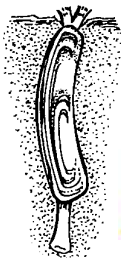


**~ Razor Clams ~  
they're not just for shaving anymore!**



**Dale Leavitt**  
(Roger Williams University)  
**William Burt**  
(SouthEastern MA Aquaculture Ctr.)



**Why are we interested in diversifying local shellfish culture opportunities?**

- ☞ Oyster and quahog are the big TWO in northeast!
- ☞ What happens to your business if you should lose a crop due to disease or some other uncontrollable environmental change?
- ☞ What other options do we have?
  - ☞ Soft shell clam
  - ☞ Bay scallop
  - ☞ Surf clam
  - ☞ European oyster

**But....**

**The more options we develop – the more opportunities we create to sustain a viable business, to make a living, and to expand the aquaculture industry in the northeast!**

**Razor clam fishery**

- ☞ Small scale fishery on-going in MA.
- ☞ Harvesting methods
  - ☞ Spearing
  - ☞ Dry digging
  - ☞ Pumping
  - ☞ Method of choice for harvesting is "salting"
- ☞ Landed value has approached \$2.00/lb live wt.
- ☞ At its best, that translates to between \$0.25 to \$0.40 per piece.

**What about farming them?**

Need to consider - biology:

- ☞ Preferred habitat
- ☞ Population characteristics
- ☞ Food
- ☞ Growth
- ☞ Predation & Disease
- ☞ Behavior

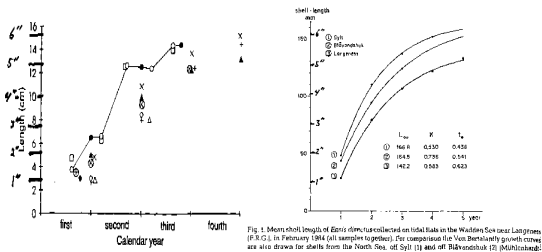
**Razor Clam habitat**

- ☞ fine to medium sand – can be muddy sand if without silt
- ☞ low intertidal to subtidal
- ☞ can live in unstable sand and tolerate dynamic areas
- ☞ Prefers areas with moderate water flow



## Food & Growth

- ☞ Suspension feeder and doesn't seem to feed on detritus
- ☞ Growth – data derived from studies in the North Sea



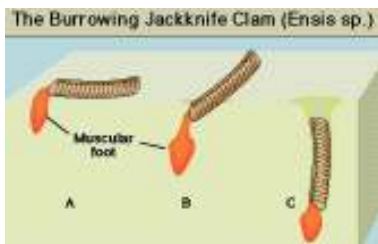
## Behavior

Razor clams are very unique bivalves with respect to their mobility.

## Behavior

Razor clams are very unique bivalves with respect to their mobility.

- ☞ They dig!



## Behavior

Razor clams are very unique bivalves with respect to their mobility.

- ☞ They dig
- ☞ They move on the surface!



## Behavior

Razor clams are very unique bivalves with respect to their mobility.

- ☞ They dig
- ☞ They move on the surface
- ☞ They swim!



## What about farming them?

Need to consider the market:

- ☞ Demand for wild product has been steady but low
- ☞ One New York buyer said he can move 1,200 lbs daily
- ☞ But, he needs consistent supply to develop market
- ☞ I identified six buyers between Cape Cod and New York in a phone survey
- ☞ Two markets identified
  - ☞ Live market
  - ☞ Processor market

## What about farming them?

### Live market (Fulton Fish Market):

- ☞ Formerly (Hoboken) Italian
- ☞ Now primarily (New York) Asian
- ☞ Product must be high quality – i.e. not sluggish (winter)
- ☞ Size acceptability
  - ☞ Buyer 1 - minimum 3 inches; not the largest
  - ☞ Buyer 2 – minimum 6 inches; only the largest

## What about farming them?

### Processor market:



- ☞ Grind clam for processed product
- ☞ Processors prefer largest sizes
- ☞ Couldn't find anyone to discuss this market – does it exist now?

## Idiosyncrasies & culture considerations

### Need to consider:

- ☞ **Lack of knowledge about species** – from basic biology to culture technology
- ☞ **Mobility** – have to contain clam from escaping via digging, crawling, and swimming
- ☞ **Predators/disease** – protection & prevention
- ☞ **Over-wintering mortality** – may be a function of tidal exposure
- ☞ **Poor shelf-life** – can they survive up to a week out of sediment?



