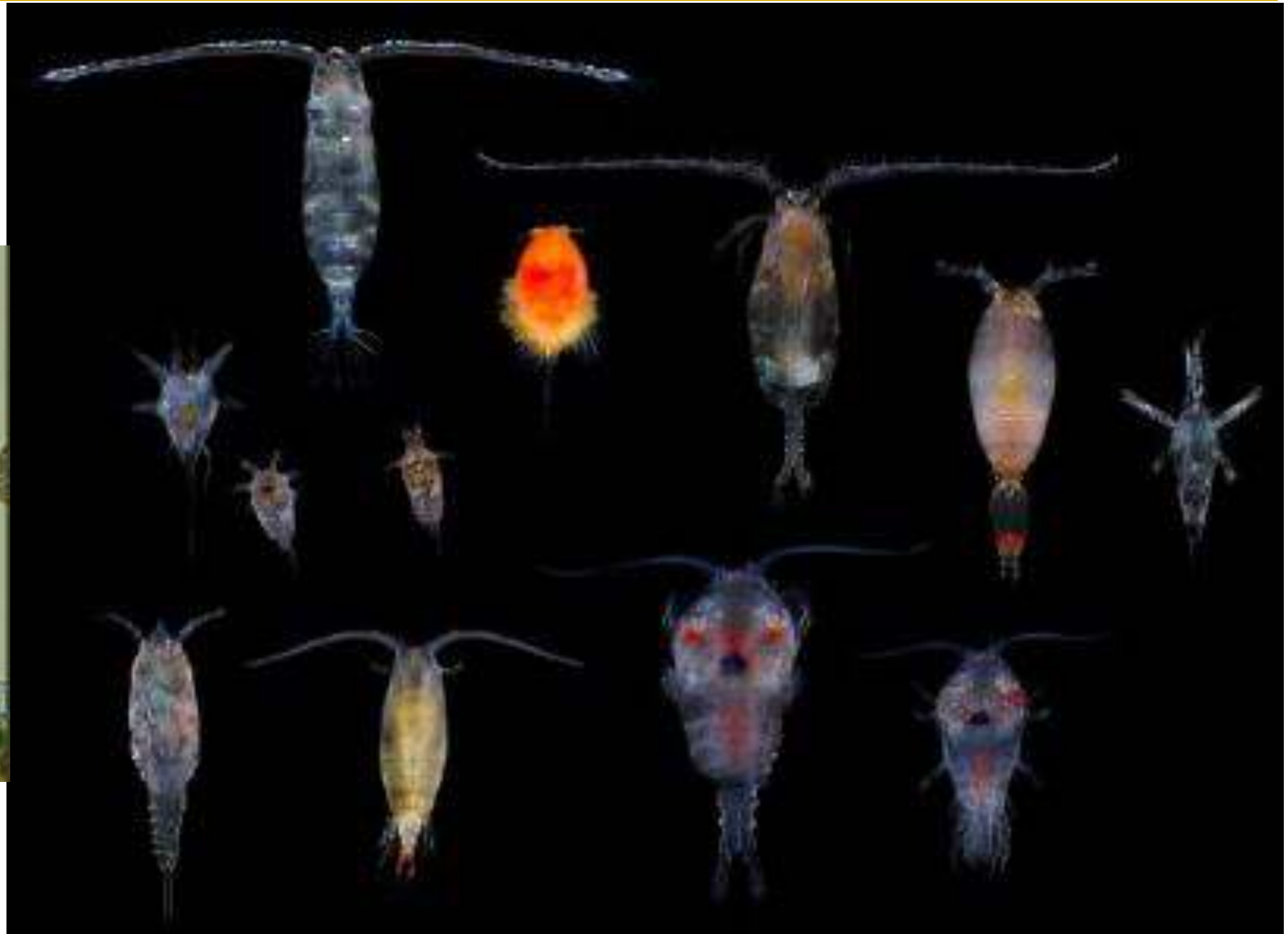



This is
MLWITTENRICH

Challenges for Breeding Marine Fishes

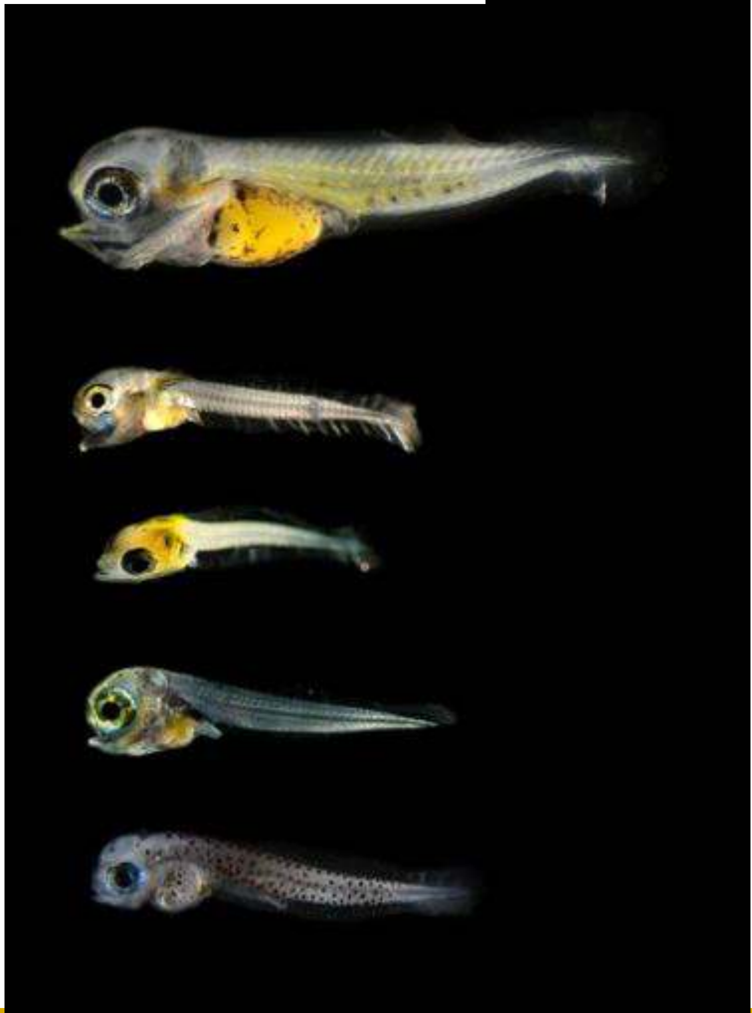
- Initial Foods





Diversity of Larval Form

Diversity of Newly Hatched Larvae



Amphiprion ocellaris

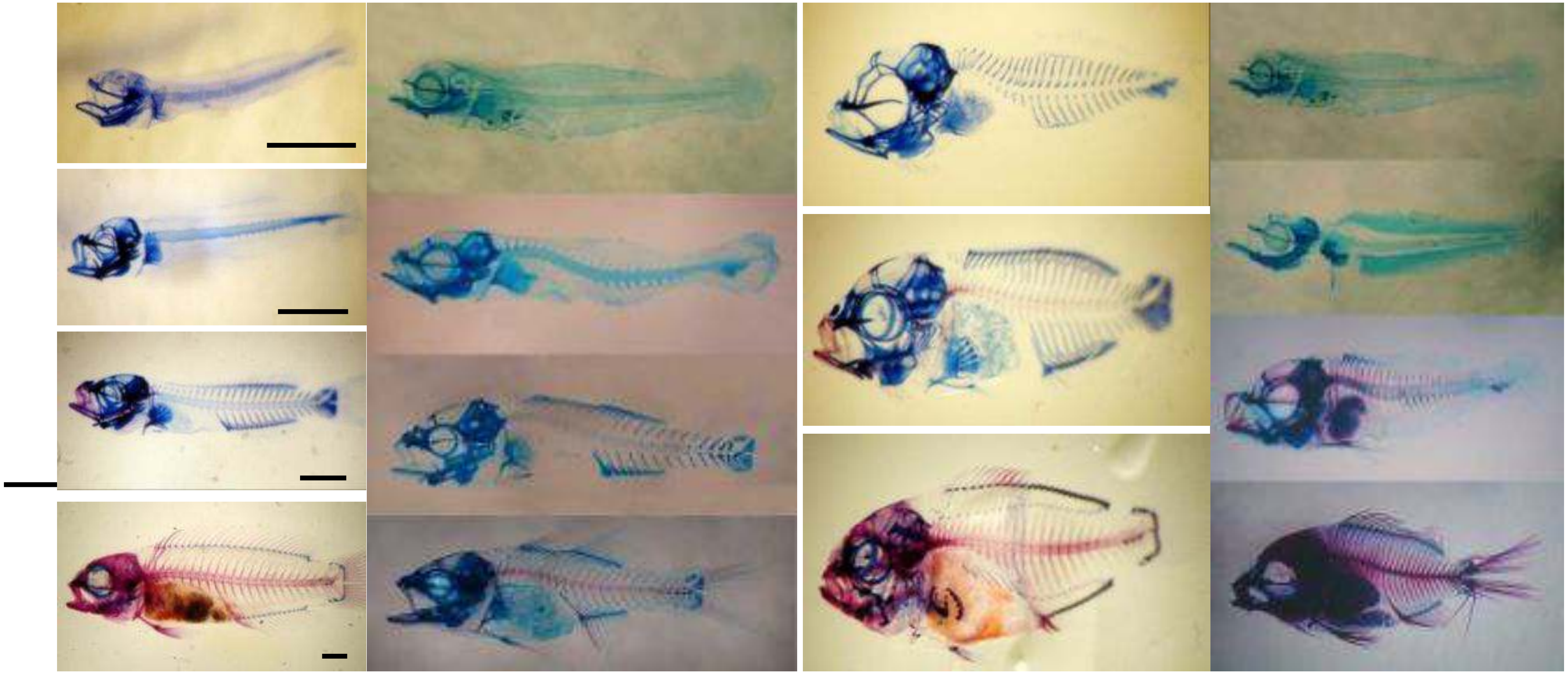
