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Coherent approach to Busycon/Busycotypus fishery management along the US Atlantic seaboard Proceedings from the 16th International Conference on Shellfish Restoration (ICSR), December 10-13, 2014, Charleston SC

Robert A. Fisher
Virginia Institute of Marine Science

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Fisheries Specialist, Marine Advisory Services
Virginia Sea Grant Marine Extension Program
Virginia Institute of Marine Science
College of William & Mary

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Marine Advisory Services

Sea Grant
Virginia

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Robert A. Fisher (rfisher@vims.edu)
Marine Advisory Services
Virginia Institute of Marine Science
P.O. Box 1346
Gloucester Point, Virginia 23062
804-684-7168

Additional copies of this publication are available from:
Virginia Sea Grant Communications
Virginia Institute of Marine Science
P.O. Box 1346
Gloucester Point, VA 23062
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Introduction

Robert A. Fisher
Fisheries Specialist
Marine Advisory Services/Virginia Sea Grant
Virginia Institute of Marine Science

Members of the Busycon and Busycotypus genera of large marine gastropods are found along the Atlantic coast of North America from Cape Cod, MA, to Cape Canaveral, FL, and are the focus of commercial fisheries throughout their range. In the 1980s, the channeled whelk (*Busycotypus canaliculatus*) and knobbed whelk (*Busycon carica*) were unregulated fisheries within state and federal waters. In the early 1990s experimental fishing permits were issued by Virginia's fisheries regulatory agency, Virginia Marine Resource Commission (VMRC) for pot fishing whelk with the objective to generate reproductive biology and fisheries stock information for the more marketable channeled whelk in state and federal waters. However, poor and inconsistent data was generated from these efforts and little information specific to channeled whelk was obtained.

The channeled whelk fishery expanded within Virginia and throughout the Mid-Atlantic as fishermen diversified their efforts. Effort peaked in Virginia in the late 1990s, decreased in the early 2000s, and increased again in 2010 as shell stock (whole, live whelk) prices increased to levels three-times higher than prices in the 1990s.

In 2000, the Virginia fishery consisted of approximately 50 boats and 150 fishermen which supported processing, distribution, and bait industries generating a total estimated economic value to Virginia in excess of $42M.

Most states with a developing whelk fishery enacted separate whelk management plans based on the data-poor Virginia whelk fishery. Further, states imposed different minimum landing size (MLS) requirements on shell width or length. Currently the MLS for shell length used in the mid-Atlantic are 5in (127mm) in New Jersey, 6in (152.4mm) in Maryland and Delaware, and 5.5in (139.7mm) in Virginia. Massachusetts MLS measure for shell width is 2.75in (70mm).

Declining size of individual landed whelk observed within various resource areas in the mid-Atlantic coupled with increased fishermen complaints of undersize whelk being harvested and legally landed by fishermen from adjoining states, basic specie biological information governing the fishery was questioned.

Personally, it was in 2008 when a whelk fisherman from Maryland, frustrated that fishermen from Virginia were coming up into Maryland waters and harvesting whelk that he was throwing back as sublegal locally, asked me "at what size do whelk mature and spawn?" Upon my review, I found that little biological assessment information was available for *B. canaliculatus* and management was based on *B. carica* biological information. Questions posed by industry relative to resource management centered on age and size at sexual maturity and relevancy of multiple MLS within the regional whelk fisheries. In 2009 study began to specifically address these questions.

In fisheries management, the intent of most MLS is to identify a harvestable size of a given targeted species that allows for juveniles to survive and spawn at least once. The channeled whelk, which has become the more marketable and therefore experiences greater exploitation, has existed as a data-poor resource with little biological assessment information available, including size at maturity.

Whelk fisheries along the US East Coast are currently experiencing various resource challenges, including

increased fishing pressure, decreasing size composition of landed whelk, and declining catch per unit effort. Further, as a data-poor resource with inadequate catch monitoring programs in place, there exists a need to address these fishery concerns and reevaluate current management regulations.

Recent research findings on age, growth, size at maturity, and reproductive potential in channeled whelk populations along the US Atlantic coast, as well as new findings within knobbed whelk resources, are now available for review.

In light of new science-based information, the opportunity is presented to forge a collaborative effort between industry, academia, and regulatory agencies to address current whelk resource concerns and provide for a coherent approach to sustainable whelk fishery management along the US Atlantic seaboard. With the annual International Conference on Shellfish Restoration (ICSR) convening in South Carolina, a special session on whelk within the conference was held for direct dissemination of information to, and discussion between, whelk stakeholders. The desired outcome was to initiate a collaborative effort to explore management options that would address the needs of the whelk resource and those fisheries that are built upon them.

This document covers the proceedings of that session, titled "Coherent Approach to *Busycon/Busycotypus* Fishery Management Along the US Atlantic Seaboard." The session provided new science-based biological information, as well as current whelk fishery constraints in whelk-producing states from southern New England to Georgia. This document includes presentation slides delivered within this session as well as a transcript of the discussion that followed.

Panelists and Presentations

Growth, age, and sexual maturity of the channeled whelk (*Busycotypus canaliculatus*) in Buzzards Bay, Massachusetts

Bradley G. Stevens and Bhae-Jin Peemoeller
University of Maryland, Eastern Shore

With the southern New England lobster fishery in distress, lobster fishermen in this region have focused more effort toward harvesting channeled whelk (*Busycotypus canaliculatus*). However, minimal research has been conducted on the life history and growth rates of channeled whelk. Melongenid whelks generally grow slowly and mature late in life, a characteristic that can make them vulnerable to overfishing as fishing pressure increases.

We sampled channeled whelk from Buzzards Bay, Massachusetts, in August 2010 and in July 2011, studied their gonad development by histology, and aged them by examining opercula. We also marked and released >8700 whelks and recovered 314 after one or two years at liberty.

Males had significantly slower growth and a lower maximum size than females. Male whelk reached 50% maturity (SM50) at 115.5mm shell length and at the age of 6.9yrs. Female whelk reached SM50 at 155.3mm shell length and at the age of 8.6yrs.

With a legal minimum size limit of 69.9mm (2.75in) in shell width, males entered the fishery at 7.5yrs, a few months after SM50, but females entered the fishery at 6.3yrs, approximately 2yrs before SM50. Various modifications to size limits and their potential impacts on landings were examined. Increased fishing pressure combined with slow growth rates and the inability to reproduce before being harvested can easily constrain the long-term viability of the channeled whelk fishery in Massachusetts.

Age, growth, and maturity of New England Whelks *Busycotypus canaliculatus*

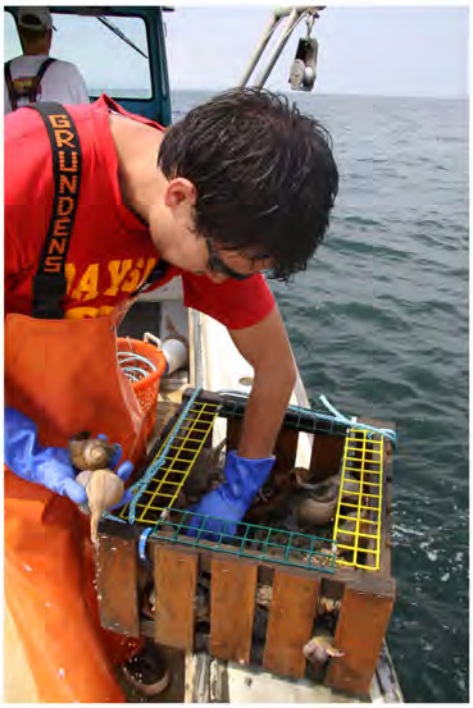
Bradley G. Stevens
Bhae-Jin Peemoeller

UNIVERSITY of MARYLAND
EASTERN SHORE

1

Introduction

- Biology
  - Slow growing
  - Low fecundity
  - Late Maturity
  - No info on size at maturity
  - *B. carica* suggested to be hermaphroditic
- Fishery:
  - Increased fishing pressure due to lobster decline
  - 1.13 M lbs in 2010 worth $5.25 million
  - Fishermen noticing deficit of large conchs



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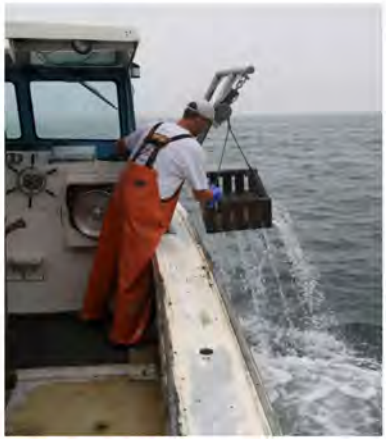
Methods – Sampling



- Buzzards Bay, MA
  - 4 trips in August, 2010
  - 5 trips in July, 2011
- Wood pots (bait w/ HS crabs)
- Held in seawater lab (1 week) at UMASS Dartmouth

3

Methods - Marking

- Remove periostracum (rotary brush)
- Etch numbers with Dremel tool
- Indelible ink
- 5-minute epoxy

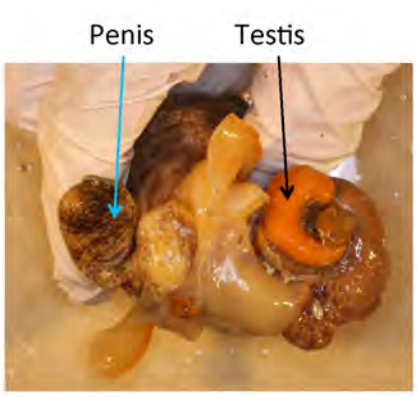
Methods - Measurement

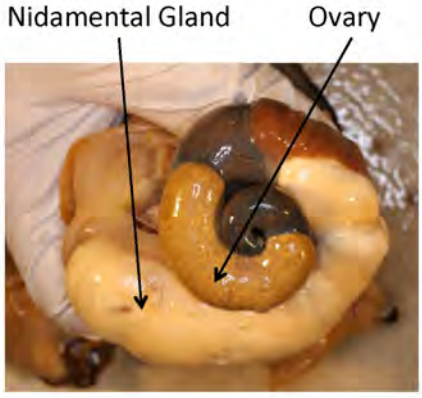
- Wet Weight, Wt
- Shell length, SL (apex to end of siphon)
- Lip width, LW (widest part of shell)

5

Methods - Dissection

- 462 whelks (cracked with hammer)
- Sex ID'd by morphology (Penis/Nidamental gland)
- Removed gonads (ovaries and testes)
- Fixed in 10% formalin – trans to 70% EtOH





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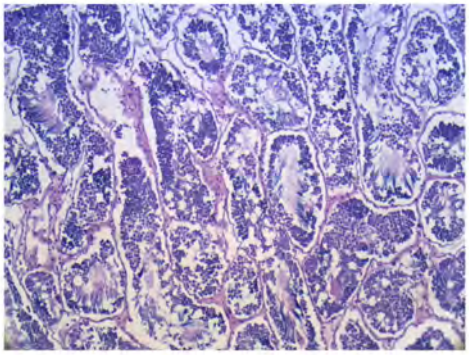
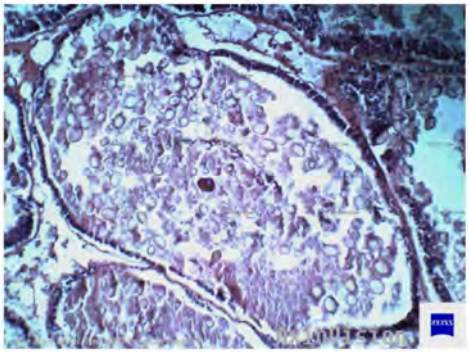
Histological Analysis

- Confirms field ID: males have penis; females have nidamental gland
- Size at maturity for males and females
- Determine development stages

Male testis: tubules w/ spermatids



Female ovary: Follicles w/ egg remnants



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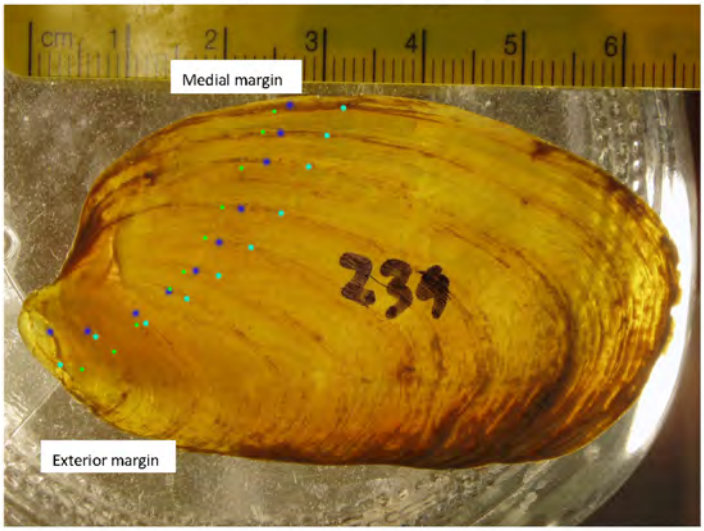
Age Analysis



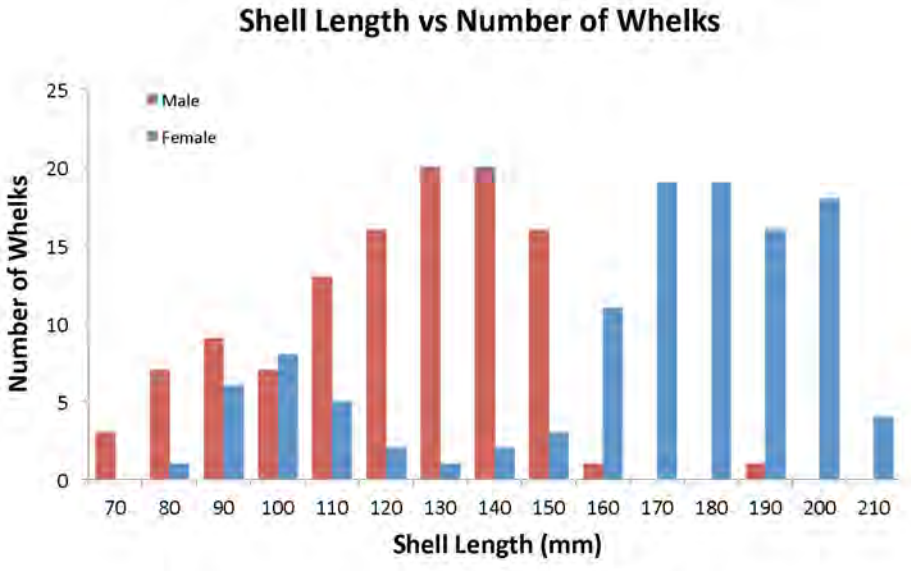
Whelk operculum with 10 growth checks
Three independent agers

8

Results

Year	Caught	Marked	Dissected	Died
2010	4962	3909	224	111
2011	5666	4808	248	172

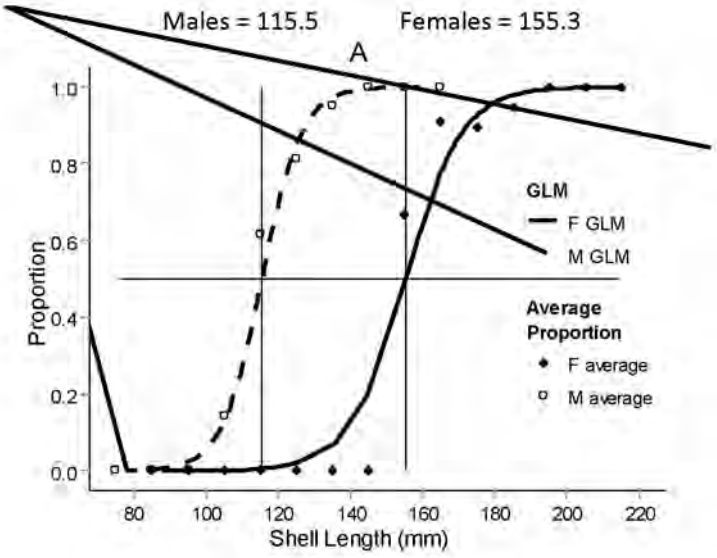
9



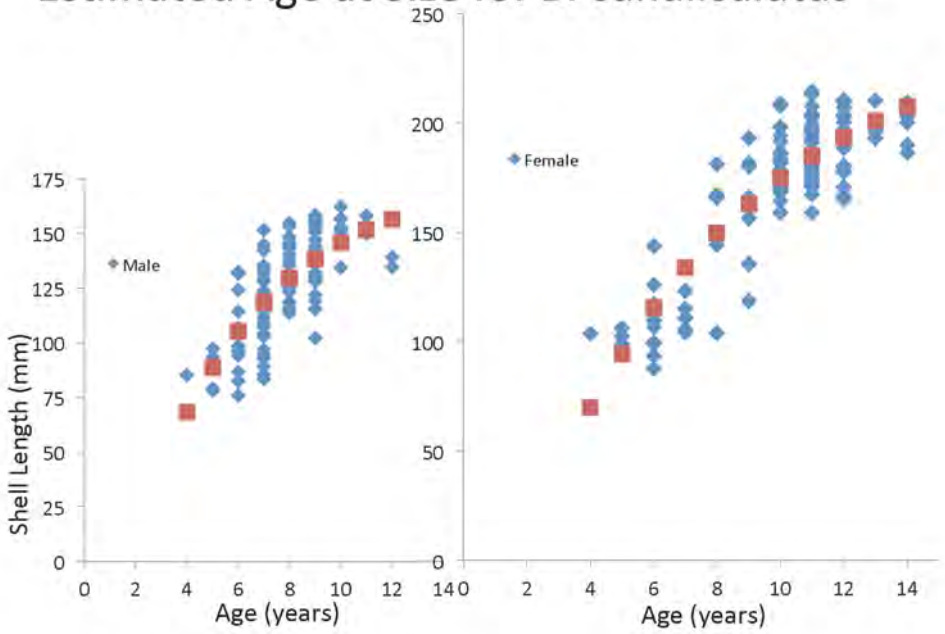
Males dominate smaller lengths,
only females above 160mm

11

Proportion Mature and Size at 50% Maturity (SM_{50})



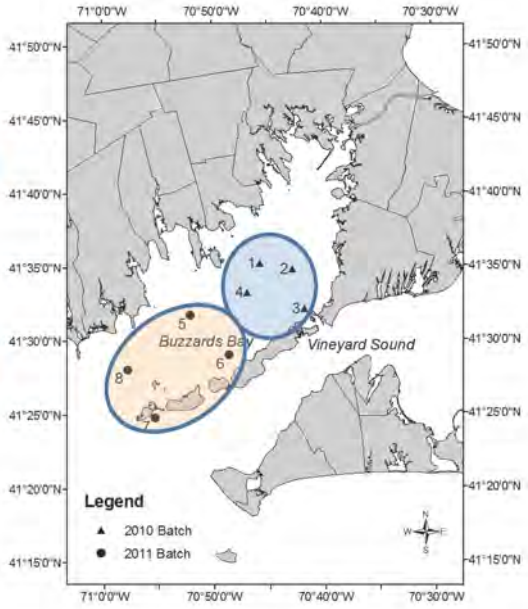
Estimated Age at Size for *B. canaliculatus*



Red squares are predicted sizes from Von Bertalanffy growth model

Marked/Released Whelks

	Group 1, 3	Group 2
Aug 2010	Sites 1-4	
July 2011		Sites 5-8
Oct 2011	Group 1	
Nov 2012	Group 3	Group 2



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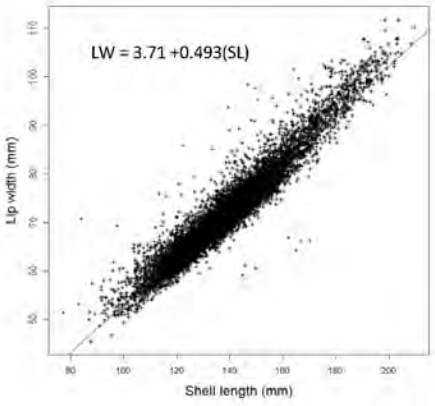
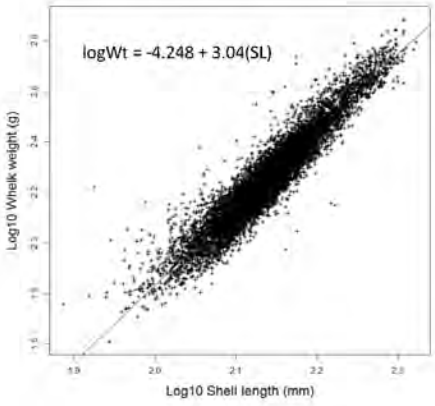
Marked/Released Whelks (n=8717)





Lip width increases linearly with shell length; minor sex difference
Weight increases exponentially; no sexual difference

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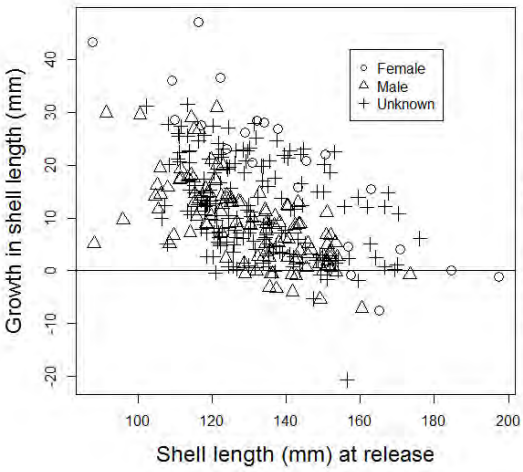
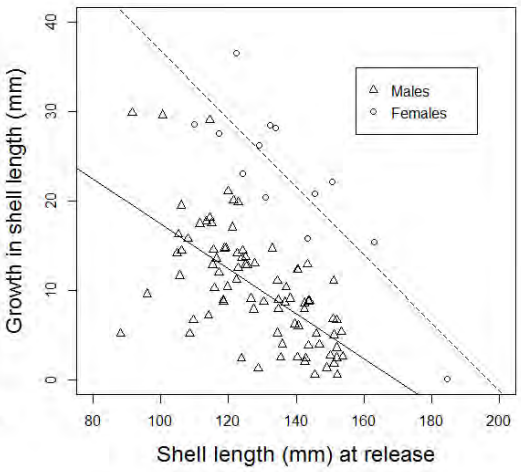
Whelks Growth (length)



Growth in shell length for all whelks



Positive 1-year growth increments for whelks of known sex

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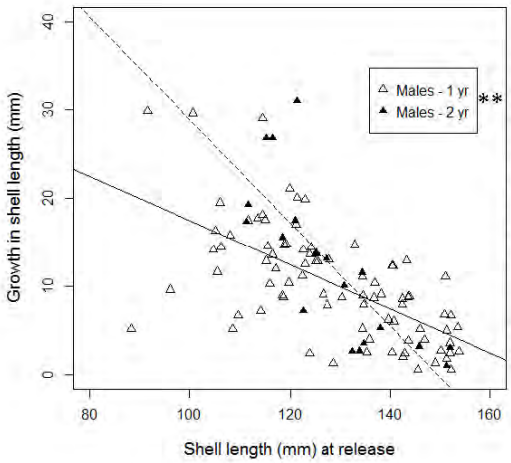
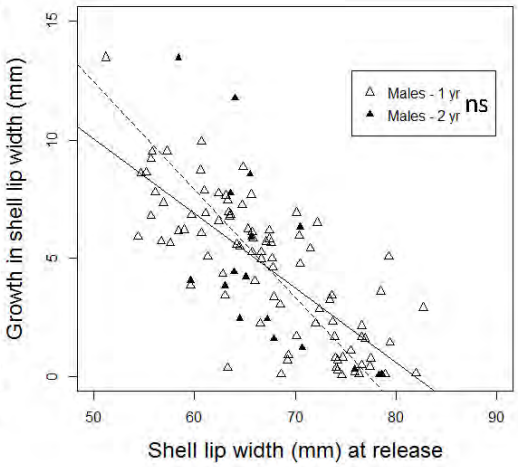
Male whelks recaptured after 1 or 2 years at liberty



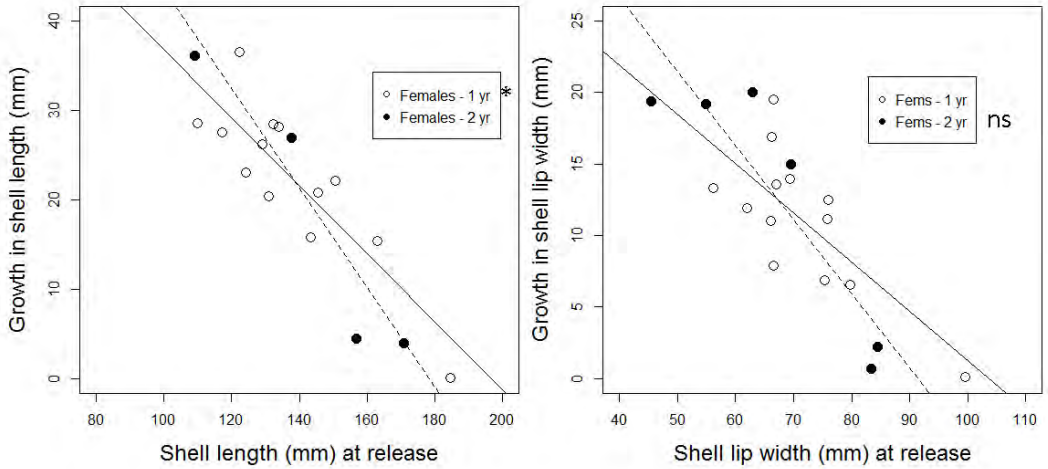
Growth in shell length



Growth in lip width

16

Females recaptured after 1 or 2 years at liberty

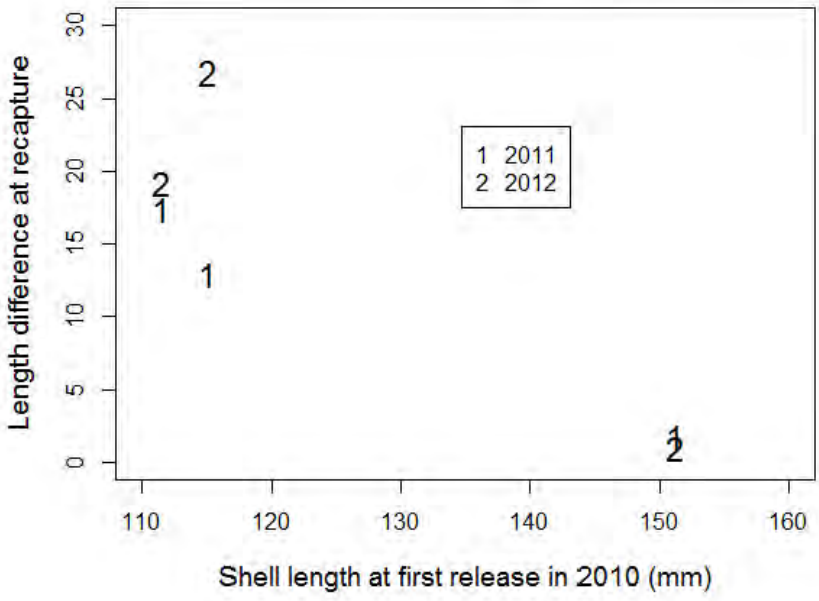


Growth in shell length

Growth in lip width

17

Growth in SL for 3 male whelks that were recaptured twice, in 2011 and 2012 (labeled "1" and "2", respectively).



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Conclusions

Males

- Have lower max size, age, and SM_{50} than females
- Enter fishery 1 yr after maturity
- Have much slower growth

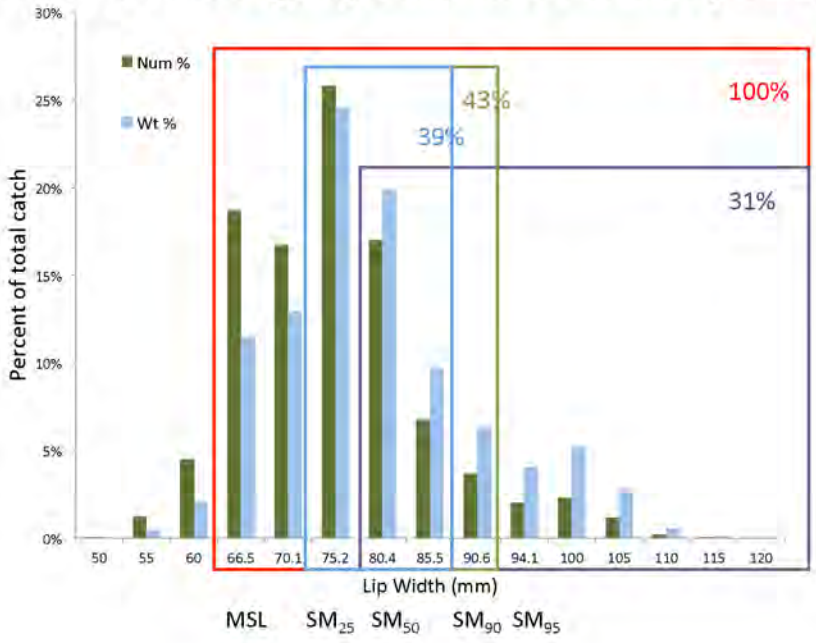
Females

- Greater growth rate, age, and size than males
- Enter fishery 2 years before maturity
- Grow faster than males

MA minimum size

- 2.75 inch shell width (70 mm)
- Male = 135mm SL, i.e. mostly mature
- Female = 132mm SL, i.e. mostly immature

Effect of changing min size limits (MSL)



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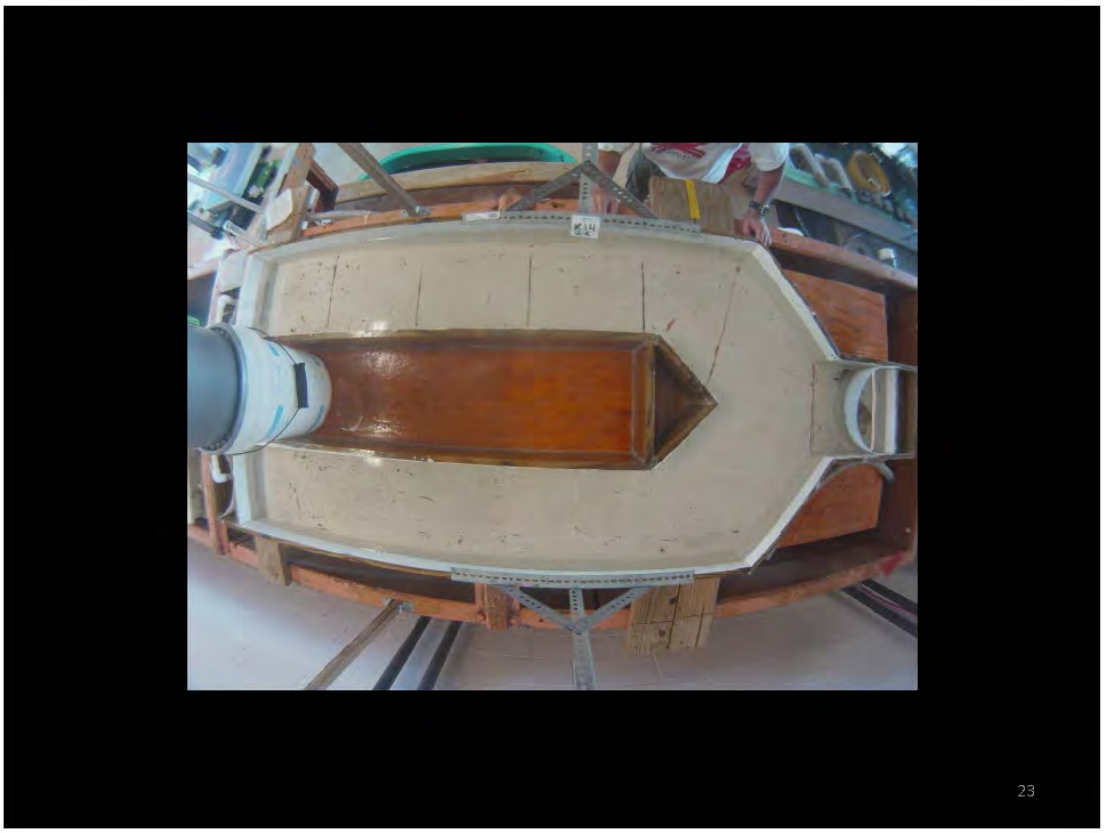
- NOAA Living Marine Resources Cooperative Science Center



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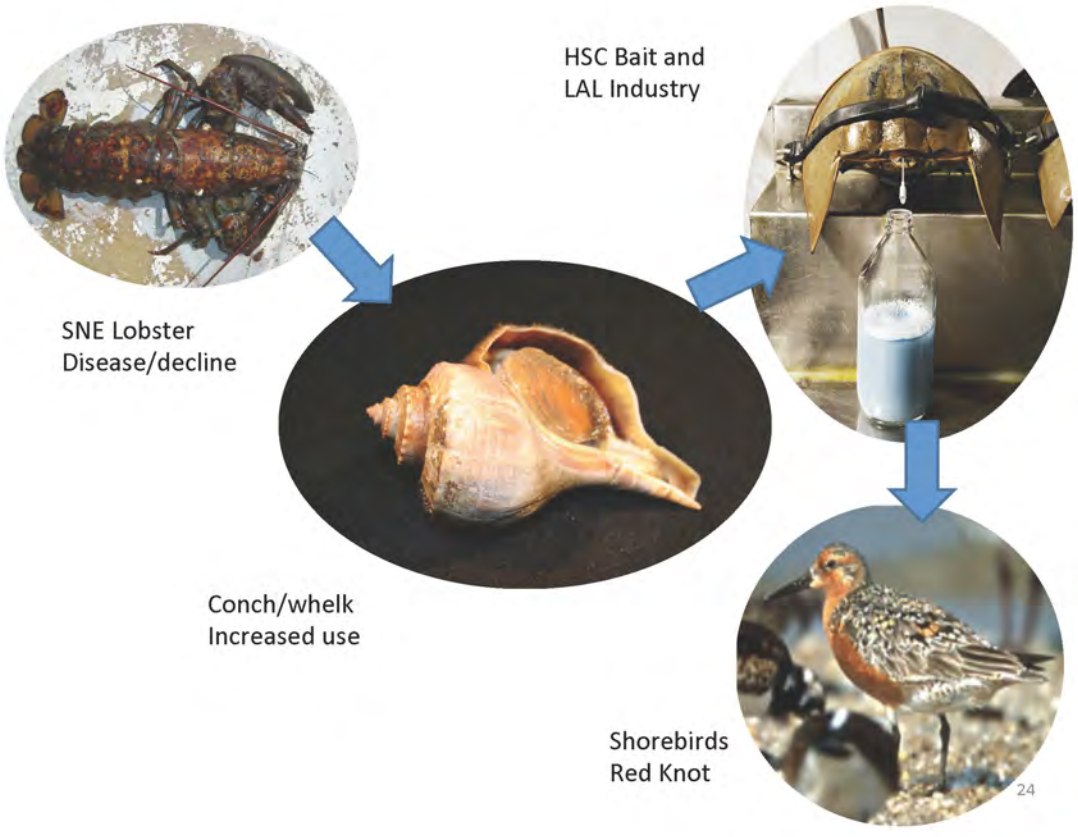
HSC Bait and
LAL Industry
SNE Lobster
Disease/decline
Conch/whelk
Increased use
Shorebirds
Red Knot

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An overview of the channeled whelk (*Busycotypus canaliculatus*) fishery in Massachusetts

Bob Glenn
Massachusetts Division of Marine Fisheries

The channeled whelk (*Busycotypus canaliculatus*) fishery in Massachusetts has traditionally been small-scale, consisting primarily of a few full-time fishermen and a moderate number of part-time fishermen who fished for whelk seasonally. The majority of channeled whelks are harvested through directed effort with conch pots, and a smaller portion harvested as by-catch from draggers and clam dredgers.

Channeled whelk landings varied between 1.5 and 2 million pounds from the 1990s through the early 2000s. In 2006 channeled whelk landings increased dramatically, reaching a peak of 3.3 million pounds in 2011, and have remained at or above 2.5 million pounds since. This increase in total harvest is the result of substantial increases in effort spurred by an unprecedented increase the ex-vessel value of whelk.

Management of channeled whelk in Massachusetts was historically based on limited entry (new permit moratorium), a 200-pot limit and a 70mm minimum shell width. The unprecedented increases in catch and effort, along with long-term declines in fishery independent trawl survey abundance indices, raises concerns about the long-term sustainability of the channeled whelk fishery in Massachusetts.

In 2011 we conducted an age and growth study to assess the efficacy of the 70mm minimum shell width. We determined that at a 70mm shell width, female channeled whelk were an average of 7yrs old and none of them were sexually mature, and that they reach the size at 50% maturity at a mean age of 9 and a shell width of 100mm.

In response to this information Massachusetts Division of Marine Fisheries has initiated a series of minimum size increases and set fishing history performance criteria on permit transfers to combat future increases in fishing effort. The effectiveness of these measures to sustain the whelk fishery in Massachusetts is not yet known.

