Review of gear type, fouling control, and tumbling effects on oyster performance

Scott Rikard

Auburn University Shellfish Laboratory, Dauphin Island, Alabama

School of Fisheries, Aquaculture and Aquatic Sciences, Auburn University

AUBURN UNIVERSITY
SCHOOL OF FISHERIES, AQUACULTURE, AND AQUATIC SCIENCES

AU SHELLFISH LAB

Why Off-Bottom Farming

- Intended for the premium, high value niche markets
  - Primarily live, raw half-shell market that emphasizes quality
  - Not in competition with shucked product or sack oysters
- High survival and of bred lines and/or triploid oysters – which do not suffer from poor summer condition
- Reduce variation in quality
- Branding potentially adds value
- Stability of income with potential for year round income compared to wild harvest.

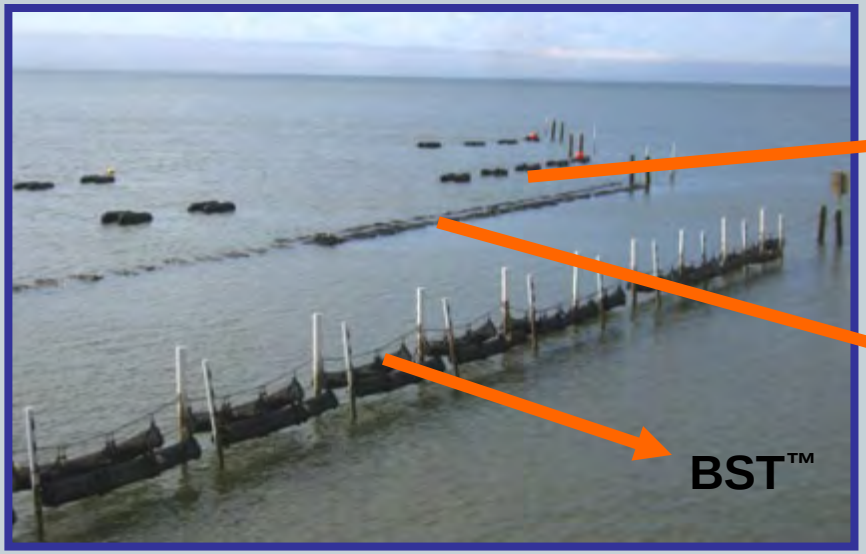
Can gear selection, fouling control, and tumbling influence oyster performance?

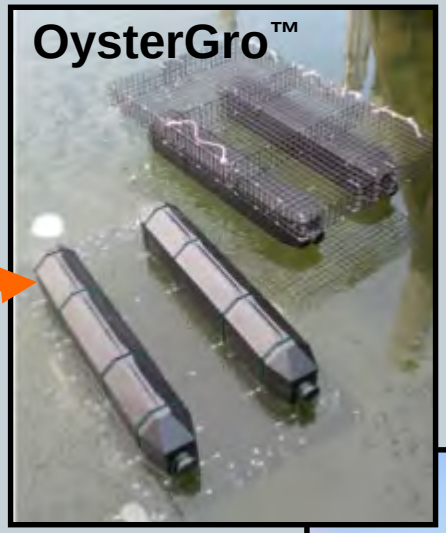
Potential effects

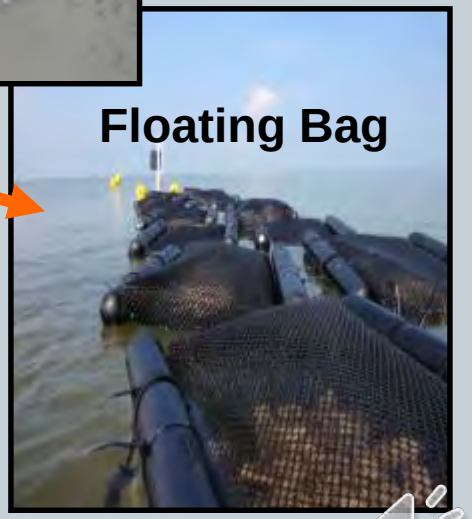
- Shell Shape – deep cups and broad fans
- Consistent and uniform size
- Clean
- Labor efficiency
- Overall economics

Photo: Scott Rikard

Gear Type







Photos: Bill Walton, Courtney Coddington, & Julie Davis

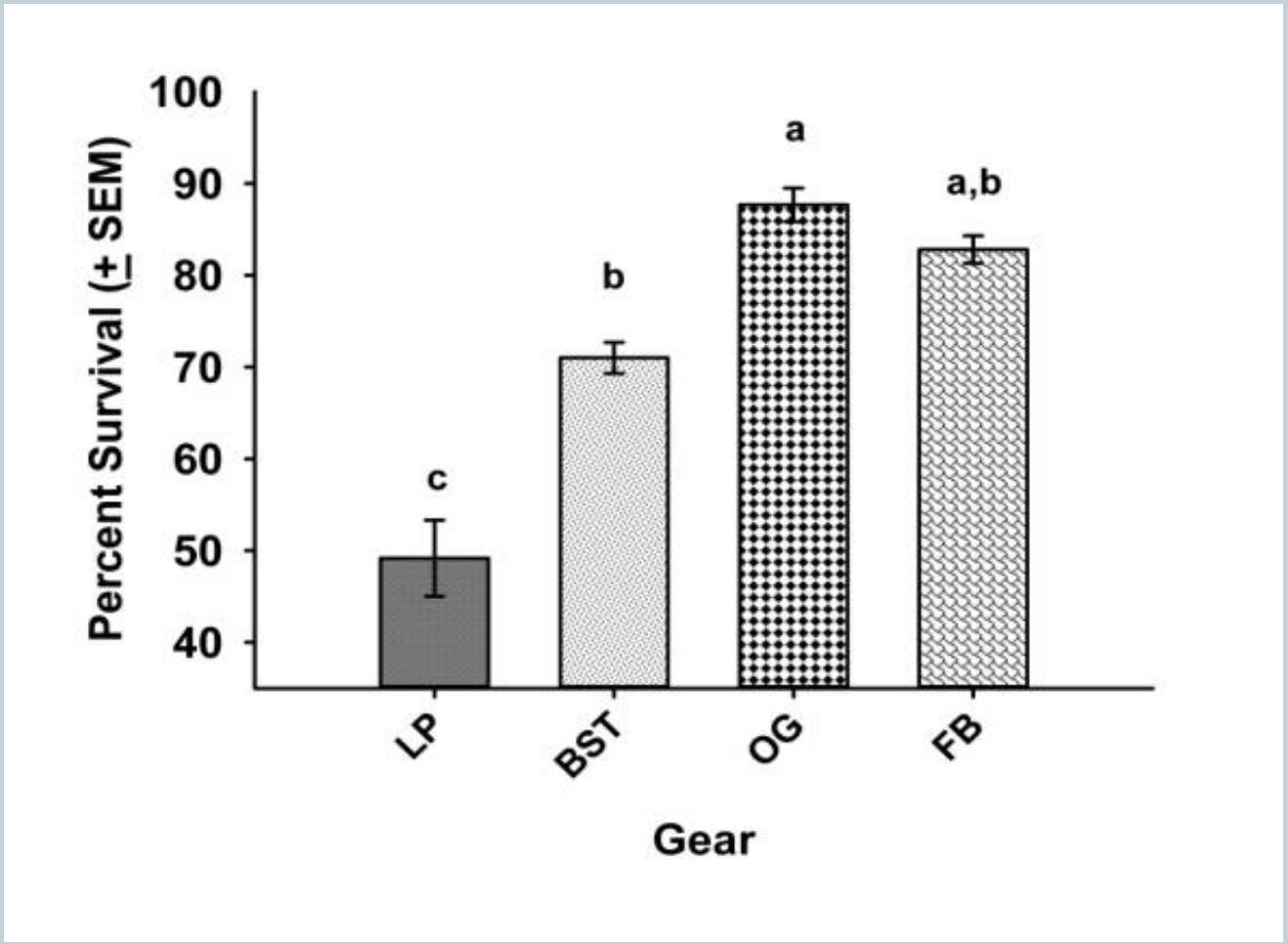
Gear Type

Experimental Analysis of Gear Type

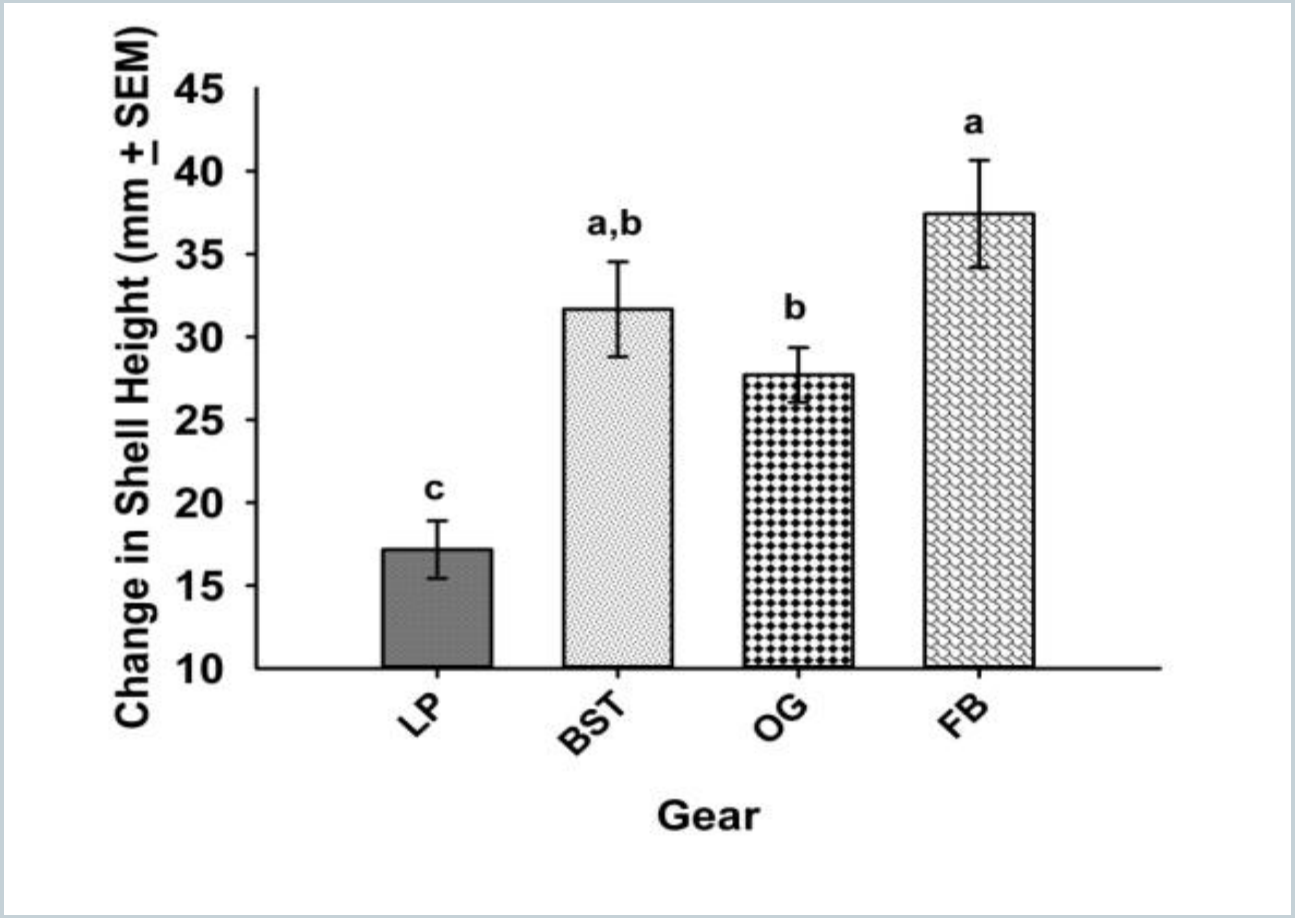
- Half sibling diploid and triploid oysters produced at the Auburn University Shellfish Lab, Dauphin Island, AL
- Larvae and juveniles raised in identical systems
- Deployed into 4 commercial gear types ($n \geq 3$) for a period of 5 months. Initial shell height 59.5mm
- Fouling control consisted of weekly air drying for Oyster Gro and BST gear and weekly flipping for Floating Bags. No control measures for LowPro cages

*For this presentation we will focus on growth of all oysters in the different gear types. The effects of ploidy will be the focus of another presentation.