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

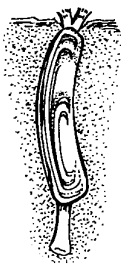
### The objectives of the project are:

- ☞ Contract with a commercial hatchery to produce 500,000 juvenile (5mm) razor clams
- ☞ Solicit proposals from the shellfish culture industry to develop techniques for razor clam culture (ME, MA, RI, NY & NJ)
- ☞ Provide selected growers with funds to construct/develop their proposed culture technology
- ☞ Provide selected growers with seed razor clams to experimentally culture
- ☞ Monitor success of growing razor clams on each farm



## What do you call a one-year old razor clam?

A little shaver!!!



**Dale Leavitt**  
(Roger Williams University),  
**Diane Murphy,**  
**Rebecca Hanson &**  
**William Burt**  
(SouthEastern MA Aquaculture Ctr.)



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

### Progress (2001):


- ☞ Contract with a commercial hatchery to produce 500,000 juvenile (5mm) razor clams
  - ☞ Aquaculture Research Corporation, Dennis, MA
  - ☞ Broodstock from Duxbury Harbor & Nauset Marsh.
  - ☞ Spawned 4x10<sup>6</sup> razor clam larvae
  - ☞ Survival poor through setting and nursery
  - ☞ Received app. 150,000 on 24 July 2001 to hold in our upwellers at MMA



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Solicit proposals from growers to develop techniques for razor clam culture
  - 16 proposals received on 31 March 2001
  - 11 growers selected
    - MA, RI, CT, NY, & NJ
  - 2 subsequently dropped out



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Participants selected to grow seed razor clams**

Proposal Number	PI Name	Company Name	State	Technique summary
scrach	Rose, James	Rose's Oyster Bar	MA	clam netted raceway
RC-02	Patricio, Michael	Cornell Cooperative Extension - Suffolk Cnty	NY	hoop tent
RC-04	Maxwell, John	Atlantic City Aquaculture, Inc	NJ	nursery box & netted raceway
RC-05a	Hernimla, Les	Barnstable Sea Farm	MA	clam tent
RC-05b	Sytala, Carl	Finn Farms	MA	boarded raceway
scrach	Ruml, Wenzle	Wellfleet Sea Farms	MA	nursery box & netted raceway
RC-08b	O'Connell, James		MA	boarded raceway
RC-10	Widoworth, John	Niantic Shellfish, L.L.C.	CT	twice cage
RC-14	Zivan, Mark	Nauset Sea Farms	MA	clam netted raceway
RC-15	Karney, Richard	Martha's Vineyard Shellfish Group	MA	upweller, floating and bottom trays
RC-16	Gardner, Jeffrey	Shellfish 4 U	RI	clam netted raceway

**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Provide selected growers with seed razor clams to culture
  - 10–15,000 seed distributed to growers between 1 and 10 September, 2001
  - Mean length: 19.45mm ( $\pm 2.24$ )



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Provide selected growers with funds to construct/develop their proposed culture technology
  - A variety of techniques were tested
    - Bottom netted raceways



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**


- Provide selected growers with funds to construct/develop their proposed culture technology
  - A variety of techniques were tested
    - Bottom netted raceways
    - Boarded raceways



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Provide selected growers with funds to construct/develop their proposed culture technology
  - A variety of techniques were tested
    - Bottom netted raceways
    - Boarded raceways
    - Bottom tents



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Provide selected growers with funds to construct/develop their proposed culture technology
- A variety of techniques were tested
  - Bottom netted raceways
  - Boarded raceways
  - Bottom tents
  - Floating trays



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**


- Provide selected growers with funds to construct/develop their proposed culture technology
- A variety of techniques were tested
  - Bottom netted raceways
  - Boarded raceways
  - Bottom tents
  - Floating trays
  - Bottom trays



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Provide selected growers with funds to construct/develop their proposed culture technology
- A variety of techniques were tested
  - Bottom netted raceways
  - Boarded raceways
  - Bottom tents
  - Floating trays
  - Bottom trays
  - Bottom cages