The Channeled Whelk (*Busycotypus canaliculatus*) Fishery in Massachusetts

MarineFisheries
Commonwealth of Massachusetts

Bob Glenn, Chief Marine Fisheries Biologist

Steve Wilcox, Marine Fisheries Biologist

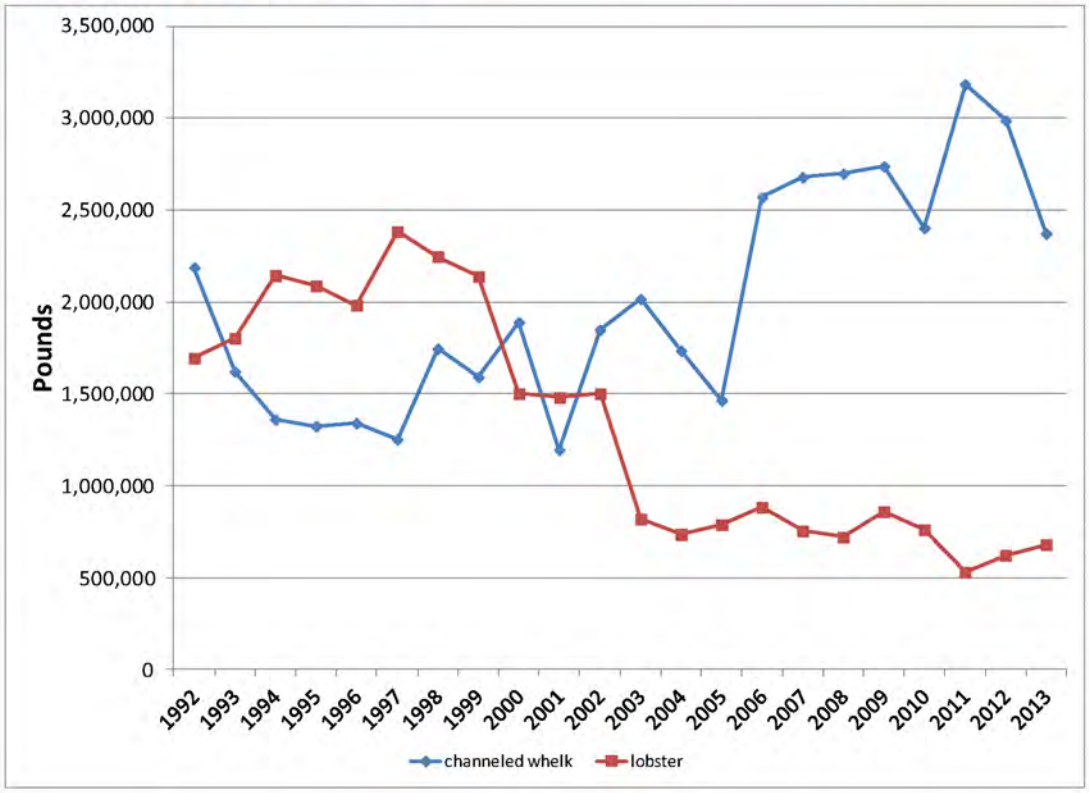
Channeled Whelk Fishery

- 2012 Landings – Over 3.6 million pounds (highest in time series)
- MA landings value >$6.1 million
- Caught using traps

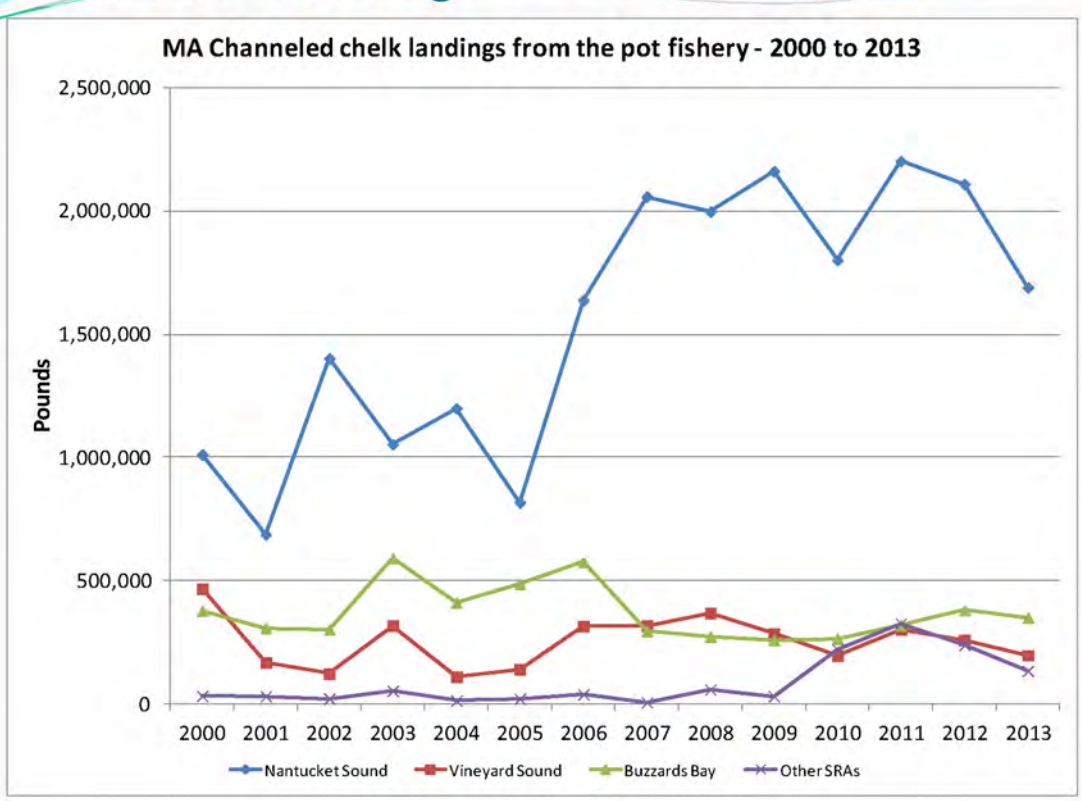
- Most harvested from Nantucket Sound (>2 million pounds)
- Most of landings occur between September and December
- 155 license issued and approximately 80 active fishermen per year

2

Landings Data

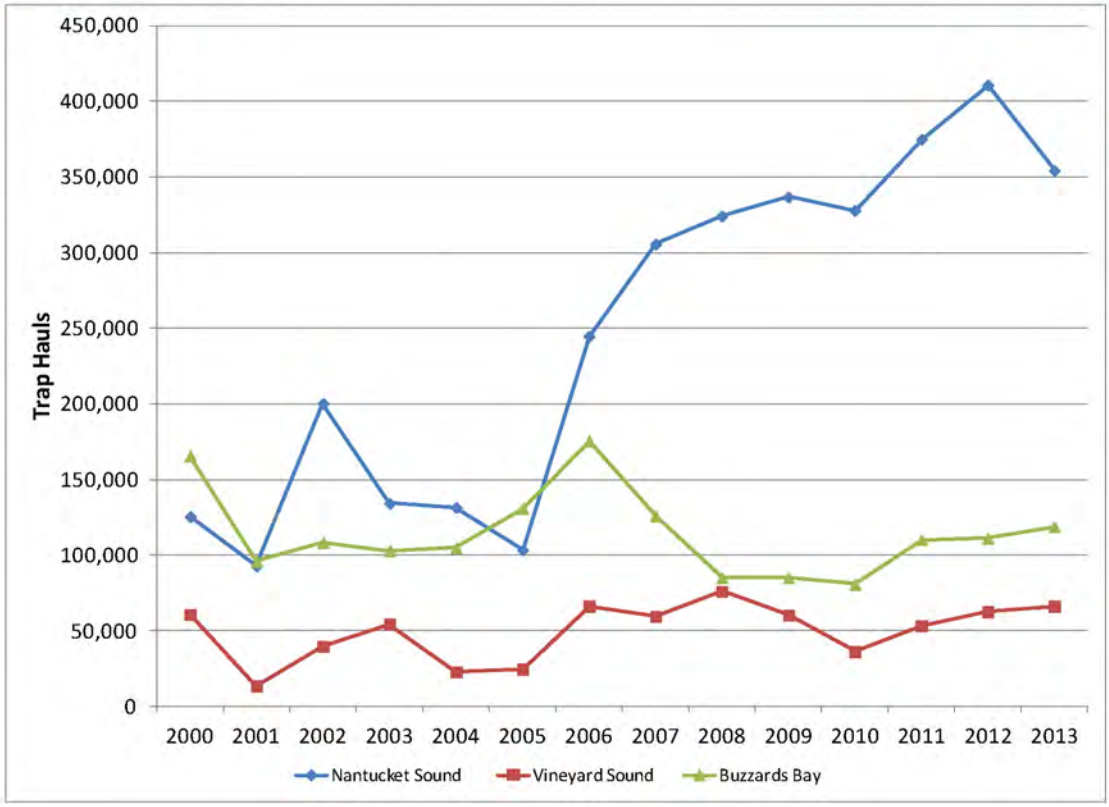


Commercial Landings



4

Effort Trends

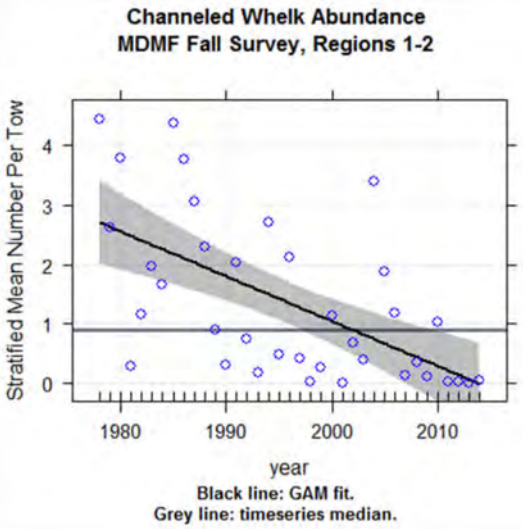


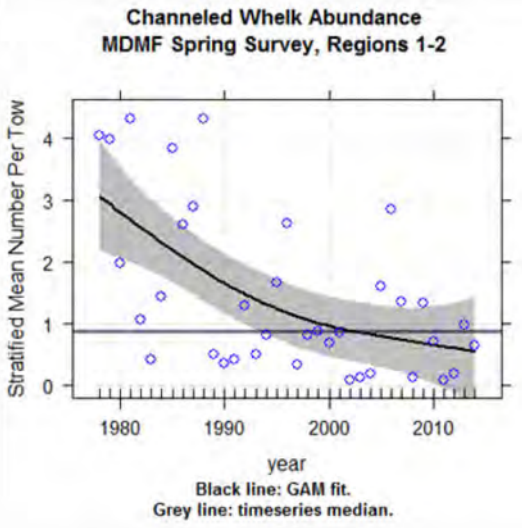
Price and Value Trends

Dealer reported channeled whelk landings and values – 2005 to 2013

Year	Pounds Landed	est. value	Price/lb.
2005	1,354,821	$1,454,295	$ 1.07
2006	2,420,481	$3,103,089	$ 1.28
2007	2,496,497	$2,466,229	$ 0.99
2008	2,701,409	$3,212,108	$ 1.19
2009	2,847,042	$3,720,139	$ 1.31
2010	2,505,859	$3,027,344	$ 1.21
2011	2,996,745	$5,307,231	$ 1.77
2012	3,603,814	$6,160,808	$ 1.71
2013	2,262,972	$5,588,912	$ 2.47

Abundance Trends





Massachusetts Regulations

- Minimum legal size of 2 ¾" width
  - No standard gauge required
  - Tolerance for undersized: EPO must measure 10% of catch; Up to 5% by count may be undersized; If more than 7% undersized, total catch seized.
- 200 trap maximum
- Closed season - December 15 – April 14
- Limited Entry since 1990
  - Temporary Moratorium on permit transfers since 2010
- By-catch allowed for Lobster Permit holders
  - Weight of conch can not exceed weight of lobsters
- Catch and retention by mobile gear allowed
  - No trip limit.

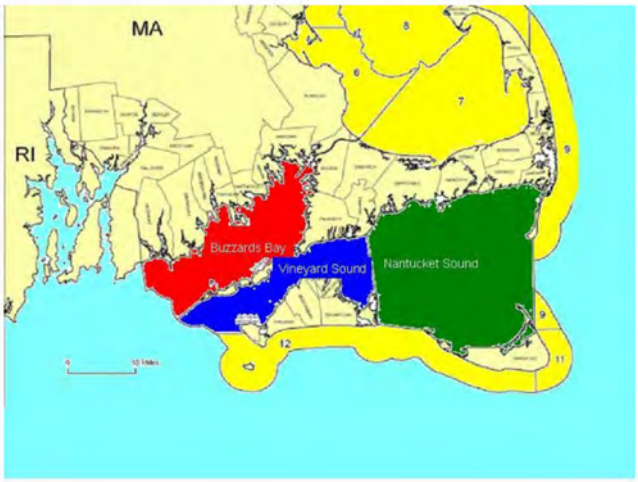
- Females anchor egg casings into sediment
- Limited dispersal mechanism
- Limited movement
- Food sources
  - Live shellfish
  - Scavengers (dead fish, shellfish and crabs)

Some Key Life History Information was Missing…

- Age & Growth Rate
  - How old are the animals you are harvesting?
  - How long does it take for them to reach minimum size?
- Sexual Maturity
  - At what size do they become sexually mature?
  - How long does it take them to become sexually mature?

DMF Channeled Whelk

- Determine size and age at maturity
  - Males
  - Females
  - Are all three areas the same
- Seasonal changes

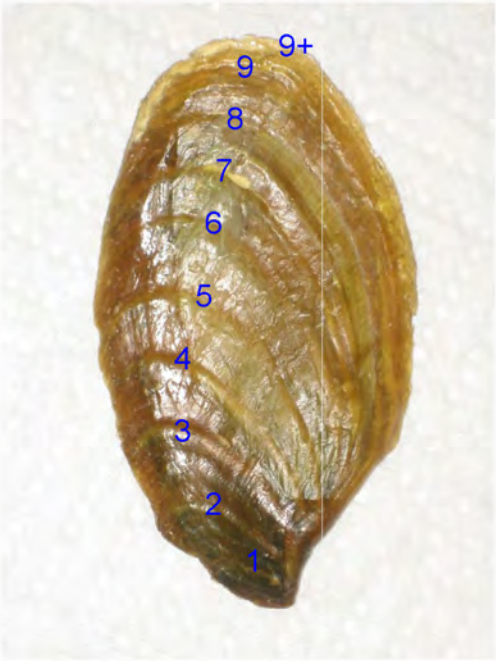


- External measurements
- Weights
- Age
- Sexual maturity

Sampling

- Was conducted using standard conch pots
- Number of Channeled Whelk Sampled
  - Buzzard Bay = 400
  - Nantucket Sound = 317
  - Vineyard Sound = 252

Determining age



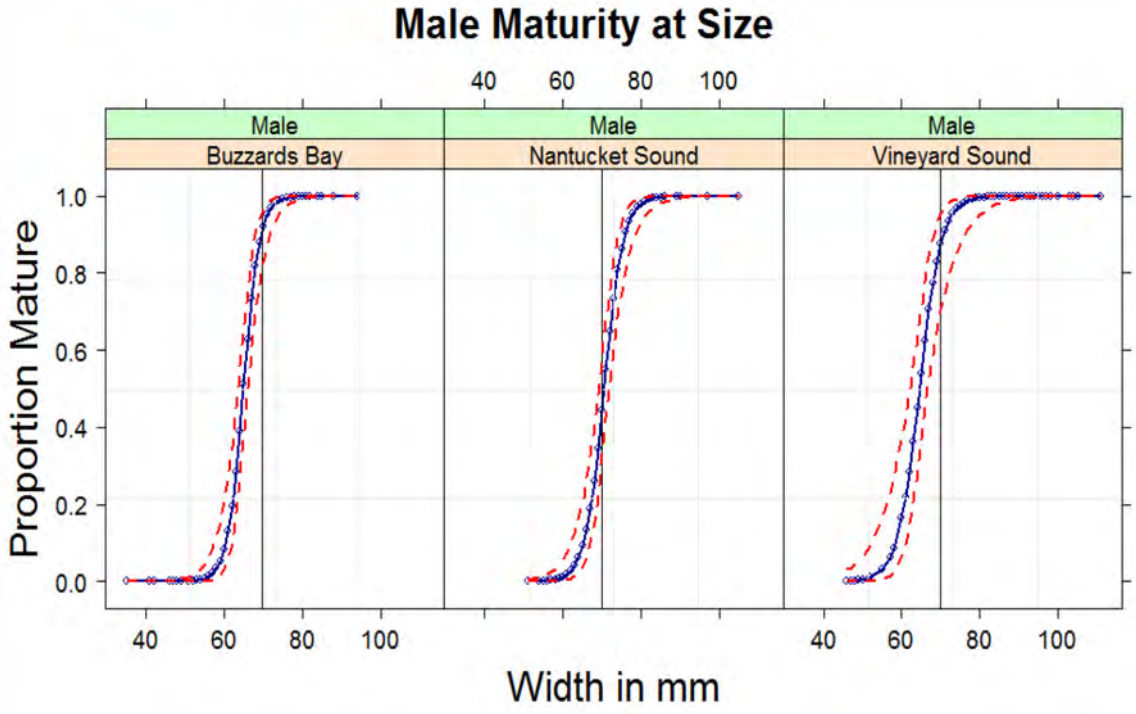
Determining Maturity

Males

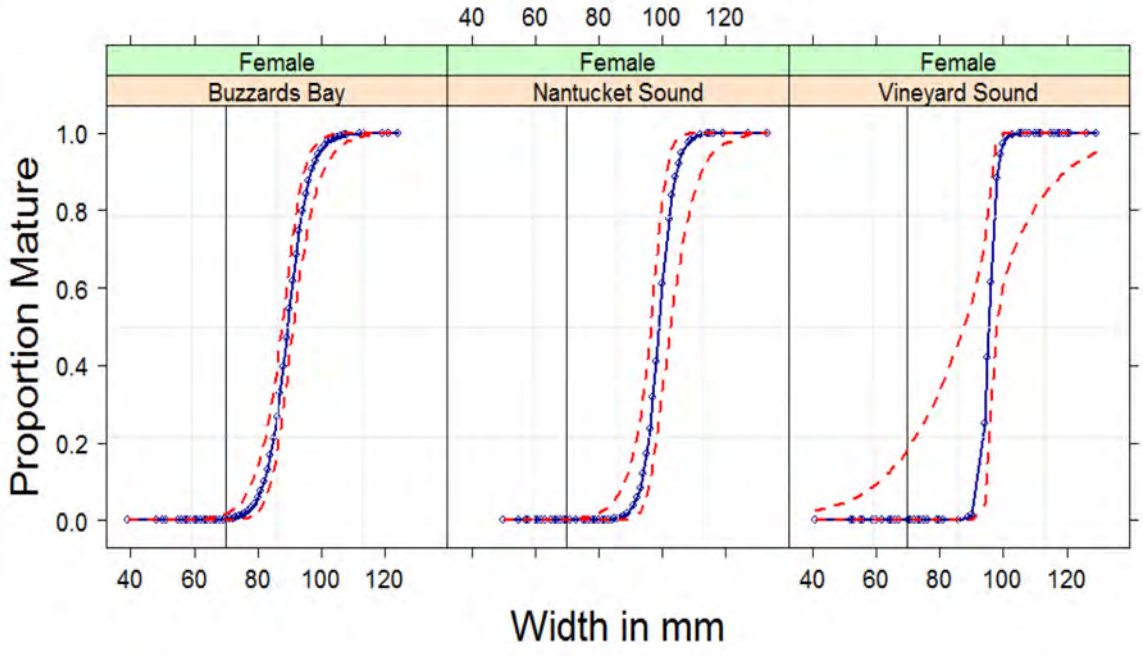
Females

Results

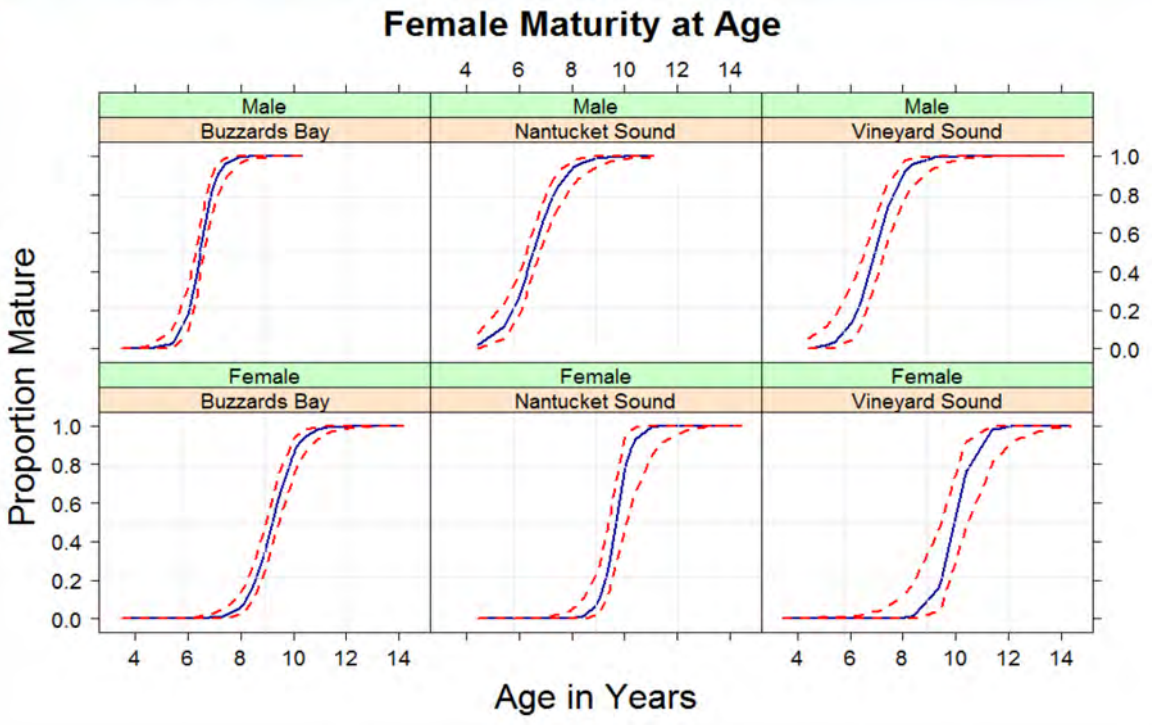
Male Proportion Mature



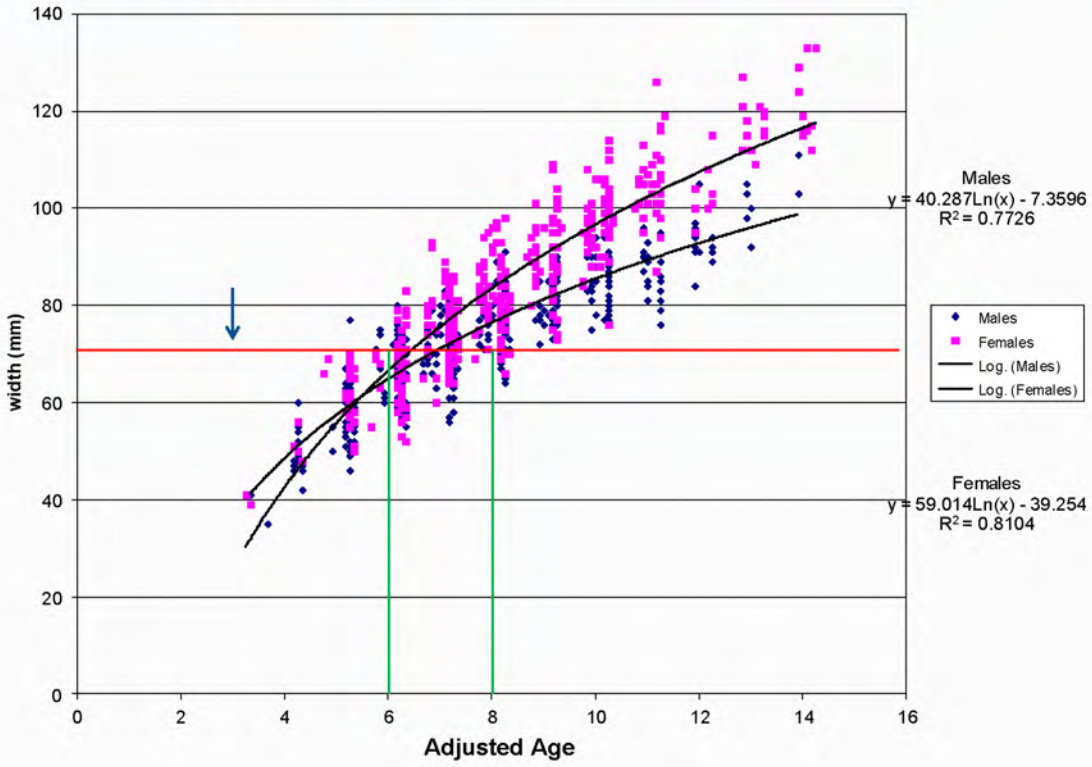
Female Proportion Mature



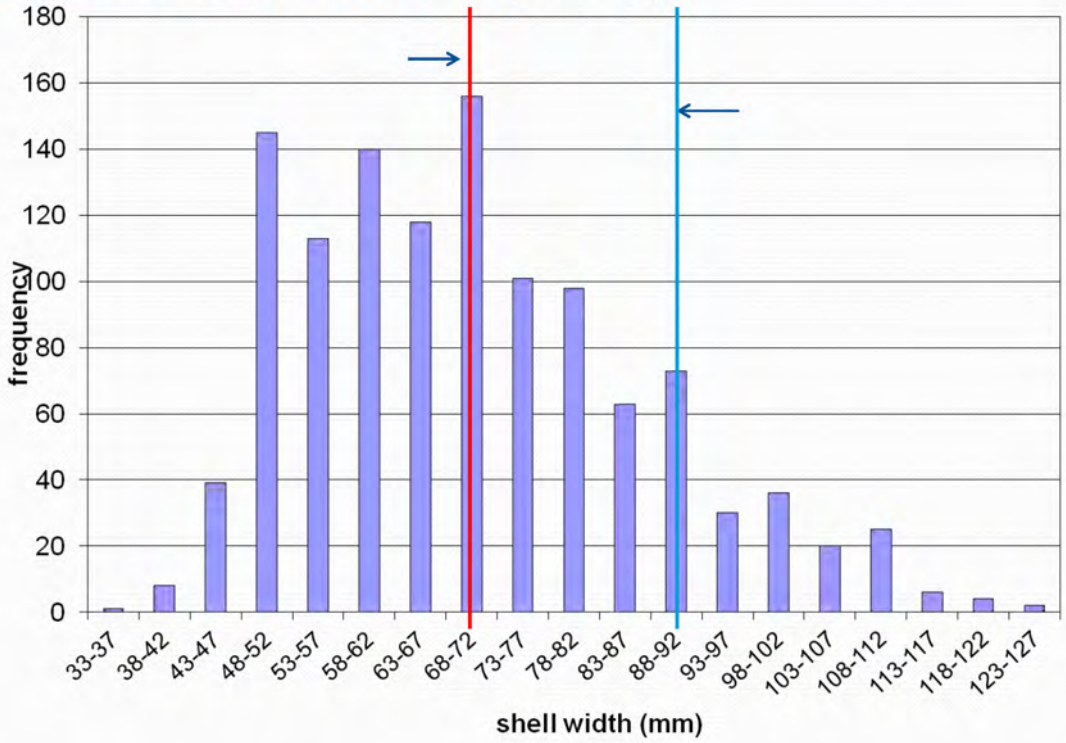
Proportion Mature at Age



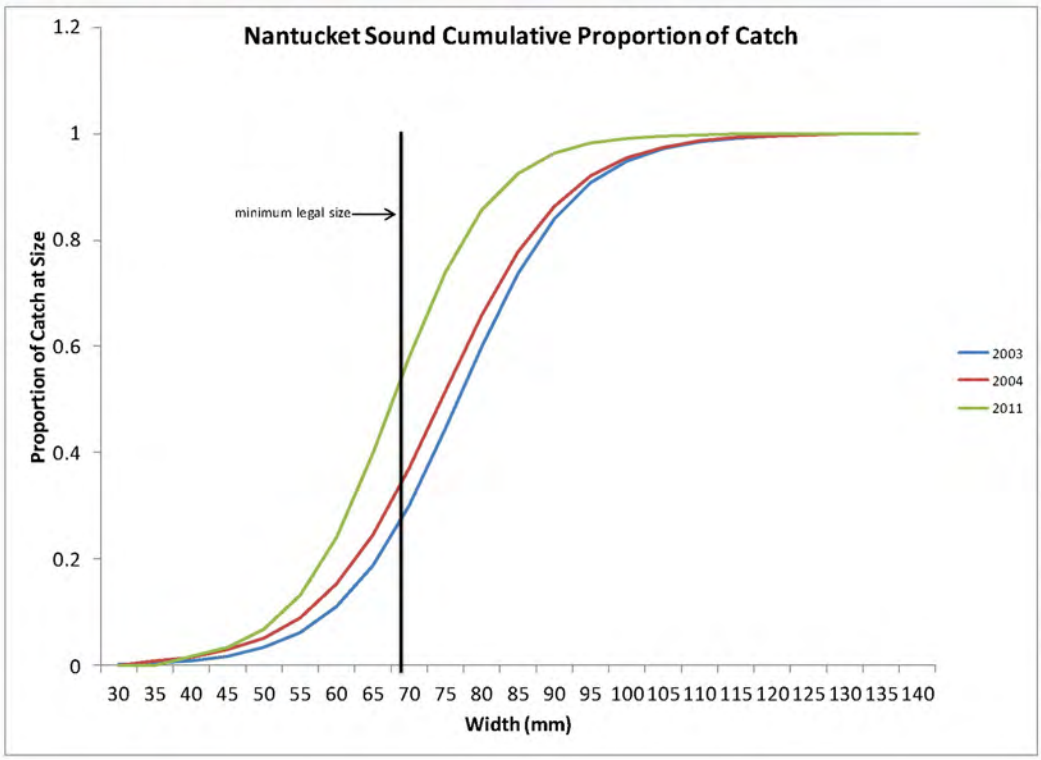
Combined Growth Rates



Commercial Size Frequency



A Comparison of Size over Time…



Lessons from Around the Globe

- Fishery Boom ↑
- Stock Collapse ↓
- Is a pattern observed consistently among conch and whelk fisheries throughout the world
  - **Common whelk (*Buccinum undatum*)** in Canada (Gendron 1992) the Netherlands (de Voys and van der Meer 2009) and Ireland (Fahey et al. 2005, 2008),
  - **Neptune whelk (*Neptunea arthritica*)** in Japan (Miranda et al. 2008),
  - **Knobbed whelk** in Georgia (Power et al 2009) and South Carolina (Eversole et al 2008)
  - **Black murex snail (*Hexaplex nigritus*)** in Mexico (Bueno 2001)
  - **Fine snails (*Zidona dufresnei*)** and **Loco (*Concholepus concholepus*)** in South America (Gimenez et al. 2005, Cleodon et al. 2005),
  - **Topshell whelk (*Cittarium pica*)** in Costa Rica and the US Virgin Islands (Schmidt et al. 2002, Toller and Gordon 2005)
  - **Abalone (*Haliotis rufescens*)** in California (Karpov et al. 2000)
  - **Queen conch (*Strombus gigas*)** in Panama (Cipriani et al 2008)

Concerns in Massachusetts…

- Effort has increased dramatically
  - Especially in Nantucket Sound
  - Increased price in 2010 and 2011 has lead to a "gold rush" mentality
  - Reports of fishermen circumventing trap limit by baiting lobster traps with horseshoe crabs
  - Concerns raised by several fishermen about conflicts with other fishermen
  - A lot of latent effort in the system
- Landings have increased dramatically overall
  - Big increase in Nantucket Sound
  - Recent declines in Buzzards Bay and Vineyard Sound
- Evidence of population decline over time in MADMF Trawl Survey
- Majority of the harvest is on conch that are not sexually mature
  - Minimum size is too low

Concerns…

- Evidence of size truncation and growth overfishing within the last decade
- Life history characteristics make conch very prone to overfishing
  - Slow growth – takes 6 to 8 years to reach minimum size
  - Slow rate of sexual maturation – majority of the females are harvested before they mature
  - Non-migratory
  - Non-pelagic larval stage.
- Current rate of harvest is not sustainable long term
  - Recovery of collapsed whelk fisheries in other places has been slow to non-existent
- Not a lot of alternative fisheries for SNE fishermen
  - Lobster stock is critically low
  - Fish potting (Sea bass , scup, and tautog) is fairly limited
  - Jonah crabs showing same alarming trends in federal waters

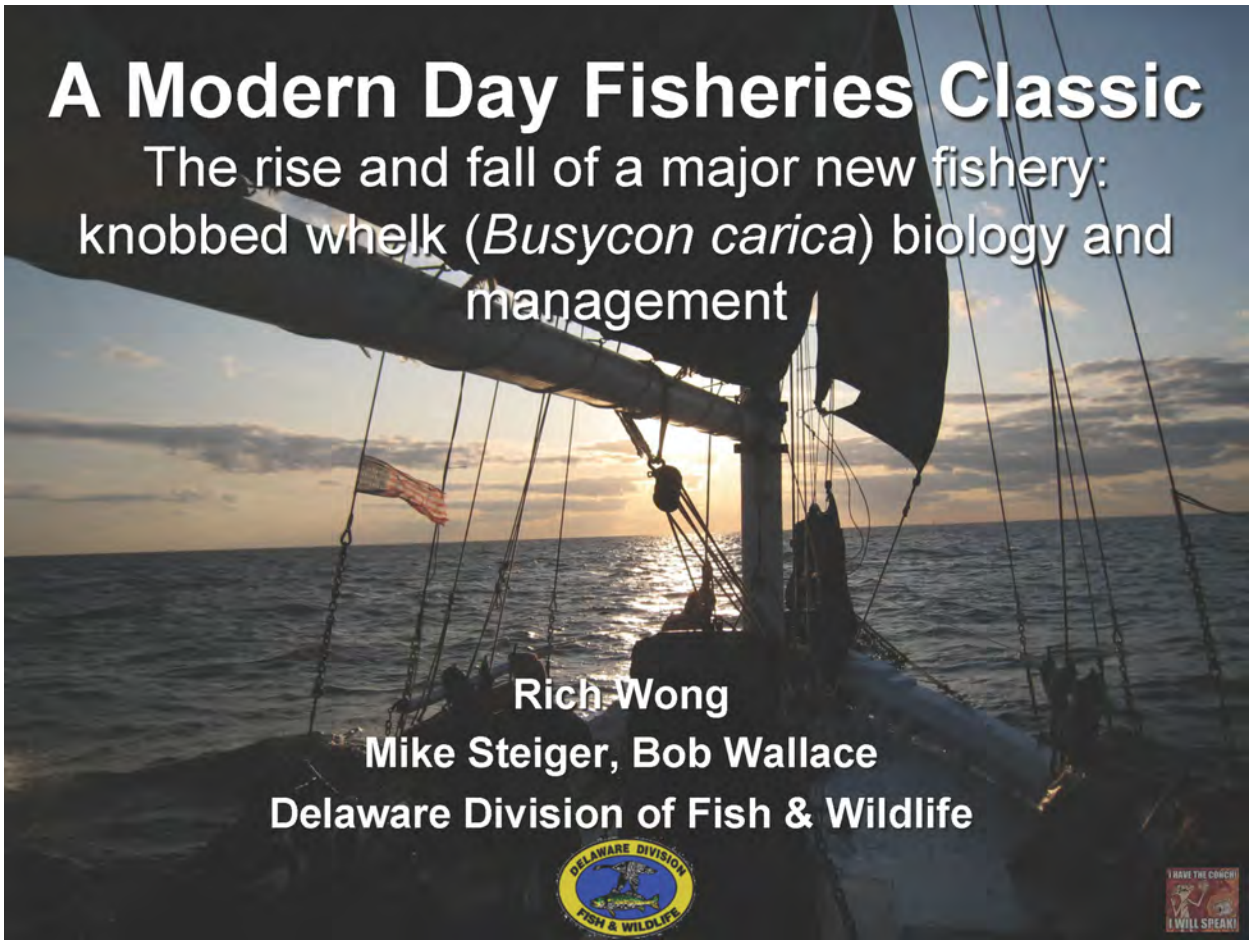
Knobbed whelk (*Busycon carica*) of Delaware: Growth and reproductive biology of the knobbed whelk and their implications to Delaware's whelk fishery

Richard Wong, Michael Steiger, Robert Wallace
Delaware Division of Fish and Wildlife

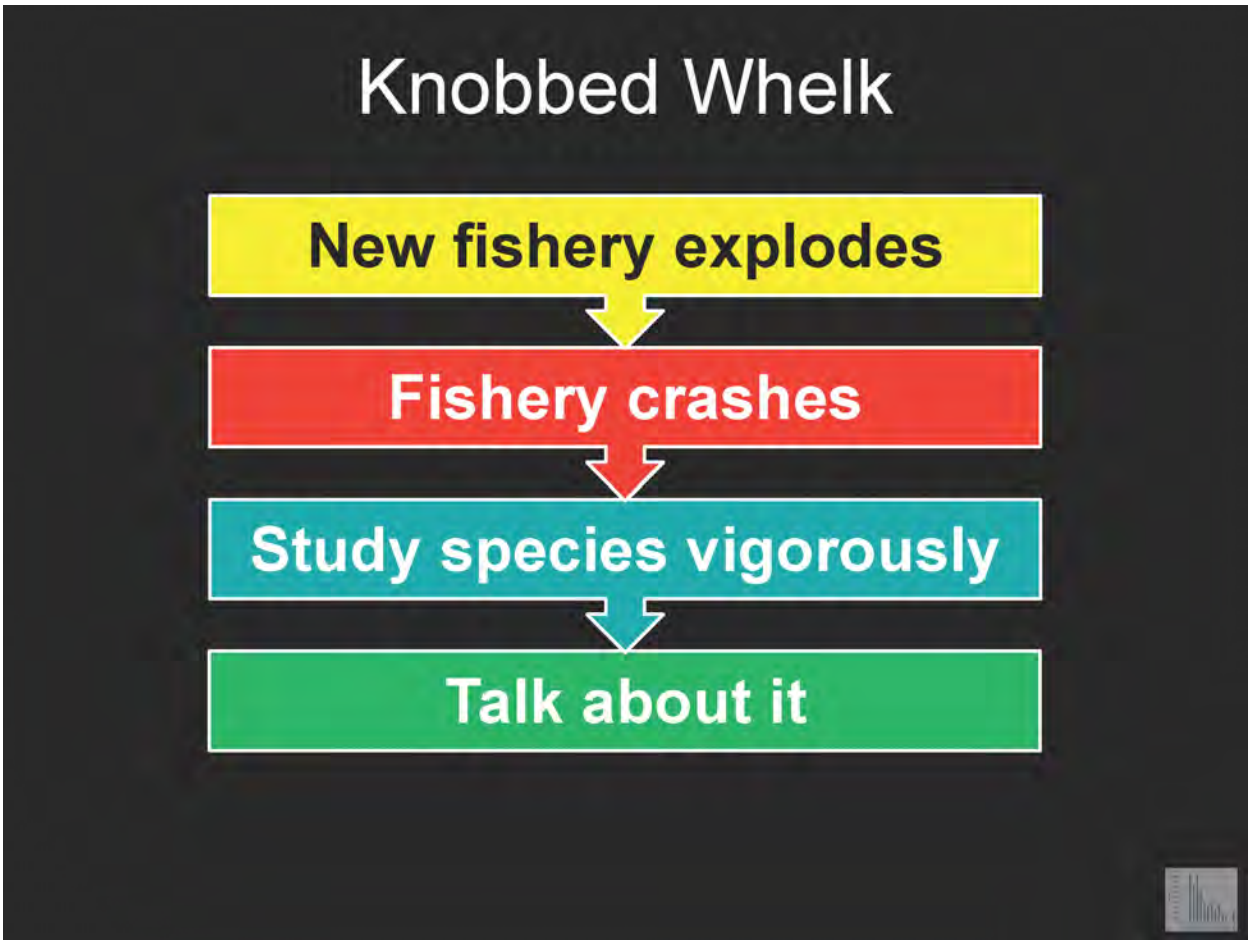
Delaware knobbed whelk landings have risen and fallen like a rollercoaster over the past 14 years. In 2001, landings rose 2,400% from 76,000 to 1.9 million pounds, earning its status as Delaware's second-largest fishery to blue crabs. High harvest levels were maintained for a few years followed by a conspicuous, steady decline in landings despite unprecedented whelk prices. Fishery catch-per-unit effort deteriorated, suggesting that the observed decline was likely driven by diminishing stock abundance.

