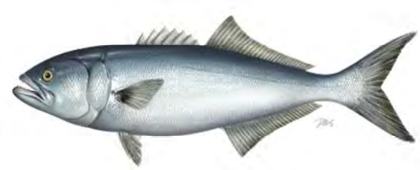
Atlantic States Marine Fisheries Commission

Report of the Quality Assurance/Quality Control Fish Ageing Workshop



St. Petersburg, Florida
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Vision: Sustainably Managing Atlantic Coastal Fisheries

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Statement of Problem

Many of the fish species managed by the Atlantic States Marine Fisheries Commission (ASMFC) identify the collection of ageing hard parts, development of sample processing and reading protocols, and regular sample exchanges as research priorities in their stock assessments. Several species managed by the ASMFC have had their own ageing structure exchange and workshop to address this. However, there is a continued need for a quality assurance/quality control (QA/QC) workshop because any gradual decline in ageing accuracy could have detrimental effects on stock assessments and consistency should be monitored over time (Campana 2001). Following the Gulf States Marine Fisheries Commission (GSMFC) protocol to hold annual QA/QC workshops for its participating members, the ASMFC made a QA/QC fish ageing workshop a research priority in their 2015 and 2016 Action Plan for the Atlantic States.

Representatives from state agencies and ageing labs along the Atlantic coast participated in a planning call in late 2015. During this call, it was decided that the species of interest for an ageing workshop were Atlantic croaker *Micropogonias undulatus*, black sea bass *Centropristis striata*, bluefish *Pomatomus saltatrix*, river herring (alewife *Alosa pseudoharengus* and blueback *A. aestivalis*), striped bass *Morone saxatilis*, and tautog *Tautoga onitis*. Each of these species previously had their own ageing workshop and the group felt that these would be most productive to include in the QA/QC exercise. Since the GSMFC QA/QC workshop is currently held at the Florida Fish and Wildlife Research Institute (FL FWRI) in St. Petersburg, representatives from FL FWI volunteered to host the meeting for the Atlantic states. Participating members provided hard parts from species they routinely age so that differences in processing or the physical appearance of samples along the coast could be considered. Samples were sent to FL FWRI's fish ageing lab in early 2016 and their staff organized and photographed the reference collection. The workshop took place from March 30th-31st at the FWRI in St. Petersburg, FL.

Workshop Objectives

The objectives of the workshop were to:

(1) Age samples collected and prepared from labs along the Atlantic coast for croaker, black sea bass, bluefish, river herring, striped bass, and tautog

(2) Identify areas of inconsistency that persist for processing or reading ageing structures

(3) Provide information on ageing error for each species to inform future stock assessments

(4) Develop recommendations to address any problems that emerge from this workshop so as to improve age data along the Atlantic coast

(5) Maintain samples as a reference collection for future QA/QC workshops as well as archive in a digital library

Previous Ageing Workshops

All species aged during the QA/QC Fish Ageing Workshop have had their own ageing workshop. Complete reports and results from those ageing workshops are available at http://www.asmfc.org/fisheries-science/research and are summarized below along with the history of how age data is used in their respective stock assessments.

I. Atlantic Croaker

Age data is used to describe the life history of Atlantic croaker in stock assessment reports, as well as in the statistical catch-at-age model in the 2010 and scheduled 2016 benchmark assessments. All ages used in these assessment reports have been from otoliths. Recommendations from the stock assessment subcommittee and the review panel during the 2005 and 2010 stock assessments identified the need to standardize ageing protocols for this species (ASMFC 2010).

The ASMFC hosted a joint ageing workshop for Atlantic croaker and red drum in 2008 to standardize methods for processing and reading otoliths (ASMFC 2008). Additionally, a goal of the workshop was to resolve the issue of identifying the first annulus from any smudges, or check marks, laid down near the core. Otolith sections were exchanged and read by participants from NJ to GA and the Southeast Fisheries Science Center (SEFSC). The workshop concluded that the smudge should not be counted but rather the first distinct ring is the first annulus.

II. Black Sea Bass

Early assessments for black sea bass were developed using simple index-based models and beginning in 2008, an age-based model was developed. Depending on the lab, age data was taken from scales, sectioned otoliths, and whole otoliths. Ages were used to describe life history parameters, but were also used in the model for the 2011 assessment of the northern stock (New England to Cape Hatteras). One of the research recommendations in the 2004 stock assessment was to develop age information for analytical models (NEFSC 2004). Additionally, concern remained that there could be different methodologies between labs ageing northern and southern stock fish.

A sample exchange and ageing workshop was held for black sea bass in 2013 to standardize ageing methodology and evaluate the consistency of ageing along the Atlantic coast (ASMFC 2013b). Differentiating between check marks and true annuli were discussed as well as the continued need for sample exchanges in the future for consistency. Participants of the workshop recommended that whole and sectioned otoliths can be used to precisely age black sea bass, but otoliths from fish older than 5 should be sectioned.

III. Bluefish

Both scales and otoliths have been used to age bluefish, although scale ages tend to overestimate younger fish and underestimate older fish. Scale ages were used in the stock assessment through 1997 and in 1998 the model began using otolith ages. Inaccuracies due to false annuli, rejuvenated scales, varying annuli counts between scales from the same fish, identifying the first annulus, and identifying annuli on scales from larger fish have all been documented (Richards 1976; NCDMF 2000; Robillard et al. 2009; NEFSC 2015). Because of these challenges, the stock assessment has used a 6+ age group in the statistical catch-at-age model to minimize the effects of ageing error for scales ages from 1985-1995.

In 2011, an ageing workshop was held for bluefish to standardize sample processing and reading procedures (ASMFC 2011). The results of this workshop established sectioned otoliths as the preferred ageing method over scales or whole otoliths and the standard protocol for processing and reading samples is that of ODU and Robillard et al. (2009). Following the workshop, Addendum I to the bluefish fishery management plan was established that required all states with substantial bluefish landings to collect and age at least 100 bluefish samples annually. Additionally, the ASMFC maintains a digital reference collection for reference and training purposes.

IV. River Herring

River herring is assessed on a river-by-river basis and the model used depends on the available data. Many rivers lack the data to do a model-based assessment so trend analysis is used. For a few rivers, age data is available and a statistical catch-at-age model is used. However, lack of data has hindered stock assessment scientists from doing full coast-wide assessment and the need for standardizing ageing techniques and collecting more age data was identified by the review panel in the stock assessment (ASMFC 2012b).

To address these needs, a sample exchange and ageing workshop was held for both alewife and blueback herring in 2014 (ASMFC 2014). The majority of samples exchanged were paired otoliths and scales. While many challenges were brought up during this workshop including identifying the first true annulus, differences between readers, and regional differences between samples, the group agreed on the standard protocol for collecting, preparing, and ageing river herring.

V. Striped Bass

Age data for striped bass has been used for both VPA- and SCA-based stock assessments, so ageing consistency among coast-wide agencies and ageing labs is critical for the management of this species. Scale ages have been used in the assessment since 1996. Scales have been the most common hard part collected and aged, but it has been acknowledged that they underestimate ages in older fish when compared to otoliths (Secor et al. 1995). Both the technical committee and stock assessment committee for striped bass expressed interest in collecting more paired samples and developing regional and annual scale age-otolith age conversion keys to correct for scale bias (ASMFC 2013a).

In 2003, the ASMFC organized an exchange of 102 known-age scale samples and held an ageing workshop (ASMFC 2003). While there was some overestimation of year 1 and 2 samples by one year, participants felt that this issue could be mitigated by routine training in the labs. Results indicated that there was good agreement between states and readers for scales ages 3-7 and that otoliths were more precise among readers and ages. Overall, the workshop concluded that scales provided accurate and reliable ages until age 10-12 or about 800 millimeter total length (mm TL). While the cost of collecting and processing otoliths can be a limiting factor, the ASMFC began working with states to collect otoliths for striped bass 800 mm or larger for future analysis.

VI. Tautog

From 1995-2011, benchmark stock assessments for tautog and the updates used a VPA model that relied on age data. A statistical catch-at-age model was developed for the 2015 stock assessment and age data was used to develop life history parameters as well (ASMFC 2015). Most states use opercular bones for ageing, but in 2001, Virginia began using otoliths to standardize readings of the operculum. Recognizing the importance that age data plays in the assessment of tautog and addressing concerns that were raised over the change in protocols in Virginia, it was recommended that a workshop be organized and conducted among participating states.

In 2012, the ASMFC organized a hard part exchange and ageing workshop for tautog to evaluate the age precision among states and establish best practices for consist age readings (ASMFC 2012a). The workshop aged operculum and otoliths, when available, and determined that precision was similar for both hard parts. Participants of the workshop recommended that operculum remain the standard for biological sampling but also encouraged otolith collection for paired sub-samples. Additionally, it concluded that the Virginia data is not significantly different from other states and it should be used in the assessments going forward. In 2013, a follow-up to the workshop was done and states remained consistent in their readings.

Sample Collection, Preparation, & Ageing Methodology

I. Atlantic Croaker

New Jersey Division of Fish and Wildlife (NJ DFW)

Since 2006, Atlantic croaker have been collected during dockside sampling by NJ DFW staff. . Fishery independent samples are also seasonally collected aboard the NJ DFW Ocean Trawl Survey. Samples are weighed, measured, and otoliths are removed as samples are being offloaded from commercial fishing vessels. Once otoliths are extracted, they are sectioned and aged under a microscope at NJ DFW's Nacote Creek Research lab. To date, 4,153 samples have been collected, with 170 samples collected in 2015.

Maryland Department of Natural Resources (MD DNR)

Maryland Atlantic croaker otoliths were collected from commercial pound nets in 2000 and then from 2002 through present (2016). A minimum of 20 samples were taken in 20 mm TL bins annually for all size groups available. Additional randomly collected pound net, gill net, and trawl commercial samples were obtained from fish dealers from 2009 to 2014. These were opportunistic sampling events, did not collect all gear in all year, and may or may not occur in the future. In 2012, croaker otoliths were also sampled randomly from commercial gill nets. All fish sampled for age were measured to the nearest mm TL, weighed to the nearest gram and sex was determined from internal examination of the gonads.

Prior to 2011, Atlantic croaker otoliths were processed and aged by the South Carolina Department of Natural Resources (SC DNR). Otoliths from 2011 to 2015 were aged by MD DNR biologists. The left otolith from each specimen was mounted to a glass slide for sectioning. If the left otolith was damaged, missing, or miscut the right otolith was substituted. Otoliths were mounted in Crystalbond 509 and were sectioned with a Buehler IsoMet® Low SpeedSaw using two blades separated by a 0.4 mm spacer. The Buehler 15 HC diamond wafering blades are 101.6 mm in diameter and 0.3048 mm thick. The 0.4 mm sections were then mounted on microscope slides and viewed under a microscope to determine the number of annuli. All age structures were read by two readers. If readers did not agree, both readers reviewed the structures together, and if agreement still could not be reached the sample was not assigned an age.

Virginia Institute of Marine Science (VIMS)

The Northeast Area Monitoring and Assessment Program (NEAMAP) is a cooperative state-federal program that has operated a Near Shore Trawl Survey in the mid-Atlantic Bight and southern New England since fall 2007. The Virginia Institute of Marine Science (VIMS) has been awarded the contract to carry out the survey. It continues and extends the methods of the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) which started in 2002. Atlantic croaker is a "Priority" species for NEAMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS uses sectioned otoliths for age determination. A total of 10,514 Atlantic croaker have been aged by the two surveys (CM 6,845; NM 3,669). VIMS has disputed that an interior 1st annulus should be counted for accurate age determination due to the time of year the species spawns and their annuli deposition. Ages have ranged from age-0 to a max age of 18.

There are three readers at VIMS and the mode age for each sample is provided as the final age. If there is no mode from the initial read, the readers reread the sample and if there is still no mode, they examine the sample together and come to a consensus age. If a consensus age cannot be determined the sample is discarded. Very few samples are discarded. Precision tests are preformed within each reader (multiple reads of the same sample) and between readers. VIMS uses similar precision and symmetry tests to the NEFSC.

Old Dominion University (ODU)

The otoliths collected through the Virginia Marine Resources Commission's (VMRC) Biological Sampling Program are processed and read by the ODU's Center for Quantitative Fisheries Ecology (CQFE) laboratory. Atlantic croaker otoliths have been collected by VMRC since 1998. Otoliths are processed following the methods described in Barbieri et al. (1994) with a few modifications. The left or right sagittal otolith is randomly selected and attached to a glass slide with Aremco's clear Crystalbond™ 509 adhesive. One transverse section is cut through the core of each otolith using a Buehler Isomet low-speed saw equipped with a three inch, fine-grit Norton diamond-wafering blade. Otolith sections are placed on labeled glass slides and covered with a thin layer of Flo-Texx mounting medium.

All fish are aged in chronological order based on collection date, without knowledge of the specimen lengths. Two readers must age each otolith independently. When the readers' ages agree, that age is to be assigned to the fish. When the two readers disagree, both readers must re-age the fish together, again without any knowledge of previously estimated ages or specimen lengths and assign a final age to the fish. When the readers are unable to agree on a final age, the fish is excluded from further analysis.

Atlantic croaker are assigned a January 1st birth date by convention. The sample date is used to assign the final age. If the sample was taken before the period of annuli formation (April to May), the age is the annulus count plus one. If the sample was taken after that, the age is the annulus count.

Historically, Virginia has counted the wide band/smudge closest to the otolith core as the first annulus, whereas most other states do not; however, since all Atlantic croaker in Virginia form that band and because Virginia uses the January 1 model birth-date, the sampled fish should be scored as the same age-class assignment as those scored in other states.

The following are links to the preparation and ageing protocols for Atlantic croaker.

- Otolith Preparation Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/atlantic-croaker-otolith-preparation-protocol.pdf

- Otolith Ageing Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/atlantic-croaker-otolith-ageing-protocol.pdf

North Carolina Division of Marine Fisheries (NC DMF)
Atlantic croaker sagittal otolith samples are collected monthly from the winter trawl, long haul seine, pound-net, sink-net, recreational hook-and-line fisheries, and NC DMF fisheries independent programs. Sagittal otoliths have been collected since 1996. Each month, samples (n=15) are distributed across the length range in 15-mm length classes starting at 100 mm total length. Sagittal otoliths are removed, cleaned, and stored dry. Samples are weighed to the nearest 0.01 kg and measured for total length to the nearest millimeter. Date, gear, and water location are also recorded for each sample.

A transverse section through the focus on a plane perpendicular to the horizontal axis of the left otolith is prepared using a Hillquist thin-sectioning machine as described by Cowan et al. (1995). The system is calibrated with an ocular micrometer before each reading session. Sections are viewed under reflected light at 21X magnification. Annuli, marginal increment, and otolith size are measured (mm) on an image projected on a high resolution monitor from a video camera mounted on a microscope. Ages are assigned based on the number of otolith annuli viewed. The ageing lab biologist reads the otolith section and measures the annuli. The samples are then independently read by the species lead biologist. If any differences are not resolved, the data are omitted.

The NC DMF publishes three-year reports that include species-specific age-length keys, which have been applied to expanded length-frequency data to estimate length-at-age for total commercial landings on an annual basis. The age-length keys and expansions are applied on a seasonal basis: winter (January–March and October– December); and summer (April–September).

South Carolina Department of Natural Resources (SC DNR)
Croaker samples are collected from several different methods in South Carolina including inshore trammel net survey (2014), SEAMAP nearshore trawl (2001 to present) and MRFSS/MRIP survey. SC DNR Inshore Fisheries section also processes croaker otoliths from National Marine Fisheries Service's Northeast groundfish survey since 1996. Otoliths are embedded in resin to facilitate cutting, cut on a low speed saw to obtain a 0.4mm transverse cross-section and then mounted on microscope slide. The sections are read using a dissecting microscope with an attached camera so that the image can be viewed with a computer program like Image Pro. All samples are aged independently by two readers to insure accurate ages. Some Atlantic croaker otoliths vary with respect to diffuse, undefined marking near the core of the otolith. These diffuse areas are not interpreted as being a ring. The first annulus is considered the first well-defined, opaque band that can be traced around the entire section.

Georgia Department of Natural Resources (GA DNR)
Atlantic croaker were collected from Georgia's coastal waters using a variety of gear types in 2010-2012 as part of a graduate thesis (Franco 2014). Transverse sections were read from 2,401 otolith samples from age 0-6. The majority (98%) of otoliths exhibited the dark, opaque area near the core that is the smudge or check mark. While the majority of age samples for GA croaker came from this project, in the fall of 1997 GA DNR initiated the Marine Sportfish Carcass Recovery Project. This project takes advantage of the fishing efforts of hundreds of anglers by turning filleted fish carcasses that anglers would normally discard into a source of much needed data on Georgia's marine sportfish. The project is a true partnership of saltwater anglers, marine businesses, conservation groups, and the Coastal Resources Division (CRD). Since 1999, a total of 43 Atlantic croaker have been donated to the project. It was decided that the largest of the croaker would be sectioned and aged for the QA/QC Fish Ageing Workshop.

II. Black Sea Bass

Northeast Fisheries Science Center (NEFSC)
Scales and otoliths have been collected since 1984 during fall and spring fishery-independent trawl surveys conducted by NMFS from New England to Cape Hatteras, NC. Approximately 350 samples are collected from each survey annually (≈700 total). Scales are typically collected from

the commercial fishery by port samplers. Samples have been collected from the commercial fishery since 2008, with an emphasis on collecting samples from large and jumbo market size fish. A few thousand samples are collected from the commercial fishery annually. The size range of fish sampled is 4 – 60cm. One reader is currently ageing both scales and whole otoliths. Samples that the age reader considers unreliable for age determination are discarded. The NEFSC will phase out scale ages and begin providing age data only from otoliths. The reader tests precision six times a year, once following each trawl survey and each quarter of the commercial fishing season and provides the results of these tests online (http://www.nefsc.noaa.gov/fbp/QA-QC/) . The threshold for precision testing is 80% agreement and a 5% mean CV.

Massachusetts Division of Marine Fisheries (MA DMF)
Black sea bass scales are collected from commercially captured fish at the fish houses (since 2014). Scales are also collected from recreationally captured fish (since 2014). The Massachusetts Resource Assessment fishery-independent trawl survey has collected otoliths since 2013. Otoliths are read whole, submerged in mineral oil with reflected light under a stereo microscope. Otoliths aged 6 and older are then sectioned and re-aged. Scales are pressed into acetate with a heat press and aged with a microfiche projector.

Rhode Island Department of Environmental Management Division of Fish and Wildlife (RI DEM DFW)
Scales have been collected on fishery-independent surveys, at recreational fishing tournaments, and from the commercial fishery since 2013. The annual target number of samples is 100. Sample collection primarily includes scales; however, otoliths are also collected on fishery-independent surveys when the whole fish is being sacrificed. All samples are currently aged annually by a single reader.

NJ DFW
Sampling for black sea bass started in 2010 during the NJ DFW Ocean Trawl Survey. Samples are collected throughout the year, and are separated into 4 length classes to distribute sampling totals. To date, 687 black sea bass samples have been collected with 126 samples collected in 2015. Once otoliths are extracted, they are sent to the NEFSC for processing and ageing.

VIMS
Scales and otoliths have been collected from two fishery-independent trawl surveys, ChesMMAP since 2002 and NEAMAP since 2007. Black sea bass is a “Priority” species for NEAMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS ages sectioned otoliths but has conducted comparison studies with scales and whole otoliths from 2010 to 2013.VIMS has aged 3,094 total Black sea bass from 2002-2015 (CM 296; NM 2,798). Black sea bass have been aged from age-0 to a max age of 16.

There are three readers at VIMS and the mode age for each sample is provided as the final age. If there is no mode from the initial read, the readers reread the sample and if there is still no mode, they examine the sample together and come to a consensus age. If a consensus age cannot be determined the sample is discarded. Very few samples are discarded. Precision tests are preformed within each reader (multiple reads of the same sample) and between readers. VIMS uses similar precision and symmetry tests to the NEFSC.

Florida Fish and Wildlife Research Institute (FL FWRI)
Black sea bass otoliths are collected on fishery-independent monitoring surveys. Most black sea bass otoliths in the collection came from a directed project was conducted in 2011 and 2012. Otoliths are read whole, submerged in water with reflected light and a black background under a stereo microscope. Otoliths aged 6 and older, or of poor quality for whole ageing, are embedded, sectioned and aged.

III. Bluefish

MA DMF
The MA DMF has been sampling and ageing bluefish since 2009. Samples come from a combination of commercial and fishery independent sources. Otoliths are the only hard part aged for bluefish in MA. Otoliths are baked, sectioned, and aged with transmitted light on a compound microscope.

RI DEM DFW
Otoliths have been collected on fishery-independent surveys and from donated recreational carcasses since 2012. The annual target number of samples is 100 per the requirements of Addendum I to Amendment I to the Bluefish Fishery Management Plan. Whole otoliths are sectioned according the protocol provided by ODU and aged annually by a single reader.

New York Department of Environmental Conservation (NY DEC)
The NY DEC has been collecting length, sex (when available), and age (otoliths) data from bluefish since 2012. The majority of samples are collected from fishery dependent sampling of commercial markets, with additional samples of larger bluefish coming from the recreational fishery. Staff sample as many bluefish as possible, but age a maximum of 10 fish per 1 cm bin. Otoliths are embedded in West System Epoxy and sectioned using an Isomet Low-Speed Saw to a thickness of ~0.3mm. Otoliths are aged on a compound microscope using transmitted light. Samples are processed and read by one person. The NYS DEC has aged 1,275 bluefish since the project began in 2012.

NJ DWF
The NJ DFW initiated a sampling program for bluefish in 2010 with the intent of filling gaps in the stock assessment age-length key. Otoliths have been collected exclusively for bluefish ageing (no scales), and samples have been derived from fishery-independent survey efforts and fishery-dependent sources. Through 2014, the average number of bluefish sampled by the NJ DFW is 90 in the spring (SD = 16 ages) and 101 in the fall (SD = 27). Ageing is complete through 2015, though a summary is not yet available for 2015.

All otolith samples are sent to the NEFSC annually for processing and age determination and protocols follow those specified in the 2011 ASMFC bluefish ageing workshop. The age distribution of samples collected by the NJ DFW is available through 2014. As recommended by the bluefish Technical Committee, NJ DFW will report ages through 8+ (including retrospectively) as ageing techniques have been validated through age 8 (Robillard et al. 2009).

VIMS

Bluefish is a "Priority" species for NEAMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS uses sectioned otoliths to age bluefish. Otoliths are sectioned using a method similar to ODU's. However, VIMS wet-sands the sections to a thinner width than ODU and does not bake the sections. Annulus counts are adjusted to reflect the timing of sample collection relative to ring formation. Age is assigned as the mode of three independent readings. VIMS has aged 5,186 total bluefish between ChesMMAP and NEAMAP from 2002-2015 (CM 492; NM 4,694). Bluefish have been aged from age-0 to a max age of 10. The majority of the specimens sampled were ages 0-2. There are three readers at VIMS and the mode age for each sample is provided as the final age. If there is no mode from the initial read, the readers reread the sample and if there is still no mode, they examine the sample together and come to a consensus age. If a consensus age cannot be determined the sample is discarded. Very few samples are discarded. Precision tests are preformed within each reader (multiple reads of the same sample) and between readers. VIMS uses similar precision and symmetry tests to the NEFSC.

ODU

VMRC obtains bluefish otoliths from the commercial catch and fishery independent sampling programs. Bluefish otoliths have been collected by VMRC since 1998. These otoliths are processed and read by ODU CQFE. ODU CQFE chooses a random subsample of otoliths collected in each length bin to age. In 2015, VMRC collected 682 bluefish otoliths and ODU CQFE aged 442 of them.

ODU CQFE uses sectioned otoliths to age bluefish. Each section is read under transmitted light using a polarizing filter. The characteristics described in Robillard et al. (2009) are used to identify the first ring and false annuli. Bluefish are assigned a January 1st birth date by convention. The sample date is used to assign the final age. If the sample was taken before the period of annuli formation (March to June), the age is the annulus count plus one. If the sample was taken after that, the age is the annulus count.

Each year, readers revisit a reference collection of samples from 2000 to increase consistency across years. Each section is aged by two readers. If the first readings disagree, the readers re-age the fish together. If a consensus cannot be reached, the sample is excluded from further analysis and, if available, another sample from the same length bin replaces it.

The following are links to the preparation and ageing protocols for bluefish.

- Otolith Preparation Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/bluefish-otolith-preparation-protocol.pdf

- Otolith Ageing Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/cqfe-bluefish-otolith-ageing-protocol-black-white-2011.pdf

NC DMF

NC DMF has collected and aged bluefish scales from 1983 – 1998, and collected and aged otoliths from 1996 – 2000 and from 2006 to the present. From 1996 – 1998, NC DMF collected paired samples of scales and otoliths for a comparison of the two structures (NC DMF 2000). NC DMF did not collect any hard parts for bluefish from 2001 – 2005, when the Bluefish TC switched to a surplus production model for assessment purposes. The SAW/SARC review of that assessment (NEFSC 2004) found a lumped biomass model inappropriate for bluefish and recommended the use of an age-structured model instead. Thus, NC DMF began collecting otoliths for bluefish again in 2006. Despite training at ODU's lab, NC DMF could not replicate ODU's process to produce readable otolith sections and discontinued processing of annual samples in favor of archiving whole otoliths.

SC DNR

The Southeast Area Monitoring and Assessment Program (SEAMAP) is cooperative state-federal program that has operated a fishery independent Shallow Water Trawl Survey in the nearshore waters from Cape Hatteras, NC to Cape Canaveral, FL since 1986. The survey is conducted by South Carolina Department of Natural Resources (SC DNR).

In 2011, bluefish was added to the list of species that received a full work-up including the collection of otoliths for ageing. As with the NEAMAP samples, the majority of bluefish samples are small, young fish; this is not surprising in a trawl survey, as older bluefish can easily out-swim a trawl. From 2000 to 2010 before SEAMAP took over sample processing, SC DNR Inshore Fisheries section was using SEAMAP caught bluefish for otolith ageing.

FL FWRI

Bluefish otoliths are collected on fishery-independent monitoring surveys. Most bluefish otoliths are incidental collections and are not targeted or regularly encountered. Otoliths are embedded in a plastic resin and sectioned on an Isomet low speed saw and aged under transmitted light on a stereo microscope.

IV. River Herring

Maine Department of Marine Resources (ME DMR)

Alewife and blueback herring scales are collected from adults at the ME DMR managed fishways on the major rivers during the spring spawning run. Some otoliths were collected in 2012, but this is not a regular practice and otoliths are not aged during production ageing. Scale samples have also been collected by harvesters and submitted to the River Herring Project at ME DMR since 2008. Scales are cleaned with soap and water and blotted dry with paper towels. Three or four scales are temporarily mounted between glass slides and viewed with microfiche readers. As many as 20 to 30 scales are used on samples when the first slide leaves a doubt in the mind of the person ageing the scales. These extra scales are not cleaned first. They are temporarily mounted between glass slides and viewed on the microfiche reader to see which scales are worth cleaning. Depending on staff availability, 1-2 staff members read each sample. If multiple readers cannot come to a consensus age, the sample is excluded from production ageing. Regenerated scales are excluded from production ageing. When a sample is done being aged, the scales are put back in the original sample envelope and kept in the archive collection.

The Augusta crew from ME DMR Division of Sea Run Fisheries and Habitat (DSRF&H) now only collects river herring bio-samples at their major fishways or fishlifts (Brunswick Dam - first dam on the Androscoggin River; Lockwood Dam, Waterville- first dam on the Kennebec River; and Benton Falls Dam - first dam on the Sebasticook River). The Augusta crew uses Brunswick fishway and the fishlift at Lockwood Dam as sources of adult river herring for truck stocking. The Kennebec River crew ages their samples (Waterville and Benton Falls) with the same methods described in the previous paragraph. The only difference is that they permanently mount 3 to 4 scales between acetate slides. The large number of scale samples aged each year by the River Herring Project crew makes it impractical to mount them permanently.

The River Herring Project crew (ME DMR DSRF&H) collected scale samples from all of the commercially harvested runs in the state from 2010 to 2013. Bio-sample data (total length, fork length, weight, sex and species) was also taken from every fish along with all of these scale samples. This data was used to compare with the samples that were collected by the harvesters. The harvesters are still collecting samples every year. This is being done to monitor the age structure of the populations of each harvested run. In order to keep harvesting these runs, each run has to be deemed self-sustaining with a healthy spawning stock bio-mass and high survival rate. In order to ensure this, we are looking for a good representation of older age classes and high repeat spawning ratio. Maine also has volunteer groups from many places in the state that are collecting scale samples from the non-harvested runs during the spring spawning run. Some of these groups are hoping to start a harvest in the future and others are just interested in keeping an eye on their local run.

MA DMF

Alewife and blueback herring scales and otoliths are collected from spawning adults in MA river systems during the spring spawning run. Otoliths are also collected from samples of the river herring bycatch of the Atlantic herring fishery. Collection of scales in MA has occurred at least sporadically since the mid-1980s. Otolith collection began in 2010 for some sample sources and increased to all sample sources by 2013. Otoliths are the primary structure used for ageing but scales are collected when available for use in spawning check enumeration. Scales to be mounted are first cleaned in an ultrasonic bath with a 5% pancreatin solution. Scales are mounted between glass slides and viewed with digital imaging software and a camera on a macro mirror stand. Otoliths are rinsed with water and allowed to air dry overnight before ageing. Otoliths are aged whole submersed in mineral oil and viewed with a stereomicroscope.

Connecticut Department of Energy and Environmental Protection (CT DEEP)
Alewife and blueback herring scales are collected from spawning adults during the spring spawning run. Scales are rinsed with water and wiped clean. 6-8 scales are mounted between glass slides and viewed with a microfiche reader. Unreadable samples (i.e., regenerated scales, scales with heavily eroded edges) are excluded from production ageing. Any scale samples of poor quality that two readers cannot reach a consensus age determination for are excluded from production ageing.

NJ DFW
Alewife and blueback herring otoliths have been collected during the NJ DFW Ocean Trawl Survey in January and April since 2007. This survey collects smaller fish than sampled in other state programs. Scale collection during this survey is not feasible, as few scales are retained on fish collected. At the time of the workshop, NJ DFW staff had just started reviewing river herring ageing materials provided by the MA DMF and practicing ageing otoliths, but had not begun production ageing. Digital imaging software is used to store images of each otolith sample collected. Staff has been slowly ageing the samples according to protocols developed at the ageing workshop but ageing is not complete.

MD DNR
River herring were captured by a multi-panel experimental anchored sinking gill net set in the North East River once a week at four randomly chosen sites from mid-March to mid-May from 2013-2015. Individual net panels were 100 feet long and 6 feet deep. The panels were constructed of 0.33 mm diameter monofilament twine in 2.5, 2.75 and 3 inch mesh. In 2015, the 3 inch mesh panel was replaced with a 2.25 inch mesh panel, as there was evidence the current mesh size selection was not successful in capturing smaller sized blueback herring. The three panels were tied together to fish simultaneously and were soaked for 30 minutes before retrieval. All river herring were sexed and measured to the nearest mm fork length (FL) and total length (TL). Scales were taken from a random subsample, the first 20 fish per species per panel for age and spawning history analysis. Up to 300 scale samples were aged per species.

VIMS
Both species of river herring, alewife and blueback, are “Priority” species for NEAMAP and ChesMMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS have collected whole otoliths for age determination. A total of 2,832 pairs of alewife otoliths have been collected by the two surveys (CM 524; NM 2,308). A total of 2,174 pairs of blueback otoliths have been collected by the two surveys (CM 155; NM 2,019).

VIMS has yet to final age assign these whole otoliths due to discrepancies in ageing protocols coast wide. An ongoing “in-house” at VIMS is currently being conducted to compare scales and whole otoliths from the same specimens to determine the most accurate and efficient method for ageing river herring.

NC DMF
Alewife and blueback herring scales and otoliths are collected from spawning adults in NC river systems during the spring spawning season. Otoliths and scales are collected during fishery-dependent monitoring (pound net survey) and scales are collected during fishery-independent monitoring (gill net survey).

V. Striped Bass

ME DMR
Historically, ME DMR collected scales from some striped bass caught by rod and reel. Since 2010, scales have been collected from fish that were caught as part of an acoustic tagging program. In this program, striped bass are caught with rod and reel, tagged, and scales were removed from most of the fish for ageing. Additionally, young of the year (YOY) are captured as part of a beach seining project in the summer and fall. Scales were removed from a few of these young of the year fish in the past.

MA DMF
MA DMF primarily collects and ages striped bass scales. Samples are collected from the commercial fishery at the fish houses, the recreational fishery via a scale collection program involving volunteer recreational anglers, and from tagging projects. MA DMF also collects racks from a fishing club and several charter boats that are processed for scales and otoliths. These structures are used to make a yearly comparison between hard parts. Scales are impressed in acetate using a heated press and aged by examining impressions on a microfiche projector. Otoliths are cross-sectioned, baked and read with transmitted light on a compound microscope.

RI DEM DFW
Scales have been collected on from the commercial fishery since 2001 and on fishery-independent surveys and the recreational fishery since 2013. The annual target number of samples is 150 rod and reel and 150 from the commercial floating fish trap fishery. Sample collection primarily includes scales; however, otoliths are also collected on fishery-independent surveys when the whole fish is being sacrificed. A single reader currently ages all samples annually.

NY DEC
New York began collecting scales from striped bass in 1984. Samples are collected through our fishery-dependent commercial fish market sampling, and recreational fishery cooperative angler program. In addition, scales are collected from our fishery-independent western Long Island juvenile striped bass beach seine survey. A sample of scales is collected from each fish and pressed onto clear acetate sheets using a heated Carver Press. Scales are aged on a microfiche by a minimum of two readers and compared for agreement. A group reading or repress of the sample settles disagreements. Samples for which no agreement can be reached are discarded from the set. Any otoliths collected are archived and stored.

NJ DFW

Striped bass scale samples have been collected regularly during several fishery independent surveys since 1989 including but not limited to the Striped Bass Tagging Survey in Delaware Bay, the Ocean Trawl Survey along the NJ coast, the Delaware River Recruitment Survey, and during sampling at fishing tournaments and on party/charter boats. Approximately 135 paired scale/otolith samples have also been collected annually although no otoliths have been processed or aged. Scales are processed using a heated Carver Press and aged using a microfiche reader.

MD DNR

Since 1985, biologists at MD DNR have been conducting the spawning stock survey survey in historic spawning locations (http://dnr2.maryland.gov/fisheries/PublishingImages/striped-bass-spawning-map.jpg) on the Upper Chesapeake Bay and the Potomac River. In concurrence with monitoring the spawning stock, MD DNR is part of the Cooperative Coastal Striped Bass Tagging Program (https://www.fws.gov/northeast/marylandfisheries/projects/Striped%20Bass.html). This program tags spawning striped bass with United States Fish and Wildlife Service (USFWS) internal anchor tags to evaluate stock dynamics of the migratory Atlantic Coast striped bass. The goal of this survey is to characterize the age, size, and sex structure, and abundance at age of spawning striped bass in Maryland's portion of the Chesapeake Bay. The survey is conducted up to six days a week from late March to mid-May. Striped bass are sampled using experimental drift gill nets in the Upper Chesapeake Bay and Potomac River. The experimental drift gill nets are a series of different mesh size, nylon multifilament panels (3, 3.75, 4.5, 5.25, 6, 6.5, 7, 8, 9, and 10 inch stretch-mesh). Each panel is approximately 150 feet long and 10 feet deep, with about 10 feet in-between each net. Drift nets are deployed for short periods of time during and near slack tide, twice a day at one random site each, in the Upper Chesapeake Bay and Potomac River.

All striped bass captured in the nets were measured for total length (mm TL), sexed by expression of gonadal products, and released. Scales were taken from 2-3 randomly chosen male striped bass per 10 mm length group, per week, for a maximum of 10 scale samples per length group over the entire season. Scales were also taken from all males over 700 mm TL and from all females regardless of total length. Scales were removed from the left side of the fish, above the lateral line, and between the two dorsal fins. Additionally, if time and fish condition permitted, U. S. Fish and Wildlife Service internal anchor tags were applied.

The scales that are selected for processing are taped shiny side up on the acetate slide. Impressions were made by the Carver press at 170°F and 18,000 lbs. of pressure for 5.5 to 6 minutes depending on the size of the fish. The final impressions were viewed in a microfiche machine to obtain the final age. At least 2 biologists looked at each scale sample to arrive at an agreed age, if they did not agree a 3rd biologist views them, if no agreement then a 4th reader views. If still no agreement, the scales were replaced with different sample, reprocessed with different scales or thrown out.

VIMS

Striped bass are collected as part of NEAMAP and ChesMMAP sampling programs. Additionally, striped bass is a “Priority” species for NEAMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS uses sectioned otoliths for age determination. The ChesMMAP survey encounters everything from Young-Of-Year specimens to fully matured adults. The NEAMAP survey often encounters large mature adults feeding on schools of prey. Ages have ranged from age-0 (YOY) to a max age of 24. A total of 5,755 Striped Bass have been aged by the two surveys (CM 5,300; NM 455).

There are three readers at VIMS and the mode age for each sample is provided as the final age. If there is no mode from the initial read, the readers reread the sample and if there is still no mode, they examine the sample together and come to a consensus age. If a consensus age cannot be determined the sample is discarded. Very few samples are discarded. Precision tests are preformed within each reader (multiple reads of the same sample) and between readers. VIMS uses similar precision and symmetry tests to the NEFSC.

ODU

VMRC has been collecting striped bass biological data since 1988. The field sampling program is designed to sample striped bass harvests within specific water areas. Since 2003, Virginia has managed its Coastal Area and Chesapeake Area harvests by two different ITQ systems, with data collections procedures intending to ensure adequate representation of both harvest areas. Samples of biological data are collected from seafood buyers’ places of business or dockside from offloaded striped bass caught by pound nets or haul seines. Some gill net or commercial hook-and-line fishermen’s harvests may be sampled directly.

Generally, only 40- 50% of striped bass sampled for scales are also sampled for otoliths. Supplementary data is collected for each biological sample, such as date of collection, harvest location, market grade, harvest area, and gear type. Scale and otolith samples are processed and read by Old Dominion University’s Center for Quantitative Fisheries Ecology (ODU CQFE). ODU CQFE chooses a random subsample of hard-parts (scales and otoliths) collected in each length bin to age.

All fish are aged in chronological order based on collection date, without knowledge of the specimen lengths. The two readers must age each otolith independently. When the readers’ ages agree, that age is to be assigned to the fish. When the two readers disagree, both readers must re-age the fish together, again without any knowledge of previously estimated ages or specimen lengths and assign a final age to the fish. When the readers are unable to agree on a final age, the fish is excluded from further analysis.