**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**


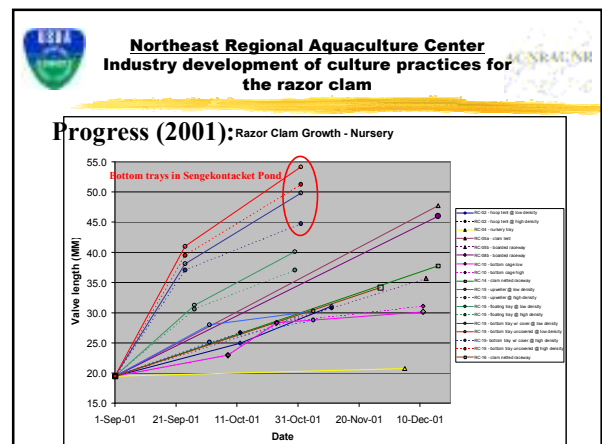
- Provide selected growers with funds to construct/develop their proposed culture technology
- A variety of techniques were tested
  - Bottom netted raceways
  - Boarded raceways
  - Bottom tents
  - Floating trays
  - Bottom trays
  - Bottom cages
  - Upweller

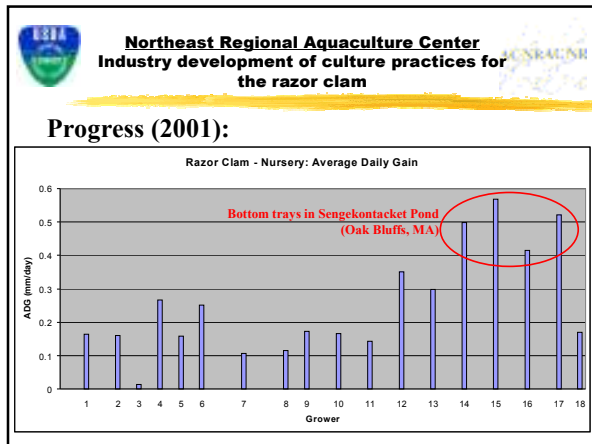


**Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam

**Progress (2001):**

- Evaluate survival and growth in the various nursery systems
- Survival
  - Ranges from 0 to greater than 100%
- Growth
  - Growth interval of app. 3 months
  - Grew from 20mm at beginning of September to 40-50mm by end of November

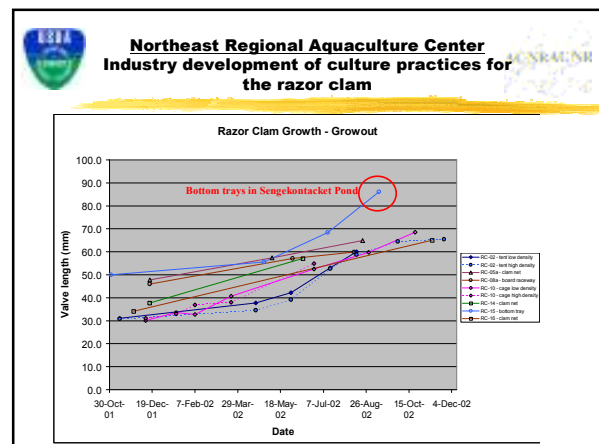


- Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam
- Progress (2002):**
- ☞ Collected broodstock
  - ☞ Distributed to
    - ☞ ARC (commercial hatchery)
    - ☞ Rutgers University (research hatchery)
    - ☞ Mass. Maritime Academy (research hatchery)
- 



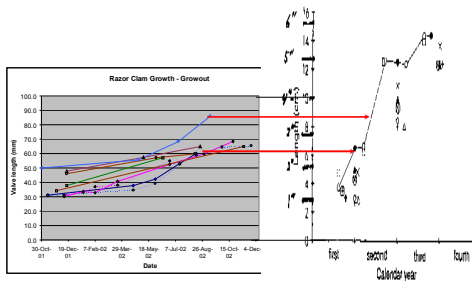
- Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam
- Progress(2002):**
- ☞ Hatchery attempts in 2002
    - ☞ Spawn in Dec 2001 @ MMA
      - ☞ Succumb to *Vibrio* infection
    - ☞ Spawn in Jan 2002 @ MMA
      - ☞ Succumb to *Vorticella* infestation
    - ☞ Spawn in Jan 2002 @ ARC
      - ☞ Succumb to neglect due to illness of manager
    - ☞ Spawn in Feb 2002 @ Rutgers
      - ☞ Succumb to unknown factors
    - ☞ Spawn in Mar 2002 @ MMA with 1/2 to ARC and a few to EATTC
      - ☞ Slowly lost due to unknown reasons
      - ☞ Water temperature?
  - ☞ Bottom Line
    - ☞ No razor clam seed for 2002 due to hatchery failure