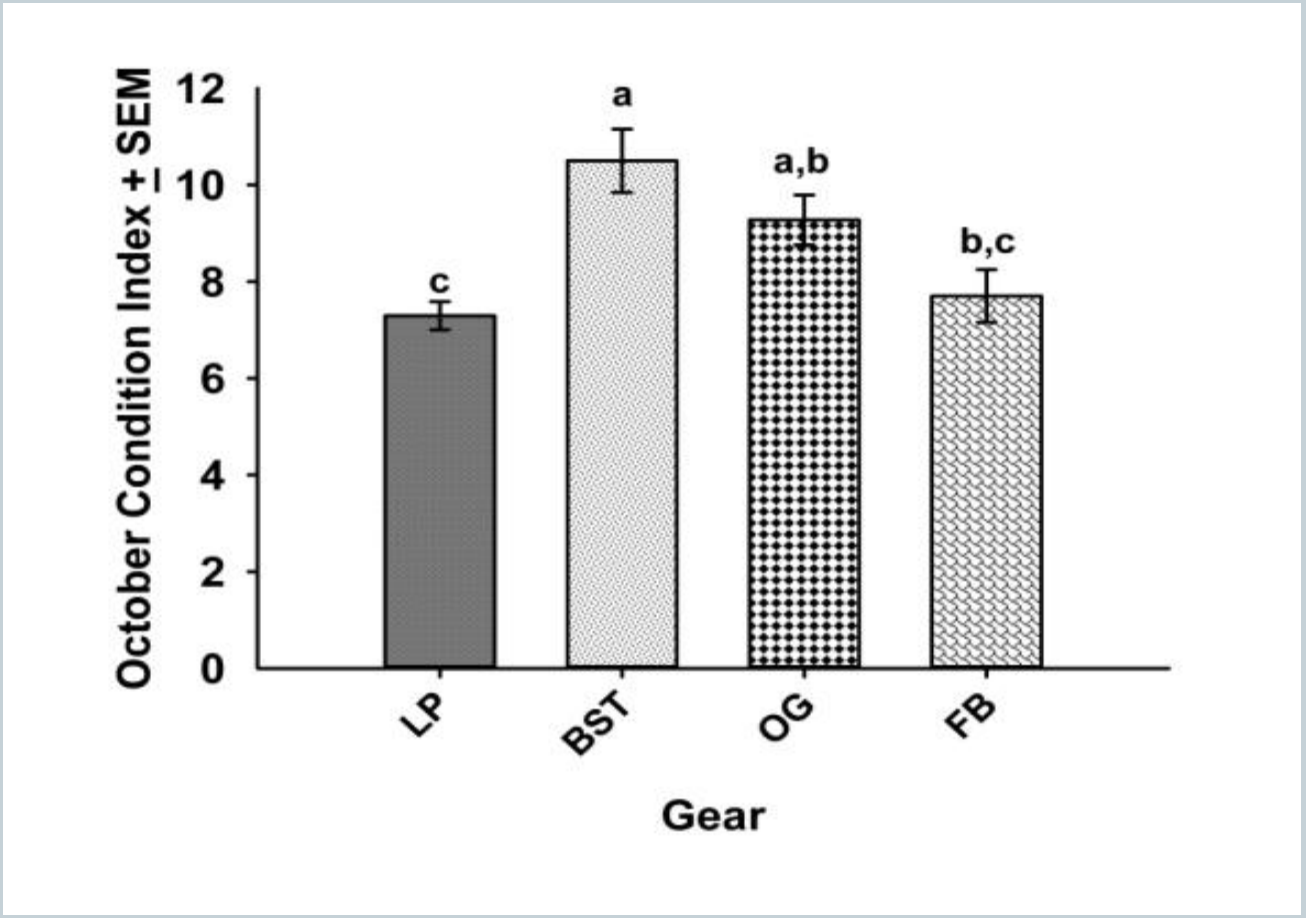
Gear Type
Survival



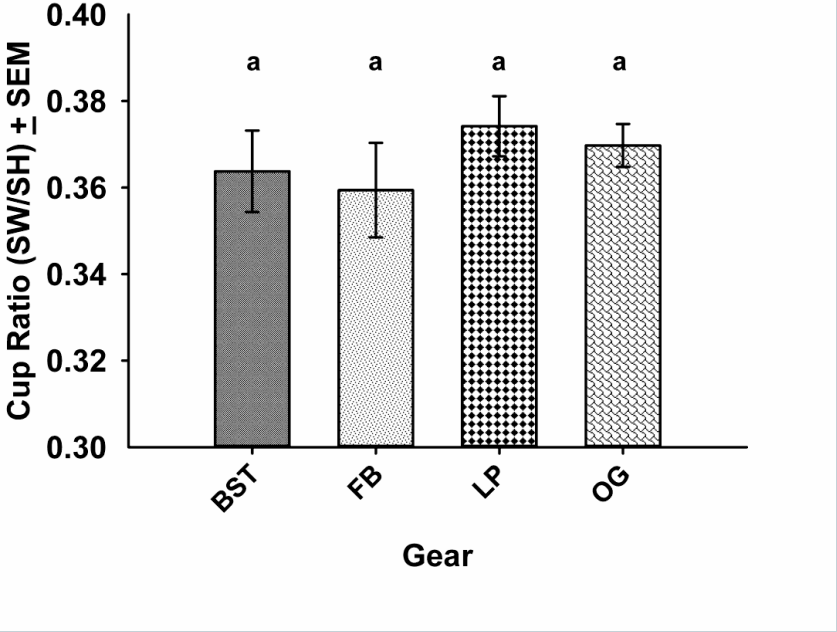
Gear Type
Growth

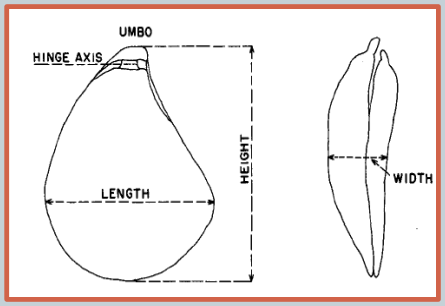


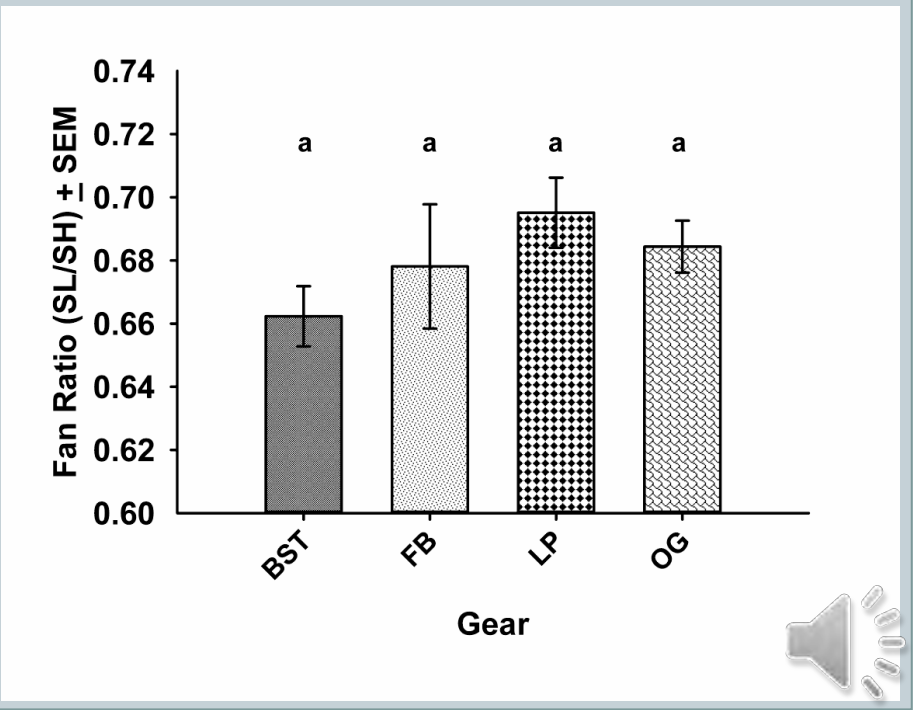
Gear Type
Condition Index



Gear Type
Cup and Fan Ratio







Gear Type

Consider fouling control strategy

- Adjustable Longline Systems (BST, Seapa, Hexcyl) – Adjust lines to exposed position to air dry baskets and oysters to control recent fouling and mud worm infestations.

- Floating Cage Systems (Oyster-Gro) – Flip cages on to floats to air dry bags and oysters to control recent fouling and mud worm infestations.

- Floating Bag Systems – Flip bags to reduce fouling on bag. Most systems do not air dry oysters to control fouling on the oysters or mud worm infestation.

- Bottom Cages (LoPro) – No fouling control other than removing bags and pressure washing or place in intertidal zone for daily exposure at low tides.

Gear Type

Consider storm planning

- Adjustable Longline Systems (BST, Seapa, Hexcyl) – Adjust lines to the lowest position.
- Floating Cage Systems (Oyster-Gro) – Sink cages with floats down so cage rests on bottom on floats. In muddy environments, cages may bury.
- Floating Bag Systems – No hurricane plan except to remove from water. Bags and floats easily tear apart or anchors pull and bags often wash inland.
- Bottom Cages (LoPro) – Leave cages in place or move to deeper water if in an intertidal area.

Gear Type
Recommendations

- **Adjustable Longline Systems and Floating Cage Systems** are ideal for Gulf of Mexico region. These systems have good oyster performance, storm plans, and fouling control strategies. Require significant capital investment. **Recommended**
- **Floating Bag Systems** have good oyster performance but no easy storm plan and no fouling control strategy (New Flip Farm system untested). Lower capital investment. **Not recommended in storm prone area** (Flip Farm untested)
- **Bottom Cages** (LoPro) – Poor oyster performance and accessible to oyster drill predation. No good fouling control measures except intertidal deployment. Not recommended in Gulf regions that have limited tidal range or subtidal areas with oyster drill issues.