Chasmodes bosquianus

Abudefduf saxatilis

Meiacanthus bundoon

Calloplesiops altivelis

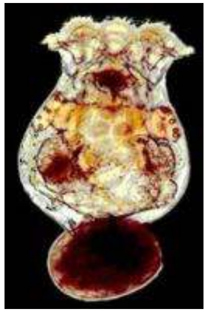
Understanding larval form



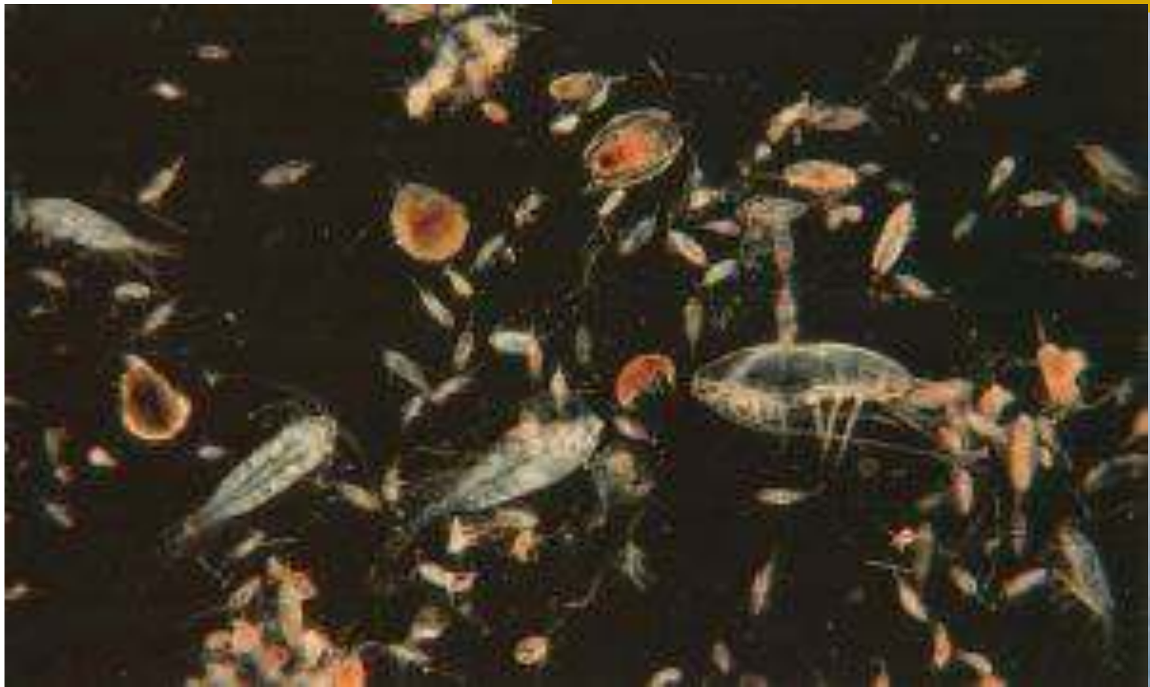
form = function

- Understand what larvae have the ability to eat

- Different species / stages?