- Northeast Regional Aquaculture Center**  
Industry development of culture practices for the razor clam
- Status of 2001 seed in 2002**
- ☞ New Jersey (nursery box)
    - ☞ Seed arrived in poor condition and didn't survive through nursery
  - ☞ Connecticut (bottom cage)
    - ☞ Doing well – alive & growing
  - ☞ Rhode Island (bottom clam net)
    - ☞ Lost seed during first summer due to emigration problem
  - ☞ Massachusetts
    - ☞ Barnstable (bottom nets)
      - ☞ Lost most immediately after deployment = emigration?
    - ☞ Wellfleet (boarded raceway)
      - ☞ High survival, little emigration & good growth
      - ☞ Lost all 2-3 inch razors in intertidal raceways in August 2002
      - ☞ Overheated?
    - ☞ Martha's Vineyard (upwellers, floating trays & bottom trays)
      - ☞ Alive and doing well





## Comparative Razor Clam growth



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

- ☞ Progress (2003)
  - ☞ Gradually lost all of 2001 seed due to a variety of reasons by winter 2002-2003
  - ☞ Larval rearing in Jan 2003
    - ☞ Attempted at Mass Maritime hatchery
    - ☞ Unsuccessful due to bacterial problems in post-set nursery (similar to 2002)
  - ☞ Had to terminate project due to failure to produce seed within proposed timeframe
    - ☞ Returned \$25,000 to NRAC



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

- ☞ The final word!
  - ☞ Hatchery stage
    - ☞ Razors can be held and handled in a similar manner to surf clams and other "cold-water bivalves"
    - ☞ Spawning, larval culture and setting are straightforward and easy to accomplish
  - ☞ Nursery stage
    - ☞ They grow like weeds (ADG >0.5mm/day)!!
    - ☞ Early post-set juveniles are highly susceptible to bacterial problems when held in conventional downwellers
    - ☞ Require high maintenance with excessively clean rearing conditions
    - ☞ A quick and dirty experiment (@ EATTC) indicated that immediate planting in sediment may be a viable alternative to post-set downwelling (cannot be "sharp" sand).



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

- ☞ The final word!
  - ☞ Growout stage
    - ☞ The growth rate is on a par with (and potentially better than) the growth of wild razors in the North Sea (the only growth data I could find!)
    - ☞ Razors will grow through the winter under some conditions
    - ☞ Market size individuals (app. 4-inches) can be harvested in two growing seasons following "field-planting"
    - ☞ Emigration and overheating of sediment (in intertidal) are two problems that need to be considered in selection of site and technology used
      - ☞ Best technology includes effective containment to prevent emigration => bottom trays or boarded raceways.
      - ☞ Probably cannot grow in intertidal zone from Cape Cod to south

## The final final word

- ☞ I am convinced that the razor clam is a viable alternative species for shellfish farmers in the northeast.
  - ☞ Good price/market
  - ☞ Encouraging growth rate
  - ☞ Relatively simple (and common) culture technology
- ☞ Still have some bugs to work out in post-set nursery to achieve adequate seed supply for growers.



## Northeast Regional Aquaculture Center Industry development of culture practices for the razor clam

- ☞ Outreach:
  - ☞ This project has been reported to the industry repeatedly through its duration
    - ☞ Milford – two times
    - ☞ RI Aquaculture Conference – one time
    - ☞ Presenting at National Shellfisheries Association Annual Meeting in April
  - ☞ Have corresponded with international community
    - ☞ Canada = DFO and New Brunswick Provincial scientists
    - ☞ Researchers from Denmark – setting up a hatchery
  - ☞ Have draft manuscript(s) of results in development
    - ☞ One for submission for publication in Journal of Shellfish Research
    - ☞ One to be published as NRAC Technical Bulletin