Non-Elucidated Mortality Events of Juvenile Hard Clams in a Hatchery System

John Aldred

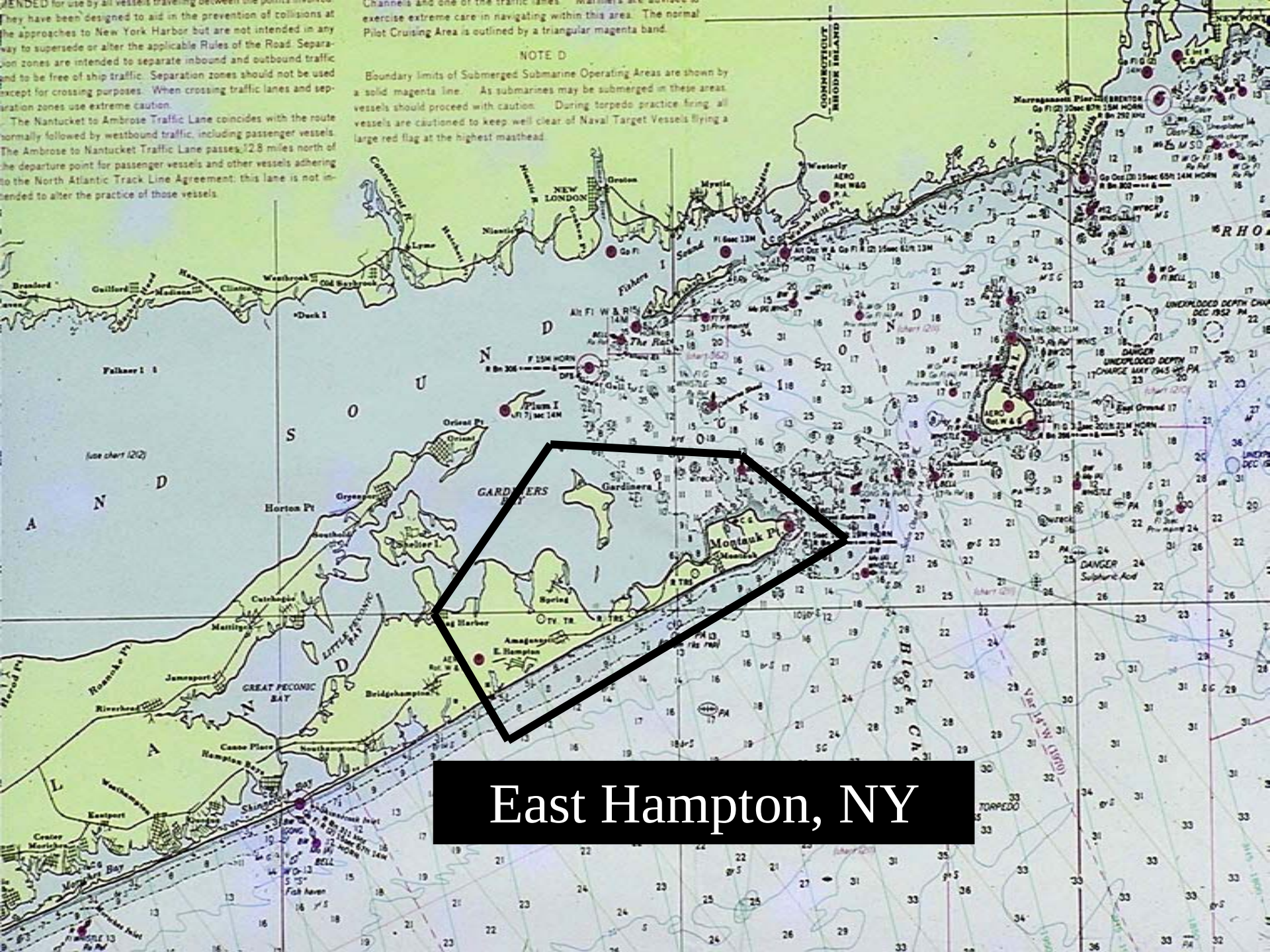
East Hampton Town Shellfish Hatchery

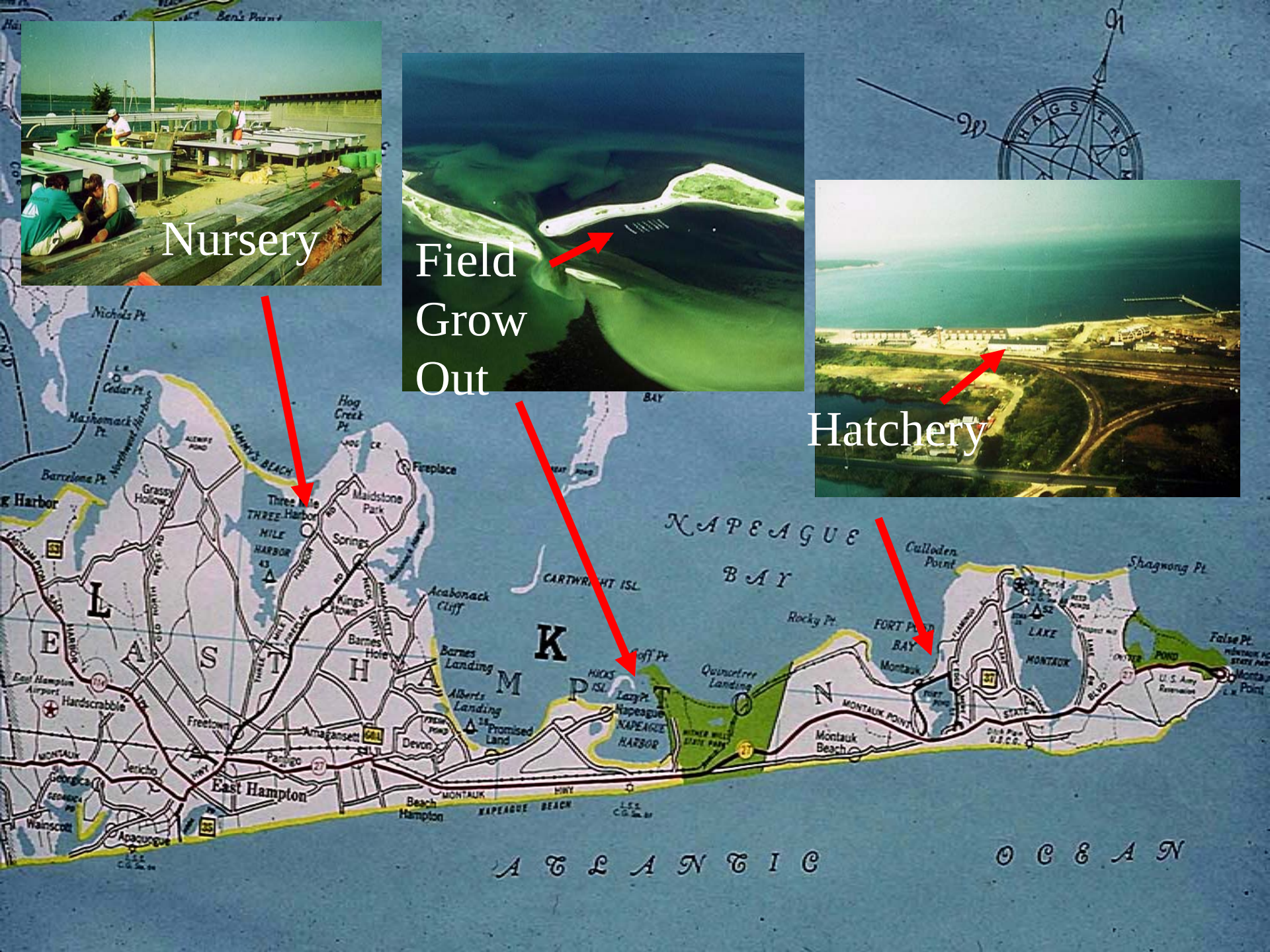
Steven Pitchford

NOAA/NMFS Milford Labs

Bassem Allam

SUNY/Stony Brook


NOTE D
Boundary limits of Submerged Submarine Operating Areas are shown by a solid magenta line. As submarines may be submerged in these areas, vessels should proceed with caution. During torpedo practice firing, all vessels are cautioned to keep well clear of Naval Target Vessels flying a large red flag at the highest masthead.
NEW LONDON
Montauk Pt
Gardiners I
GARDINERS BAY
Horton Pt
Plum I
Orient Pt
Shelter I
Falkner I
Duck I
Westerly
Narragansett Pier
Block Is
East Hampton


Nursery
Field Grow Out
Hatchery
NAPEAGUE BAY
ATLANTIC OCEAN
EAST HAMPTON
Montauk
Montauk Beach
Napeague Harbor
Hardscrabble
Freetown
Amagansett
Devon
Promised Land
Barnes Landing
Alberts Landing
Acabonack Cliff
Barnes Hole
Kings-town
Springs
Three Mile Harbor
Maidstone Park
Fireplace
Hog Creek Pt.
Grassy Hollow
Nichols Pt.
Cedar Pt.
Mashomack Pt.
Barcelona Pt.
Northwest Harbor
Cartwright Isl.
Hicks Isl.
Lazy Pt.
Quonotrer Landing
Rocky Pt.
Fort Pond Bay
Calloden Point
Shagwong Pt.
False Pt.
Montauk Point
Lake Montauk
Wainscott
Apaquogue
Georgica
Jericho
Paumanok
Beach Hampton
Napeague Beach
Montauk Point State Park
U.S. Army Reservation