Striped bass are assigned a January 1st birth date by convention. The sample date is used to assign the final age. If the sample was taken before the period of annuli formation (April to June), the age is the annulus count plus one. If the sample was taken after that, the age is the annulus count.

The following are links to the preparation and ageing protocols for striped bass.

- Otolith Preparation Protocol

http://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/striped-otolith-preparation-protocol.pdf

- Otolith Ageing Protocol

http://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/striped-bass-otolith-ageing-protocol.pdf

- Scale Preparation Protocol

http://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/STRIPED%20BASS%20SCALE%20PREPARATION%20LATEX%20MAIN%20DOCUMENT.pdf

SC DNR

Striped bass have been aged in South Carolina since the 1950's by the Wildlife and Freshwater Fisheries Division of SC DNR, which still ages them today. Historically, striped bass were aged with scales although some are now aged with otoliths. Gill nets and electrofishing are the methods used to collect the specimens. SC DNR Marine Research Division released mariculture-raised striped bass from 2006 through 2014. During 2014 some of these fish were recaptured and processed by SC DNR Inshore electrofishing survey and otoliths were kept for ageing.

VI. Tautog

MA DMF

Tautog otoliths and operculum are collected from several sources; cooperation from commercial fisherman, within division fish potting, and cooperation with several recreational anglers. Opercula have been collected since 1995 and otoliths have been collected since 2012. Opercula are boiled and brushed clean before being dried and aged without magnification. Otoliths are baked, sectioned and aged with transmitted light under a compound microscope.

RI DEM DFW

Opercula have been collected primarily from donated recreational carcasses since 1987. The annual target number of samples is 200 per the requirements of Addendum III to the Fishery Management Plan for Tautog. Sample collection primarily includes operculum; however, a subsample of otoliths have also been collected since 2012 following the recommendations of the 2012 Tautog Ageing Workshop. A single reader currently ages all samples annually.

NY DEC

Fishery dependent tautog samples are primarily collected from commercial markets and headboat fish racks. While the current goal is to satisfy the requirements of the FMP, availability of samples has fluctuated over time. The total length of each fish is measured, and the opercula bone is removed and frozen until further processing. Otoliths from a subset of these fish are also collected. Previously frozen samples are thawed and boiled for 2 minutes and the flesh is gently scraped off the opercula. The bones are allowed to air dry overnight and are then read without magnification using overhead lighting. Aged samples are available from 1993 to the present.

NJ DFW

Sampling for tautog was initiated in 2007, collecting samples primarily from Commercial and Party/ Charter vessels. Fishery Independent samples are also occasionally collected aboard the NJDFW Ocean Trawl Survey when caught. Racks are collected from fishery dependent vessels, where lengths and sex are recorded, and opercula are removed. The opercula are processed and aged at the Nacote Creek Research lab, where they are viewed under a magnisight machine. Since initiation, 7,013 samples have been collected, with 387 samples collected in 2015.

MD DNR

Maryland has collected tautog opercula for ageing since 1996. The current IFMP requires that each state to collect 200 opercula and 50 otolith samples per year. Tautog have been collected by hook and line, commercial fish pots and on rare occasion spearfishing. Juvenile tautog have also been collected by seining eel grass beds in 2015 which provided samples of the smallest length groups in the population. The most productive method is hook and line with a partnering professional charter boat.

The goal is to randomly sample and fill each 10mm length group with five samples. Each fish is measured (mm total length) and weighed (kg) using the digital scale. The gonads are observed to determine the sex of the fish. These data are recorded on scale envelope. Both opercula are removed and placed in the envelope(s). The fish heads are tagged with a tuna or yellow perch tag and that tag number is recorded on the opercula envelope(s). All heads are frozen until the otolith bins are calculated to ensure all 10 mm length groups have amble representation; all large fish (>600mm) have otoliths removed. Starting in 2013, DNA was collected for scientists at VIMS.

Each operculum is boiled in water, cleaned, and placed in a new envelope for reading. All readers must re-read the reference collection that contains 20 opercula samples for each year since 1996, (except for 1997 and 1998 which has less than 20) prior to reading the current year samples. The reader uses no magnification. The first year annular line is typically 7-8 mm from the articular apex and the second year around 12-15 mm. The spacing between year's decreases as the fish gets older. The outer edge (new growth) is counted to promote (X+1) if the operculum was collected between 1 Jan to 30 June, otherwise it is not counted. A representative sample of 20 aged opercula is added to the reference collection for the following year.

VIMS

Tautog are collected for both NEAMAP and ChesMMAP surveys and additionally is considered a "Priority" species for NEAMAP, meaning that length, weight, sex, maturity state, stomach, and otoliths are collected for 5 individuals from each length bin on each tow. VIMS uses sectioned otoliths and opercula for age determination. Both opercula and otoliths have been collected since 2010 as per comparison purposes due to the low number of encounters by each survey over their time series. Prior to 2010 only opercula were collected. A total of 276 Tautog have been aged by the two surveys (CM 50; NM 216).

There are three readers at VIMS and the mode age for each sample is provided as the final age. If there is no mode from the initial read, the readers reread the sample and if there is still no mode, they examine the sample together and come to a consensus age. If a consensus age cannot be determined the sample is discarded. Very few samples are discarded. Precision tests are preformed within each reader (multiple reads of the same sample) and between readers. VIMS uses similar precision and symmetry tests to the NEFSC.

ODU

Tautog have been collected as part of VMRC's Biological Sampling Program since 1998. Both otoliths and operculum are collected. Operculum are removed and frozen until prepared for age reading. Thawed samples are boiled 5-6 minutes to loosen attached tissue. When sample is removed from the water, skin and tissue are removed. Clean opercula are read by counting annuli. Otoliths samples are cleaned and baked in a Thermolyne 1400 furnace. After baking, otoliths are embedded in epoxy resin and sectioned.

All tautog samples are aged by two different readers. When readers disagreed, they re-aged the fish together without knowledge of lengths or previously estimated ages. Fish that did not result in agreement were excluded from analysis.

Tautog are assigned a January 1st birth date by convention. The sample date is used to assign the final age. If the sample was taken before the period of annuli formation (May to July), the age is the annulus count plus one. If the sample was taken after that, the age is the annulus count.

The following are links to the preparation and ageing protocols for tautog.

- Otolith Preparation Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/tautog-otolith-preparation-protocol.pdf

- Otolith Ageing Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/tautog-otolith-ageing-protocol.pdf

- Operculum Preparation Protocol

https://www.odu.edu/content/dam/odu/offices/center-for-quantitative-fisheries/docs/tautog-operculum-prep.pdf

Workshop Proceedings & Discussion

Participants in the workshop met on Wednesday, March 30th, in a conference room at the FL FWRI building in St. Petersburg to go over the goals of the workshop, agenda, and to make introductions. An overview of each species was conducted to review ageing techniques since not all states are familiar ageing all of the species. Scott Elzey from MA DMF introduced ageing river herring scales and otoliths, Heather Corbett from NJ DMF introduced ageing striped bass scales and otoliths and Atlantic croaker otoliths, Jameson Gregg from VIMS introduced ageing bluefish and black sea bass otoliths, and Nicole Lengyel from RI DEM DFW introduced ageing tautog operculum and otoliths.

Jessica Carroll from Florida's Fish and Wildlife Conservation (FL FWC) Commission reviewed the goals and structure of the Gulf States' annual ageing workshop because the workshop for the Atlantic States was to proceed in a similar fashion. Carroll and the staff at FL FWC, including Kristin Cook, Kristen Rynerson, and David Westmark, set up stations ahead of the workshop for the hard part reading exercise. Participants broke into four groups, each led by one of the FL FWC employees, and begun ageing the structures at each station. Not all states or labs age all the species at the workshop, so the groups were developed to mitigate the effects of readers unfamiliar with a species.

For each of the six species, every member of the group aged the samples (n=20 per species) and the group came to a consensus for annulus count, margin code, and final age. Each structure was assigned a margin code from 1-4. A code 1 represented a structure with an annulus just forming or having just finished forming at the edge of the structure. Code 2 was assigned when the growth outside the last visible annulus was less than 1/3 the growth between the two previous annuli. Code 3 represented 1/3 to 2/3 growth and code 4 was for more than 2/3 growth. In the case of river herring, some states use a margin code to reflect the age and spawning history. For example, a sample with 8 annuli and 4 spawning checks would be scored as "8R4", where the "R" indicates a repeat spawner, and a fish on its first spawning run with 4 annuli would be scored as a "4". A catch date was provided for each sample to make final age determinations, but no other information was provided during reading. Once the four groups aged all samples for all species, the group broke for the day.

The following morning, on Thursday, March 31st, the attendees of the workshop met to go over the average percent error (APE) for each species (Table 1) and to revisit samples with high disagreement. Discussion regarding each species follows and sample images can be found in Appendix B.

I. Atlantic croaker (Table 2)

The 7.76% APE for croaker was higher than the group anticipated since it was generally acknowledged that identifying annuli is easy for this species. The group attributed disagreement to the persisting issue of whether or not to count the smudge, or check mark, found between the core and first annulus in the majority of samples. While it has been determined that this check mark should not be counted (ASMFC 2008), many felt that fish were not being classified to their correct year class because of this.

The group revisited samples #8, 14, and 15. Sample #8 was aged as a 10 year old by VIMS, the lab that provided it, but most groups at the workshop had this aged as an 8 year old. After much debate about counting the smudge and considering its catch-date, the group settled on age 9 for this sample. Similarly, after reviewing sample #14, the group came to consensus that this was an age 6 without counting the smudge, an age 7 if you count it. There was also a lot of debate about sample #15 because based on its catch date, VIMS argued that it didn't make sense to count this as an age 0. Because it was caught in November, it would be classified to age 0 using the current ageing guidelines even though this was a 175 mm fish and is most likely about a year and a month or two old.

The group then came to consensus that the labs ageing croaker should participate in a conference call in the future to revisit the issue of whether or not to count the check mark or smudge. Of the seven labs at the workshop that said they were currently ageing croaker, four wanted to count the check mark and the other three neither disagreed nor agreed. All felt that the check mark was present in their regions. The labs that want to count the check mark felt that they are not submitting the accurate ages for croaker management and therefore are potentially skewing the assessment by overestimating the biomass of younger age-classes.

II. Black Sea Bass (Table 3)

Black sea bass samples had the lowest APE between groups at 3.67%. Gregg led the group through the samples with disagreement. Starting with sample #6, the group found that the outside 9 annuli were easy to count, but the first few annuli were hard to read. Gregg pulled up a slide from his initial presentation introducing the species to review this otolith and the consensus was that this was an age 16. Sample #15 was supplied by NEFSC and reviewed by Eric Robillard. He pointed out the two visible annuli and the plus growth concluding that this was an age 3. There was some debate between age 2 and age 3 and the sample was compared to an age 1 (sample #14) and an age 5 (sample #16). Although no group consensus was reached for black seas bass #15, the majority of the participants believed it to be a 3 year old while minority opinion held that it was an age 2. Carroll showed sample #20 from FL, counted 4 opaque zones and bumped it to an age 5, and the group agreed.

III. Bluefish (Table 4)

Bluefish had the highest APE of all the fish aged at the workshop at 23.06%. Because Robillard has the most familiarity ageing bluefish and published literature regarding its age-validation, he led the group through the samples with high disagreement. There were 3 samples inflating the APE, bluefish #7, 11 and 18. Bluefish #2 was reviewed because the workshop found this sample to be a clear age 4 even though NC submitted this sample as an age 5. Likewise, ODU submitted #4 as an age 12 but all the groups agreed this was an age 11. Bluefish #7 had a lot of disagreement and it was acknowledged that age 0s are often challenging. Robillard reminded the group that bluefish have a lot of growth in the first year and if they are 1 or older they often exhibit a prominent protrusion on the ventral surface (Robillard et al. 2009). Therefore, bluefish #7 was a spring spawned, age 0 fish. Bluefish #11 was similar to #7 in that it lacked the protrusion and did not exhibit a complete annulus. It was recognized that this was a large fish (27 cm) for an August catch date, but there was nothing on the otolith that would indicate that it was a 1 year old so consensus was age 0. Bluefish #18 posed the same challenge as the previous two. It was agreed upon that it was age 0 because May or June is the latest to see an annulus on the edge, so it would have more growth by its August catch date if it were an age 1. Lastly, it was recognized that the 3 samples skewing the APE were all YOY and that identifying the first annulus is the biggest challenge for ageing bluefish.

IV. River Herring (Tables 5 & 6)

Both alewife and blueback had an APE of 13.32%. Disagreement was found between otolith samples for both species of river herring. Elzey walked the group through alewife samples #2, 3, 4, 5 and blueback otolith sample #4 since his lab is the only one currently ageing herring otoliths. David Molnar said that CT DEEP sometimes collects and ages otoliths, but scales are primarily used in CT just like the other Atlantic states. Therefore, the APEs of 13.32% for alewife and blueback likely represent the experience of the agers rather than the quality of the samples since otoliths often result in higher precision than scales for experienced readers (e.g. Boxrucker 1986; Welch et al. 1993; Robillard and Marsden 1996). Separating the APE between ageing structures resulted in an APE of 15.26% for alewife otoliths, 11.20% for alewife scales, 19.40% for blueback otoliths, and 7.06% for blueback scales. Some felt that this was a more accurate representation of the APEs since most states are not currently ageing otoliths for river herring.

The group agreed that alewife sample #2 is not a good sample and that is why there is a lot of disagreement. For alewife #3, Elzey pointed out two visible annuli and then counted the edge so the group came to a consensus of age 3. For alewife #4, the first annulus is visible and then it was bumped to an age 2 because of the catch date. The alewife #5 otolith was lost during the workshop and the second otolith was crystalized and should not be used for reading, but the group decided it was an age 5 based on the photo of the original sample, reviewing the crystalized sample, and considering the catch date of December. Blueback #4 had one visible annulus and because it was caught in January, it was bumped to an age 2.

Mark Pasterczyk from ME DMR led the workshop participants through the alewife and blueback herring scale samples that had high disagreement since he ages this structure routinely. For alewife #6, there was some disagreement in the group because some felt that what was being called annulus 2 was in fact a freshwater mark. There was discussion around how herring vary widely by river system and along the coast in appearance. After learning this sample was collected from the south, the group consensus was that this was an age 5. Alewife #8 was a sample from Maine and Pasterczyk pointed out the 8 annuli and 4 spawning checks on the right side of the scale. The group agreed that this sample was an age 8. The last river herring scale the group revisited was blueback #10. After Pasterczyk showed how to count the annuli, participants agreed that this was a 5 year old.

V. Striped Bass (Table 7)

The APE for striped bass was the second lowest of the workshop at 4.96%, particularly among the scale samples. The group reviewed striped bass #17, an otolith sample, and came to the consensus that it was an age 5. For striped bass #20, Jonathan Tucker from SC DNR said that this was a stocked fish that was later recaptured so that is why this sample might look unusual to people. The group determined that this was an age 1.

VI. Tautog (Table 8)

Participants of the workshop felt that an APE of 6.09% for Tautog was satisfactory and there was no single sample to review. Discussion focused on the challenge of finding the first annulus. Molnar said that CT looks at a length frequency for ages 0, 1, and 2 to double-check a sample's age and make sure the first annulus was counted correctly. Jessica Gilmore from ODU said that CQFE often checks the annulus count from the operculum with the otolith. It was agreed that an ager could not base their age on the size of the operculum because male and female are so different and older fish sometimes have small operculum.

Workshop Recommendations

Overall, the participants of the workshop felt that there was no obvious sample processing issues along the coast that needed to be addressed. They were satisfied with the agreement among species and samples along the coast, with the exception of Atlantic croaker. The group made the following recommendations:

- An Atlantic coast QA/QC fish ageing workshop should be held annually if possible, in person, to maintain consistency between states and labs

- The states and labs that are currently ageing Atlantic croaker should participate in a conference call to discuss the persisting issue of whether or not to count the check mark or smudge, particularly since the benchmark stock assessment for croaker is underway

- Black drum, winter flounder, Atlantic menhaden, and summer flounder are species that could be added to the list of samples for future workshops

- Samples should be maintained and re-aged for future workshops and stored at the FL FWRI facility

- A digital copy of the samples will be circulated among the group for training or reference purposes

- Future workshops should consider state-by-state comparisons for states that are actively ageing each of the species in addition to calculating group APEs and the possibility of using paired samples for striped bass and tautog

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Tables

Table 1. The sample size, ageing structure, and average percent error (APE) between the four ageing groups for each species aged at the QA/QC Fish Ageing Workshop.

Species	Sample size	Ageing structure	APE
Atlantic Croaker	20	otoliths	7.76%
Black Sea Bass	20	otoliths, scales	3.67%
Bluefish	20	otoliths	23.06%
Alewife	10	otoliths, scales	13.23%
Blueback	10	otoliths, scales	13.23%
Striped Bass	20	otoliths, scales	4.96%
Tautog	20	opercula	6.09%

Table 2. Ageing worksheet for Atlantic croaker at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes (scored from 1 to 4), and final age as well as average percent error (APE) values between groups.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	ODU	10	9/23/2014	10	3	10	10	4	10	10	4	10	10	4	10	10	0.0%
2	NJ	0	10/1/2012	0	4	0	0	4	0	0	4	0	0	4	0	0	0.0%
3	GA	6	7/1/2014	5	2	5	5	2	5	5	3	5	5	2	5	5	0.0%
4	GA	1	5/15/2012	0	4	1	0	4	1	0	4	1	0	4	1	1	0.0%
5	SCDNR	2	5/14/2014	2	1	2	2	1	2	1	4	2	2	1	2	2	0.0%
6	NJ	12	9/16/2010	12	3	12	12	4	12	12	3	12	12	4	12	12	0.0%
7	GA	5	6/29/2011	4	2	4	4	2	4	4	2	4	4	1	4	4	0.0%
8	VIMS	9	5/10/2014	8	1	8	8	1	8	8	1	8	8	1	8	8	0.0%
9	ODU	3	4/21/2014	3	2	3	3	1	3	3	2	3	3	1	3	3	0.0%
10	SCDNR	3	5/14/2014	3	2	3	3	1	3	3	1	3	3	1	3	3	0.0%
11	NJ	4	10/3/2006	4	4	4	4	4	4	4	4	4	4	4	4	4	0.0%
12	NCDMF	6	3/26/2013	5	1	5	4	4	5	4	4	5	4	4	5	5	0.0%
13	MD	2	10/1/2019	2	4	2	2	4	2	2	4	2	2	4	2	2	0.0%
14	ODU	6	8/18/2014	6	3	6	6	4	6	6	3	6	6	3	6	6	0.0%
15	VIMS	1	11/5/2014	0	4	0	1	3	1	0	4	0	0	3	0	0.25	150.0%
16	NCDMF	7	3/26/2013	6	1	6	5	4	6	5	4	6	5	3	6	6	0.0%
17	MD	3	10/1/2018	3	4	3	3	4	3	3	4	3	3	4	3	3	0.0%
18	MD	7	10/1/2017	7	3	7	7	4	7	7	3	7	7	3	7	7	0.0%
19	NCDMF	3	6/13/2013	3	2	3	3	2	3	3	2	3	3	2	3	3	0.0%
20	VIMS	9	4/26/2014	7	2	7	8	1	8	7	1	7	7	1	7	7.25	5.2%
																Average APE	7.76%

Table 3. Ageing worksheet for black sea bass at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes (scored from 1 to 4), and final age as well as average percent error (APE) values between groups. All samples are otoliths except for #10-13 which are scales.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	VIMS	4	5/8/2009	5	1	5	5	1	5	5	1	5	4	4	5	5	0.0%
2	VIMS	1	10/21/2015	1	4	1	1	3	1	1	3	1	1	4	1	1	0.0%
3	VIMS	3	10/4/2007	3	3	3	3	1	3	3	3	3	3	2	3	3	0.0%
4	VIMS	7	5/15/2008	7	1	7	7	3	7	7	1	7	7	1	7	7	0.0%
5	VIMS	11	9/23/2010	11	3	11	11	2	11	11	2	11	11	2	11	11	0.0%
6	VIMS	16	5/11/2008	11	1	11	11	4	12	15	1	15	13	2	13	12.75	9.8%
7	MA	7	Spring	5	1	5	5	4	6	6	4	7	5	4	6	6	8.3%
8	MA	8	Spring	6	4	7	6	4	7	7	1	7	7	1	7	7	0.0%
9	MA	3	Spring	2	4	3	2	4	3	2	4	3	2	4	3	3	0.0%
10	RI	3	5/29/2015	3	1	3	2	4	3	2	4	3	2	4	3	3	0.0%
11	RI	6	5/22/2014	6	1	6	5	4	6	5	4	6	5	4	6	6	0.0%
12	MA	2	8/14/2015	3	3	3	3	2	3	2	1	2	3	2	3	2.75	13.6%
13	MA	6	8/21/2015	6	2	6	6	2	6	6	2	6	6	2	6	6	0.0%
14	NEFSC	1	3/15/2013	1	2	1	1	1	1	0	4	1	0	4	1	1	0.0%
15	NEFSC	3	3/18/2013	2	4	3	2	4	3	3	4	4	1	4	2	3	16.7%
16	NEFSC	5	4/13/2014	5	1	5	4	1	4	4	4	5	4	4	5	4.75	7.9%
17	FL	4	11/27/2012	4	4	4	4	4	4	4	4	4	4	3	4	4	0.0%
18	NJ	0	10/11/2012	0	3	0	0	4	0	0	3	0	0	3	0	0	0.0%
19	NJ	7	6/19/2013	4	4	5	5	4	6	6	2	6	7	2	7	6	8.3%
20	FL	5	5/6/2012	4	2	4	4	2	4	4	4	5	4	1	4	4.25	8.8%
																Average APE	3.67%

Table 4. Ageing worksheet for bluefish at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes (scored from 1 to 4), and final age as well as average percent error (APE) values between groups.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	NJ	4	6/4/2014	3	4	4	2	4	3	4	1	4	3	4	4	3.75	10.0%
2	NCDMF	5	3/29/2014	3	4	4	3	4	4	3	4	4	3	4	4	4	0.0%
3	VIMS	1	9/25/2009	1	3	1	1	3	1	1	2	1	1	2	1	1	0.0%
4	ODU	12	3/10/2015	11	1	11	11	1	11	10	4	11	11	1	11	11	0.0%
5	SCDNR	1	7/12/2014	1	3	1	1	1	1	1	1	1	1	4	1	1	0.0%
6	MA	6	9/16/2015	6	2	6	6	2	6	6	2	6	6	2	6	6	0.0%
7	SCDNR	1	9/22/2014	0	3	0	0	3	0	1	2	1	0	4	0	0.25	150.0%
8	RI	2	11/2/2012	2	4	2	2	4	2	2	4	2	2	3	2	2	0.0%
9	FL	7	5/23/2012	6	4	7	6	4	7	6	4	7	6	4	7	7	0.0%
10	NJ	3	6/14/2014	2	4	3	2	4	3	2	4	3	2	4	3	3	0.0%
11	ODU	0	8/12/2015	0	3	0	0	2	0	1	1	1	0	4	0	0.25	150.0%
12	NY	4	5/3/2012	3	4	4	3	4	4	3	4	4	3	4	4	4	0.0%
13	RI	6	6/10/2012	6	4	7	6	4	7	6	4	7	6	4	7	7	0.0%
14	VIMS	1	10/9/2009	2	3	2	1	3	1	1	2	1	1	2	1	1.25	30.0%
15	NY	5	10/23/2013	4	1	4	3	3	3	3	3	3	3	4	3	3.25	11.5%
16	NCDMF	7	2/20/2014	6	4	7	5	4	6	6	4	7	6	4	7	6.75	5.6%
17	NCDMF	10	2/20/2014	8	4	9	8	4	9	8	4	9	8	4	9	9	0.0%
18	MA	0	8/28/2015	1	3	1	0	2	0	1	1	1	0	4	0	0.5	100.0%
19	VIMS	9	5/11/2014	8	4	9	8	4	9	8	4	9	9	4	10	9.25	4.1%
20	NY	2	5/31/2013	2	2	2	2	1	2	1	4	2	1	4	2	2	0.0%
																Average APE	23.06%

Table 5. Ageing worksheet for alewife river herring at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes, and final age as well as average percent error (APE) values between groups. Samples #1-5 were otoliths and samples #6-10 were scales.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	MA	0	12/19/2014	0	4	0	0	3	0	0	4	0	0	4	0	0	0.0%
2	NJ	6	1/10/2009	3	4	4	6	4	7	4	4	5	4	4	5	5.25	16.7%
3	CT	3	4/29/2014	2	1	2	2	4	3	2	2	2	2	4	3	2.5	20.0%
4	NJ	1	1/25/2012	0	4	1	1	4	2	1	4	2	1	4	2	1.75	21.4%
5	MA	5	12/21/2014	4	4	4	7	3	7	6	3	6	5	4	5	5.5	18.2%
6	NCDMF	5	5/1/2014	6R2		6	4	1	4	4	1	4	3	4	4	4.5	16.7%
7	CT	3	4/29/2014	3	4	4	3	2	3	2	4	3	2	4	3	3.25	11.5%
8	ME	8	5/25/2014	8R4		8	6	1	6	5	4	6	5	4	6	6.5	11.5%
9	MD	5	3/25/2015	5R2		5	5	4	6	5	4	6	4	4	5	5.5	9.1%
10	MD	6	3/18/2015			8	6	4	7	5	4	6	6	4	7	7	7.1%
																Alewife otolith APE	15.26%
																Alewife scale APE	11.20%
																Total Alewife APE	13.23%

Table 6. Ageing worksheet for blueback river herring at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes, and final age as well as average percent error (APE) values between groups. Samples #1-5 were otoliths and samples #6-10 were scales.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	MA	2	12/19/2014	1	4	1	2	4	2	2	3	2	2	4	2	1.75	21.4%
2	MA	0	12/19/2014	0	4	0	0	4	0	0	4	0	0	4	0	0	0.0%
3	MA	7	1/12/2015	7	1	7	7	4	8	6	4	7	7	4	8	7.5	6.7%
4	NJ	3	1/10/2009	1	2	1	3	4	4	1	4	2	1	4	2	2.25	38.9%
5	NJ	4	1/24/2012	1	3	2	3	4	4	1	4	2	1	4	2	2.5	30.0%
6	MD	6	4/29/2015			6	5	4	6	4	4	5	5	4	6	5.75	6.5%
7	MD	3	4/22/2015			3	3	1	3	2	3	3	2	4	3	3	0.0%
8	NCDMF	5	12/24/2014	5	4	5	5	2	5	5	1	5	5	3	5	5	0.0%
9	ME	4	5/11/2010			4	5	2	5	4	4	5	3	4	4	4.5	11.1%
10	ME	5	6/8/2015	5R2		5	4	4	5	3	2	3	3	4	4	4.25	17.6%
																Blueback otolith APE	19.40%
																Blueback scale APE	7.06%
																Total Blueback APE	13.23%

Table 7. Ageing worksheet for striped bass at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes (scored from 1 to 4), and final age as well as average percent error (APE) values between groups. Samples #1-10 were scales and samples #11-20 were otoliths.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	RI	11	8/5/2015	10	3	10	11	2	11	9	2	9	11	3	11	10.25	7.3%
2	NY	5	7/15/2015	5	2	5	5	2	5	4	2	4	5	1	5	4.75	7.9%
3	NY	3	7/1/2015	3	2	3	3	2	3	3	2	3	3	2	3	3	0.0%
4	NJ	10	3/28/1996	7	4	8	9	4	10	8	2	8	8	2	9	8.75	8.6%
5	RI	4	5/19/2015	4	2	4	4	1	4	4	2	4	3	4	4	4	0.0%
6	ME	2	6/20/2012	2	2	2	2	2	2	2	1	2	2	2	2	2	0.0%
7	ODU	19	3/19/2015	14	2	14	16	4	17	15	4	16	16	4	17	16	6.3%
8	ME	6	6/22/2010	6	1	6	6	1	6	6	1	6	7	1	7	6.25	6.0%
9	MD	8	4/21/2012	6	4	7	8	1	8	6	4	7	7	4	8	7.5	6.7%
10	MA	14	10/15/2015	12	4	12	13	4	13	12	3	12	14	4	14	12.75	5.9%
11	VIMS	3	6/1/2014	3	2	3	3	1	3	3	1	3	3	2	3	3	0.0%
12	VIMS	6	11/13/2014	7	2	7	7	3	7	7	4	7	7	4	7	7	0.0%
13	ODU	25	3/4/2015	26	1	26	23	4	24	23	4	24	24	4	25	24.75	3.0%
14	ODU	4	3/9/2015	3	4	4	3	4	4	3	4	4	3	4	4	4	0.0%
15	MA	11	7/3/2014	10	2	10	11	1	11	10	1	10	10	4	11	10.5	4.8%
16	SCDNR	1	12/18/2014	1	4	1	1	4	1	1	4	1	1	4	1	1	0.0%
17	VIMS	5	6/1/2014	4	1	4	4	4	5	5	4	5	5	1	5	4.75	7.9%
18	MA	18	9/7/2014	19	3	19	18	3	18	16	4	16	18	2	18	17.75	4.9%
19	MA	9	9/15/2014	9	2	9	9	3	9	9	3	9	9	2	9	9	0.0%
20	SCDNR	1	4/8/2014	2	1	2	1	1	1	1	1	1	1	1	1	1.25	30.0%
																Average APE	4.96%

Table 8. Ageing worksheet for tautog at the workshop with the sample number, lab providing the sample and their assigned age, catch date of the sample, workshop group annulus counts, margin codes (scored from 1 to 4), and final age as well as average percent error (APE) values between groups.

Sample #	Lab	Age	Catch date	Group 1			Group 2			Group 3			Group 4			Average Age	APE
				Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age	Annulus count	Margin code	Final age		
1	VIMS	2	10/6/2011			2	2	4	2	2	4	2	2	3	2	2	0.0%
2	MD	28	2/20/2014	28	4	29	26	4	27	27	4	27	24	4	25	27	3.7%
3	RI	3	9/8/2015	2	4	2	2	4	2	2	4	2	2	4	2	2	0.0%
4	VIMS	4	10/6/2011	4	3	4	4	4	4	3	4	3	4	4	4	3.75	10.0%
5	MA	12	11/6/2015	11	3	11	11	4	11	11	3	11	11	3	11	11	0.0%
6	RI	2	9/8/2015	2	3	2	2	4	2	2	4	2	2	4	2	2	0.0%
7	VIMS	20	10/6/2011	16	3	16	20	4	20	18	4	18	17	4	17	17.75	7.0%
8	MD	19	2/20/2014	20	2	20	18	4	19	17	1	17	18	4	19	18.75	4.7%
9	NY	7	5/19/2015	7	4	8	6	4	7	7	4	8	7	4	8	7.75	4.8%
10	NY	8	6/14/2015	7	2	7	7	1	7	9	1	9	8	2	8	7.75	9.7%
11	NY	10	11/19/2015	8	4	8	8	3	8	8	1	8	8	2	8	8	0.0%
12	MD	6	12/6/2014	6	4	6	6	4	6	5	4	5	5	4	5	5.5	9.1%
13	ODU	6	4/25/2014	6	4	7	6	4	7	5	4	6	6	4	7	6.75	5.6%
14	ODU	17	4/27/2014	18	4	19	18	4	19	14	4	15	17	4	18	17.75	7.7%
15	MD	3	12/16/2014	3	4	3	3	4	3	2	4	2	3	3	3	2.75	13.6%
16	ODU	3	11/22/2014	6	4	6	4	4	4	6	3	6	6	4	6	5.5	13.6%
17	MA	6	10/31/2015	6	4	6	6	3	6	5	4	5	5	4	5	5.5	9.1%
18	MA	9	11/6/2015	9	4	9	9	4	9	8	4	8	9	4	9	8.75	4.3%
19	NJ	9	1/11/2012	9	4	10	10	4	11	7	4	8	10	4	11	10	10.0%
20	NJ	5	1/10/2012	3	4	4	3	4	4	3	4	4	4	4	5	4.25	8.8%
																Average APE	6.09%

Appendix A: Agenda

Atlantic States Marine Fisheries Commission's QA/QC Fish Ageing Workshop

Wednesday, March 30, 2016 – 9:00 a.m. to 5:00 p.m.
Thursday, March 31, 2016 – 9:00 a.m. to 3:00 p.m.

FWC Fish and Wildlife Research Institute
100 8th Ave SE
St. Petersburg, Florida

Agenda

Wednesday, March 30th

1. Call to Order/Introductions
2. Overview of Species
    a. Introduction to Ageing River Herring (*S. Elzey*)
    b. Introduction to Ageing Striped Bass (*H. Corbett)*
    c. Introduction to Ageing Atlantic Croaker (*H. Corbett)*
    d. Introduction to Ageing Bluefish (*J. Gregg*)
    e. Introduction to Ageing Black Sea Bass (*J. Gregg)*
    f. Introduction to Ageing Tautog (*N. Lengyel)*
3. Conduct Hard Part Readings Exercise for River Herring, Striped Bass , Atlantic Croaker, Bluefish, Tautog, and Black Sea Bass

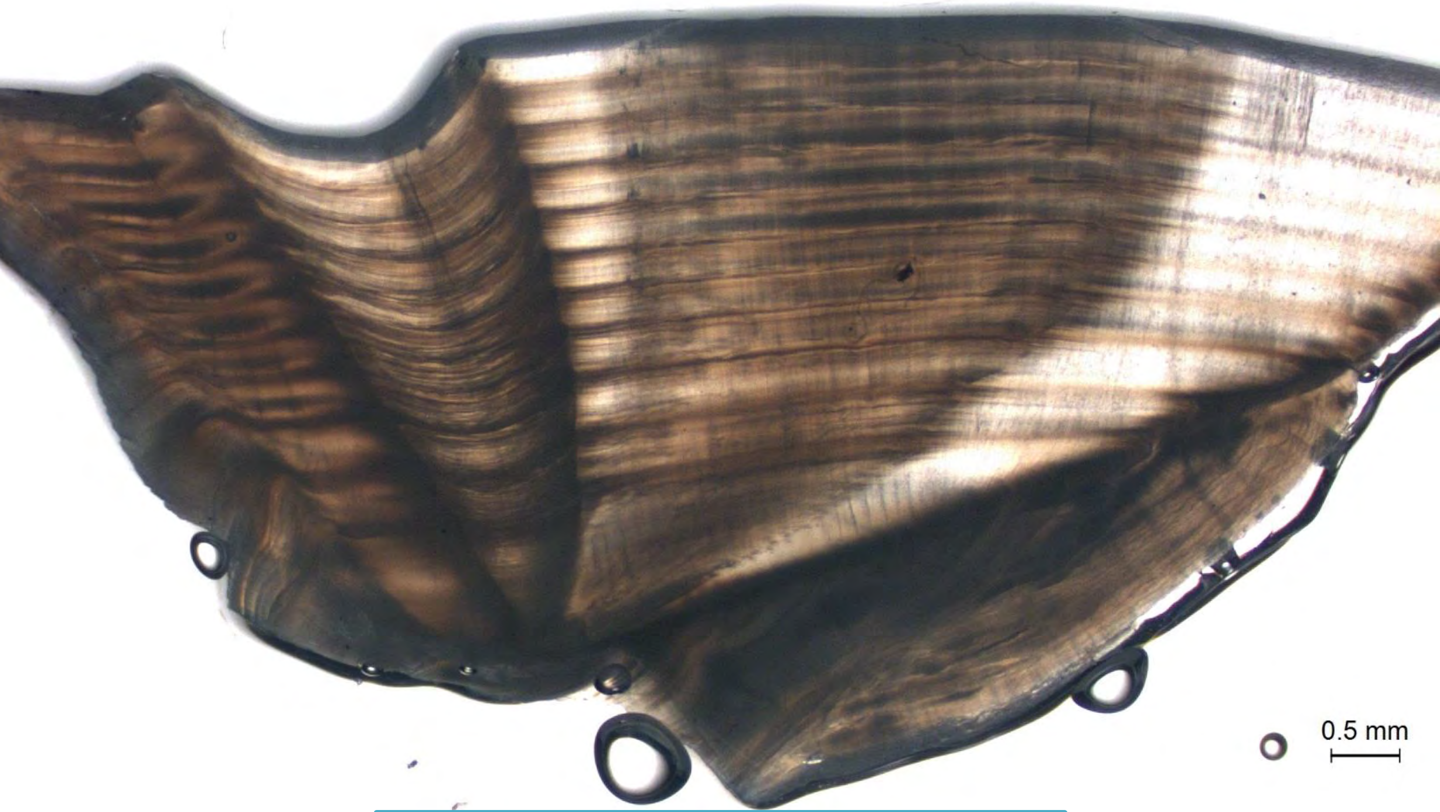
Thursday, March 31st

4. Review and Comparison of Otolith Reading Exercise by Groups
5. Discussion and Review of Issues and Differences Encountered during Reading Exercise
6. Other Business

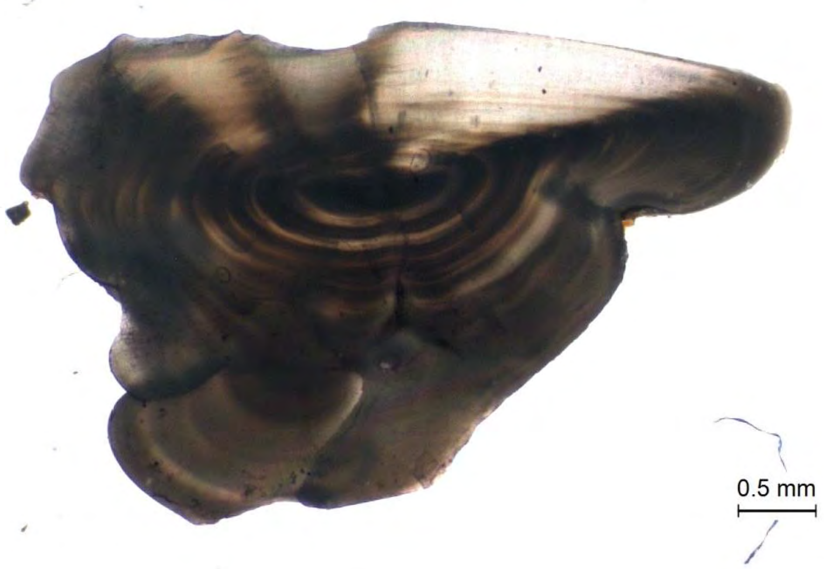
Adjourn

Name	**State/Lab**	**Provided Samples of:**
Mark Pasterczyk	ME	Striped Bass, River Herring
Scott Elzey	MA	Striped Bass, River Herring, Bluefish, Tautog, Black Sea Bass
Eric Robillard	NEFSC	Black Sea Bass
Nicole Lengyel	RI	Striped Bass, Bluefish, Tautog, Black Sea Bass
David Molnar	CT	River Herring
Jesse Hornstein	NY	Striped Bass, Bluefish, Tautog
Heather Corbett	NJ	Striped Bass, River Herring, Atlantic Croaker, Bluefish, Tautog, Black Sea Bass
Craig Weedon	MD	Striped Bass, River Herring, Atlantic Croaker, Tautog
Jessica Gilmore	ODU	Striped Bass, Atlantic Croaker, Bluefish, Tautog
Jameson Gregg	VIMS	Striped Bass, Atlantic Croaker, Bluefish, Tautog, Black Sea Bass
Holly White	NC	River Herring, Atlantic Croaker, Bluefish
Jonathan Tucker	SC	Striped Bass, Atlantic Croaker, Bluefish
Donna McDowell	GA	Atlantic Croaker
Jessica Carroll	FL	Black Sea Bass
Kristen Anstead	ASMFC	

