C.A.R.E. 2017 MEETING MINUTES 4-6 APRIL 2017

Nineteenth Biennial Meeting of the Committee of Age Reading Experts

AFSC Sand Point Facility, NOAA Western Regional Center

7600 Sand Point Way, NE, Seattle, WA, USA Bldg. #4, Jim Traynor Conference Room 2076

Tuesday, April 4, 2017

I. Call to Order: 2017 CARE Chairperson (Chris Gburski; AFSC) called the meeting to order at 8:38 am.

II. Host Statement: Dr. Tom Helser (AFSC), Age and Growth Program Manager, welcomed the group to the 19th CARE conference. Both Helser and Chris Gburski gave updates on safety, housekeeping, and the CARE social. Helser informed the group about the workshop on developing longnose skate age criteria and the funded project to reage the AFSC collection. Helser also informed people about his seminar on Thursday on Fish Tails: 18 Otolith and Increments at 1pm and that he will give an abridged version on Wednesday. Gburski ended the host statements by thanking people for bringing posters and updating people on room availabilities for workshops.

III. Introductions: CARE attendees/members went around the room and introduced themselves and stated which agency they worked for as well as brief summaries of their history and/or directed work (Table 1, Figure 1: 2017 CARE Attendee List).

IV. Approval of 2017 Agenda: Chris Gburski asked for edits to the proposed 2017 agenda. Suggested edits included Delsa Anderl (AFSC) presenting the Sablefish Working Group report, scheduling Tom Helser's abridged seminar on Wednesday at 1:00pm, and updating workshop timing. With these changes, the 2017 agenda was approved by CARE.

V. Working Group Reports and Activity since CARE 2015:

1. **TSC Meeting 2016:** Chris Gburski gave an overview of the 2016 meeting that Lance Sullivan (NWFSC) CARE Vice Chair attended in Newport, Oregon. Gburski read CARE updates posted on the TSC website including:

    - No consensus has been reached on the preferred method of otolith storage and agencies will continue with different techniques
    - Thin section updates will be added to the manual
    - The CARE website committee will update agency production numbers for 2015 and

2016, post exchanges, and meeting minutes (All of these were done)

- All age structure exchanges were finalized
- The Charter committee wants to update timelines on the TSC report submissions
- The Sablefish working group added new members and tasks were reassigned and an update to the manual was scheduled to be completed by Summer of 2016
- The Shortraker working group will continue to focus on pattern criteria and exchange specimens. A workshop will be help at CARE 2017. I was suggested that
- Ergonomic recommendations were drafted for CARE to CARE and CARE to TSC

2. **Storage media:** Tom Helser asked whether anyone is actively looking into storage media. Steve Wischniowski (CDFO) mentioned that he had updates in his agency reports. Helser remarked that they have concerns about the use of thymol. Elisa Russ (ADF&G) commented that this was good to address because of previous reports of no consensus. Chris Gburski suggested that this be added to the CARE to TSC recommendations.

3. **Exchanges:** Lance Sullivan (NWFSC) gave updates on CARE exchanges. He reported that all 2014 and 2015 exchanges were finalized, but two of the four 2016 exchanges were not complete. The two incomplete exchanges were arrowtooth flounder, blue and decon rockfish complex; and these were waiting on age reader calibration and sample size, capture area, and participating agency information. There was one 2017 exchange with yelloweye rockfish, but no agency information nor sample sizes have been received. Sullivan requested additional information. (Table 3: 2016 CARE Structure Exchanges)

4. **Website:** Jon Short (AFSC) CARE Webmaster gave updates on the CARE website. Short presented the current website and pointed out updated content including production numbers and previous meeting minutes. Short also addressed updating or changing the website CMS, because the current version of Joomla has not been supported since 2009. Short commented that the current PSMFC server is no longer using Joomla; that contributors may not need prior experience; and that moving to a new version or CMS would require time to program and update links likely but would not cost anything if CARE moved to a free CMS. Suggested servers were updated versions of Joomla, Drupal (used by PSMFC), and WordPress. Short also commented that updating tables, populated by databases, would take time as well. In the previous meeting, other agencies had suggested using ASP.NET as a server, but that is not compatible with the PSMFC website. CARE members suggested that two servers could be suggested by the website committee. Short also commented that the database parts of the website could be supported by other agencies (ADF&G) and the updated CMS could support ASP.NET windows.

5. **CARE Forum:** Nikki Atkins (NWFSC) gave an update on the CARE website forum. Atkins remarked that the forum has users from CARE as well as users from different countries, but there is not much information on the forum. Further, with potential updates to the website, Atkins suggested members copy information off the forum before it is potentially erased. Also, to get a username and password, contact Atkins, and updates to the website might help forum security.

Tom Helser (AFSC) commented that the current Age and Growth Lab's webpage may change. Jon Short elaborated that current information may be combined with other centers to group similar information.

6. **Website Publication Portal:** Kevin McNeel (ADF&G) CARE Secretary gave updates on the website publication database portal and walked through the use of the portal. The portal has search and upload features currently available for member publications. The link to the database is a sublink within "Related Links" and the link to the publication database is not visible until the Related Links is clicked. There currently are no publications on the website and some of that is due to questions about distributing copyrighted material. Jon Short (AFSC) mentioned that when these questions get answered, this can be moved into the main links. Tom Helser and Craig Kastelle (AFSC) commented that it will be an issue getting copyrighted material and suggested that maybe abstracts could be uploaded and agencies could upload their own reports. Sonya El Mejjati (ADF&G) reminded the group about the publication list already published online and suggested that we use this to help populate the database. Helser suggested that the journal source should be a drop down to make standardized journal names to make searching possible. Short suggested that a complete list be presented first, but to include the search at the top of the page. Short also suggested looking into copyright laws regarding posting abstracts.
7. **CARE Manual:** Elisa Russ (ADF&G) provided updates on the CARE manual. The additional changes have not been incorporated into the manual, but the baking otolith section, ergonomic section, and lingcod otolith section are complete, reviewed by the working group and approved by CARE. The new sablefish section is complete, but still needs to be reviewed by the manual working group. The manual is getting clunky, but all sections should be reviewed by all members.
    a. Chris Gburski (AFSC) reported on progress make to the skate and spiny dogfish section of the manual. Beth Matta (AFSC) recommended that this be included in the manual as a reference to the published literature. There is a draft of the skate manuscript that is not yet complete, but the dogfish section was published by Dr. Cindy Tribuzio (AFSC, not present). Either a citation or summary should be included within the manual, but Tribuzio should be contacted
    b. Russ commented that the walleye pollock section has not yet started, and baking otolith references and removing redundancies within the manual will get coved in the CARE recommendations
8. **CARE Charter:** Elisa Russ (ADF&G) gave updates on the charter working group. The time between the CARE meeting and the TSC meeting is short. Developing an executive summary to report at the meeting is two days to a few weeks. Russ proposed moving meeting times to help chairs write executive reports. TSC and CARE did not want to change meeting times in previous years. Sandy Rosenfeld (WDFW) suggested moving the meeting back to even years and Nikki Atkins (NWFSC) commented that the CARE meetings were moved to odd years to facilitate people going to the Western Groundfish Conference and Russ commented that TSC meets every year. Russ commented that a later meeting, after the TSC meeting, would conflict with survey activities. Russ finished updates with reiterating that it was recommended to put agency production numbers in the charter and coordination with host agencies.

