

## Develop Systems and Diet Strategies to Reduce Yellow Perch Larval Mortality Burst in Indoor RAS



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## Objectives

- ✓ Develop system(s) to address physical and behavioral barriers to enhance mass production and survival of yellow perch (YP) from onset of first feeding up to 70 days.
- ✓ Develop strategies to increase survival of fry and larvae of yellow perch reared indoors using different feeding regimens.

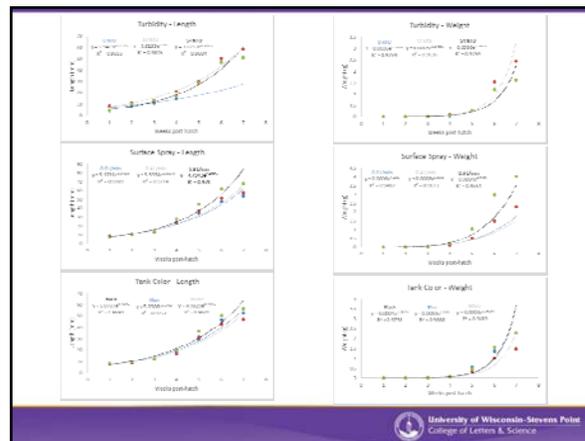
## Deliverables

- ✓ Develop modules for self/group training. Modules should be prepared at the initiation of the project and updated to include new procedures/protocols learned from the project.
- Prepare an overall report of the findings including an executive summary.



## Tank Environment – Year 1 (UWSP) Broad Range

- Turbid water: Clear (0 NTU), slight (32 NTU), turbid (54 NTU).
- Surface spray: No flow (0 L/min), moderate (0.4 L/min), high (0.8 L/min).
- Tank color: white, blue, black
- Recorded:
  - Temperature (20°C)
  - Dissolved oxygen (8.6 mg/L)
  - For 25 fry/tank: length, weight, survival
  - Swim bladder inflation, food in the gut, cannibalism



## Tank Environment – Year 2 (UWSP) Narrower Range

- Turbid water: Slight (12.5 NTU), moderate (25 NTU), turbid (37.5 NTU).
- Surface spray: Low (0.6 L/min), moderate (0.8 L/min), high (1.0 L/min).
- Tank color: Black
- Nine combinations; three replicates = 27 tanks
- Recorded:
  - Temperature (20°C)
  - Dissolved oxygen (8.6 mg/L)
  - For 25 fry/tank: length, weight, survival
  - Swim bladder inflation, food in the gut, cannibalism



## Results – Year 2

- No differences seen in growth among treatment combinations.
  - Length & weight gain slightly greater for:
    - Surface spray 1.0 L/min with turbidity at either 25 or 37.5 NTU.
- Food in gut:
  - After week 1, all fry had food in gut.
  - After 3 weeks only 50% had food in gut.
  - Weeks 5-8, 75% of fry had food in gut.
- 96% of fry has inflated swim bladders from weeks 1-8.
- Cannibalism was very low, but skeletal and developmental deformities were high.



### Conclusions (UWSP)

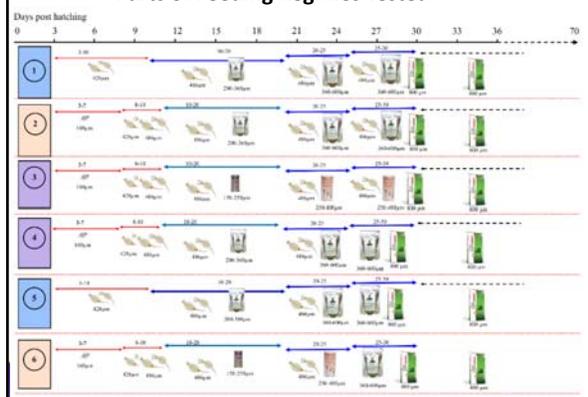
- Culture environment, tanks conditions, were further refined for the first 70 days post-hatch.
  - Black tank
  - Turbidity ranging from 25 – 37.5 NTU.
  - Surface spray ranging from 0.6 – 1.0 L/min.
- 2-3 weeks post-hatch is critical period for food consumption.
- Culture guide developed; online modules in development.