Given concern for the stock, shell length size limits were raised from 5 to 6in from 2007 to 2010, while a temporary dredge license moratorium was put into effect from 2006-2011. Landings stabilized during this period of management intervention, concomitant with reduced commercial demand and price, and elevated fuel expenses. Currently, the whelk fishery is the fourth largest commercial fishery in Delaware.

Since 2005, extensive work has been completed on the age, growth, and reproductive biology of knobbed whelk. Aging methods based on operculum and statolith structures have been compared. Sex-specific growth rates have been generated. Size-at-maturity and age-at-maturity schedules have been constructed based on histological examinations of gonads for both sexes. Reproductive seasonality and spawning frequency have been explored. Exploitation rates have been investigated in an effort to determine the stock status.

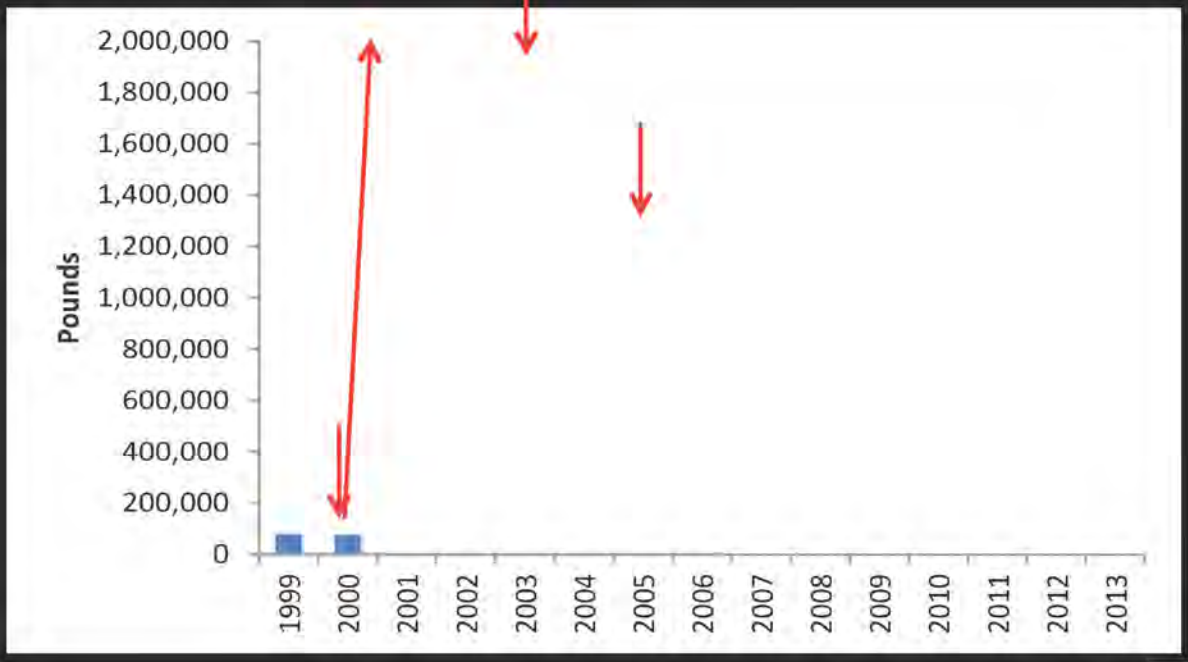

A Modern Day Fisheries Classic
The rise and fall of a major new fishery: knobbed whelk (*Busycon carica*) biology and management
Rich Wong
Mike Steiger, Bob Wallace
Delaware Division of Fish & Wildlife
DELAWARE DIVISION
FISH & WILDLIFE


I HAVE THE CONCH!
I WILL SPEAK!
quickmeme.com

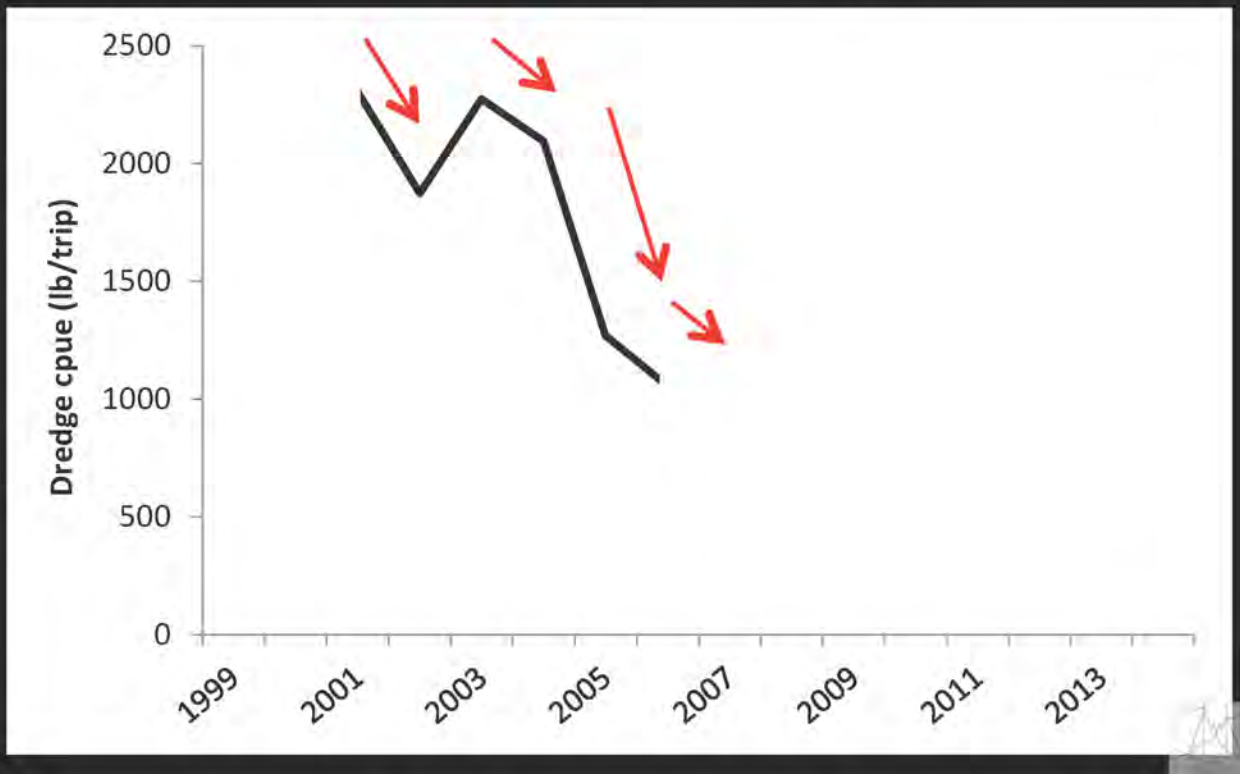

Knobbed Whelk
New fishery explodes
Fishery crashes
Study species vigorously
Talk about it


La Monica
SCUNGILLI
SLICED CONCH

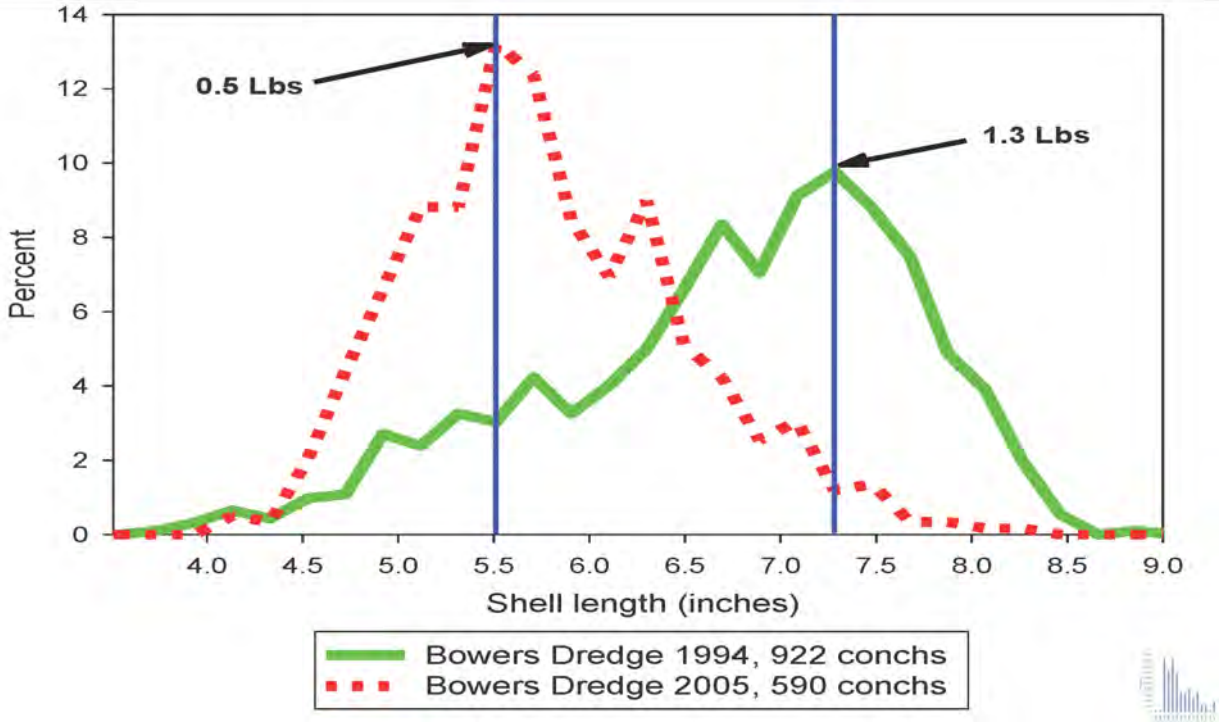
Fishery Landings & Timeline



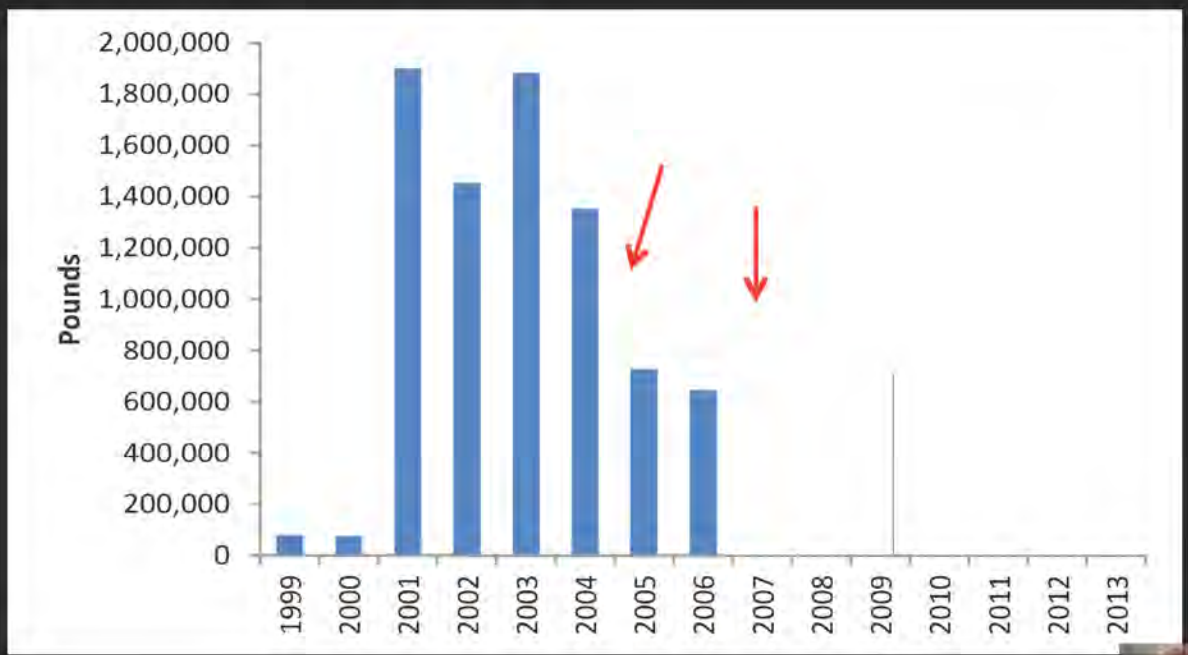
Stock Decline: Fishery CPUE

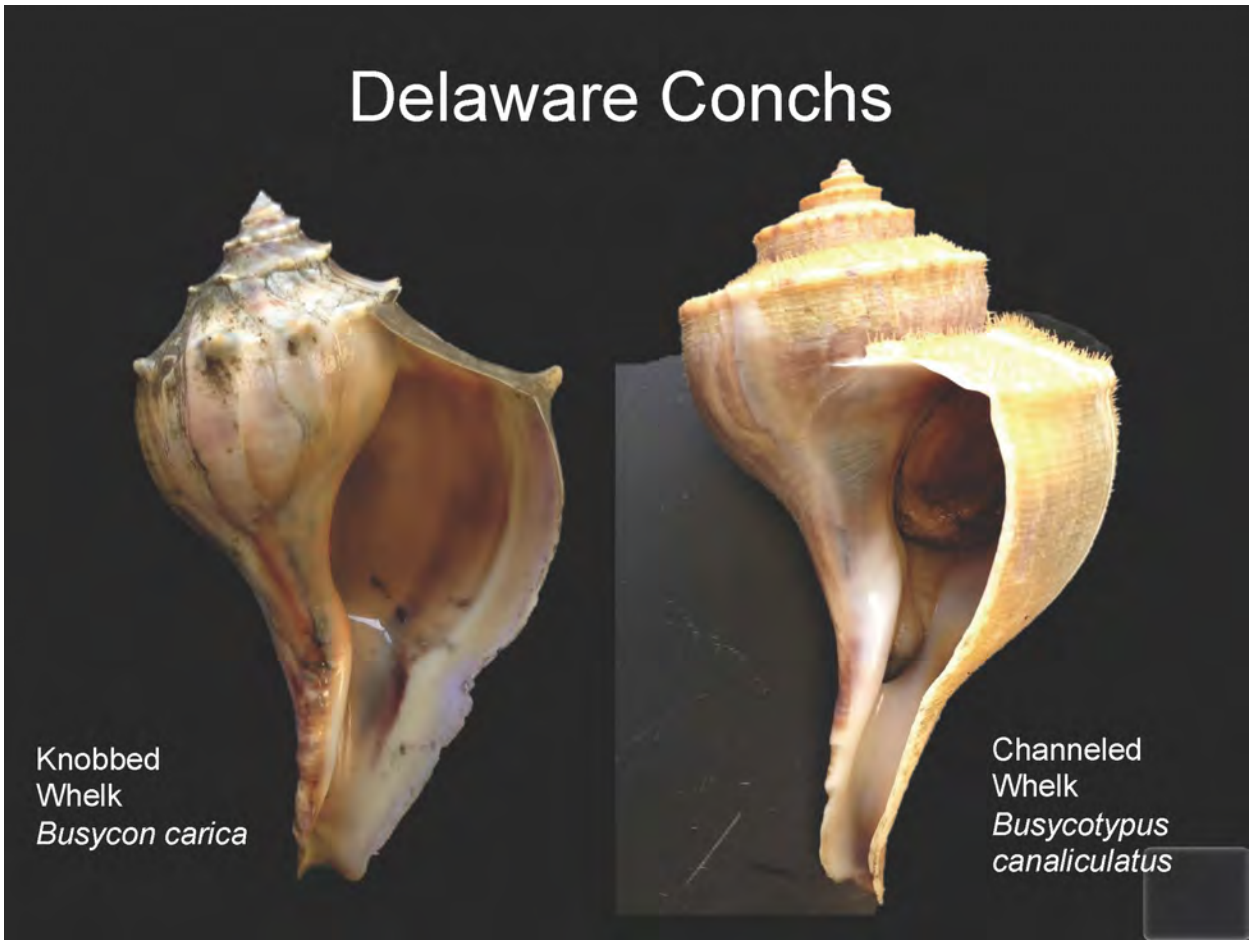


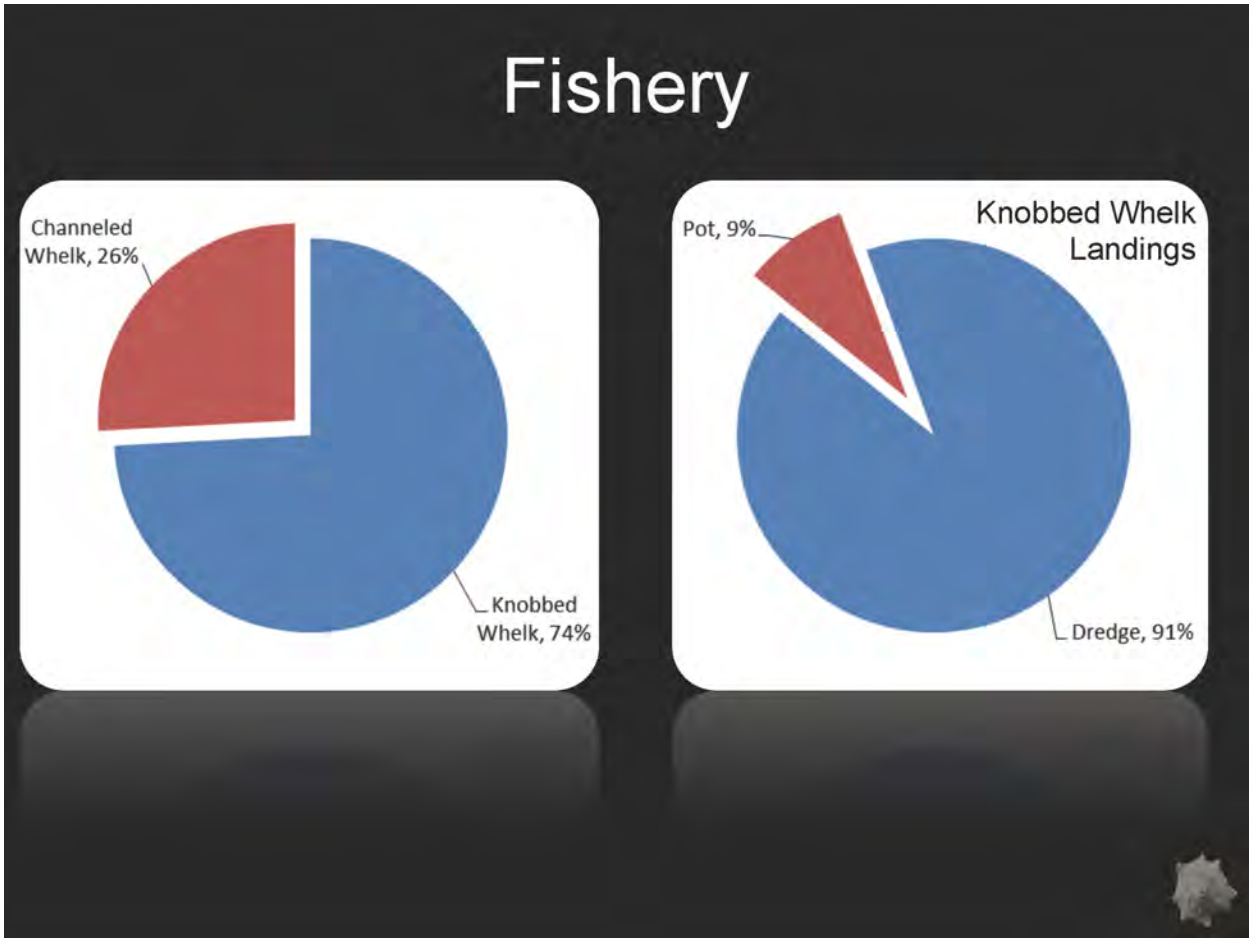
Stock Decline: Size Truncation



Fishery Landings & Timeline

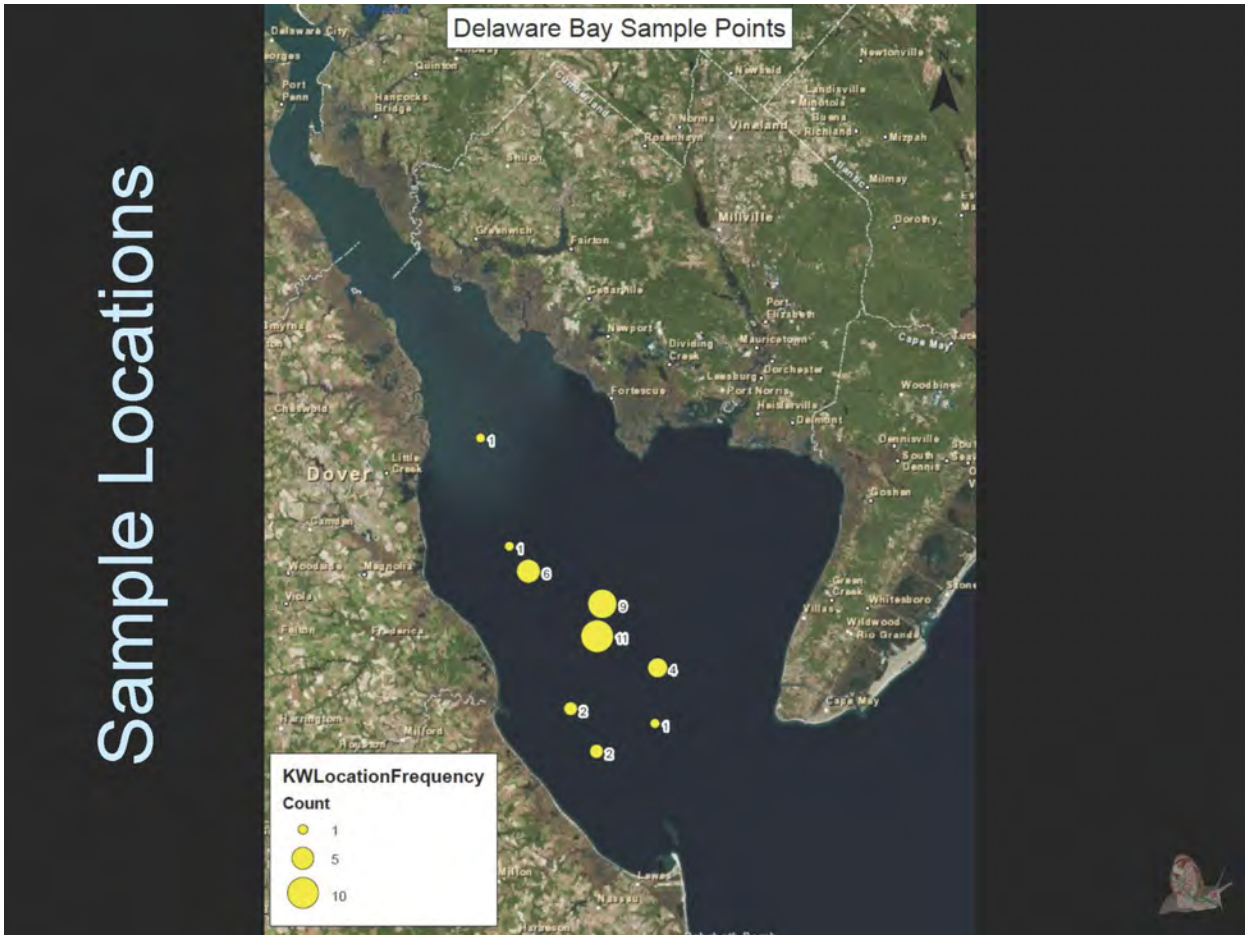



Delaware Conchs
Knobbed
Whelk
Busycon carica
Channeled
Whelk
Busycotypus
canaliculatus

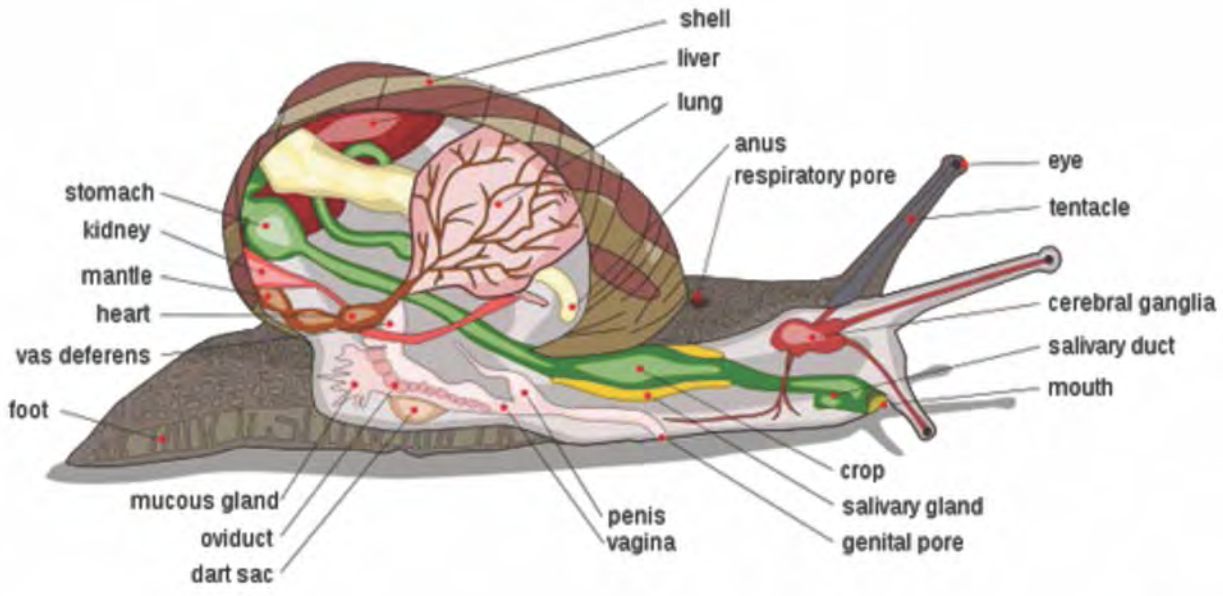

Fishery
Channeled
Whelk, 26%
Knobbed
Whelk, 74%
Knobbed Whelk
Landings
Pot, 9%
Dredge, 91%

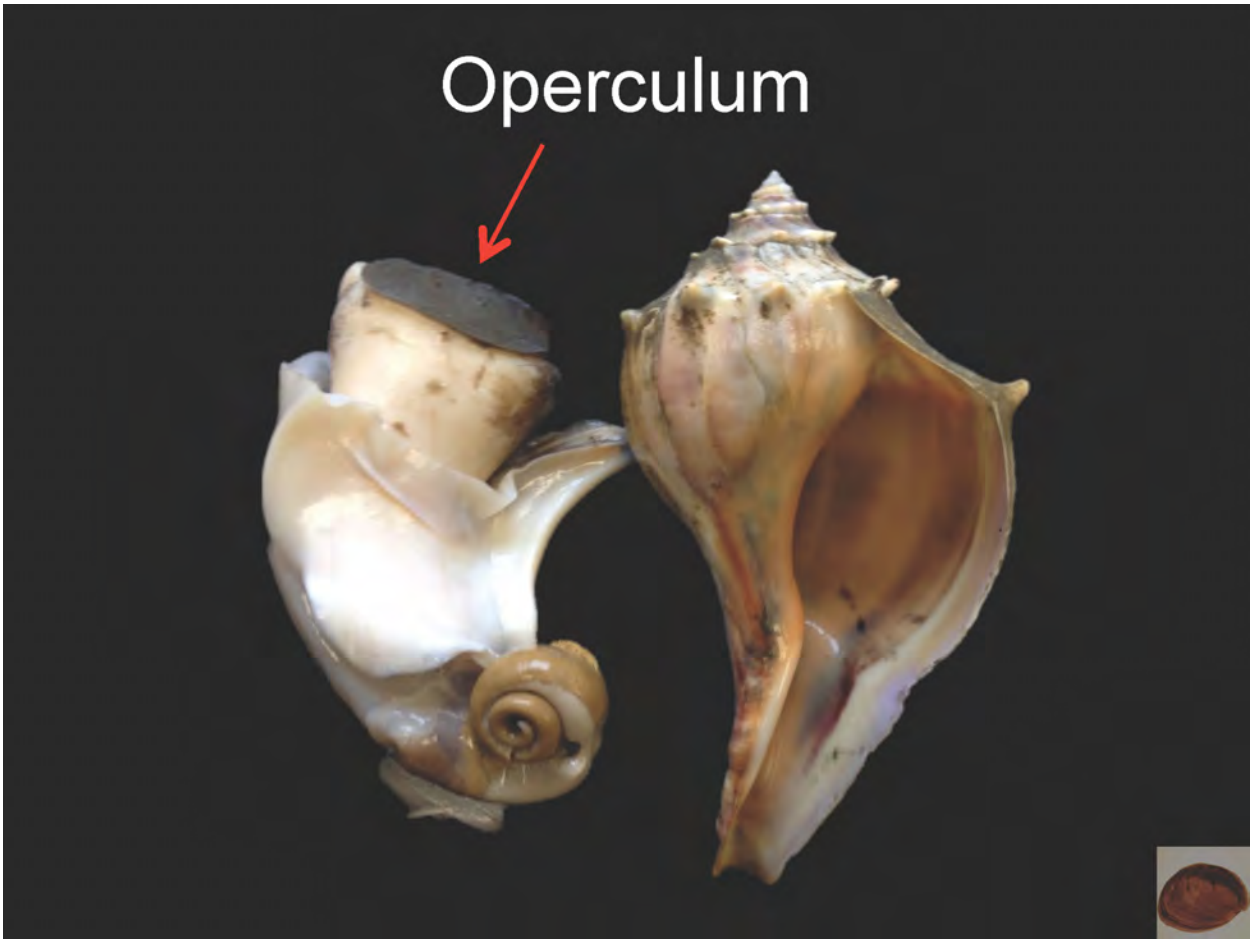

The Knobbed Whelk

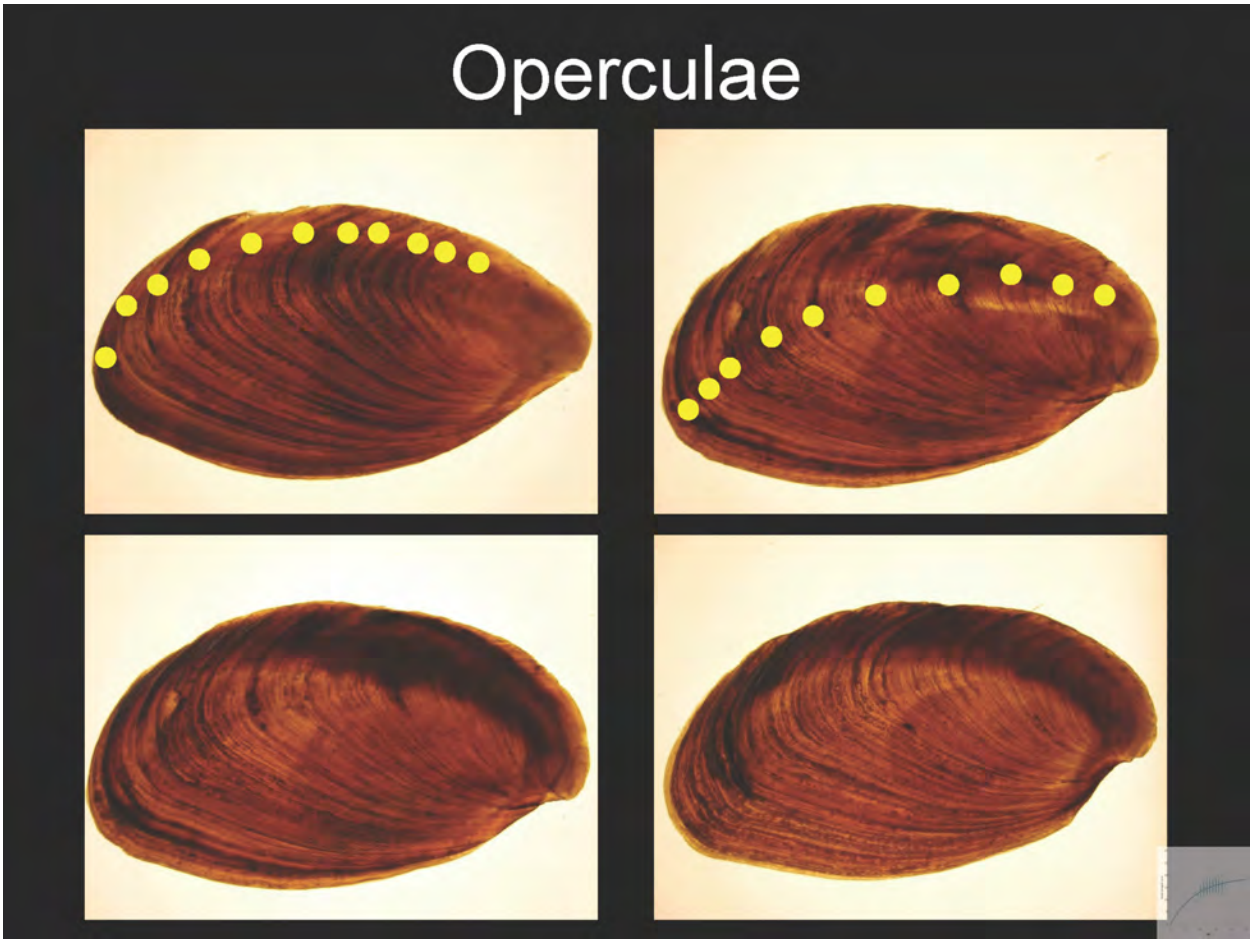

Study Site
Dover


Sample Locations
Delaware Bay Sample Points
KWLocationFrequency
Count
1
5
10
Dover
Millville
Vineland
Cape May