9. **Sablefish:** Delsa Anderl (AFSC) gave updates on the working group. The participating agencies: Sclerochronology Lab (CDFO), AFSC, Age Determination Unit (ADF&G), and NWFSC, age sablefish across the western coast, Gulf of Alaska, and Bering Sea. The group tries to have at least one exchange per CARE. In the 2008 CARE, the ad hoc committee was created to 1) revisit criteria, 2) recalibrate, and 3) look at potential latitude differences. To look at latitudinal difference, the agencies sent 0 and 1-year-old sablefish otoliths to the ADU to be measured. To recalibrate, the agencies performed a round robin exchange of approximately 100 otoliths prior to the 2009 CARE meeting. At the 2009 meeting, representatives reviewed discrepancies and identified common patterns to look at. AFSC received known age sablefish from sablefish tagged and released as 0 and 1-year-olds at St. John the Baptist Bay. Anderl chose otoliths that represented the pattern and exchanged 15 samples with the other agencies. During a WebEx meeting and at the 2011 CARE meeting, the group discussed the results of the exchanges. At the 2013 CARE, the working group agreed to submit an update to the sablefish manual, summarize the 0 and 1-year-old otolith measurements, and document each lab's protocols. These were completed and sent to the manual committee and suggested that the working group be disbanded.

V1. CARE Recommendations [9:56 – 10:15]

1. **CARE to CARE 2015: Chris Gburski (AFSC) reviewed the 2015 CARE to CARE recommendations:**

   Working Group: Gburski remarked that Betty Goetz (AFSC) recommended that the website include the history of CARE, which could be documented by the secretary. Also, that updates be made to the CARE manual lingcod otolith and overall thin section methods. Elisa Russ (ADF&G) commented that this was made to reduce redundancy and that species-specific methods could be added. Further, baking methods could be included in general laboratory procedures. Gburski commented the ergonomic section was complete. The walleye pollock section has not been initiated, but the current AFSC manual section could be used. Tom Helser (AFSC) commented on a current walleye pollock age validation project using ^{14}C. Goetz and Russ offered to work together on this section. Gburski brought up the CARE to CARE recommendation to add an acknowledgement section and provide historical versions of the manual. Elisa remarked that for the next version of the manual to remove outdated documentation, members could not remember the issue with an acknowledgement section, and that we agreed to retain the historical editions of the CARE manual.

   Gburski reviewed the previous recommendations to the forum and website. Members agreed that the forum should be continued. Gburski remarked that agency links have not been added to the species tables, that the publication database is done, that caveats still need to be added to the species page, that the species table still has inconsistent capitalization, agency methods need to be added to the species, production numbers need to be updated, code B&B need to be updated to reflect break and burn vs break and bake, adding the table for agency contacts has yet to be finalized. CARE members agreed that the species common name table needs to be updated and sent to Jon Short (AFSC); Kevin McNeel (ADF&G) and Elisa Russ (ADF&G) offered to submit edits.

   Russ, Sonya El Mejjati (ADF&G), and Gburski discussed how agency processing, age reader list, and production numbers could be reported. El Mejjati suggested a table that reported a list

of agencies and the species they processed to help new age readers find appropriate contact agencies. El Mejjati and Russ agreed to work on this further and agreed that this information could be updated in Google Docs. Gburski went over the template already in place and the group agreed that this would be a good format. The currently distributed agency updates and location on the website were discussed. The group suggested turning agency acronyms into links and that an agency contact link can be added to the list on the CARE website. Further, updated information should be kept separately in case agencies were not able to present data and so contacts and production numbers would be kept separate; agency contacts will be updated via Google Docs.

Gburski reviewed the website updates and it was agreed that ASP.NET was not an option. Charter Working Group updates were already reported and those concluded the CARE to CARE recommendations.

Break 10:42-11:00

After break Gburski continued reviewed the remaining 2015 CARE to CARE recommendations to send minutes and production numbers to the TSC report.

2. **CARE to TSC 2015 (see pages 27, 28 in 2015 CARE Meeting Minutes): Chris Gburski (AFSC) reviewed and lead updates to the 2015 CARE to TSC recommendations.**

    a. Media: Gburski reminded the group that CARE agencies were going to continue with their own best practices for storage media and asked for updates on agency issues with glycerin thymol. Elisa Russ (ADF&G) commented that TSC wanted a report from CARE and that CARE responded to that. Then Russ asked what the TSC to CARE recommendation was. Gburski reviewed the TSC to CARE recommendation to remove the recommendation on storage. Russ suggested that TSC requested further research on storage during the TSC meeting. Gburski reviewed 2015 and 2016 TSC recommendations and both Gburski and Russ commented that the written recommendations from TSC were identical to the CARE to TSC recommendations. The group discussed the previous CARE meeting conclusion to continue with agency specific methods. Tom Helser (AFSC) and Steve Wischniowski (CDFO) discussed briefly the pros and cons of glycerin, the issue of recipe, and the potential inability to study the effect of media. Delsa Anderl (AFSC) gave an overview of the storage media report submitted in 2015. The importance of the recipe was reiterated and inconsistencies in the media solution were suggested. Anderl commented that the thymol being added to the solution may not be dissolved when some media is made, and when it isn't dissolved, otoliths can degrade. Wischniowski added that the thymol should be dissolved in the glycerin, because it precipitates out of the water solution (forms crystals). Each processor produces an individual solution and the issue with producing a study on solution effects is that the original solution is unknown.

    Helser suggested that a representative from each lab report a solution. Wischniowski reported that CDFO is going to store their otoliths dry and Andrew Claiborne (WDFW) reported that they are storing otoliths dry as well. Helser commented that it would be

difficult to convince the survey group to switch media. Russ reiterated that there is a difference between the TSC recommendations reported earlier and updates that she Russ received.

Anna Hildebrandt (WDFW) asked whether the glycerin thymol solution would have any effect on chemical analysis. Wischniowski commented that they ran a test and glycerin does not affect ^{14}C but it would affect elemental analyses. Craig Kastelle and Tom Helser (AFSC) commented that their ^{18}O analyses have been on otoliths stored in ethanol, so they did not test the impact of thymol. Wischniowski commented that when looking at near detection limits of chemical differences, having an unstandardized solution of glycerin would make the test useless. Beth Matta (AFSC) mentioned that they had both dry and thymol stored cod otoliths that need to be analyzed to test the effects of media.

b. Ergonomics: Chris Gburski (AFSC) opened the discussion on ergonomic protocols. Managers are already providing ergonomic updates. Steve Wischniowski (CDFO) commented that their lab upgraded workstations to include height adjustable desks and that this helped employees with health problems. Gburski commented that AFSC has a program to ergonomically fit workstations. Elisa Russ (ADF&G) commented that they do not have all options yet. Russ asked whether people did not have the option available.