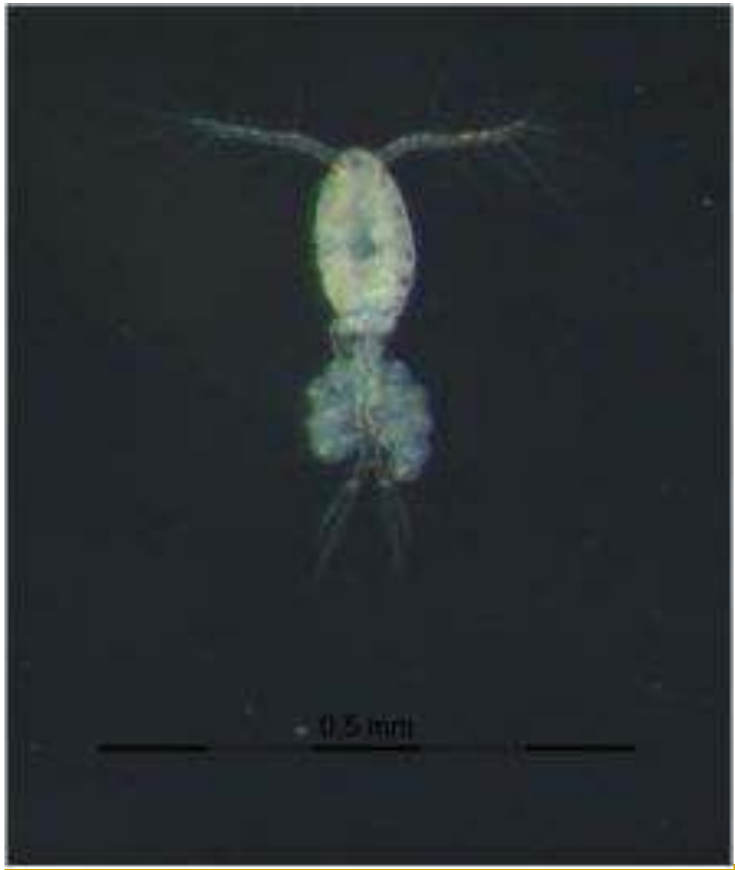
Let Them Choose



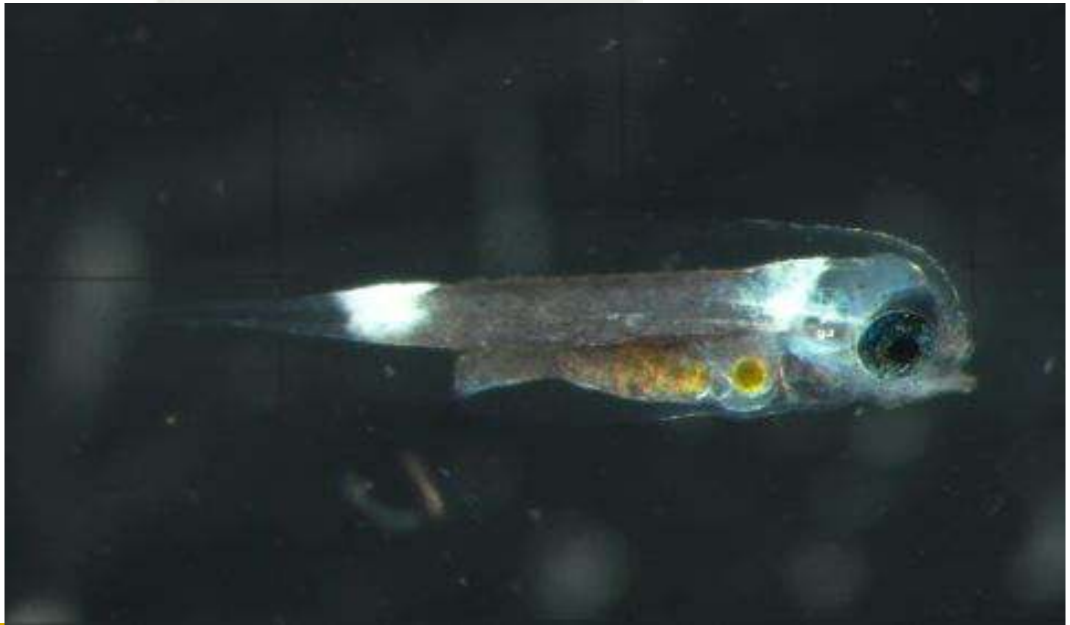
Find Out What They Eat

Culture What They Eat