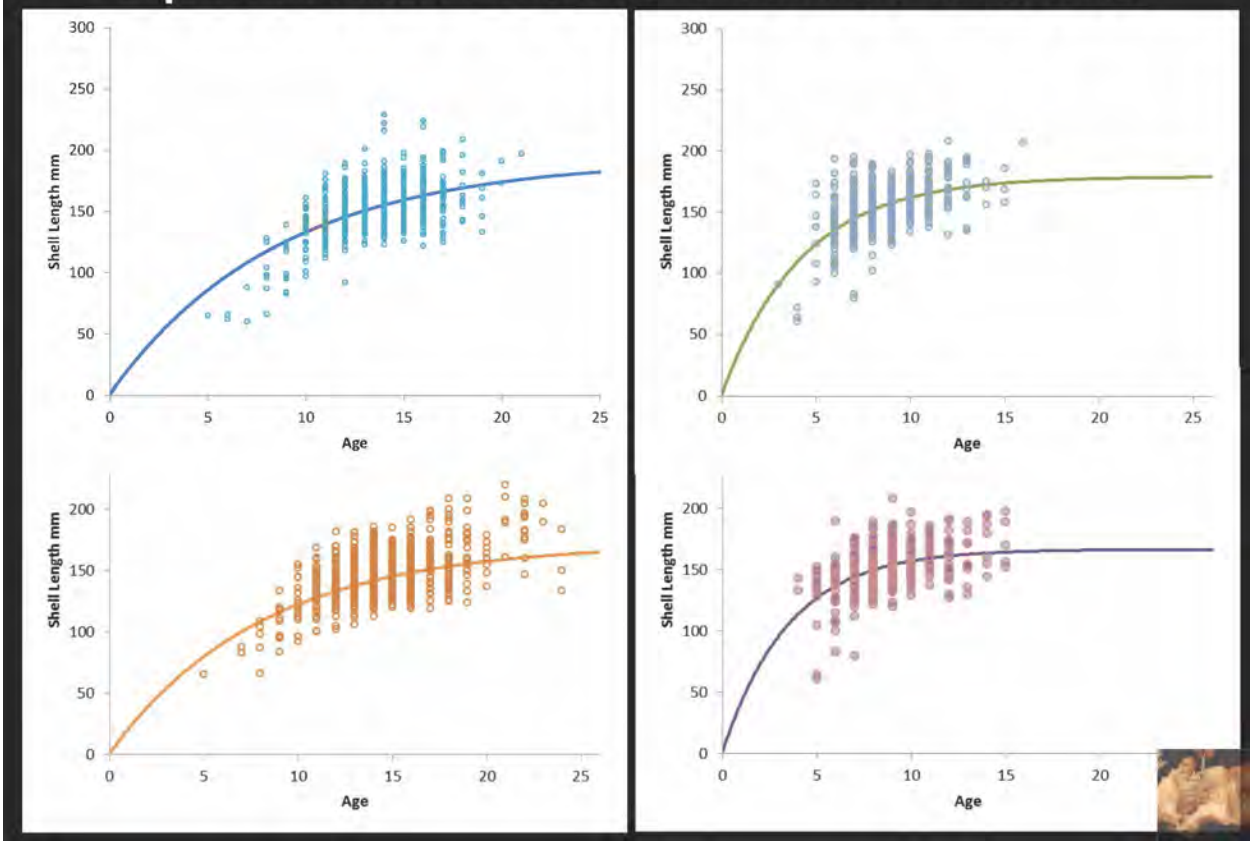
Not a Fish


shell
liver
lung
anus
respiratory pore
eye
tentacle
stomach
kidney
mantle
heart
vas deferens
foot
cerebral ganglia
salivary duct
mouth
crop
salivary gland
genital pore
penis
vagina
mucous gland
oviduct
dart sac

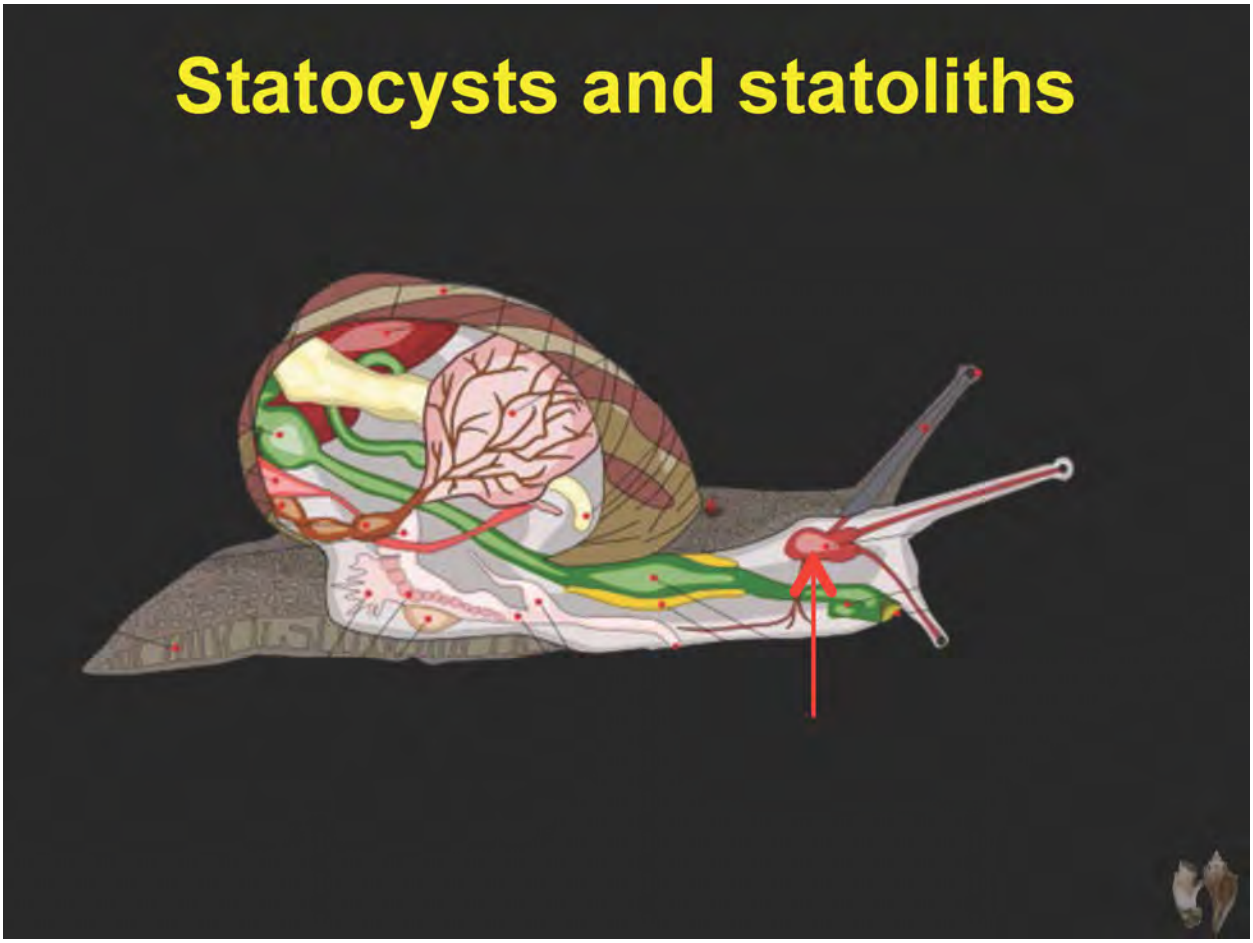

Operculum

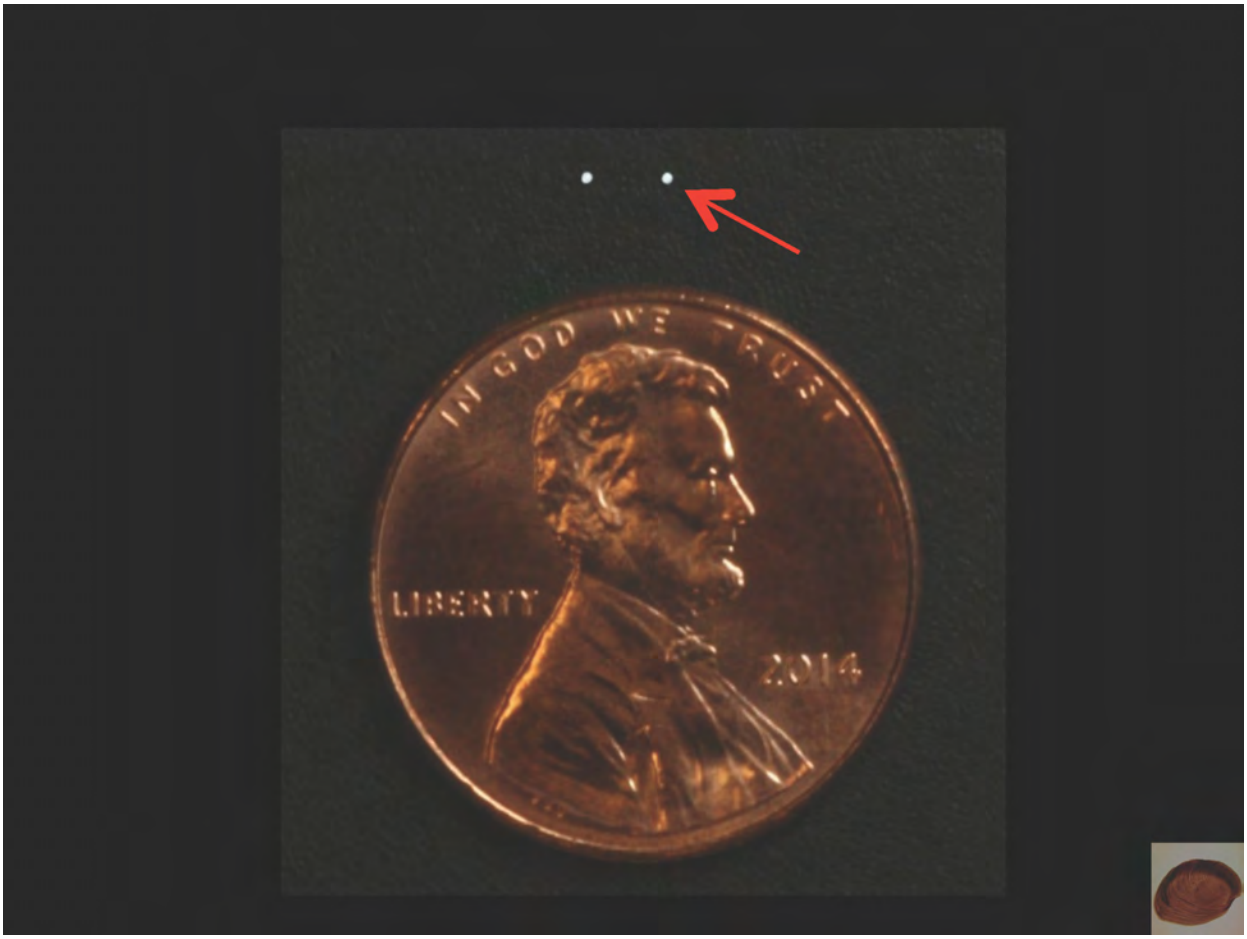

Operculae

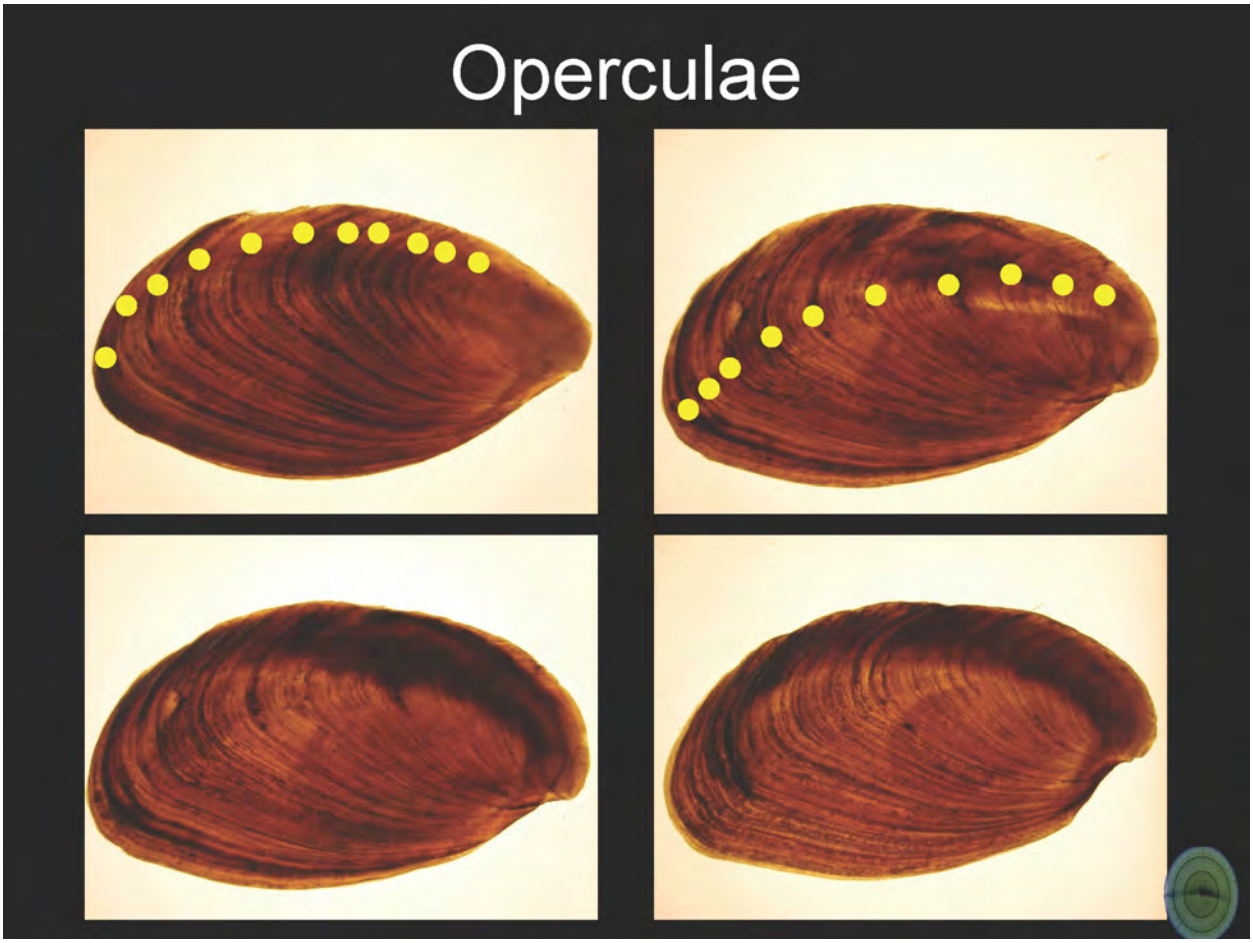
Operculum Based Growth Curves

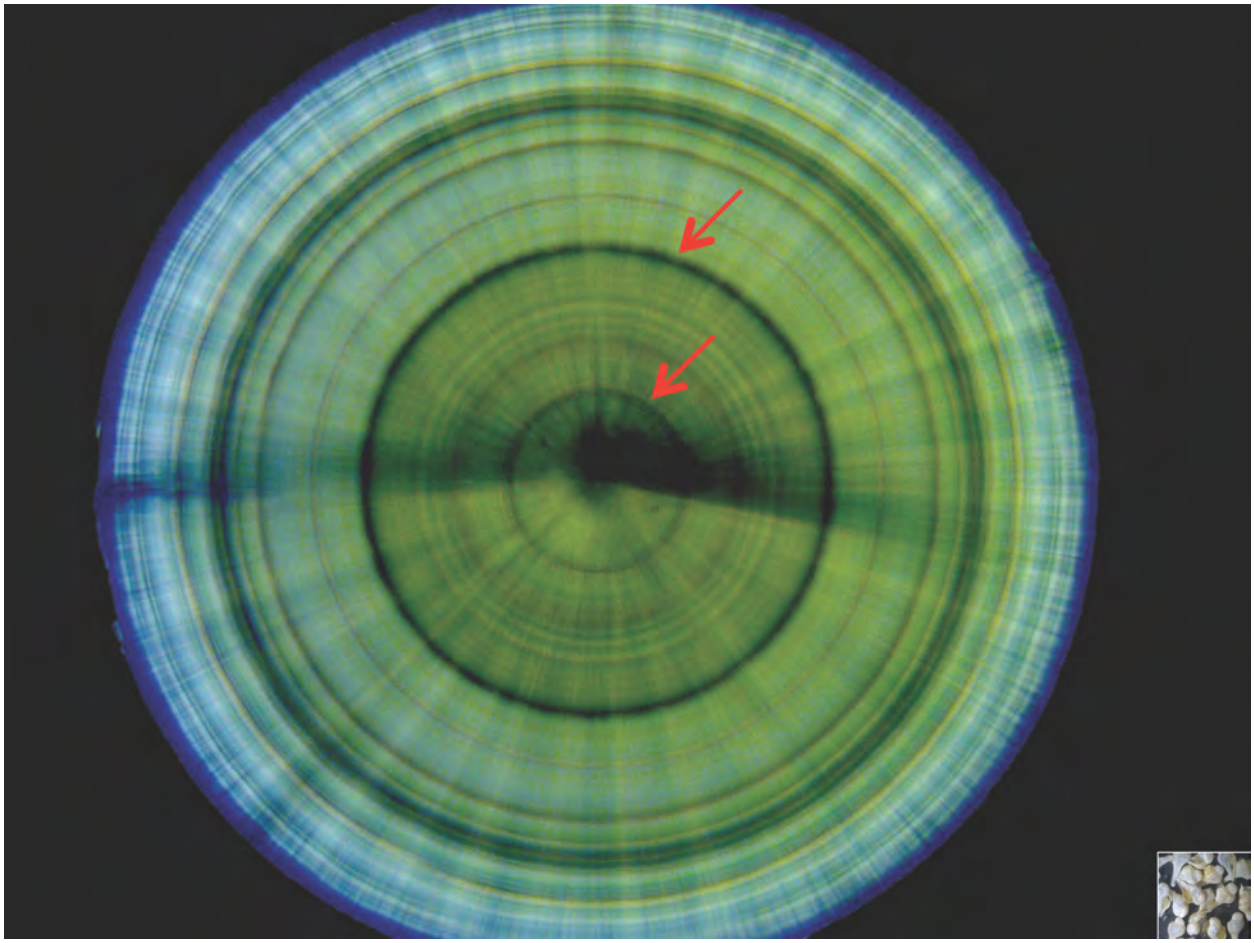


Statocysts and statoliths

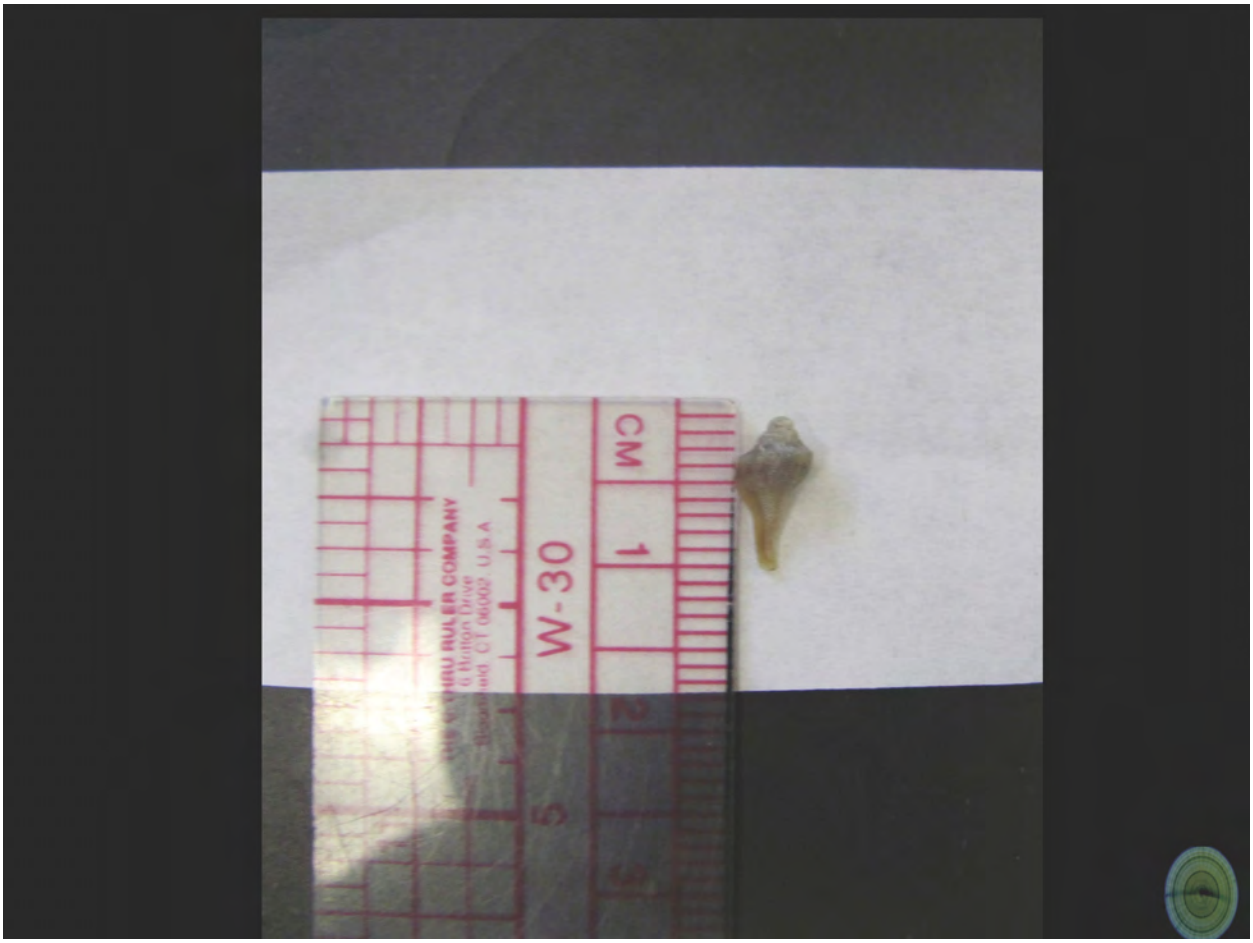


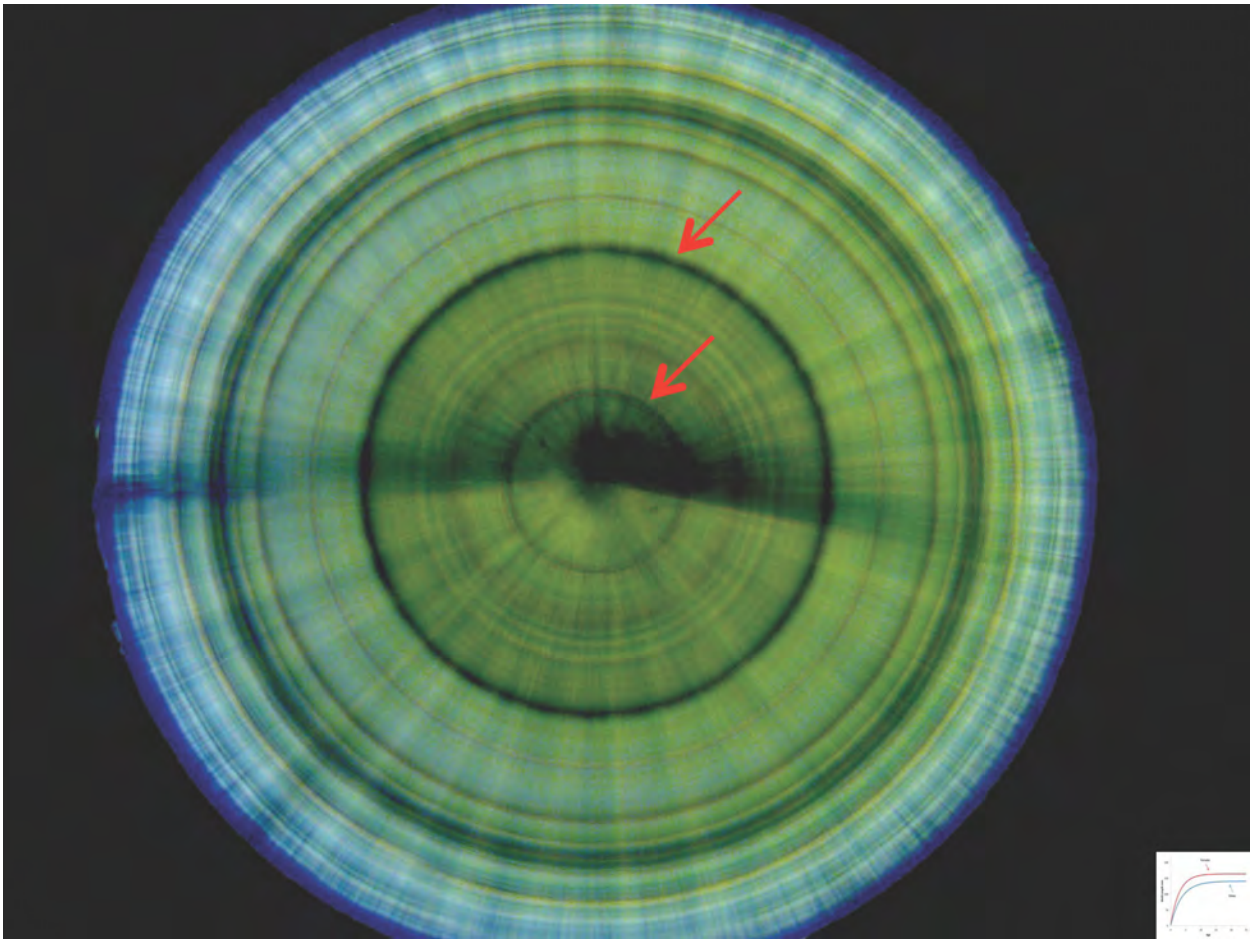

IN GOD WE TRUST
LIBERTY
2014

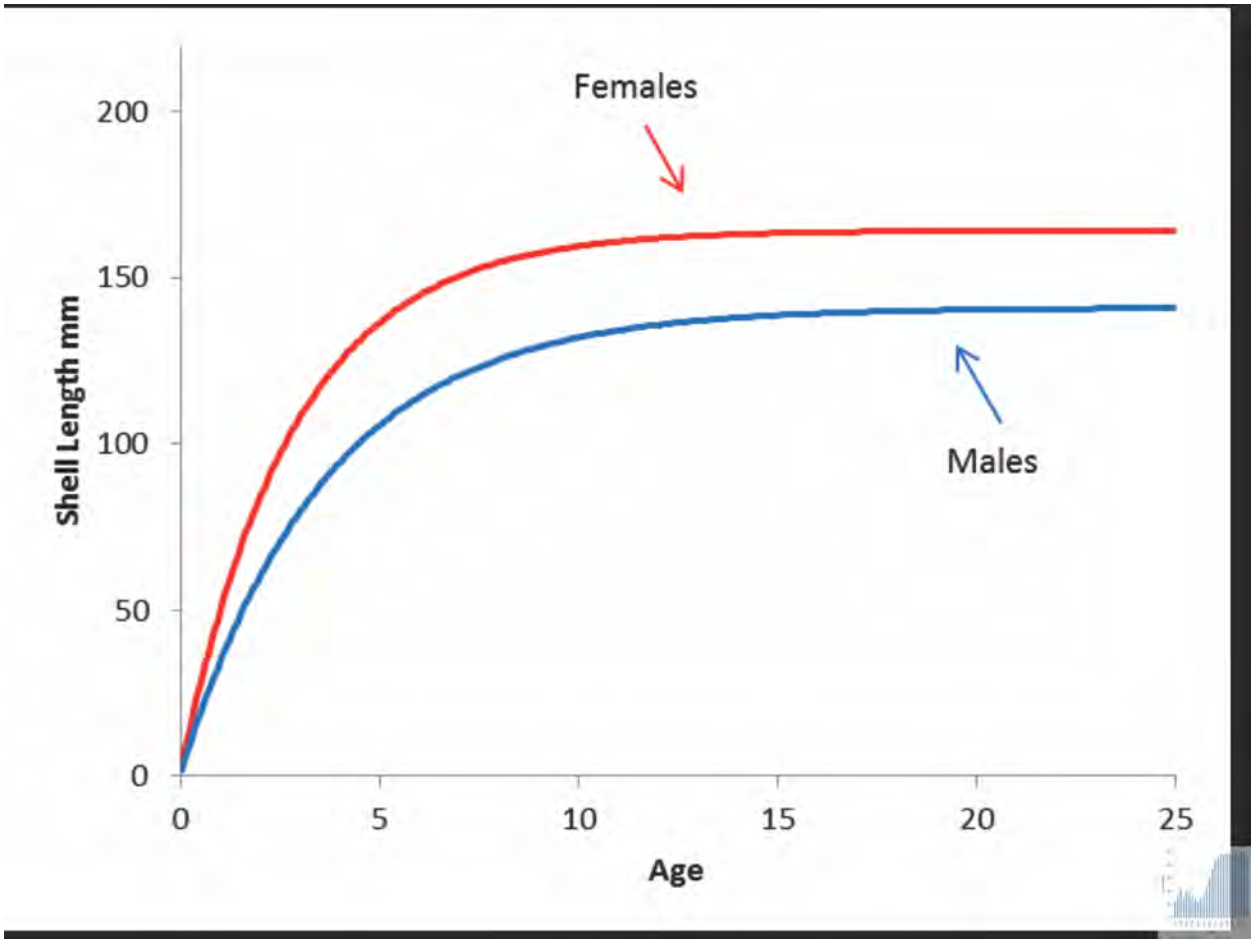

Operculae

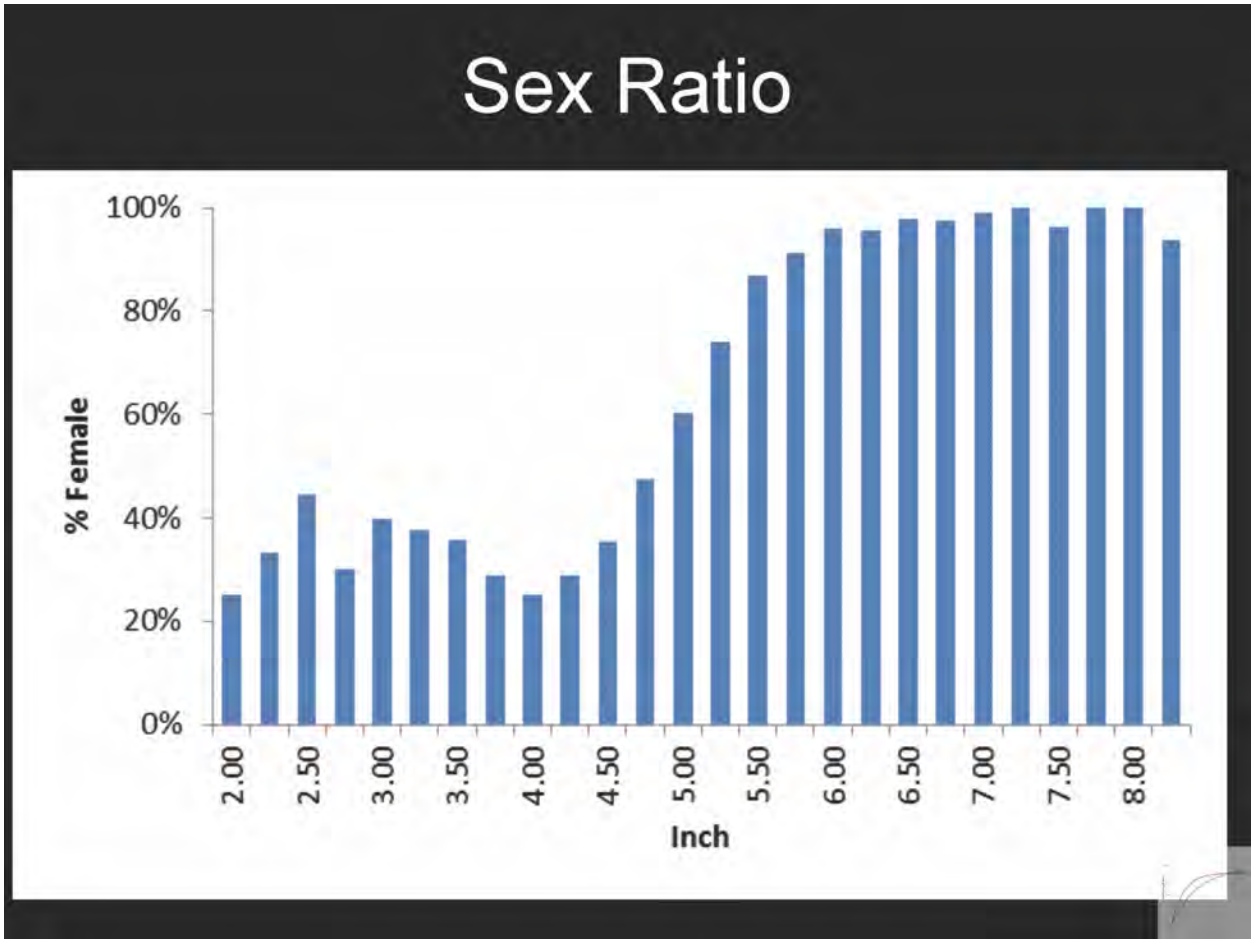



New Hatchlings

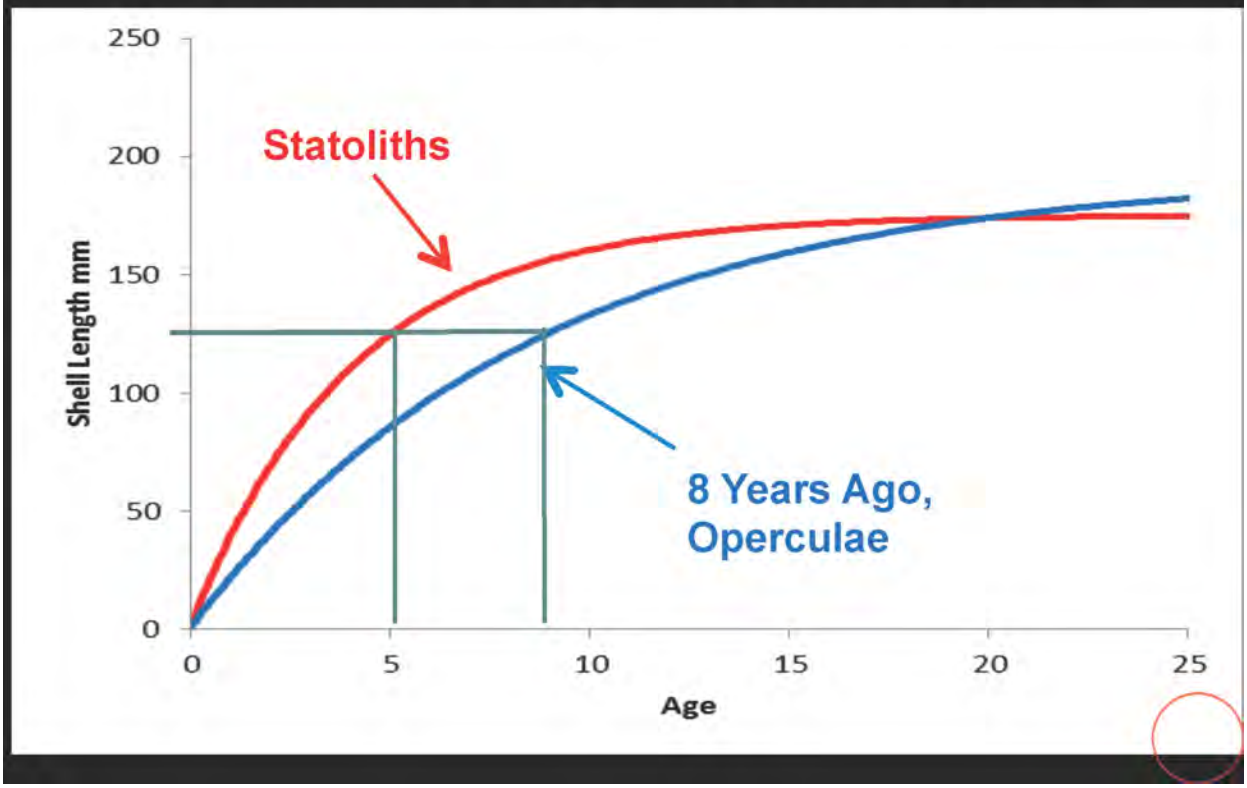

W-30
CM
1
2
5



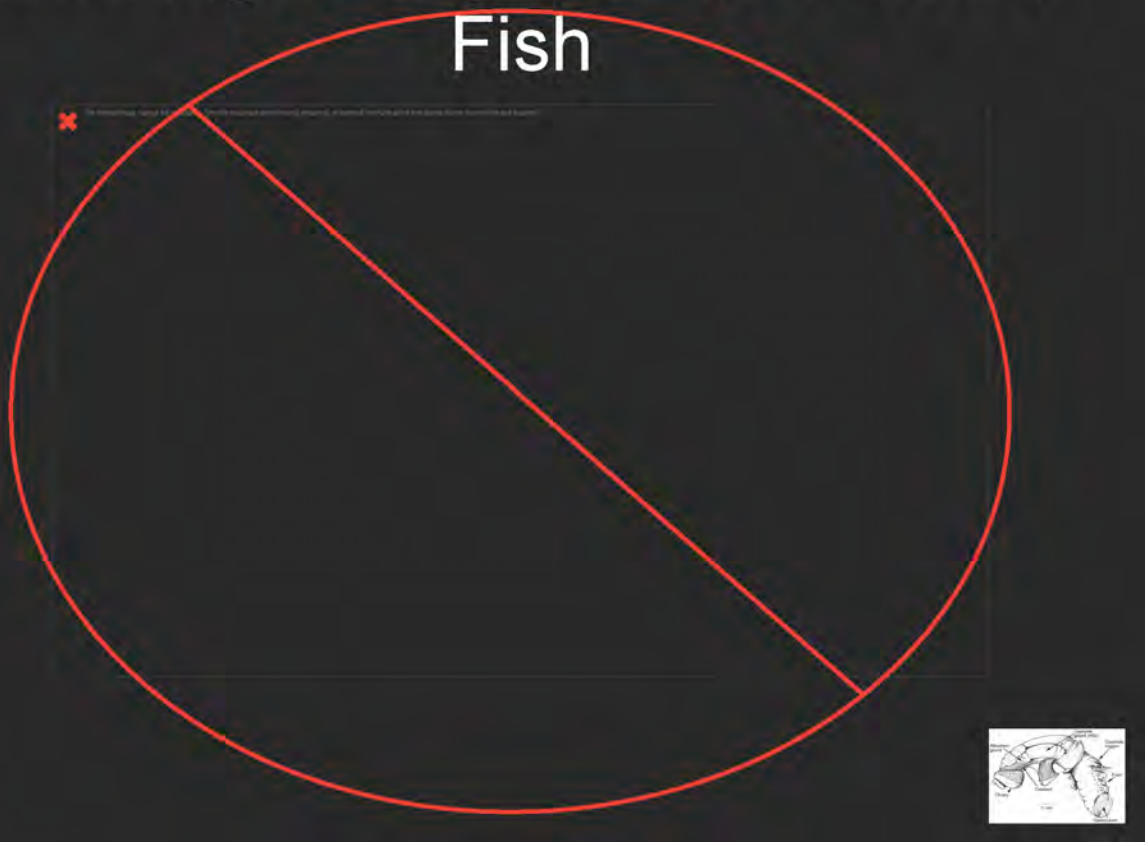

Females
Males
Shell Length mm
200
150
100
50
0
0
5
10
15
20
25
Age


Sex Ratio
% Female
100%
80%
60%
40%
20%
0%
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
Inch