### Develop and Improve Marine Rotifer Production and Feeding Systems (OSU-Piketon)

- Two commercial-scale algae auto feeders and rotifer production systems were constructed.
- This allowed us to feed rotifers 24 hours per day using a peristaltic pump, and digital repeat cycle timer. Important because marine rotifers can only survive for 15 – 20 minutes in freshwater
- Eight rotifer/arteria auto-feeders were constructed and paired with sixteen yellow perch fry production tanks in a cold bank system.



### Parts of Feeding Regimes Tested



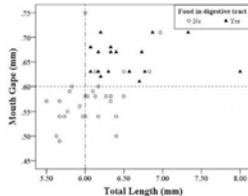
### Effective Regimes Identified

1	3-7 dph	5-10 dph	8-20 dph	21-30 dph	30-45 dph	45-55 dph	55-
Rotifer	small Artemia	Regular Artemia +	Regular Artemia +	Regular Artemia +	Regular Artemia +	Regular Artemia +	Starter
180 µm	428 µm	Ochromis B1 + AP100-150	Ochromis B2 + AP100-150 + AP150-250	Ochromis B2 + AP100-150 + AP150-250	Ochromis B2 + AP250-450 + Starter	B2 + AP250-450 + Starter	
2	3-10 dph	8-20 dph	21-30 dph	30-45 dph	45-55 dph	55-	
Small Artemia	Regular Artemia +	Regular Artemia +	Regular Artemia +	Regular Artemia +	Regular Artemia +	Regular Artemia +	Starter
428 µm	Ochromis B1 + AP100-150	Ochromis B2 + AP100-150 + AP150-250	Ochromis B2 + AP100-150 + AP150-250	Ochromis B2 + AP250-450 + Starter	Ochromis B2 + AP250-450 + Starter	Ochromis B2 + AP250-450 + Starter	

Groups fed with the above protocols showed ~30% survival rates by the 30 dph.

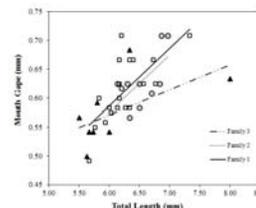
### Additional Findings (OSU-Piketon)

- We found that a key reason of poor indoor survival of YP larvae is that the mouth gape of newly hatched fry is too small to ingest *artemia* at the beginning.
- Examination of food in digestive tract, combining with mouth size as well as total length data proved that the yellow perch larvae were able to ingest live feed, either rotifer or *artemia*, when only total length reached 6 mm and mouth gape reached 0.6 mm, regardless the age of larvae, which was usual from 1 to 7 DPH.
- Therefore, Yellow perch larvae are not able to ingest small size *artemia* (~428 µm length) until they reach > 6 mm of total length and mouth gape > 0.6 mm according to our observation (Fig.).



### Mouth Gape in Some Families is Bigger Than Others

We have identified some strains/families that produced significantly larger-mouth gape progeny and larger eggs than others. By monitoring egg size produced by different strains/families,



### Conclusion (OSU-Piketon)

- A effective marine rotifer production and feeding system was developed.
- Effective feeding regimes and protocols were identified.
- Mouth gape is the key determinant of larvae survival, which can be selected as a quantitative trait.
- Developing yellow perch broodstock with larger mouth gape and larger size of egg using improved fish to increase indoor survival of larvae and fry is critical to the YP industry development.
- Yellow perch fry need live feed for 30 days because:
  - 1) digestive system is not well-developed
  - 2) 30 dph fry will accept formula feed without any problem

### Deliverables (ISU)

Two videos were produced by Iowa State University:

- "Feeding Yellow Perch Fry":  
<https://vimeo.com/127717048>
- "Growing & Maintaining Natural Feeds for Larval Fish":  
<https://vimeo.com/127639646>
- They are available on the NCRAC website under the "videos" tab and on the NCRAC Vimeo channel.
- Modules for self/group training will include new procedures/protocols learned from the project.