- *Oithona colcarva*

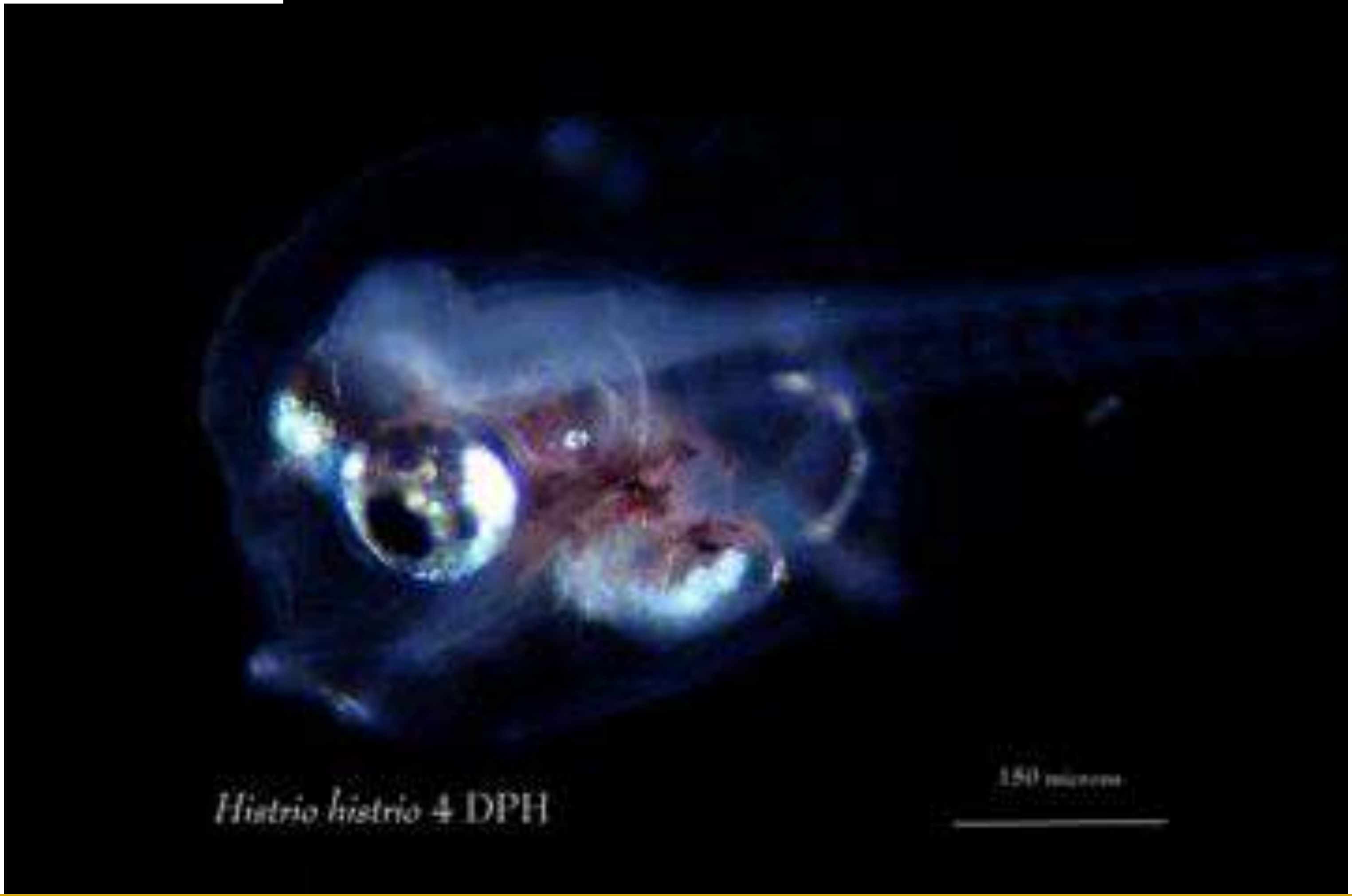


3 dph



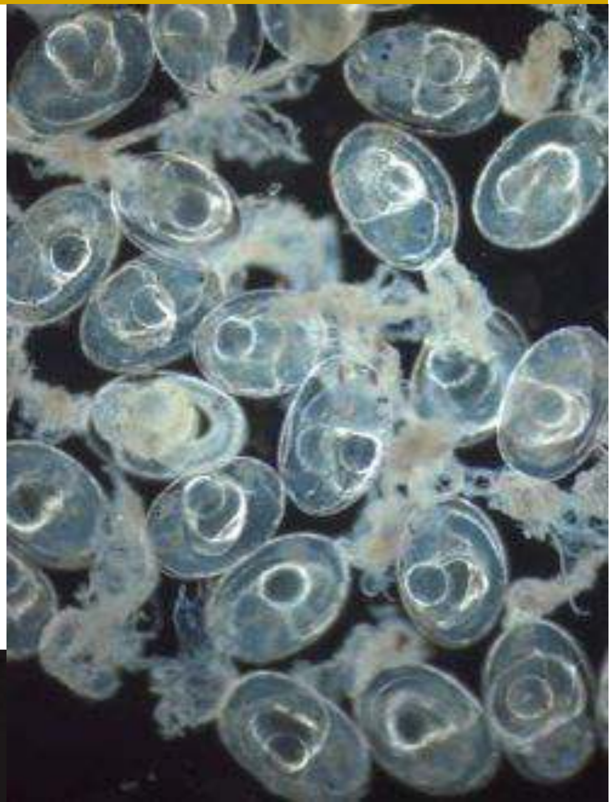
THE FLORIDA AQUARIUM
CENTER FOR CONSERVATION