Products

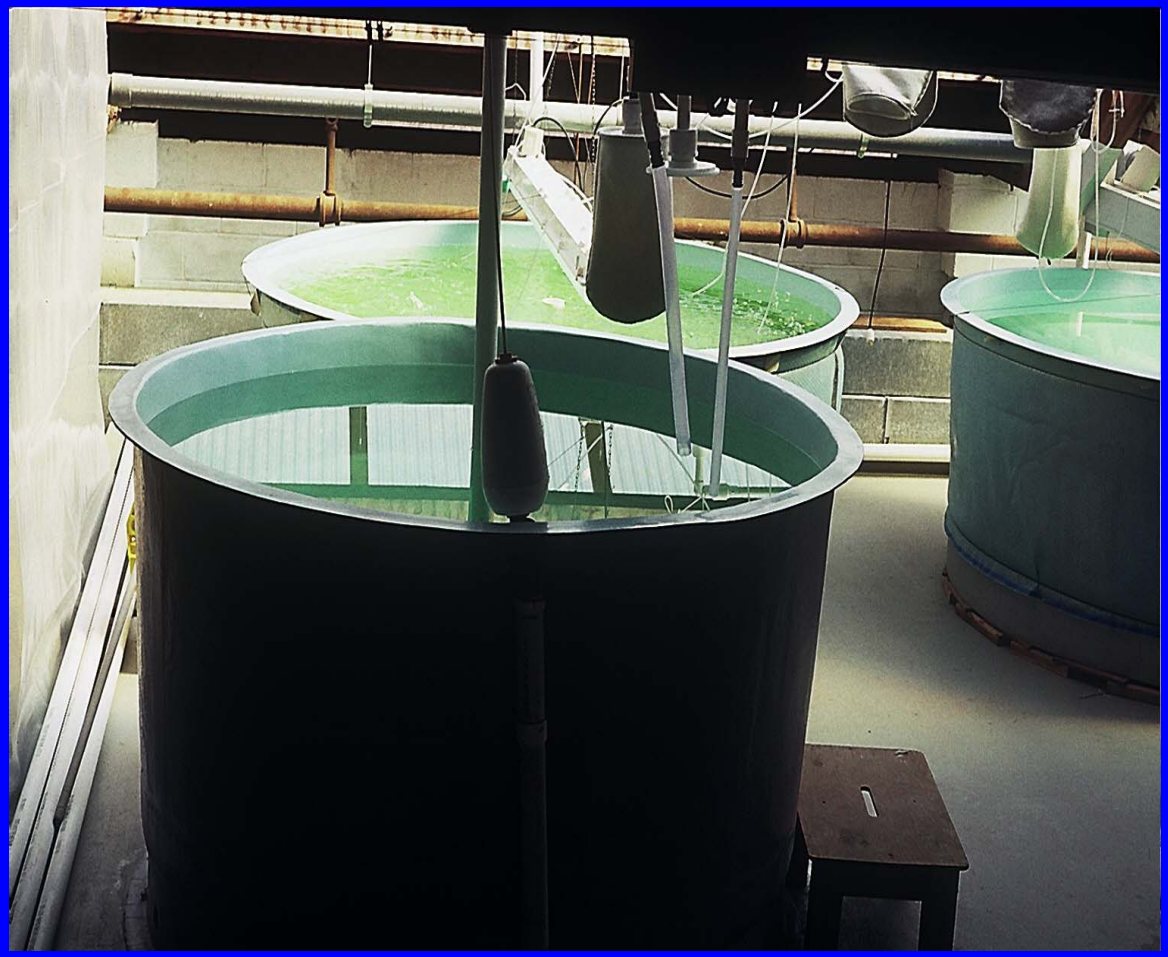
Brood Stock Conditioning

- Static water @ 16 C
- Water change 3x/week
- Tank, feed tank, piping & tubing clorox washed bi-weekly
- Continuously drip fed a mix of *Thalassiosira weisflogii*, *Pavlova lutheri*, *Isochrysis galbana*
- Six week conditioning period
- One batch oysters, three batches clams, several batches scallops

Raw Water Receiving Tank

Origin of water used throughout hatchery

- Incoming water 1 micron bag filtered
- Tank brought to temperature by recirculating through heat exchanger
- Gravity fed to culture tanks
- Above in continuous process
- Tank, piping, hoses chlorinated overnight monthly, filter bags weekly
- Intake pipes freshwater flooded overnight monthly



Algae Stock and Flagellate Culture

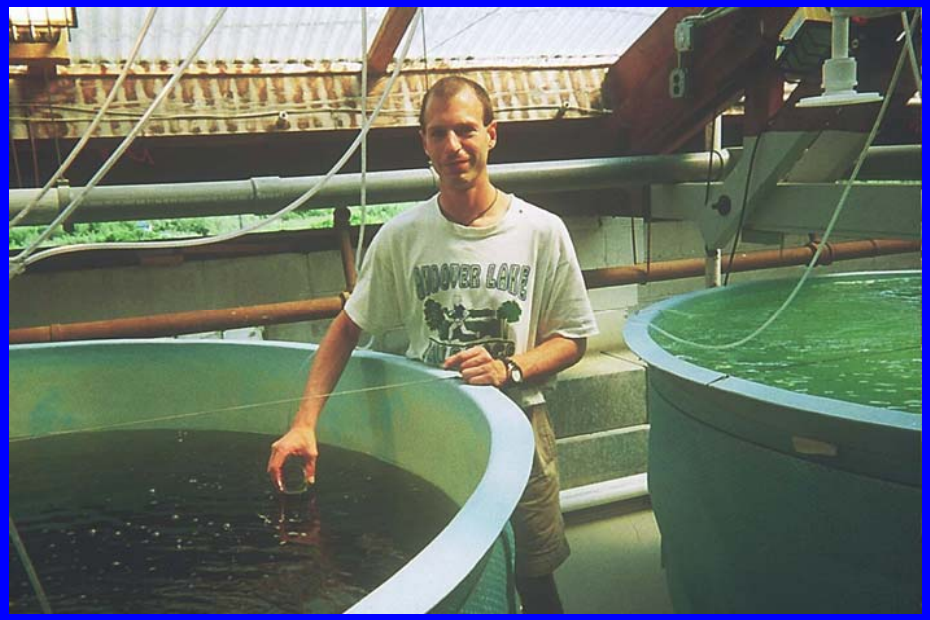
Isochrysis galbana and Pavlova lutheri

- Algae room @ 20 C
- 1 micron filtered water
- Autoclave flasks
- Chlorinate/dechlorinate carboys & kalwall tubes
- Batch culture to 7 days maximum
- Batch feed flagellates from tubes
- Glass & plastic ware clorox or acid washed as emptied
- Fill and drain piping & tubing chlorinated monthly

Diatom Mass Culture

Thalassiosira weisflogii or Tetraselmis spp.

- Second story under clear roof panels
- Chlorinate/dechlorinate 1 micron filtered culture water
- Batch culture to 5 days maximum
- Batch feed
- Oxalic acid wash tanks
- Tanks and feed piping & tubing chlorinated overnight monthly



Larval and Post Set Culture

- 100 gallon larval conicals
- 200 gallon set tanks
- Cultured @ 24-27 C
- Tanks & tubing clorox washed bi-weekly
- UV filter available in tank fill line
- Animals leave room @ 1mm

Recirculated downwelling
(prior to ambient upwelling)