Appendix B: Sample Images

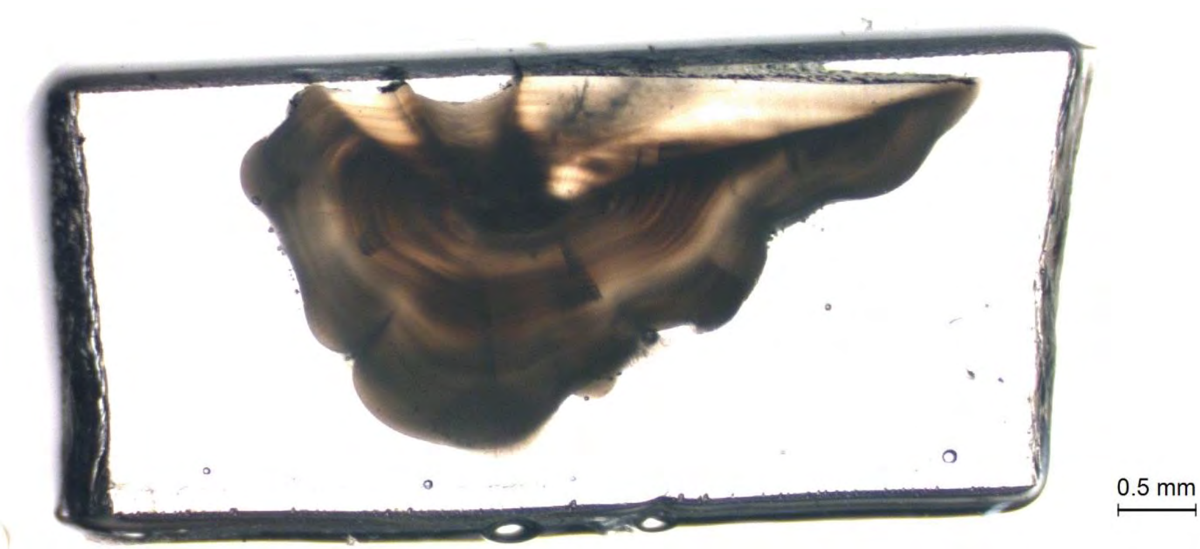


Atlantic Croaker 1   9/23/2014

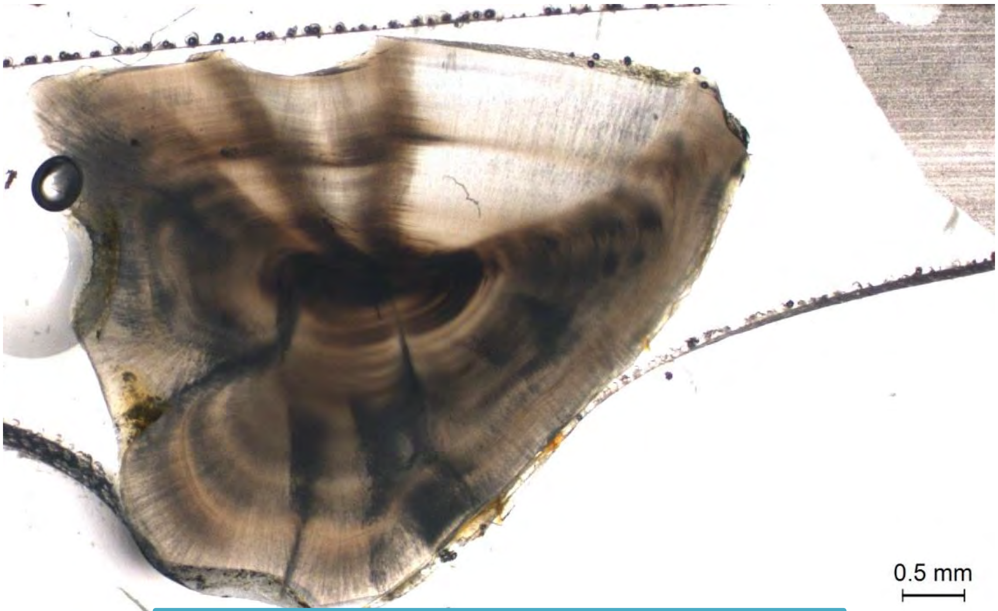


Atlantic Croaker 2   10/1/2012

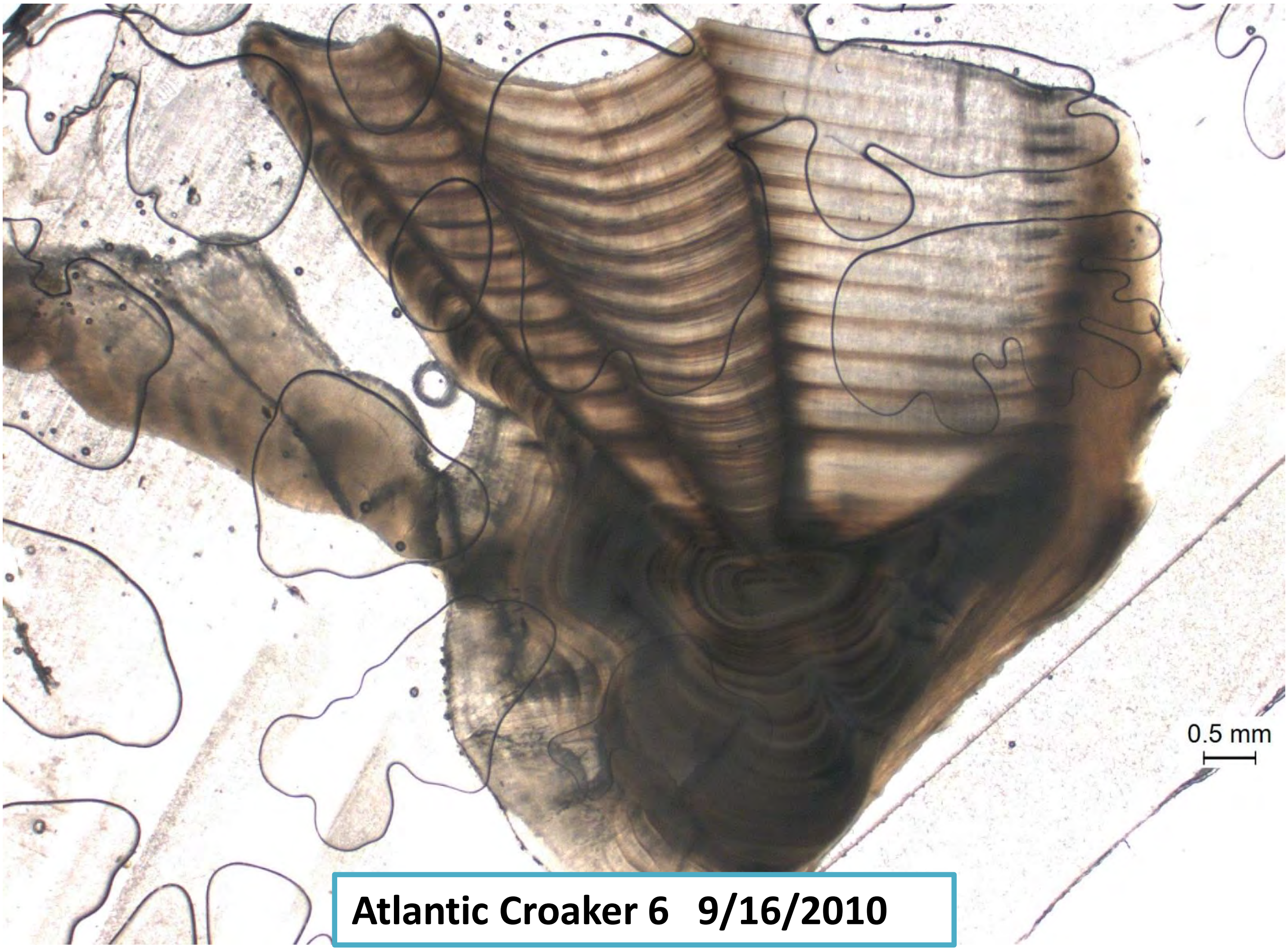
Atlantic Croaker 3   7/1/2014



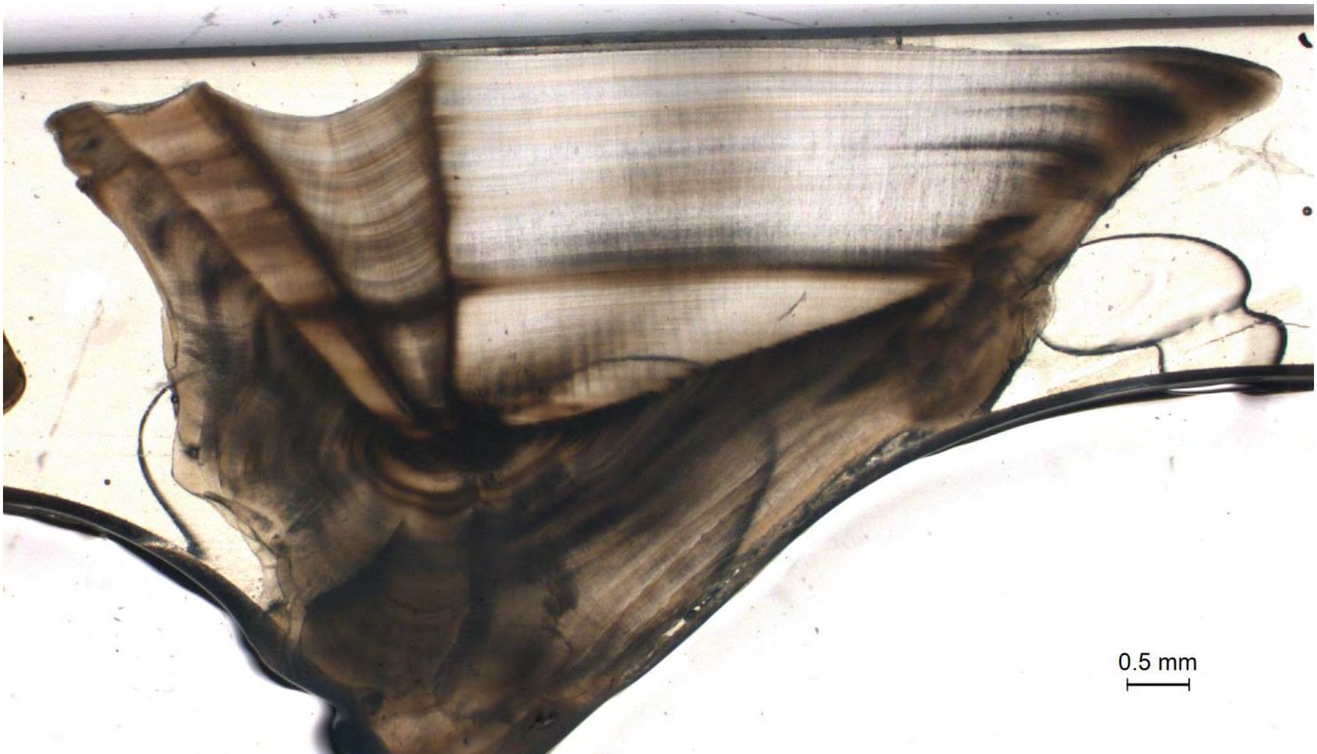
Atlantic Croaker 4   5/15/2012



Atlantic Croaker 5   5/14/2014

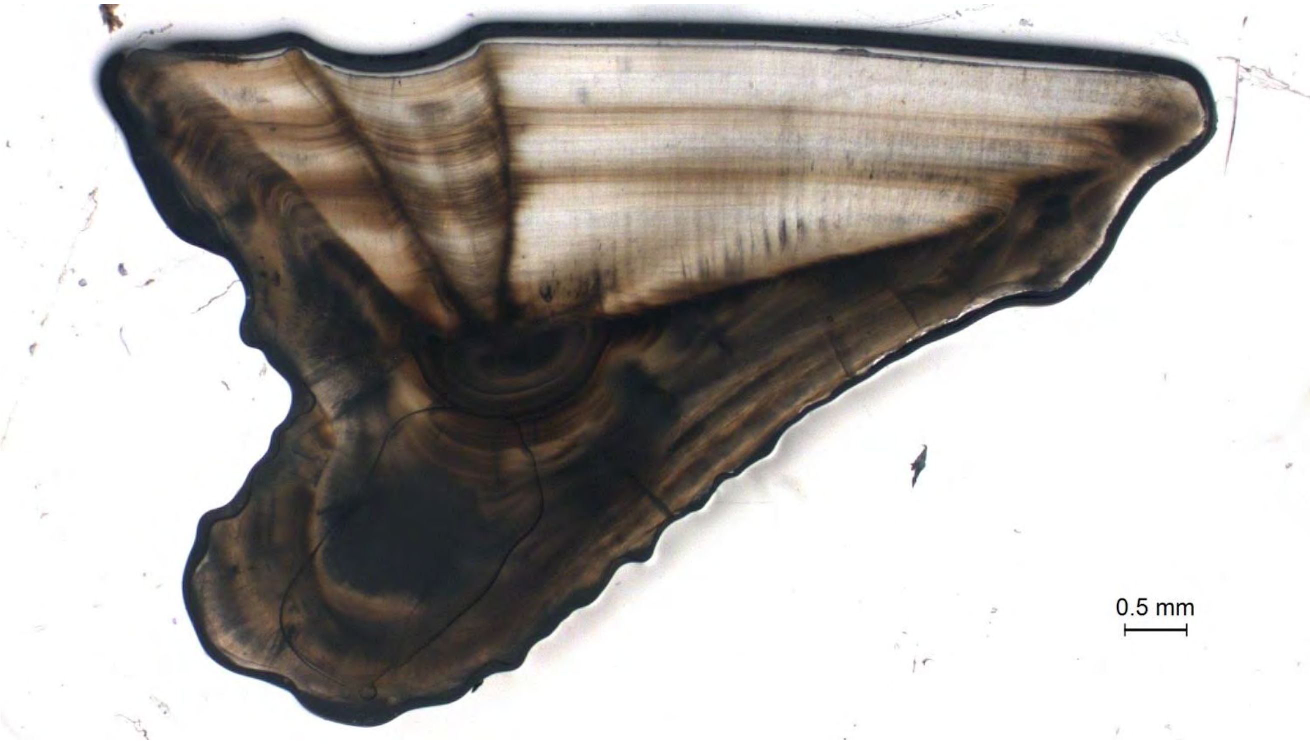


Atlantic Croaker 6   9/16/2010

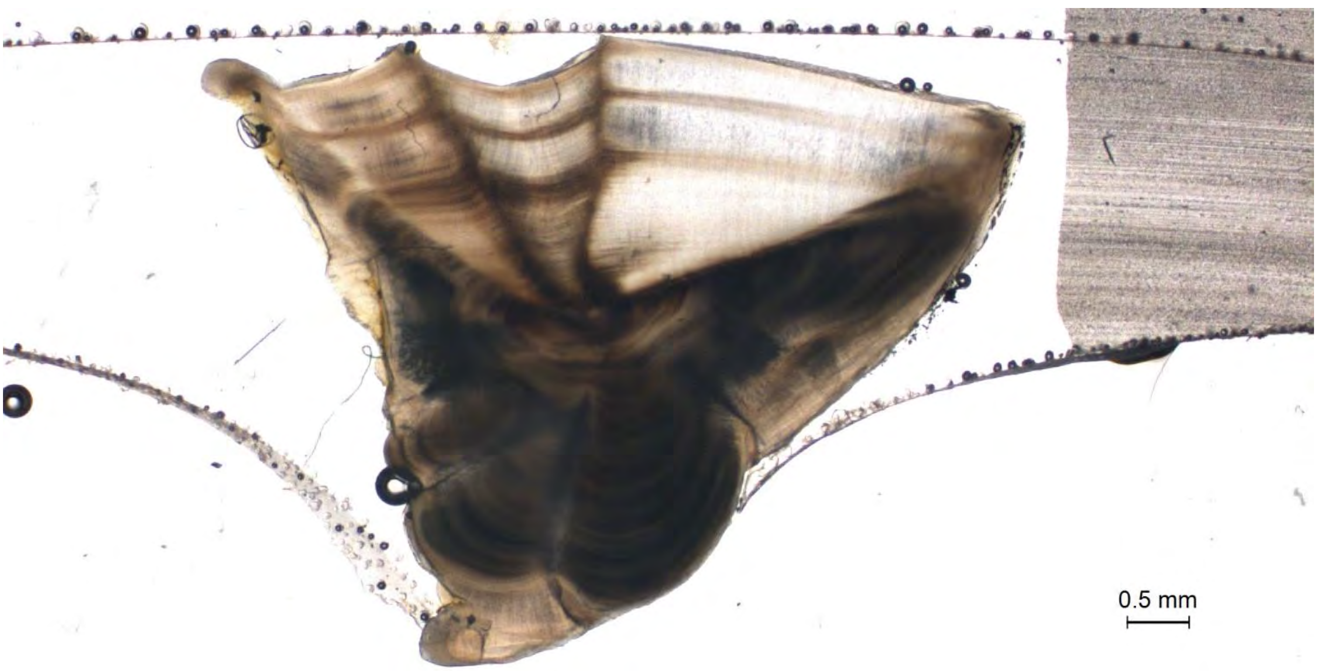


Atlantic Croaker 7   6/29/2011

Atlantic Croaker 8   5/10/2014



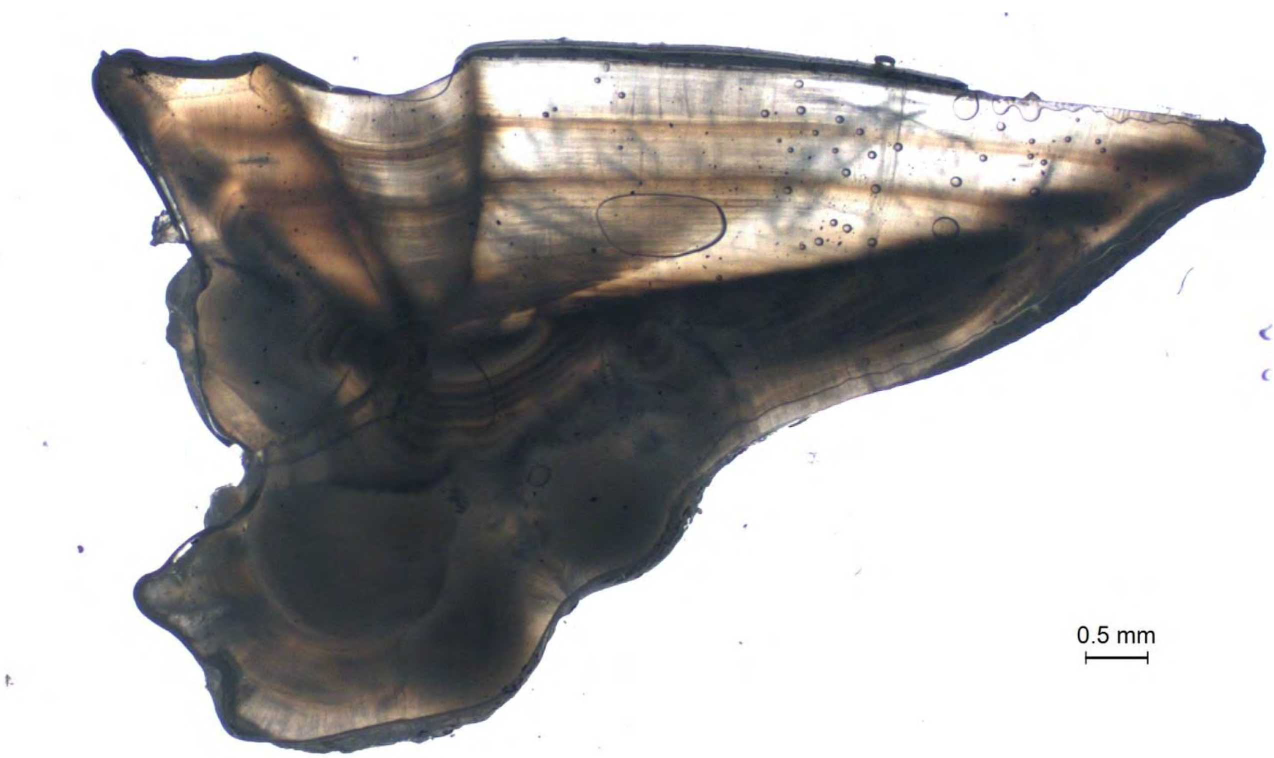
Atlantic Croaker 9 4/21/2014



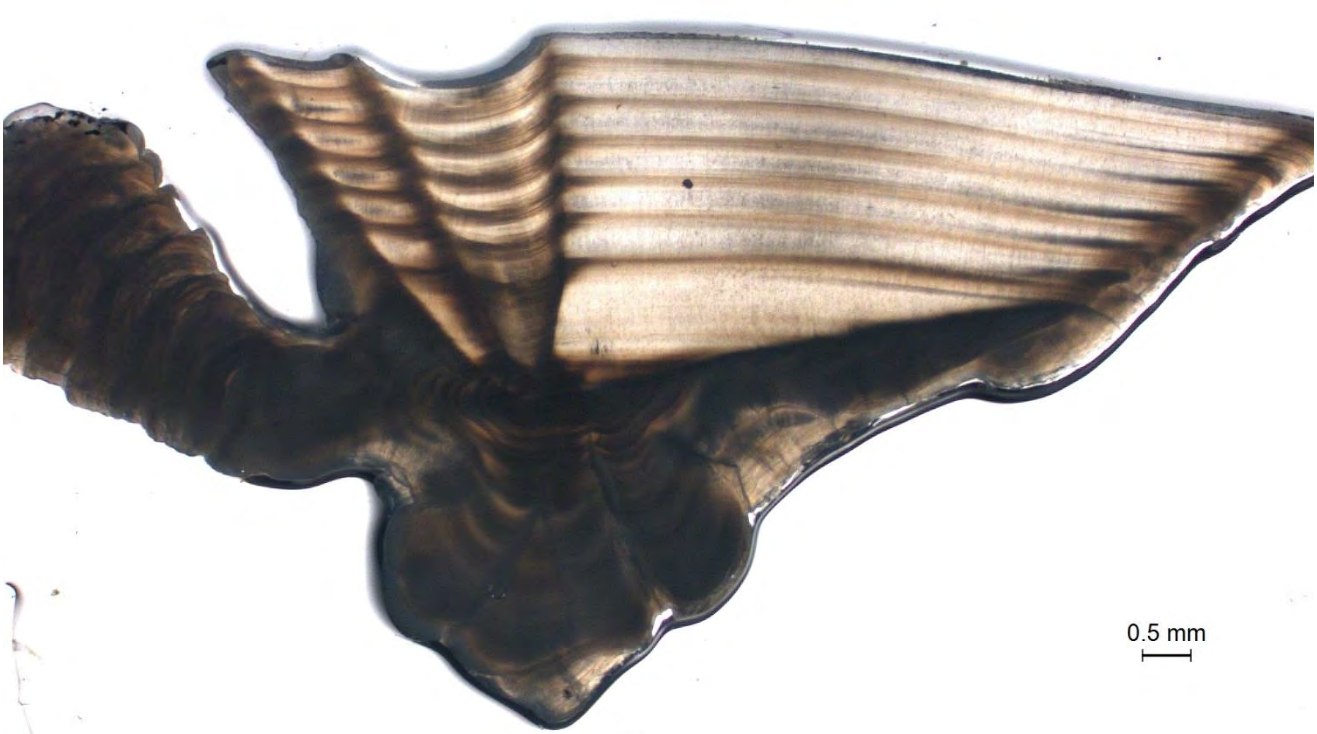
Atlantic Croaker 10 5/14/2014

Atlantic Croaker 11 **10/3/2006**

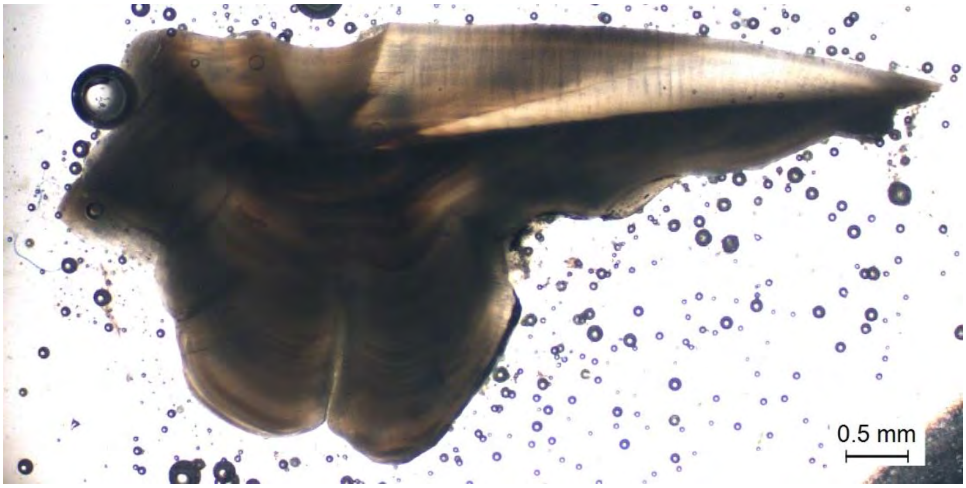
Atlantic Croaker 12 **3/26/2013**



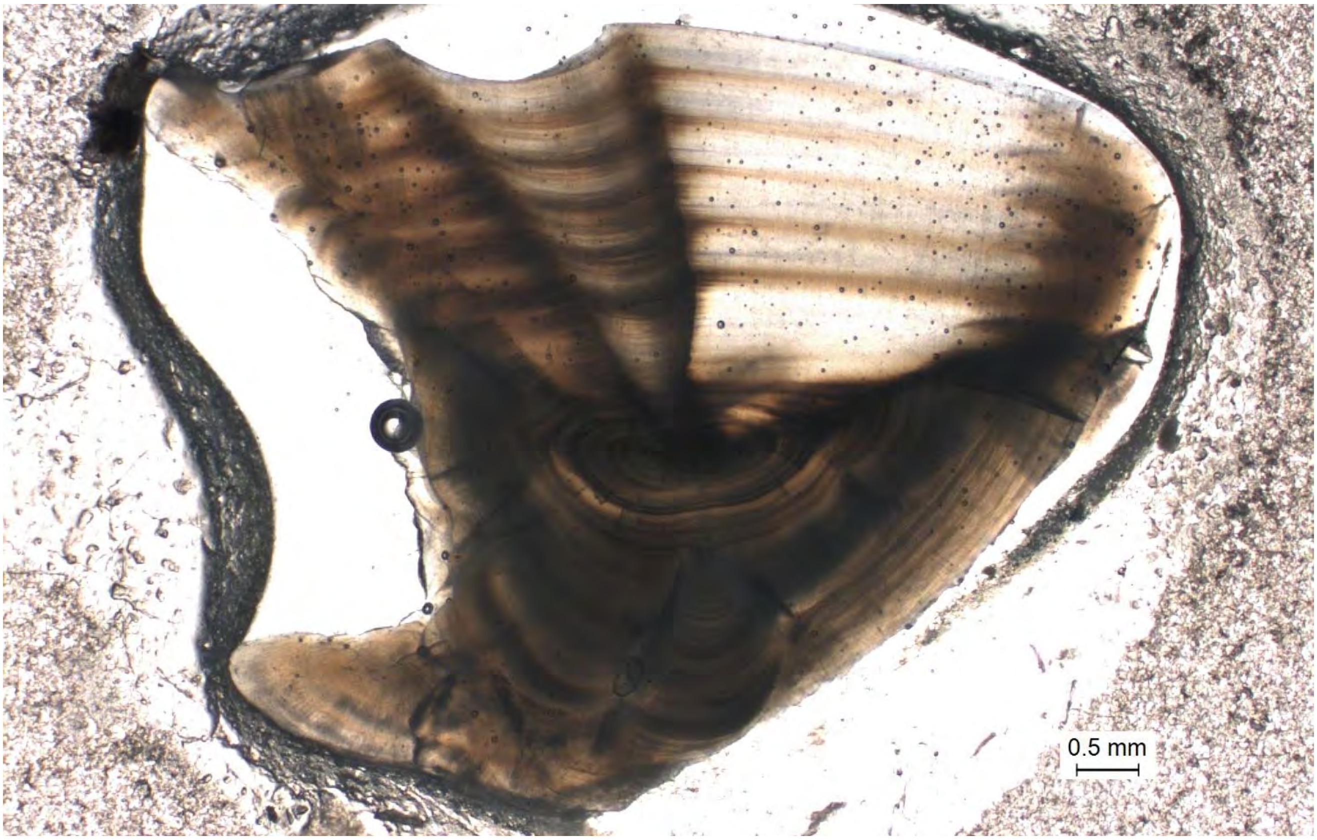
Atlantic Croaker 13 10/1/2009



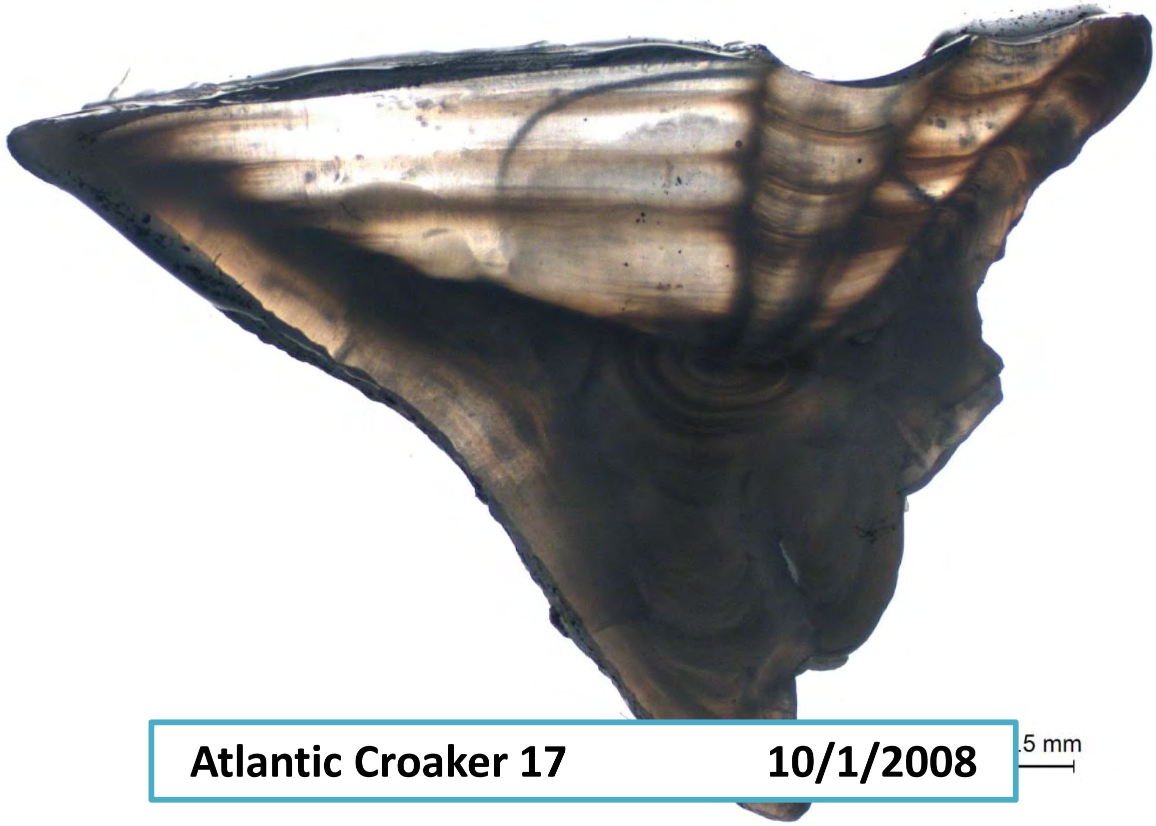
Atlantic Croaker 14 8/18/2014



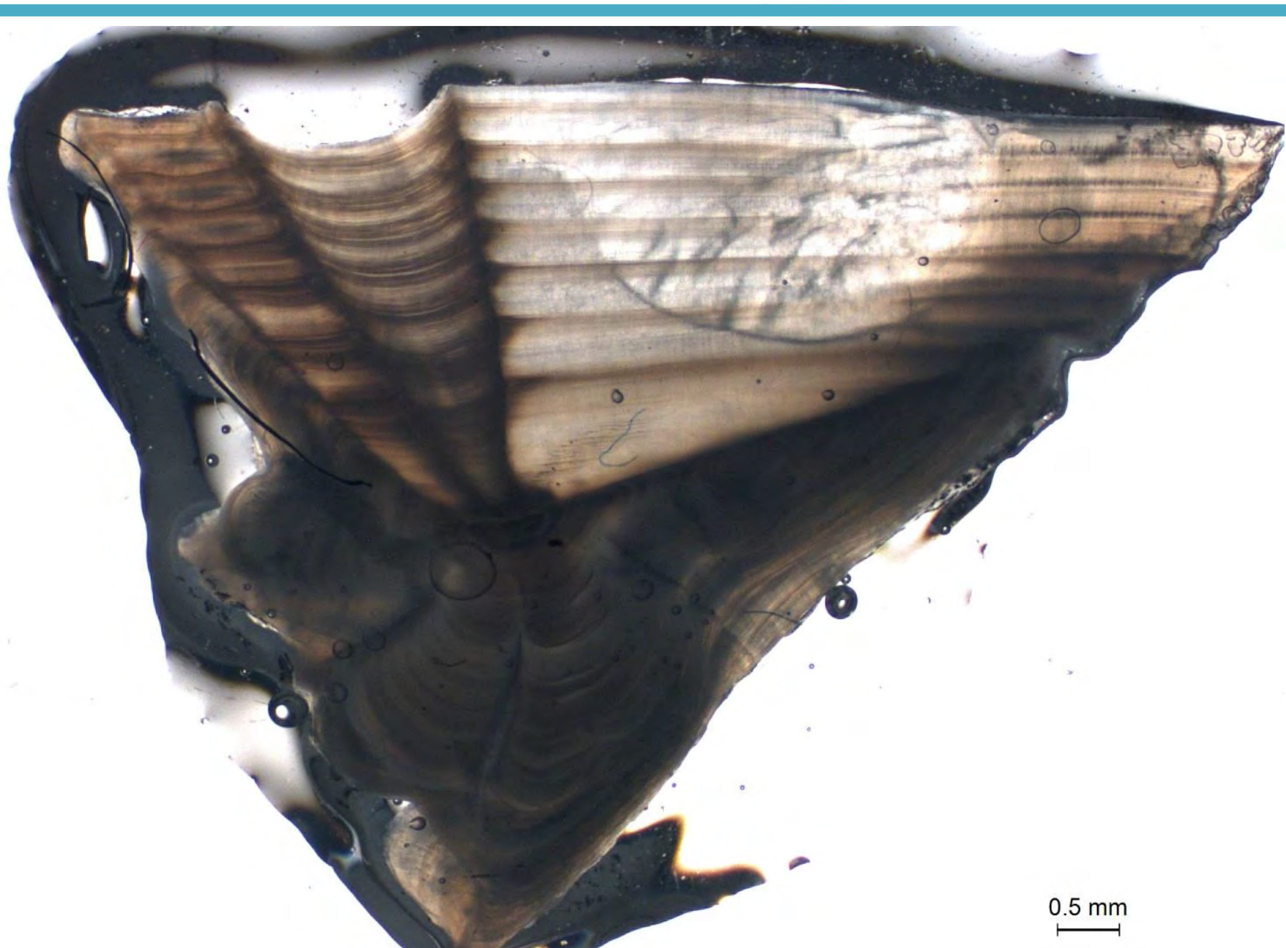
Atlantic Croaker 15 11/5/2014



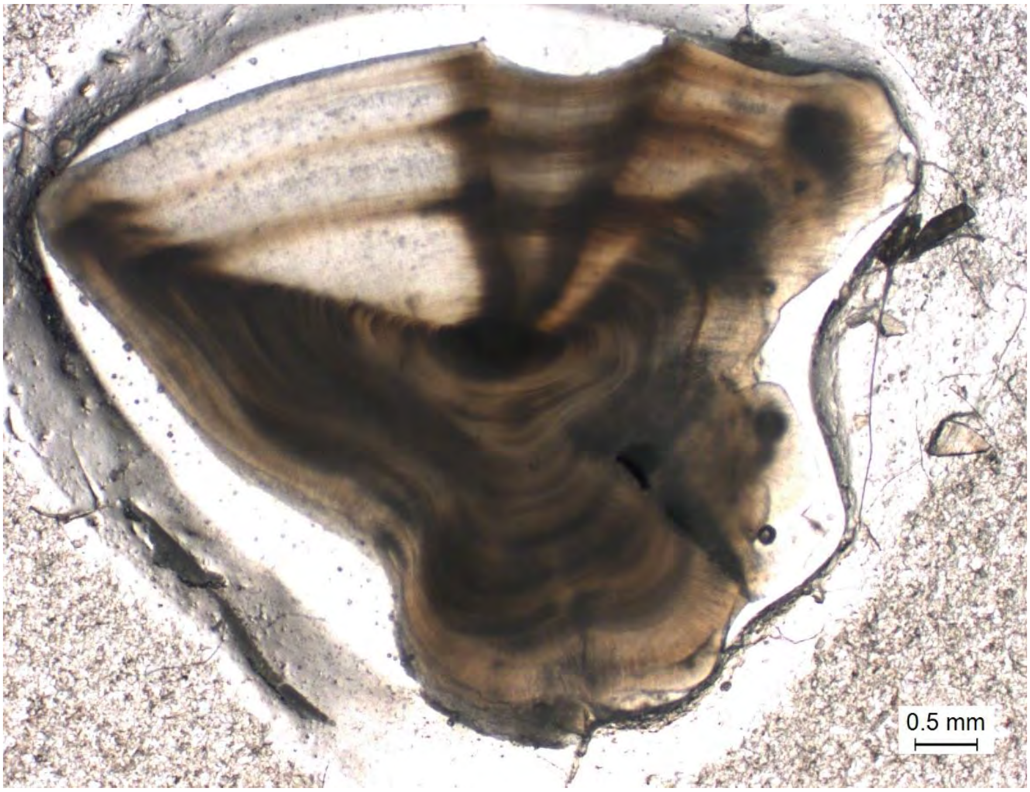