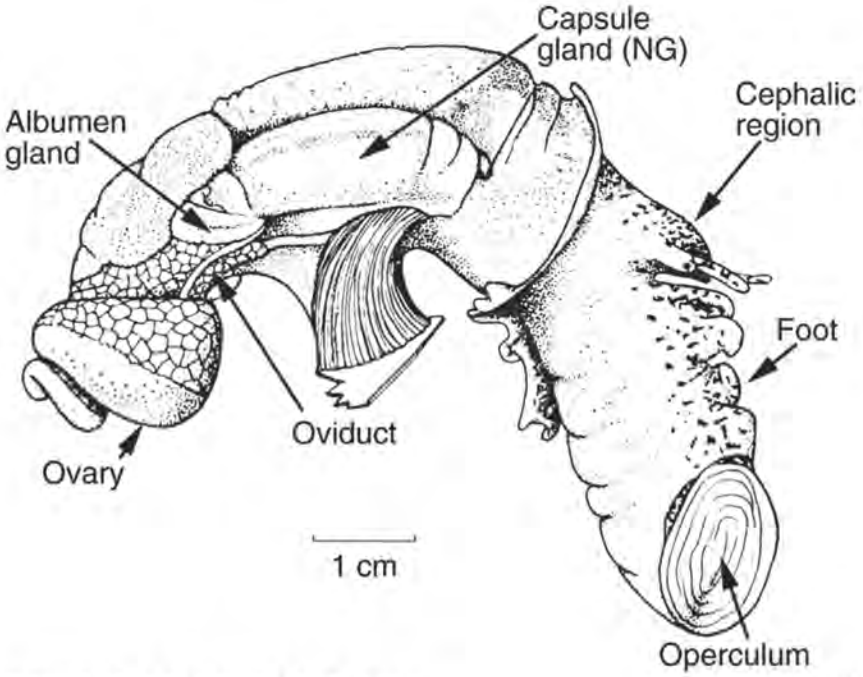
Understanding Growth Rates



Looking at Reproduction: Not a Fish

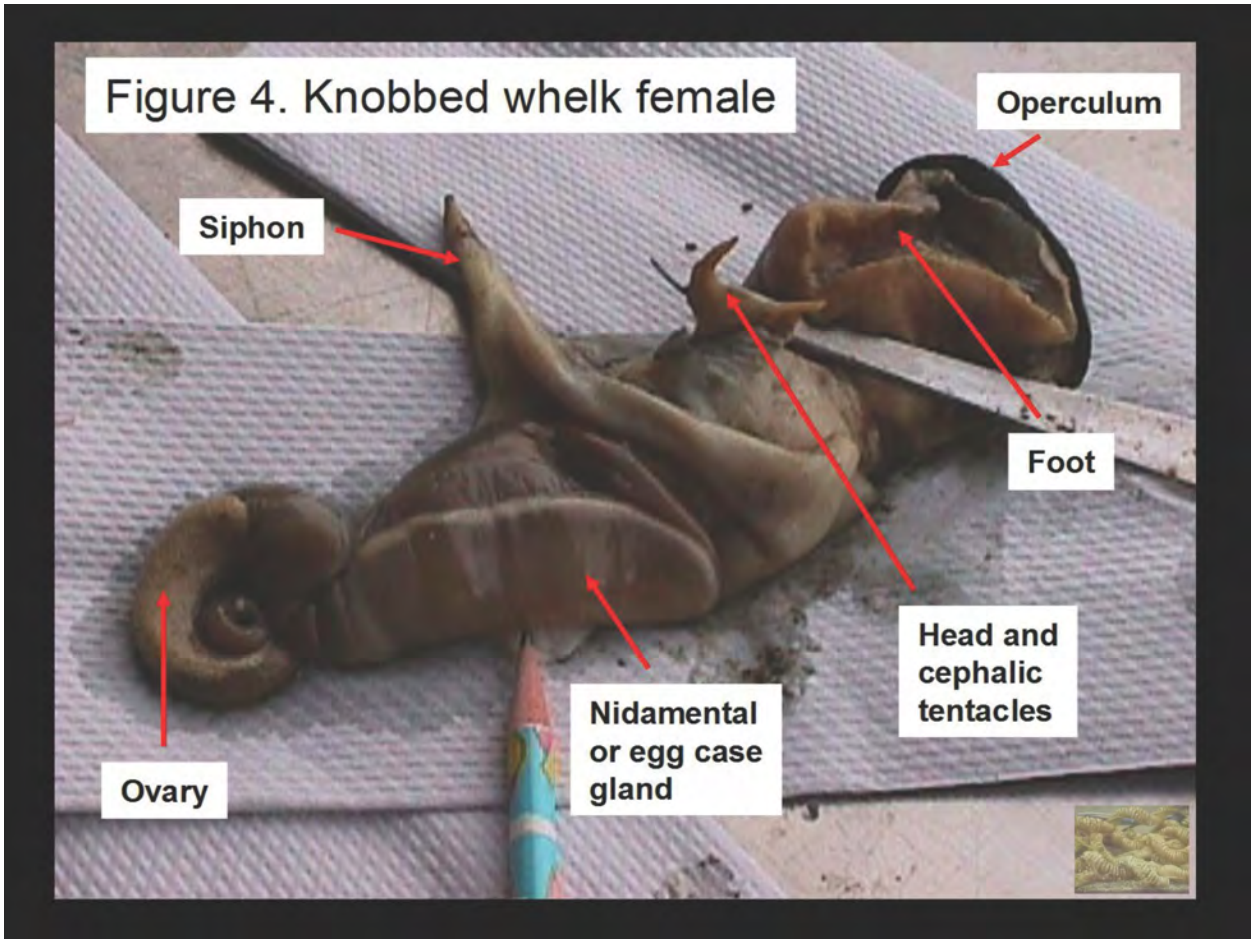


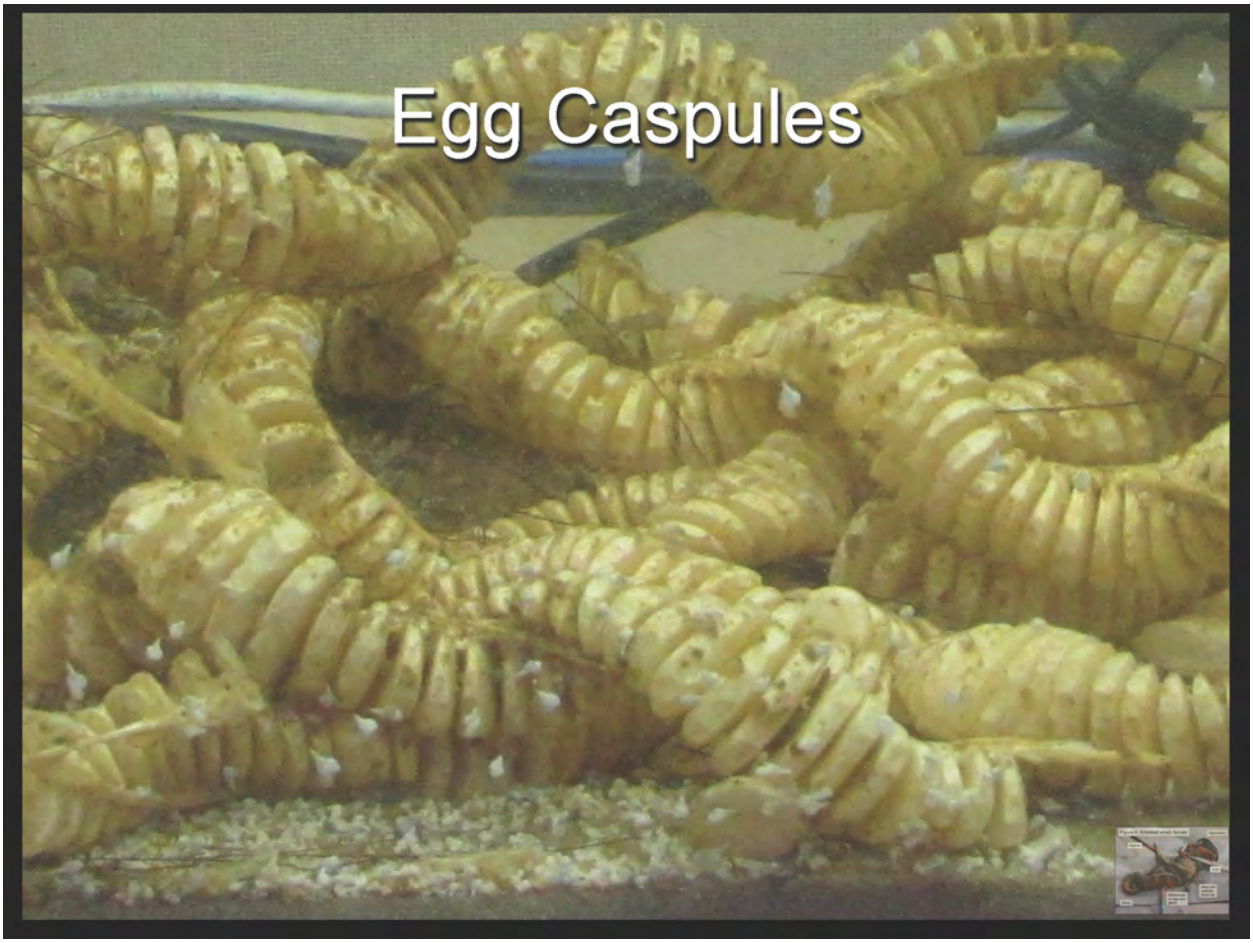
Reproductive anatomy of a prosobranch



Rapoport H S , and Shadwick R E J Exp Biol 2007;210:12-26

The Journal of Experimental Biology




Egg Caspules

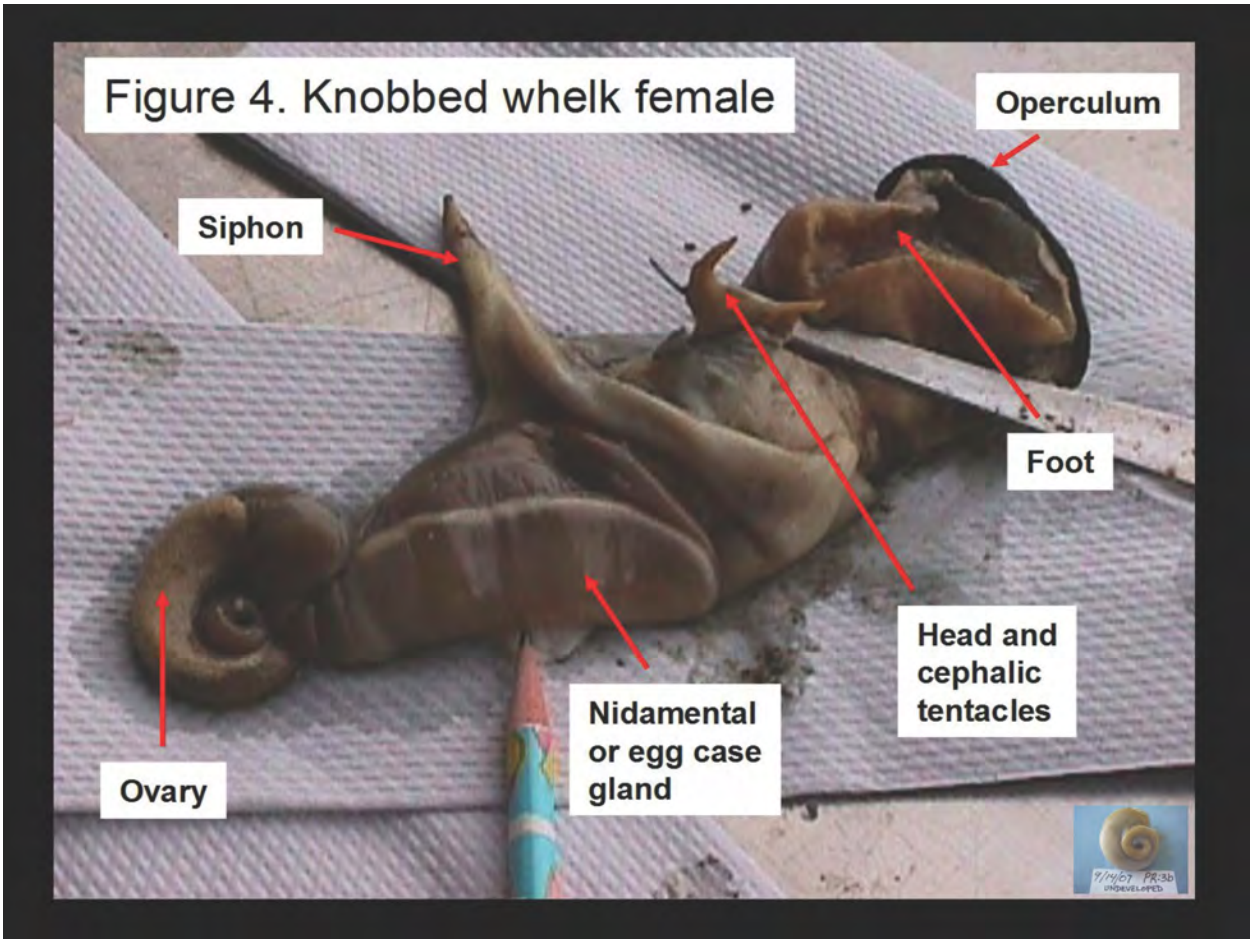
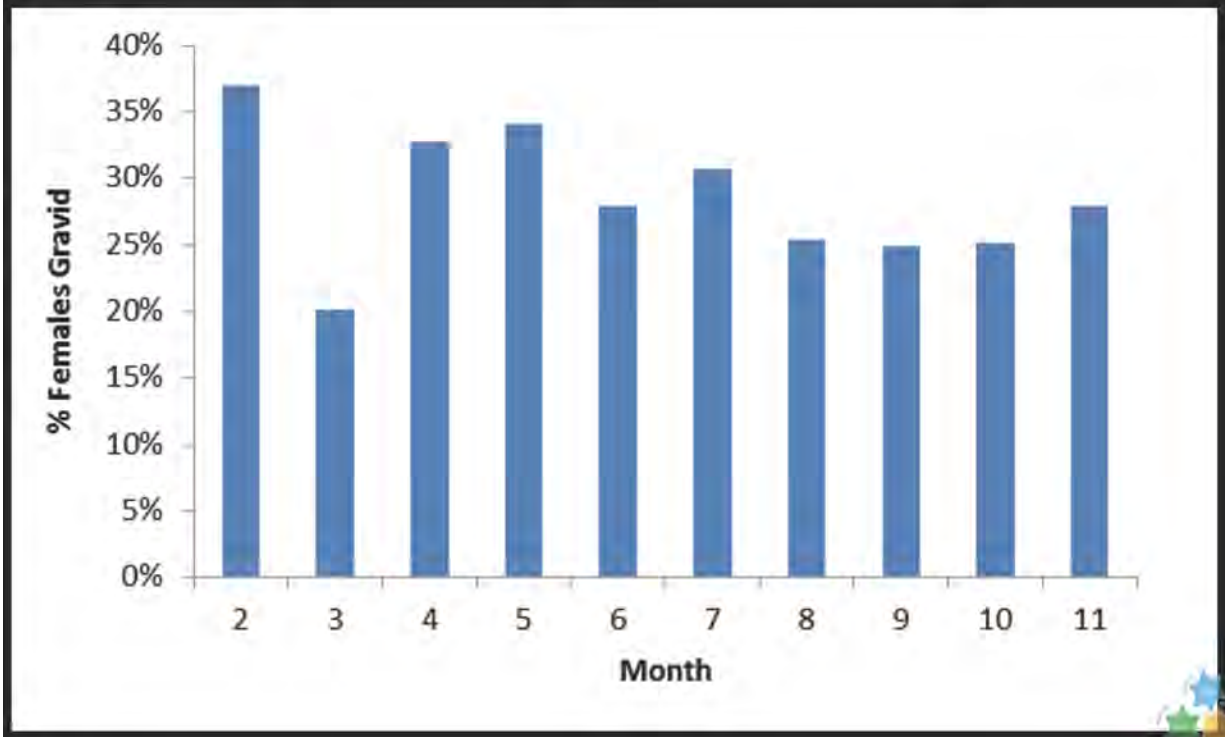


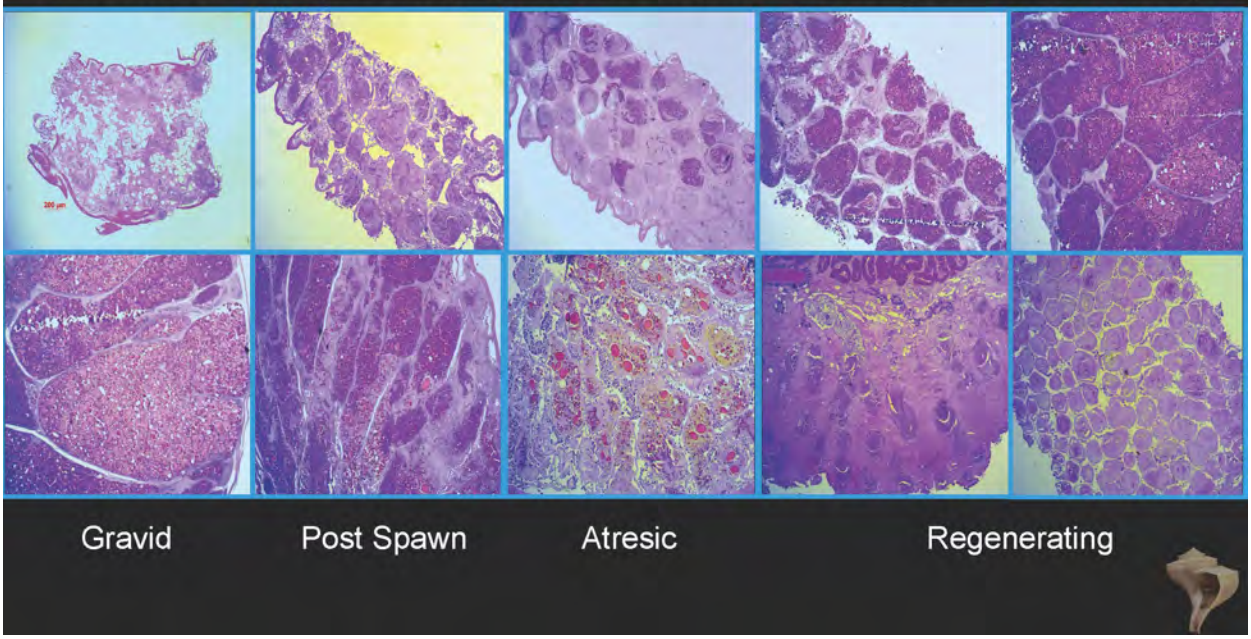
Figure 4. Knobbed whelk female
Operculum
Siphon
Foot
Head and cephalic tentacles
Nidamental or egg case gland
Ovary

Spawning Seasonality

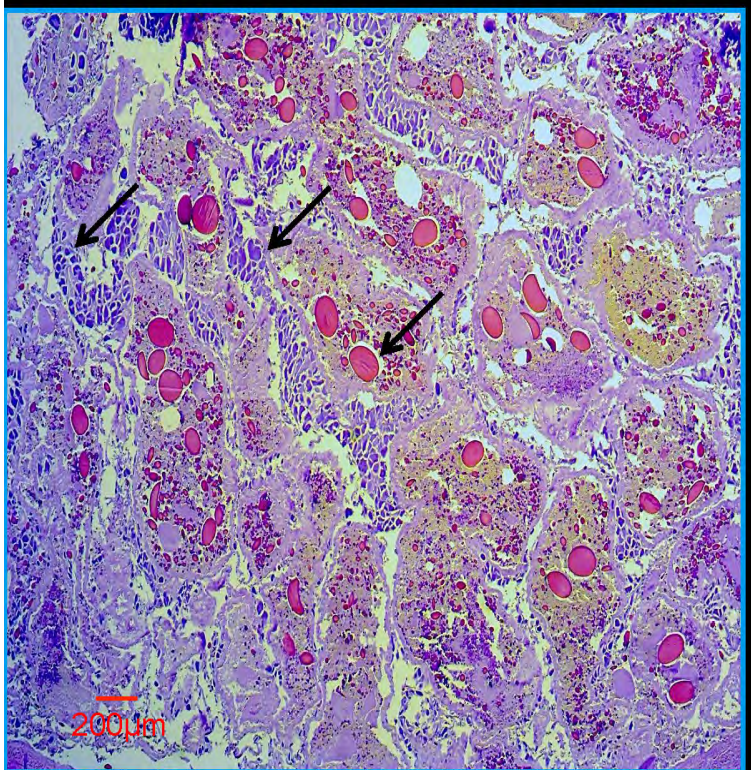


Macroscopic Ovary Staging

Histology



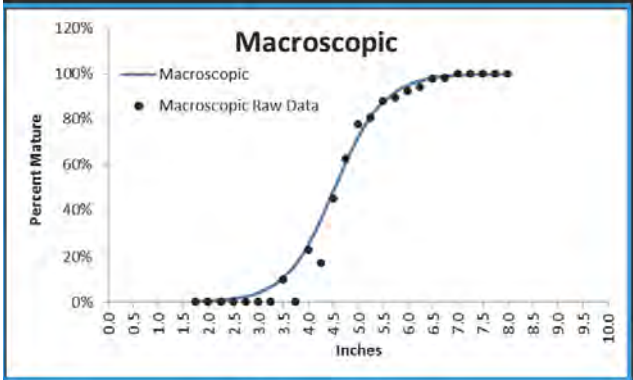
Histological Examination

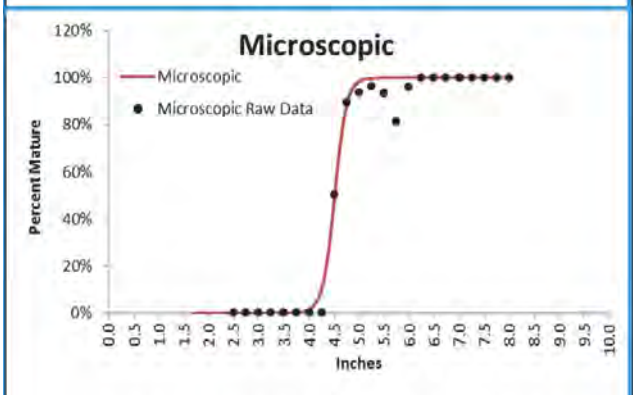


Atresic

- Oocytes were generally circular, with signs of membrane erosion
- There was open space seen between the oocytes
- No elongated oocytes like the ones seen in the previous stage
- Large yolk granules were still present, and were still in the process of being absorbed
- Phagocytic cells were seen enveloping some of the larger yolk granules

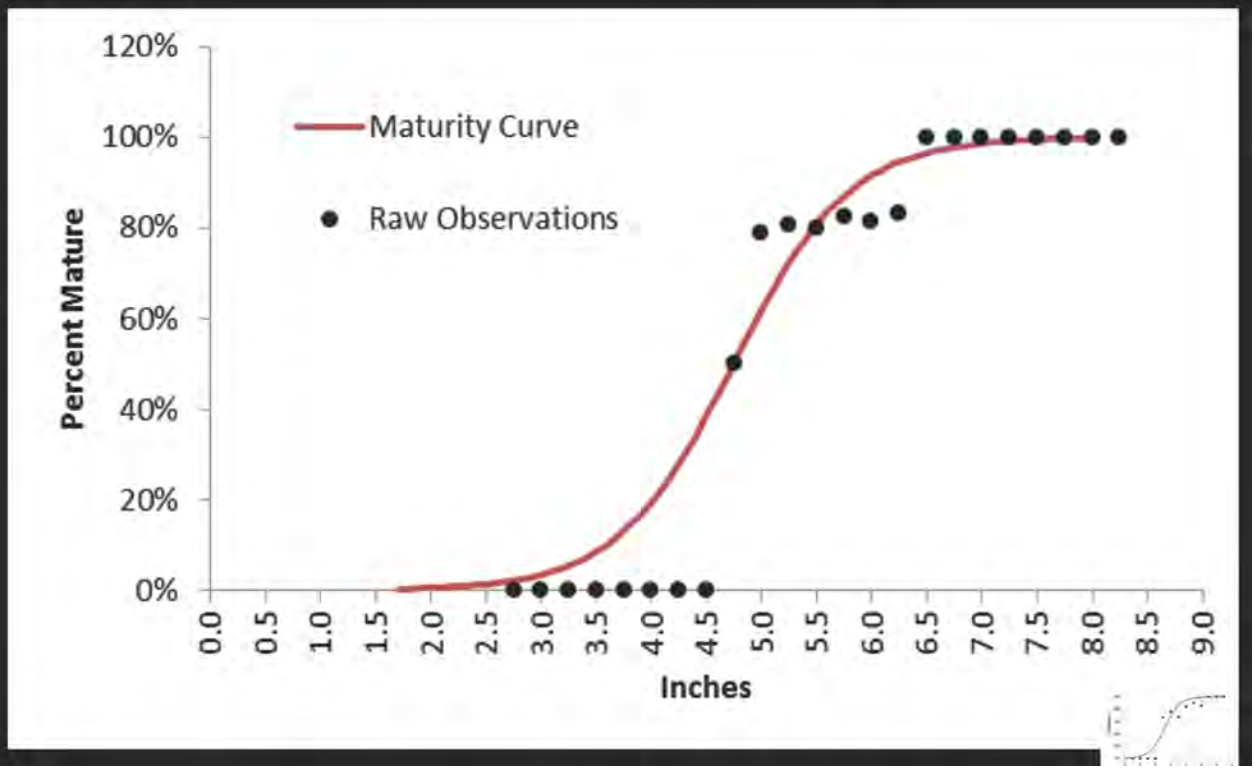
Macro VS Micro



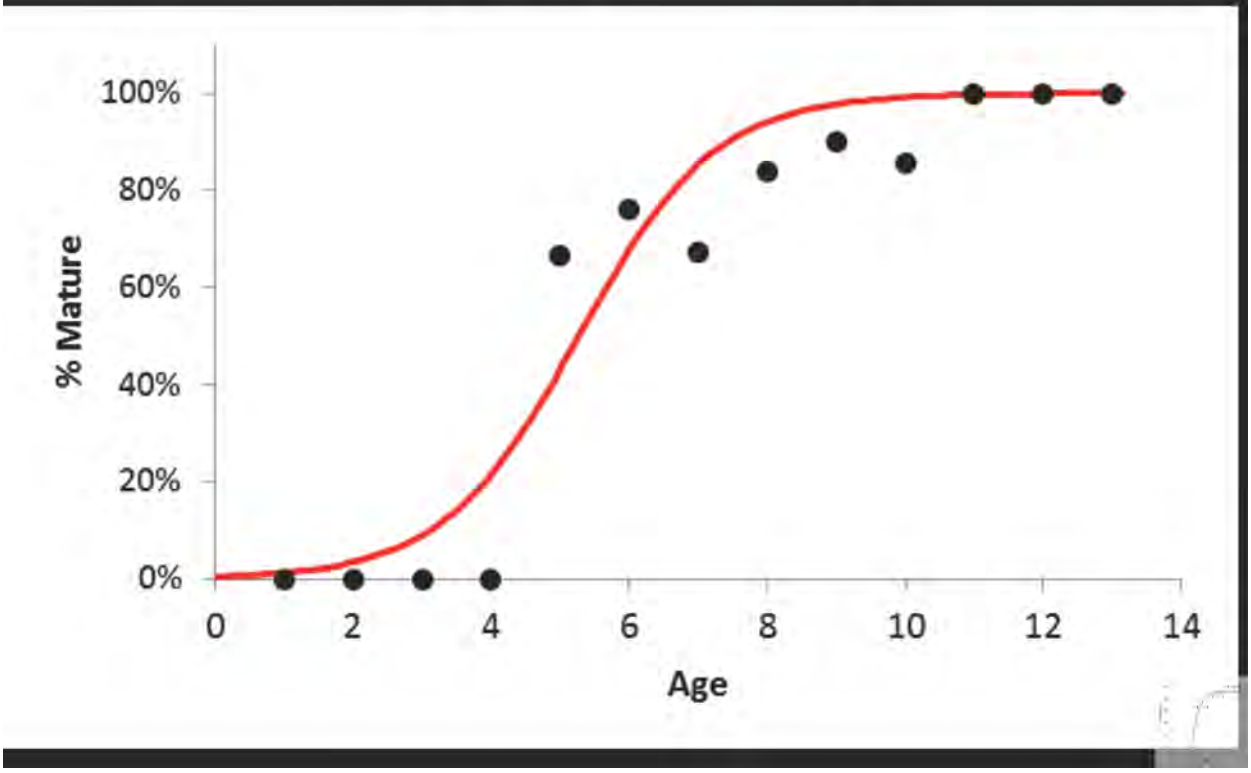


- Regenerating animals in the 5"-7" throw off the curve
- Curve is weighted, there are more observations at the larger sizes
- Macroscopic curve shows mature animals in the 2.5"- 4" range
- Knife-edge change from immature to mature with microscopic curve
- 50% mature at 4.5" for both curves
- 100% maturity at:
- 6.25" macroscopically
- 5.25" microscopically