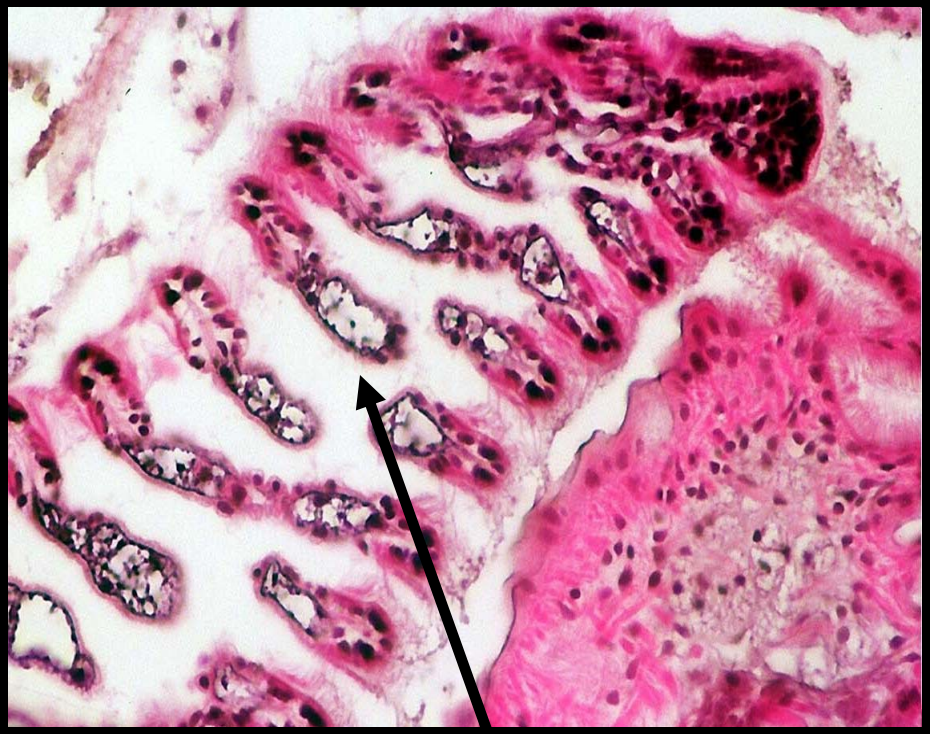
- Animals introduced at 26 C, cools to 20 C
- Kept here about 2 weeks for additional growth and 'hardening off'
- Hatchery schedule set to deliver first clam seed to upwelling system when ambient water reliably reaches 15 C (mid May to early June)
- Initial mortalities observed in this system in May of 1996, 2001, 2003

History of Problems

- 1994 – No growth, subsequent mortality in upwelling system in Montauk hatchery. Suspected oceanic algal makeup. Upwelling system moved to more estuarine location.
- 1996 – Sudden mortalities in 1mm clams in hatchery downwelling system. Subsequent unaffected batches succumbed sequentially. Suspected new algae. Algae challenge trials in 1997 did not replicate mortality.
- 2001 – Mortalities similar to 1996 in downwelled 1mm clams. Histopathology revealed mycosis as cause of death. Problem somewhat managed by moving to upwelling system.
- 2003 – Mortalities similar to 1996 & 2001. Histopathology revealed only unknown chain structures. Problem again managed by early move to upwelling system.