Atlantic Croaker 16 3/26/2013



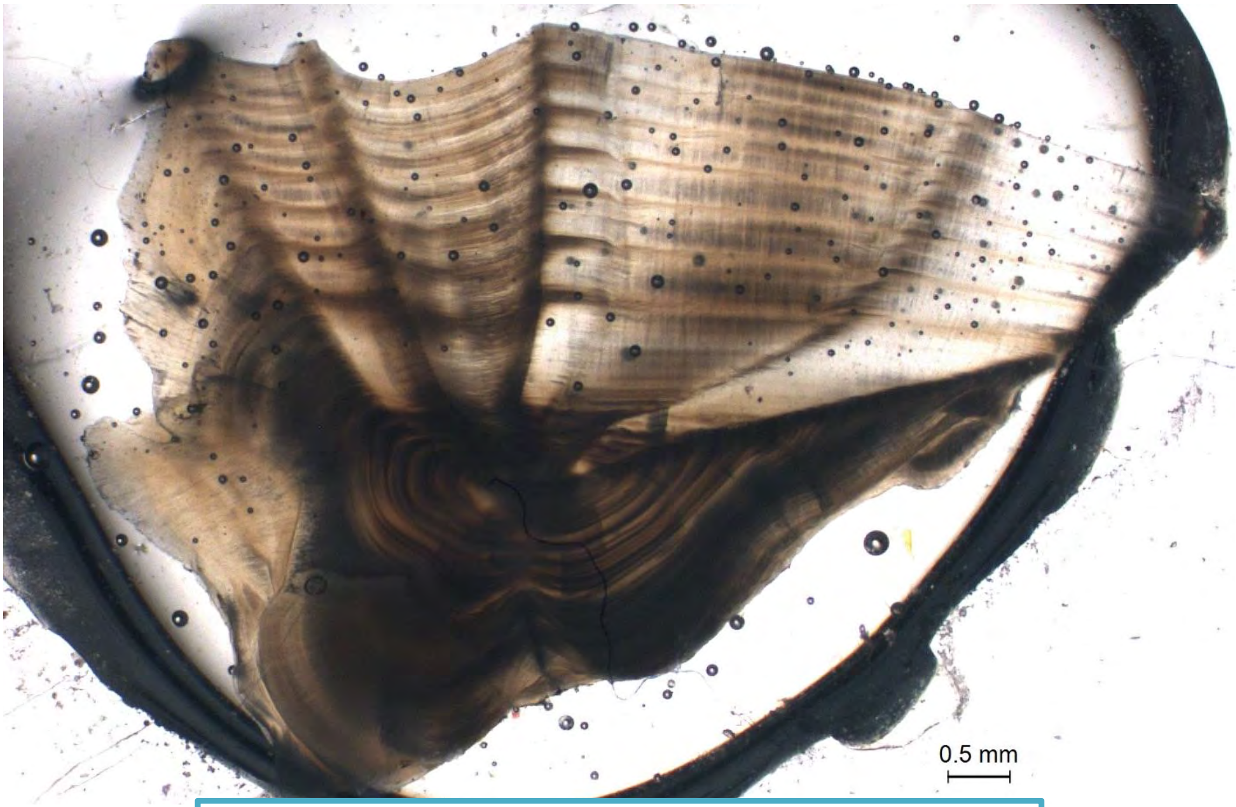
Atlantic Croaker 17 10/1/2008



Atlantic Croaker 18 10/1/2007

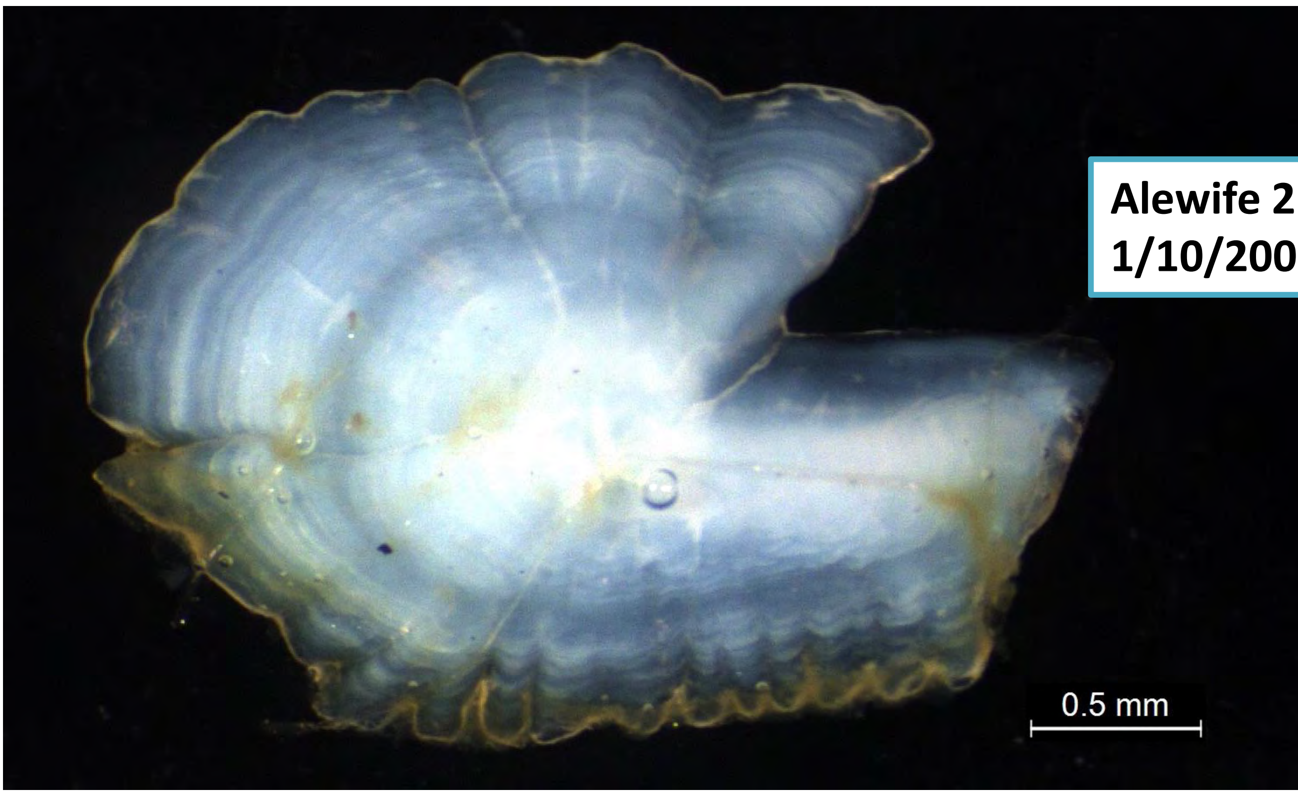


Atlantic Croaker 19 6/13/2013

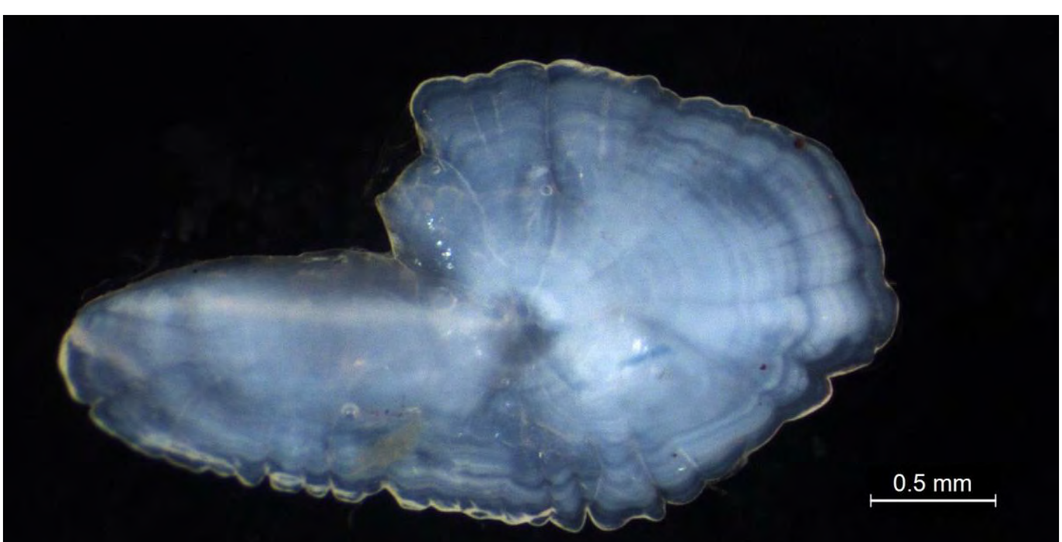


Atlantic Croaker 20 4/26/2014

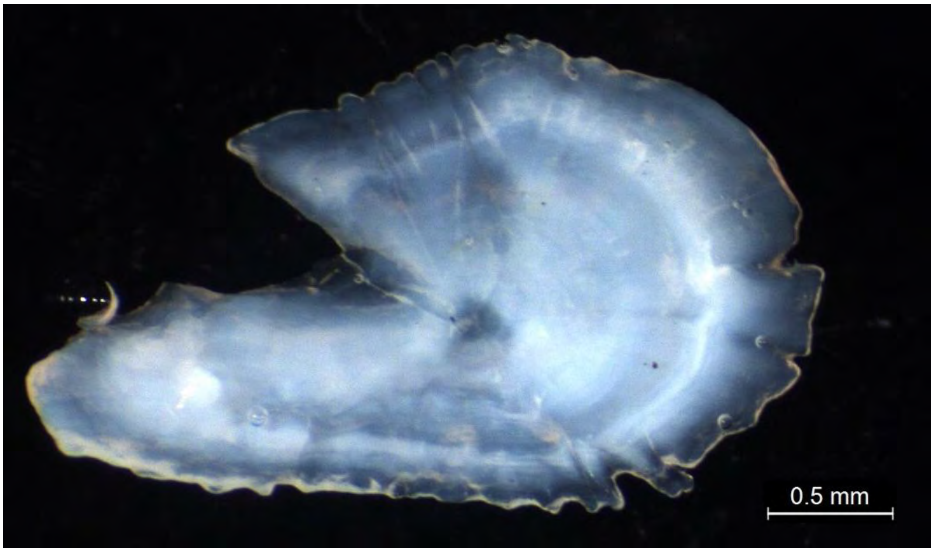
Alewife 1
12/19/2014



Alewife 2
1/10/2009



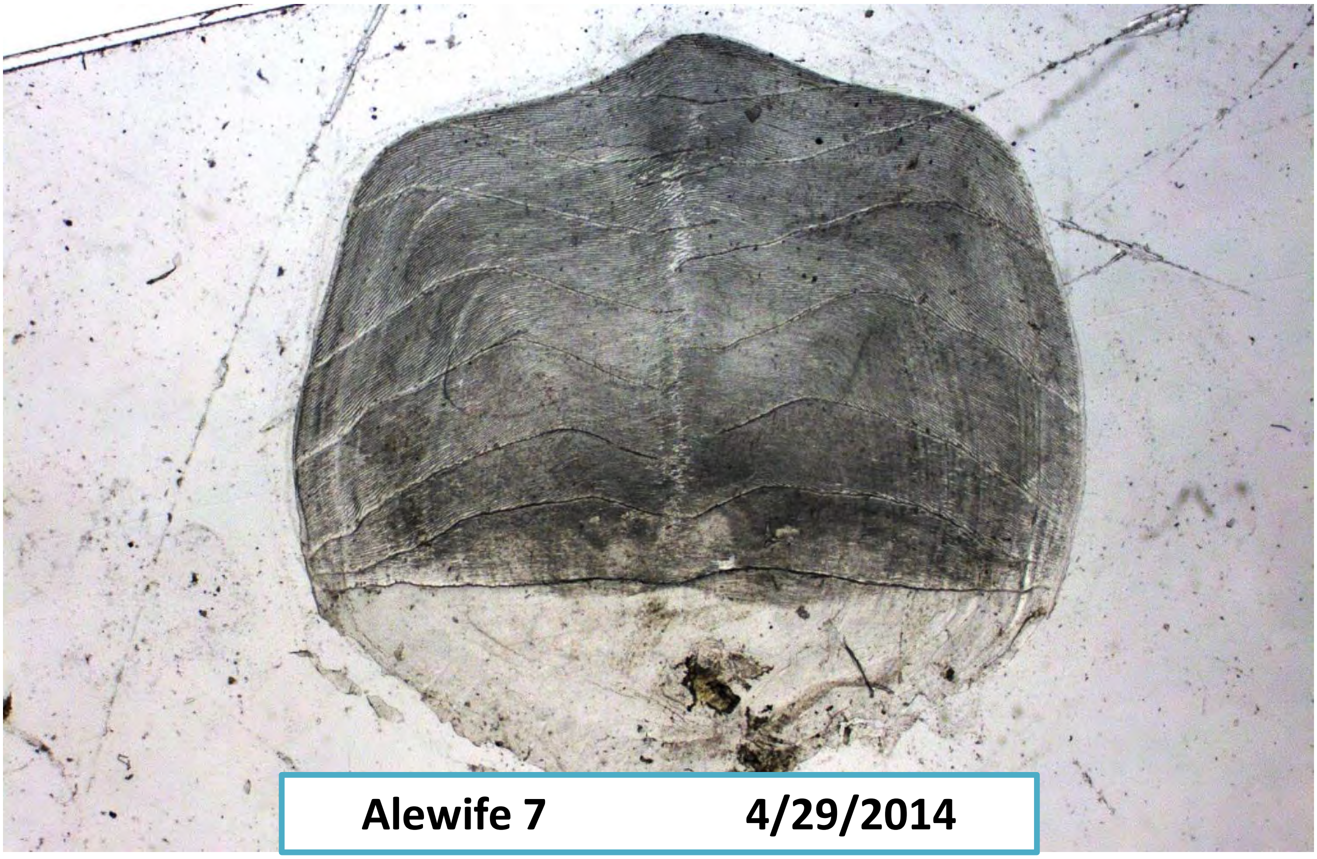
Alewife 3
4/29/2014



Alewife 4 1/25/2012

Alewife 5 12/21/2014

Alewife 6 5/1/2014



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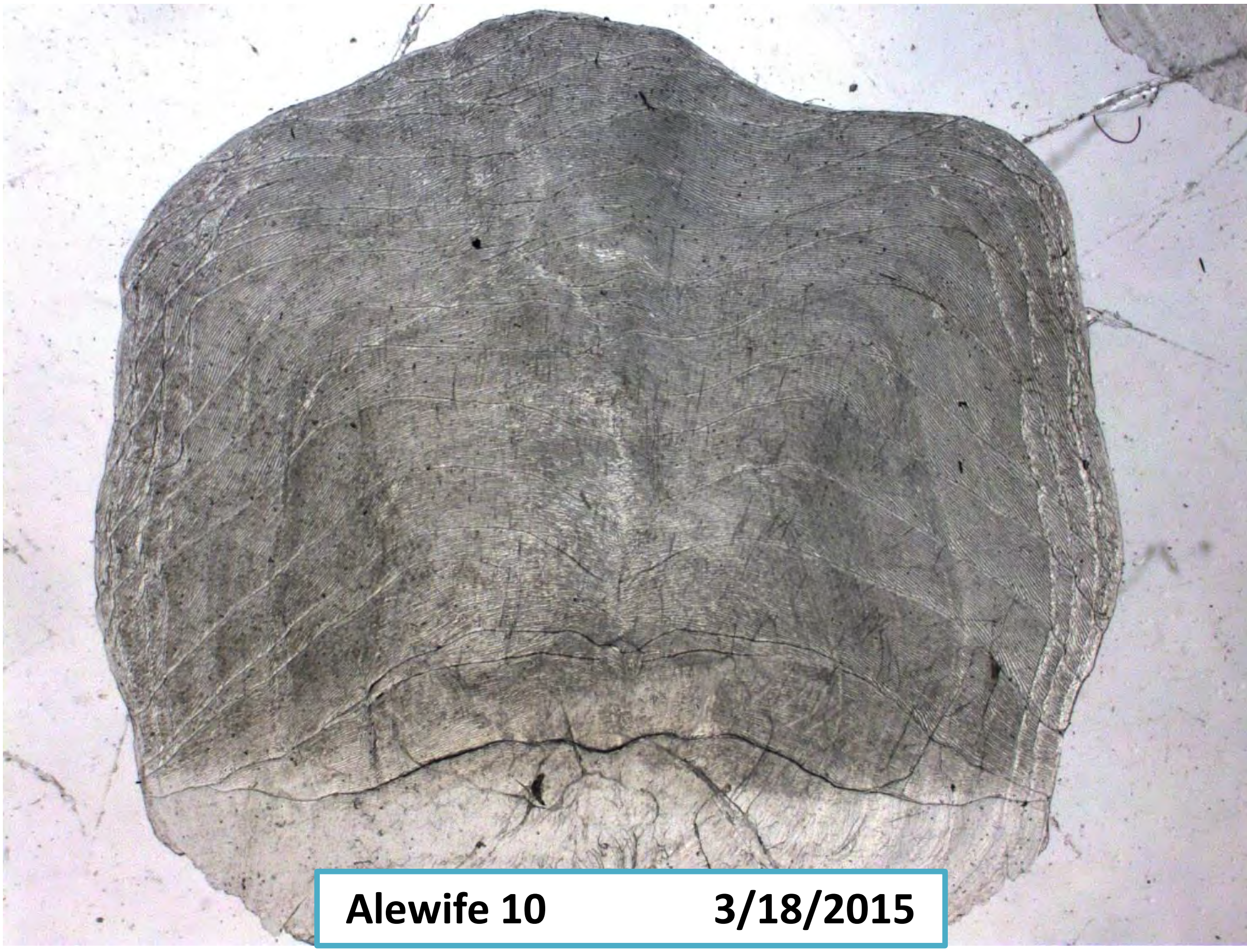
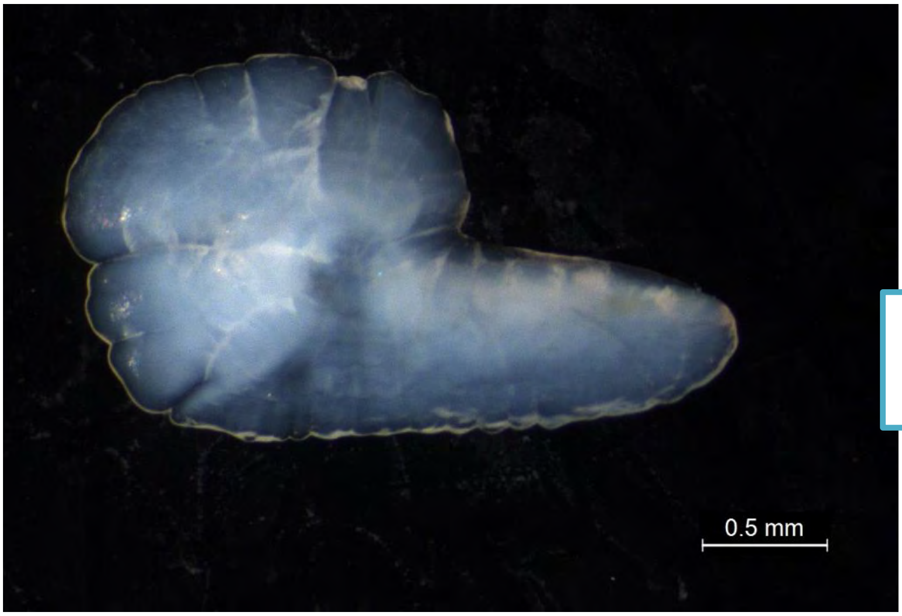
Alewife 8 5/25/2014

Alewife 9 3/25/2015

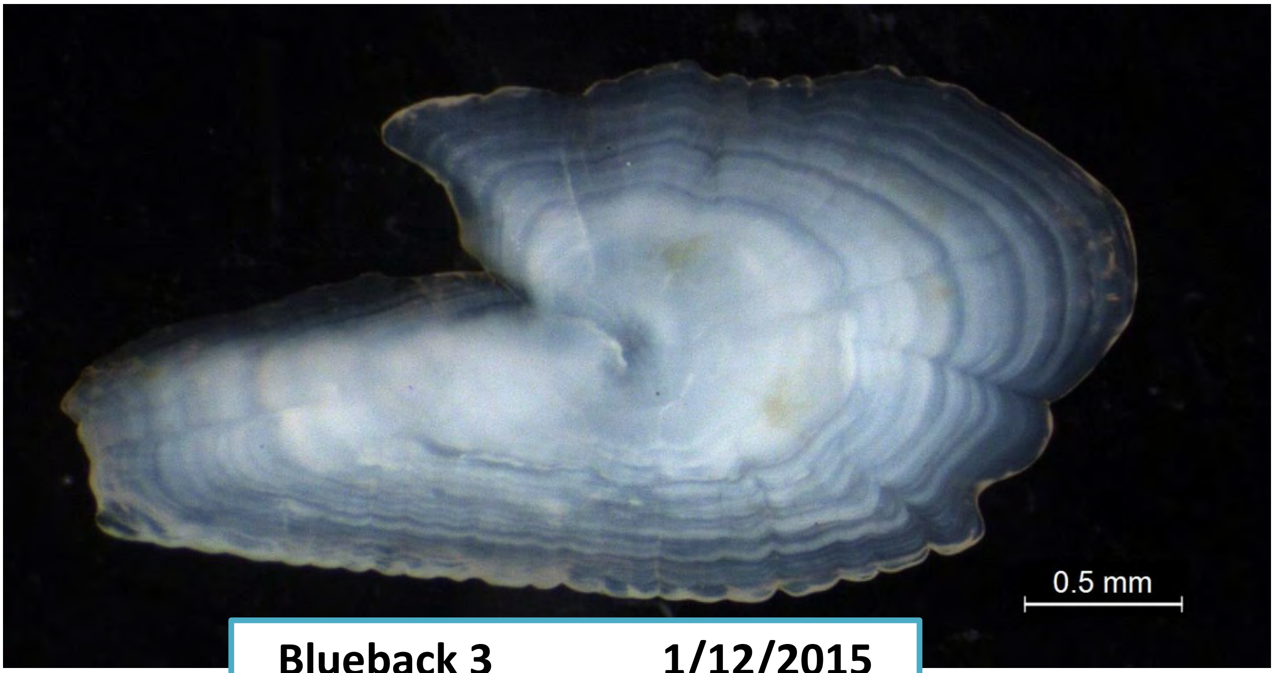


Alewife 10 3/18/2015

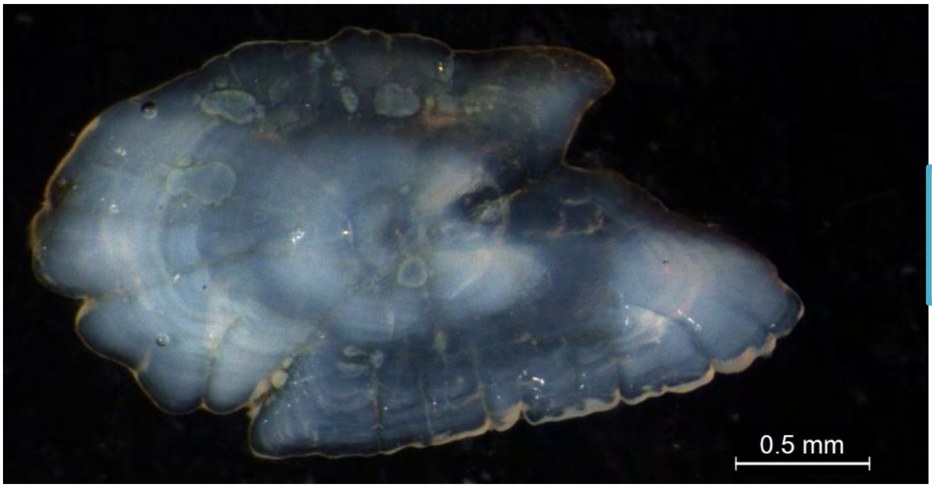
Blueback 1 12/19/2014



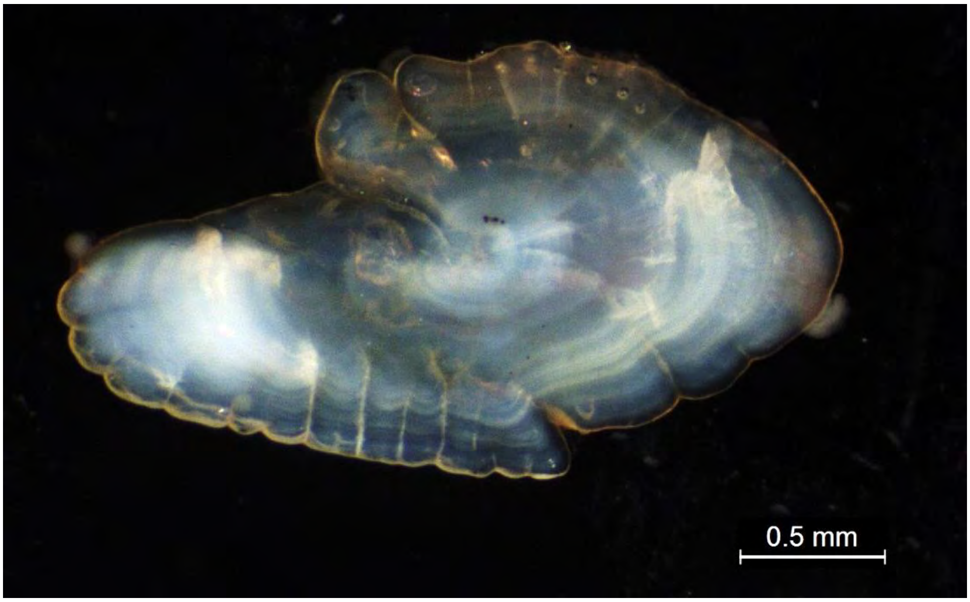
Blueback 2
12/19/2014



Blueback 3 1/12/2015



Blueback 4
1/10/2009



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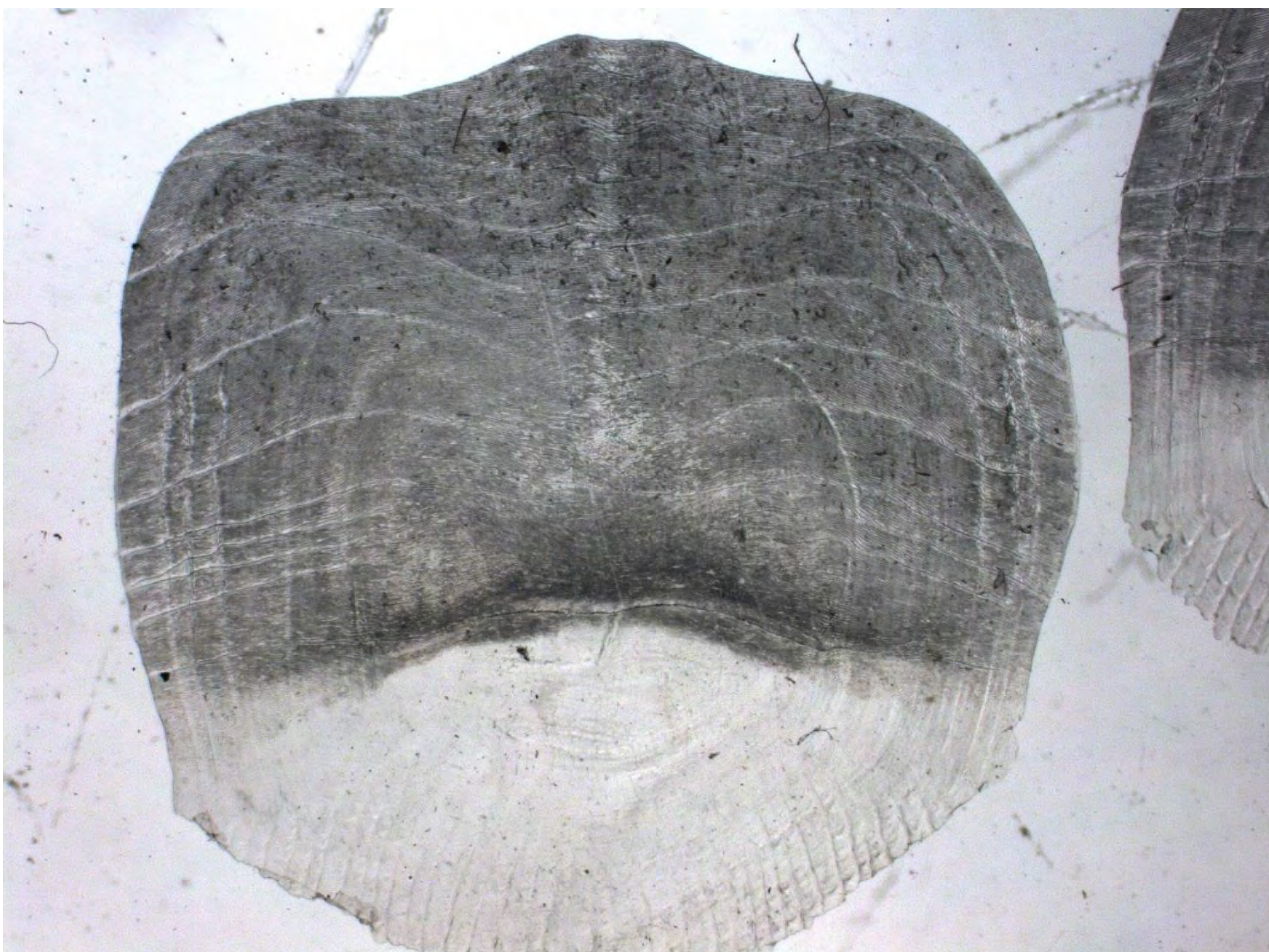
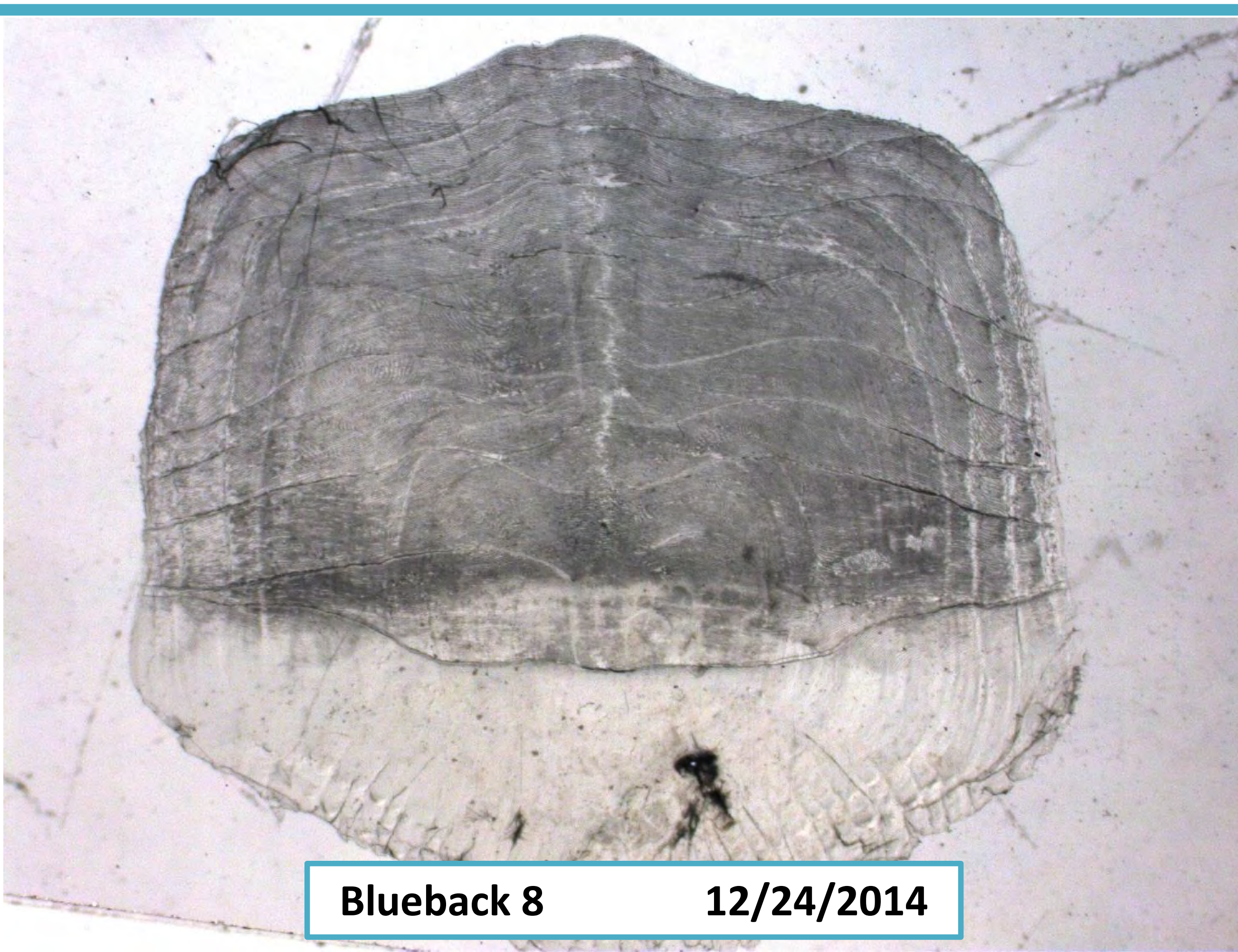
1/24/2012