   Anna Hildebrandt (WDFW) asked the group about ergonomic equipment for grinding or sectioning otoliths. April Rebert and Kevin McNeel (ADF&G) reported that they use low and high-speed saws and a PetroThin with a diamond cup grinding wheel. Hildebrandt commented that they are trying to preserve the edge and core. Rebert and McNeel commented that the PetroThin has a mount for slides and has an armature that holds the slide perpendicular to grinding wheel but has some issues for fast processing. McNeel said that they would be willing to provide quotes.

c. Invertebrate Processing: Chris Gurski (AFSC) reviewed the CARE to TSC recommendation that CARE explores new methods for invertebrate processing, but no discussion followed.

d. TSC Meeting Schedules: Chris Gburski (AFSC) reviewed the recommendation to TSC to schedule TSC meetings in the same year as CARE to no earlier than the last week of April to allow for enough time for the CARE Chair to write the executive report. CARE scheduled the 2017 meeting for earlier in April to allow for three weeks to write the report. Gburski remarked that this was likely enough time. Elisa Russ (ADF&G) remarked that TSC could not meet any later.

3. TSC to CARE 2015/2016:

2015

a. Storage media: Chris Gburski (AFSC) reviewed the TSC recommendation to find another avenue for investigating storage media practices. Elisa Russ (ADF&G) confirmed that this this was what she thought. New age reader access to ergonomics was brought up. Tom Helser (AFSC) asked Kali Williams (AFSC) if she had ergonomic updates and she had not yet been fitted. Betty Goetz (AFSC) remarked that she might need a note from a doctor, but other members from AFSC commented that employees no longer needed that. Gburski addressed the recommendation to support the investigation of invertebrate age reading. Elisa Russ (ADF&G) said that TSC supported investigation of crustacean processing, but TSC did not need CARE to report on updates to invertebrate process, because that was not related directly to groundfish.

2016

a. Storage media: Chris Gburski (AFSC) reviewed the TSC recommendation to include recipe for otolith integrity and to continuation of agency investigation. Elisa Russ (ADF&G) recommended that CARE summarize updates to agency protocols. Gburski supported developing a summary, because of the changes. Russ commented that the recipe and summary developed by Delsa Anderl (AFSC) and Joan Forsberg (IPHC) was submitted to TSC.

b. Ergonomics: Chris Gburski (AFSC) reviewed the TSC recommendation that new age readers are oriented to available ergonomic equipment, that requests are supported by the 9 agency managers, and that proactive program procedures are in place to prevent workplace injury. Gburski remarked that most upgrades were implemented after requests and Appendix 5 documents the Ergonomic Checklist. Gburski also reminded the group that an ergonomic specialist should be available for the evaluation of work stations and remarked that these are available to the AFSC Age and Growth Program.

c. Gburski remarked that the 2016 recommendations on invertebrate age reading and TSC meeting times were similar to 2015 recommendations.

VII. Agency Reports [10:30 – 11:15] Activity since CARE 2015 (~ 5 min each)

1. CDFO

Steve Wischniowski (CDFO) gave updates for the Sclerochronology Lab. Wischniowski remarked that this was his first time at CARE as program manager representing the SCL, and that he has 10 staff, lost term age reader, and new staff are typically student recruits from Vancouver Island University (VIU). It is a long process to train someone and they are insuring that there is commitment from students before training them to become permanent staff. One of the biggest issues is that in 3-4 years half of staff are going to retire, because most of the age readers were hired at the same time they will retire at the same time. This will mean that the Sclerochronology Lab may have to compensate by making adjustments to its services in the arena of data entry and structure processing: they have already stopped geoduck processing and are looking into stopping salmon scale data entry and processing. The lab is heading towards a strict ageing focus with a 10-20% research component. Shayne MacLellan and Darlene Gillespie are retired, but have stayed on as alumni, which is free work for the lab and brings experience and training to new staff.

The program is driven by stock assessment biologists, and they have some species that they age yearly: hake, sablefish. Otherwise, all species come in as stock assessment requests, which can be frustrating when an assessment is not done for 10-15 years. Wischniowski is working with groundfish biologists to develop a forecasting model to give the lab a five-year request for species specific request to ensure that the lab has time to process the samples and calibrated age readers.

The Sclerochronology lab processed hake, sablefish, lingcod, *S. alutus*, *S. maliger*, *S. aleutianus* and *S. melanostictus*, *Sebastolobus altivelis* (longspine thornyhead), *S. caurinus*, *S. proriger*, dover sole, petrale sole. These represent all groundfish and the lab aged over 30,000. The lab ages salmon: Chinook (77,252), chum (23,197), coho (10,774), sockeye (50,505). The lab also ages pelagic fish including herring (46,688), geoduck (831). They are studying *S aleutianus* and *melanostictus* because there seems to be hybridization and they are looking at DNA studies and potential otolith age pattern comparisons between species. In total, the lab has produced roughly 240,000 ages in the last two years. The lab is starting to age eulachon again; they are doing a hard part analysis to find the best structure and they are currently down to a comparison of scales and otoliths. However, the species sheds its scales rapidly, so collections at sea are mainly otoliths. The lab is working with First Nations people to get scale and otolith samples from freshwater systems where they spawn and get that by end of year. The lab is taking on a new species of shellfish, Rocky Mountain Ridged mussels (a freshwater species). Barb Campbell (CDFO) is currently working on thin-sectioning, which has been promising. The mussels are long-lived (can maybe be 20) and are endangered. So, the lab is going to validate ages using 18O.

Wischniowski gave an overview of the Sclerochronology Lab's structure archiving. Investigations began at the IPHC doing bomb carbon studies. All otoliths were collected into glass vials with water, glycerin, and thymol. It was apparent that some of the smaller otoliths were turning into paste. Older halibut (over 5 years) did not seem to have the problem. At the Pacific Biological Station, gradual deterioration is occurring. This can cause partial or complete loss of ageing readability, with the risk of extending throughout the collection representing 1.6 million fish sampled since 1970. Mold can engulf the outer surface of even well-cleaned otoliths, producing a chalky or decalcifying effect, and penetrates the interior microstructure causing age interpretation difficulties.

To investigate this, the lab reviewed approximately 3,800 samples in 2016 from 6 species collected in the decades of 1970, 1980, 1990 and 2000.

Sablefish juvenile whole surfaces were more susceptible to deterioration and indicated decalcification. Generally, the burnt cross-section ageing plane was not affected in most years but showed slight chalkiness beginning on burnt distal and proximal surfaces.

Hake whole surface and burnt cross-section samples of older fish collected in 1980, 1990 and 2000 were generally clean and clear, with no or very slight signs of chalkiness. The otoliths from young fish (two to three-year-old) showed chalkiness along the crenellated edge and a very slight amount over entire surface. The one-year-olds showed the most sign of deterioration; quite chalky, soft edges breaking down.

Widow Rockfish: there were no signs of deterioration or chalkiness; however, these were

whole and unaged otoliths of older, larger specimens.

Eulachon (1990 and 1999): all 700 otoliths were lost (turned to the texture of toothpaste).

English Sole: otoliths of medium to large size were either in excellent or very poor condition. All small otoliths were lost; whole otoliths exhibited major surface chalk or were the texture of toothpaste.