Determine the Environmental Conditions That Elicit a Feeding Response



Green Chromis, *Chromis viridis*

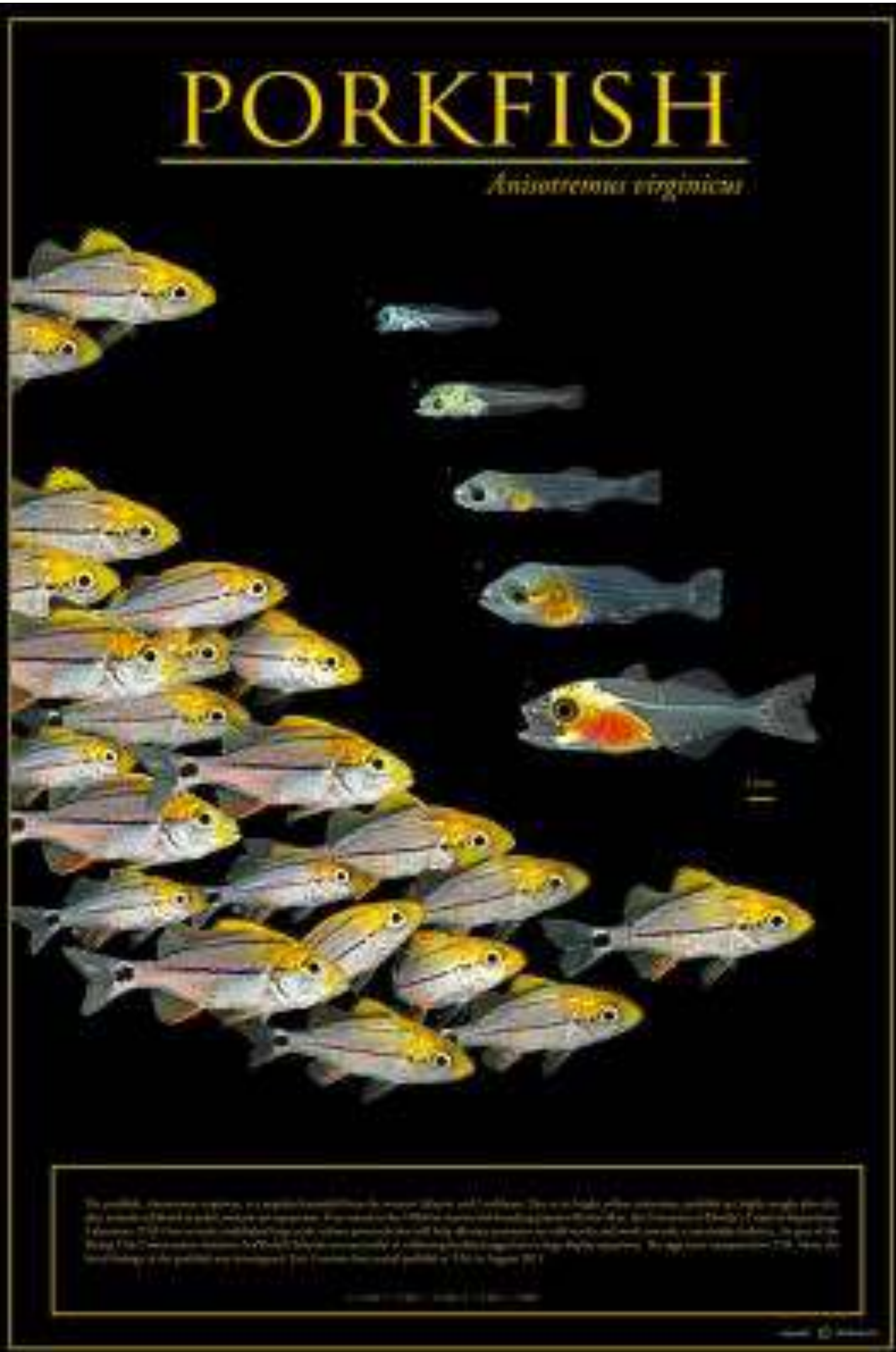
- Virginia Aquarium
  - Green Chromis (*Chromis viridis*)
  - ~100,000 eggs
- Larviculture to ~20 dph
- Bottleneck in survival ~8 dph



1 dph (2.3 mm)

Porkfish, *Anisotremus virginicus*

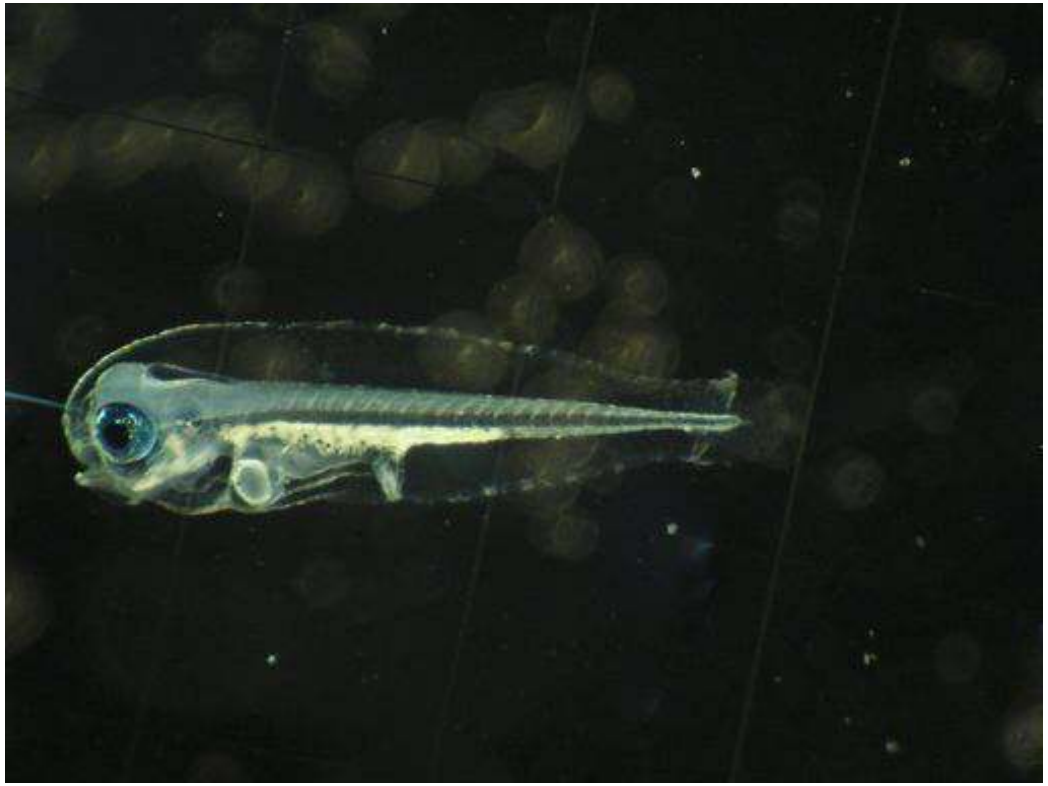
- Sea World Orlando (SWOR)
- Initially fed wild zooplankton and live microalgae
- Commercially conducive early feeding regime
  - First feeding diet = rotifers / algae paste
  - *Artemia* at ~10 days post hatch; dph
  - Artificial feed at ~20 dph
- Metamorphosis at ~25 dph
- ‘First’ using cultured live feeds
- SWOR (eggs) → Industry ($) → SWOR (juveniles)