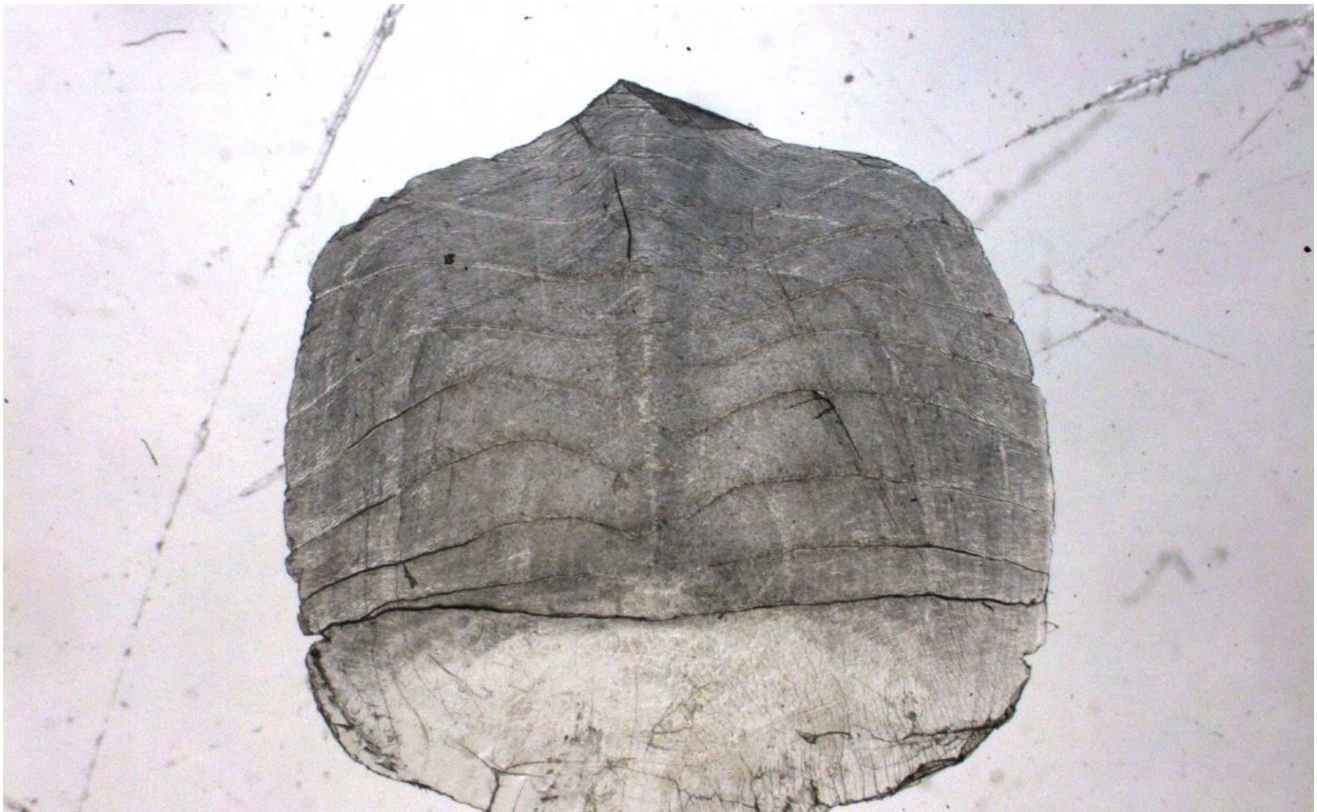


Blueback 6 4/29/2015

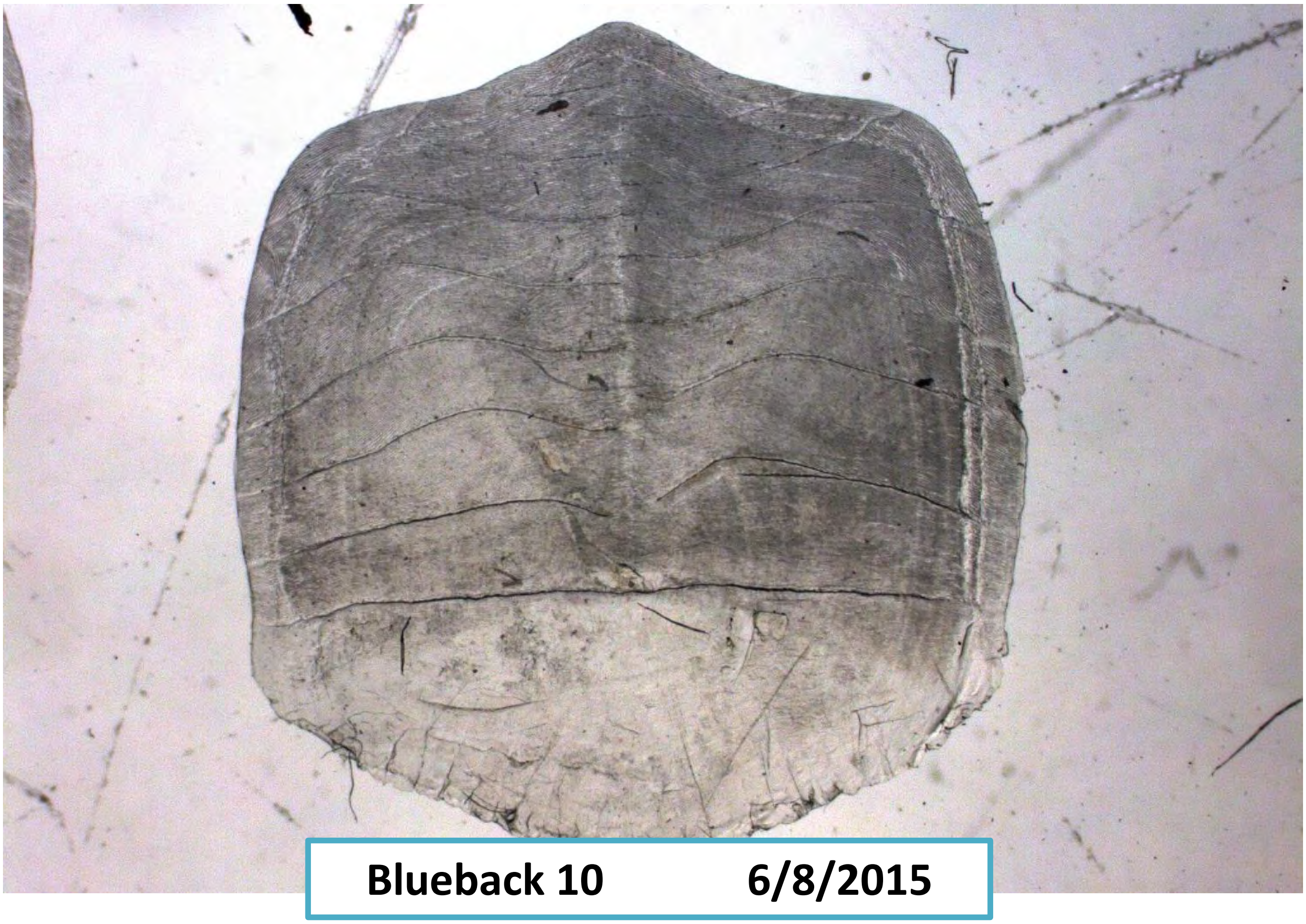
Blueback 7 4/22/2015



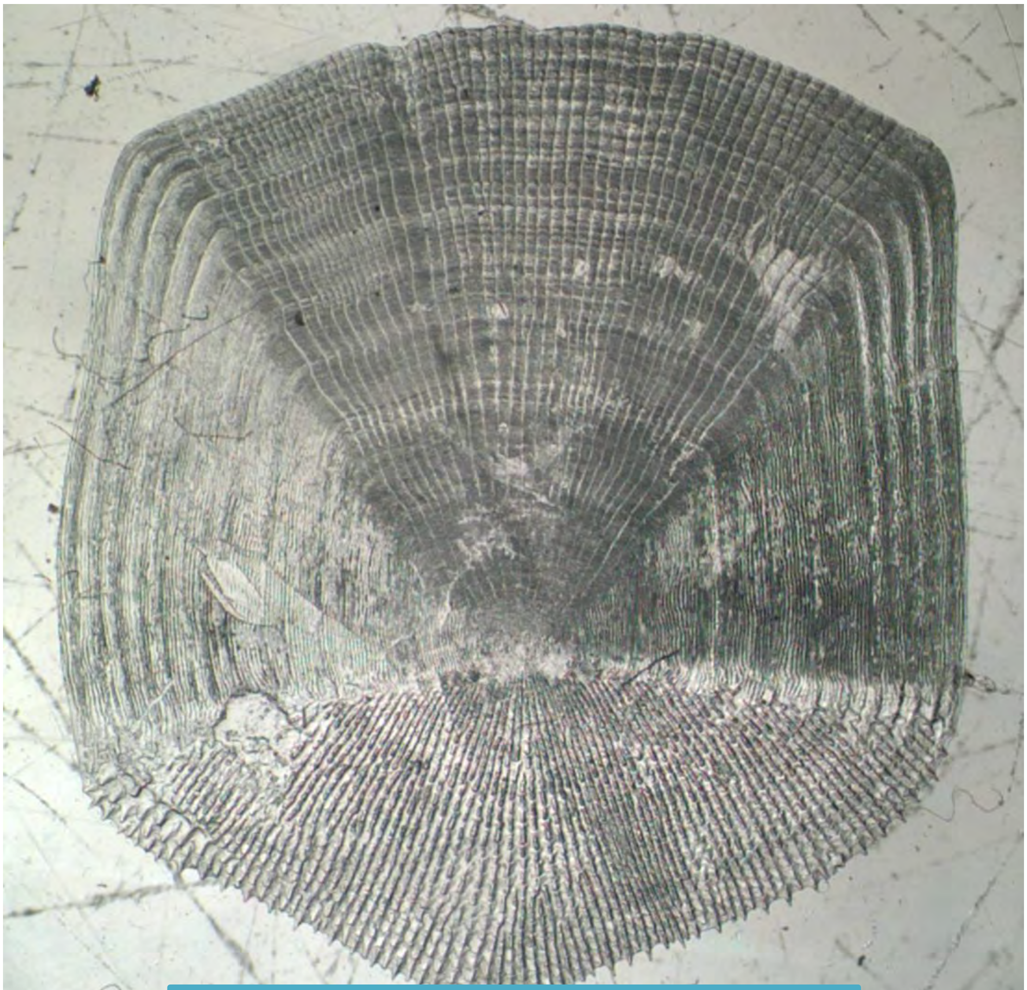
Blueback 8 12/24/2014



Blueback 9 5/11/2010



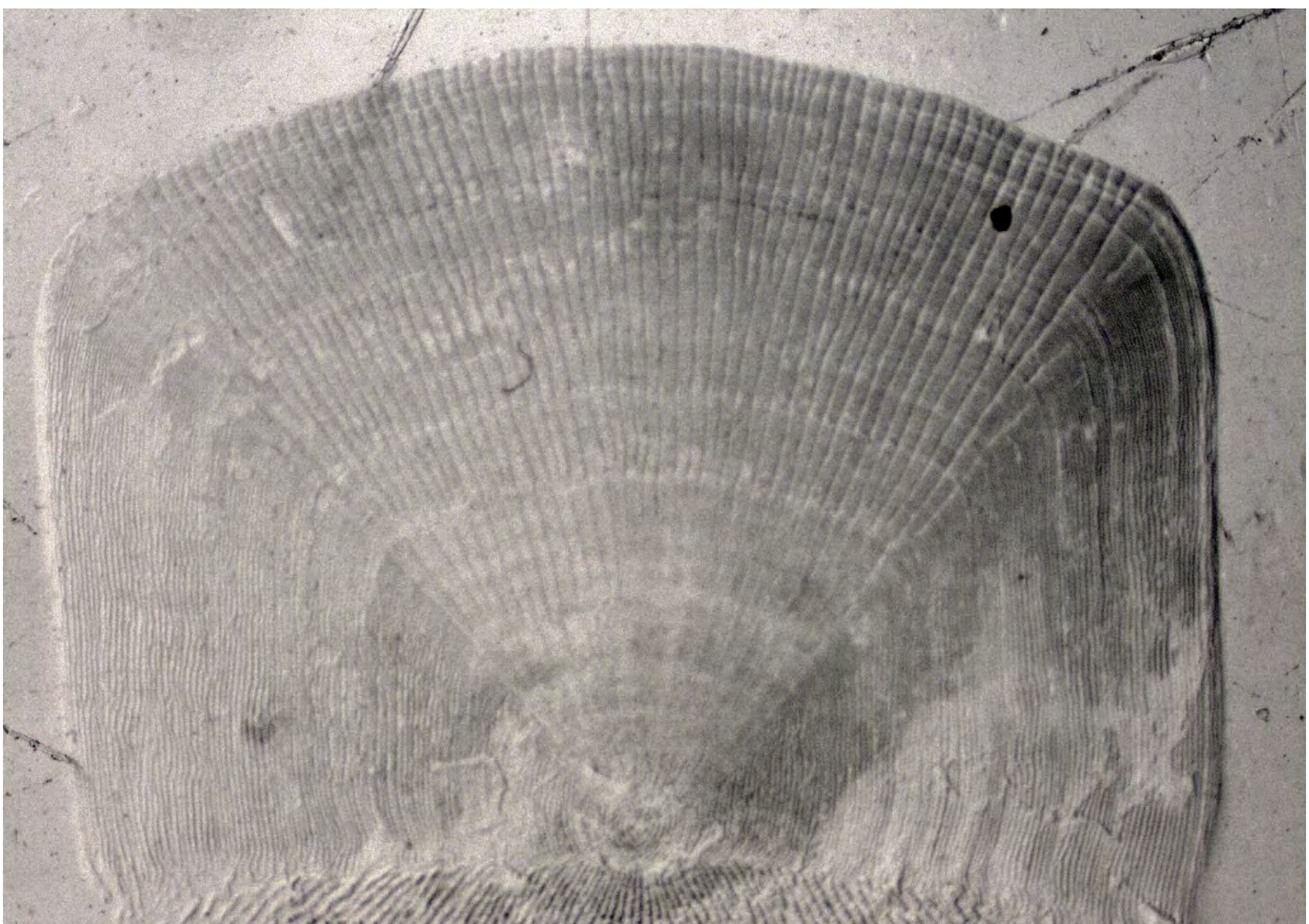
Blueback 10 6/8/2015



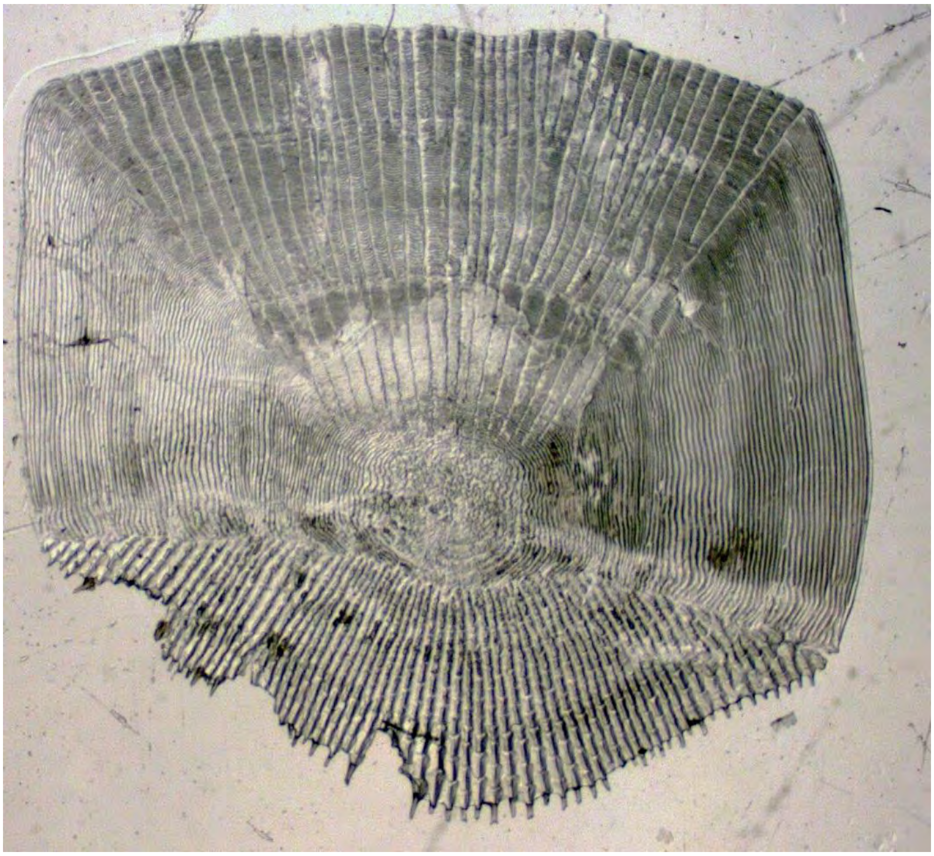
Striped Bass 1 8/5/2015

Striped Bass 2 7/15/2015

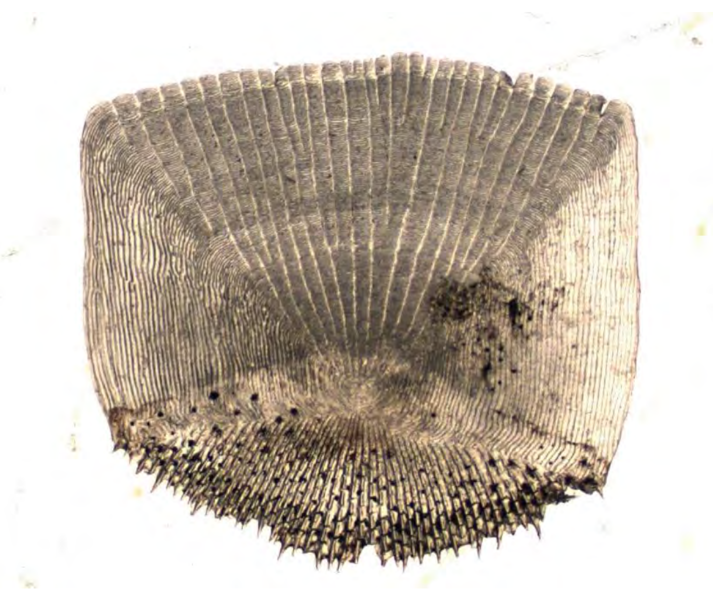
Striped Bass 3 7/1/2015



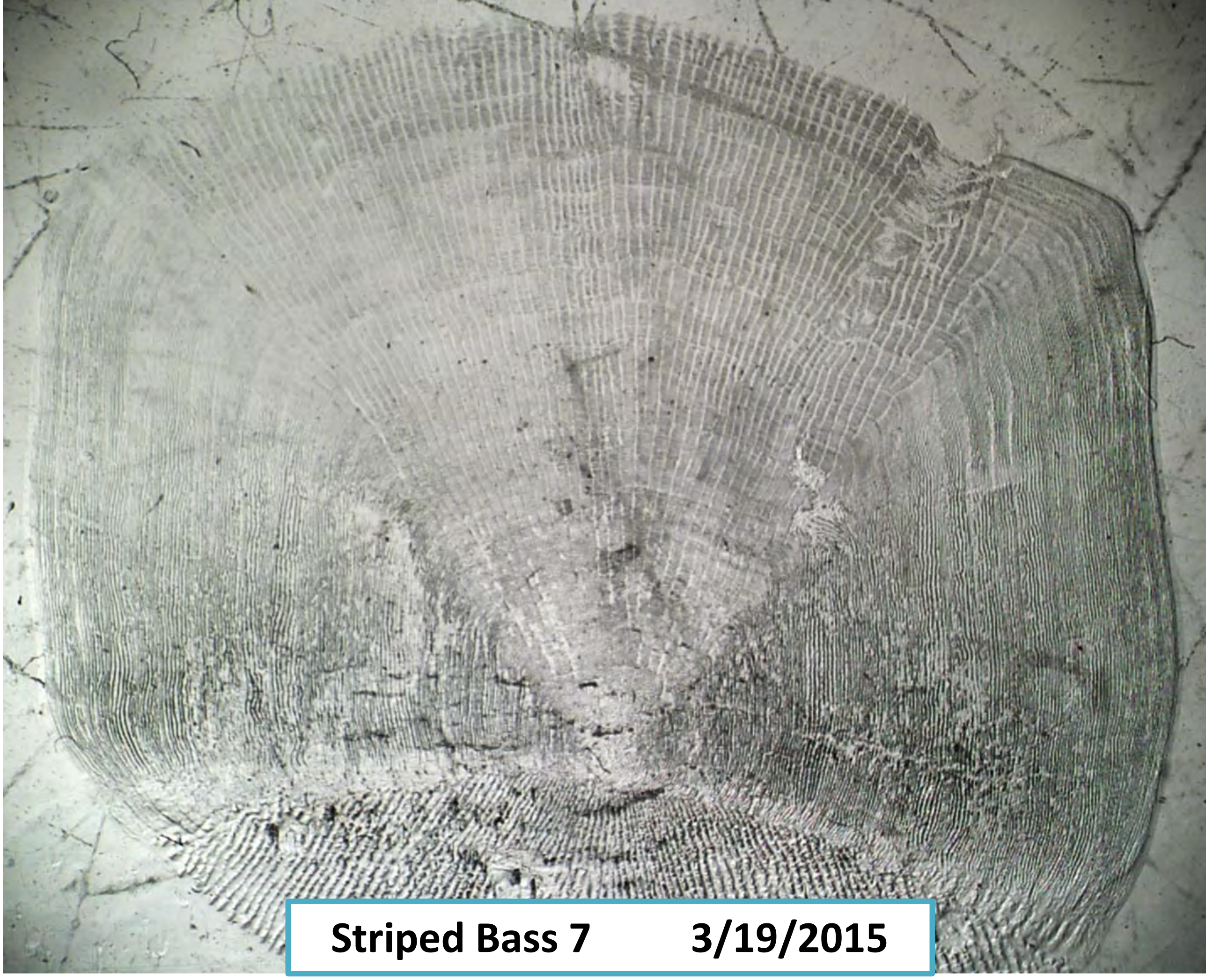
Striped Bass 4 3/28/1996



Striped Bass 5
5/19/2015

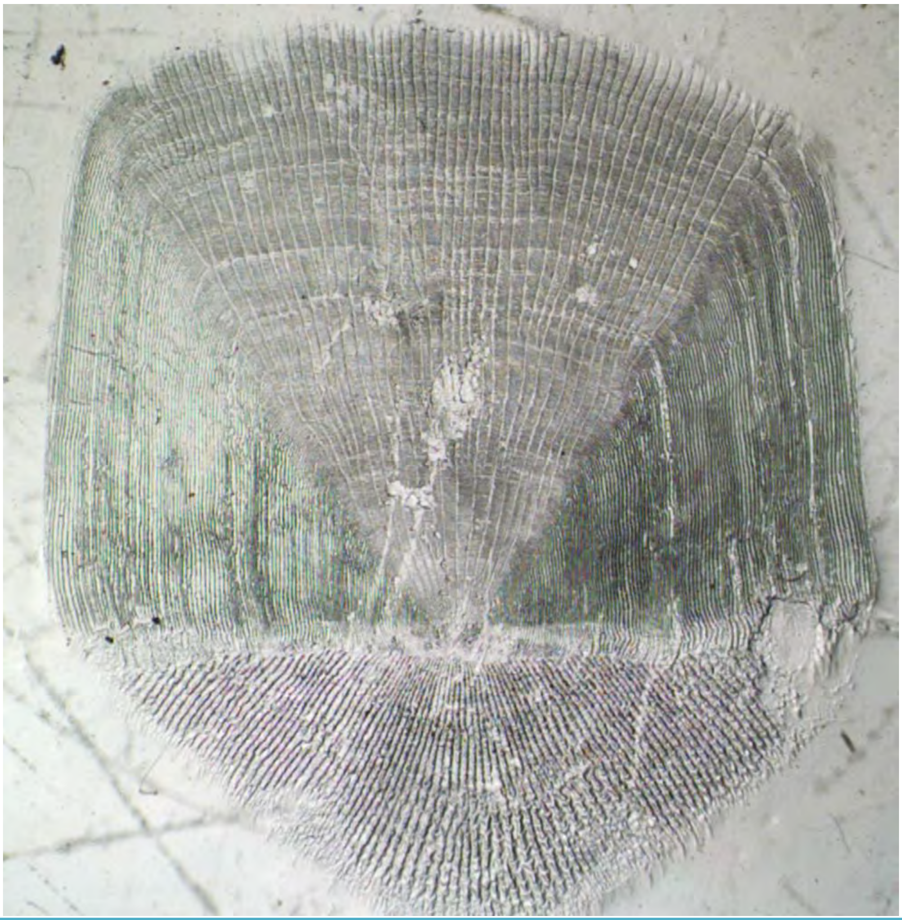


Striped Bass 6
6/20/2012

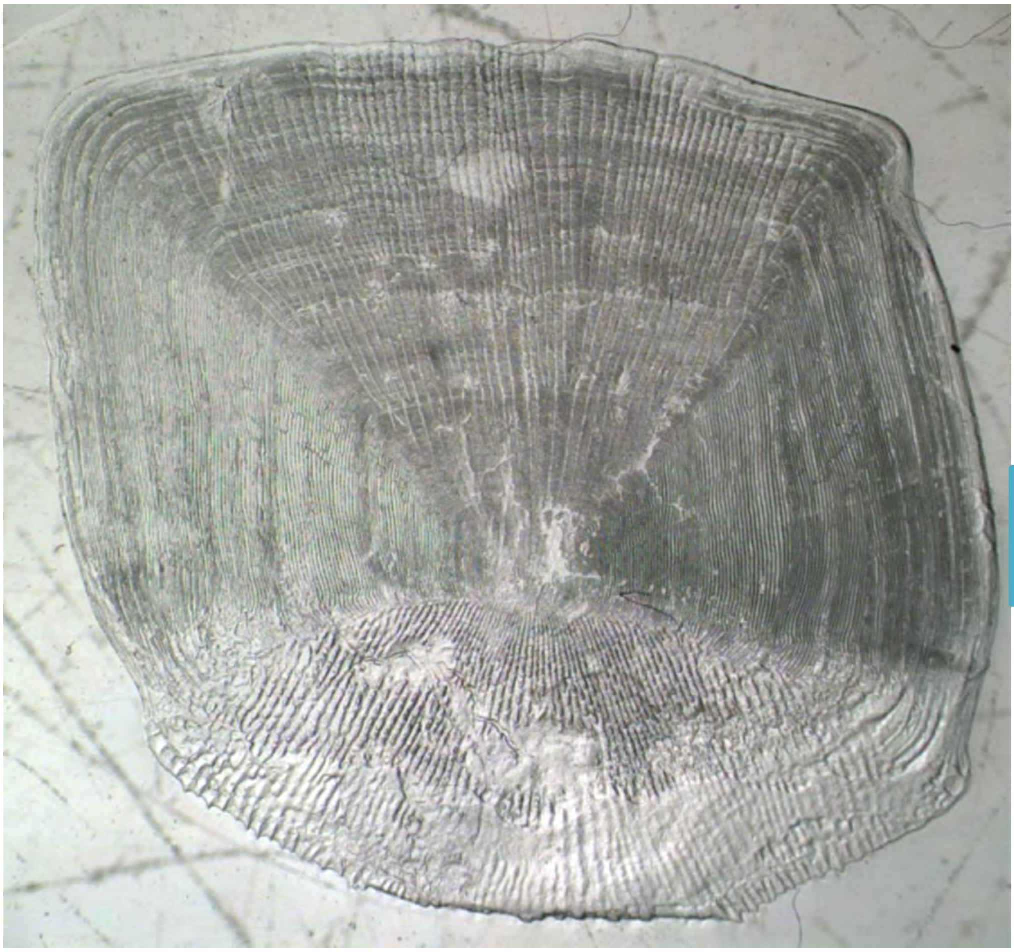


Striped Bass 7 3/19/2015

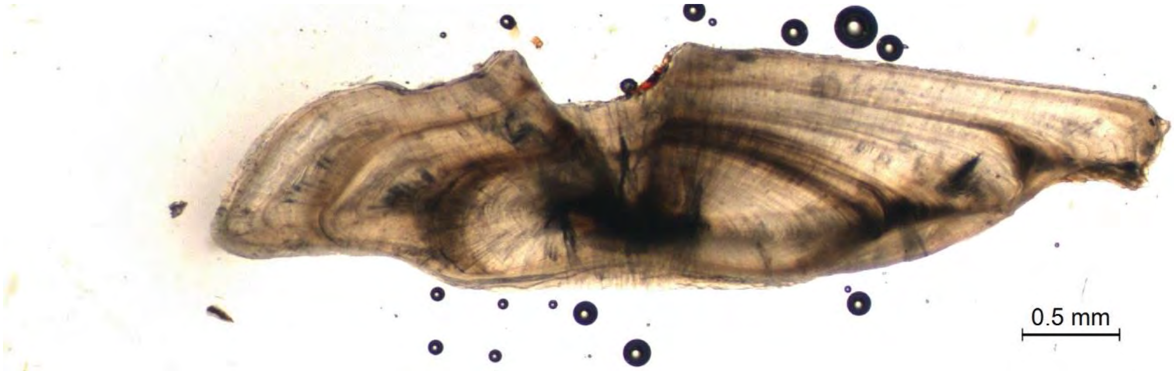
Striped Bass 8 6/22/2010



Striped Bass 9
4/21/2012



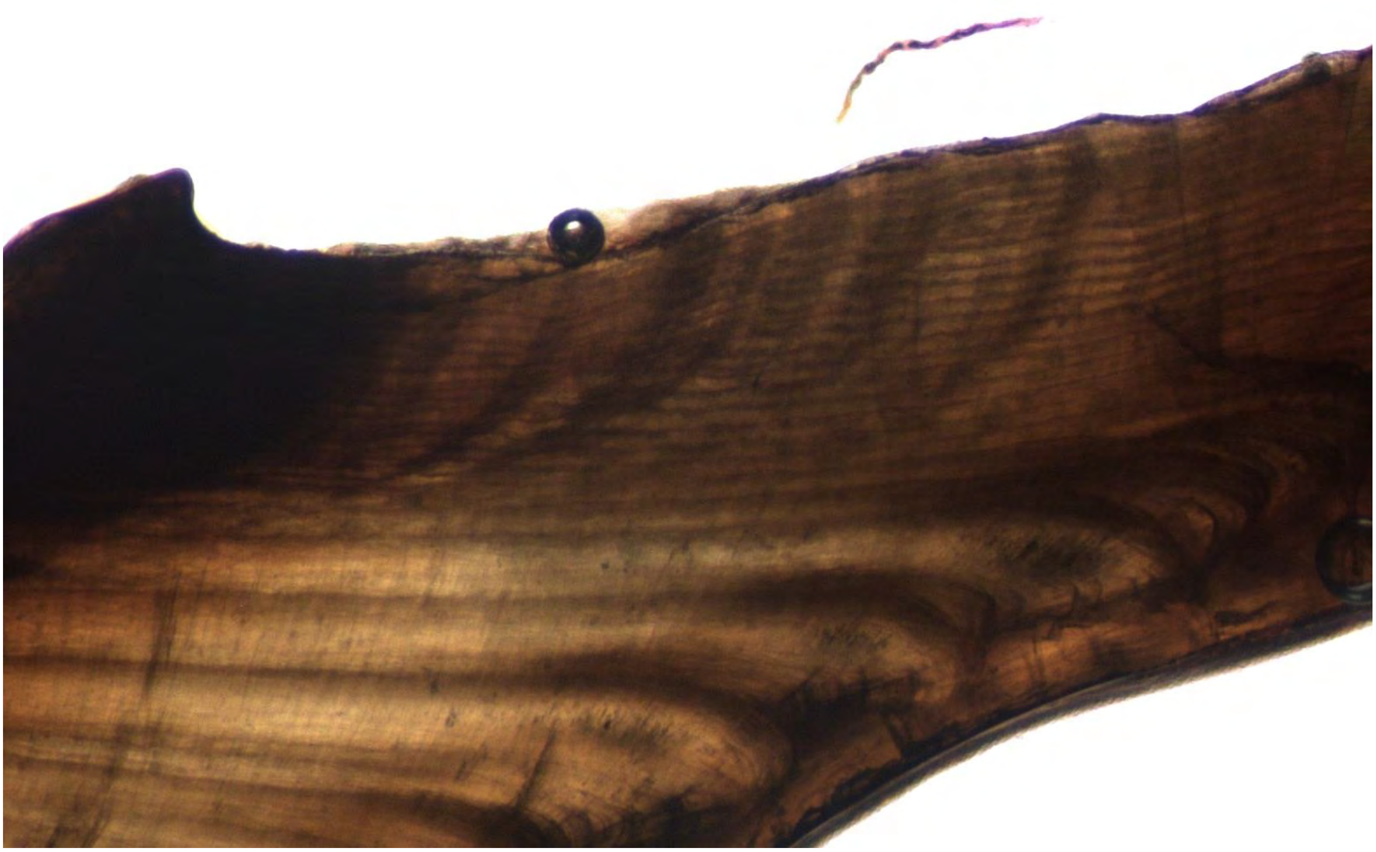
Striped Bass 10
10/15/2015



Striped Bass 11 6/1/2014

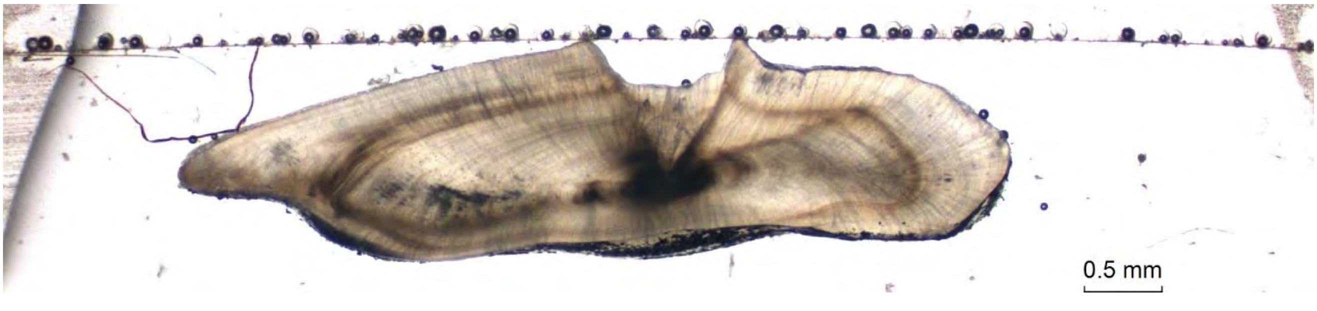
Striped Bass 12 11/13/2014

Striped Bass 13 3/4/2015

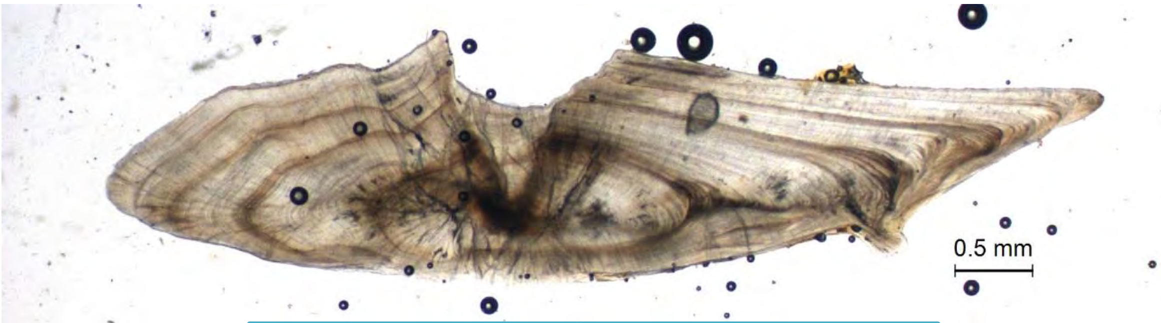


Striped Bass 14 3/9/2015

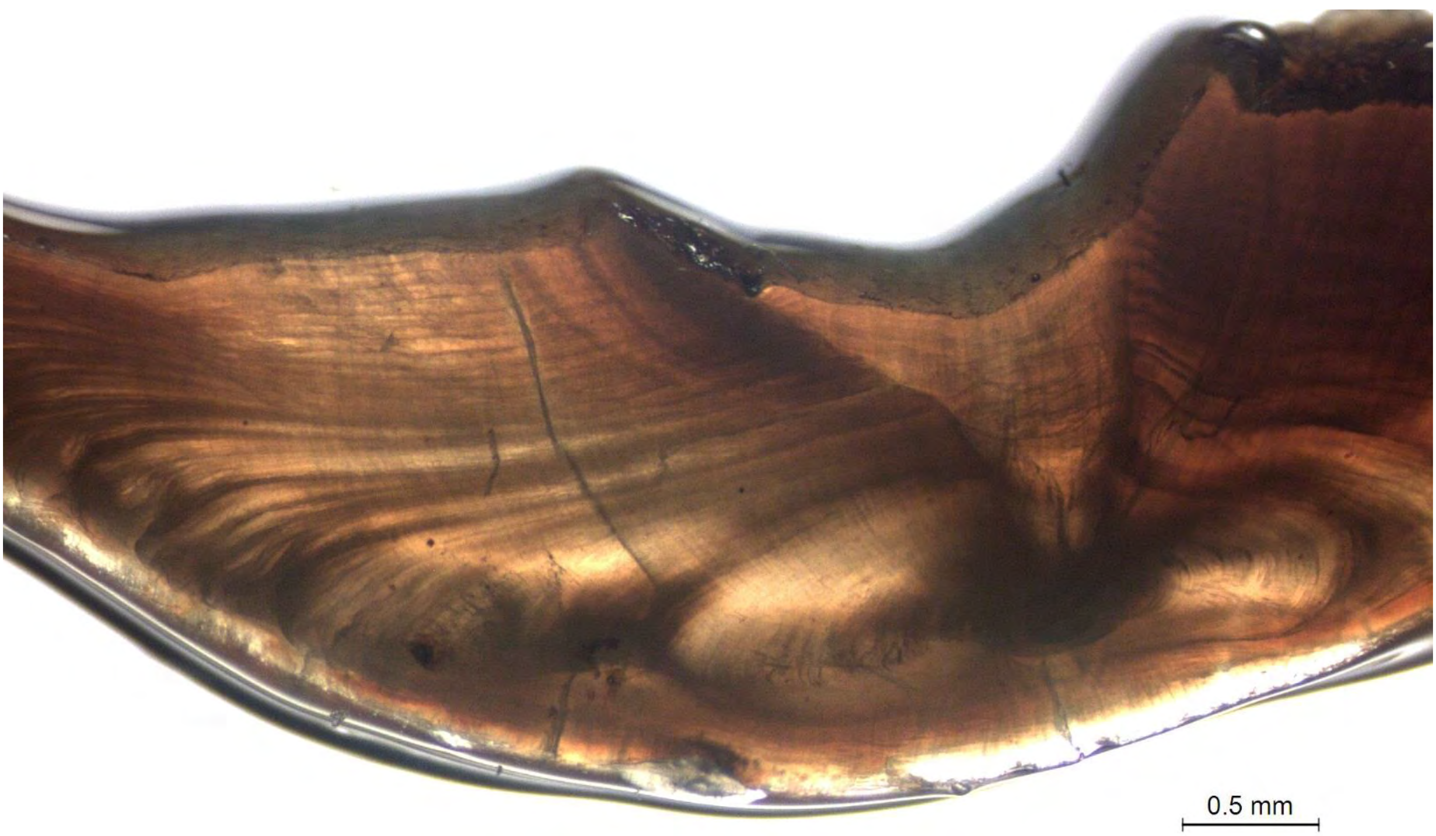
Striped Bass 15 7/3/2014



Striped Bass 16 12/18/2014