Fouling Control
The Problem

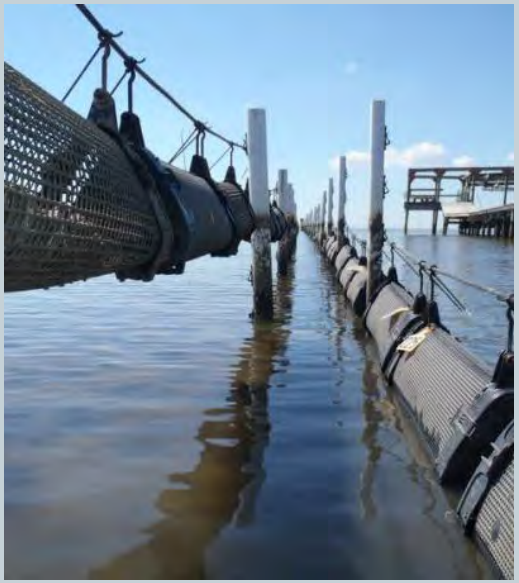
- Fouling of gear and oysters can present challenges to off-bottom oyster farming.
- Fouling can reduce water flow through culture gear resulting in reduce growth rates and in extreme cases, cause mortality. Fouling organisms also compete for food with oysters.
- Fouling of oysters can make product less appealing and less marketable.
- The extra weight of fouling on culture gear can lead to gear failures.
- Mud worms burrow into oyster shells causing mud blisters on shell interior, making product less appealing. Mud worm blisters on shell interior can also rupture during shucking and release an “rotten egg” smell that is not desirable.

Fouling Control
The Solution

- The simplest and most efficient solution to fouling problems in air drying at regular intervals.

- Oysters can survive being out of the water for extended periods of time. Newly set fouling organisms and mud worms can not survive out of the water for extended periods of time.

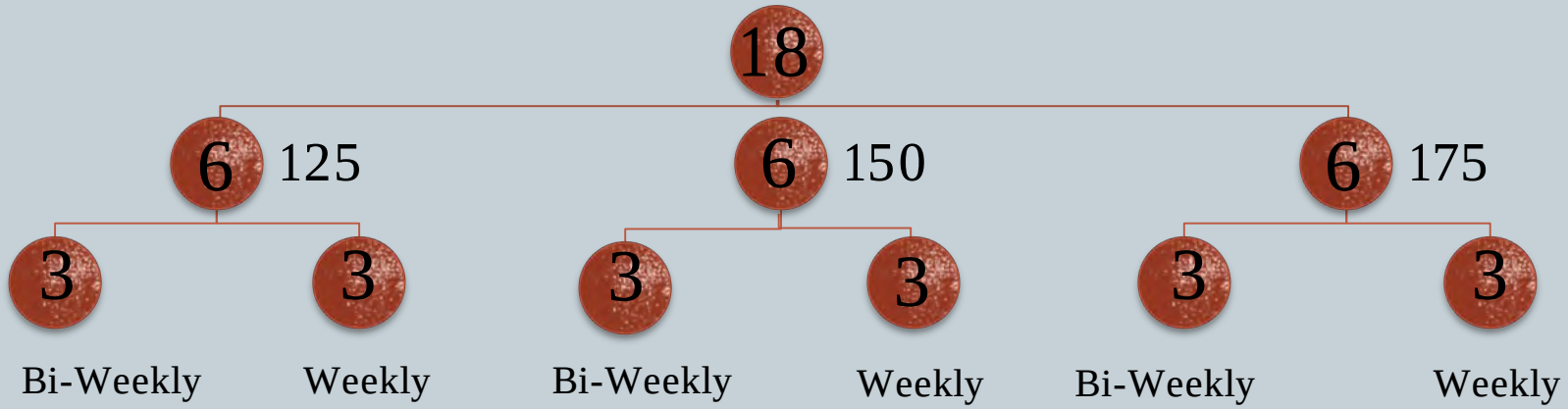
- How does air drying affect growout performance?



Fouling Control

Experimental setup

TRIPLOID / DIPLOID BAGS

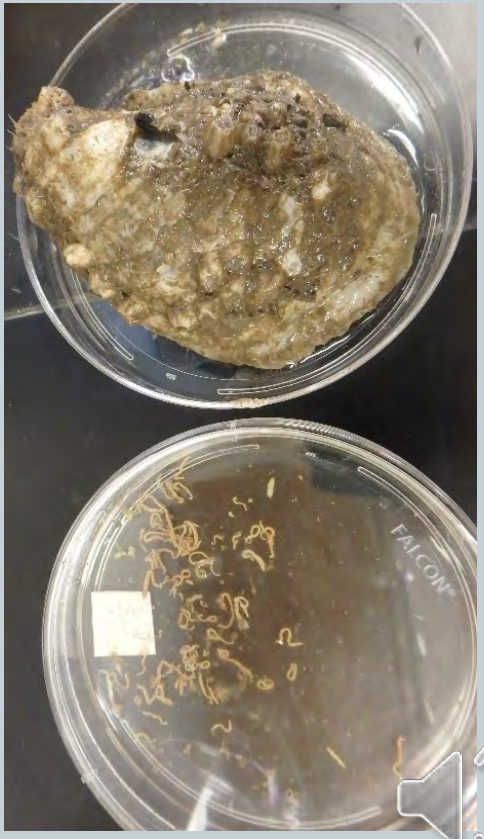


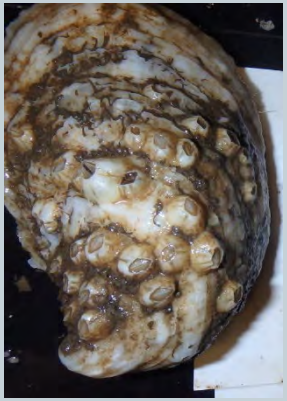
Here we will focus on the bi-weekly or weekly air drying

Fouling Control

Experimental setup

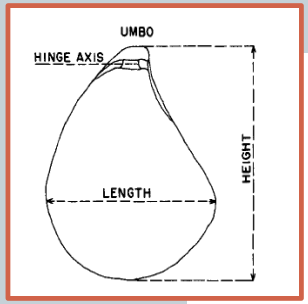
- Oysters sampled monthly for a period of 3 months
- Measure shell metrics to assess growth
- Assess condition index
- Measure fouling
- Assess mud worms