PORKFISH
Anisotremus virginicus

Palette Surgeon, *Paracanthurus hepatus*

- Columbus Zoo & Aquarium

Palette Surgeon, *Paracanthurus hepatus*

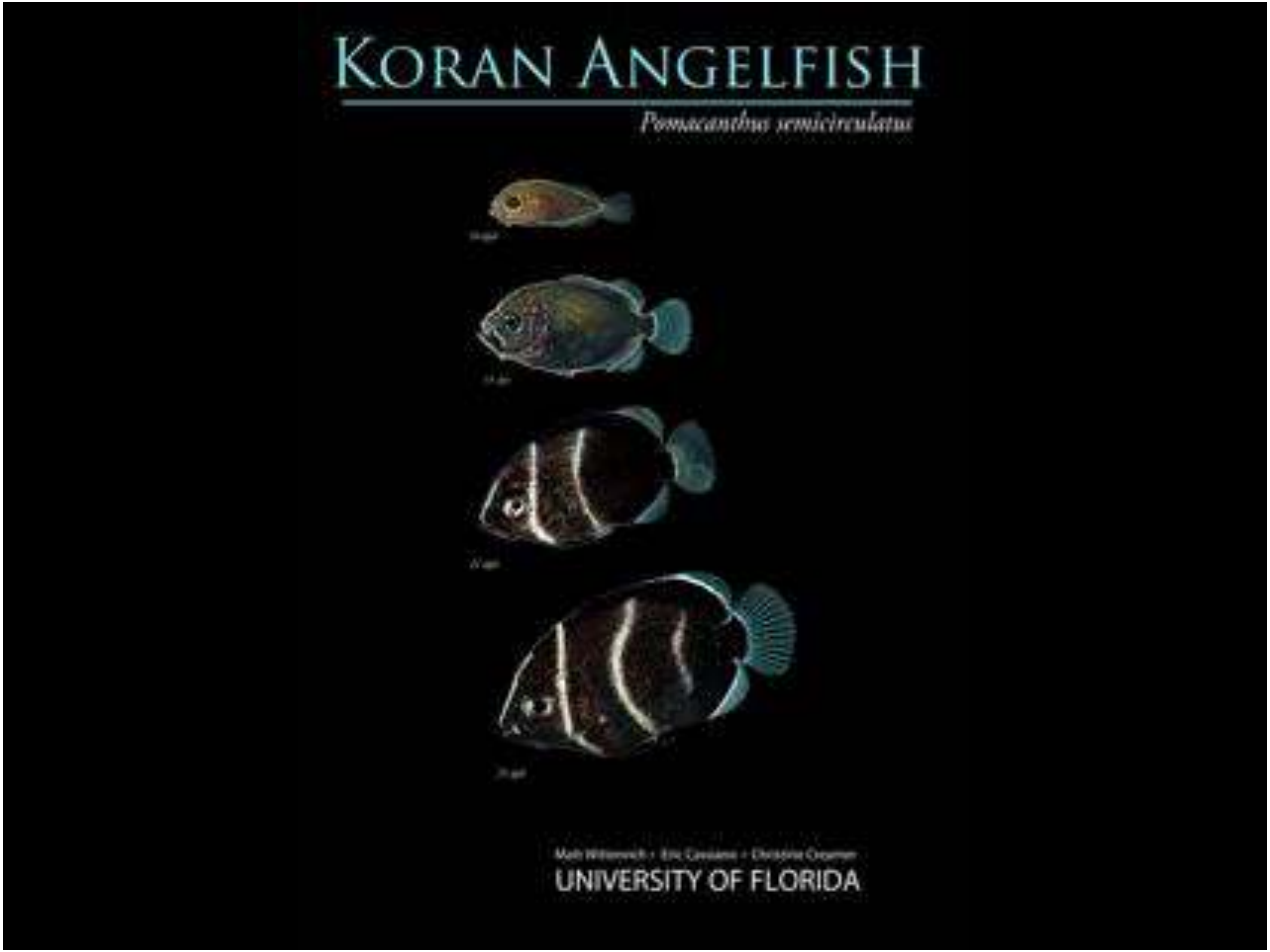


9 dph

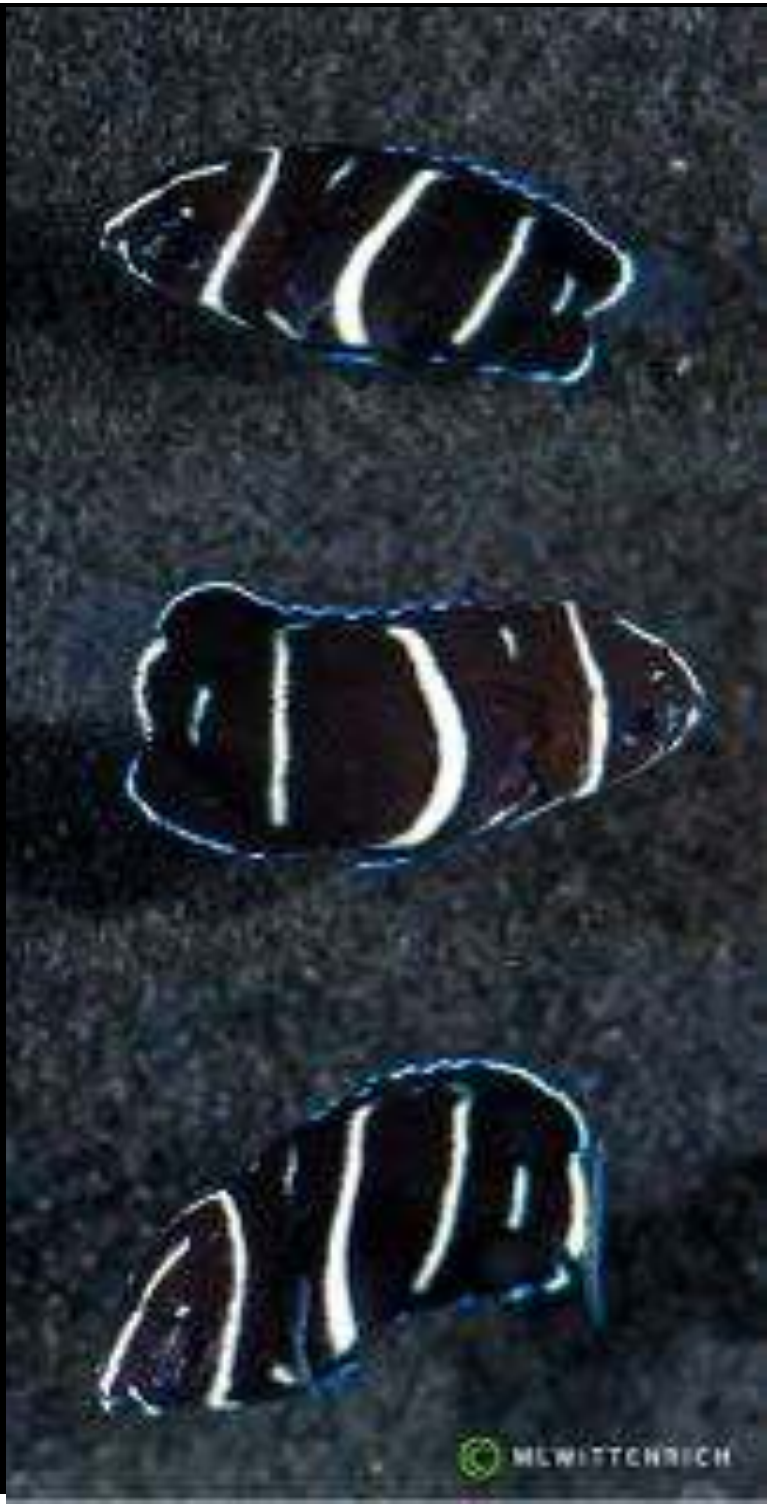
Koran Angelfish, *Pomocanthus semicirculatus.*

- Columbus Zoo & Aquarium
- First feeding 3 dph; wild zooplankton (<150 µm)
- Sparse; noticeably larger ~6 dph
- Vertical development ~8 dph
- Accept *Artemia* at ~12 dph
- Metamorphosis
  - 140 gallon tank = ~19 dph
  - 50 gallon tank = ~25 dph
- First time reared in captivity

45 dph


KORAN ANGELFISH
Pomacanthus semicirculatus
UNIVERSITY OF FLORIDA

120 dph



Unknown Pomacanthid
45 dph

Ternate Damsel, *Amblyglyphidodon ternatensis*

- Steinhart Aquarium (2 shipments)
- Demersal spawner
- Incubation = 7-8 days with aeration
- Four larvae hatched (~3 mm length)
- Feeding regime
  - *Live microalgae*
  - *Pseudodiaptomus pelagicus*
  - *Artemia* at ~10 dph
- Reach metamorphosis at ~18 dph
- Well suited for commercial production