Dover Sole: from observations during routine ageing (2015/16) indicated 50% of samples prior to 2010 showing chalky edges of varying degrees.

Wischniowski remarked that three factors have been identified as root or direct causes for the deterioration of the Sclerochronology Lab's otolith library; it is uncertain at this time if these causes are mutually inclusive or exclusive. These are: 1) the library is in non-environmentally controlled conditions and evaporation has occurred leaving otoliths in 100% glycerin, 2) poor field removal of tissue exhausts the thymol, 3) omission of thymol or incorrectly mixed thymol in the otolith solution.

Wischniowski proposed to pull all samples from offsite non-environmental controlled buildings, renovate the newly determined location, wash and dry all current otoliths in the SCL library. Future otoliths will be collected and stored dry, only structures selected for age estimation will be rehydrated in glycerin. Experiments will begin to determine if glycerin is even necessary for the "break and burn" technique. Washing of 1.6 million otoliths will start with the early 1960 samples and will be treated per box consisting of 28 Tray Biens. Tray Biens will be soaked in water for 24hrs and the soaking and rinsing will be repeated 4 times before air dried. Tom Helser (AFSC) asked about the sampling protocol. Wischniowski reported that the otoliths are already field collected and stored dry before the addition of glycerin at the time of submission to the SCL. Craig Kastelle (AFSC) asked why they are rehydrated. Wischniowski and Joanne Groot (CDFO) reported that glycerin was traditionally used to keep otoliths in a state of "age readiness, this however was during a time when the accepted otolith reading technique was surface age estimation. It has not been determined if glycerin is still required for otoliths where the "break and burn/bake" technique is incorporated. Hence a study to determine if it's even necessary for the "break and burn/bake" technique. Lisa Kautzi (ODFW) remarked that they clear all of their otoliths in ethanol (at least 50%) and move otoliths back and forth between trays. Wischniowski commented that it takes 3-4 months to rehydrate larger rockfish otoliths and their lab is currently looking into means to speed that up.

Wischniowski concluded the Sclerochronology lab's update by reporting that the lab is centralizing their library, trying to incorporate 20% research into their age production, and developing their ability to mill and laser ablate otoliths to perform and support otolith microchemistry research. They are working with a researcher at the Institute of Ocean Sciences (IOS) who has an ICP-MS machine to become primary users of this machine.

2. IPHC

Joan Forsberg (IPHC) gave agency updates for the International Pacific Halibut Commission (IPHC). They currently have 4 on-site readers; their off-site reader, Linda Gibbs, retired in

2015. All readers have other duties, but they age full time June-Oct. They read about 30-35,000 individual otoliths a year; about 15,000 from the setline surveys, 15,000 from commercial catches, 1,500 from ADF&G -sport otoliths, and small amounts from tag recoveries. The stock assessment uses ages from current-year samples and collections. So, otoliths need to be collected in glycerin solution to facilitate in-year ageing of 100% of the samples. There is a separate collection that was started in 2010 where otolith pairs are collected and stored dry for future elemental work. There is a target of 100 pairs per year from each IPHC management area for this collection (around 800-1,000 pairs are collected per year; over 6,600 pairs have been collected so far).

Forsberg reviewed their storage methods. Commercial samples are collected in pill organizers with glycerin solution and moved to Tray Biens in the office. Setline and NMFS trawl survey otoliths are put directly in Tray Biens with the otolith juice. The tag recovery and ADF&G sport otoliths are collected dry in coin envelopes and transferred to Tray Biens in the office. These otoliths need to be cleared in glycerin solution for 4 weeks before they can be read. The IPHC otoliths are all stored in glycerin thymol solution after ageing, with the exception of otoliths from the 'juvenile surveys' conducted between 1926 and 1986; in the mid-2000s, these otoliths were removed from glycerin solution, washed in water, and stored dry after it was discovered that samples ≤2 years old were deteriorating. Between 2013 and 2014, IPHC readers reaged approximately 10,000 otoliths collected from the 1920s to the 1990s as part of a study looking at surface vs break and bake ages from historical and recent otolith collections. While re-reading these otoliths, readers also evaluated the otoliths' condition after up to 80 years of storage in glycerin solution. A lot of the otoliths were in good condition, a few of them had signs of chalkiness, and a few had obvious mold growth (these likely didn't have thymol in the solution). Most of their otoliths are now stored offsite at National Archives in Seattle; they were stored in the office garage at the IPHC's former location, but that was not temperature controlled. The IPHC has used break and bake (since 2003), still use surface ages 0-5-year-old otoliths. Still find that the surface ages of small otoliths is accurate. The lab does mainly production reading, but they did do some research. They collected increment measurements as part of an NPRB project to look at changing size at age. Dana Rudy (IPHC) analyzed the increments and is presenting a poster of the analysis. There were some unexpected results and their lab is going to expand the study by taking otolith radius measurements.

3. ADF&G

Elisa Russ (ADF&G), Kevin McNeel (ADF&G), and Sonya El Mejjati (ADF&G) gave the updates for the ADF&G labs. Russ started the updates by commenting that she manages the ADF&G age lab in Homer, McNeel runs the age lab in Juneau, and El Mejjati runs the program in Kodiak. For commercial fisheries, the Homer lab ages walleye pollock, pelagic shelf rockfish (PSR; black, dark, dusky, and yellowtail), and demersal shelf rockfish (yelloweye, quillback, canary, etc.). All slope rockfish, lingcod, and sablefish otoliths are sent to the ADU (Age Determination Unit). In addition to managing the commercial groundfish ageing project, Russ manages the commercial groundfish port sampling project. Barbi Failor (ADF&G), who could not attend this or the last CARE due to budget cuts,

manages the sport caught groundfish ageing and port sampling programs. The sport fish project ages all samples they collect, which is mainly rockfish, but they also age lingcod using fin spines. The commercial groundfish project switched to collecting lingcod otoliths as the preferred age structure over a decade ago.

Both Homer labs process samples from fish caught in Cook Inlet, Prince William Sound (PWS), and the North Gulf of Alaska coast (Central Region). The sport fish project also collects samples from Kodiak (Westward Region). For the commercial groundfish project Andy Pollak (ADF&G) is the primary age reader. Andy is also the main port sampler in Homer with additional samplers in Cordova and Seward. Both Andy and Elisa travel to Whittier, Seward, and Kodiak during certain fisheries. Due to budget cuts, Russ has assumed fishery management duties in the Prince William Sound Area, in addition to the Cook Inlet Area. In winter 2016-17, a temporary technician was borrowed for 3 months and trained to age yelloweye rockfish to assist in ageing the backlog of rockfish samples; it took over half of that time just in training. In 2016, 1,100 walleye pollock, 850 black rockfish from the directed PSR fishery, and 1,500 yelloweye rockfish caught as bycatch, were aged in the commercial groundfish project. All otoliths were stored dry and not rehydrated prior to age reading. Currently all Pacific cod samples are being archived due to funding shortages, although Russ and Pollak have trained with Delsa Anderl (AFSC) and Sonya El Mejjati (ADF&G) to age Pacific cod. Russ is providing Pacific cod biological data (length and sex) to NMFS stock assessment (SA) authors; Russ has inquired if NMFS authors (SA) would also be interested in similar data from PWS walleye pollock. Russ also plans to inquire if NMFS Age and Growth staff would be interested in ageing Pacific cod otoliths (currently being archived) for the SA. The Homer lab is planning to purchase an analytical balance to start collecting morphometric data on otoliths.