2001- Sections through the Adductor Muscle and Gill

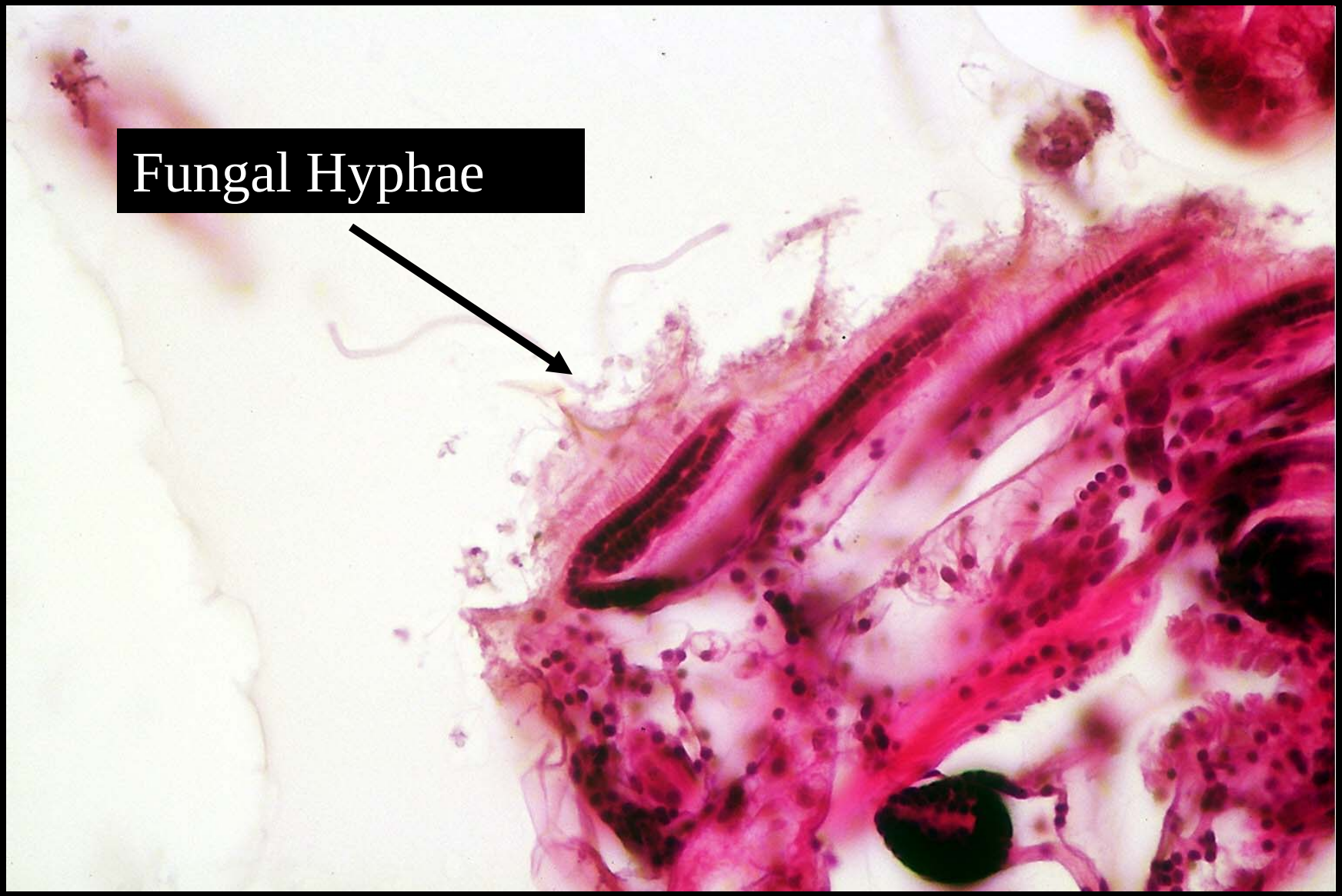
Atrophied Adductor Muscle



Erosion of the Gill

Inke Sunila, CT
Bureau of Aquaculture

2001 - Section showing fungal mycelia with thin hyphae



Inke Sunila, CT Bureau of Aquaculture

Bacterial Counts

June 10, 2003

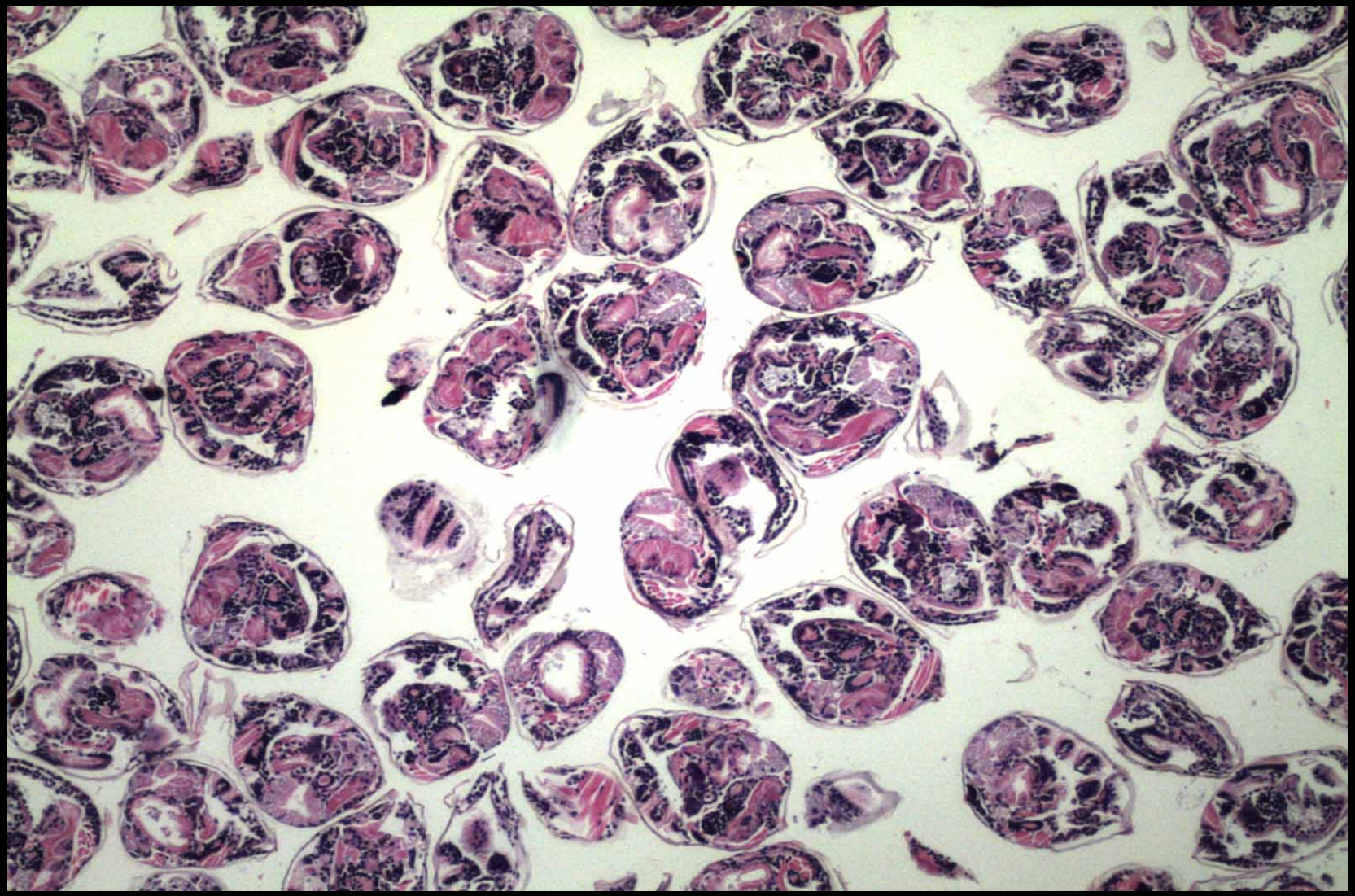
Steven Pitchford
NMFS, Milford Labs

Source	Media	Colonies/ml	Comments
1. Inlet Sea water	TCBS MA	0 3.7×10^3	T=15C
2. Recirculating Sea water system	TCBS MA	20 2.3×10^4	1u bag filtered, heated to >25C from open conical upstairs (Head Tank)
3. Thalassiosira			Open conicals upstairs (Mass Algae Culture Tanks), temperature not taken but >25C
3a. Tank 1 (6/7 batch)	TCBS MA	20 6.0×10^5	
3b. Tank 2 (6/9 batch)	TCBS MA	0 2.7×10^4	
3c. Tank 3 (oldest- no date)			Tank with thick bottom sludge layer. Two samples taken, one from the surface and the other directly from the sludge layer.
3c(1) Surface	TCBS MA	0 2.0×10^5	
3c(2) Sludge layer	TCBS MA	140 1.2×10^8	
Algal Paste	TCBS MA	0 $>6.7 \times 10^3$	Spread directly onto plates, no dilutions performed or sample brought back to lab. Bacterial population may be much higher.