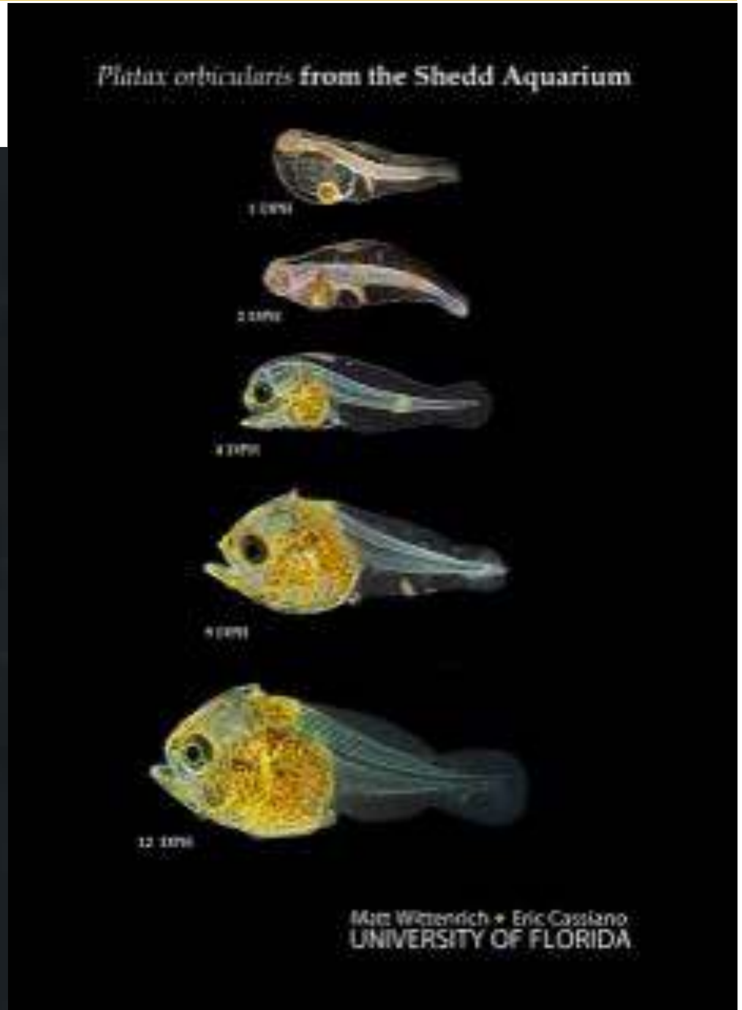
20 dph

25 dph


©Charles Delbeek

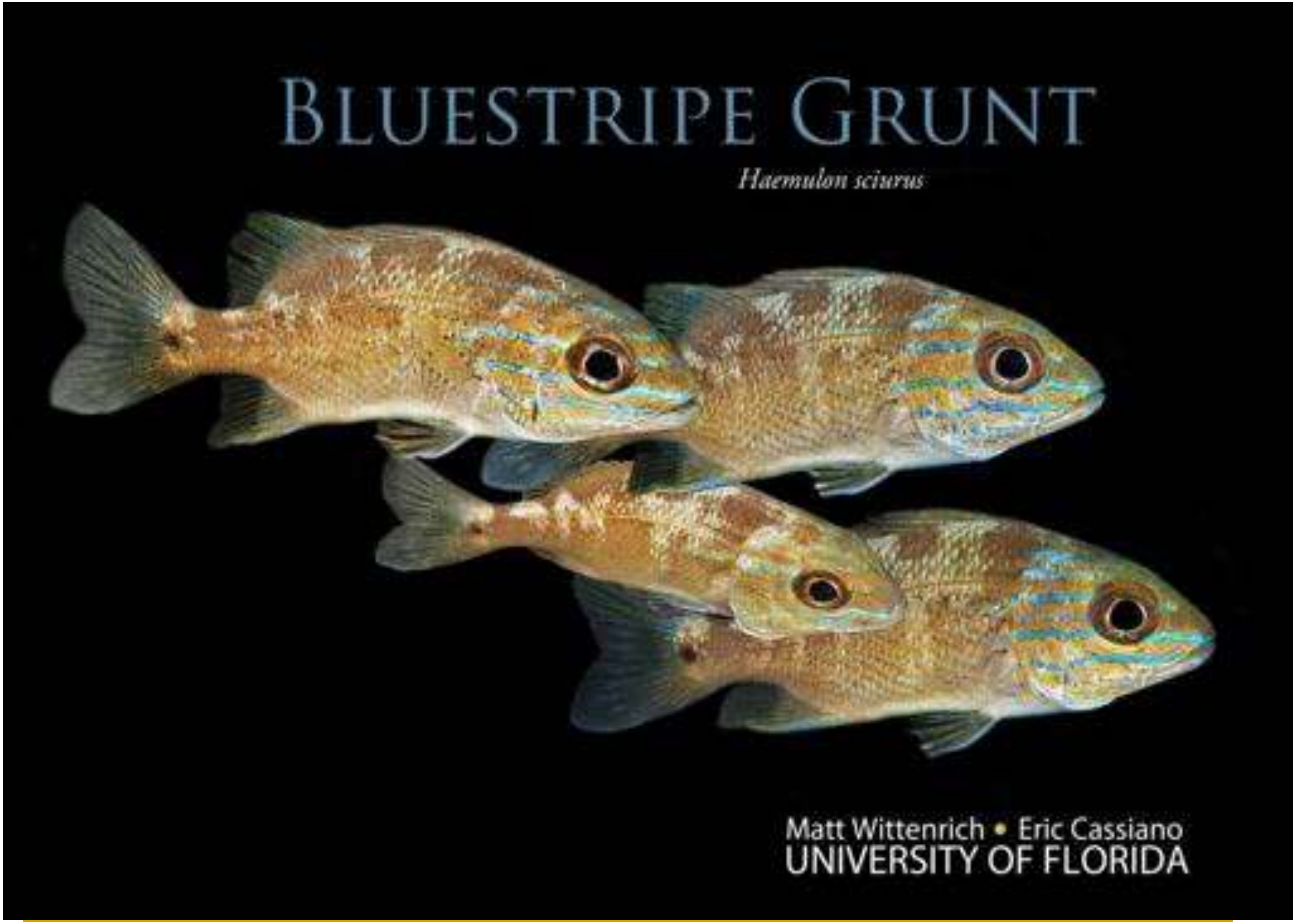
Orbiculate Batfish, *Platax orbicularis*

- The Shedd Aquarium



Bluestripe Grunt, *Haemulon sciurus*

- The Florida Aquarium
- Bluestripe Grunt
- Bottleneck at ~25 dph
- Larviculture ~35 dph
- 26 dph = ~15 mm


BLUESTRIPE GRUNT
Haemulon sciurus
Matt Wittenrich • Eric Cassiano
UNIVERSITY OF FLORIDA


SeaBream
Matt Wittenrich • Eric Cassiano
UNIVERSITY OF FLORIDA

Next Steps for TAL

- DNA analysis of larvae and gut contents to confirm who is eating what.
- Provide important species for display.
- Provide species with conservation status.
- Transfer technology to commercial breeders.

Next Steps for Aquariums

- Involve more aquaria for egg collection
- Commitments from Columbus Zoo & Aquarium, Sea World and The Florida Aquarium to fund continuing collections.
- Exhibits and graphics
- Spawning observations


Born at The Aquarium
These fish started as eggs in our Coral Reef Exhibit!
The microscopic eggs float to the top and are collected in a basket that skims the surface.
When they hatch the tiny fish are the size of this comma, and they need very, very tiny food.
Breeding fish in captivity reduces collection from the wild and helps conserve habitats such as coral reefs.
At the University of Florida Tropical Aquaculture Lab in nearby Ruskin FL, the hatchlings are fed just the right diet of plankton.