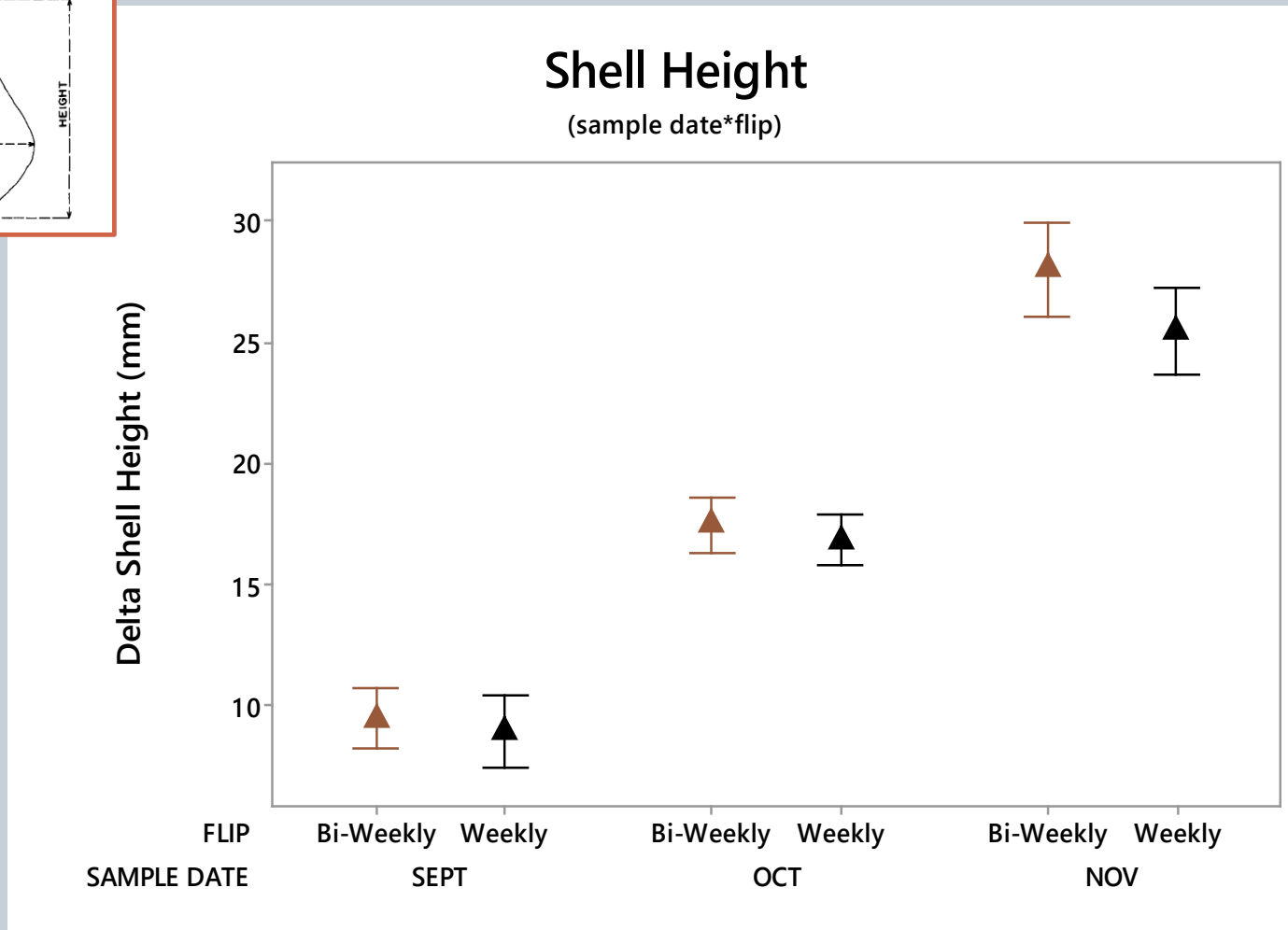




Fouling Control

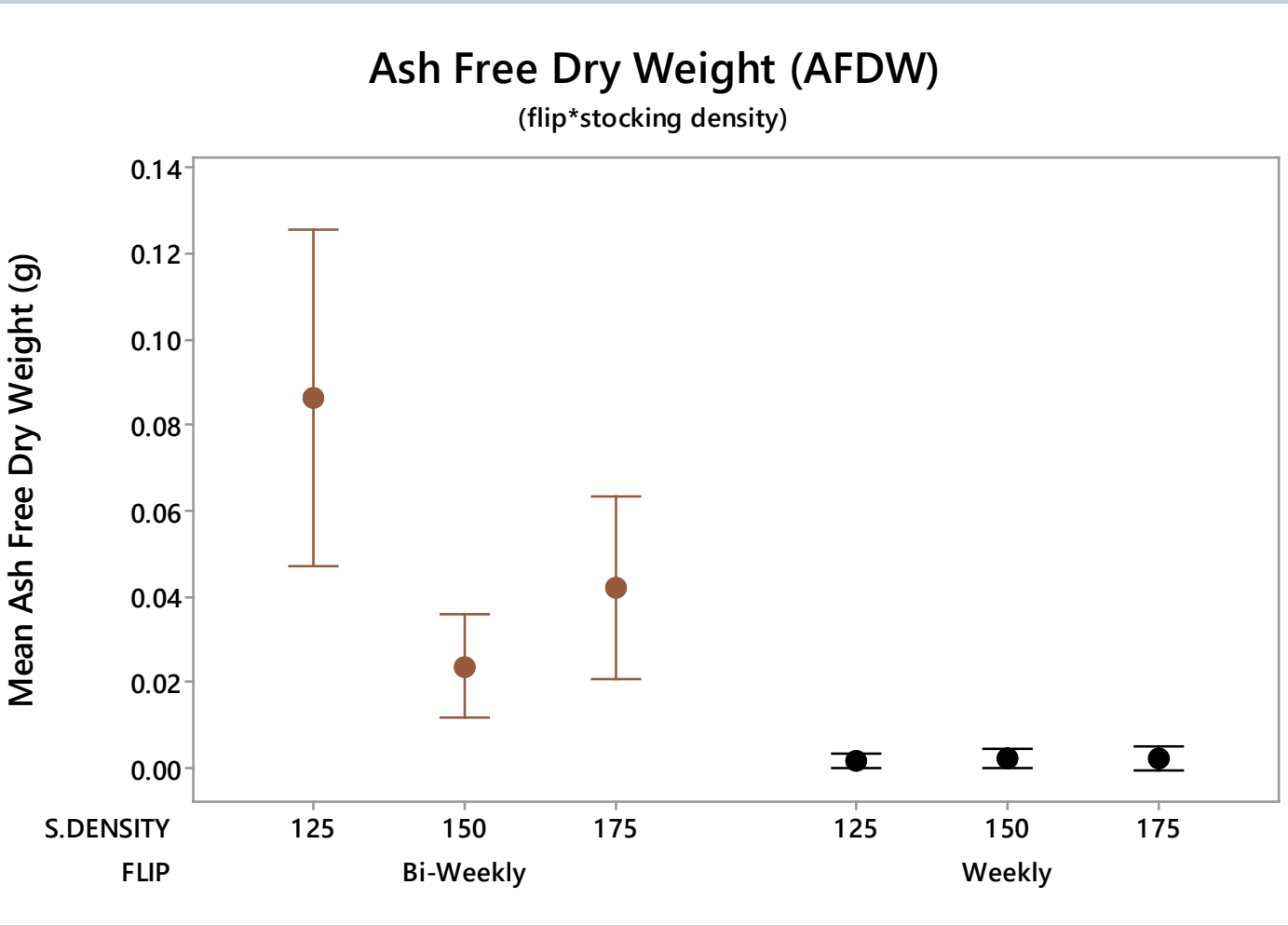
Change in Shell Height





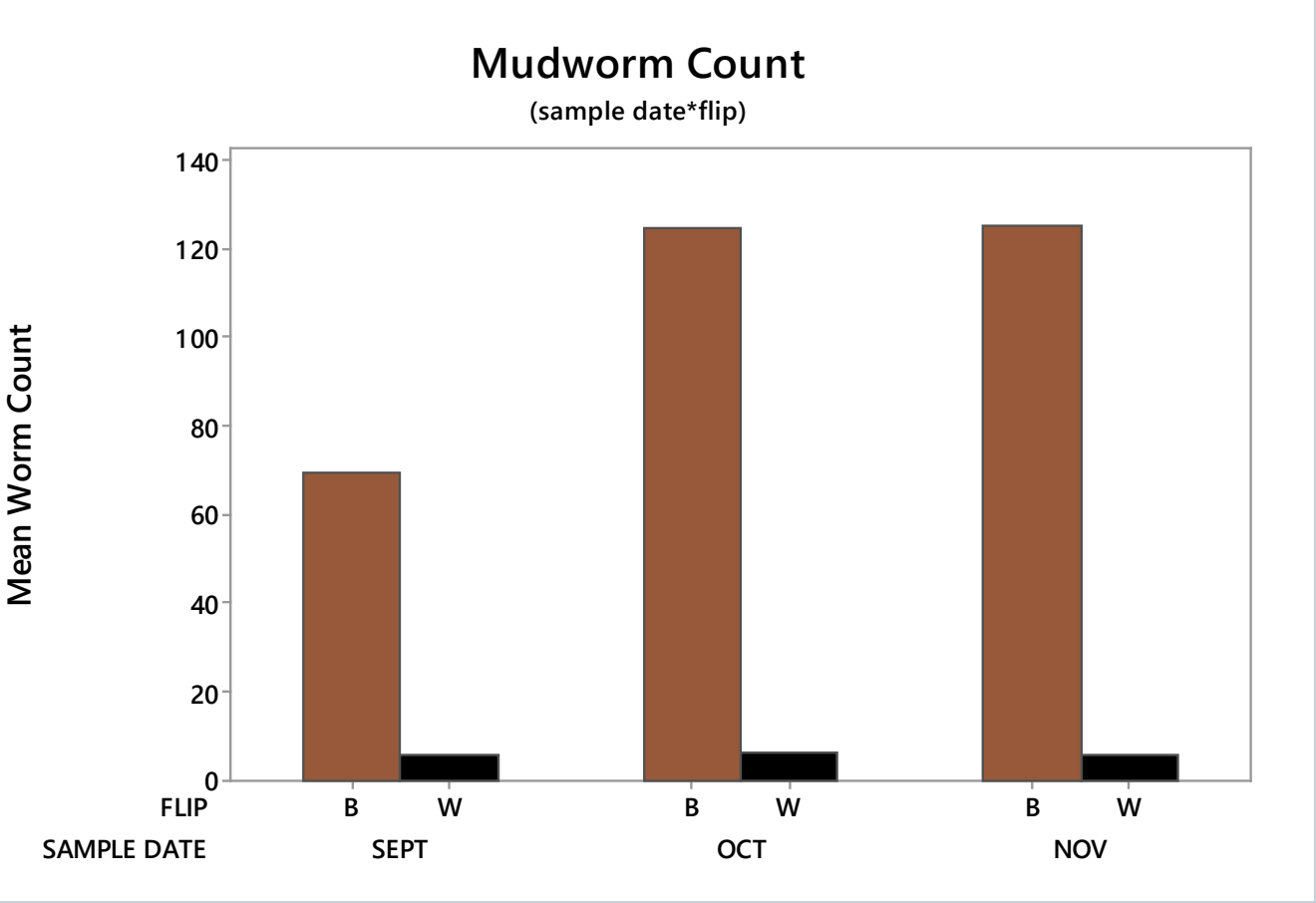
Fouling Control

Effect on Fouling



Fouling Control

Effect on Mud Worms



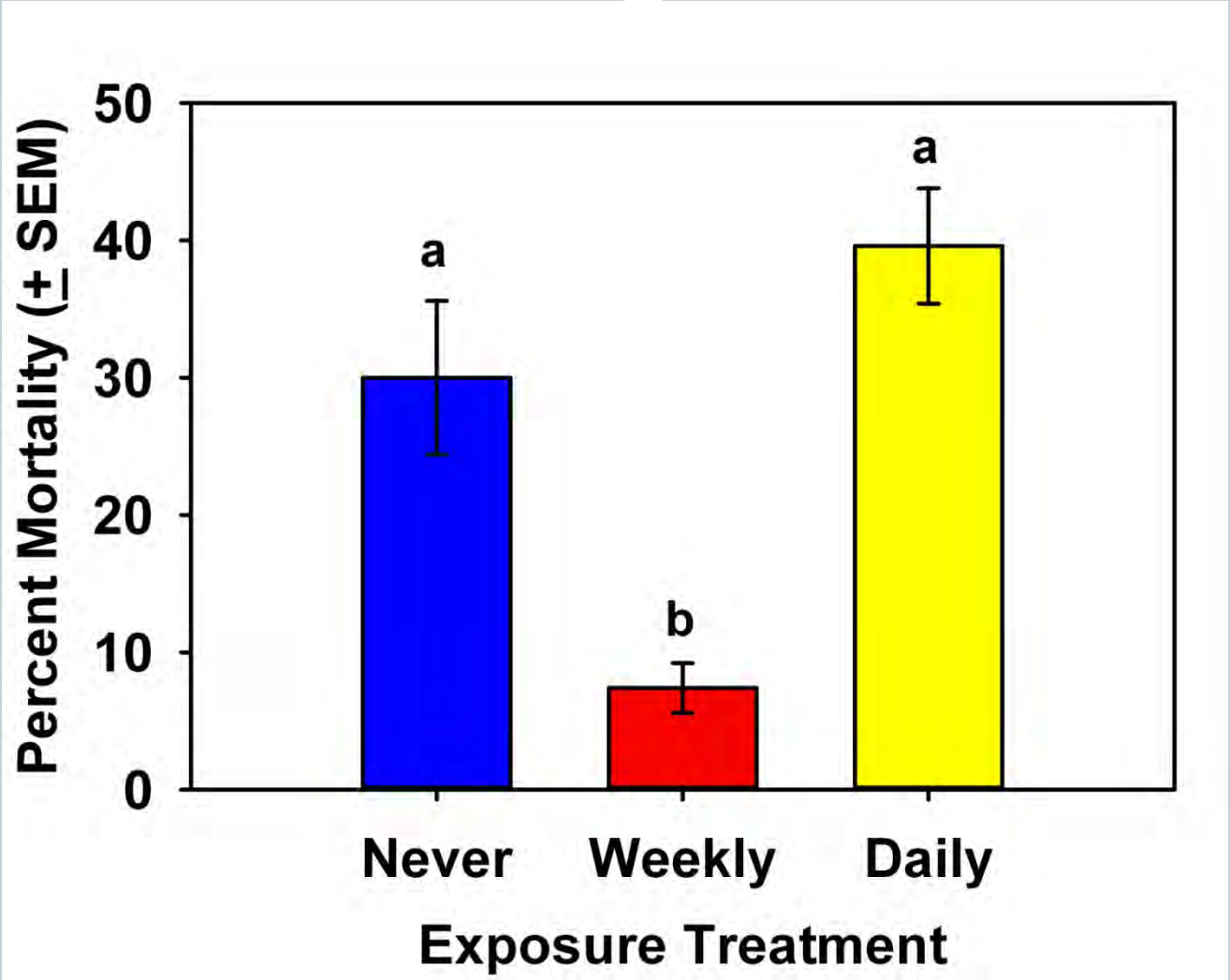
Fouling Control

Additional study on Air Drying

- Another study looked at Never Drying vs Weekly Drying for 24 hours vs Drying Daily (exposed at low tide).
- Study used adjustable longline system.
- Stocked with juvenile oysters in May with final analysis in January of the following year (8 month study period).
- For this data we will build on the previous study and look at survival and growth.