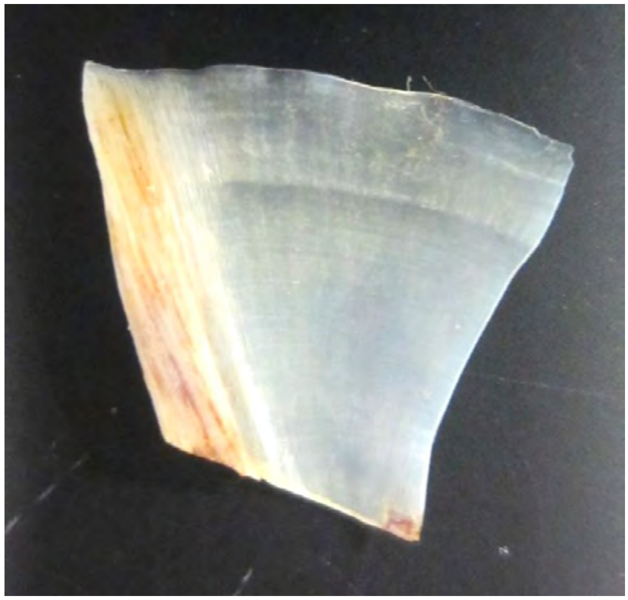
Striped Bass 17 6/1/2014



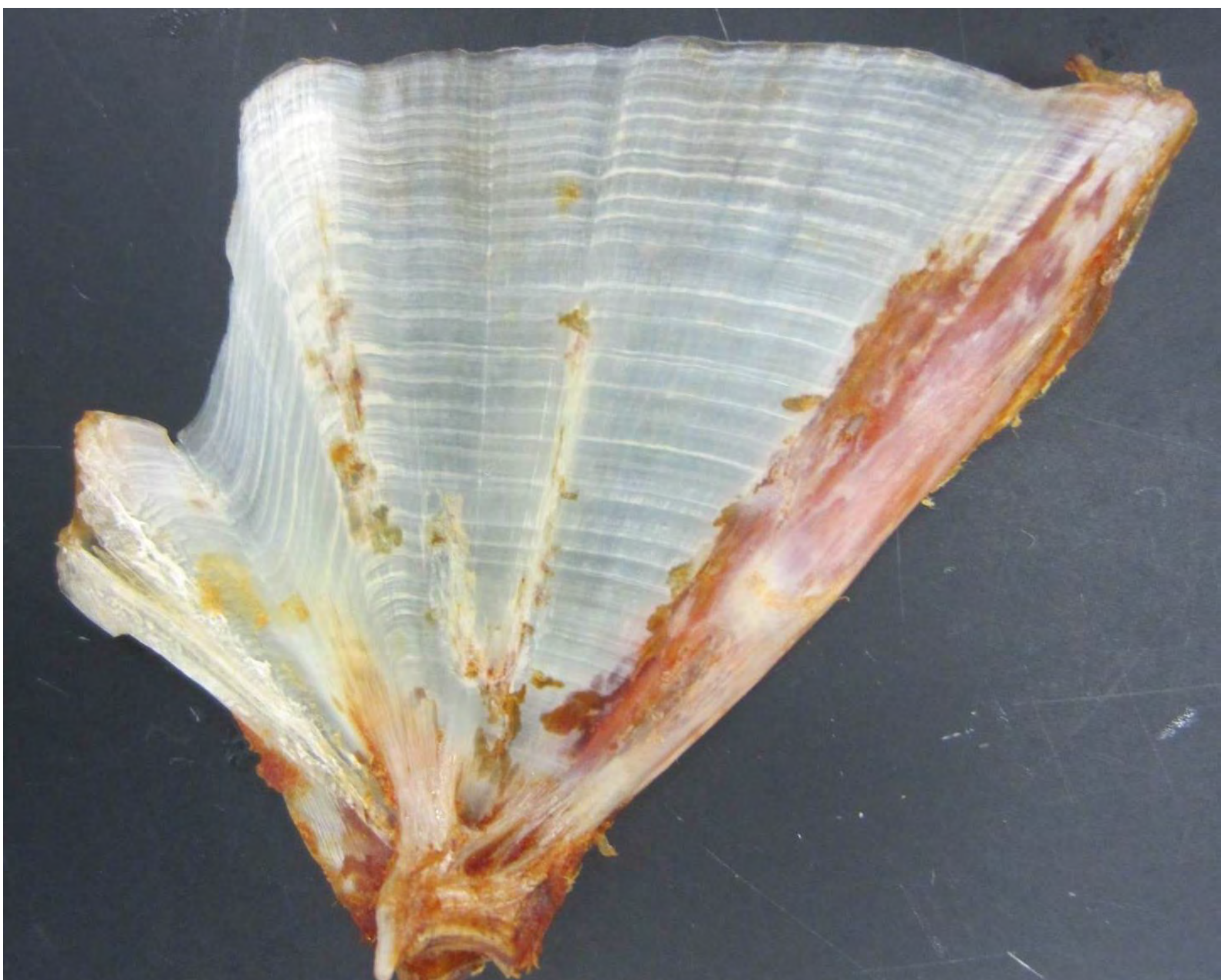
Striped Bass 18 9/7/2014

Striped Bass 19 9/15/2014

Striped Bass 20 4/8/2014



Tautog 1 10/6/2011



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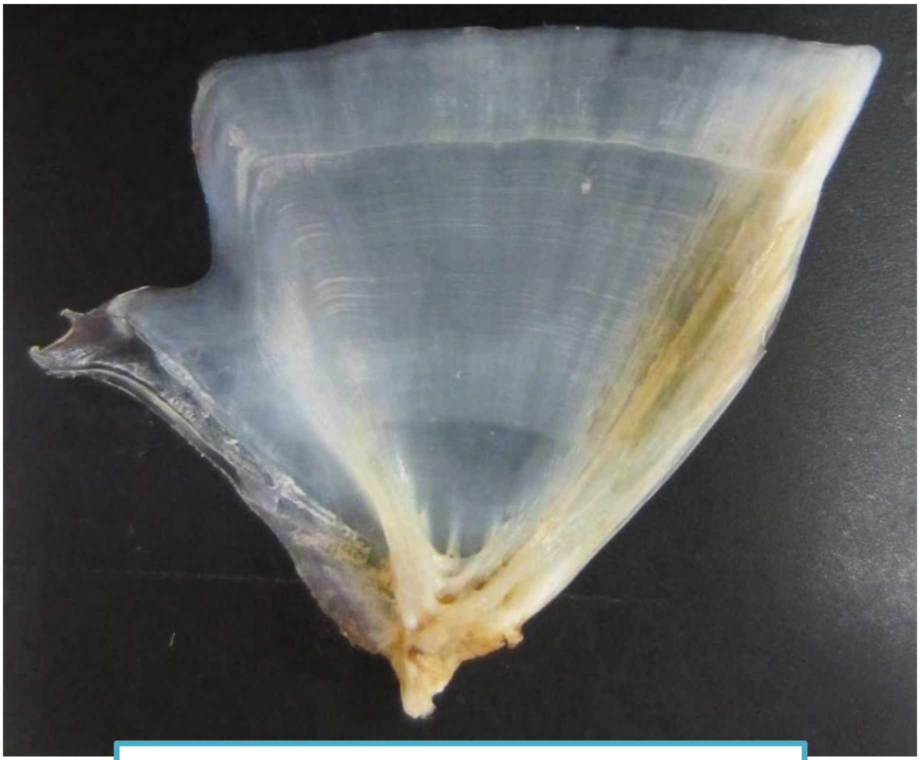
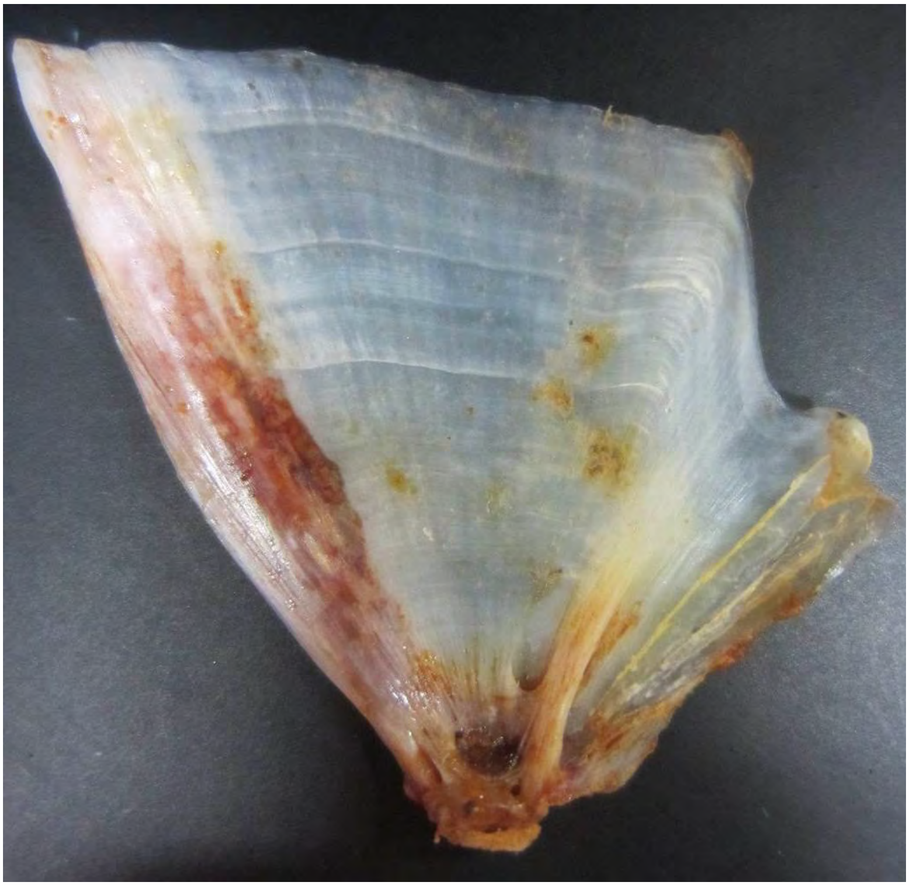
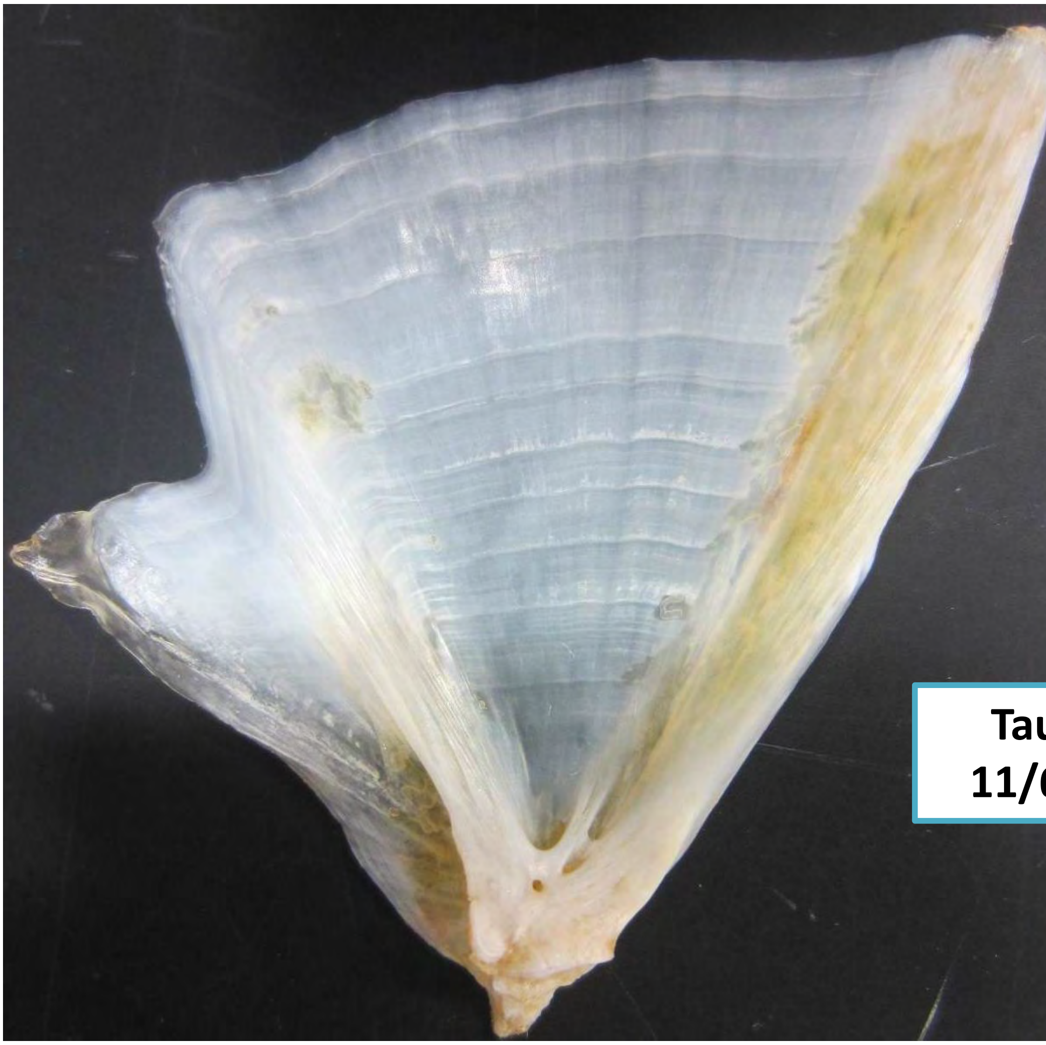


Tautog 3 9/8/2015



Tautog 4 10/6/2011



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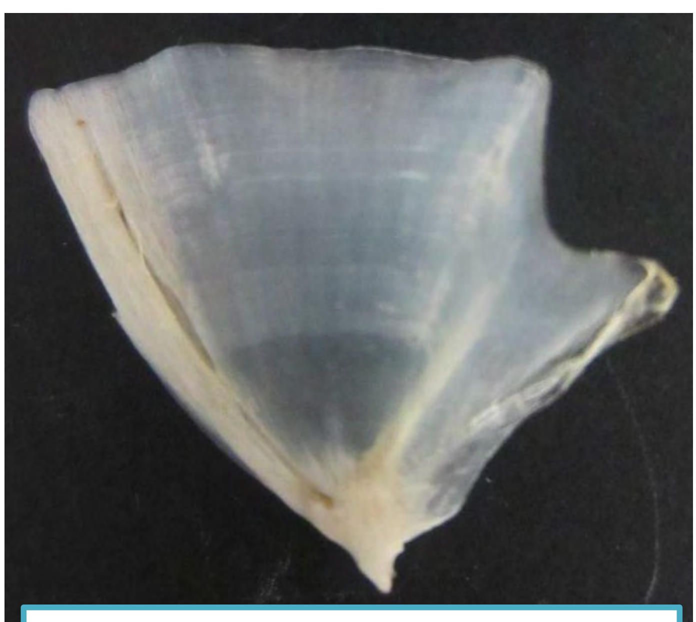
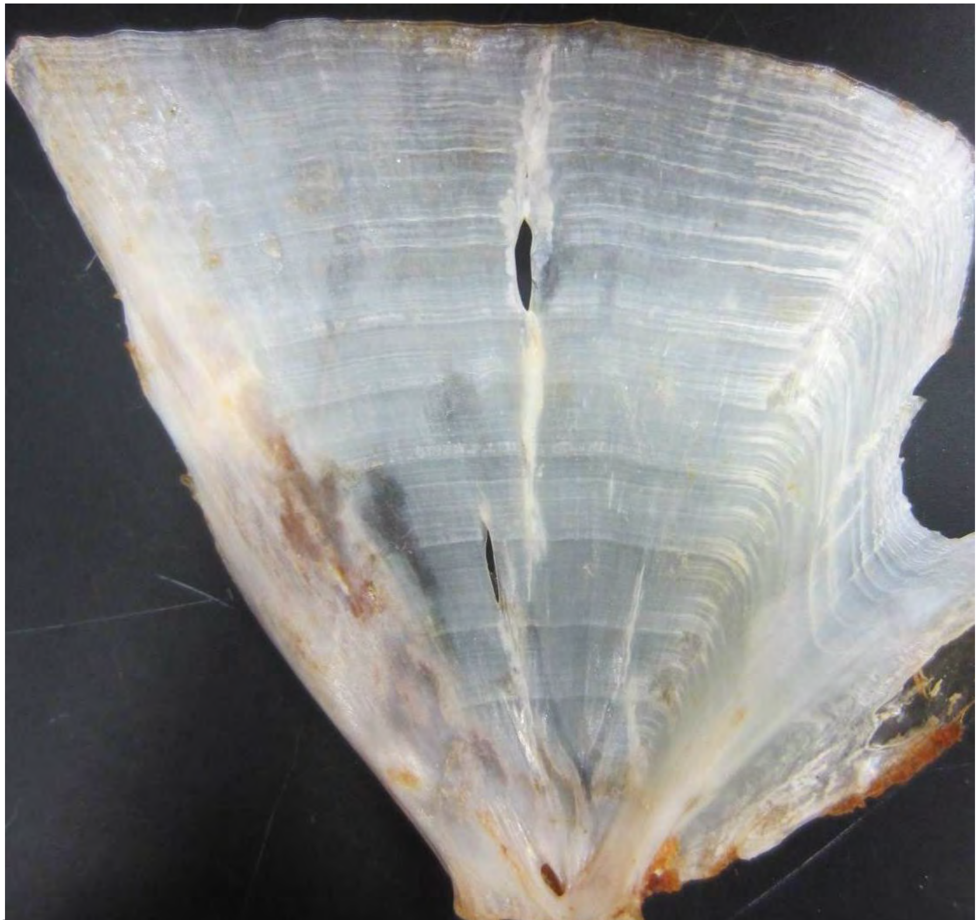
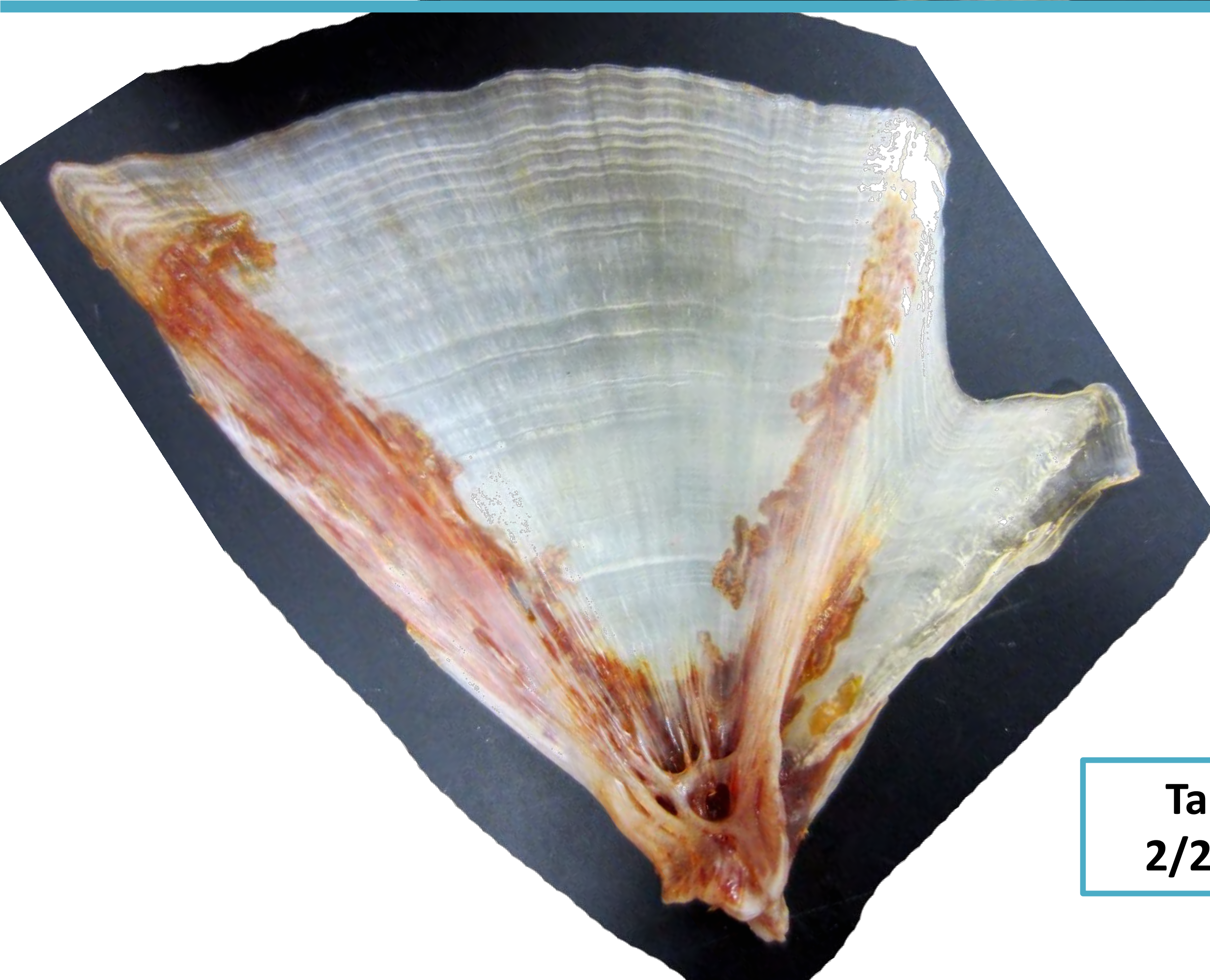
11/6/2015



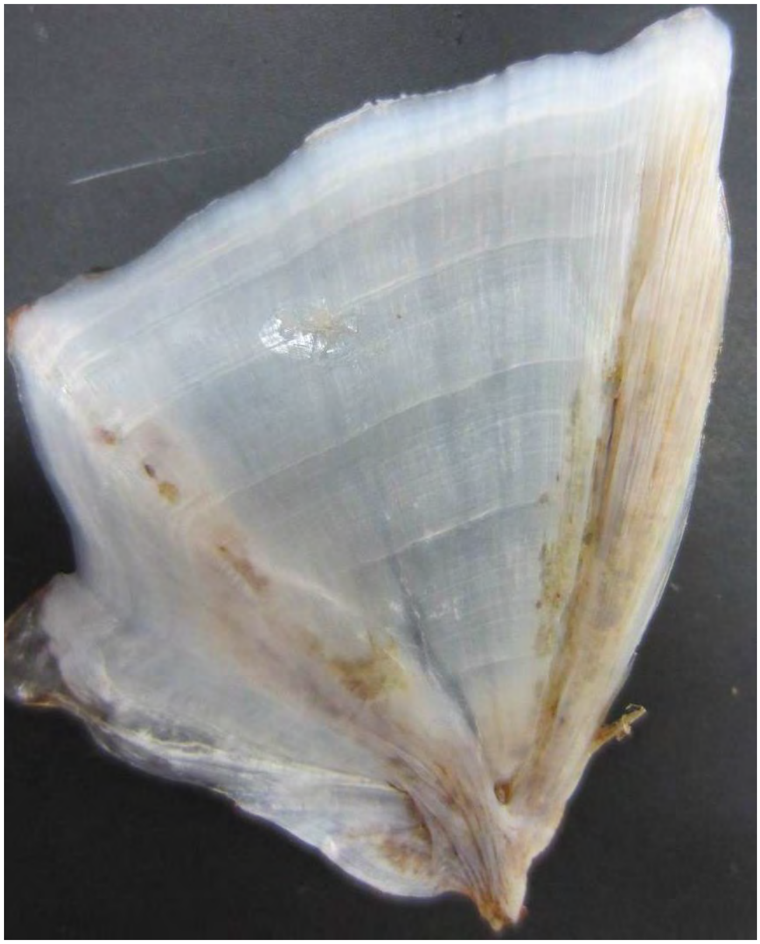
Tautog 6 9/8/2015

Tautog 7
10/6/2011

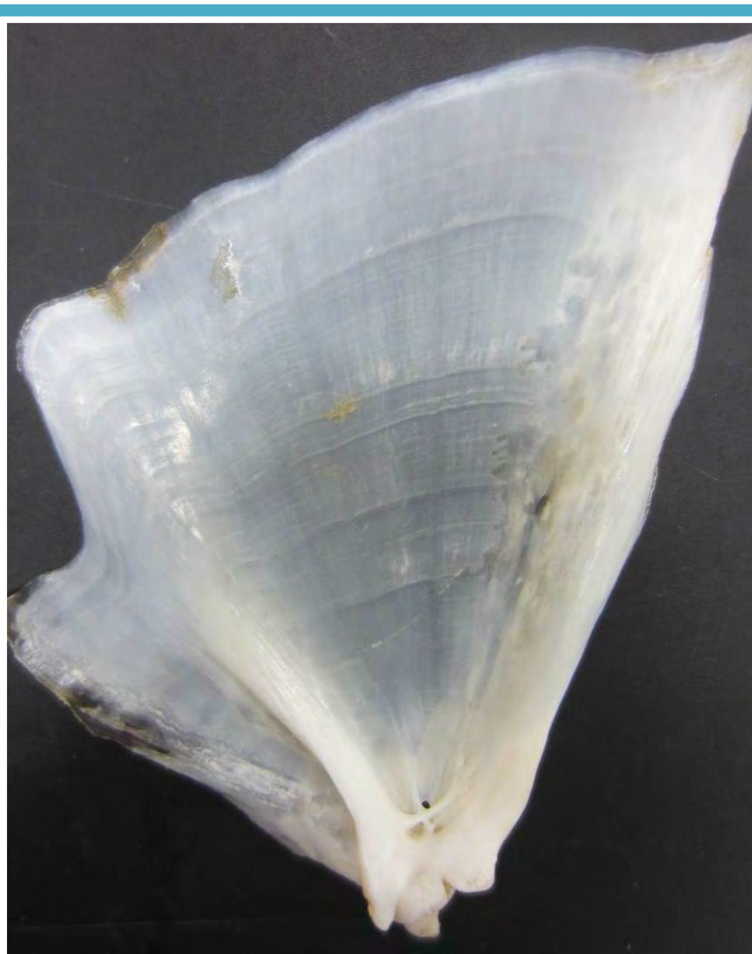




Tautog 8
2/20/2014



Tautog 9
5/19/2015



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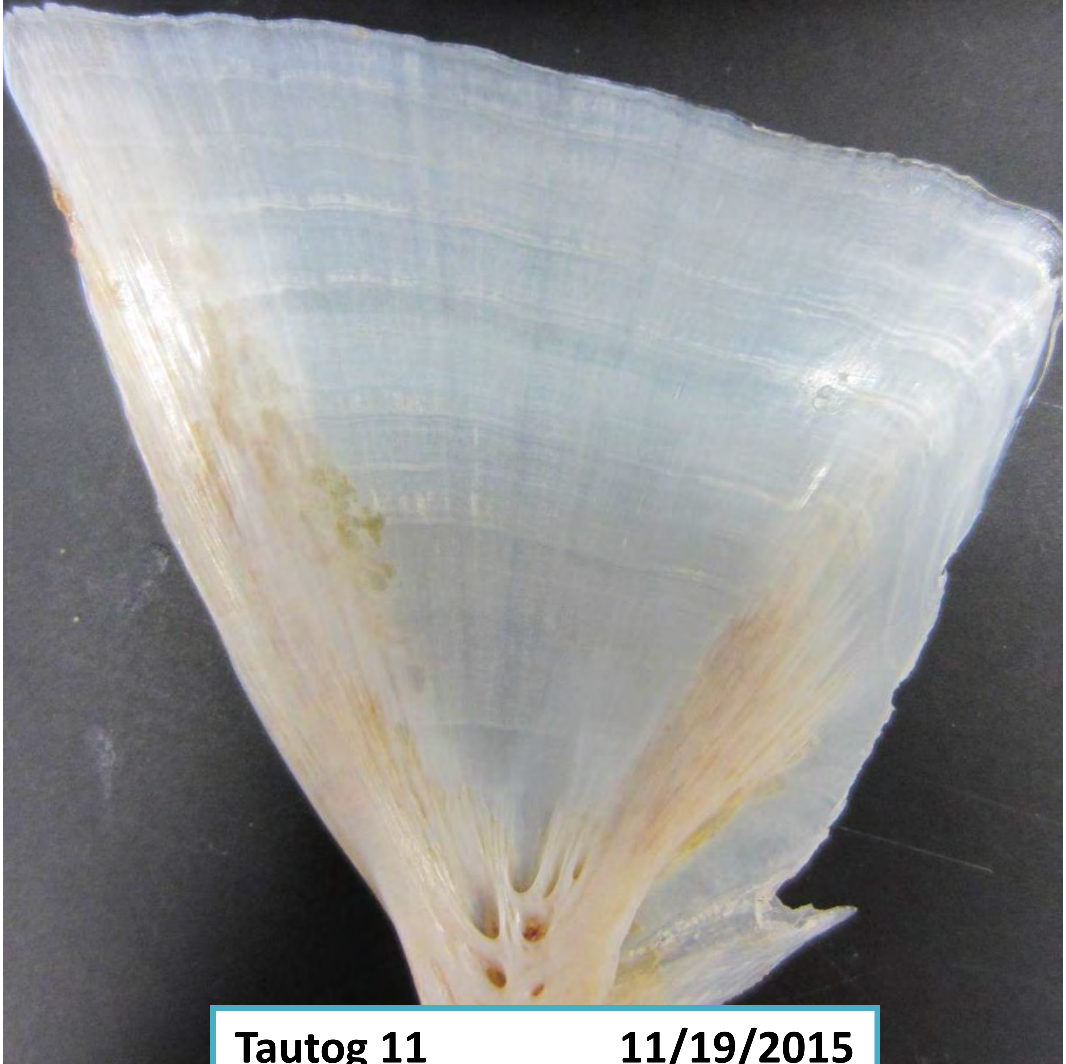
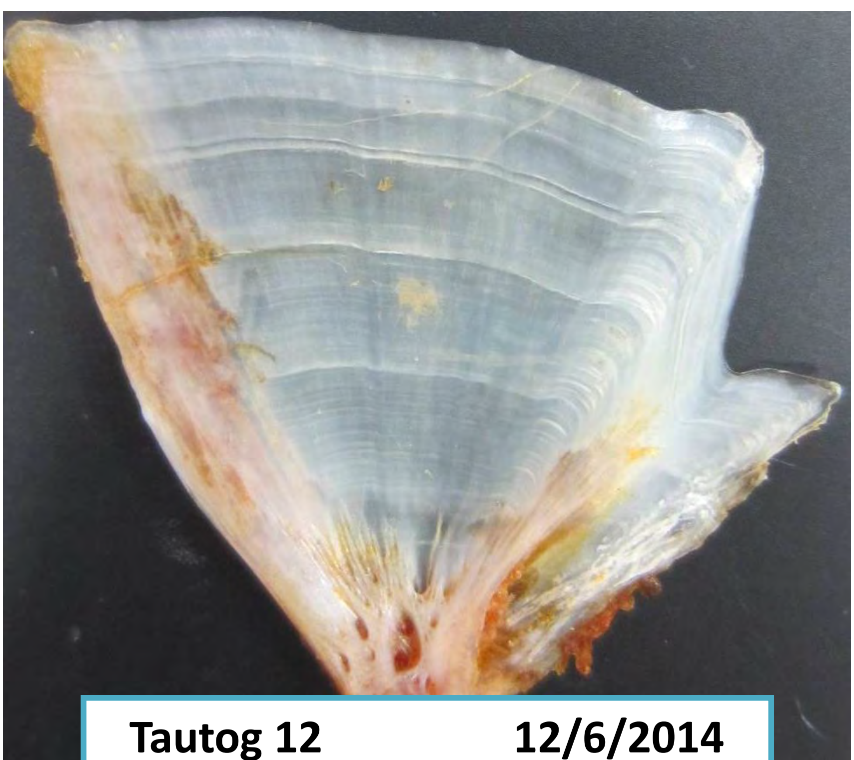
6/14/2015



Tautog 11 11/19/2015



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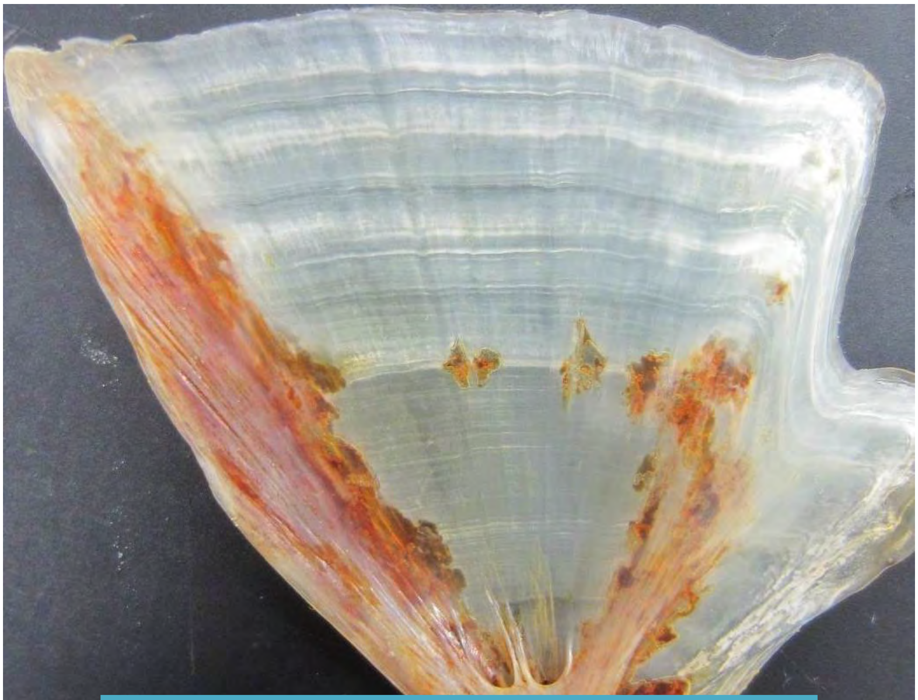

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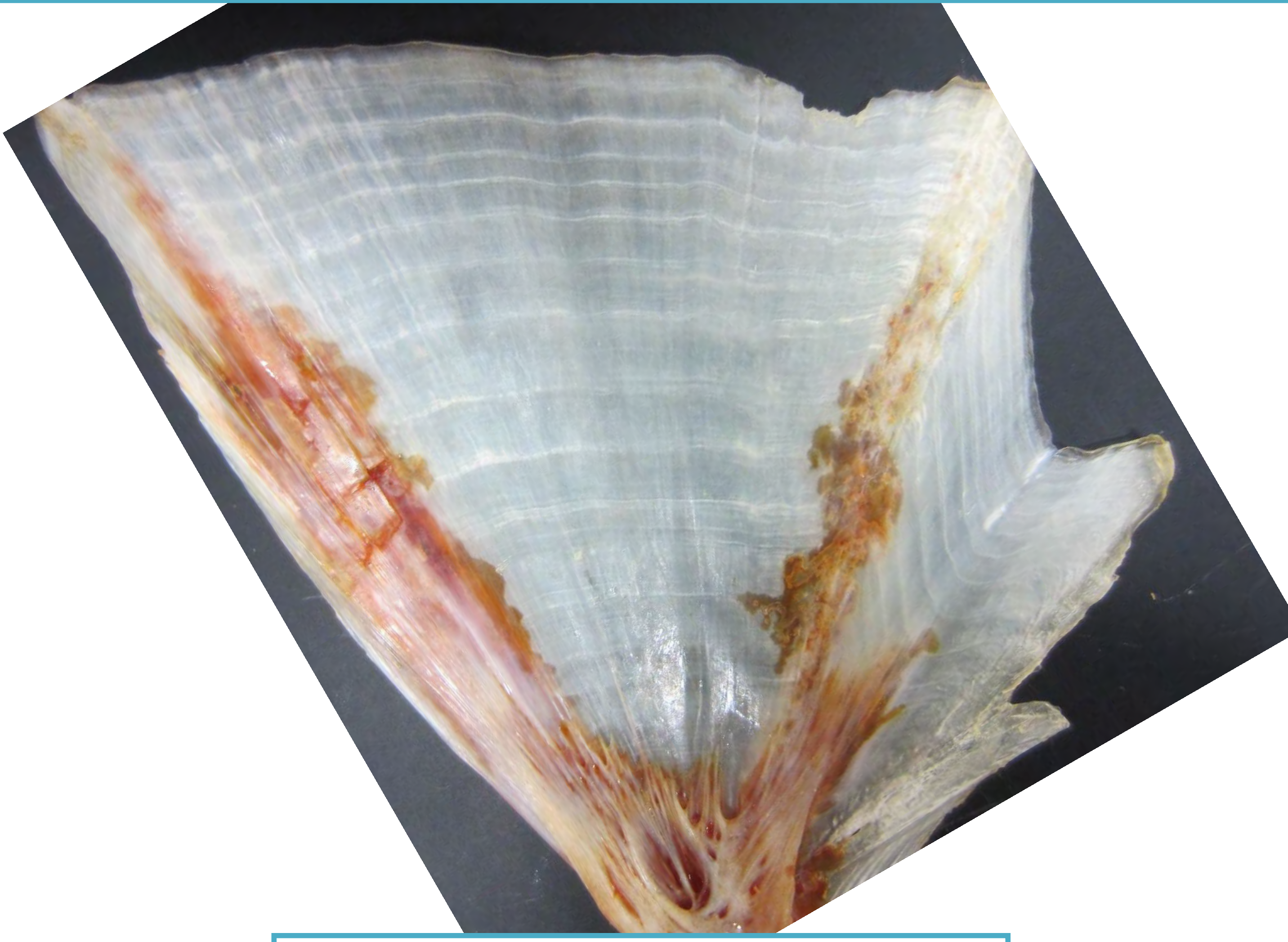

