



2011 Clam Industry Workshop

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SELECTION FOR HEAT TOLERANCE IN CLAMS USING BIOMARKERS

WHY SELECTIVE BREEDING?

- ✖ Select desired traits
- ✖ Adapt to specific growing conditions



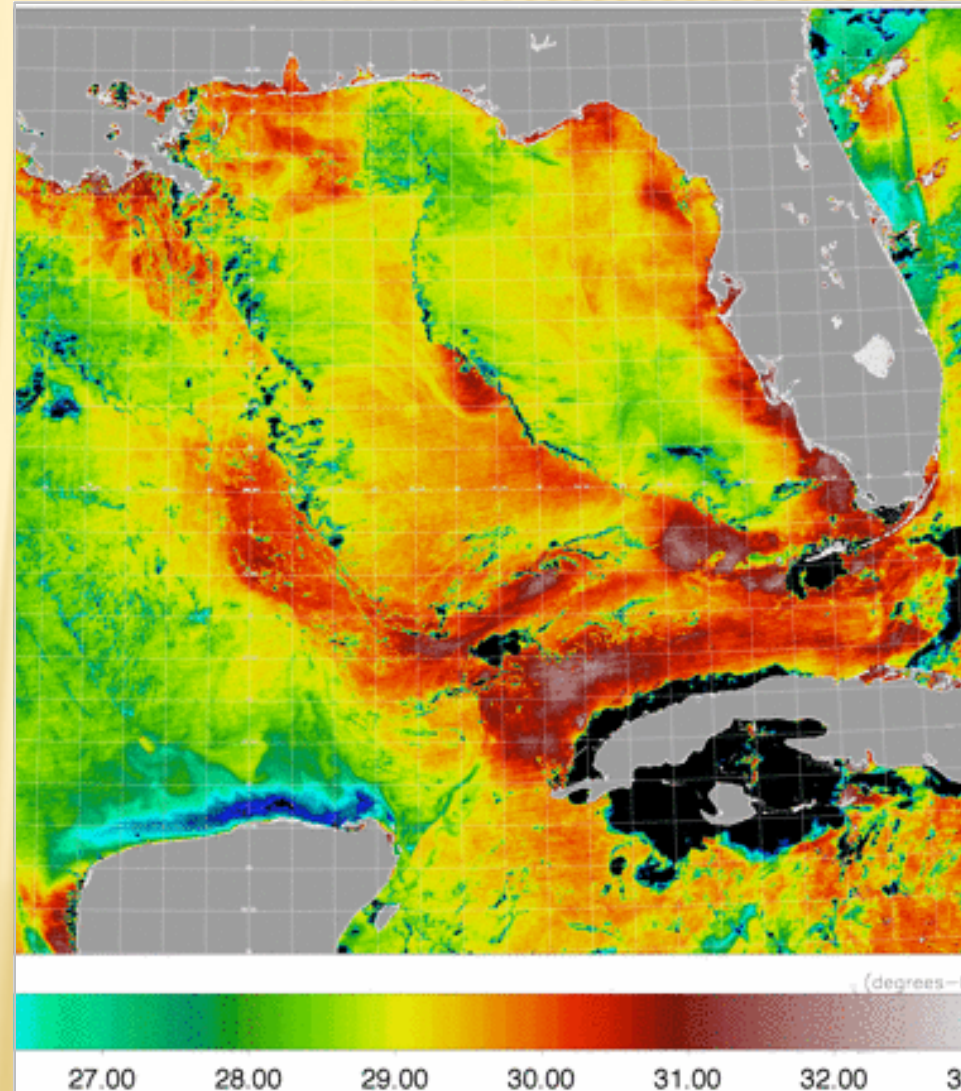
WHY SELECTIVELY BREED HARD CLAMS?

- ✗ Need a heat tolerant clam for Florida
- + Northern quahogs, *Mercenaria mercenaria*, are “living on the edge”
 - ✗ Near southern limit of their natural distribution
 - ✗ Summer water temperatures in growing areas regularly exceed 90°F
 - ✗ Temperature related mortalities observed in lab and field



WHY SELECTIVELY BREED HARD CLAMS FOR HEAT TOLERANCE?