2003 – Preserved Clam Samples

Fix Date	Batch	Length (mm)	System Location	Degree of Infection	Final disposition of batch after move to upwellers
5/19	C1	± 1.0	Dwl	+	Moderate survival
5/19	C2	± 1.0	Dwl	++	Little survival
5/19	C2	± 1.0	Dwl	++	Little survival
5/19	C3	± 0.3	Set Tanks	–	High survival (early move) No survival (late move)
6/04	C4	± 0.15	Conicals	–	Eventually little survival

2003 - Recently set healthy juveniles



H&E stain

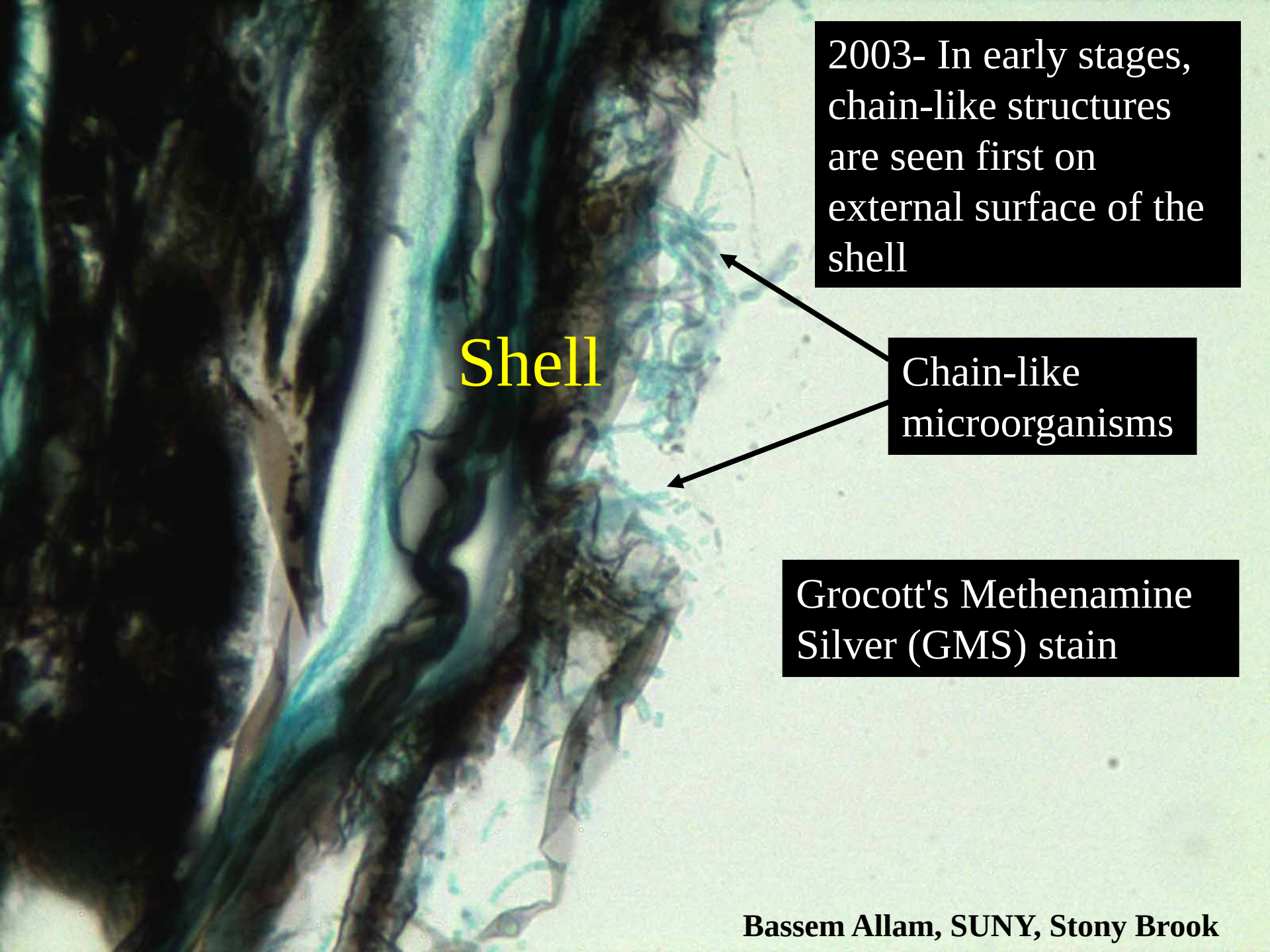
Bassem Allam, SUNY, Stony Brook

2003 - Low magnification of a section from a juvenile batch with low mortality

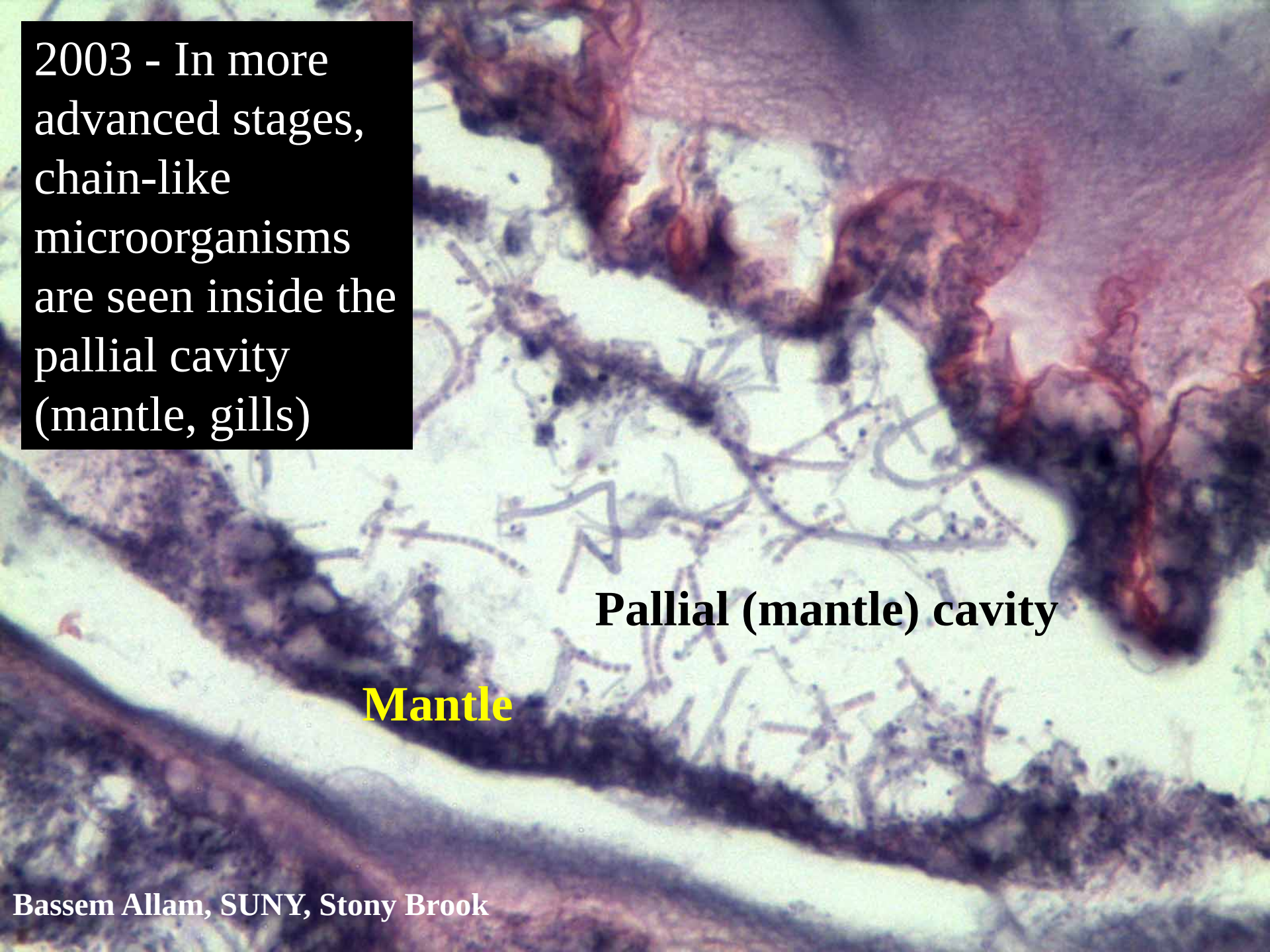
Atrophied adductor muscle

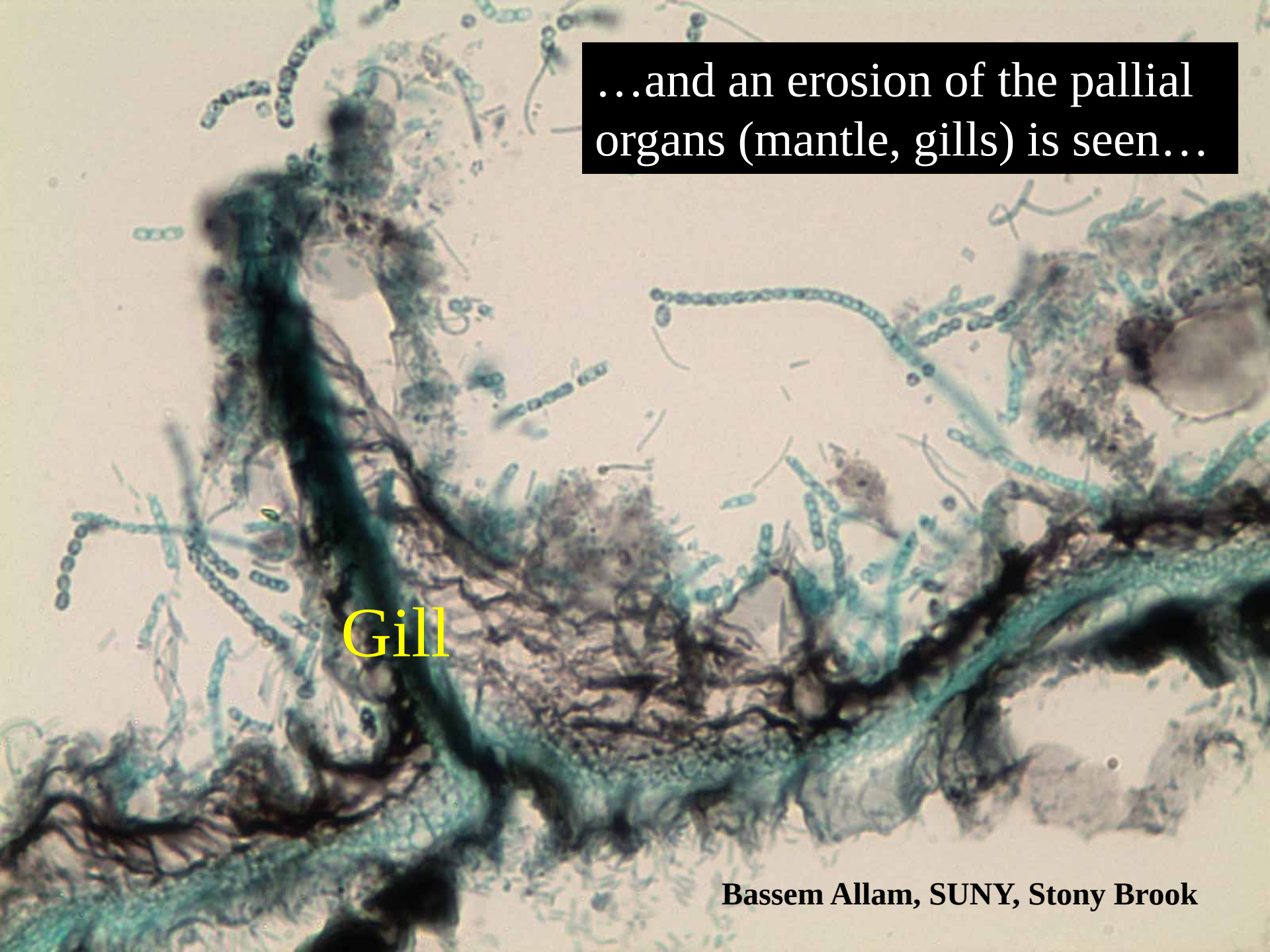
A careful look at the surface of the shell shows chain-like structures