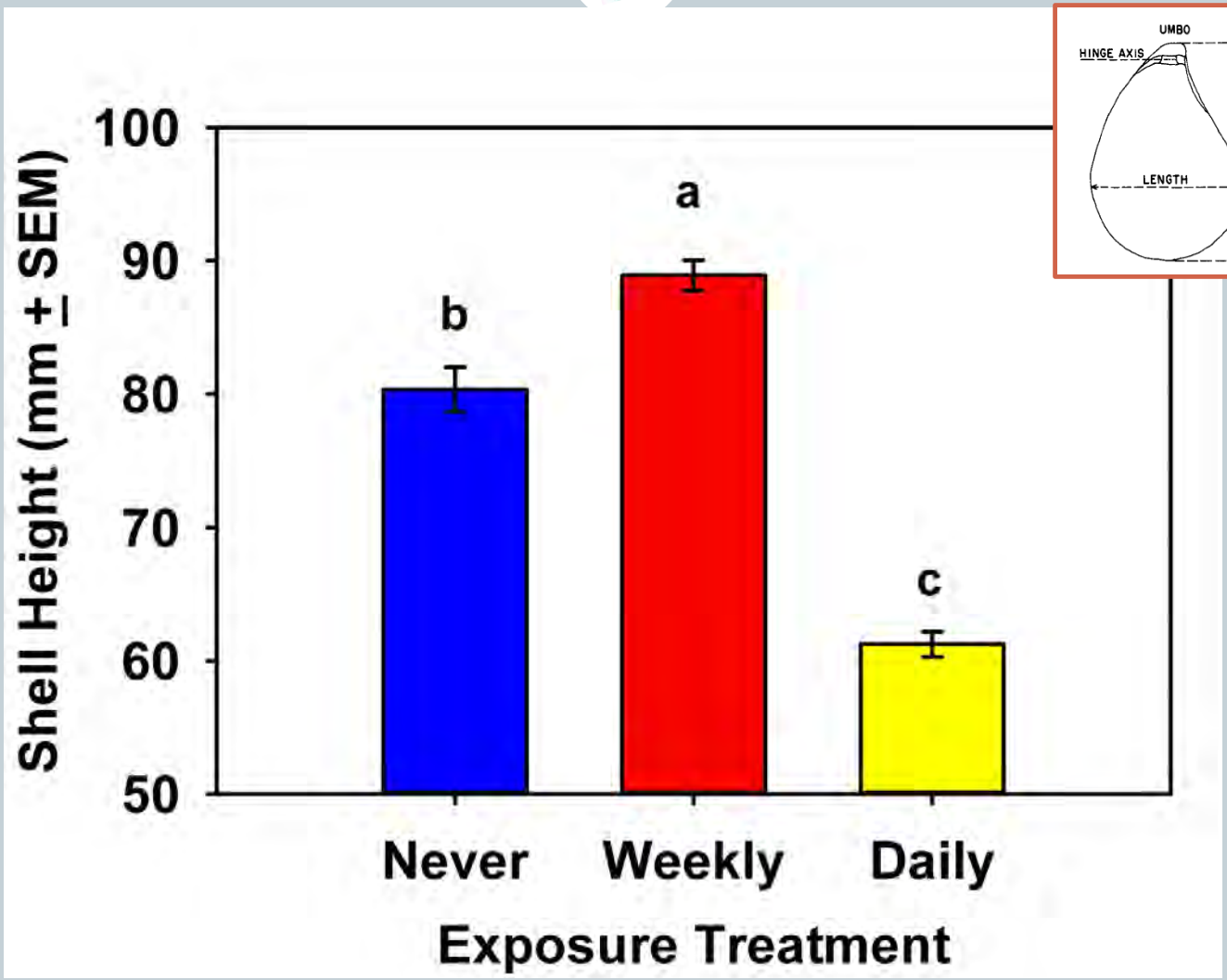
Fouling Control

Percent Mortality



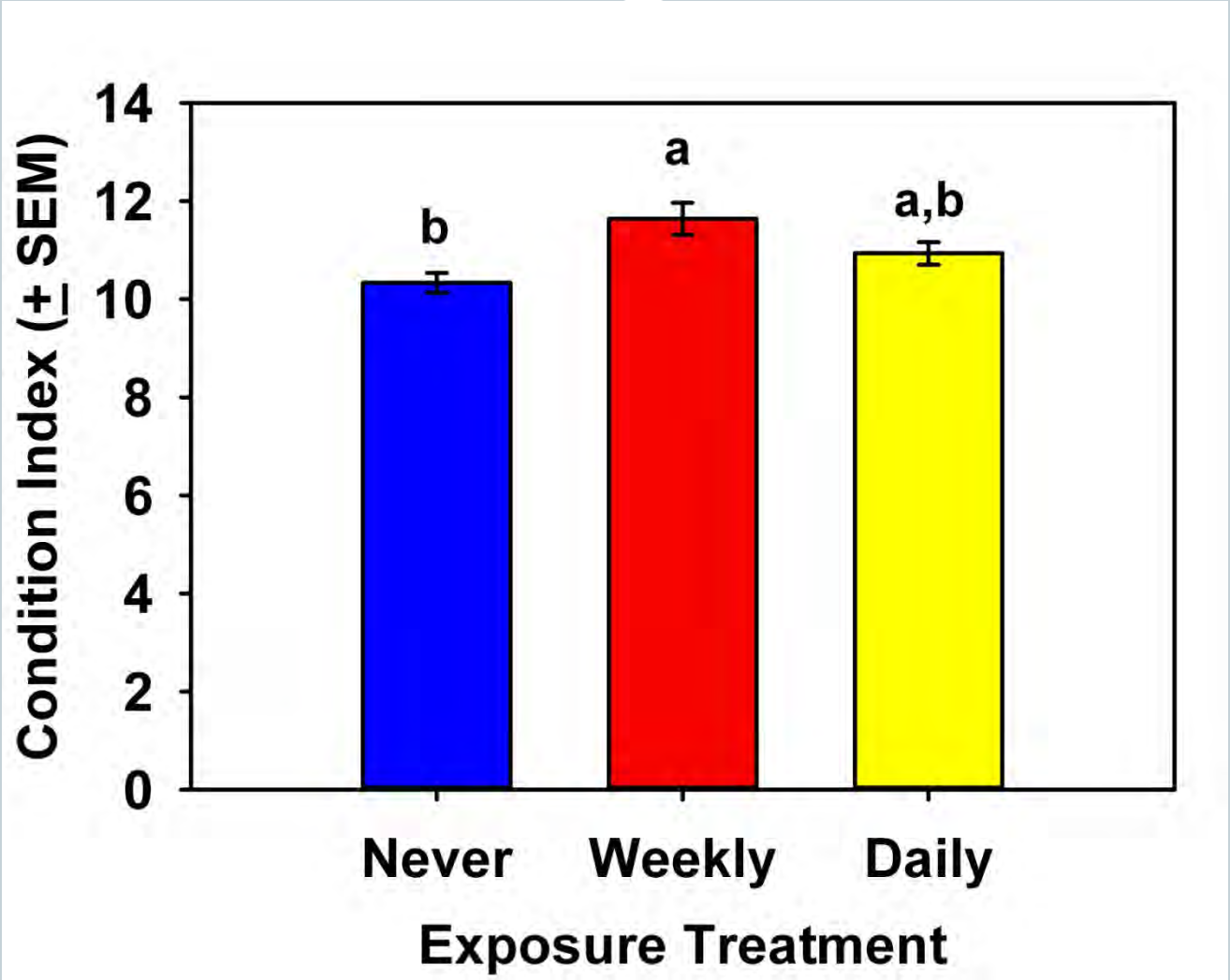
Fouling Control

Final Shell Height



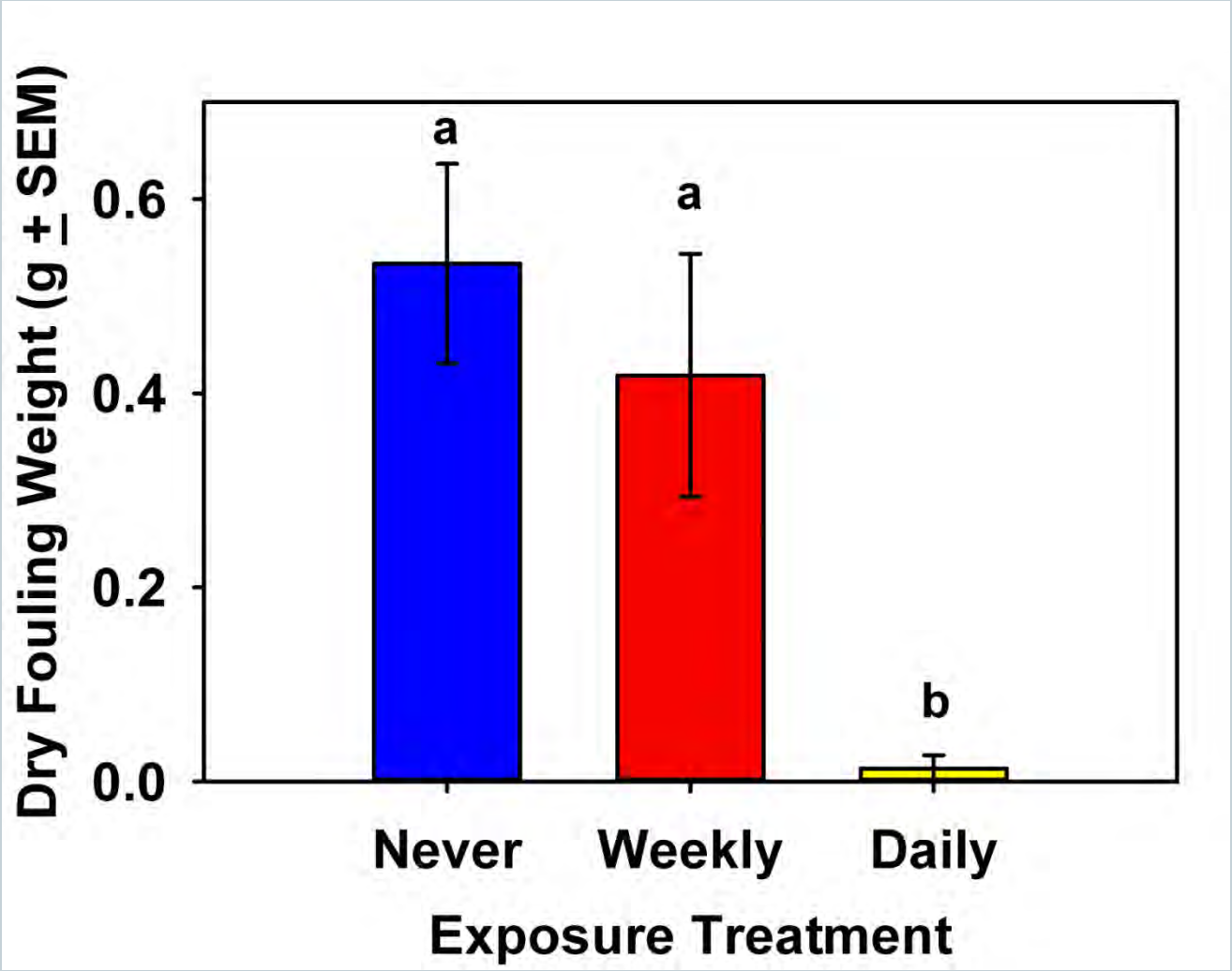
Fouling Control

Effect on Condition Index



Fouling Control

Effect on Fouling



Fouling Control

Take Home Message

- Air drying led to a slight growth penalty for weekly dried oysters but a more significant penalty for daily exposed oysters .

- BUT… there were clear benefits to fouling and mud worm control.

Fouling Control

Recommendation

- Air Dry oysters and gear weekly from mid-March to mid-November for 24 hours at a time.
  - Reduced to overnight desiccation if air temperature exceeds about 95° F.
- Air Drying for colder months drop to every two weeks or once a month.
  - Can be increased if problems seen (e.g., barnacle set)
- May be able to set adjustable longlines to an appropriate intertidal depth to control fouling but not limit growth too much.
- These are rules of thumb. Optimize AND evaluate for your farm location!

Tumbling Effects
Why Tumble?