- ✗ Prepare for global climate change
 - + Water temperatures in harvest areas have already increased by over 0.5°F in last 30 years
 - + Water temperatures are predicted to increase by another 3.5°F in next 100 years



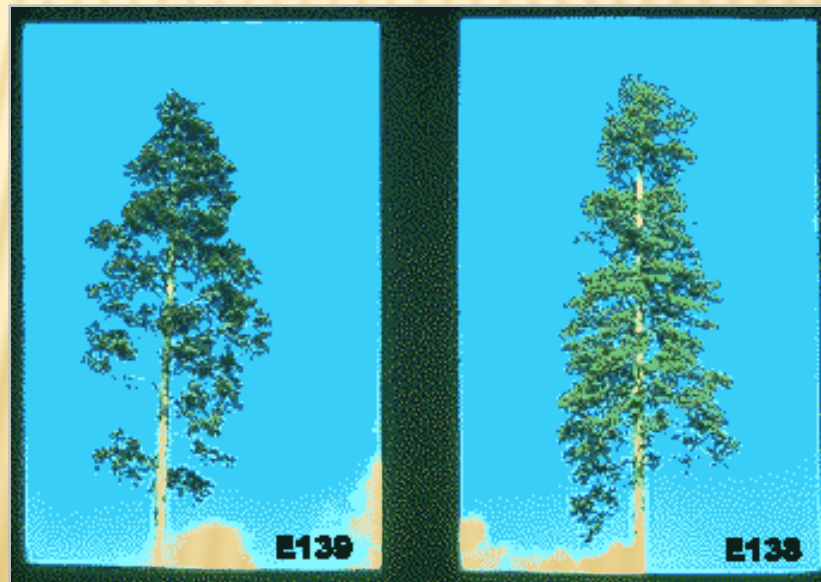
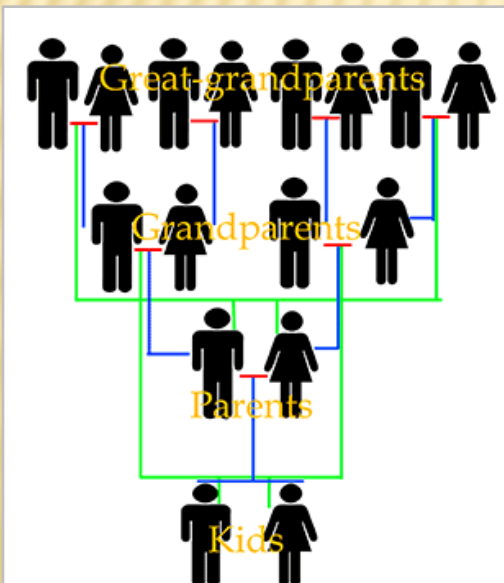
WHY DO WE THINK WE CAN SELECTIVELY BREED HARD CLAMS ?

- ✗ Clam families differ
 - + Scarpa lab challenge (hi T): One family had 93% survival compared to 28% and 39%
 - + Baker lab challenge (hi T, low S, low O₂): One family survived almost 3 days longer

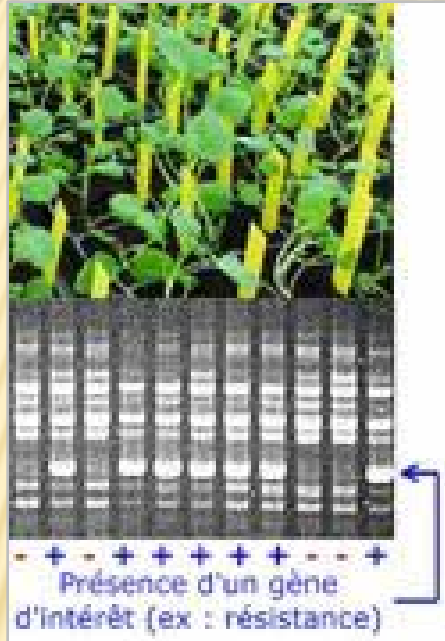


CAN WE USE TRADITIONAL METHODS TO BREED HARD CLAMS FOR HEAT TOLERANCE?

- ✗ It could take a long time
 - + Heat challenge clams
 - + Breed survivors
 - + And so on....
- ✗ It could be cost-prohibitive
 - + Many families
 - + Large amount of space & labor