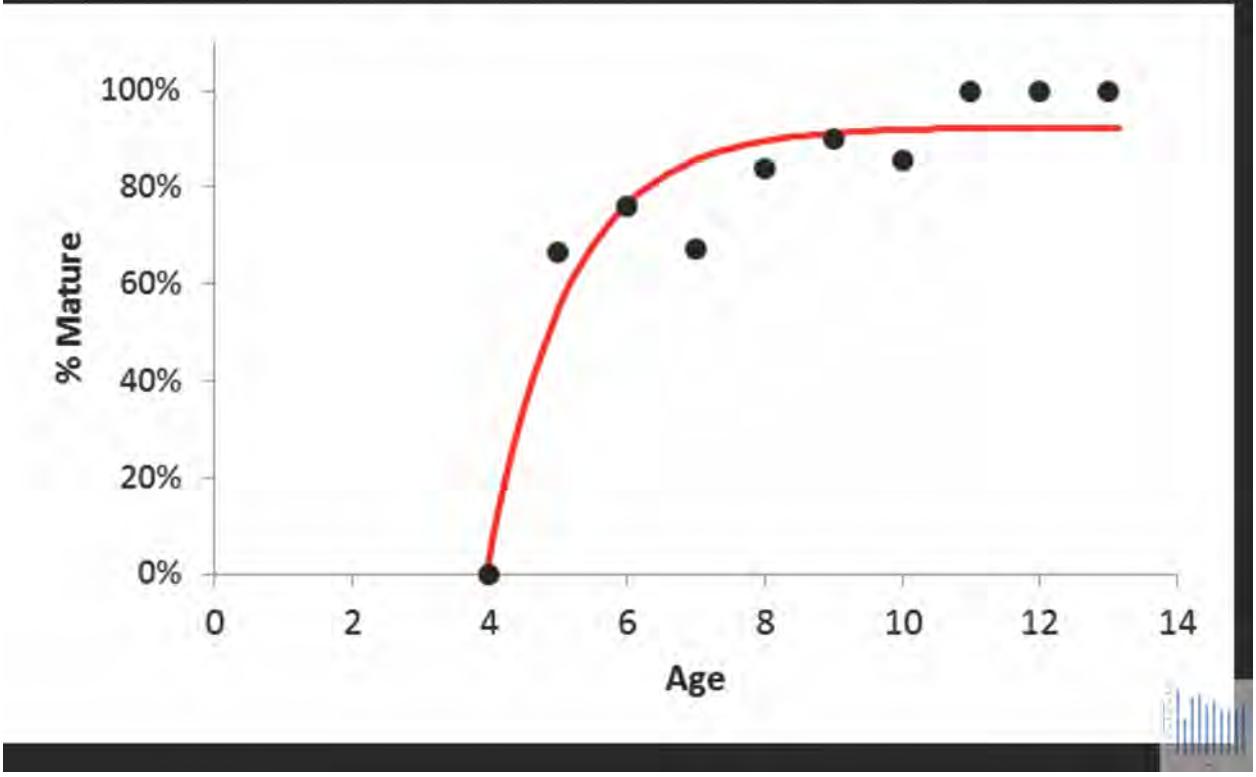
Size at Spawning



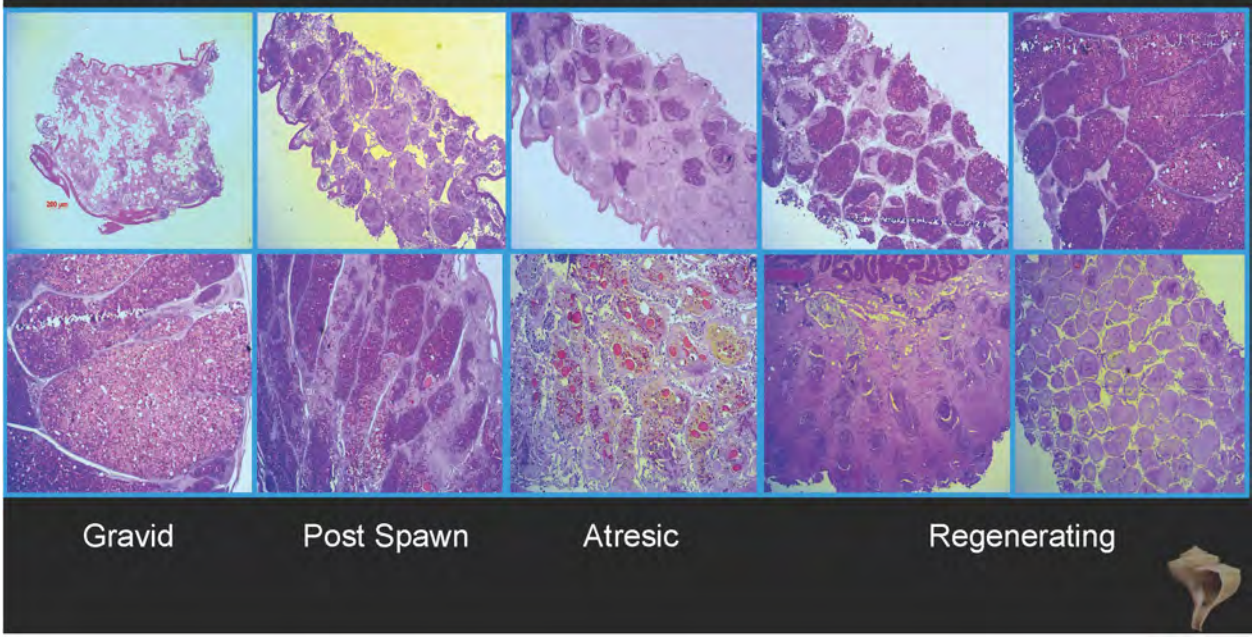
Age at Maturity



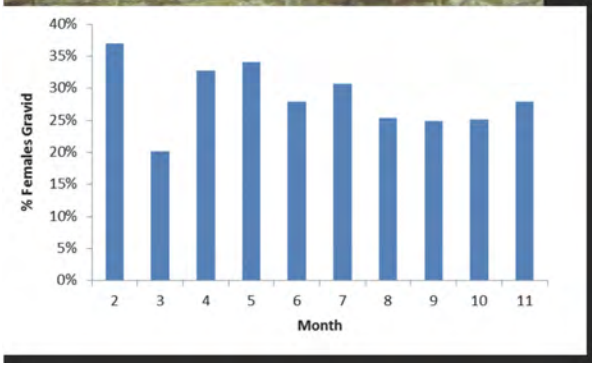
Age at Maturity

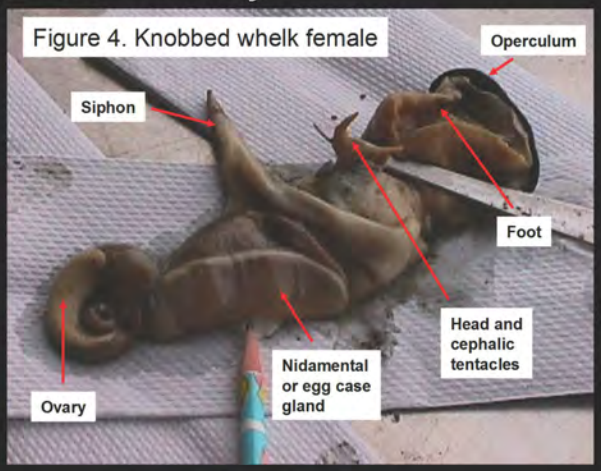


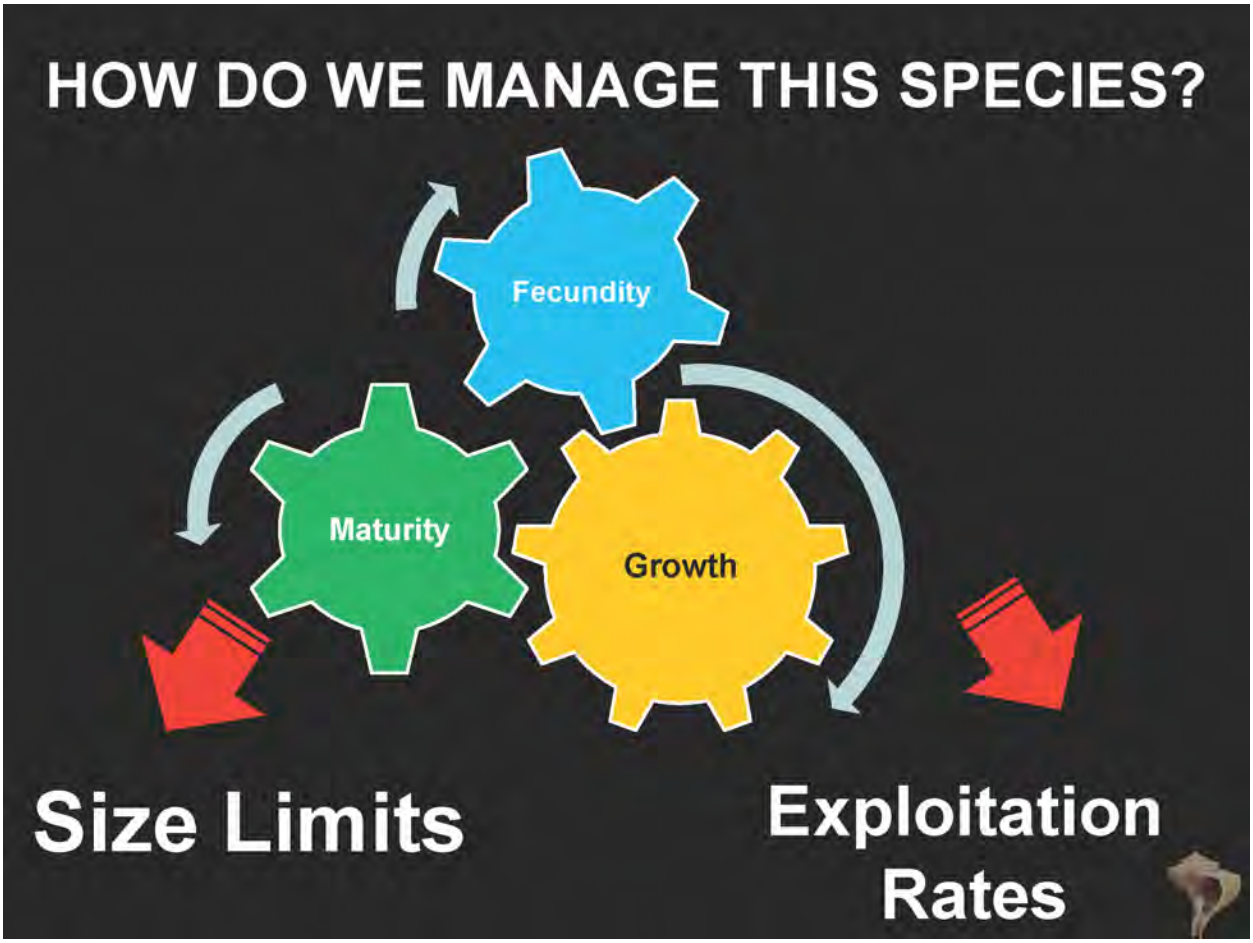
Synchronous Oocyte Development
Huge Energy Investment in Oocytes

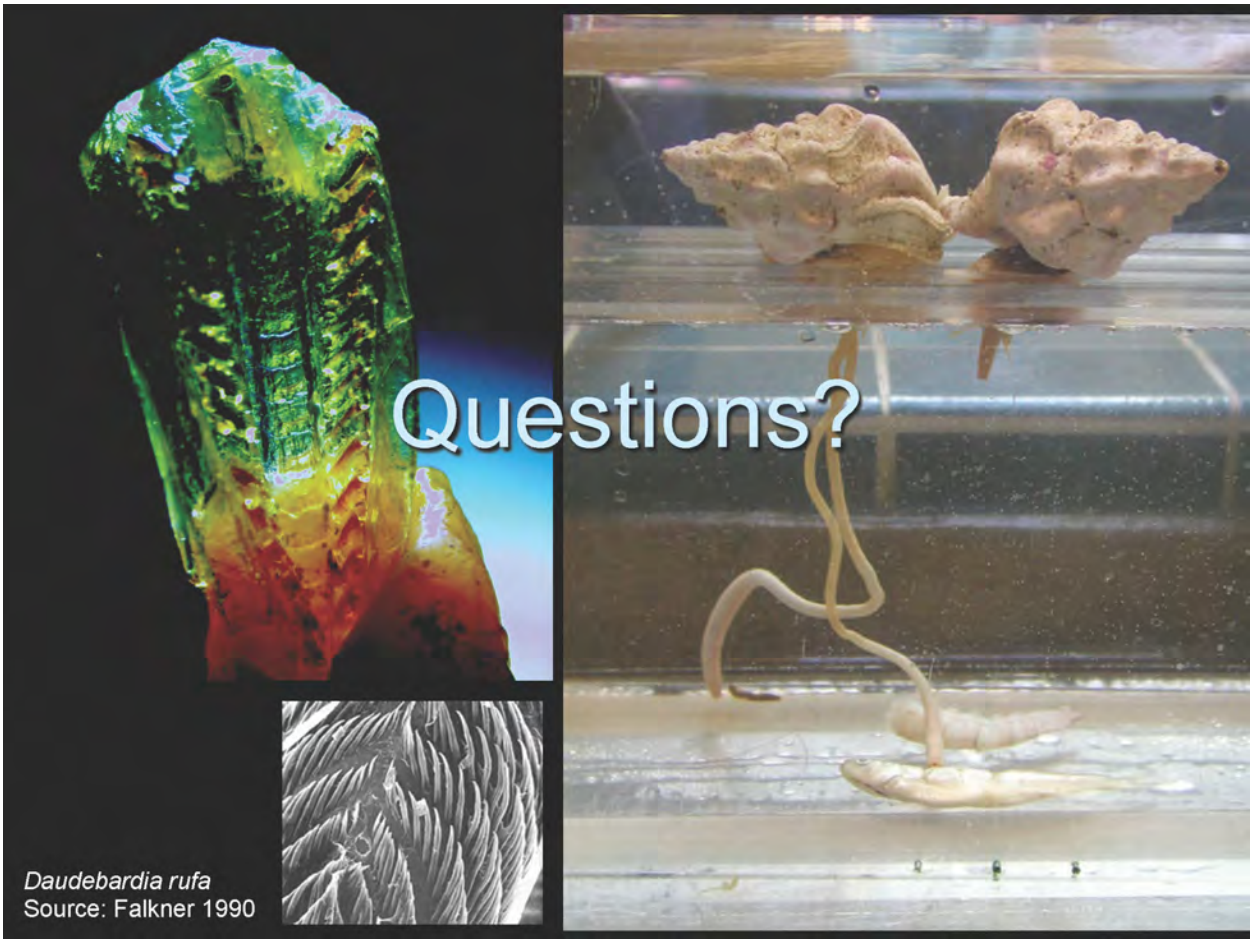


Intermittent Spawning Frequency
Big Investment into Egg Case
Low Fecundity
No Spawning Seasonality






HOW DO WE MANAGE THIS SPECIES?
Fecundity
Maturity
Growth
Size Limits
Exploitation Rates


Questions?
Daudebardia rufa
Source: Falkner 1990

Reproduction Synopsis

- Synchronous oocyte development
- Lack of seasonality in spawning
  - Inability to set birth date for statolith aging
- Low fecundity
- Suggests substantial energetic costs
  - protective egg capsules
  - Tremendous oil/yolk production
  - Fully formed, shelled hatchlings
- Intermittent Spawning Frequency?

Conclusions

- Highly vulnerable to overfishing
  - Slow growth (but not as slow as we thought)
  - Low fecundity
  - Prolonged & costly reproductive cycle with no spawning seasonality suggests intermittent spawning frequency

Age, growth, size at sexual maturity, and reproductive biology of channeled whelk (*Busycotypus canaliculatus*) in the US Mid-Atlantic

Robert A. Fisher
Fisheries Specialist
Marine Advisory Services/ Virginia Sea Grant
Virginia Institute of Marine Science

The channeled whelk (*Busycotypus canaliculatus*) was sampled from three in-shore commercially harvested resource areas in the US Mid-Atlantic: off Ocean City, Maryland (OC); Eastern Shore of Virginia (ES); and Virginia Beach, Virginia (VB). The largest whelk measured 230mm shell length and was recorded from OC. Mean SL was largest in OC site (158.1mm), followed by ES (137.6mm), then VB (132.4mm). Both VB and ES populations showed a unimodal length-frequency distribution with the single peak at shell length less than minimum landing size (MLS) for those regions, while OC population showed a bimodal (two peaks) distribution with the smaller peak at shell length less than the MLS for that region and larger peak at shell length greater than the MLS. Growth coefficient (k) was higher in males than females from all areas, and highest for both sexes in VB (male 0.245, female 0.155), followed by ES (male 0.220, female 0.151), then OC (male 0.112, female 0.100). The median size at 50% mature varied between resource area and sex. Males from ES and VB reached maturity at a smaller mean size (123mm and 121mm, respectively) than OC (134mm). Females from VB reached maturity at a smaller size (148.9mm) than ES (157.6mm) and OC (158.6mm). Recruitment to the fishery was estimated to occur at about 6yrs for VB and 7 to 8 yrs for ES and OC, calculated from length at age estimates from the von Bertalanffy growth model. Under current MLS for each area, whelk harvested from VB recruited into the fishery at a much younger age to those from OC. Under current MLS, the probability of females reaching MLS prior to sexual maturity is quite low for all three resource areas examined.

Full report of this work can be found at www.vims.edu/Greylit/VIMS/mrr15-15.pdf

Channeled whelk
Busycotypus canalicalatus
In the Mid-Atlantic Region

Robert Fisher
Virginia Sea Grant, Marine Advisory Program
Virginia Institute of Marine Science
College Of William & Mary

ICSR 2014, Charleston, SC

Channeled whelk (conch)

- The channeled whelk *Busycotypus canalicalatus* supports commercial fisheries throughout the Atlantic states, but little information is available on its reproductive biology and population structure

DATA POOR FISHERY

- Project investigates the reproductive biology of the channel whelk population in the Mid-Atlantic region and in particular calculates the size and age at which the population becomes sexually mature.
- Investigate the current sexual composition and the size-frequency of the channeled whelk resource to determine implications of management size regulations.

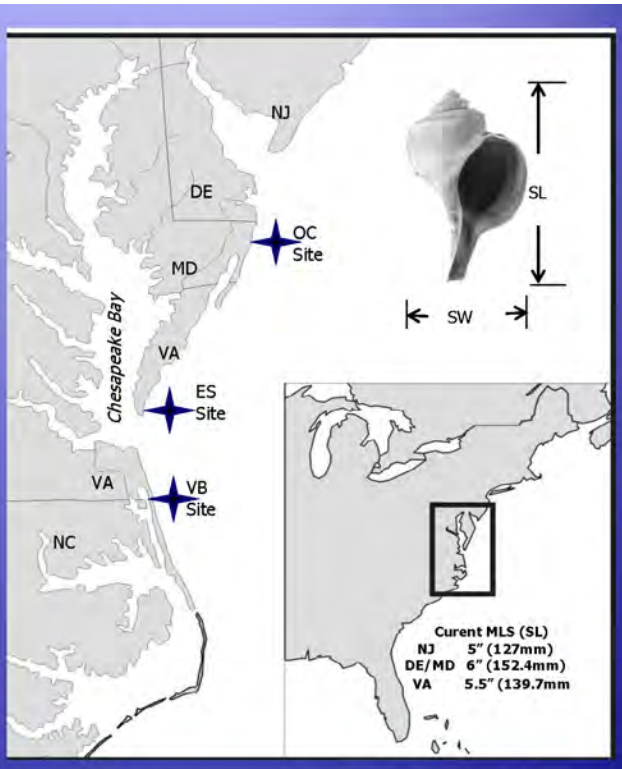
Virginia Conch Pot Fishery (1999) (2010)

- Approximately 50 boats and 150 fishermen (25/75)
- 120-150 individuals involved in providing bait and in the processing and distribution of harvested conch (~110)
- generates an estimated $7 M in revenues for VA processors (5M)
- total estimated economic value to VA in excess of $42 M (15-20 M)
- Variability of catch

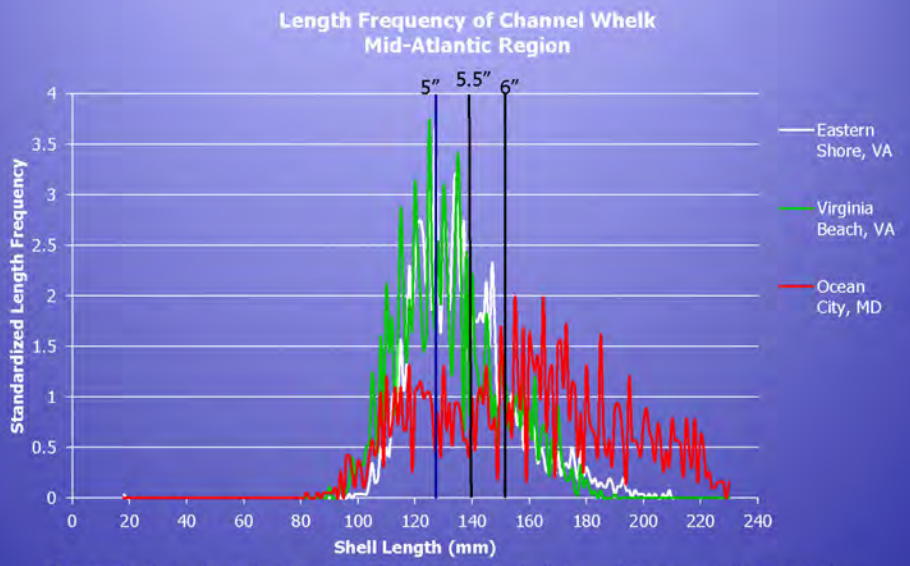
Virginia: smaller whelk being landed, market sizes reduced

With declining size of individual landed whelk observed within various resource areas in the Mid-Atlantic, coupled with increased fishermen complaints of undersize whelk being harvested and legally landed by fishermen from adjoining states, basic specie biological information governing the fishery was questioned by fishermen. Questions posed by industry relative to resource management centered on age/size at sexual maturity and relevancy of multiple MLS within the Mid-Atlantic whelk fishery. Upon review it was found that little biological assessment information was available specific for *Busycotypus canaliculatus*.

In 2009, Virginia Resource Grant funded project to research population and reproductive biology of the channeled whelk in the Mid-Atlantic



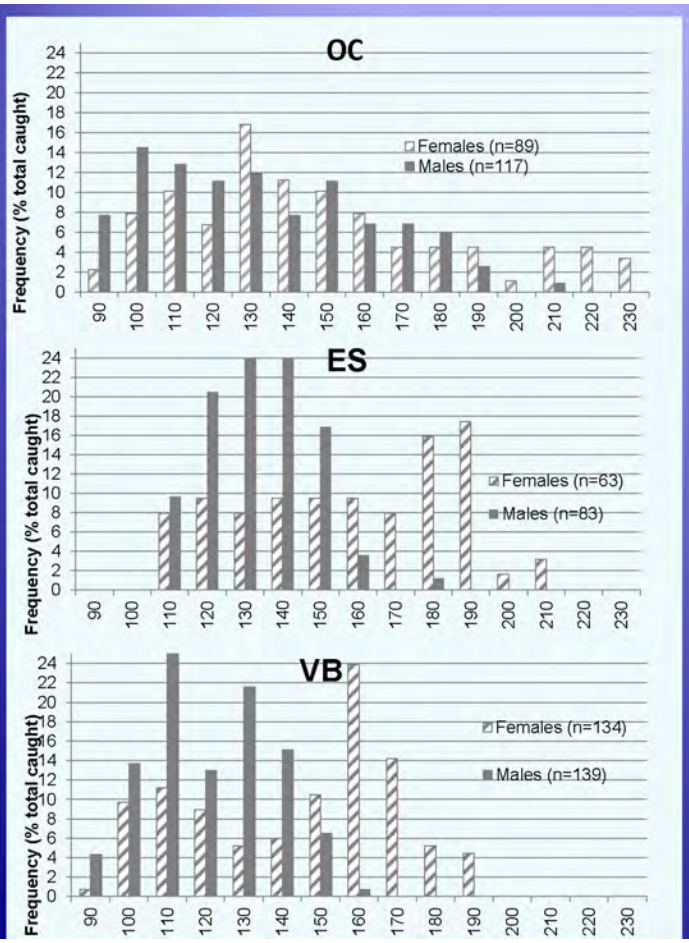
Whelk resource areas sampled; Maryland/Delaware boarder (OC), Eastern Shore of VA outside Hog Island Bay (ES), and off southern Virginia Beach, VA (VB). Whelk measurements; shell length (SL), shell width (SW). Channeled whelk current (2013) minimal landing size (MLS) for Mid-Atlantic States.



B. canaliculatus. Length-frequency distribution of whelk from 3 commercially targeted populations (OC, ES, VB) in the Mid-Atlantic, US. Vertical lines represent current minimal landing size (MLS) of 5.5″ (139.7mm) and 6″ (152.4mm).

Note differences between areas; bimodal distribution observed in OC, the first peak (~120mm, well below MLS) suggests large number of recruits followed by high mortality, with the second peak (~160mm, above MLS) suggesting decrease in mortality with increase size. The first peak shows potential for recruitment to the fishery, though at size/age under that of estimated sexual maturity.

Unimodal distributions were observed in ES and VB with peaks (~120-135mm) less than MLS of 139.7mm (5.5″) for that resource area. A unimodal distribution reflects high recruitment followed by high mortality, possibly from predation or fishing pressure.



*Percent sublegal (<MLS for give area) whelk caught per resource area:

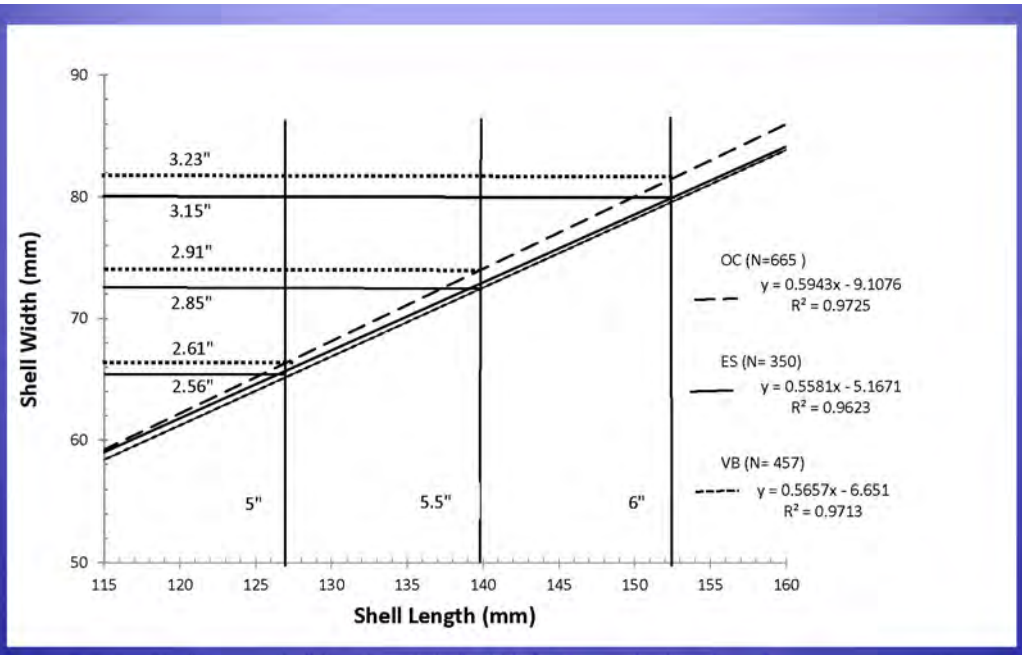
VB (69%)
ES (60.1%)
OC (43%).

B. canaliculatus. Sex ratio and average size (SL) of whelks within each resource area over all sampling periods.

Area/sample period	Ave SL (mm) Male/Female	Sex ratio (M:F)	N
VB Fall 2009	136.5/152.6	1.03:1	273
VB Spring 2010	117.2/137.1	1.1:1	116
VB Fall 2010	124.3/129.8	1.1:1	132
ES Fall 2009	137.5/162.4	1.3:1	146
ES Spring 2010	125.3/140.6	1.5:1	162
ES Fall 2010	140.6/154.5	1.2:1	99
OC Fall 2009	136.5/152.6	1.3:1	206
OC Spring 2010	136.2/143.3	1.8:1	234
OC Fall 2010	131.5/145	2.0:1	88

The overall sex-ratio (M: F) varied within each resource over all sampling periods. Males dominated smaller whelk size in all areas, but more so in ES and VB. Within all resource areas larger whelks were predominantly females.

*Average whelk size in both sexes from 2010 sampling was also observed to decrease from 2009 Fall sampling.



Relationship between shell length and shell width for *B. canaliculatus* from 3 resource areas with resulting shell width (inches, mm) given current minimal landing size (MLS; 5", 5.5", and 6") in shell length.

A strong linear length-width relationship for *B. canaliculatus* was demonstrated for all areas. Shell width in OC whelk increased slightly greater than ES and VB whelk (mm, inches) with increasing SL. There was no sexual dimorphism observed for whelk length-width relationship in OC and VB, the furthest geographically separated populations.

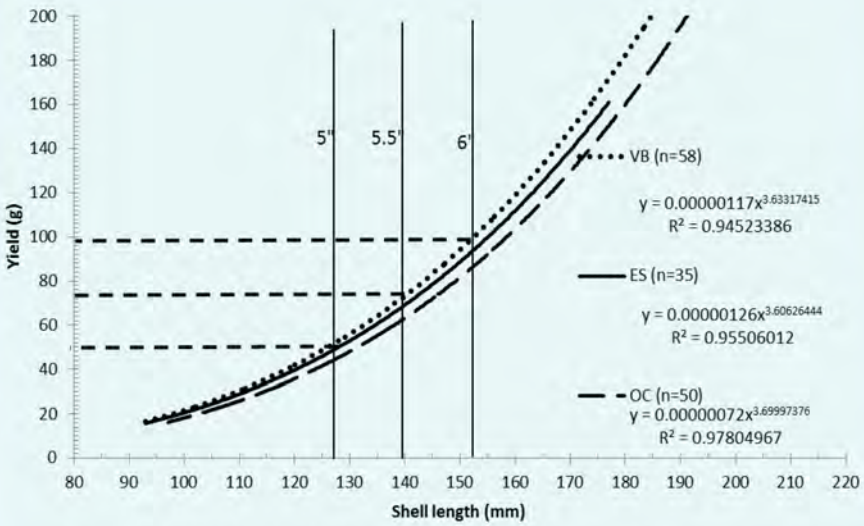
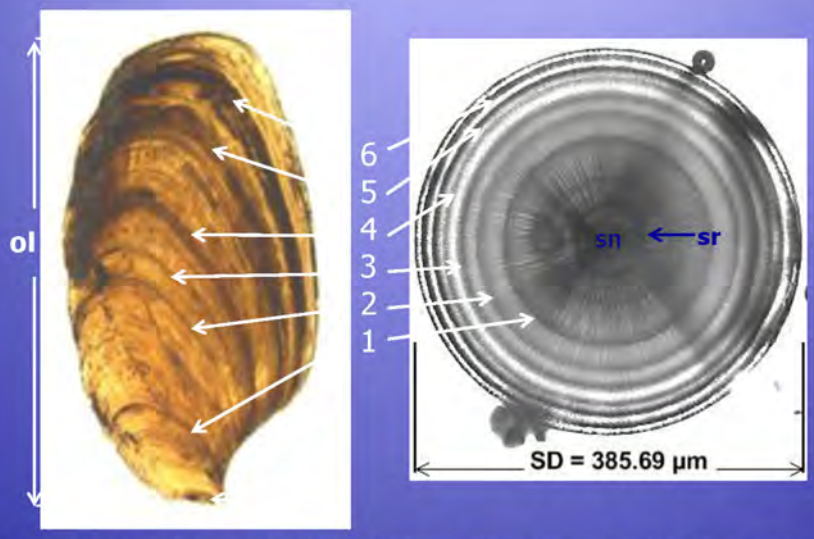


Figure 15. Flesh yield (g) of fresh, unfrozen *B. canaliculatus* from 3 resource areas. Vertical lines are current minimal landing sizes (MLS: 5", 5.5", 6") in shell length. Horizontal dashed line is yield for VB area.

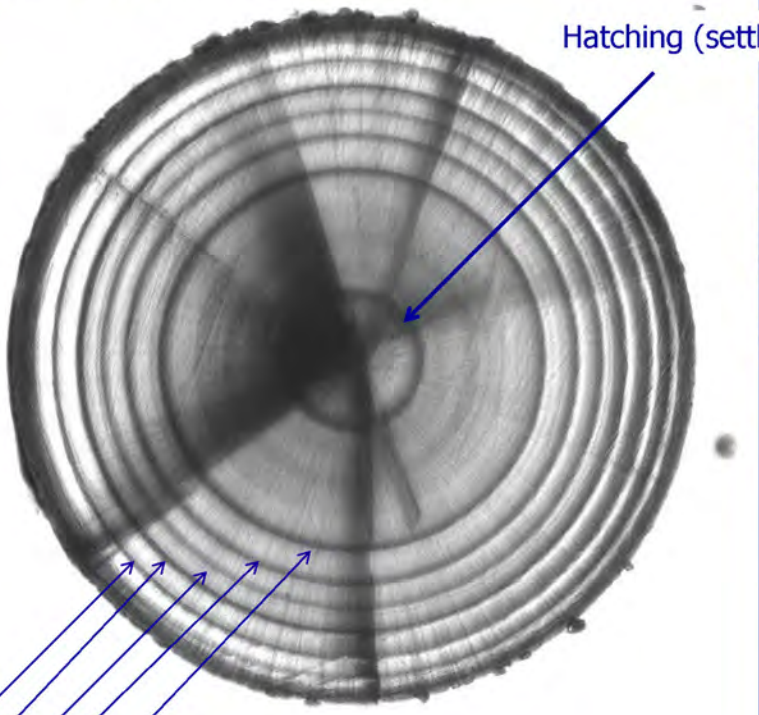
Relative to variable MLS, an increase in flesh yield of 41% was observed in VB whelk going from MLS of 5-5.5" (127-139.7mm), and 37.2% from 5.5-6" (139.7-152.4mm). Yield nearly doubles (94% yield increase) in VB whelk from MLS 5" (51.5g) to 6" (99.5g).



Opercula (left) and statolith (right) from the same whelk showing markings (numbered stria, rings, respectively) used to estimate age for *B. canaliculatus* in this study. ol=opercula length, on=opercula nucleus, SD=statolith diameter, sn= statolith nucleus, sr= settlement ring

Age estimate for *B. canaliculatus* was most easily performed counting opercula stria, however, more precise aging was observed through annuli counts from sectioned statoliths. Operculum aging in this study underestimated age in comparison to aging results from sectioned statolith

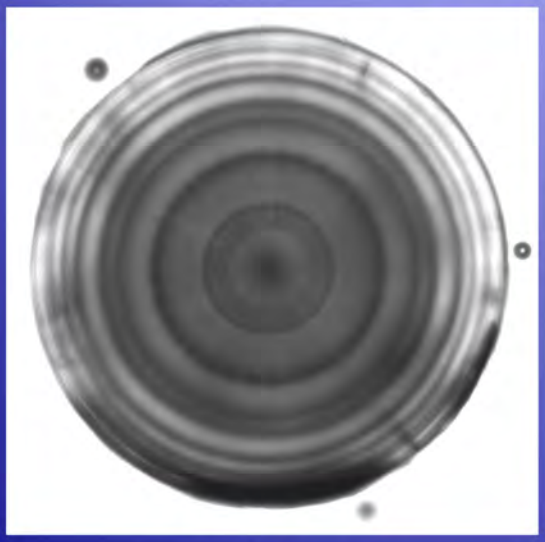
Channeled Whelk Statolith



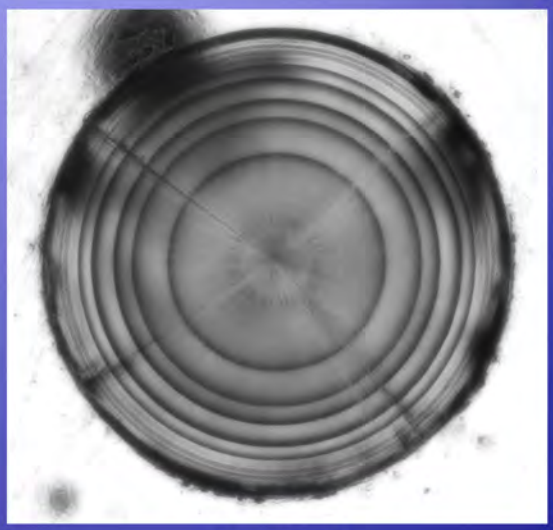
Settlement ring = ~age 0 verified in study to be laid down shortly after hatching during transformation to benthic life

Statoliths located in statocysts; paired sense organs for equilibration

concentric rings deposited used to estimate age.



Whole

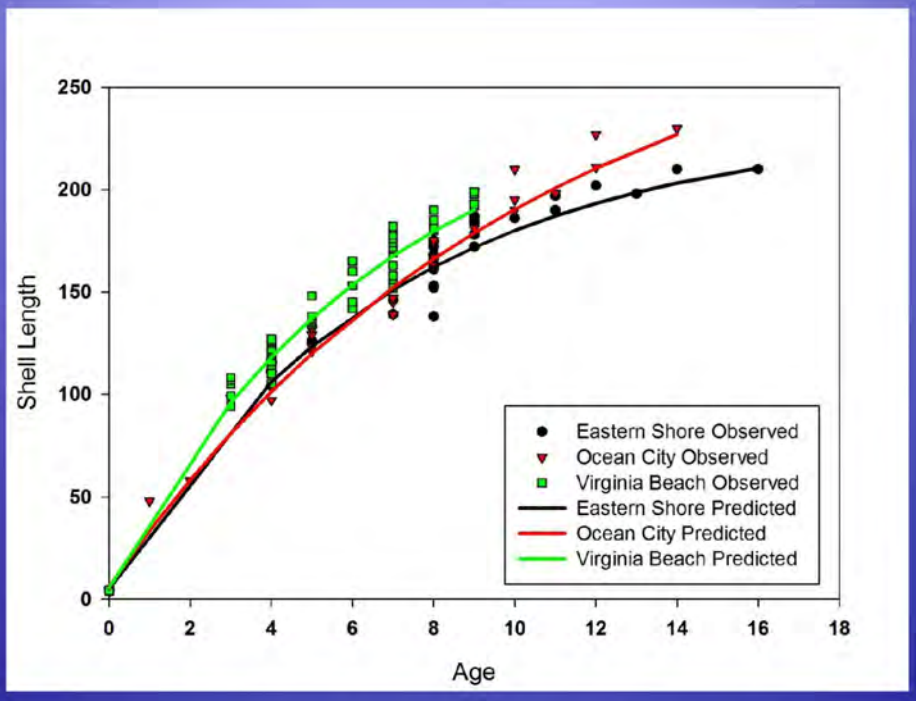


Sectioned

Statoliths from 141mm channeled whelk, ~350 microns in diameter (.35 mm)

Age estimates for *B. canaliculatus* from three resource areas by sex and combined. Sectioned statoliths used for aging.

Location	Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
VB	Sexes Combined															
	Ave SL (mm)				103	117.3	135.6	146.8	168.5	183.2	195.5					
	SD				4.708149	8.253764	5.143398	10.2344	10.37075	4.32435	3.511885					
	n				13	26	11	15	15	5	4					
	Females															
	Ave SL (mm)				103.5	119.2	138	153	170.2	183.2	195.5					
	SD				5.75326	6.26564	5.09902	9.721111	10.08426	4.32435	3.511885					
	n				6	14	6	5	13	5	4					
	Males															
	Ave SL (mm)				102.5	115	132.8	143.7	161							
	SD				4.035556	9.899495	3.898718	9.42868	2.828427							
	n				7	12	5	10	2							
ES	Sexes Combined															
	Ave SL (mm)					115	127.57	132	141.28	161	177.33	175.5	189.75	202	198	210
	SD					2.54951	4.755949	5.656854	6.750661	9.268087	10.94836	14.84924	6.130525			
	n					5	7	2	7	13	6	2	4	1	1	1
	Females															
	Ave SL (mm)					114	129.5		142.2	164.77	181.2	186	192.3	202		210
	SD					2.645751	4.949747		4.949747	8.496731	6.140033		4.041452			
	n					3	2		2	9	5	1	3			1
	Males															
	Ave SL (mm)					116.5	126.8	132	140.8	153.5	158	165	182			
	SD					2.12132	5.01996	5.656854	7.823043	5.802298						
	n					2	5	2	5	4	1	1	1			
OC	Sexes Combined															
	Ave SL (mm)		48	60.5	98	102.3	122.5	136.5	142.8	163.1	186.2	193.3	198	210		230
	SD			3.535534		7.531983	6.587024	3.109126	5.303301	10.32523	7.596052	8.807464		17.52142		0
	n		1	2	1	13	10	4	8	17	5	7	1	3		2
	Females															
	Ave SL (mm)		48	58	98	105	126.25		144.5	168	190	198.33	198	219		230
	SD					9.165151	5.123475		3.785939	5.033223	12.72792	10.40833	198	11.31371		0
	n		1	1	1	3	4		4	4	2	3	1	2		2
	Males															
	Ave SL (mm)			63		101.5	120	136.5	141.25	161.61	183.66	192.33		192		
	SD					7.33712	6.60303	3.109126	6.652067	11.19924	3.21455	3.05505				
	n			1		10	6	4	4	13	3	3		1		



Busycotypus canaliculatus . Length at age data for three resource areas in the Mid-Atlantic with fitted von Bertalanffy growth curves, Age estimates from sectioned statoliths, sexes combined.