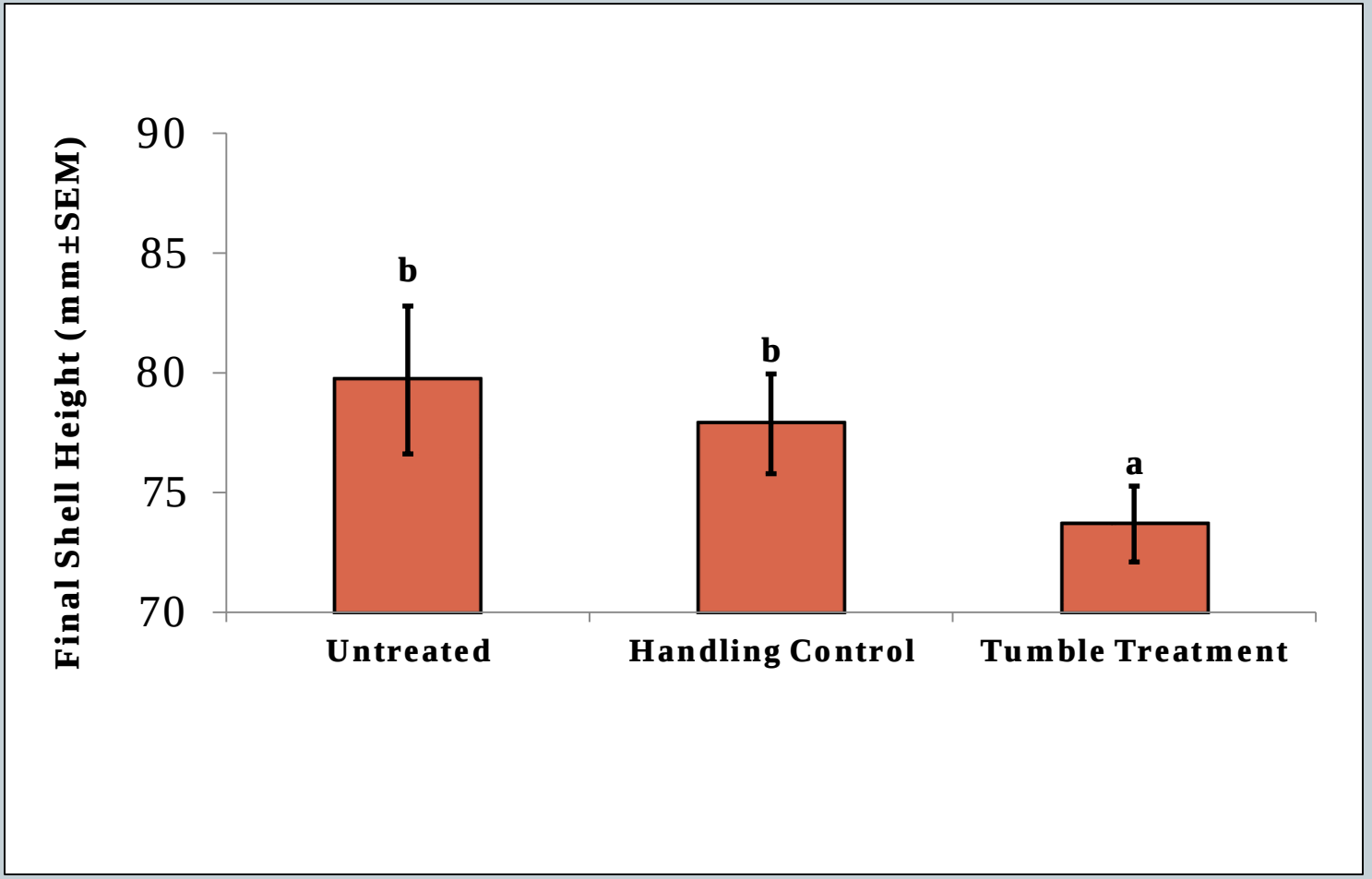
- Tumbling oysters through a mechanical sorter may improves quality by “trimming” the shell resulting in:
  - Thicker shells
  - Deeper cups
  - Less Fouling
  - More uniform shape

- Does it really? Let’s take a look!

Tumbling Effects
Tumbling Experiment 1

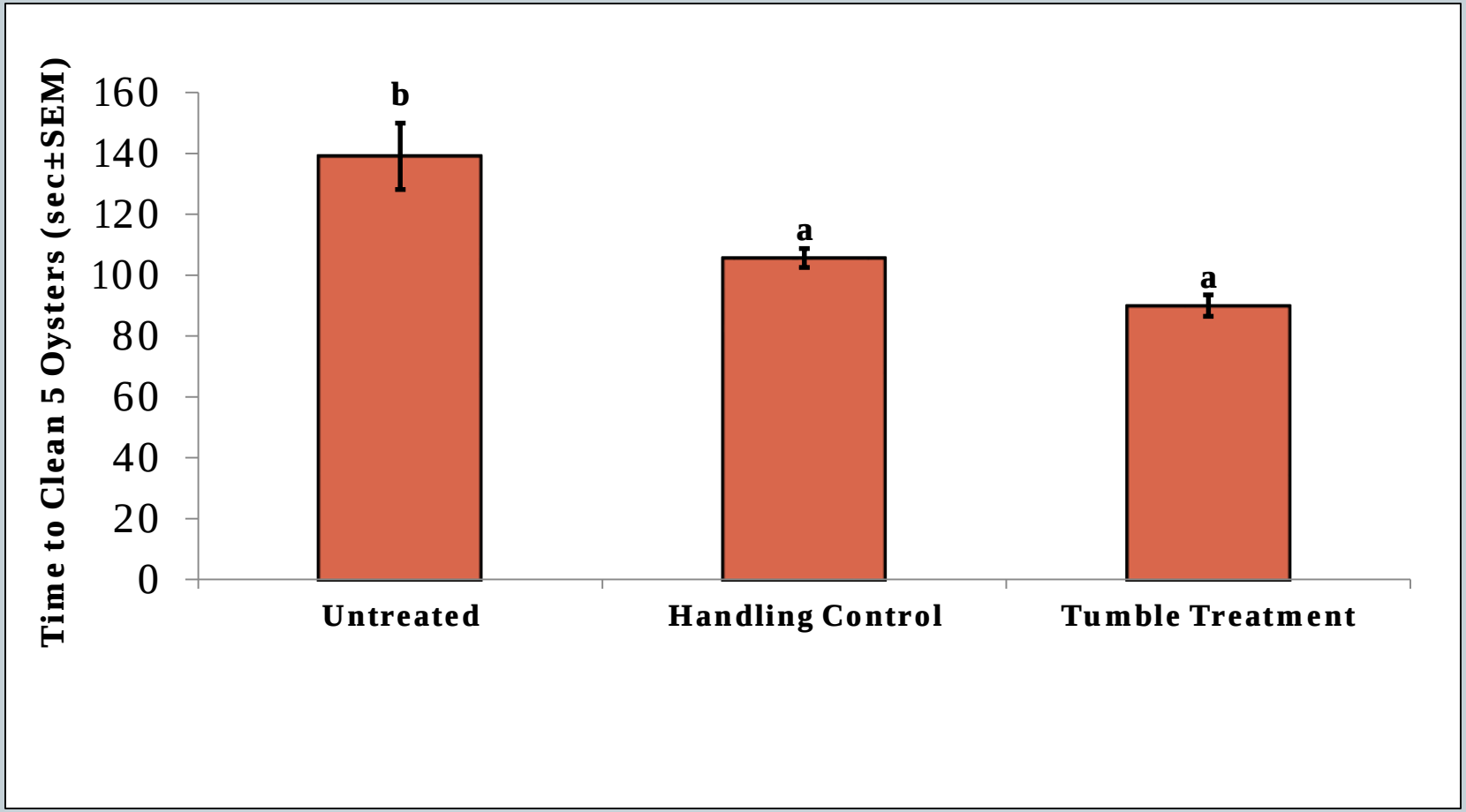
- Tumbling in larger oysters nearing harvest in all 4 previously discussed gear types
- Initial shell height 59.5mm
- Treatments
  - Untreated (Never tumbled or removed from water)
  - Tumbled Monthly
  - Handling Control (removed from water but not tumbled)
- Follow grow out from June to November

Exp 1 – Tumbling Effects on Shell Height



Tumbling Effects

Exp 1 - Tumbling Effect on Fouling



Tumbling Effects
Conclusions Experiment 1

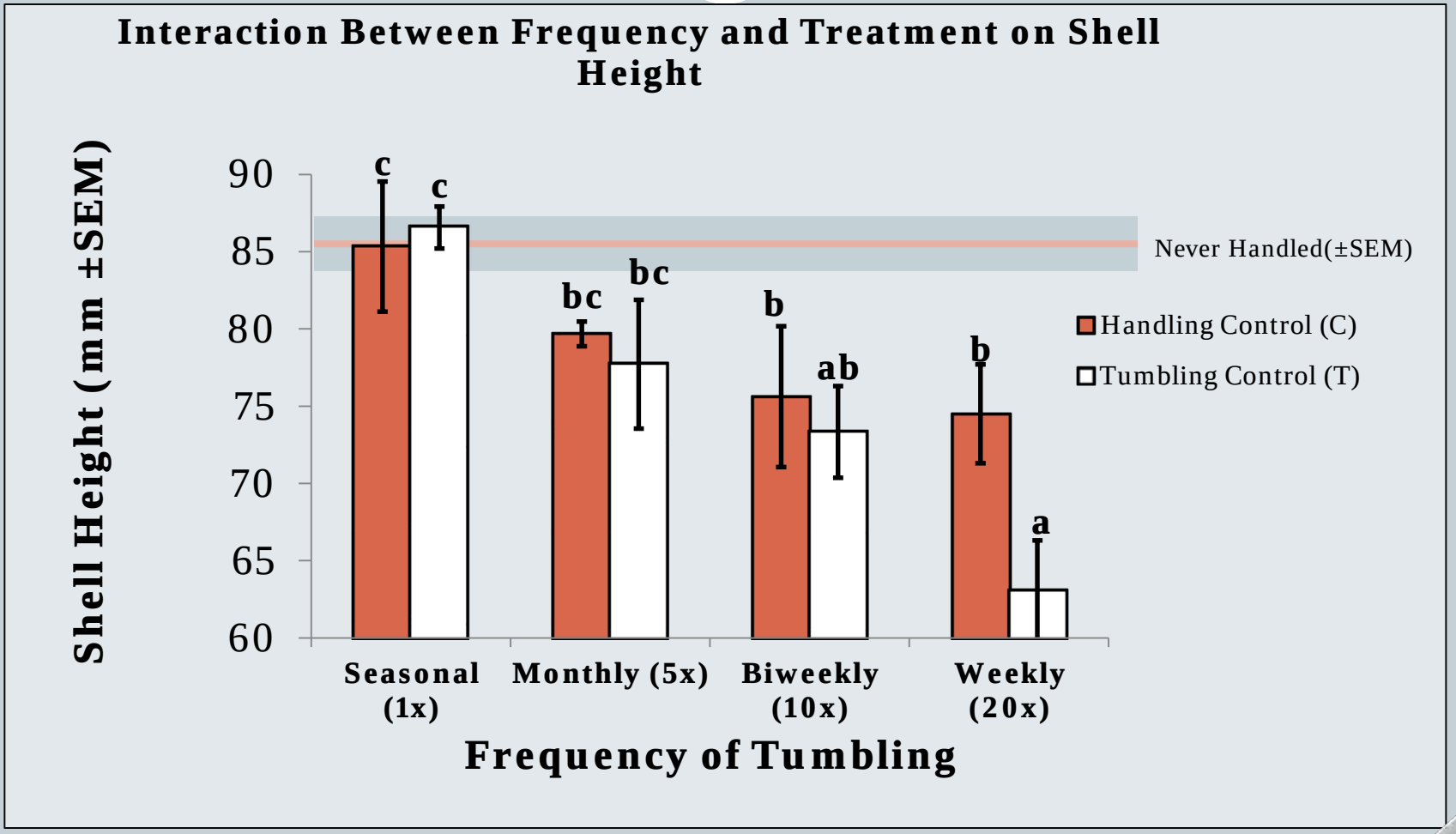
- In this first experiment, effects on shell quality were confounded by gear type.
- Let's dig a little deeper….Experiment 2