Kevin McNeel (ADF&G) gave the update for the ADF&G Age Determination Unit in Juneau. The ADU currently has two permanent and two seasonal staff, and their time is divided between age reading, administrative, and other tasks. The ADU recently hired Jodi Neil (ADF&G) who is trained on sablefish, yelloweye, and other rockfish species. Rob Dinneford (ADF&G) is still currently working with the lab is now ageing yelloweye rockfish and lingcod. The ADU also has had interim personnel that have been trained to be able to use them from other programs throughout the State.

In 2015 and 2016, the ADU received approximately 20,000 and 10,000 sets of age structures from Central and Southeast Gulf of Alaska commercial fisheries and survey samples. These collections represented 35 and 16 species. During this period, the ADU processed sablefish, lingcod, yelloweye, shortraker, rougheye rockfish, and shortspine thornyhead and distributed approximately 13,000 ages in 2015 and 5,000 ages in 2016. These reads were only for groundfish, but the ADU is also involved in the crustacean age reading project.

For quality control, a random 20-30% of a sample is selected for second reads and modeled fish and otolith size-at-age is used to submit outlying specimens back to age readers. These resulted in approximately 8,000 additional reads in 2015 and 7,000 in 2016. Currently, the ADU has modeled fish length and otolith weight-at-age for lingcod, yelloweye, rougheye, shortraker rockfish, shortspine thornyhead, and sablefish using von Bertalanffy and exponential growth models.

The ADU helped to analyze the 0 and 1 year old sablefish measurements; a complex relationship was found between latitude, but there were also effects of day. The results of the study will not be included in the manual, but hopefully a table will be added with size ranges. The ADU helped update the manual on sablefish; finalized results from geoduck age structure exchanges with CDFO, and WDFW; and worked on the updates to the publication website. The ADU currently has three staff in graduate programs: McNeel is doing research on shortraker rockfish in Prince William Sound, which will be presented later; Rebert is doing work on crustacean age reading, which will also be presented; and Neil is doing salmon scale increment analysis, which will not be presented.

Sonya El Mejjati's (ADF&G) updates were scheduled for after lunch.

4. AFSC

Tom Helser (AFSC) gave the update for the AFSC Age and Growth Program. The lab has 15 fulltime people including 3 graduate students and 2 undergraduate students. Morgan Arrington (AFSC) and Jeremy Harris (AFSC) are graduate students, and Kali Williams (AFSC) and Sandi Neidetcher (AFSC) are new age readers. Their lab has been working closely with the University of Washington with undergraduates on their senior capstone projects and has shepherded 8-10 of them through the lab in the last couple of years. In total, the lab averages approximately 36,000 ages (principally from otoliths) and processed 38,000 in 2014 and 41,000 in 2015.

Helser noted that they have a micromilling machine to do microsampling for stable oxygen isotope as well as ^{14}C analysis. The lab is currently up to 5 dissecting and compound microscopes with image analysis systems and brought on another high-speed sectioning saw. The have folded in a reproductive biology studies activity to enhance their program. Neidetcher and Todd TenBrink (AFSC) as well as 4 FTEs are involved in the reproductive studies to get a more synergistic picture of fish life history. The lab brought on a NRC post doc to support the national effort to increase efficiency by reducing the number of otoliths collected and to evaluate tradeoff between otolith sample size and assessment model precision. The outcomes of this will be a white paper, NOAA Technical Memorandum: Importance of Age Data Collection and Utilization for Stock Assessments, A US National Perspective, and a simulation framework and operating model for different classes of fish to dial in samples sizes while evaluating precision losses. This work should be wrapping up by next December and will be the framework used for other science centers. The lab is also involved in another national working group called the Sample Intensity and Processing working group (SIP). This is an effort to rationalize fishery based biological sampling to try to identify who needs more money to sample fish and collect otoliths for stock assessments. The group has already worked towards identifying needs and strengths for length samples and the next step is to look at otolith/age structure collection. Redesigning age-based applications by combining 8 different databases into one SQL server database application and make it more relational. They hope to have this operational in 2018. The lab is also exploring machine-based age estimations based on a near infrared spectrometer. Preliminary evaluation on walleye pollock, Pacific cod, and yellowfin sole showed promise with precision estimates based on human determined ages up to 90%. They hope to get it

operational by next year. Efficiency estimates showed that the machine would surpass 2 FTEs. Over the last two years, the program has garnered over $2,000,000 in grants from NPRB, FATE, and the Office of Science and Technology. This represents research products including bomb validation of some rockfish and Pacific cod and walleye pollock. This also includes looking at sampling framework at sea to compare random sampling (seen on commercial samples) to length stratified sampling (seen on surveys). This will look at tradeoffs between how these two sampling designs impact stock assessments. The program also has two NPRB funded studies to look at age validation and reproductive biology of rockfish and flat fish in the Bering Sea, specifically to examine how maturity and growth compare across the Eastern and Northern Bering Sea shelfs. Another is to improve stock assessment of a wide-ranging species by estimating temporal and special variability in life history parameters of longnose skate. Helser commented that the workshop during CARE is the venue for developing age criteria decision rules, which Morgan Arrington (AFSC) will be working on specifically as a graduate student. With Beth Matta (AFSC), the program developed another proposal on the effects of high and low frequency environmental variation on fish growth and stock assessment reference points. This uses sclerochronology tools to integrate that information into stock assessment. The program is also looking into the stock structure of Pacific cod using genetic and otolith microchemistry; this will be using a genetic approach called RADs along with otolith chemistry. In the Arctic, the program is involved in an IRP to age Arctic and saffron cod and to characterize habitat usage, growth variability, and survival. Staff from the Age and Growth Lab have contributed at least 15 peer reviewed articles.

Andrew Claiborne (WDFW) asked how the near infrared spectrometer works. Helser replied that the NIR spectrometer measures energy emittance in the infrared band, making it chemical-energy quantification of age rather than optically based. There appears to be a relationship with the near infra-red chemical signature and the fish age; this makes sense because as an otolith grows older, they incorporate more otolin protein. A calibration is set using roughly 100 otoliths with agreed ages and the machine uses Fourier transformation to get the calibration ages. So, the machine cannot do any better than the ages that are provided (if the ages are biased, the machine will be biased). So, it is still important to perform age validation to insure the age estimates are correct. However, with the calibration, the program has an R2 around .98 with walleye pollock. So, the machine gives and age within 30s and the tests have shown the age that it gives will be +/- 0.5 years. The machine is about $60,000 and it was assured that it doesn't require much maintenance. The machine has been around for a while and was perfected in the medical industry and its use on otoliths was first done by CSYRO (Commonwealth Scientific and Industrial Research Organization) in Australia. CSYRO has been working for the last 3-5 years on a variety of species and it seems best with species with lower longevity, so walleye pollock would be a good candidate. This is nondestructive and can be applied to wet or dry unprocessed otoliths. Jon Short (AFSC) gave further information on the utility of the machine. Short mentioned that there were about 4 publications on the use of the machine on elasmobranch vertebrae and fish otoliths.