Growth rates of *B. canaliculatus* differed between study areas, with VB whelk observed to grow faster (k) than ES and OC, but reaching a smaller maximum length SL (L∞) than ES and OC .

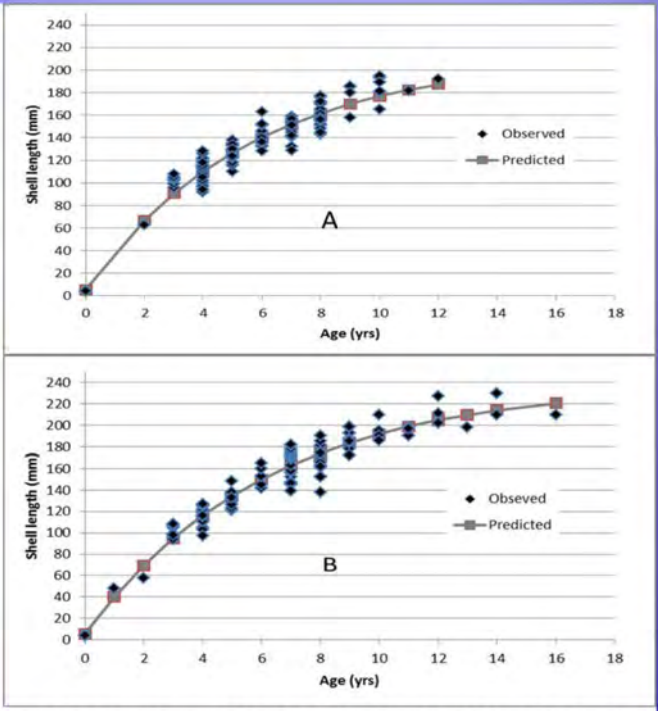


Figure X. Growth curves for male (A) and female (B) channeled whelk from combined areas. Age estimates are from statolith readings .

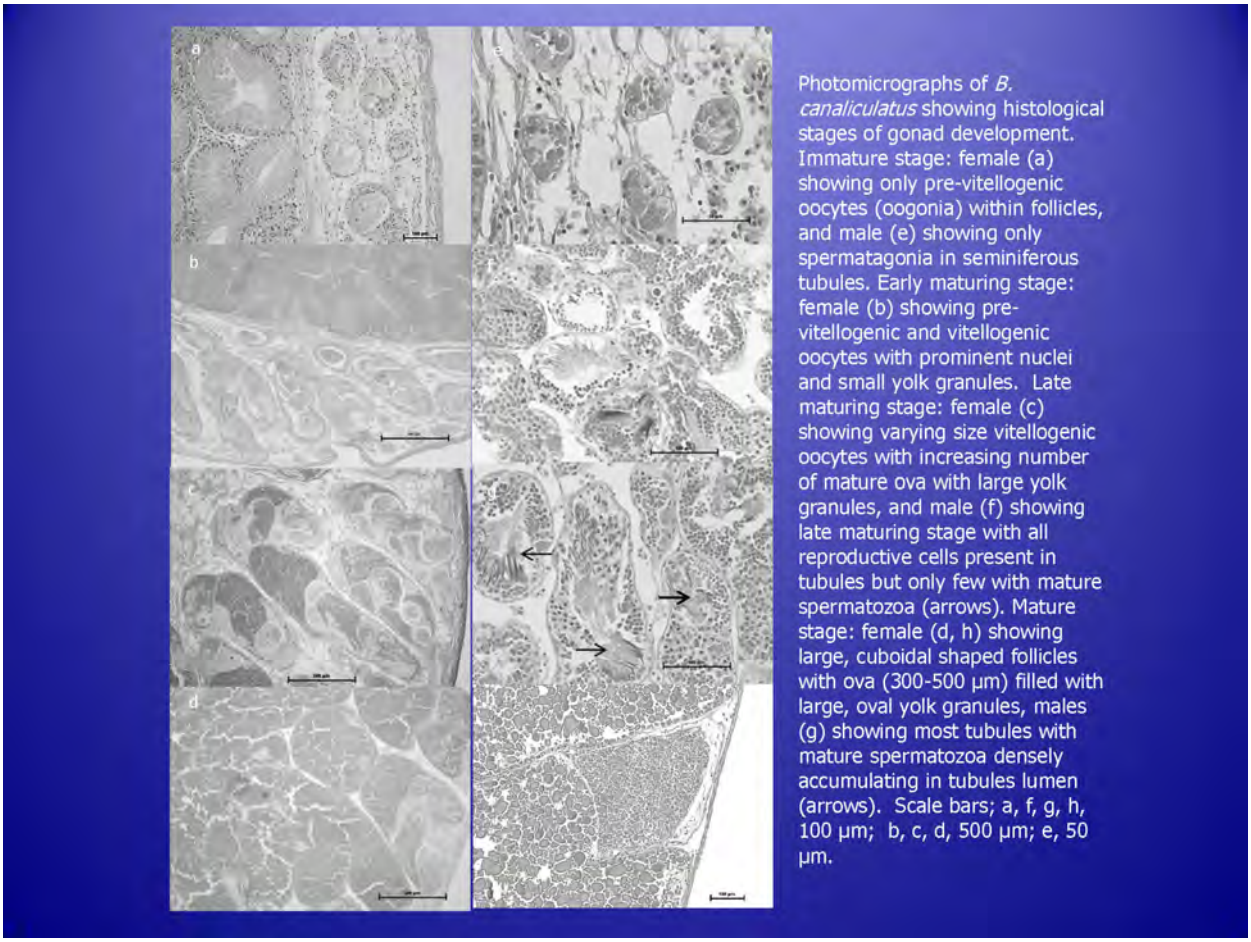
male channeled whelk grow faster (k) and reach a smaller maximum size ($L\infty$) than females.

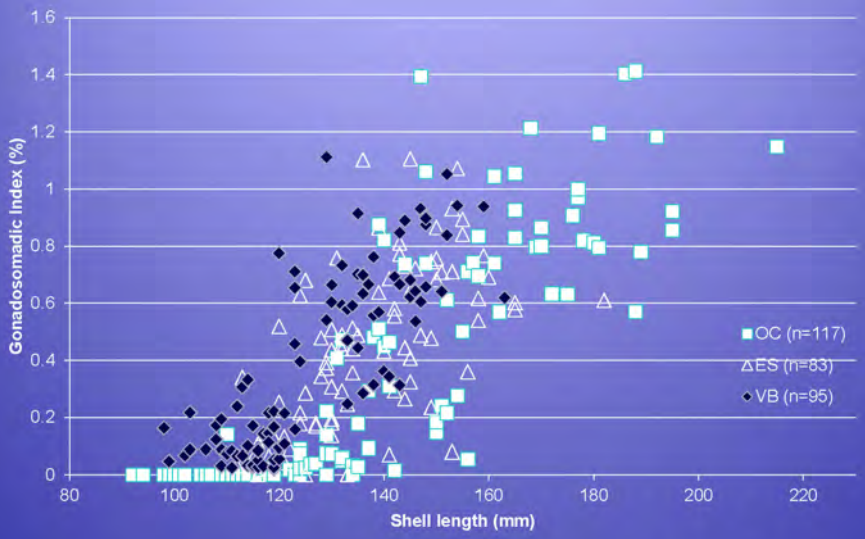
Estimated von Bertalanffy growth parameters for male and female *B. canaliculatus* from three sampling regions are shown with values for estimated maximum length ($L\infty$), growth rate coefficient (k), and theoretical time at length zero (t_o).

Location	Sex	L_∞	k	t_o
Ocean City	Female	304.45	0.100	-0.178
Ocean City	Male	273.74	0.112	-0.140
Eastern Shore	Female	235.53	0.151	-0.122
Eastern Shore	Male	184.48	0.220	-0.105
Virginia Beach	Female	255.23	0.155	-0.116
Virginia Beach	Male	185.76	0.245	-0.093

Growth rates (k) were observed faster in VB whelk than ES and OC, but reached a smaller maximum length SL ($L\infty$) than ES and OC.


Sexing Channeled Whelk: Gonad color, penis?, oviduct?
♀
♂
vd
Convoluted (coiled) visceral section of vas deferens (vd) full of mature spermatozoa.
Penis size


a
b
c
d
e
f
g
h
Photomicrographs of *B. canaliculatus* showing histological stages of gonad development. Immature stage: female (a) showing only pre-vitellogenic oocytes (oogonia) within follicles, and male (e) showing only spermatagonia in seminiferous tubules. Early maturing stage: female (b) showing pre-vitellogenic and vitellogenic oocytes with prominent nuclei and small yolk granules. Late maturing stage: female (c) showing varying size vitellogenic oocytes with increasing number of mature ova with large yolk granules, and male (f) showing late maturing stage with all reproductive cells present in tubules but only few with mature spermatozoa (arrows). Mature stage: female (d, h) showing large, cuboidal shaped follicles with ova (300-500 µm) filled with large, oval yolk granules, males (g) showing most tubules with mature spermatozoa densely accumulating in tubules lumen (arrows). Scale bars; a, f, g, h, 100 µm; b, c, d, 500 µm; e, 50 µm.

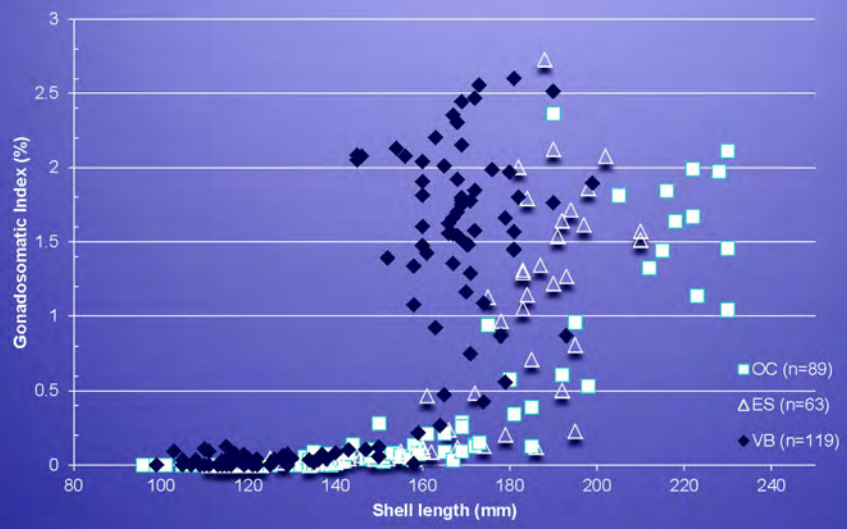


Male *B. canaliculatus* gonadal somatic index (GSI) by resource area late fall 2009

GSI= gonad weight/somatic weight x 100

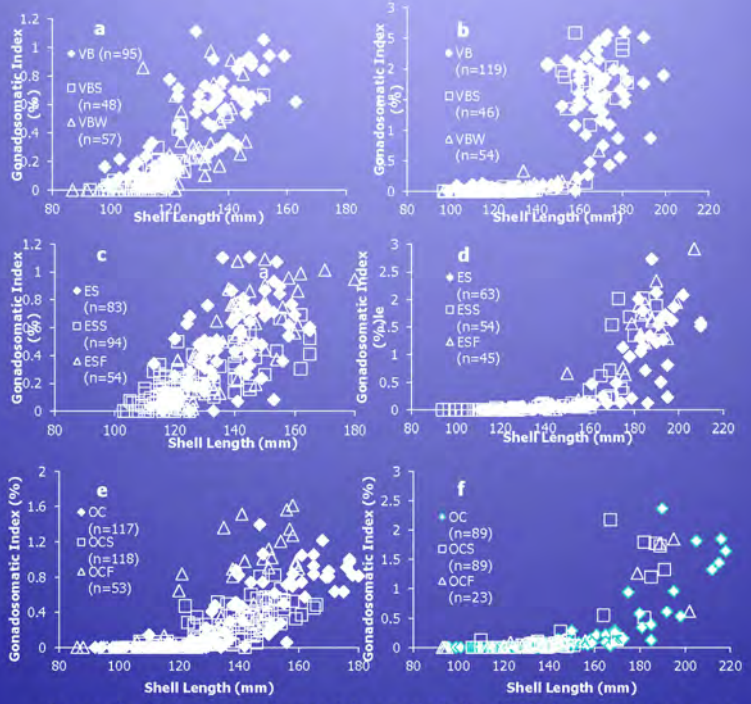
somatic weight = total wet body weight minus gonad weight

Males: VB maturing at smaller size than ES and OC



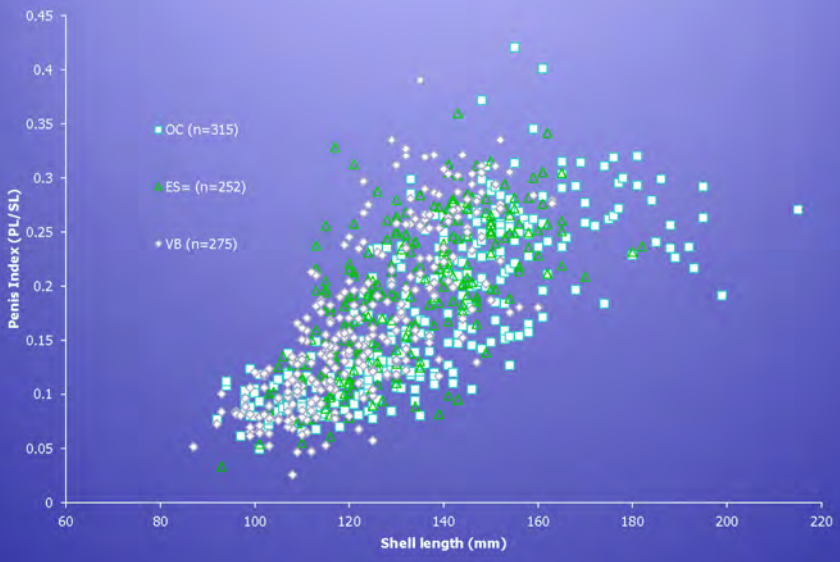
Female *B. canaliculatus* gonadal somatic index (GSI) by resource area late fall 2009.

Females: VB maturing at smaller size than ES and OC



B. canaliculatus seasonal gonadal somatic index (GSI) from three resource areas- males (a,c, e), females (b,d, f). VB, ES, OC= fall 2009; VBS, ESS, OCS= spring 2010; VBF, ESF, OCF=fall 2010

GSI-shell length relationships indicating spawning occurring in both fall and spring



B. canaliculatus. Relationship between shell length and penis index for male whelks from three resource areas.

PI < 0.1 = Immature
PI > 0.1-0.2 = Maturing
PI > 0.2 = Mature

Defining maturity stages of *B. canaliculatus*.

CG=capsule gland;

CT=connective tissue;

GSI=gonadal somatic index;

PI=penis index;

Vd=vas deferens)

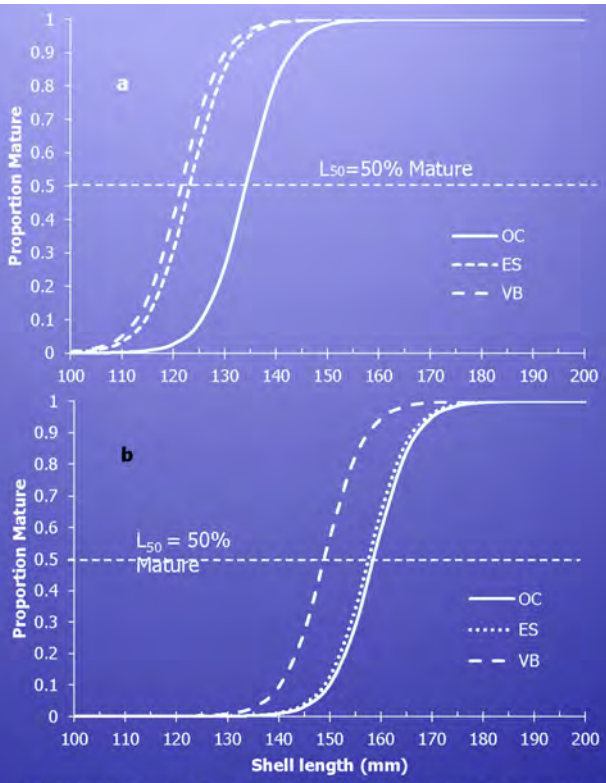
	Immature	Maturing	Mature
Male	GSI <0.1	GSI 0.1-0.2	GSI >0.2
	PI < 0.1	PI 0.1-0.15	PI >0.15
	Vd; visceral section thin, straight, anterior section not visible	Vd; visceral section thickening, slight coiling during late stage, anterior section becoming slightly visible	Vd; visceral section highly coiled, full of sperm, anterior section prominently visible on body surface
	Gonad color light/pale orange	Gonad color pale orange	Gonad color dark orange/red
Female	GSI <0.01	GSI 0.01-0.1	GSI >0.1
	Gonad mostly CT appearing as a light band of tissue; Follicles small with pre-vitellogenic oocytes (oogonia) <10 µm	Early: follicles rounded with significant CT between, gonads lacking of texture, vitellogenic oocytes 50-150 µm with prominent nuclei and small yolk granules. Late: follicles expanding with increasing number of large ova (300-500 µm diameter) with large oval yolk granules (20-30 µm), texture firming, becoming granulated in appearance	Follicles columnar, densely packed with ova (300-500 µm) full of large, oval yolk granules and inconspicuous nuclei; gonads highly granular in appearance
	CG thin, beige, non-conspicuous	CG: early; small, beige, flaccid late; medium, beige, becoming firm	CG large, plump, light beige
	Gonad color off-white, translucent	Gonad color light, pale orange progressing to yellow/brown	Gonad color ranging from orange-yellow to yellow-brown

A logistic model using binomial maturity determinations (0=immature, 1=mature) for both sexes was fit to the data.

Predicted median shell length at 50% maturity

Males from OC matured at a significantly greater shell length (134.05 mm) than both ES (122.51mm) and VB (121.03mm) males.

Females from VB (149.21mm) matured at a significantly smaller shell length than ES (157.65mm) and OC (159.28mm) females.



B. canaliculatus. Maturity ogives for (a) male and (b) female whelks by resource area.

B. canalicuatus are observed to mature at different sizes under different management MLS

5.5"=139.7mm SL 6"=152.4mm SL

Predicted size at maturity; area, sex, size at maturity, lower and upper confidence limits				
Resource area	Sex	Size at maturity (mm)	Lower Limit (95%)	Upper Limit (95%)
OC	F	159.28	153.09	165.25
	M	134.05	130.57	137.26
ES	F	157.65	154.28	161.80
	M	122.51	117.59	126.10
VB	F	149.21	145.17	153.03
	M	121.03	118.91	123.02

Based on non-overlapping confidence intervals of the Bootstrap L50, as well as multiple contrast generated from logistic regression models, significant differences in size at maturity within areas are observed.

Females from VB matured at a significantly smaller shell length than ES and OC females
Males from OC matured at a significantly greater shell length than both ES and VB males

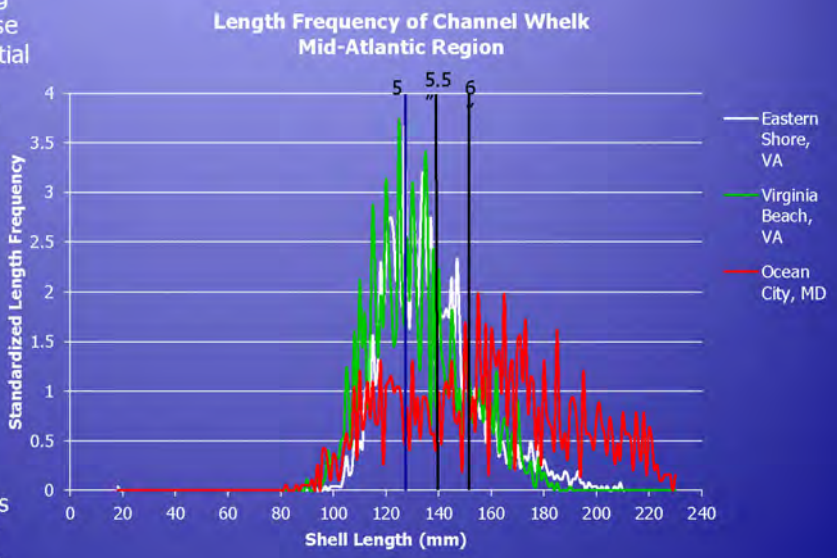
Under current MLS for each study area, whelk harvested from VB recruited into the fishery at a much younger age to those from OC

Table 8. *B.caniculatus.* Estimated age and probability of maturity at which whelks reach minimum landing size (MLS) as calculated from von Bertalanffy growth parameters by sex and area.

Location	Sex	MLS (mm)	Calculated Age @MLS	Probability of Maturity @MLS
Ocean City	Female	152	6.74	0.157
Ocean City	Male	152	7.12	0.990
Eastern Shore	Female	139.7	5.85	0.010
Eastern Shore	Male	139.7	6.32	0.985
Virginia Beach	Female	139.7	5.00	0.086
Virginia Beach	Male	139.7	5.60	0.990

The probability of females reaching MLS prior to sexual maturity is quite low given current MLS

Bimodal distribution observed in OC of this study, the first peak (~120mm well below MLS) suggests large number of recruits followed by high mortality, with the second peak (~160mm above MLS) suggesting decrease in mortality with increase size. The first peak shows potential for recruitment to the fishery, though at size/age under that of estimated sexual maturity.



Unimodal distributions were observed in ES and VB with peaks (~120-135mm) less than MLS of 139.7mm (5.5") for that resource area. A unimodal distribution reflects high recruitment followed by high mortality, as from predation or fishing pressure

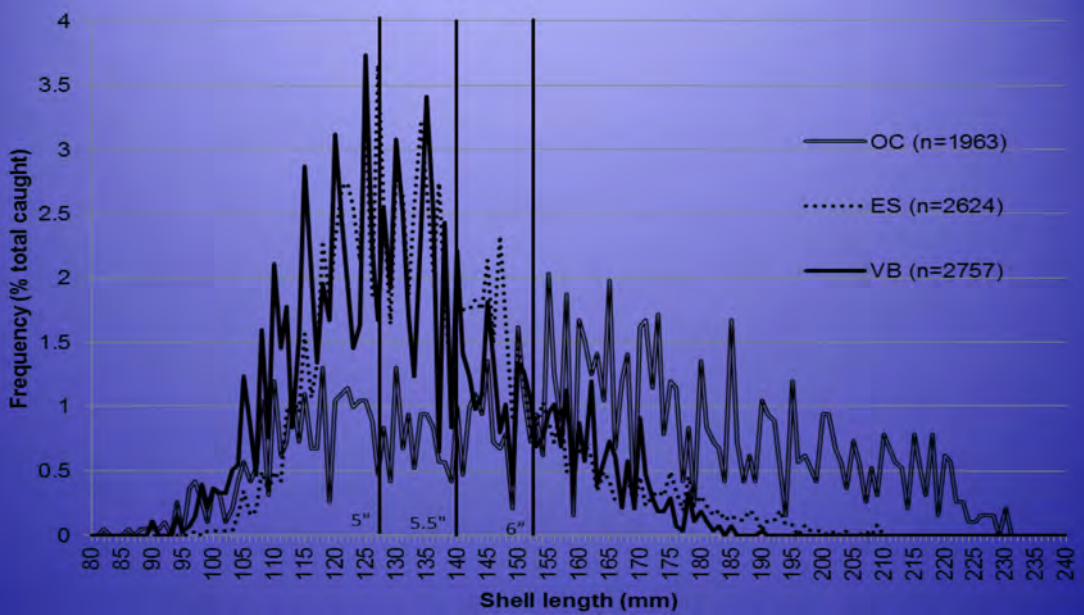


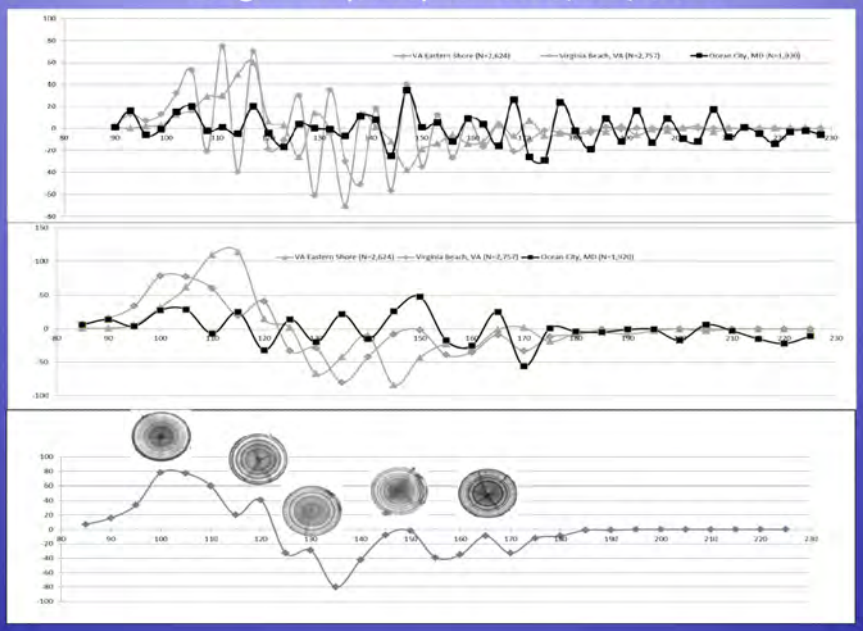
Figure 45. *B. canaliculatus*. Length frequency distributions by area. Vertical lines represent current minimal landing sizes (MLS) for the region.

Multiple Annual Cohorts ? Distribution shows signs of multiple cohorts…secondary peaks with low amplitude over short shell length range

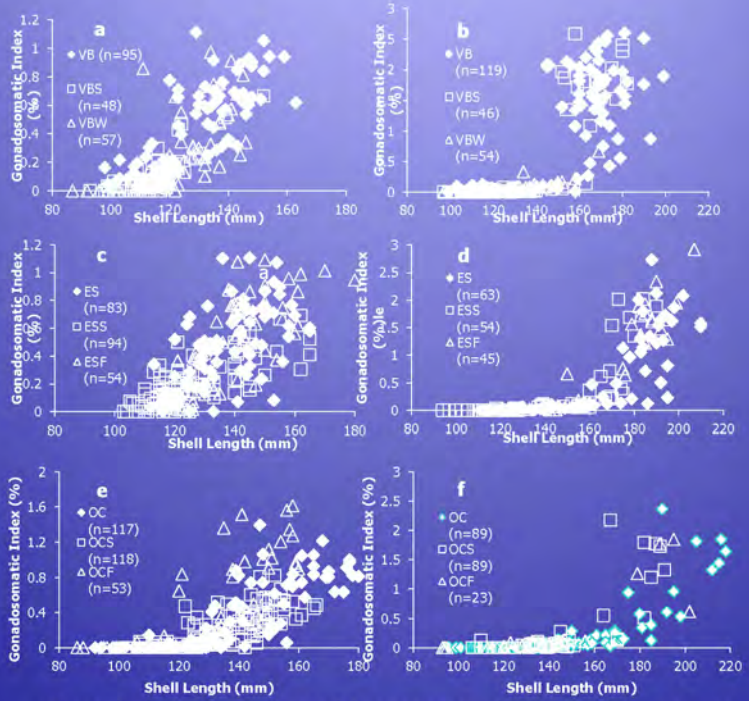
Length Frequency: Bins b-a, c-b, d-c.....

Bin size 3

Bin size 5



By aggregating size groups to reduce frequency "noise" over shell length, major peaks were identified which matched up with size ranges corresponding with whelk age estimates (inset aged statoliths) in this study



B. canaliculatus seasonal gonadal somatic index (GSI) from three resource areas- males (a,c, e), females (b,d, f). VB, ES, OC= fall 2009; VBS, ESS, OCS= spring 2010; VBF, ESF, OCF=fall 2010

GSI-shell length relationships indicating spawning occurring in both fall and spring

Parting slide……In fisheries management, the intent of most MLS is to identify a harvestable size which allows for juveniles to survive and spawn at least once….

5.5″=139.7mm SL
6″=152.4mm SL

Table 8. *B.caniculatus.* Estimated age and probability of maturity at which whelks reach minimum landing size (MLS) as calculated from von Bertalanffy growth parameters by sex and area.

Location	Sex	MLS (mm)	Calculated Age @MLS	Probability of Maturity @MLS
Ocean City	Female	152	6.74	0.157
Ocean City	Male	152	7.12	0.990
Eastern Shore	Female	139.7	5.85	0.010
Eastern Shore	Male	139.7	6.32	0.985
Virginia Beach	Female	139.7	5.00	0.086
Virginia Beach	Male	139.7	5.60	0.990

****Under current MLS for each study area, whelk harvested from VB recruited into the fishery at a much younger age to those from OC. The probability of females reaching MLS prior to sexual maturity is quite low given current MLS

Whelk fishery in Georgia

Tom Bliss
University of Georgia

The whelk fishery in Georgia has declined over the past 20 years. From 1981 to 1997 whelks were harvested as by-catch from winter crab trawls and were not regulated as an independent fishery until 1998. The following is a brief overview of the sex ratio and size of whelks observed in surveys conducted from 2000 to 2006 by University of Georgia Marine Extension Service to evaluate the whelk populations offshore and inshore and status of the current fishery in Georgia. Of the four species of whelk observed, the knobbed whelk was the most common species caught followed by the channel, lightning, and pear whelks. The ratio of male to female was skewed towards females with 1:1.33 for channeled whelk, 1:1.33 for pear whelk, 1:2.80 for knobbed whelk, and 1:22.8 for lightning whelk. For each species, females obtained larger mean sizes in shell length, shell width, and weight than males. Female lightning, knobbed, pear and channeled whelks had mean shell lengths of 150mm, 122mm, 106mm, and 105mm, correspondingly. For knobbed whelk, females reach maturity at 100mm and males at 85-90mm.

MAREX
The University of Georgia Marine Extension Service

Update on the whelk fishery in GA

Thomas Bliss
University of Georgia
Marine Extension Service
Shellfish Research Laboratory

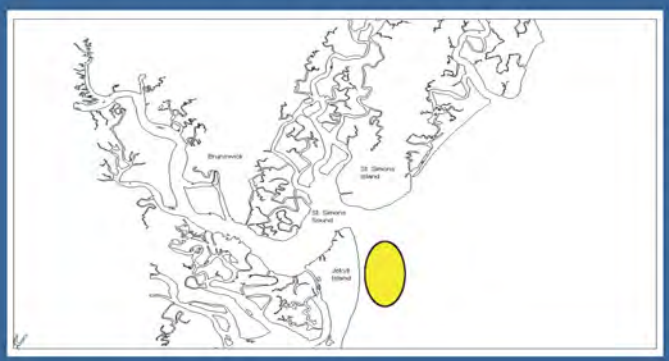
12/15/15

MAREX
The University of Georgia Marine Extension Service

History

•Experimental fishery evolved from the winter crab trawl fishery where whelks represented a large portion of the fishery's bycatch

•In 1998, CRD was officially given the statutory authority to regulate the commercial whelk fishery independent of crab trawling



MAREX
The University of Georgia Marine Extension Service

Population

- Population skewed towards females
- males
  - sexual maturity at 85-90 mm in shell length at an age of 4 years
- females
  - sexual maturity at 100 mm and at an approximate age of 6 years

MAREX
The University of Georgia Marine Extension Service

Inshore

- Inshore
  - tend to concentrate on or near oyster reefs from April to August
  - movement is generally along the contours of the oyster reefs
  - females as a group move more than males
  - remain in intertidal areas during summer

Whelk Landings

Table 1. Whelks, *Busycon* and *Busycotypus* species, production in pounds of meat landed from 1880 to 1999 in Georgia. Data are from Georgia Department of Natural Resources (1979-2010) and National Marine Fisheries Service (1880-1978).

Year	kg of meat	$ value	$/kg	year	kg of meat	$ value	$/kg
1880 to 1979	0	0	0	1995	252,709	336,654	1.33
1980	83	120	1.44	1996	193,019	254,717	1.32
1981	3,106	4,337	1.40	1997	281,785	389,437	1.38
1982	38,809	42,076	1.08	1998	264,224	406,942	1.54
1983	91,162	88,579	0.97	1999	268,148	401,195	1.50
1984	253,843	263,558	1.04	2000	191,073	277,482	1.45
1985	92,125	95,692	1.04	2001	147,763	245,330	1.66
1986	56,216	52,346	0.93	2002	28,842	49,621	1.72
1987	423,664	519,091	1.23	2003	40,900	69,393	1.70
1988	455,337	403,949	0.89	2004	1,531	3,693	2.41
1989	230,526	257,426	1.12	2005	1,157	2,544	2.20
1990	462,197	507,718	1.10	2006	2,136	5,729	2.68
1991	399,741	464,121	1.16	2007	487	1,315	2.70
1992	206,940	247,566	1.20	2008	2,036	5,878	2.89
1993	179,656	242,049	1.35	2009	7,423	17,380	2.34
1994	305,094	377,323	1.24	2010*	7,121	18,844	2.65

Channeled whelk management and sustainability

Richard B. Robins, Jr.
Chesapeake Bay Packing

Following a rapid expansion in the 1990s, the US fishery for channeled whelk has been managed to varying degrees by Atlantic coastal states throughout the range of the fishery from North Carolina through Massachusetts. The resource is data-poor, and the regional population has not been assessed. States have used a combination of technical measures (including minimum sizes and trip limits, combined in some cases with limited entry) to manage the fishery. Absent any adequate stock assessments for the species, it is difficult for managers to determine appropriate scales for the fishery or fleet size. As demand for the species continues to grow, a fisheries improvement project (FIP) could be an effective strategy to ensure the sustainability of this valuable and data-poor fishery.

Rick Robins was appointed to the Mid-Atlantic Fishery Management Council in August, 2007, and has served as Chairman since 2008. He currently serves as Chairman of the Council Coordination Committee, comprising the leadership of the eight regional fishery management councils in the US. He owns a whelk processing business on Virginia's eastern shore, Bernie's Conchs, L.L.C., and exports seafood in conjunction with Chesapeake Bay Packing in Newport News, VA. He was appointed as an Associate Member of the Virginia Marine Resources Commission in 2004 and chairs the Commission's Blue Crab Management Advisory Committee. He processed seafood in Kodiak, AK in the early 1990s and subsequently developed export-based fisheries in Virginia. He is an avid recreational angler.

Robins received the MBA from the University of North Carolina at Chapel Hill and a BA in economics and history from Washington and Lee University in Lexington, VA.

Channeled Whelk Management and Sustainability

Richard B. Robins, Jr.
December 14, 2014
Charleston, South Carolina

Presentation overview

- Summary of Channeled Whelk management
- Risks to ecological and economic sustainability
- Potential solutions

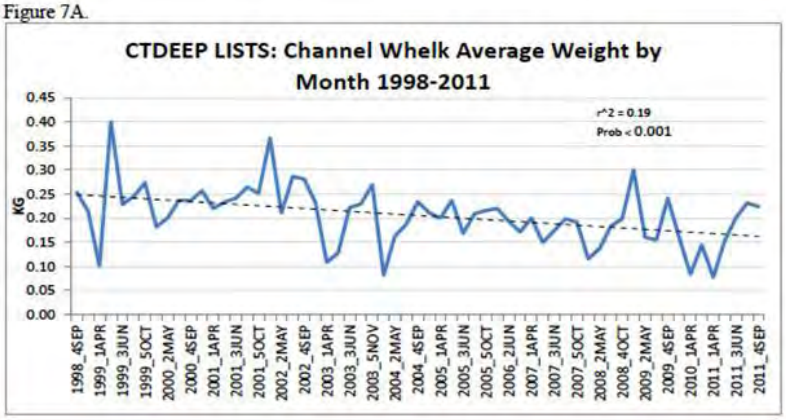
Current Management

State	Minimum Size	Reporting	Access
NC	---		---
VA	5 ½″	Yes	Mixed
MD	6″	Yes	Limited
DE	6″	Yes	Open/mixed
NJ	5″		Limited 270
NY	Pending 5 ½″	Mixed	Limited 250
MA	2 7/8″ whorl	Yes	---

Limited biological sampling

Long Island Sound Channeled whelk

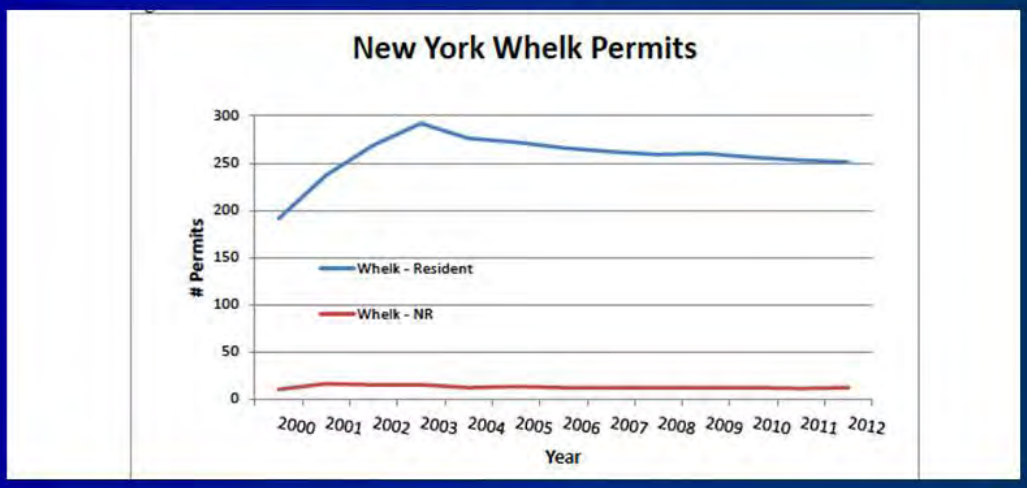
Figure 7A.