Tumbling Effects

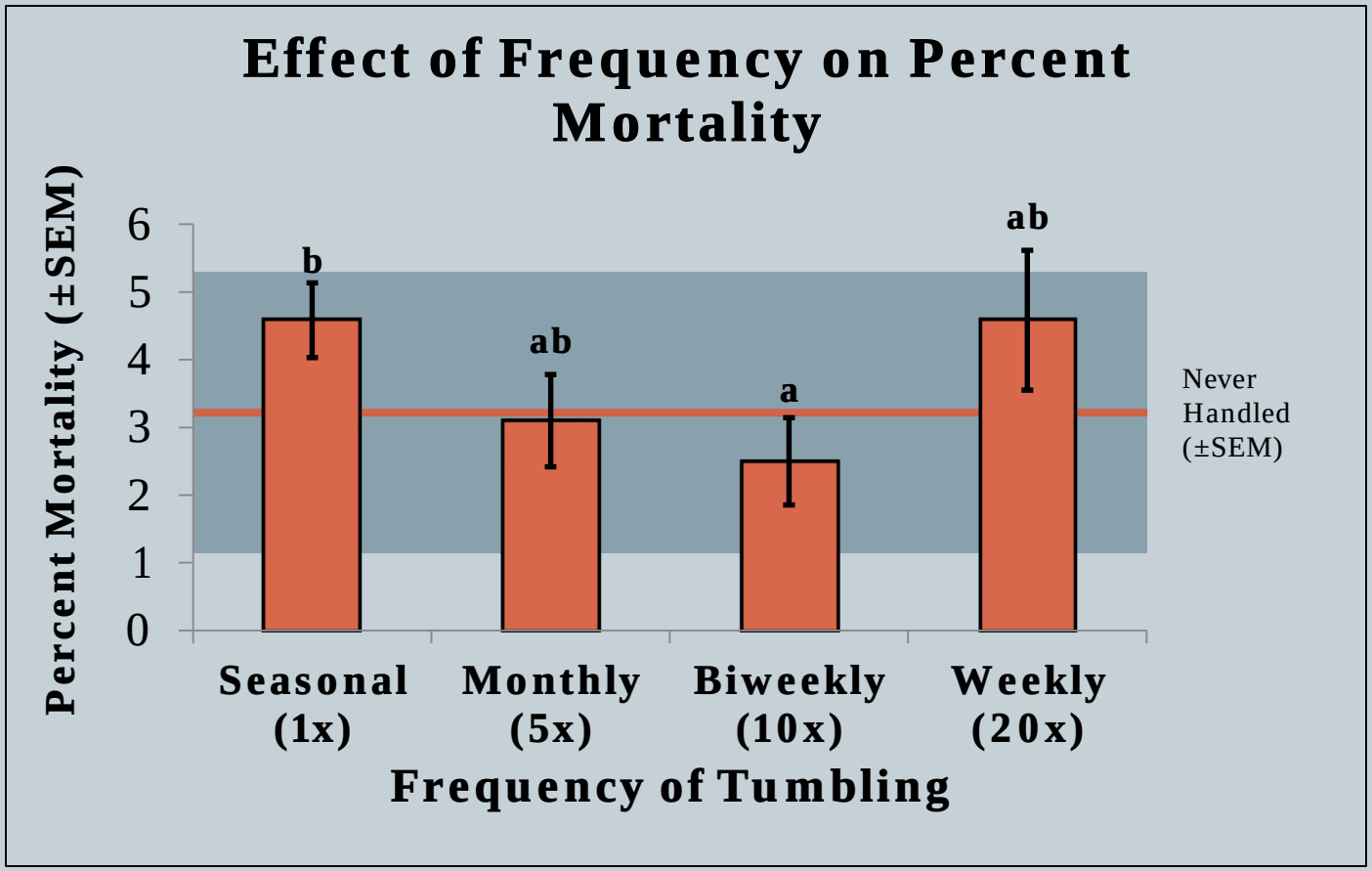
Tumbling Experiment 2 - Frequency

- Tumbling in larger oysters nearing harvest in a single gear type (floating bags)
- Initial shell height 59.5mm
- Investigate tumbling frequency treatments
  - Tumbled Seasonally (1x)
  - Tumbled Monthly (5x)
  - Tumbled Biweekly (10x)
  - Tumbled Weekly (20x)
- Treatments
  - Untreated (Never tumbled or removed from water)
  - Tumbled Monthly
  - Handling Control (removed from water but not tumbled)
- Follow grow out from June to November

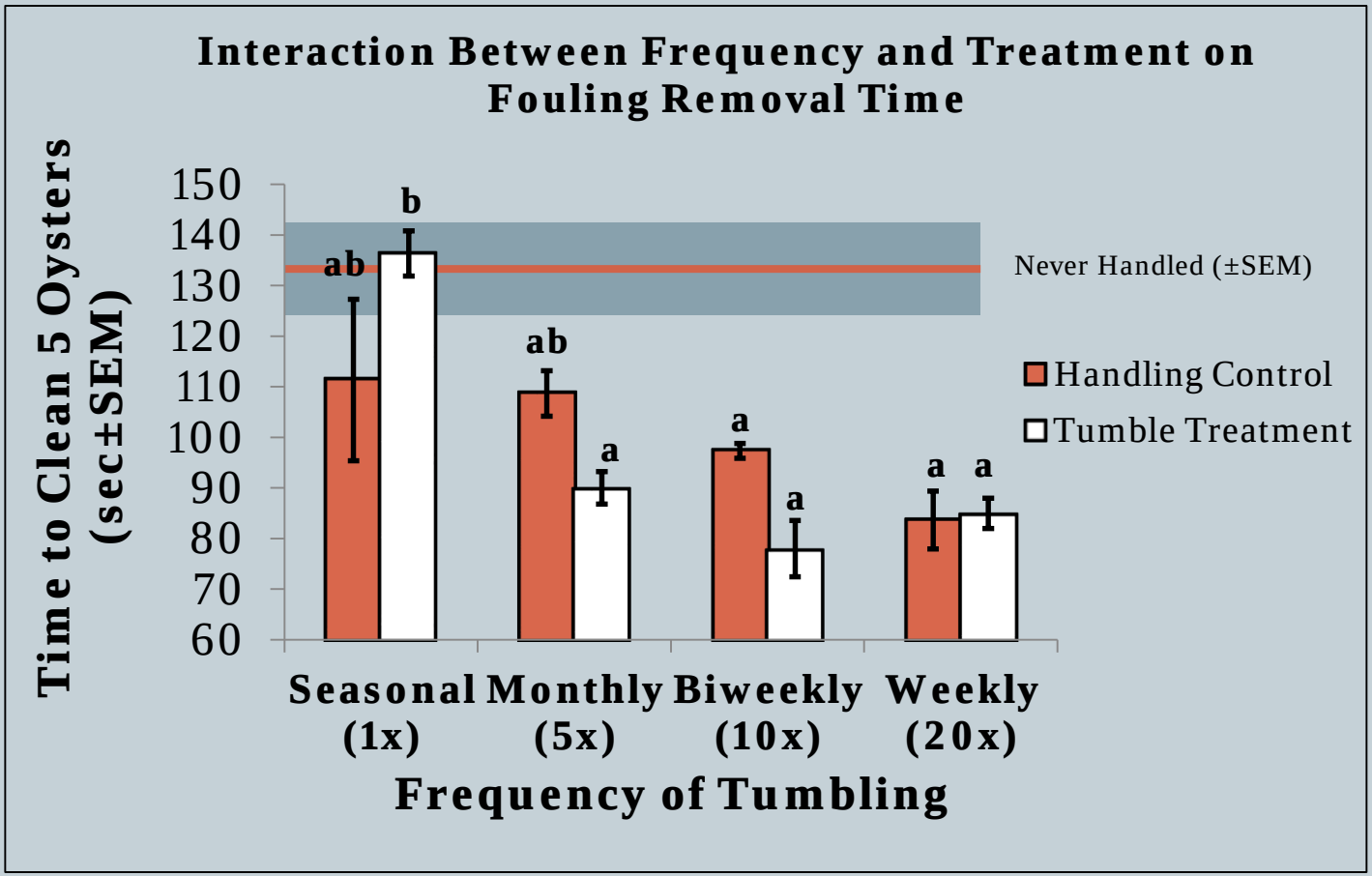
Exp #2 - Shell Height



Exp #2 - Percent Mortality



Exp #2 Results: Fouling Removal Time



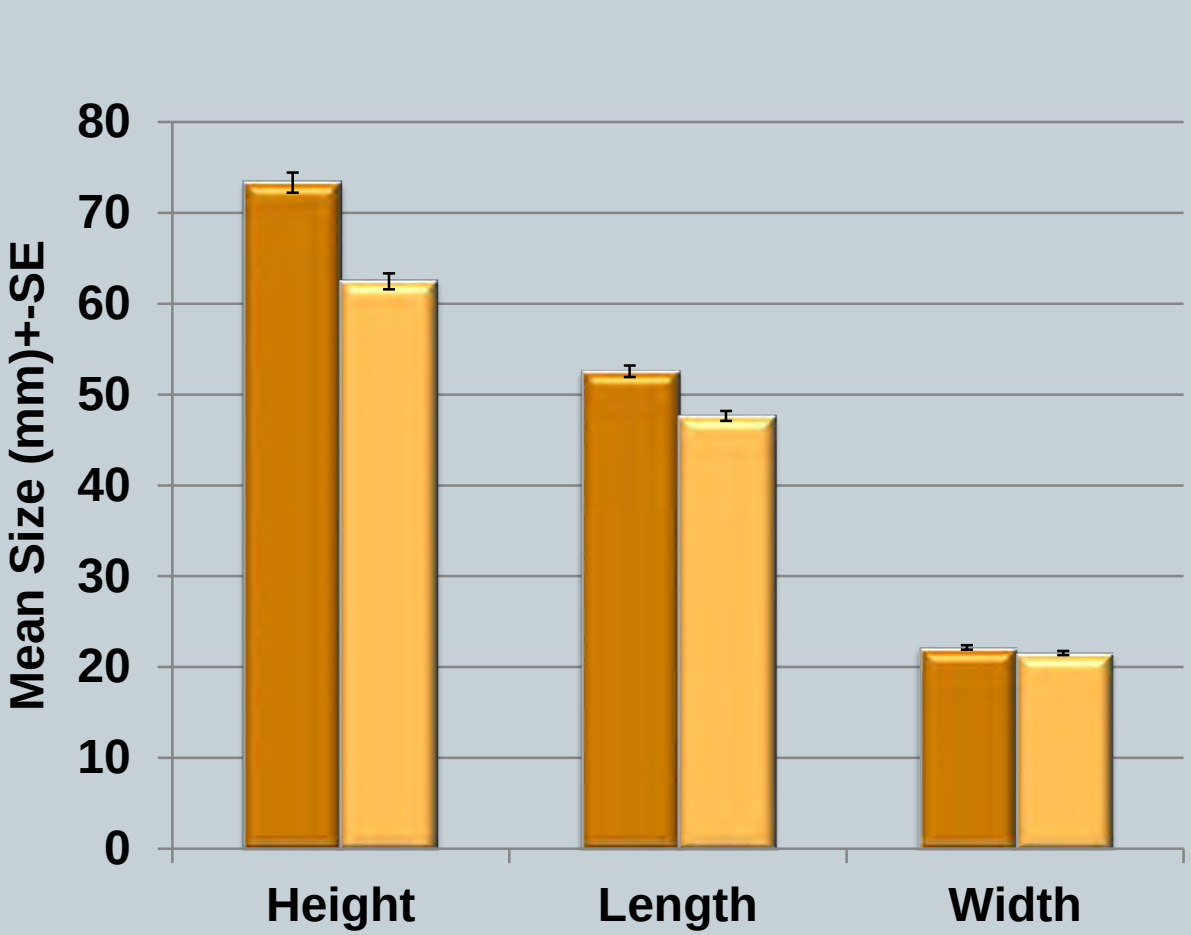
Tumbling Effects
Conclusions Experiment 2