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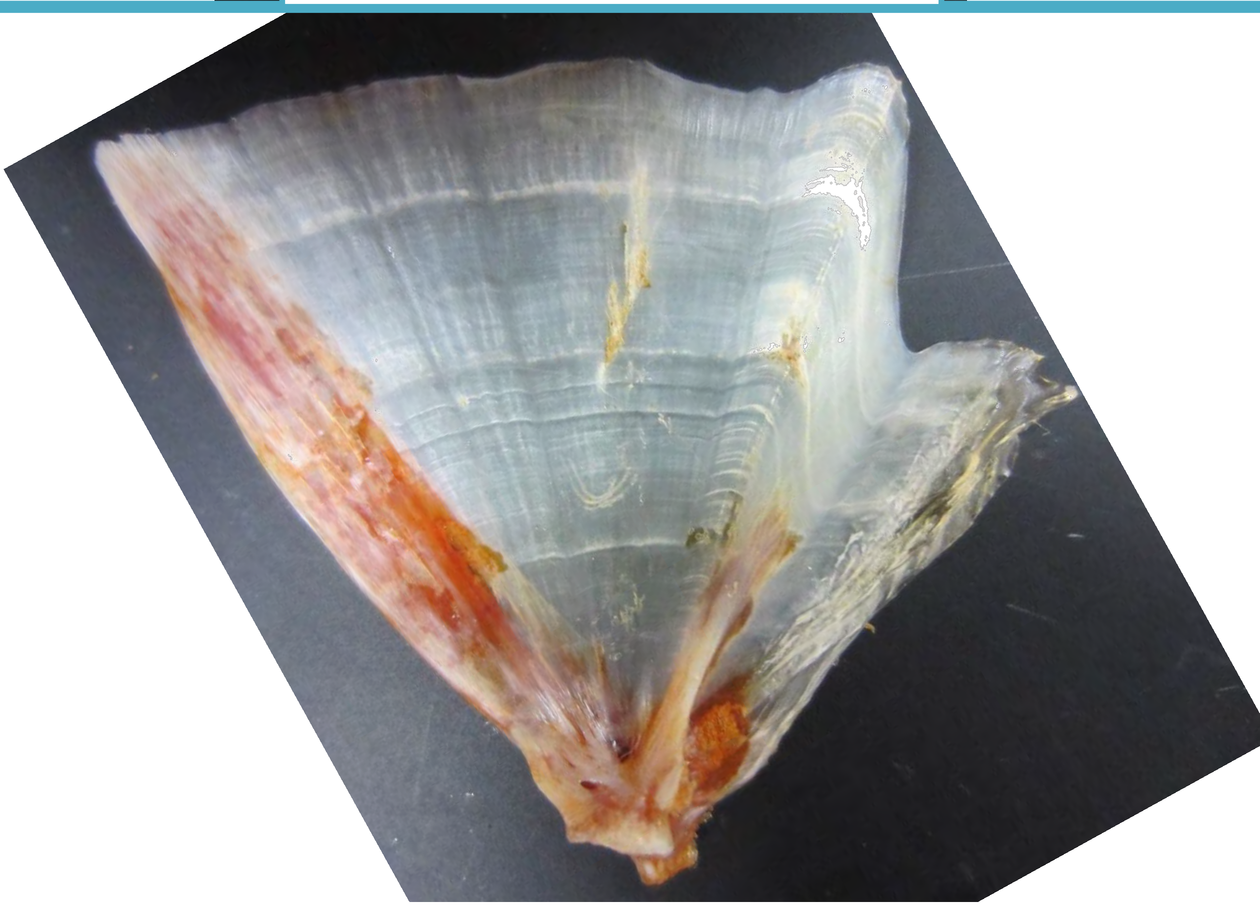
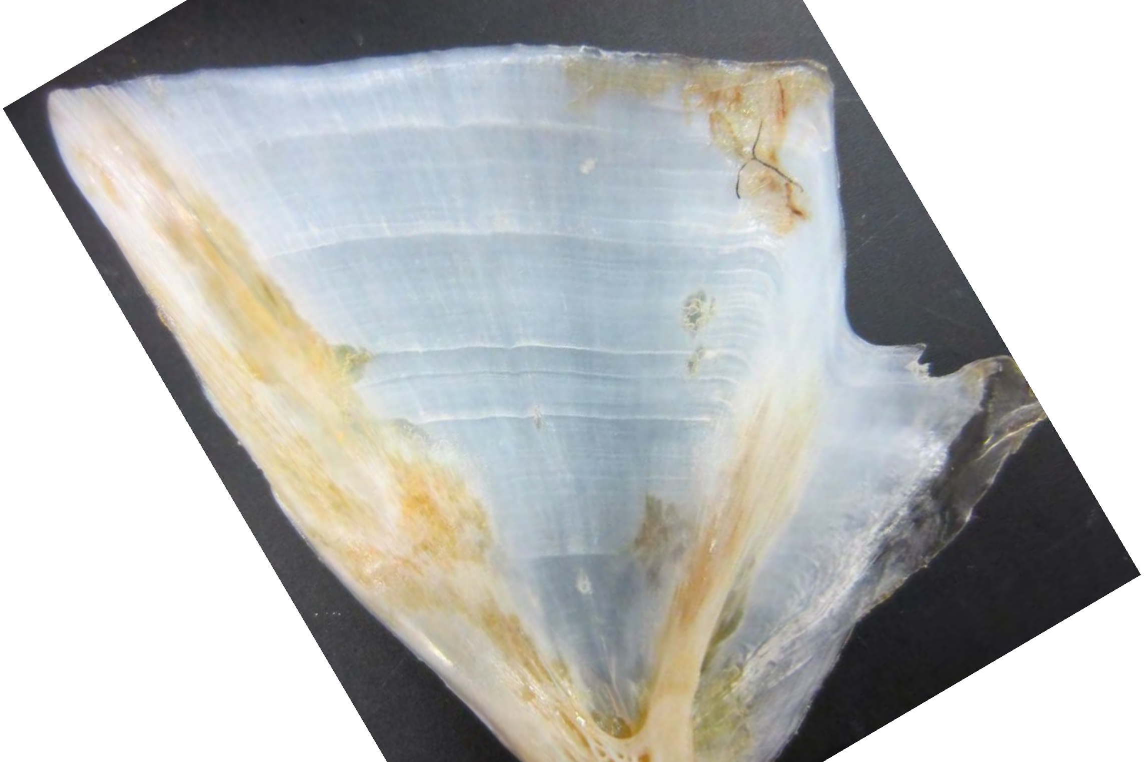
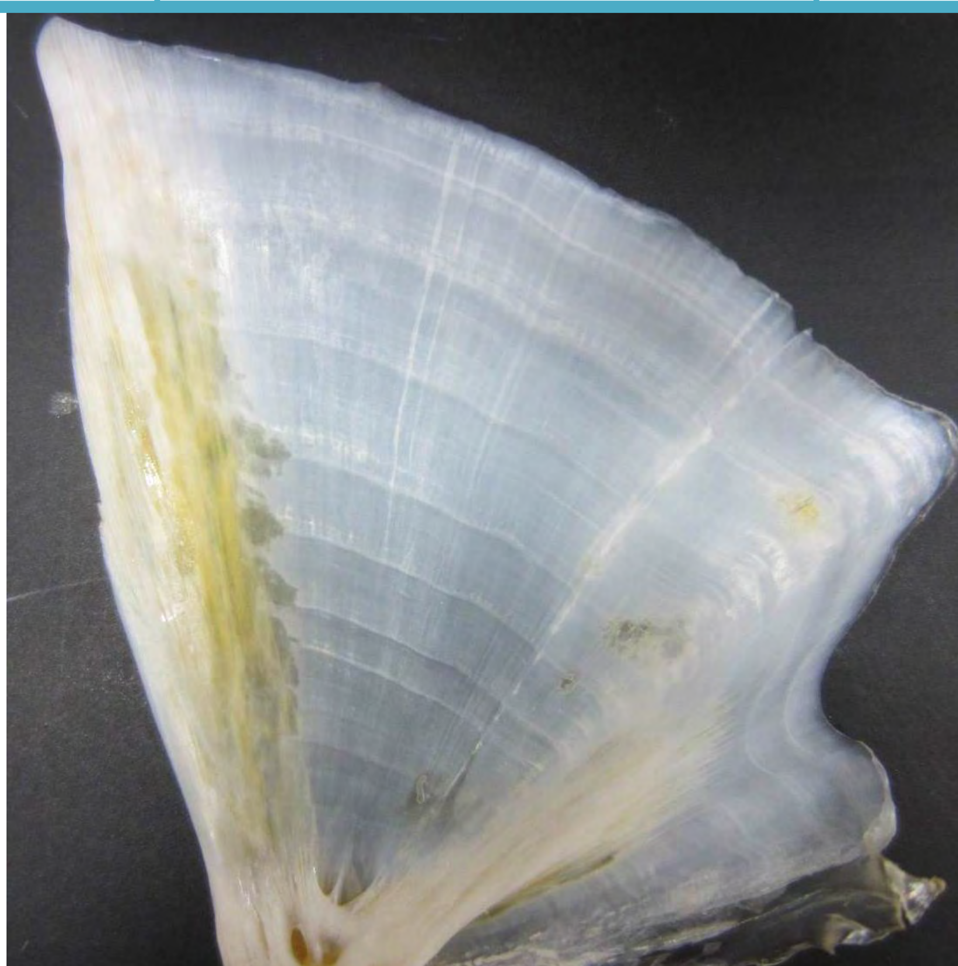
Tautog 15 12/16/2014