12:40-1:45 lunch break

5. ADF&G Agency Update Continued

Sonya El Mejjati gave an update on the ADF&G age lab in Kodiak. Their dockside program samples State managed groundfish and shellfish species that are harvested in Kodiak, Chignik, and South Alaska Peninsula areas. Shellfish species include Tanner crab, Dungeness crab, red sea cucumbers, and occasionally BSAI King and snow crab; groundfish species include Pacific cod, black and dark rockfish, lingcod, and occasionally Prince William Sound walleye pollock. Sampling goals include sampling 500 Pacific cod within each area, 1000 black rockfish and 1000 dark rockfish primarily from Kodiak, and lingcod is sampled opportunistically. At the age lab, all employees are generally employed January through April (2-4 months). They had 3 age readers in 2016: Joan Brodie, Kayla Bevaart, and El Mejjati. Bevaart moved to the management office and is no longer age reading, but she does help with data entry and verification and archiving samples. In 2017 they also had three age readers: Brodie, Mike Knutson, and El Mejjati. Brodie is retired but returning age reader with 37 seasons of experience. Knutson started in 2014 and has been in another position and in graduate school but is currently with the lab and going to school.

Precision testing is done on 40% of all samples and on 100% of samples that are aged by new readers. Training typically lasts about 1-3 weeks for a new age reader and then when precision tests are below a threshold, rereads go down to 40%. All differences are resolved. The lab uses the break and burn method for rockfish. For Pacific cod, one otolith is broken, and the other is cut with an Isomet saw; halves of each otolith are baked rather than burned as Pacific cod otoliths tend to spit material (a.k.a. bursting). The process is time consuming, but they save time while age reading.

In 2017, they started collecting morphometric measurements for all species (otolith length, width, and weight and excluding crystalized or broken otoliths). El Mejjati requested information from other labs that collect information on methods and equipment, and how data is used. El Mejjati noted that Pacific cod otoliths are getting noisier and checkier. The lab is interested in looking into using Pacific cod fin rays but is curious about absorption issues and preparation logistics.

6. NWFSC

Patrick McDonald (NWFSC) gave updates for the lab. McDonald reported that they briefly had 7 staff with the newest hire Jamie Hale (NWFSC). They had 6 full time age readers and McDonald as a part time ager/supervisor. However, in early 2016, they lost Cassandra Whiteside and haven’t replaced her, so they are currently at 6 staff.

The lab gets otoliths from survey and commercial samples from California Fish and Game, ODFW, and WDFW. They store all of their otoliths dry, off-site in a storage unit. They mostly perform break and burns on otoliths; the only species that they do break and bakes on is arrowtooth flounder. Other species that they normally process are hake and Pacific Ocean perch. New species that they age include lingcod, which they sent Nikki Atkins (NWFSC) and Tyler Johnson (NWFSC) to WDFW to learn how to age fin ray structures a year ago. They had a backlog of survey lingcod specimens in our freezer since 2009 and dedicated 2 age readers full time last year to the task of working through the backlog- prepping and ageing. Yellowtail rockfish, California scorpionfish, and yelloweye rockfish are also new species. They are also looking into processing skate and are participating in the workshop. Sablefish wasn’t assessed this year, and the lab has a lot of unaged structures. So, they will

likely be processing those in the future. In 2016, Lance Sullivan (NWFSC) cored 31 black rockfish otoliths using a micromill and the material was sent to NOSAMS for analysis. This year, they hope to core some canary rockfish.

The lab sent everyone to the 2016 Western Groundfish Conference. There was a presentation on vermillion rockfish ages analyzed by John Harms (NWFSC-FRAM) that the lab provided. Jamie Hale and Cassandra Whiteside also presented the poster "Use of otoliths weight to check age estimates in POP and P. Hake."

Elisa Russ (ADF&G) asked if they stored their otoliths dry. McDonald replied that they do, but the survey otoliths are collected and stored temporarily in 50% ethanol and are either aged when they are received or transferred into dry storage. They do look at otoliths in water, but do not rehydrate otoliths. They are currently ageing lingcod using fin rays. The group commented that there is a mixture of otoliths and fin rays throughout the agencies. Atkins mentioned that they are doing a comparison of lingcod fin rays and otoliths.

7. ODFW

Lisa Kautzi (ODFW) provided updates for the ODFW age lab. Currently, Kautzi is the only marine age reader. She receives samples from commercial, recreation, special projects and all structures are stored dry. The majority of her time was spent production ageing and testing work for 2017 stock assessment for blue and deacon rockfish. Kautzi ages everything and then does another 20% of the sample. She then goes back and resolves differences. With blue and deacon rockfish, Kautzi has done exchanges with the SWFSC: last fall she exchanged about 110 structures and this winter exchanged about 175 structures. She was also involved in a black rockfish project with ODFW and NWFSC, a redbanded and brown rockfish project that was published as an ODFW agency report, and a kelp greenling project. In total, she produces about 4,000 structures per year (3,649 structures (707 tested) were aged in 2015, and 4,466 structures (892 tested) were aged in 2016). Kautzi commented that she might also be involved in future skate and herring work.

8. WDFW

Andrew Claiborne gave the agency updates for WDFW. They are in a unit with thermal mark lab (salmon centric) and fish ageing lab. The Fish Ageing Lab processes groundfish (Sandy Rosenfield and Jenny Topping), one ager (Lucinda Morrow) that does invasive and freshwater species, Claiborne and one part-time ager (John Sneva) age primarily salmon and steelhead, and another employee that is working on microchemistry projects with Lance Campbell. The lab has a total of 5 employees with one part-time employee.

The lab processes 100,000-130,000 salmon a year: mainly Chinook, chum salmon and steelhead. They process samples from the Columbia River, coastal Washington, and Puget Sound commercial and escapement surveys. Their salmon projects run November-March concurrent with the North of Falcon season and allocation meetings. The marine processing is based on stock assessment cycles.

Campbell and the lab are using microchemistry for studies of salmon and steelhead to

reconstruct life history and validate methodology. Anna Hildebrandt is involved in a fin ray chemistry project with bull trout. They looked into non-lethal sampling for endangered species where they removed a fin ray and measured mortality. Then they looked at the chemistry of the bone to find evidence of anadromy. Rosenfield, Topping, Theresa Tsou, Claiborne, and co-workers in the Montesano regional office looked at lingcod age structures in response to TSC recommendations. They looked at the precision of lingcod whole otoliths reads, fin rays, and vertebrates; the results were presented to the TSC. The WDFW Fish Ageing Lab is also involved in the Salish Sea Marine Survival Project (joint project between CDFO, First Nations, and Washington tribes, Long Live the Kings, University of Washington, etc.) which is investigating the factors influencing survival of Puget Sound Chinook, coho, and steelhead. One study was looking at historical and modern scales to compare early marine growth to survival estimates and environmental factors. Another study used otolith chemistry to look at survival of different life histories of Chinook salmon in Puget Sound.