Risks to Sustainability

- Inadequate catch monitoring
- Limited fisheries dependent and fisheries independent sampling
- Lack of stock assessment
- *Limited access programs are inadequate and are not scaled to resources*
- Some minimum sizes do not match maturity schedules
- Catch controls may not be adequate

The risk of unlimited access



Potential framework for sustainability

- Consider issues common throughout the range of the fishery
  - Catch Monitoring
  - Biological sampling/surveying/assessment issues
  - Develop a coordinated strategy to address data and science needs

Potential framework for sustainability

- Initiate Fisheries Improvement Projects (FIPs) at state level
  - Engage fishermen and managers
  - Develop goals and objectives for the fishery
  - Assess the risks to biological and economic sustainability
  - Develop and implement strategies for sustainable management

Questions?

Transcript of Presentation by Rick Robins, Industry Member

Bob Fisher: Our last panel speaker will be Rick Robins. Rick brings to this discussion both a great industry perspective, being a business owner within the whelk fishery in Virginia, as well as a managerial perspective, one who has served in both state and regional management capacities. From our presentation thus far, we acknowledge the biological science that will likely lead the effort for amending current whelk regulations, but there are financial concerns involved with management decisions within these fisheries, and those concerns need to be addressed and integrated in the dialogue as we plow forward.

Rick Robins: Bob, thank you. Thank you very much for the opportunity to be here and participate in this session. I'm going to race through my props so we can have some time at the end for panel discussion that Bob wanted to get to and envision today. This talk is entitled "Management Sustainability of Channeled Whelk." I'm hopeful that following on the work that's been done up and down the coast that you've heard so much about today, that we can ultimately find some way to put both of these works together in the same sentence in a way that's intelligent, because right now it looks like it's almost an oxymoron.

There are clearly very serious threats in the sustainability of the [channeled whelk] fishery and hopefully we can find a way to ensure, ultimately, a sustainable outcome. I've been involved in the fishery for 20 years on the processing side of the business. I've also served for eight years on the Virginia Marine Resources Commission, and then I chaired the Mid-Atlantic Fishery Management Council. [Channeled whelk] is not a federally managed species. As you know, it has been managed on the state level and in a lot of different ways up and down the coast with most of the emphasis being on the minimum sizes. Some of the states have used a combination of different measures to try to limit the effort on the fishery or the output within the fishery.

But those in a lot of ways, I think, have been inadequate, and I think you see the evidence of that piling up pretty quickly here today. So I'm going to summarize management today, talk about the risks of the ecological and also the economic sustainability, and talk a little bit about solutions. We focused a lot so far on the biology, that is the minimum sizes, or at least the maturity schedules throughout the mid-Atlantic and southern New England regions. That's obviously an important concern and it shows up very quickly here, but there are other problems here as well. So just thinking about the minimum size issues that relate to maturity, you have different minimum sizes throughout the range of the fishery, in Virginia we have a five and a half-inch minimum, as you go north, Maryland has a six inch minimum, Delaware six inches, New Jersey five inches, New York is considering implementing regulations—right now they don't have anything—and they have a large-scale fishery. The three biggest fisheries right now are Massachusetts, New York, and Virginia. Those are the three big producers. And so it's important to consider the rates of exploitations in those states.

There clearly is a disconnect between the minimum sizes and the maturity schedule. Just stepping back and thinking about this, this is a very difficult setup because this is a very mature fishery. While there has been recent entry into it that's been ongoing now for two decades, there's a high degree of dependence economically on the fishery by the participants in it. And it's largely been unmanaged, so it's a very challenging setup as we consider how we might move into a more sustainable future. Minimum size is an issue relative to maturity. The fishery in some areas is probably not unreasonable in those terms, for example in Maryland where you have a six inch minimum size. That's relatively close to that medium maturity value, that's probably about six and one-eighth inches. In other states it's clearly focused on the harvest of immature animals, and so it's what looks like a peeler crab fishery, or elver eel fishery in those states, and yet it's [the channeled whelk fishery] highly valuable, that's part of the problem and part of the driver here.

When I started in the [whelk] business in the early 90s, they were 60 cents a pound, today they're $2.65 a pound. So there's a very strong economic pressure on the resource, but again it's functioning almost like a fishery on juveniles in some states. That's not the only problem; there are a couple of other major issues that need to be addressed. Reporting throughout the range of the fishery is very inadequate. While some states have mandatory reporting departments for their fishermen, other states do not. So New York, for example, has sort of a mixed set of requirements, depending of which license you hold. It paints a very incomplete picture and I think sometimes the species are comingled in the reporting so in New York and New Jersey you have a very rapidly emerging fishery for Buccinum undatum, the little waved whelk, and I think some of those landings are showing up as being possibly comingled with the others, and then there's a big disconnect between the state data and the federal data. So if you query the National Marine Fishery service and try to look at whelk landings, it's just very difficult to get a handle on it. They're very incomplete.

So some of the states that have the large directed fisheries, it sounds like what we heard earlier today, the Massachusetts data appeared to be perhaps more precise than what we've seen in some of the other states. Virginia does have a mandatory reporting requirement, compliance with that over time has not been ideal, so we still have I think some incomplete pictures of the actual scale of these fisheries. One of the biggest challenges, there really aren't any significant output controls. If you think about the fishery in Virginia, we do have trip limits. That's one of the few controls on output. There aren't any quotas on this fishery, there aren't any stock assessments, it's data poor, output is not really being tightly controlled. On the input side, effort is not being effectively controlled because access is limited or open in a lot of states, but even when it's limited, it's not limited in any meaningful way. It's not constraining on the fishery. So the state of Maryland has potentially 2,000 licensees that could go in the fishery. So it's limited access but it doesn't mean anything. New York has about 250, New Jersey has about 270, and I submit that these numbers aren't scaled in any meaningful way to the resource and that has to be addressed. Because if we're gonna think about having an outcome that not just facilitates biological sustainability, but also social economic sustainability, and maintains the community's connection to the fishery, we got to find a way through that. And there's no way that the current scale of the fishery can be preserved coming out of that process. So access and limiting access effectively is going to have to be considered.

There's really not much fisheries independent data, you've already seen some today, they all paint the same picture that it's one of the declining resources. This time-series goes back to 1998, this is from the Connecticut trawl survey along Island Sound and so you know, you see a declining average weight of the animals over time. I think that pretty much paints the same picture that you've already seen. So I read through some of risks just in a qualitative way looking at what the consequences of those [declining average weights] are for the fishery.

There's still inadequate catch monitoring, and that's one of the most basic aspects in management, and it's still not effectively in place throughout the range of the fishery. There is very limited fisheries-dependent and fisheries-independent sampling, even within those states that have active fisheries; some of them don't have active monitoring programs to collect biological data. There's really a complete lack of stock assessment. I highlighted the fact that limited access programs are inadequate, and they're not scaled in the resources; I see that as one of the biggest threats. Some of the minimum sizes don't match the maturity schedules and the catch controls overall may not be adequate; that's probably an understatement because the catch controls are almost non-existent. So this just looks at the situation in New York where they had almost 300 permits, now they have 250. You know the resource at the state level can probably support a directed fishery for 20 or 25 or 30 boats. Virginia has 81 eligible permits, 31 are active, 20 of them are effectively directing on the fishery. I would argue if 10 more boats came into that fishery it would probably collapse.

So the scale of the [channeled whelk] resource is very sensitive to the overall level of effort, and I think we have to get serious about really drawing a tight circle around that, and talking about the future of the fishery to do that. So one possible framework for moving towards a more sustainable future, I think, would

be to look at those challenges that are common across all the jurisdictions, and I think those include the obvious gaps in reporting, the obvious gaps in data and science, and trying to develop a cohesive approach to addressing those.

I think in terms of management though, I think… these are non-migratory fisheries, I think what makes sense is trying to engage the fishermen in essentially the state level and talking about the future of the fisheries at the state level. And then considering the development of the fishery improvement project that would really bring people together, bring fisheries together, bring the scientists and managers together, and try to begin to forge a fishery for the future. And I think that has to be framed around the scale of the fishery, which the states currently don't really have a handle on. But I think that type of initiative can happen at the state level as opposed to federal type level.

One of the biggest challenges: a lot of the focus so far has been on minimum size limits and I think one of the things that we need that would be a benefit across all the different fisheries would be some yield modeling, because there's all these trade-offs when you start to talk about imposing a minimum size, or whether you want to have a slot limit. I think we need to be able to model those trade-offs so that we can have discussions about what that valley might look like for the fishery. If you're gonna transition to a different minimum size than what we have now, if we went straight to the minimum maturity schedule in Virginia and went from five and a half inches to six and one-eighth inches (our fisheries are off-shore fisheries predominantly), and the cost structure of that fishery is such that if you took 60% of the catch out of the equation, individuals wouldn't be able to operate on a trip level. So the microeconomics have to figure into that too. You know, I think if we were gonna maintain a similar selectivity pattern in that fishery, the only way that it would be sustainable is to ensure that the scale is appropriate. And maintain catches at a more conservable level. So you have these different trade-offs between how to control it [the channeled whelk fishery], whether it's through the minimum size or whether through the combination of minimum size and scale, but I would argue that we have to get a handle on overall levels of exploitation in the fishery. That's where they all go.

Bradley Stevens: Rick did you say that Maryland had 2,000 licenses?

Robins: Yes, they would say that's a limited access program, but it's anybody that has a shellfish license (or whatever their overall commercial license is), they're qualified to participate in the [channeled whelk] fishery. But their fishery is quite small; I mean they'll produce between 50 and several hundred thousand pounds a year. Virginia's fishery by contrast is 1 million plus.

Stevens: There's not that many boats in Maryland.

Robins: Well you're right.

Stevens: They only have, what, 15 miles of coastland?

Robins: Right, and they can catch blue crabs too, that's another problem.

Question: Has ASMFC [Atlantic States Marine Fisheries Commission] been involved?

Robins: They've discussed it; they have not chosen to initiate management at the ASMFC level. We did have some discussions about the need for some catch monitoring, making sure that states are at least collecting the catch data. Because right now, a lot of the states still aren't doing that. New Jersey doesn't. New Jersey doesn't do a collection … and as Rich [Wong] spoke about the dredge fishery for knobbed whelk in Delaware Bay, New Jersey's fishery is much larger but it doesn't show up that well in the data because they're not collecting all the catch information. But sometimes they have very large catches of knobbed whelk.

Question: Would that be a logical thing for ASMFC or are they sort of overwhelmed with other fisheries?

Robins: I think that on the data collection side of it, it could go through ASMFC or it could be something coordinated among the states, it wouldn't require regulatory action. But I think that's a Fishery 101 deal, just making sure you have the adequate catch monitoring but that's not in place. So that's still a problem to varying degrees up and down the coast. In some states they're doing a good job of it.

Comment/Question: How are things outside the fishery itself, like attention to horseshoe crabs, which are primary bait for pot fishery, and the right whale reduction plan for weak links and things of that nature in the ocean fishery? How is that affecting the effort, for example in Virginia or the pot fishery that's apparently in the ocean?

Robins: Well the horseshoe crabs fishery is now managed, at least in the Delaware component, in a sustainable way under the adaptive resource management model, but ASMFC has framed that around a male-only harvest strategy in the Delaware Bay. And so it's catching about (you know the exploitation rate is about) 2% of the population. I think that ensures the sustainability of that link to the fishery. Weak links are now required in the vertical lines. I think the agency just published their final rule on vertical lines where they have to be marked appropriately so that if there is an interaction with a vertical line they can determine what fishery that came out of. But otherwise it is an individually buoyed trap fishery.

Comment: Well I mean for example, our state has taken all the blue crab fishermen out of the ocean.

Robins: Okay.

Comment: I don't know what that's gonna do up in Virginia, I mean maybe ya'll are not part of the right whale migratory pattern, they may be further off shore there. But I mean it's pretty much put an end to that fishery in our state.

Robins: Yeah well I think there's been interactions off our coast in that area but when National Marine Fisheries Service published that rule, they included marking requirements so that's where the management of that issue is right now. But we clearly have a lot of work to do, I think, to get a handle on the scale of these fisheries, because I think every line of evidence you see suggests that the pattern and extent of exploitations could be a problem. And there's no way, I don't think, that we can take all of the effort that's in the fishery today and come out the other end with a sustainable result and have that many participants in the fishery, or that many eligible licenses in the fishery.

Stevens: That rule about the horseshoe crabs management plan has changed the bait that the industry is using too. Up in Massachusetts when we first heard it, they were using mostly horseshoe crabs, now they're using green crabs and shark heads.

Robins: There's been a lot of innovation in that. Bob Fisher was involved in the development of some conservation devices in Virginia, as with mesh bait bags that allow fishermen to use less bait. About three years ago we actually ran out of bait, there was a shortage of horseshoe crabs at the time, and the fishermen learned from that [shortage] and really became involved their fishing practices, and they started experimenting with different mesh size bait bags and chopping the bait up more finely. They were forced to create their efficiency improvements.

Fisher: Virginia fishermen make these concoctions as well using several different bait items. Most it seems having a portion of it used to extend the fishing life of the horseshoe crab part of the concoction

Nancy Balcom, University of Connecticut Sea Grant: I have a question for you Rick, you're a processor. Connecticut is a disaster in terms of conch, the whelk fisheries right now. We have a Bureau of Aquiculture that issue licenses for anyone who wants to land more than half a bushel a day. Beyond that, there's absolutely no management in our fisheries division, no legal authority to manage mollusks. New York is thinking on changing, but a couple of years ago some of our processors came to us with concerns about the

demand for smaller and smaller size whelks. Do you feel that same pressure? Do you see a difference in the yield or is it hurting you to have demands from overseas for smaller whelks?

Robins: Well I think the market's insatiable essentially. The market demand is very strong. So you know the demand doesn't necessarily drive the problem, relative to the sizing. Because some of the states like North Carolina don't have any minimum size and so, you know, what that sets up as the fishery develops is clearly the potential for disaster because at that point you have everything that's being caught is going to include very immature animals and that state also does not have other controls on fisheries…

Balcom: Yeah we're just saying that processors came and said we don't want to be getting whelks less than four inches length so we tried to talk to the fishermen about maybe a community management because there's no regulatory authority in the state. I think we're going to have to do something.

Robins: Yeah I agree. This unfortunately follows a history of fisheries failures relative to the southern New England lobster. I mean that fishery collapsed, you saw very clearly the massive shift in this fishery and in New York, and I mean their fishery is just teetering on the verge of commercial liability as a consequence because the scale of what happened in the bulk of that fishery was just so great. And like I said, they got 250 eligible licenses, you know there's just no handle on it whatsoever.

Balcom: And so we're in the same boat?

Robins: Yes, I think in Virginia that will be our first order of business is really trying to get a handle on that eligibility pool, and right now we have 31 active licenses, but in terms of how many boats can really direct on that fishery is probably, just probably 20. So that's part of our challenge. Bob, you wanted to have more of a panel discussion?

Transcript of Panel Discussion

Bob Fisher: Yes, [I would] love to get feedback from the information presented today. We provided you with some biological assessment of the channeled whelk and fishery indicators showing distress in the fisheries along the East Coast; the writing is on the wall. Personally I see Virginia experiencing the stress of what the fishing pressure and regulations have been over the years. Because of the high amount of pressure on the small whelk as the result of the MLS, now we're seeing whelk maturing at a smaller size. This has been observed in other whelk fisheries in Europe. When you put high pressure on the smaller animals they tend to mature at a smaller size. We are understanding why the resources are being stressed. And like Rick [Robins] pointed out, it's not simply a no-brainer with just increasing the MLS, because the livelihood of these fisheries and the people who fish them are at hand. Massachusetts is progressing to slow incrimination of landing size, which is good, but the economic aspect of it to the individual fisher needs to be addressed as well. I'm looking for what information, or what questions that you guys can afford the conversation to go forward, with the intent here to capture feedback for mangers in these different states to evaluate and also create an atmosphere of open dialogue so all stakeholders' concerns can be addressed.

Comment/Question: Well I'm here in South Carolina. In South Carolina we assume that our population is similar to Georgia's but in fact we don't have any data. There's no one way or the other, and we certainly haven't been collecting any data lately. But it was collected back about the same time where Randy Walker [biologist, researcher] was doing the work in Georgia. We have a management plan for an offshore knobbed whelk fishery. And actually I don't think the management plan specifies what whelk is but that's just what you would catch there. But it's somewhat irrelevant because no one is fishing in that fishery. They can come and get a license, but they don't because what they catch wouldn't pay for the fuel because there aren't any whelks out there anymore because they [fishermen] caught them all. But we're starting to see some signs that people are fishing for them inshore and it's started out, and I think it still is, predominately by-catch in crab traps, but we're starting to think maybe people are more targeting the whelks than they are the crabs. We have absolutely no information on which to manage that fishery. We have no license for whelks, as long as they have a commercial license they're good to go. They don't need anything special for whelks. There are no limits – there is the size limit from the offshore fishery [that] would presumably apply, but that's it. So I guess one of the things we need to know is: do we good to go out and sample our whole fishery or, those of you who know more about whelks, do you think we can extrapolate from Georgia and use their numbers? Would that be a huge mistake? Or…help. We don't know what to do.

Fisher: And that's a great question, because as seen today from two different presentations earlier on whelk resources from Massachusetts/southern New England and within the Mid-Atlantic, we see there are differences observed in growth rates and size at maturity, so there is that regional component that needs to be addressed, I feel.

Comment: And I can say in our state, they can still catch whelks in our crab traps down in Georgia as a by-catch and do it that way. A standard crab trap actually targets larger whelks, I think 150mm and larger, and they were actually the poorest performing when we tried a different style of pots. So if it's the standard trap, you can actually modify them really easily and you can catch more whelks. That's what we saw. We had a graduate student look at about five or six different methods of doing modifications to see how you catch them.

Comment: Right, and I don't think in South Carolina they have to tell us what their pot looks like. And they can buy as many pot licenses as they want, it's totally unlimited. And they don't have to have a special license to be doing whelks. We're trying to get catch data but we've only just started to try to get it. Before that

we got catch data only if somebody just happened to add it on to their crab trap data when they turn in their crab landings, because there wasn't really a separate form for whelks since they don't have to have a separate license for whelks.

Comment: Well at $2.50 a pound you can bet they're gonna be out there trying to catch them.

Comment: Well yeah.

Comment: I might get into the fishing business.

Rich Wong: Rick, what's the mechanism on the policy to encourage the state to at least to report their landings like New Jersey?

Rick Robins: Well, I think that you could have a more formal discussion through a body like the ASMFC, perhaps their policy board? That would be one impetuous or avenue for doing that. You know, if there were another scientific body that was interested in the question, they could also contact the states individually, up and down the coast, and encourage that. But you know it's clearly it's just, it's asymmetrical right now. It's very, I think it's very inadequate. You know, sounds like Massachusetts has a good handle on what's being caught out of everything I've seen, but the reporting is just inadequate.

Fisher: And that's the key, Massachusetts has the best reporting of whelk of all the states. Historically they've done a good job of reporting on their fisheries. And that's where the other states have to get to if we're going to make any sense of future sustainability issues.

Wong: Will something come out of this session from the Sea Grant that we could send to New Jersey or other states that don't report?

Fisher: We're going to package this and get it out in some sort of format, modified proceeding likely, so you guys can use it and distribute it to your whelk stakeholders. But the intent of this special session was/is to use this venue to bring the information together from all regions in which whelk is being harvested and start the conversation as to how we can go forward in adopting more adequate management policies to sustain both our whelk resources and the fisheries side that extends from them.

Bob Glenn: Yeah, one other thing I wanted to add was there were a lot of questions about "would this be appropriate to manage whelk under ASMFC," and one of the difficulties is life history characteristics of whelk don't really fit well under ASMFC model. ASMFC species, for the most part, with the exception of maybe horseshoe crab, deal with species that are migratory, or you know move up and down the range of the Atlantic Coast. And you know whelk, just based on data we've collected and some other researchers have, we did see differences in our fishery on a scale within a state, never mind across state borders. So it's a difficult framework and I think that probably some of the reluctance ASMFC has had to picking whelk management is probably that. The one thing that I think is applicable to ASMFC management would be the interstate commerce and, being from Massachusetts, we know that whelk, being next door to Rhode Island, whelk go back and forth and anytime we have differences in minimum size between those adjacent states it's instant black market trading across the border between the two. Guys catch their undersized whelk and bring them to Rhode Island to process. Luckily Rhode Island has recently followed suit with us and so far we've kind of stuck on the same schedule for minimum size increases. That's helped that out. And the other thing I wanted to touch on was your question about, could you look at say, data from Georgia and see if that was applicable, and just based on my experience in Massachusetts I would say no. I couldn't make these decisions based on… I could make an argument for having differential management measures within our states because it's that fine a scale of differences in their life history characteristics, and actually in the fishing effort, catch, and everything. Really, really fine scale of differences in those fisheries and I think that's a real challenge to manage…

Tom Angel, Rhode Island Fish and Wildlife: I kind of wanted to piggyback off what Bob [Glenn] just said. We have a fishery, we're right next door to Massachusetts' fishery, and there are differences I would say, but you know, one size for everybody is not gonna work based on regional differences. Also, in Rhode Island, our whelk fishermen are mostly shell fishermen fishing in our coop fishery. They are very, very concerned that if we start protecting these snails that it's going to decimate that fishery which employs far more people. So we're kind of at odds right now. We had plans to move up but our fishermen are…they're not happy at all with it. So that's kind of what is happening in Rhode Island right now.

Fisher: Are they opting for other management strategies?

Tom Angel: No, no, they would probably just prefer to be left alone, you know? No, they haven't suggested any other types of ways to manage the fisheries. Except, well I will say that they're also concerned because we don't really have a limited entry into that fishery so they would like to see that happen But I don't want to have to deal with going through another allocation process saying, you're in, you're out.

Fisher: Nancy, do you want to add to that?

Nancy Balcom: One of the questions that came up at our very lively meeting was the fact that with the shell breakage, the minimum length is difficult to do. And I was wondering, in Massachusetts you have the width, so are they using like a ring, I mean we heard all sorts of suggestions, so not the same as using calipers?

Glenn: No, we actually, we developed a standardized gauge for whelk. It's basically…it's piece of stock aluminum that is mounted to a board, has two…basically take the whelk and you pull it through almost like a grocery scanner, you can pull it through and if it pulls through that inside amulet then it's too small. If it stops then…we actually put the size increases for the first round. We made enough of those to distribute to all our analysts and fishermen to help… concerns that and also we tried to standardize them. Because it's a difficult animal to measure we wanted to make sure our industry members were measuring them the same way our law enforcement officers were so we tried to standardize that. Law enforcement officers carry the same gauge and so there was not as much question as about to what's caught and measured, and in the past they would deal with ring sizes and as you're all aware, you tilt it this way and that way, it gets pretty difficult.

Wong: There is a breakage in the shell length but the correlation…agreement between shell length and shell width is so tight it makes no difference whether you use shell length or shell width for your minimum size limit. It's so— there's such a great agreement—it's really tight.

Robins: Bob [Fisher], I understand that we've had that problem in Virginia because we just have a ring diameter and there's no minimal thickness on the gauge. And the alternative that, I mean that's a really ingenious solution ya'll have in Massachusetts with that U-shaped piece of aluminum. Alternatively, if you had a minimum thickness on the gauge itself that would preclude the twisting effect. Because you can take a larger whorl and twist it through a smaller hole if you get it at the right angle. So that causes all kinds of headaches with law enforcement.

Fisher: Like a piece of PVC or something… a tubular cull device with length equal to or greater than the whelk SL would be needed to maintain whelks perpendicular orientation to tubes opening (plane of linear measurement), thereby prevent manipulation of whelk linear maximum width.

Robbins: A gauge that I'm just going to follow and say I think for all the developed fisheries throughout the region, every one of them have a scale problem and I think in terms of some of the next steps, one thing that would be really helpful would be some work done on population dynamics modeling, really thinking about yield projections and how that might play out under different management alternatives. I think that would help us all because in a data-rich situation we could have a very well-informed discussion with the industry about what the trade-offs are going to be in terms of how we get from point A to point B, and this is what the valley is going look like that you have to go through. As opposed to where we are right now, we're just

talking about potentially changing minimum sizes, given the fact that some fisheries are inshore, some are offshore. You got all these different cost structures. I think we would be challenged to have that conversation right now in our state without at least some sense of the tradeoffs. Like in the sea scallop fishery we went through this and it was easier I think to paint a picture of what the result would be because you can see how you can maximize yield per recruit and how to really change the productivity of the fishery, and that's exactly what happened. But you know, finding a way to get from here to there is gonna require some evaluation of those different yield streams that will come out of the fisheries. So you know some sort of modeling work I think is in order on that side of it.

Bill Quimby, Seafood Trading Company: Hello. My name is Bill Quimby, I'm with the Seafood Trading Company. I certainly don't promote ASMFC getting involved in another fishery. I mean I've had some recent experience watching their eel business actually, and something that someone from your state there put on the table once was to show how the Europeans manage their eel fishery and they actually put, I don't know it's 50% or a certain percent of the catch/the harvest, they throw them back in the water and they do a good reporting and so they know it should be a help, and have some satisfaction that a sustainable fishery by throwing things back, and I don't know if we can get people to throw catch back in the water very easily but that's just something I'd throw out. And it seems like it's gonna be a state permitting issue probably… Good luck.

Fisher: There is definitely going to be growing pains. Are there any other thoughts?

Comment: Just a question. I had a question regarding, since this is such a valuable resource at this point you were saying, it doesn't seem like the market is going to be saturated any time soon. If you would enact these higher size limits, and it would reduce the amount of product, do you see that that would compensate the dockside value of the product and that could help sell it? Or is it, would the price be stable regardless of how it's being landed?

Glenn: I would… my anticipation and I would probably defer to Rick [Robins] on this because he would know more about the market side of things, but as he indicated before all appearances are that the market is pretty much insatiable so if one state… One of the concerns we had in Massachusetts and going forward is if you're the first one to step out off the train platform by yourself then you're gonna get hit by the train. You're putting your own… If one fishery in one state goes forward on some of these things you're putting yourself at risk in the market place because there's a whole East Coast of states ready to fill in the void behind you.

Robins: Well, but the individual states can't increase their output; I mean it's very limited right? So you know, I would suggest that relatively price inelastic, I mean if we decreased output the price would go up but it wouldn't go up by the same percentage that the output went down. For example, I think Brad had the thing up there with the schedule of what percentage would be lost relative to the current catch, in one case you'd be retaining 30-something percent of the current catch? So if you decrease your output—

Bradley Stevens: That's with a sudden increase—

Robins: So if you decrease your short-term output by 60% at the individual, when looking at the microeconomics of the trip and that boat leaving the dock, this is for the boats that participate in it, it's, they describe it as the most expensive small boat fishery they participate in because they may carry $1,000 worth of bait, burn, in our case, $4,600 worth of fuel, and have three or four heads on the boat, so the cost structure is very, very high cost for a trip. And if we decrease what they could land by 60%, even if you had a 20% increase in price, that trip's probably not viable at that level. So output could go, theoretically in the fishery we went straight from maturity schedule to output in fishery at state level, to 0. Now those states have nearshore fisheries and those components would have different cost structures and may still be viable. But I made that point because if you think about trying to have a sustainable outcome in all those different dimensions it may indicate a different strategy, whereas for us we focus on more of incremental approach to

the maturity schedule…But really try to get a handle on output and also on thinking about making sure that we don't have open loopholes for entry so that people won't come in and continue to hurt the resource.

Wong: And that is exactly what happened in Delaware, increased the size limit a quarter inch for over 40 years, and over that time eventually it didn't just reduce the harvest, there was nobody that went out. You know because it wasn't cost effective for them to go out and catch…it just wasn't cost effective on the trip level but that short-term pain, it looks like the momentum is growing back in the fishery now. The size limits have been six inches for four years and now we're starting to see the landings go back up. So that without the yields modeling that we did 10 years ago, say if you go to six inches, eventually if you give it time for recruitment, for increased recruitment to enter the fishery, you're gonna have greater yield. So hopefully the experiment is gonna work and we'll see the yield actually does increase the fishery. That's like a real world. That yield modeling is just theoretical, it's on paper but hopefully what we're seeing now in Delaware is actually really happening.

Glenn: Just to follow that up, I agree. I think the yield modeling is important and it certainly, you know it's promising that increasing minimum size, but as you are well aware as you indicated, it's a theoretical exercise. It probably depends a lot on what your mortality rates are. So you think in addition to minimum size, do you have any other management, are there any other management measures on the books that are going to limit the fishing mortality rates officially so you may actually realize some of those increase recruitments down the road?

Wong: No, we don't have effort controls on the fishery.

Glenn: I think that's kind of the point I think we're all facing, is that one without the other is kind of difficult at best as far as looking forward and pulling it through to be successful, and minimum size measures by themselves are a good stop-gap measures, but I don't think it solves any of your long-term problems. You mentioned that looking at output controls because in the absence of any control on harvest those are; you still can swap any of the prodigal effects of those.

Wong: Yeah certainly. And then you do have to have some limit on effort for closed entry.

Shelly Edmundson, University of New Hampshire: I just want to say, in between all that, it's important with by-catch. We're allowing by-catch in the other fisheries so you're almost increasing the pressure through by-catch if there is zero by-catch like with our fluke fishery , things that are now targeting whelk because the value is so high. I think that would be effective and important.

Stevens: Yeah Bob [Glenn] do you monitor by-catch landings?

Glenn: Yeah I do. And in fact, this past year because of the huge increase in prices, everybody wants to keep every whelk they can. To the point where we always allowed non-targeted by-catch of mostly knobbed whelk but also some channeled whelk in our fluke fishery in Nantucket Sound would be a tow or two a day of whelk. And then what happened this year is that the fluke daily tripled, and that's a very small couple hundred pounds of them. And it usually only takes about a tow for one of their boats to get their fluke limit. And in the past they would do their tow and keep whatever by-catch. Well what happened between horseshoe crabs and whelk, which are both by-catch in that fishery, they just started going and making four or five tows to deck-load up with as many whelk and as many horseshoe crabs as possible, meanwhile they're shoveling dead fluke over the side. So that's obviously not a practice we're supportive of, so we had to put trip limits on whelk by-catch and horseshoe crab by-catch and trying to limit that, but to some degree it's still occurring. That's really problematic.

Joe Facendola, North Carolina Division of Marine Fisheries: I'm just gonna fill in the black hole of North Carolina. We have no size limits, no trip limits, basically no regulation at all, and we're fairly data-poor. We just implemented our fishery dependence sampling on whelk so we don't really have any idea of what

the composition between the four potential species we have, but it's primarily just from kind of anecdotal looking. Knobbed, and channeled, and some lightning but pretty much for the last 20 years it's existed only as a by-catch fishery with minimal actual targeting effort and estuarine, either crab pots or flounder trawls, and a little bit in the ocean in flounder trawls. And then just in the past maybe four years we've seen a kind of the historical high of 300,000 pounds landed in a year, in the 80s and then kind of petered out, participation dropped out, and we kind of hovered around this 30,000 pound range. In the last three years we've seen it bump and increase here to 50-something, 55,000 pounds landed. And that was still primarily participants landing whelk had increased, but still they were just landing it as by-catch in other fisheries and we had maybe like 10 to 12 people who were actually targeting whelk, and I think one to two in the actual ocean, in the federal ocean.

Stevens: And those were mostly knobbed whelks right?

Facendola: Knobbed and then I think the more towards the Virginia border there's gonna be some channel whelk.

Fisher: And that's in the offshore fishery?

Facendola: Yes, that's the, I think the little piece of offshore…cause last year we went from having, I think hundreds of pounds of offshore whelk landed to 8,000 pounds landed so we're kind of in a unique place. I guess if we don't have that target fishery, maybe we can sneak some regulations right in there without too much uproar, maybe…

Fisher: Well, I know we have way overshot our time-slot for this session, but I do appreciate that all of you participated in today's session. I want to thank the presenters today for sharing their research and overall knowledge of their respective whelk resources and fisheries. And thank all of you for engaging in this discussion and providing valuable feedback that can be shared with all stakeholders. I'll put something together with the presentations that were given today as well as transcript from the discussion portion of this session. If you would like to contact me directly with questions or comments extending from this session, please do so. My email address is rfisher@vims.edu. Contact information from all attendees to the ICSR conference will also be distributed by ICSR staff, which will have most, if not all, of us participating here in this whelk session. Thank you again, and feel free to submit comments to me at any time, I'll direct them to the right people. Thank you.

Concluding Remarks

Robert A. Fisher

Marine Advisory Services/Virginia Sea Grant
Virginia Institute of Marine Science

The objective of this special session at the ICSR conference was to bring together academia, industry and regulatory groups concerned with the observed stressed currently exerted on whelk resources along the US east coast. Participants representing whelk-producing states from New England to Georgia shared information regarding specific whelk stocks and the fisheries that extend from those stocks. Academia presented new science-based biological assessment information on these data-poor resources, providing insight on current pressures exerted on those resources. Research highlighted important life history, growth parameters, and size at sexual maturity of whelk stocks, commercially harvested from leading producing areas from Virginia to Southern New England.

Regional variations of growth and maturity exist within these whelk resources. This information, primarily size at maturity schedules across all whelk stocks, strongly suggests that current minimum landing size (MLS) regulations are inadequate. Further, whelks are observed to mature at different sizes under different management MLS. Currently, large proportion of immature female whelks are being legally harvested, minimizing recruitment back into those stocks.

The interactive discussion centered on sustainability of the whelk resources and that of the fisheries they support. Adjusting MLS is recognized as a starting point, largely through implementing schedules for incremental size increases, but that alone would be a short-term solution, with the need to employ a compliment of other strategies. The microeconomics of fishermen within each whelk fishery needs to be addressed for a sustainable outcome. Effort controls and better reporting and monitoring common across all the jurisdictions resonated as important aspects that need to be incorporated into management framework. Some states have mandatory reporting, but compliance and reporting as mixed-species are an issue, while others do not have any reporting requirements in place. Consideration of more effective access and limiting access controls relative to the scale of a given fishery was identified for biological and social economic sustainability.

As a result of the presentations and interactive discussion during the session a better understanding of overall whelk resource issues was established. Regional variations observed in whelk growth and maturity between whelk stocks along the US East Coast requires consideration for conservation management and may preclude regional policy framework.

Simply adjusting minimal landing size was recognized as not a standalone solution, but integrating MLS adjustments with controls on effort and establishing more aggressive reporting and monitoring is needed. The need for a coherent approach to *Busycon/Busycotypus* fishery management was established.

Presenters' Contact Information

Robert A. Fisher

Fisheries Specialist
Virginia Institute of Marine Science
Marine Advisory Services, Virginia Sea Grant Program
804-684-7168
rfisher@vims.edu

Bradley Stevens

Professor and Distinguished Research Scientist
Living Marine Resources Cooperative Science Center
University of Maryland Eastern Shore
410-651-6066
bgstevens@umes.edu

Richard Wong

Biometrician, Department of Natural Resources
and Environmental Control
Delaware Division of Fish & Wildlife
302-735-2975
Richard.Wong@state.de.us

Bob Glenn

Chief Marine Fisheries Biologist
Invertebrate Fisheries Program
Massachusetts Division of Marine Fisheries
508-990-2860
robert.glenn@state.ma.us

Rick Robins

Whelk Industry member
Chesapeake Bay Packing
757-876-3778
richardbrobins@gmail.com

Tom Bliss

Director: Shellfish Research Laboratory
University of Georgia
Marine Extension Service
912-598-2348
tbliss@uga.edu

Robert Glenn

Chief Marine Fisheries Biologist
Invertebrate Fisheries Program
Massachusetts Division of Marine Fisheries
1213 Purchase St
New Bedford, MA 02740
(508) 990 - 2860 x 113 office
(508) 468 - 6451 cell
Robert.Glenn@state.ma.us