Bassem Allam, SUNY, Stony Brook



Bassem Allam, SUNY, Stony Brook


2003 - In more advanced stages, chain-like microorganisms are seen inside the pallial cavity (mantle, gills)
Pallial (mantle) cavity
Mantle
Bassem Allam, SUNY, Stony Brook


…and an erosion of the pallial organs (mantle, gills) is seen…
Gill
Bassem Allam, SUNY, Stony Brook

Focus Area 1

Recirculating receiving water system acting as a microbiological breeding ground

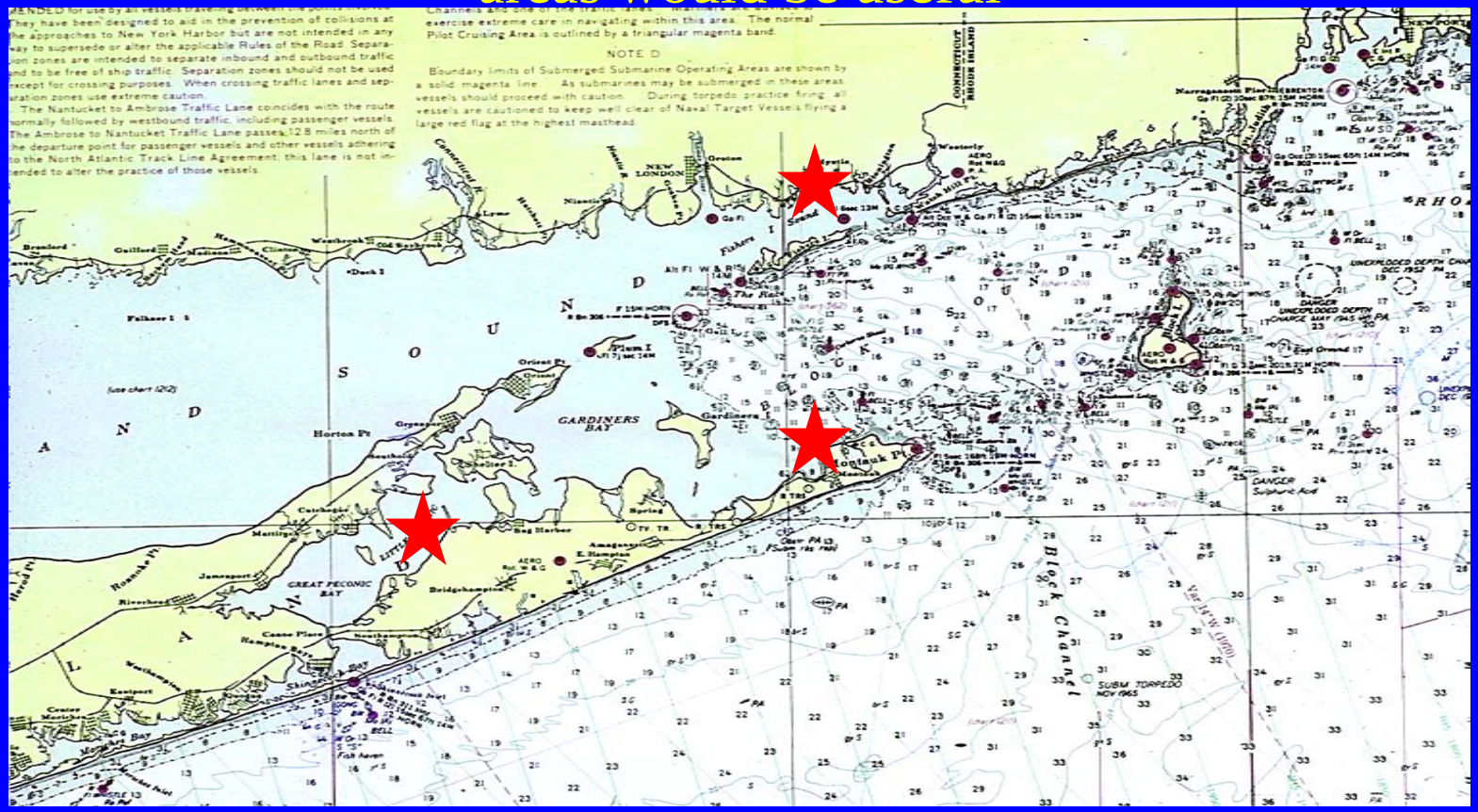
Possible strategy: Add in-line UV

Focus Area 2

Settled Cells in Mass Algae tank acting as microbiological breeding ground

Possible strategy: Avoid stirring tank of taking off feed from tank bottom

Focus Area 3

Periodic presence of harmful algae as stress factor (In 2003 *Gymnodidium* identified as problem source in Noank, CT and 'dinoflagellate-like cells' were found in dying juvenile oysters in Peconic Bay)

Regular assessments of the algal communities in shellfish growing areas would be useful