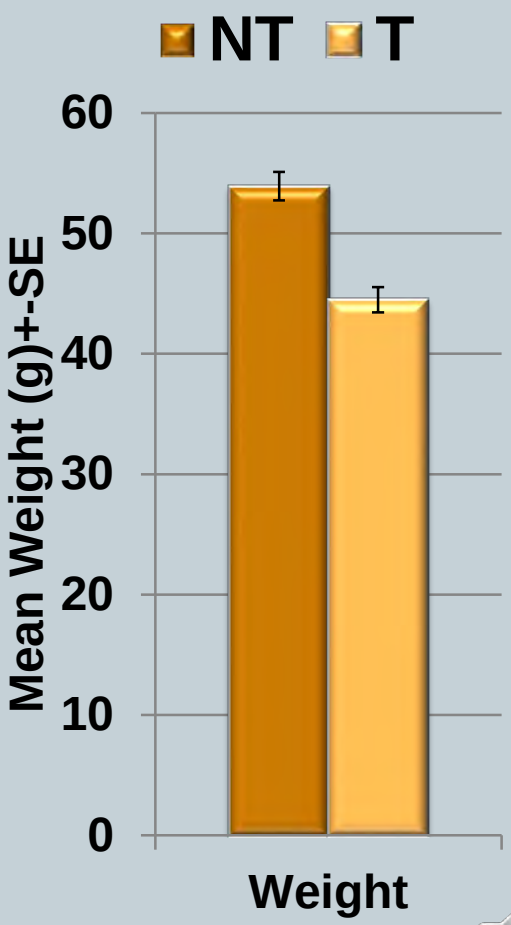
- Tumbling weekly is leads to big growth penalty.
- We did not see any effect on shell quality and any reduction in fouling was similar to handling controls
- 1 month tumbling frequency seems to be the sweet spot that doesn't effect shell height too much and mortality is low.
- Starting to tumble when oysters are large maybe to late to see an effect. **What if we started tumbling sooner?**

Tumbling Experiment 3 – Early tumbling

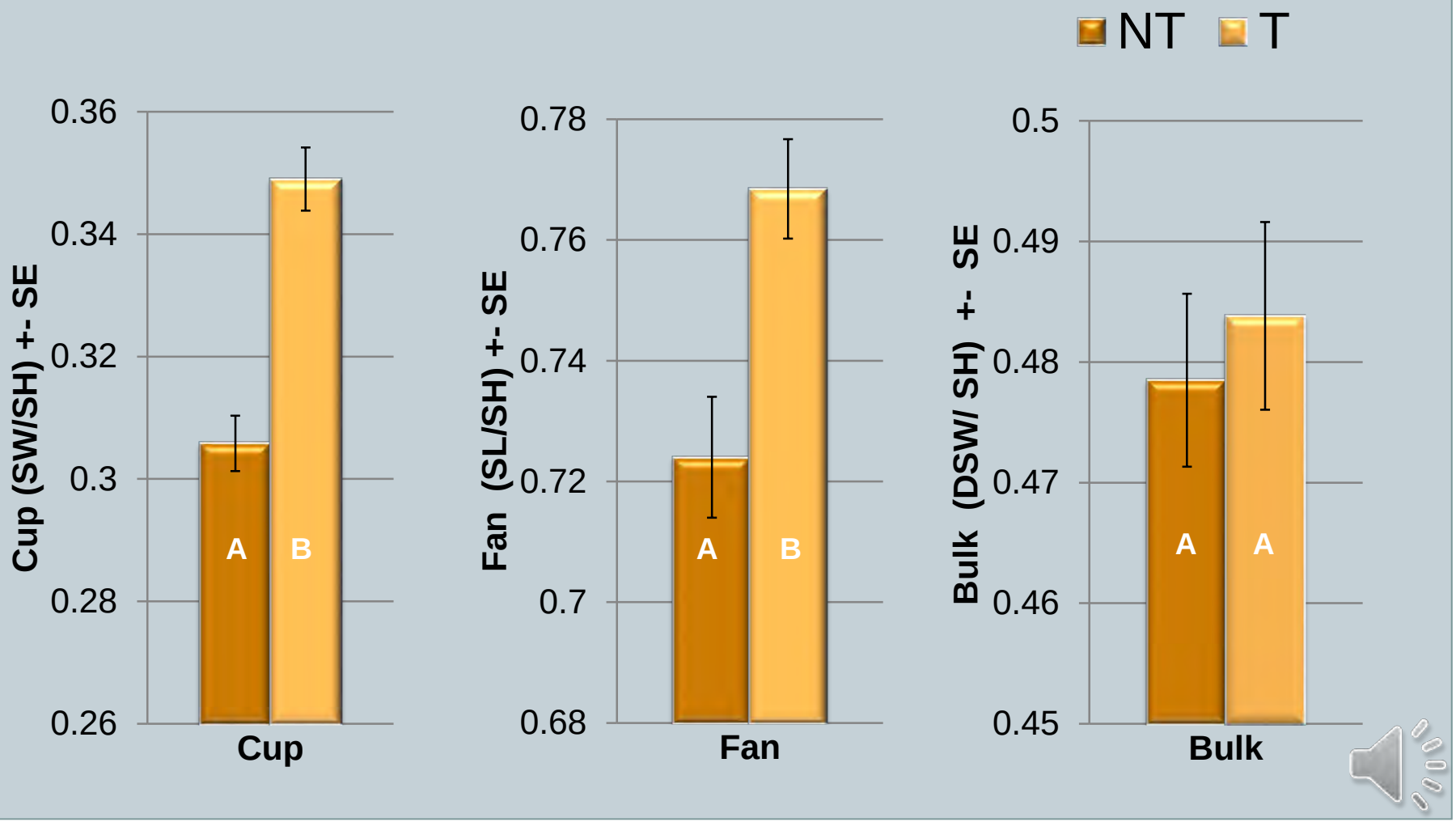
- Tumbling started at 3 months of age and continued to 9 months of age.
- Initial shell height 19.37mm
- Tumble monthly
- Sample quarterly

Exp #3 - Shell Metrics at Final Sample

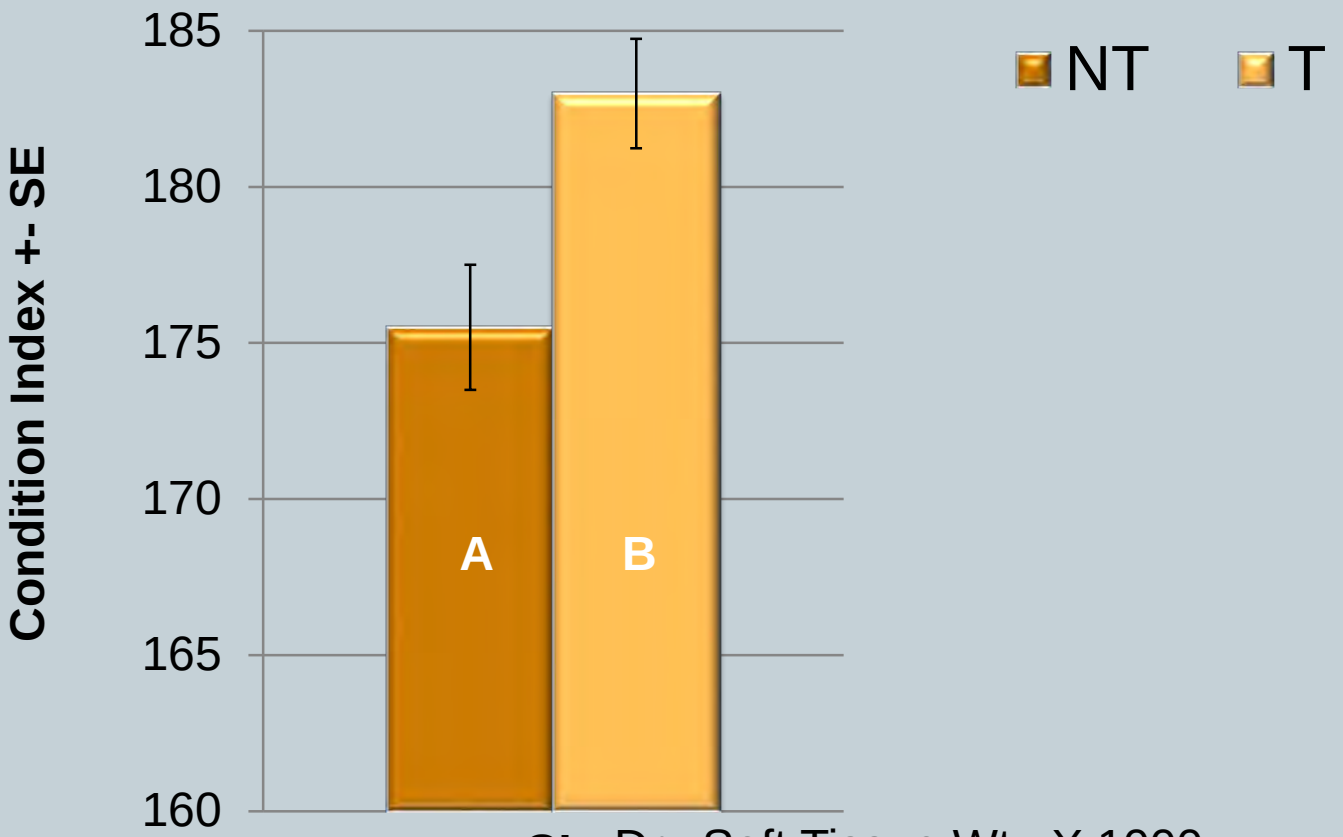




Exp. 3 - Shell Shape



Exp. 3 – Condition Index



CI= Dry Soft Tissue Wt. X 1000
Total Live Wt. – Dry Shell Wt.

(Crosby and Gale, 1990)

Tumbling Effects
Conclusions Experiment 3

- Monthly tumbling in the first year show a minor growth penalty but positively affects cup depth, fan, and condition index.

- **Recommendation** – Begin tumbling monthly when oysters reach 15 to 20mm in shell height.

Good Culturing!