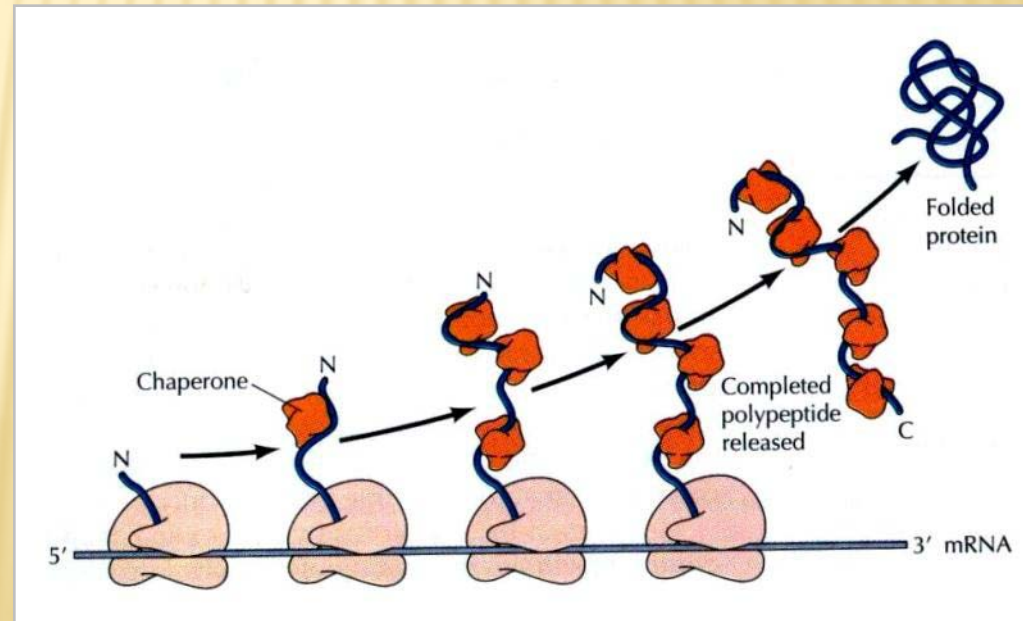
CAN WE SPEED UP THE PROCESS?



- ✗ Marker assisted selection
 - + Select parents based on markers associated with trait of interest
 - ✗ Physiological
 - ✗ Molecular
 - ✗ Genetic
 - + Reduces the number of generations , families, time and space required to select for a trait

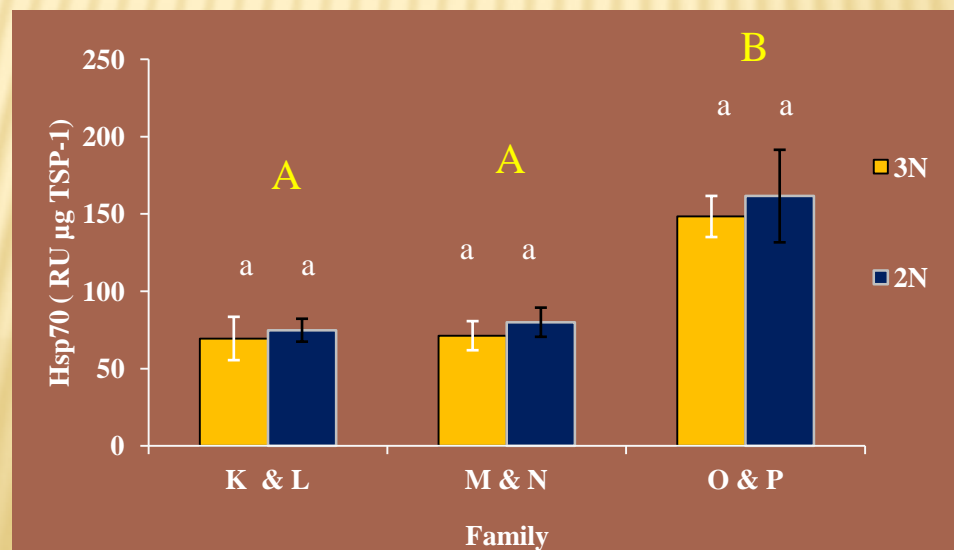
WHAT MARKER CAN WE USE TO SELECT FOR HEAT TOLERANCE IN HARD CLAMS?

- ✗ “Heat shock” proteins (Hsp)
 - + Form, transport, and degrade proteins in cells
 - + Cognate Hsp – Cellular housekeeping
 - + Inducible Hsp – Increase in response to protein-damaging stressors
 - ✗ Temperature
 - ✗ Salinity
 - ✗ Oxygen



WHY MIGHT HSP BE A GOOD MARKER FOR HEAT TOLERANCE IN HARD CLAMS?

- ✗ Level of cognate Hsp is associated with survival following temperature challenges
 - + Family with 2x Hsp had 93% survival (compared to 28% and 39%)
 - + Other studies suggest that Hsp levels are inherited



El-Wazzen, 2008

WHAT ARE WE PLANNING?

- ✗ Overall goal:
 - ✗ Assess if markers (e.g., Hsp, metabolic characteristics) can be used in selective breeding for heat tolerant hard clams
- ✗ Specific objectives:
 - + Determine if markers are consistently associated with temperature tolerance (survival, production, product quality)
 - + Determine if marker levels are inherited in hard clams
 - + Provide information to you
- ✗ What we're not doing:
 - + Producing heat-tolerant clam strains



STAY TUNED....AND KEEP CLAM