When they get bigger, the young fish are brought back here for display.

A Rising Tide of Conservation Begins...

These porkfish and other tropical fishes aren't easy to breed in aquariums–their tiny eggs are usually lost when water is filtered and cleaned. The Rising Tide project involves collecting fish eggs at public aquariums and raising them in specialized tanks to ensure their survival.

Goals of Rising Tide:

- Change the aquarium industry by breeding tropical species.
- Share knowledge with commercial growers and entire marine fish community.
- Diminish the impact on precious reef habitats.
- Ensure colorful and cool marine fishes will be seen by generations to come.

SeaWorld continues to connect families to the ocean and the fragile beauty of reefs–you can make a difference through everyday actions.

- Recycle
- Keep Waterways Clean
- Support Sustainable Seafood
- Learn More at: RisingTideConservation.org

Meet the Newest Rising Stars of Fish Conservation.

Fast, fun porkfish are named after the grunting, piglike sounds they create. Colorful reef species like these aren't just cool, they're a vital link in the delicate food web we all rely on. But these fantastic fishes and their coral homes face an ocean of challenges.

- Habitat Loss
- Warming Ocean Temperatures
- Pollution
- Over-Collecting

To help, SeaWorld, the University of Florida and other dedicated conservationists have teamed up to create the Rising Tide fish breeding project.

Rising Tide

RisingTideConservation.org