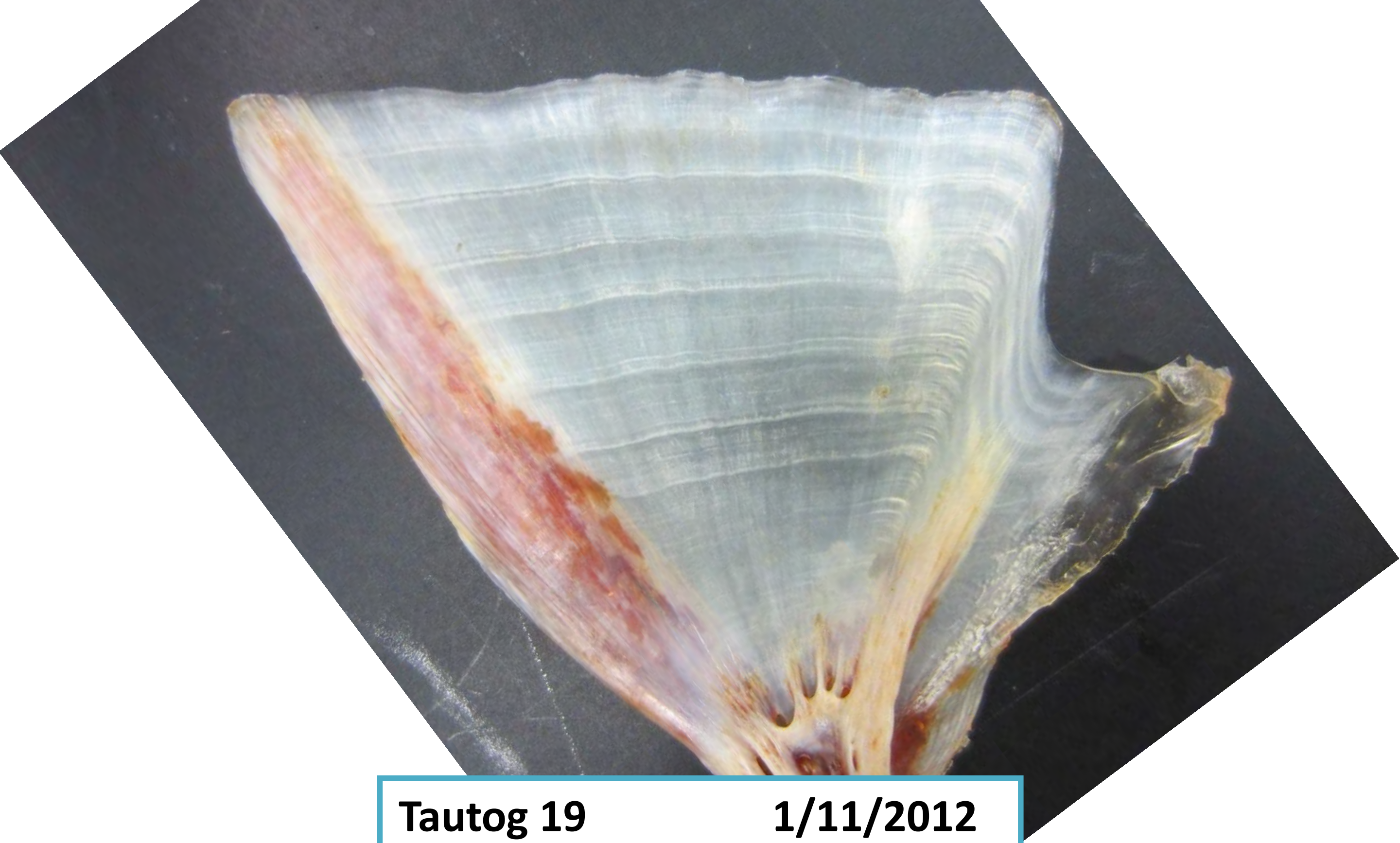
Tautog 16 11/22/2014



Tautog 17 10/31/2015

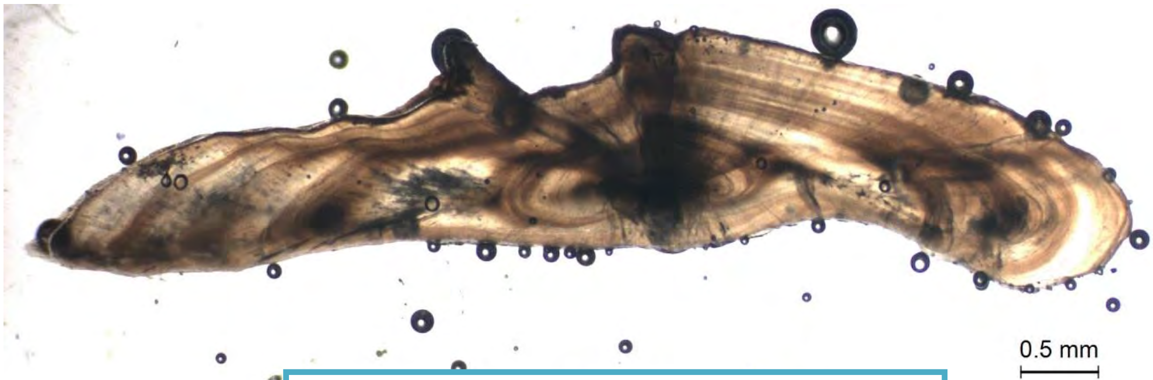


Tautog 18 11/6/2015

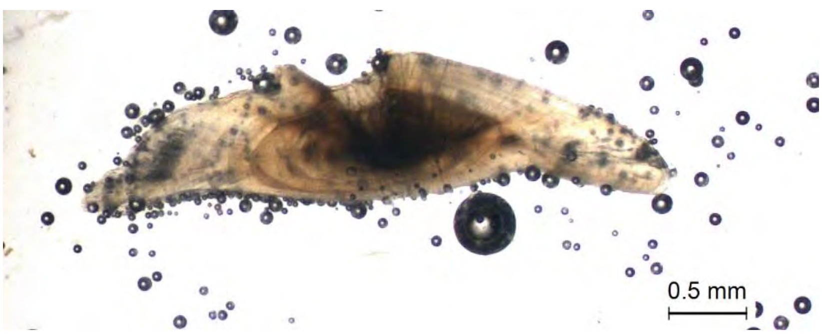


Tautog 19 1/11/2012

Tautog 20 1/10/2012



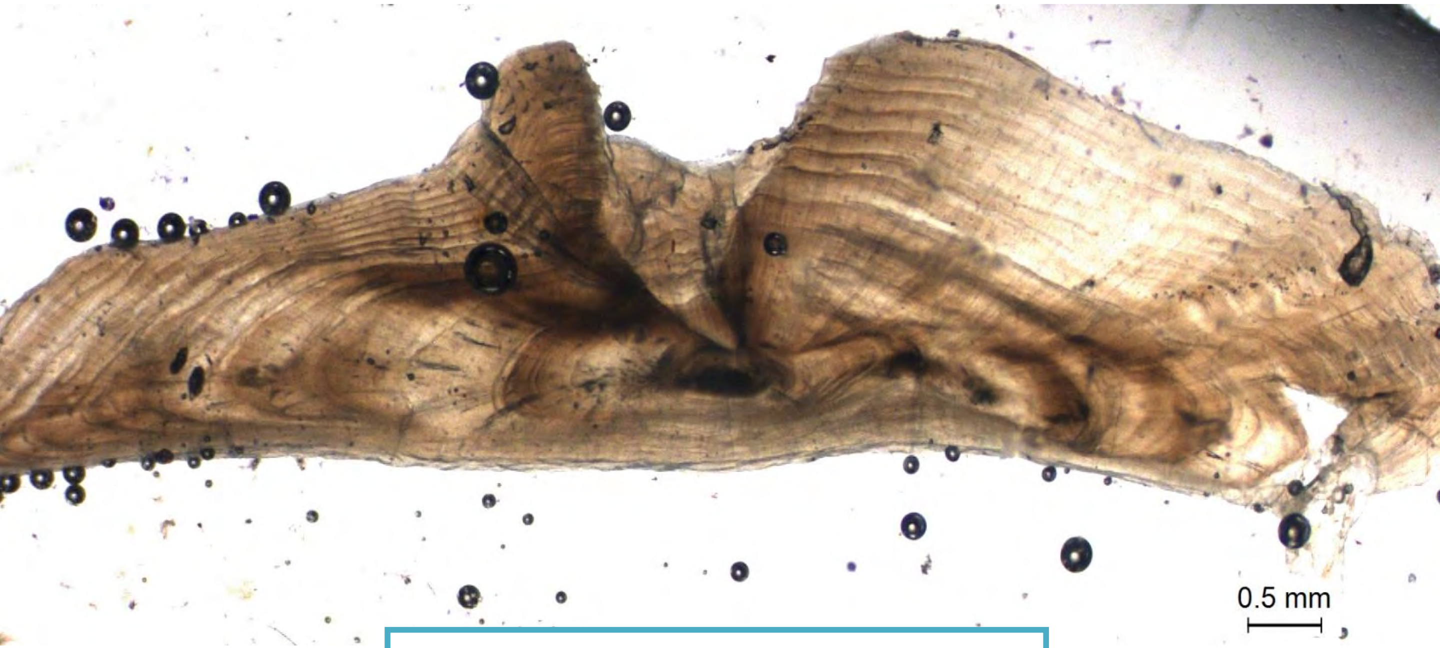
BSB 1 5/8/2009



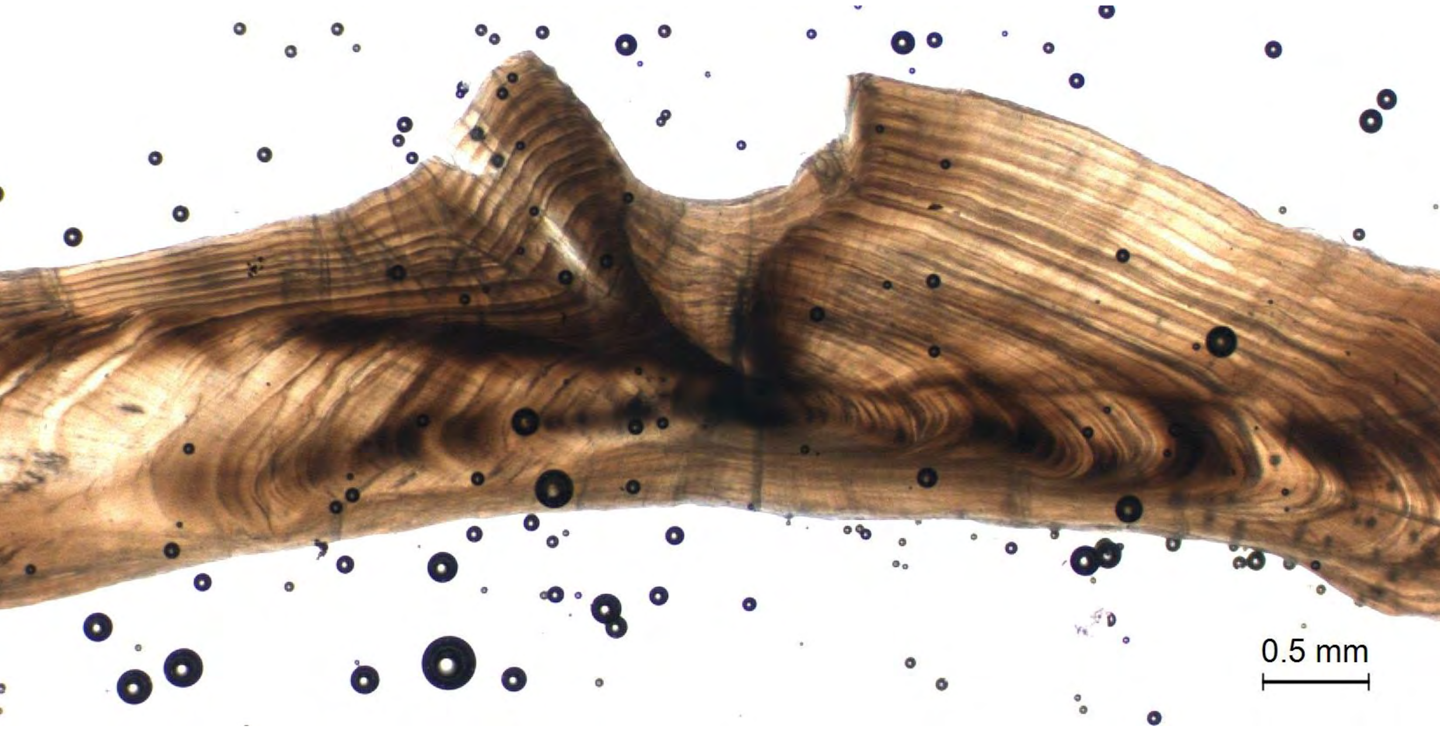
BSB 2 10/21/2015

BSB 3 10/4/2007

BSB 4 5/15/2008

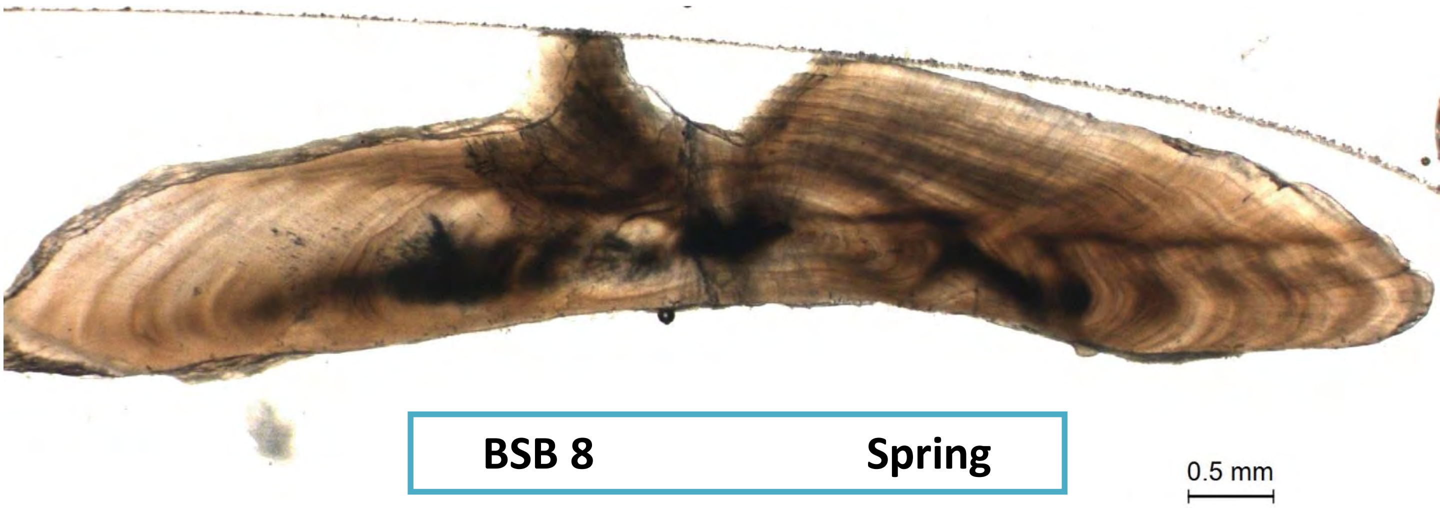


BSB 5 9/23/2010



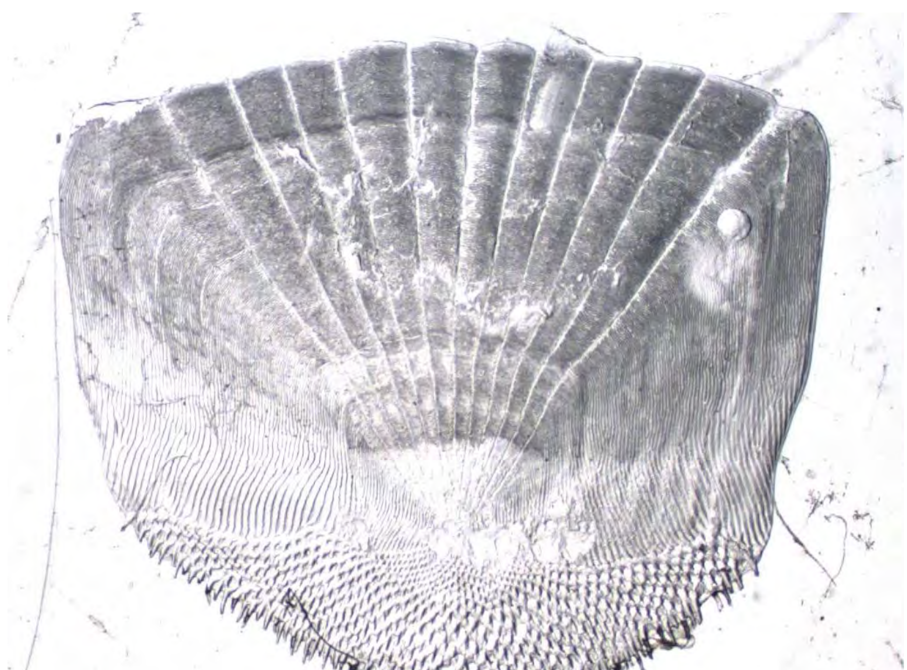
BSB 6 **5/11/2008**

BSB 7 **Spring**

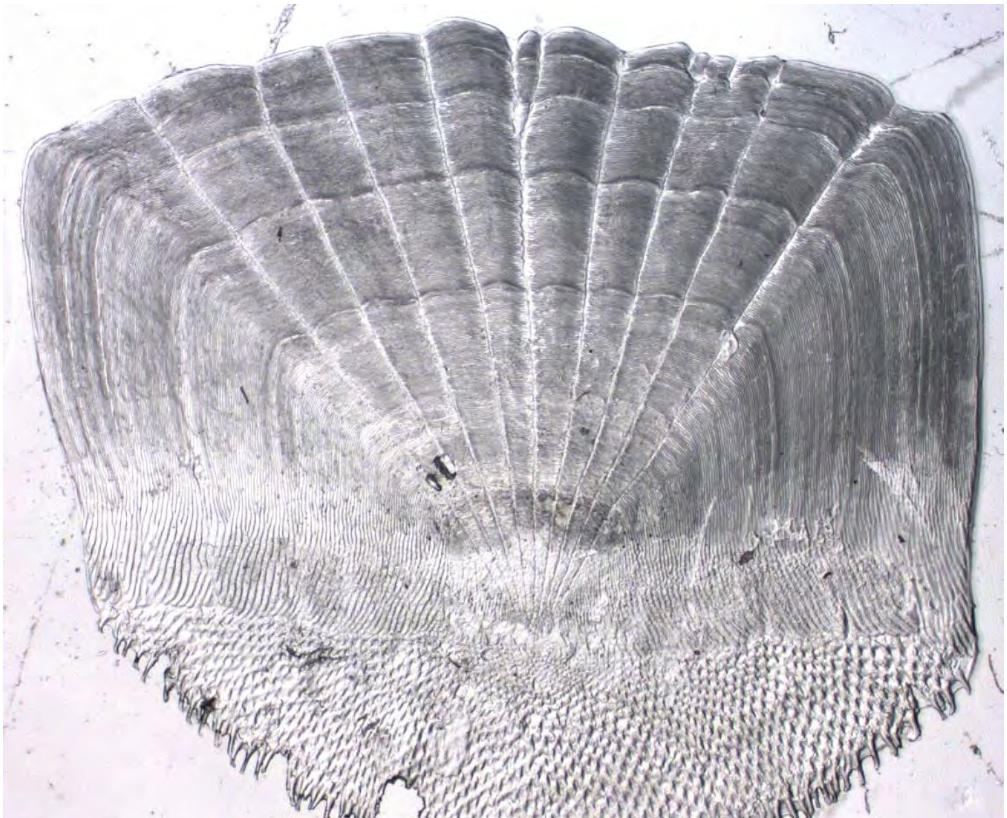


BSB 8 Spring

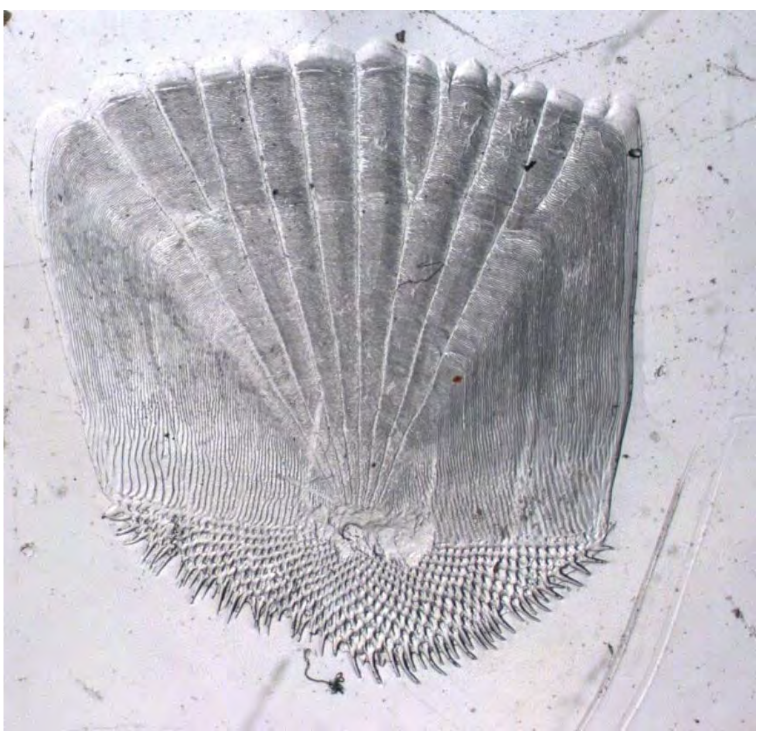
BSB 9 Spring



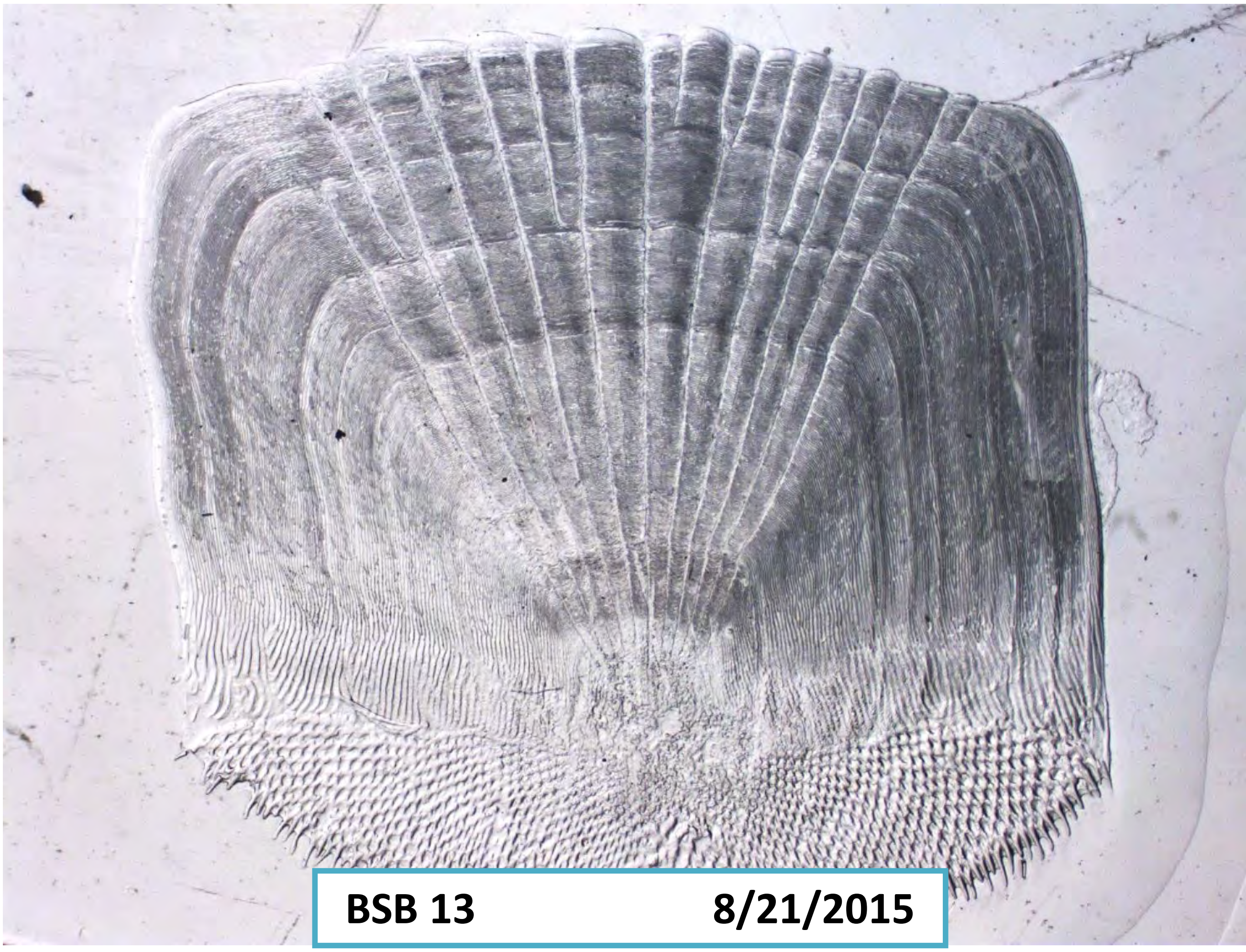
BSB 10 5/29/2015



BSB 11 5/22/2014



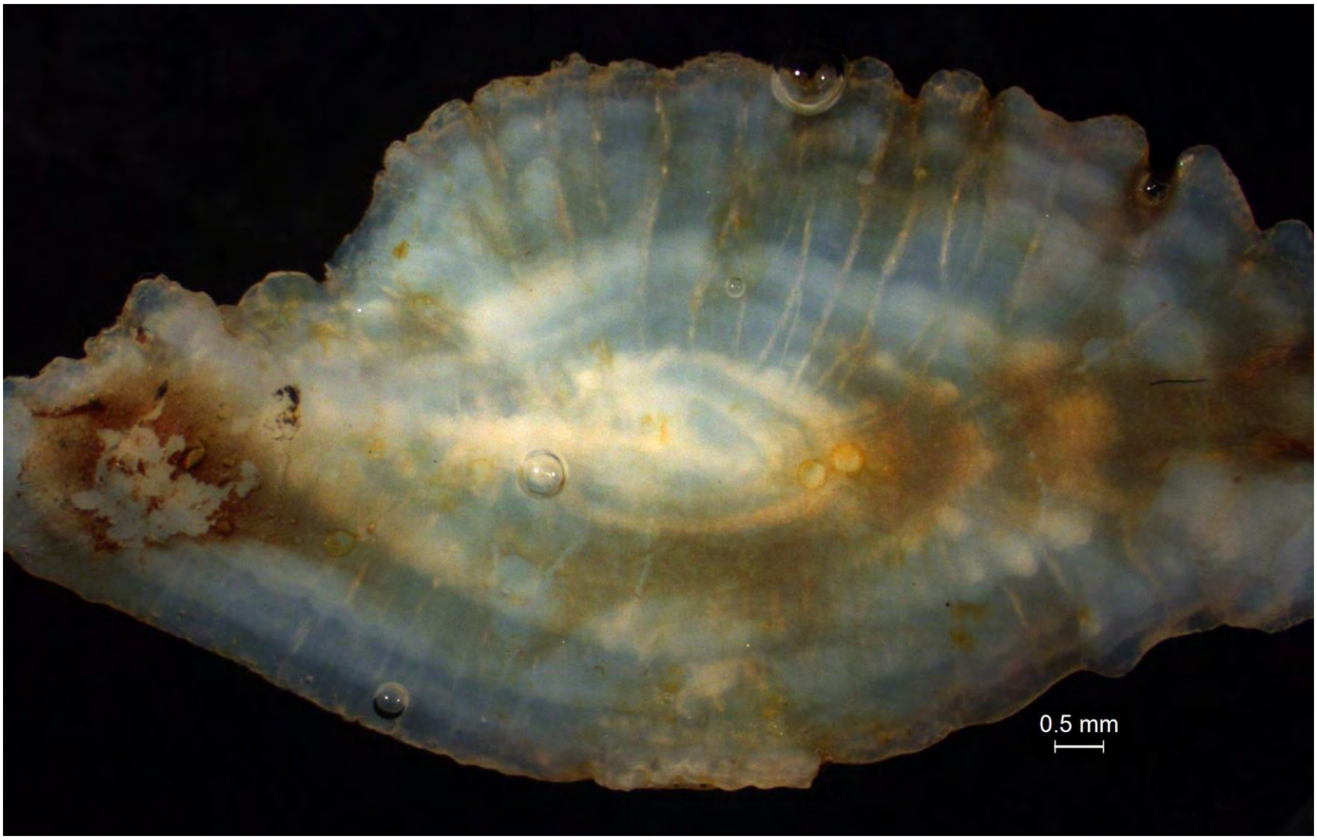
BSB 12 8/14/2015



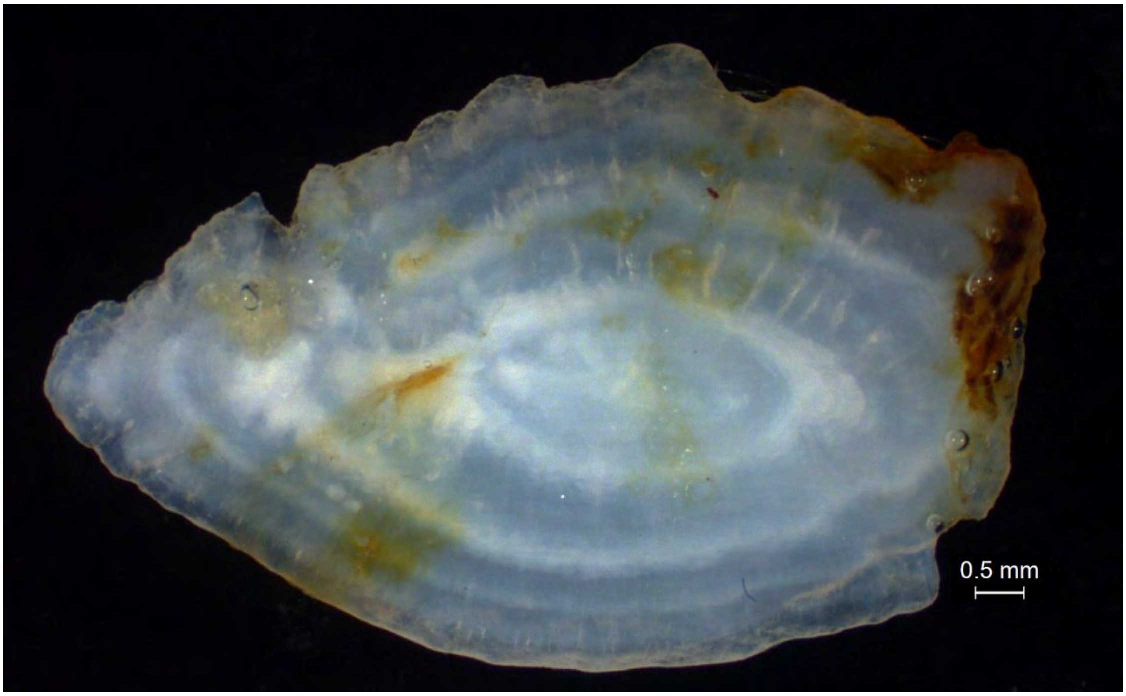
BSB 13 **8/21/2015**

BSB 14 **3/15/2013**

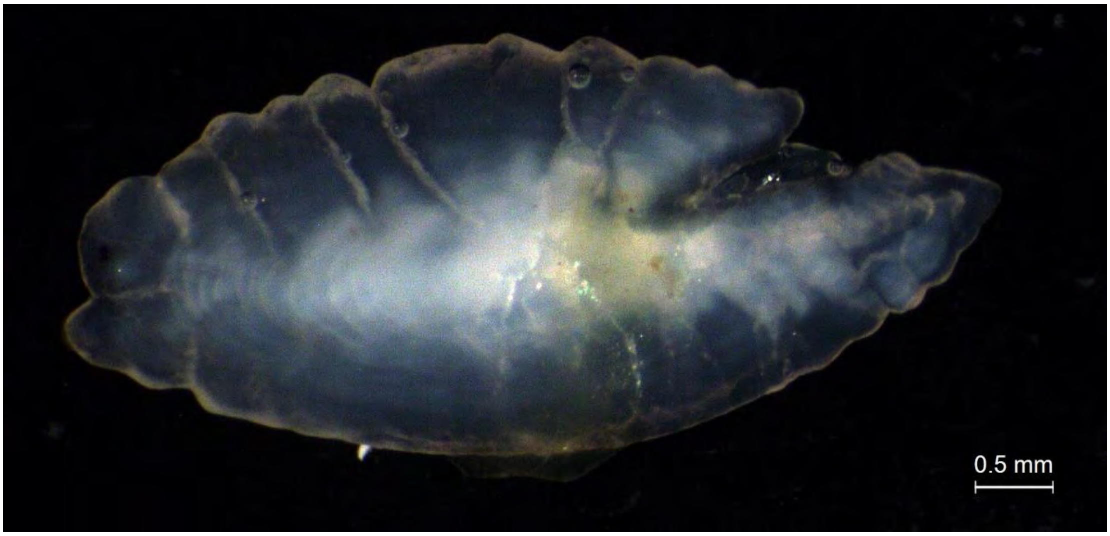
BSB 15 **3/18/2013**



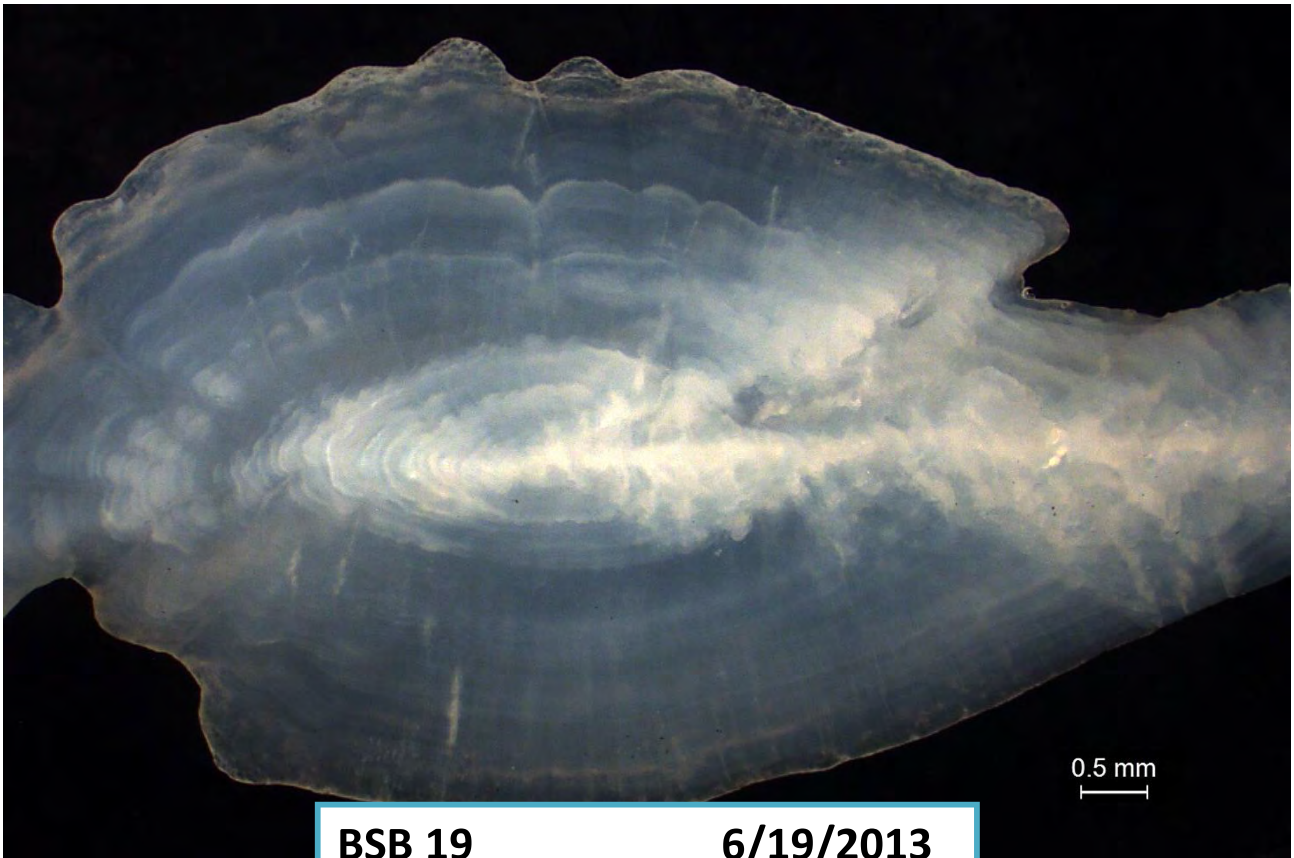
BSB 16 **4/13/2014**



BSB 17 11/27/2012

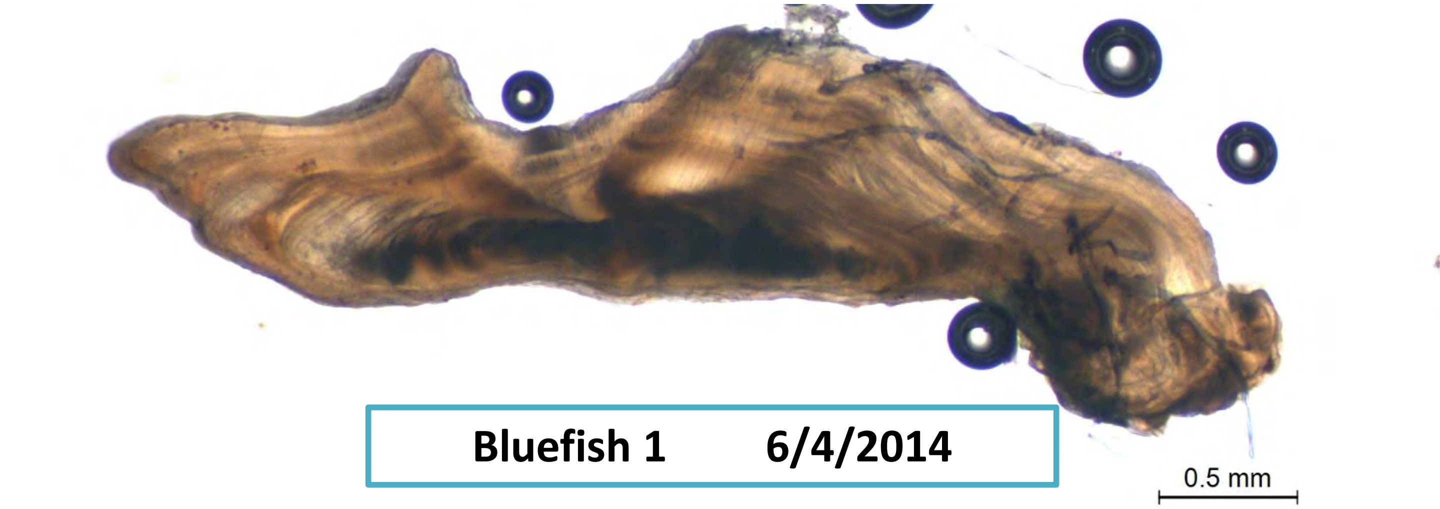


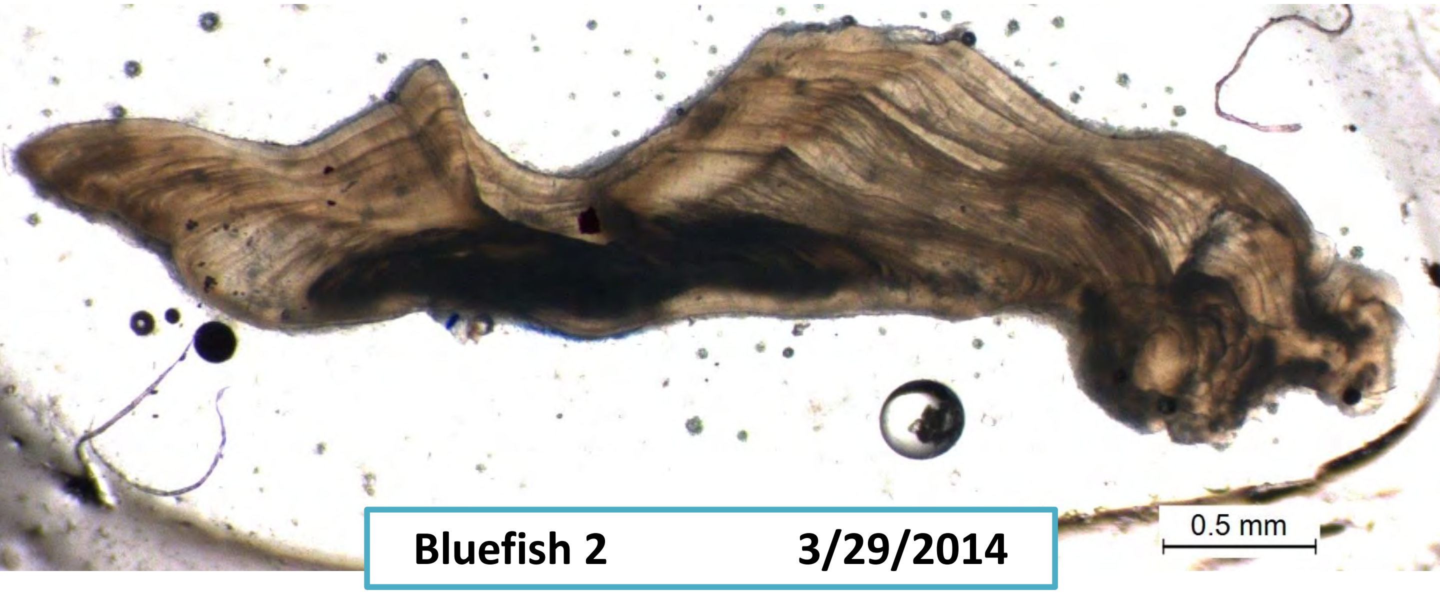
BSB 18 10/11/2012

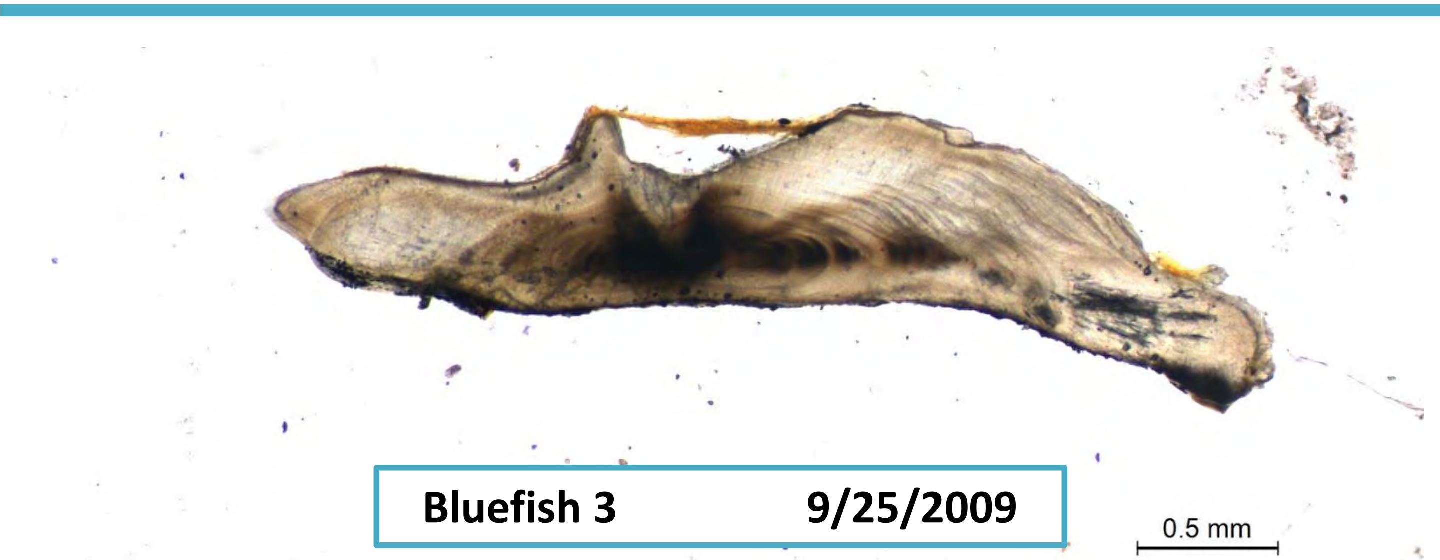


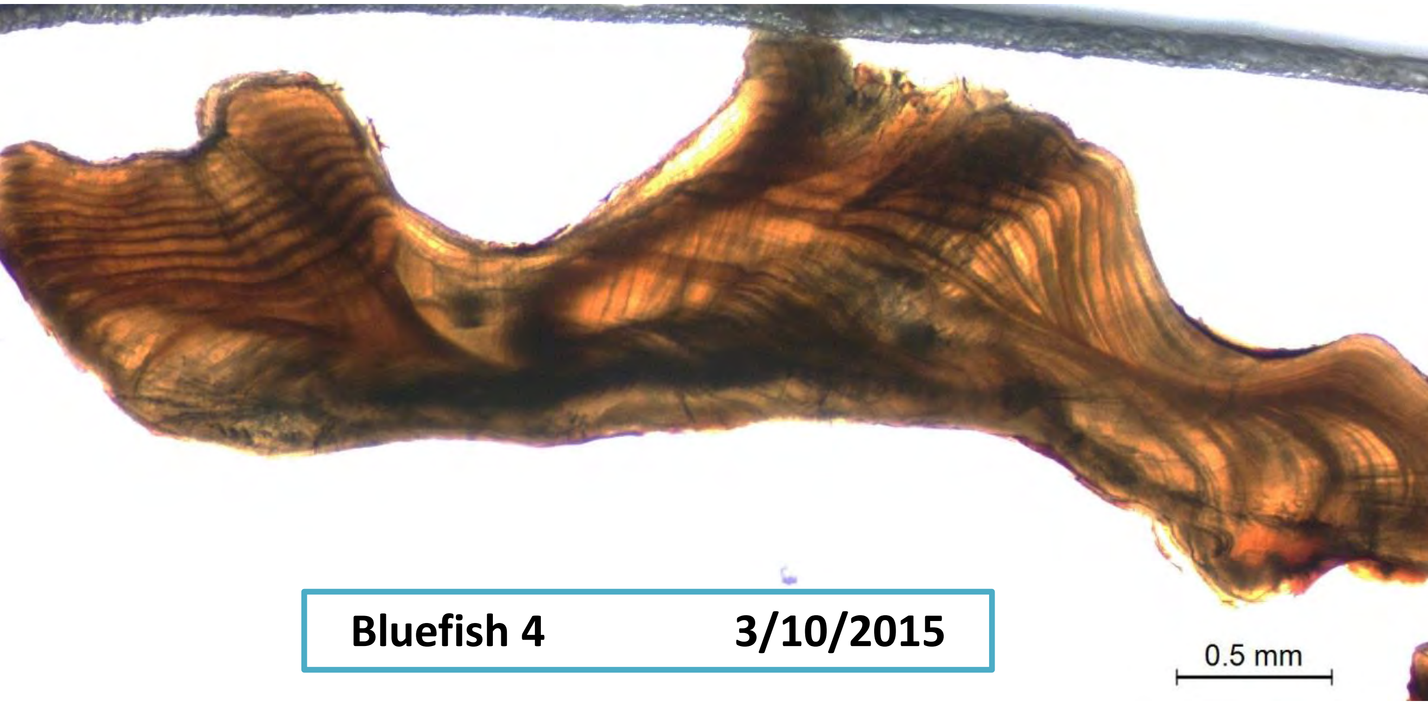
BSB 19 **6/19/2013**

BSB 20 **5/6/2012**

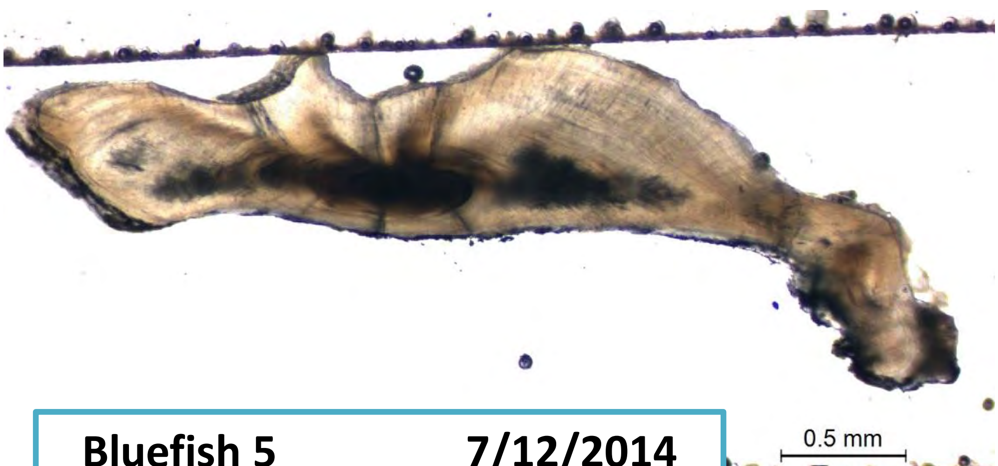

Bluefish 1 6/4/2014
0.5 mm


Bluefish 2 3/29/2014
0.5 mm

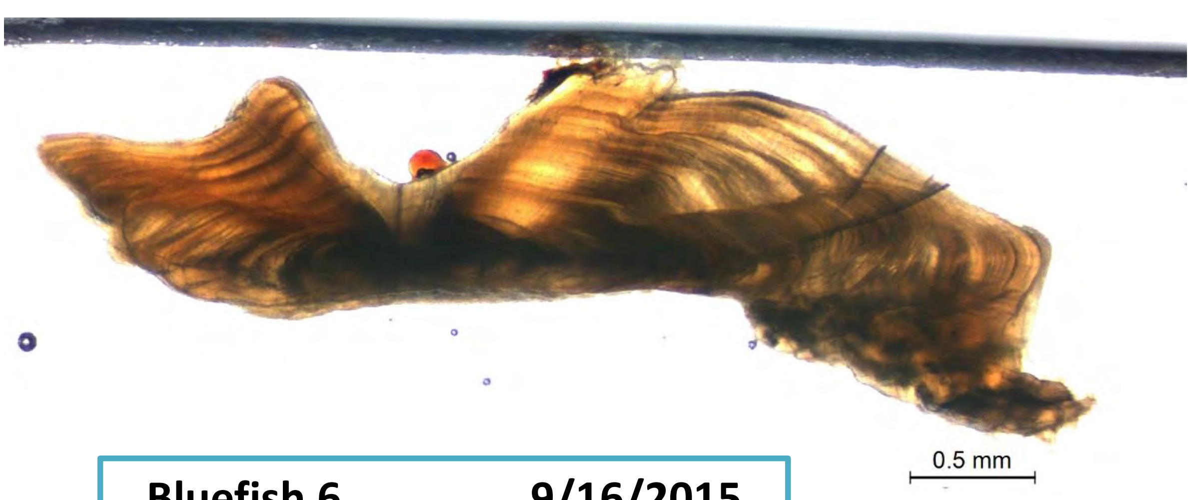

Bluefish 3 9/25/2009
0.5 mm



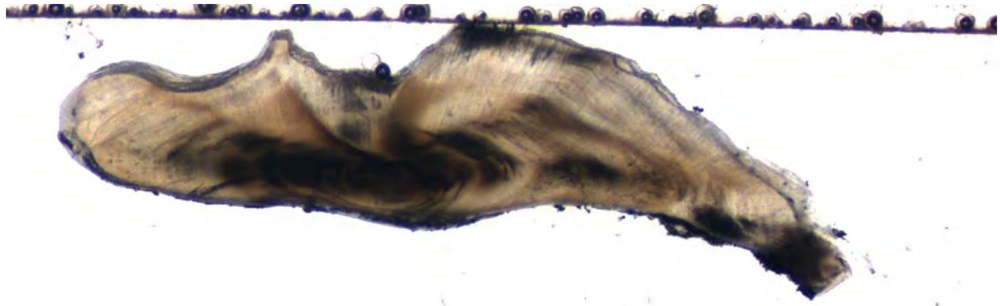
Bluefish 4 3/10/2015



Bluefish 5 7/12/2014



Bluefish 6 9/16/2015



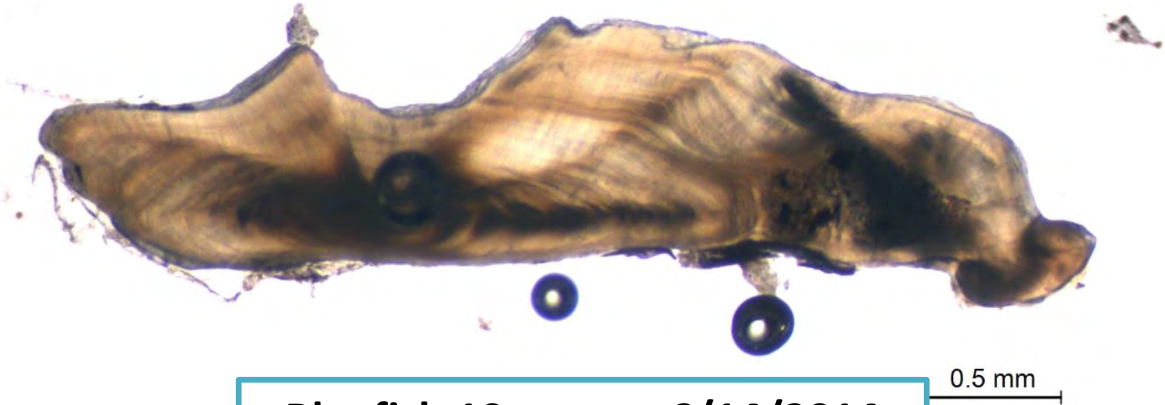
Bluefish 7 9/22/2014

0.5 mm

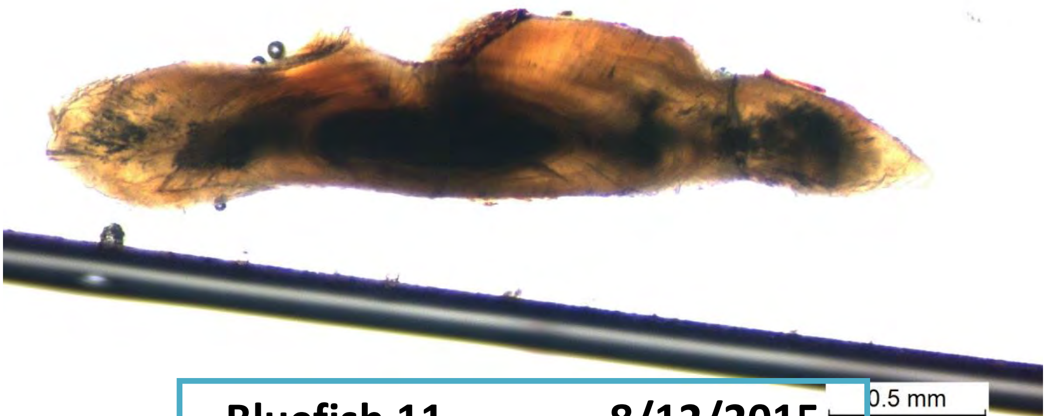
Bluefish 8 11/2/2012

0.5 mm

Bluefish 9 5/23/2012

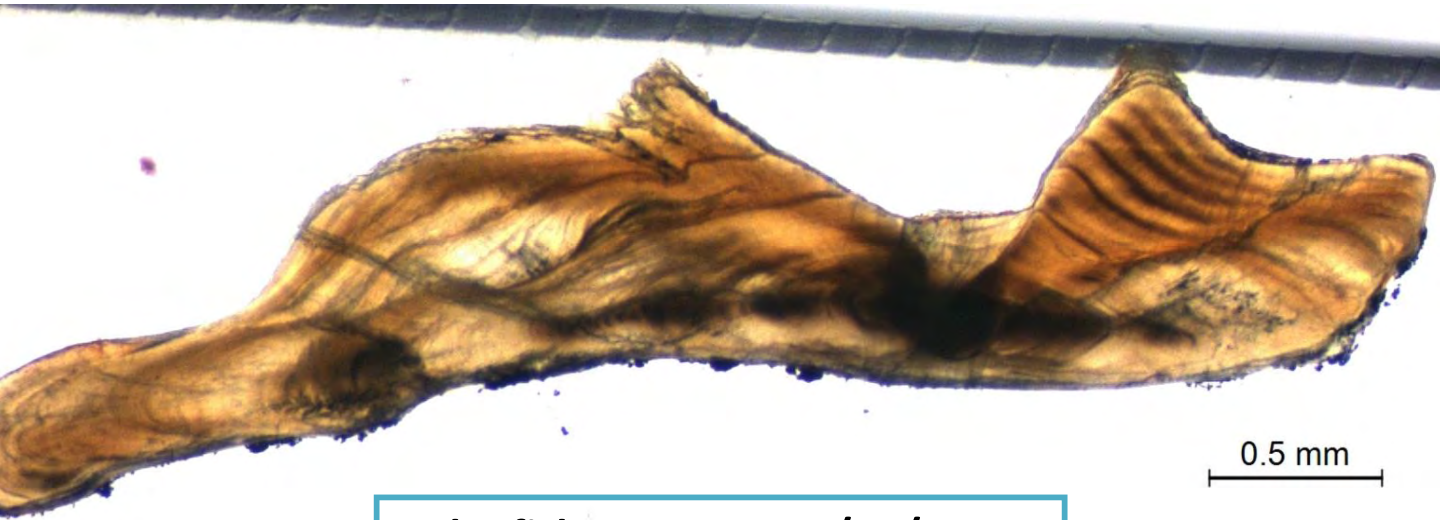


Bluefish 10 6/14/2014



Bluefish 11 8/12/2015

Bluefish 12 5/3/2012



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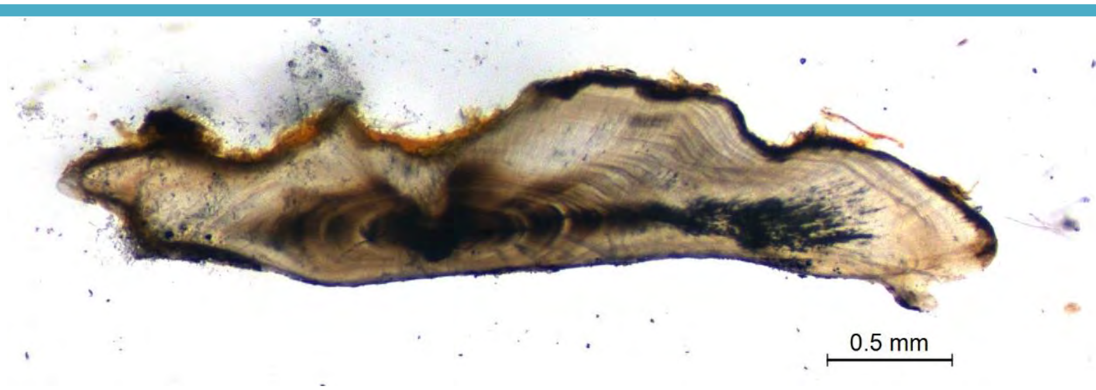
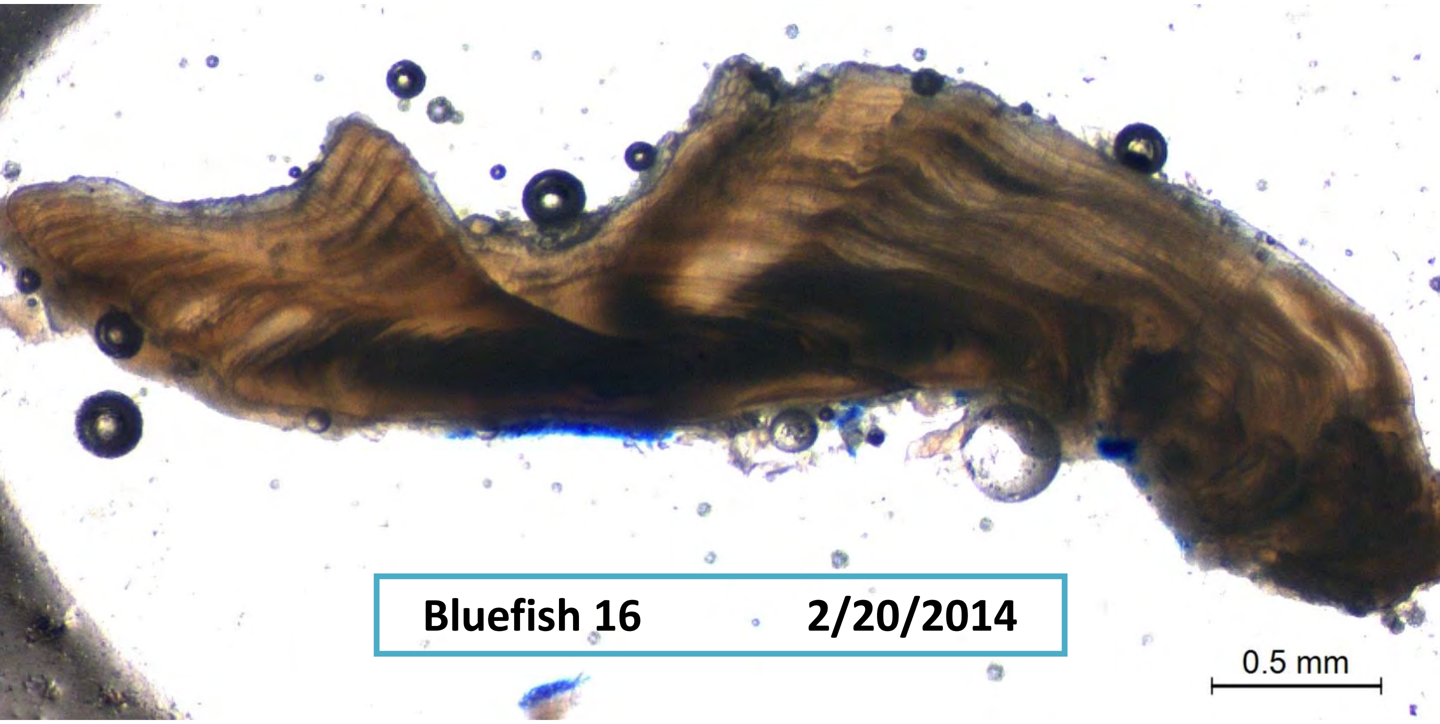


Bluefish 14 10/9/2009

Bluefish 15 10/23/2013



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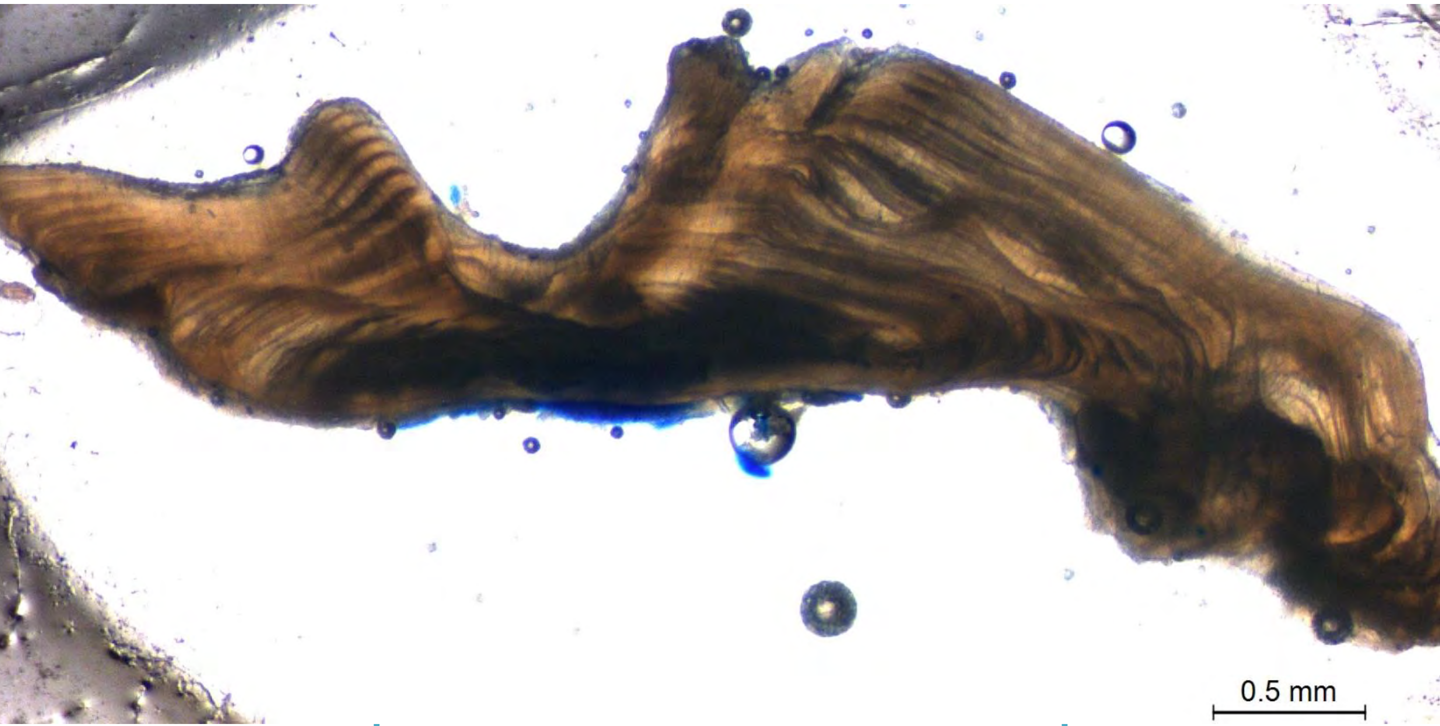

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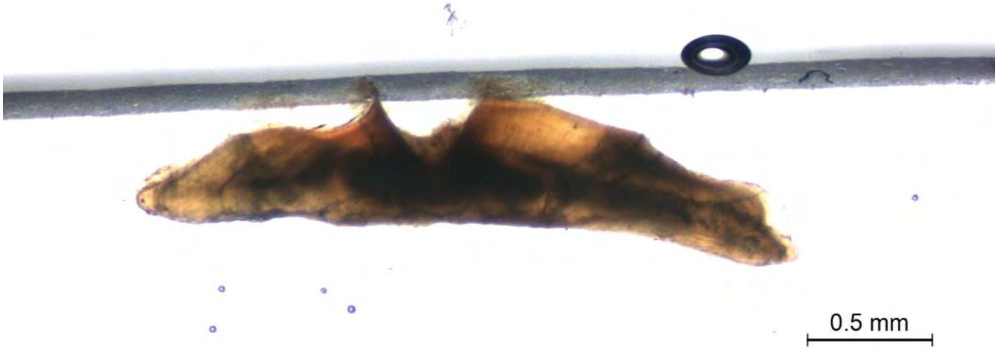

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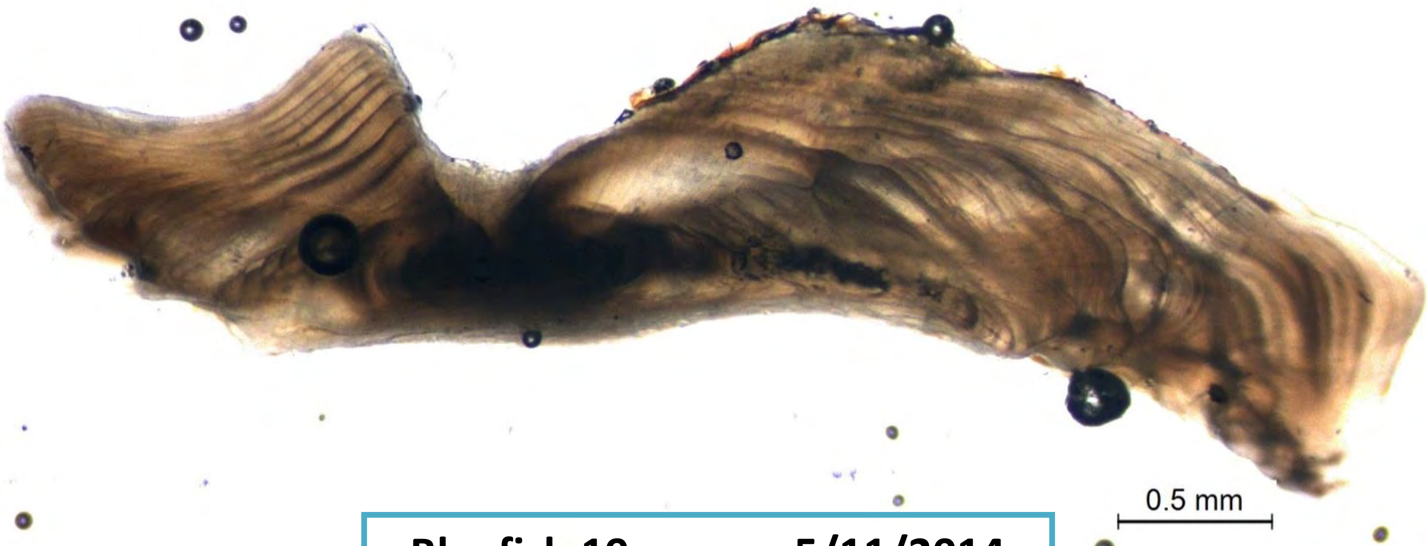
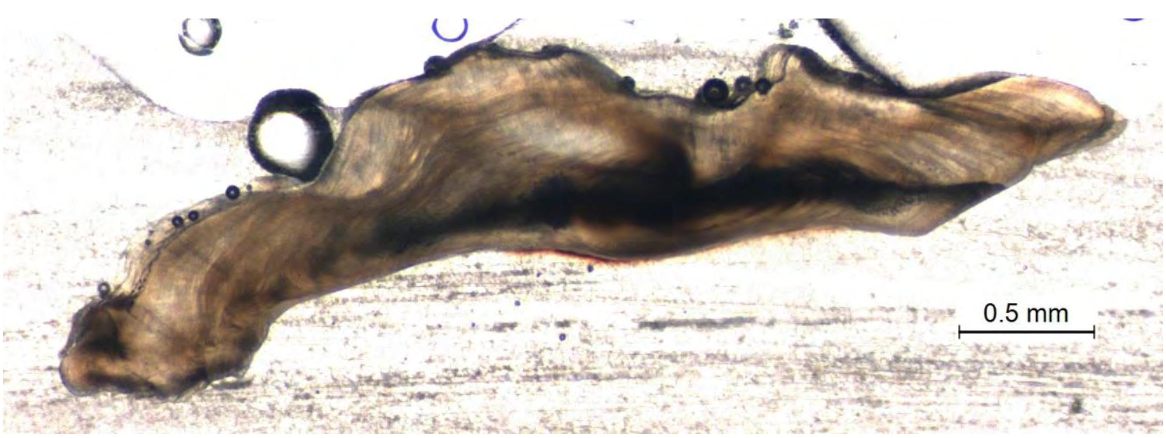


Bluefish 19 5/11/2014



Bluefish 20 5/31/2013