Sandy Rosenfield gave an overview of the rockfish age reading. Rosenfield and Jenny Topping produce all rockfish and groundfish ages. In the last two years they have processed China rockfish, black rockfish, Pacific Ocean perch, yelloweye rockfish, yellowtail rockfish, petrale sole, English sole, lingcod, sardine, anchovy, and kelp greenling. Topping also aged some eulachon and their group helped train Nikki and Tyler Johnson from the NWFSC and Laurel Lamb from the SWFSC to age lingcod. In 2015 and 2016, the lab aged over 13,000 otoliths (excluding double reads and retraining). Rosenfield remarked that all of their otoliths are stored dry.

Bethany Stevick presented the update for the subtidal team. They manage Washington's commercial dive fisheries; the big fishery is the wild stock geoduck fishery. In 2015 and 2016 she aged 1,500 geoduck and an additional 20% reaged for precision. Highlights include staining difficult slides with Mutvei's solution and found it that it improves the slides and increased the amount of older specimens. Stevick is also working on the Salish Sea Marine Survival Project with Corey Green (NOAA) to use geoduck increments to produce a mean sight chronology and relate that to primary productivity and marine survival. This is to get a historical perspective on productivity and comparing that to salmon and steelhead abundance to better forecast what will happen in the future.

Elisa Russ (ADF&G) asked whether they store their otoliths dry and Rosenfield responded that they are and that they have been since the mid-1980s. Craig Kastelle (AFSC) asked about the Mutvei's solution and Stevick responded that there is a group of publications that looked at methods across groups of species. Stevick presented pictures of the staining results and commented that she has started staining all sections. Chris Gburski (AFSC) asked what the stain works on. Stevick responded that the solution is etching the growth bands and the stain adheres to mucopolysaccharides to produce shades of blue and a 3-dimensional surface.

VIII. Scientific PowerPoint Presentations (Appendix 1: 2017 Oral and Poster Presentation Abstracts)

1. Kevin McNeel - Update on shortraker rockfish (*Sebastes borealis*) otolith analyses. (20

minutes)

Kevin McNeel presented his study on shortraker rockfish shape analysis, bomb radio carbon data, and biochronology. He went over previously identified shape differences between rougheye and shortraker rockfish otoliths; described genetic identification of shortraker (10), rougheye (2), and blackspotted rockfish (8); and summarized the shape analysis using the R package shapeR. Results described differences between otoliths. Tom Helser asked what the sample size was for the shape analysis, and McNeel said that they sample was from 40 otoliths. Another question was asked on whether the plotted differences were between individual species and McNeel replied that the results were differences among the three species, but that the program could also compare groups. Elisa Russ asked how the individual measurements were taken and whether they were image based; McNeel responded that the R program drew the outline reconstruction based on black and white images. Helser asked what measurement were being collected; McNeel responded that the program was collecting many measurements included Fourier transformation and wavelet estimate. McNeel went through data grouping and linear discriminate analyses and concluded that separation was good and error rates were low. Helser asked what the error rates were made from and both McNeel and Helser agreed that the sample size was low and that a distinct test sample would be better for cross-validation.

McNeel then went over bomb radiocarbon and biochronolgy analyses on shortraker rockfish. He compared shortraker rockfish radiocarbon data with Pacific halibut and yelloweye rockfish references, and model estimates were not different between species. McNeel also took annuli increment measurement from mounted thin sections of broken and burned shortraker rockfish otoliths. He went over the software and models used and described a mixed-effect model to describe growth. Initial results suggested significant correlations between shortraker rockfish growth and temperature.

Helser asked what the age range was in the chronology; McNeel responded that they are between 80 and 50 years of age. Helser questioned how temperature fed to changes in somatic size for such old fish, assuming that the otolith growth was related to somatic growth. McNeel responded that he assumed that somatic growth was not changing, and that otolith growth was related to biology and temperature. Helser suggested that the growth could be related to the productivity of the system. McNeel agreed that sea surface temperature should not have a direct effect on growth and mentioned that he had other covariates. The group then discussed the differences between somatic and otolith growth and what some of the assumptions were.

Craig Kastelle asked about the model used to analyze the radiocarbon data. Specifically, which parameter was identified among the three sets of data. McNeel described the parameters in the model and said that he held all parameters the same for all data sets but estimated separate parameters for the year at 50% rise in radiocarbon activity. McNeel, Kastelle, Helser, and Russ then discussed why these sample shortraker fit the reference curve better than previous samples.

2. **April Rebert – How old is that crab? Progress on an age old question.** (20 minutes)

April Rebert showed a short film introducing her presentation and summarized the project. Rebert mentioned that bands were found in gastric mills and eyestalks of red king crab and snow crab, and in the eyestalks of spot shrimp. The project goals were to find which structures have the best banding patterns and to do validation. Objectives were to look at sections and compare band counts between size groups, and to look at calcein work. Rebert established a method for processing the three species and sectioned all structures across the entire length. They then applied a readability code to all sections to find which structures had visible bands. Band criteria was then developed with collaboration from Dr. Raouf Kilada and Jesse Leland. They used five specimens per species and established boundaries between cuticle layers and what a complete band might be. They took these reference specimens and tested them among four age readers on red king crab so far. Rebert showed examples of growth patterns in crab. Helser ask what the conventional age of the animals is, and Rebert replied that red king crab can be 20, snow crab are younger, and spot shrimp can be around 10 years. For initial evaluation, the group is only assigned clarity, but ages were done for red king crab and Rebert summarized precision.

For calcein studies, Tanner crab, red king crab, and spot shrimp were exposed to two levels of calcein for 24 hours, their hard parts were harvested at different intervals after exposure, the structures were cut and imaged with confocal microscopy, and red channel images were subtracted from green channel images to expose the calcein mark. Rebert noted marks on the potential growth edge of red king crab and Tanner crab, but that the mark flooded the spot shrimp structures. Rebert overviewed the work so far and then mentioned future histological work to ensure whether the endocuticle is retained during molt and whether band counts change across shell condition. Rebert then ended her talk with another short film.

Bethany Stevick asked whether they were able to get known age red king crab from captive rearing programs. Rebert answered that they had three known age specimens from the Kodiak lab, but that they were small. These specimens were going to be used in references and for histology work. Helser commented that the specimens could be marked with calcein and held in the lab for several years. Rebert mentioned that the calcein work was a pilot to see if the mark was retained through molting and the work will be continued.

3. Craig Kastelle – Elevating the management tier of commercially important rockfish: II-Age determination and accuracy. (20 minutes)

Craig Kastelle presented work on a North Pacific Research Board funded project to evaluate the criteria and reading precision and produce a bomb produced age validation for red striped and harlequin rockfish. The age method is the typical break and burn method described in the AFSC age determination manual and fish collections were made between 1977 and 2015. Approximately 300 specimens with birth years between 1958-1970 were chosen and 40 random specimens for each species were selected to target the range impacted by bomb radiocarbon. Kastelle then showed examples of the broken and burned otoliths to describe method and then showed that the first two years were removed from each otolith to be sample at Woods Hole. These samples were compared to two reference chronologies: Piner and Wischniowski 2004, and Wischniowski's more recent reference from the Bering Sea. They used a five-parameter model and focused on the year of mean rise parameter. The year

of midrise was around 1963 for the Gulf of Alaska reference collection. For precision results, fish were aged four to six times and Kastelle showed results from two paired reads. There were no young fish, because their ages did not fall within target bomb radiocarbon years. Percent agreement was 46%, the APE was high, and the CV was 4.4. For ^{14}C, the estimated year of midrise was also 1963. The distribution of the parameter showed a 50% probability of under aging by 0.5 years, and underageing by more than one year is 30%. Helser added that reader agreement was also about 50%, and that included plus or minus one year is 80%. So, the precision for this rockfish was good. For harlequin, the percent agreement was good, the specimens were much older. For ^{14}C, the midpoint for the harlequin model was about 1966, so this indicates that there is a high probability of under aging by several years (about 50% probability of under aging by 3.5 years). Results suggested that redstriped rockfish were aged correctly and harlequin were potentially under aged by several years. This will help inform pattern criteria. Helser added that the study also increased the maximum longevity of the two species to 76 years for harlequin, and 45 years for red striped rockfish. These have been used to update management reference points. Kastelle clarified that these were not the same specimens that were submitted to ^{14}C analysis but were part of the larger group that used the same methods. Helser also mention that they are working on a model that incorporates age reader uncertainty into the radiocarbon analysis to get a true probably given age ranges.

McNeel noted two outlying specimens on one of the ^{14}C comparisons. Kastelle mentioned that those could have been large errors that need to be looked at. Helser suggested that these may be errors, or these specimens may not fit the assumptions of the bomb carbon analyses. Kastelle suggested that they may have been in a different location and Helser said that most analyses generally see several outliers. Helser also mentioned that they are planning a coastwide analysis for thornyhead rockfish that could include multiple agencies.

Wednesday, April 5, 2017

IX. Call to order:

Chris Gburski called the CARE meeting to order at 8:38am. Afterwards Elisa Russ went over TSC-CARE recommendations to clarify recommendations. In the 2015 recommendations to CARE, TSC thanked CARE for its work, but was discouraged that no best storage practice was decided upon. TSC asked that CARE continue work at the 2017 meeting and prepare a report of agency practices. Russ remarked that CARE has produced a list of practices, but that there is no consensus on the best practice. TSC was going move this request forward to the US Groundfish Management Team to pass this request onto the Council's Science and Statistical Committee to produce a study proposal on the best practices for otolith storage. TSC also acknowledged ergonomic issues and supported agencies working within to address issues. The TSC further supported non groundfish related work but reminded CARE that the original mandate is to work with groundfish and shellfish work need not be included on further TSC reports. Russ and CARE members clarified that groundfish are largely fish besides shellfish, salmon, and herring. Russ further summarized that TSC acknowledged the timing of CARE and that a summary of the CARE meeting could be submitted immediately following the meeting.

In the 2016 TSC recommendations, the TSC recommended to its parent committee that otolith storage be included as a five-year research priority. This was included and communicated to the Secretary of Commerce. The TSC removed the TSC-CARE recommendation since the research priority was developed. Craig Kastelle and Russ tried to clarify what was expected of CARE members. Kastelle and Russ recommended that a working group be developed to help on the subject.

X. Workshops, working groups, hands-on microscope work [8:30-5:00]

b. Rougheye rockfish workshop [9:00 – 12:00] Imaging Room 1110

The goal of this workshop was to look at early growth years and investigate any inter lab/agency ageing criteria for rougheye rockfish. Additionally, mixed species with rougheye rockfish (i.e., blackspotted rockfish) were discussed. Attendees viewed annotated rougheye rockfish break and burn otoliths on dissecting microscopes at imaging workstations. Samples were provided by the AFSC and ADF&G. Measured early year (first year) growth patterns and size from different regions were compared. Jeremy Harris (AFSC) provided support while using imaging software to calibrate measurements and scale bars for first year growth bands. Kevin McNeel brought young rougheye otoliths from North Gulf of Alaska with fish length and otolith length, height, and weight. From Harris's measures, the group identified identifiable first annulus with 1-1.5 mm dorsal-ventral width. They also discussed plus growth, clarified potential differences, and discussed differences in processing (i.e. breaking or cutting otoliths and using water dishes to clear whole otoliths). Betty Goetz (AFSC) and McNeel suggested the port samplers should collect young rougheye released during adult female sampling to get a better idea on the size of otolith between 0 and 1-year-old. There were 13 participants from AFSC, ADF&G, CDFO, and NWFSC.

Betty Goetz suggested that agencies talk about the research they were involved with rougheye, blackspotted, and shortraker rockfish. Harris and Charles Hutchinson (AFSC) are involved in research working on blackspotted, rougheye, and shortraker genetically identifies specimens. Lance Sullivan commented that the NWFSC is also going to work on a collection of potential blackspotted and rougheye rockfish. The workshop went back to the Traynor Room to go over shape analysis using shapeR. McNeel walked through an analysis of rougheye, blackspotted, and shortraker rockfish that he ran on previously tested specimens. Harris and Hutchinson commented that rougheye/blackspotted rockfish could impact results and that they had 19 out of 700 rougheye/blackspotted hybrids in their sample. McNeel commented that there was no indication of hybridization within the samples he tested. During the analysis, Joan Groot commented that readers at CDFO noted two distinct rougheye rockfish otolith patterns and felt that these might be related to rougheye and blackspotted. Harris commented that individuals at AFSC likely couldn't distinguished between the two species based on the shape of the whole otolith without analysis. After McNeel's demonstration, he told the group that the R script would be uploaded to the CARE forum.

B. Lingcod Workshop [10:30 – 12:00] (Imaging Room 1110 for ageing, Groundfish Lab 1125 for structure prep.)

Comparative age structures (i.e., sectioned fin rays, whole vertebrae, and otoliths) and ageing was discussed at this workshop. Andrew Claiborne (WDFW) began the workshop with a PowerPoint presentation 'Lingcod ageing & structure comparison.' Nikki Atkins (NWFSC) demonstrated lingcod fin ray preparation (pinning and drying) prior to sectioning and slide mounting for ageing. There were 14 participants from WDFW, AFSC, ADF&G, CDFO, and NWFSC.

XI. Scientific PowerPoint Presentation Continued [1:00 – 1:45]

1. Tom Helser - Fish Tales: isotopes, trace elements and increments, and what they tell us.

Tom Helser overviewed recent research projects and results. Helser started by acknowledging AFSC project members and funding agencies including NSF, University of Wisconsin Madison, Smithsonian, WISC SIMS, NPRB, OSU, and Woods Hole. He then went on to describe isotope, radiocarbon, and trace element work that AFSC has worked on for the sake of age validation, describing fish-climate relationships, and fish migration. Specifically, Helser summarized yellowfin sole research on how otolith increments, and somatic growth relate to temperature and climate change. He summarized how radiocarbon is tested and how that can change across geography and latitude. Helser emphasized the difference between processing error and observation error and making sure that the reference is appropriate for the test sample; he also emphasized that bomb radiocarbon analysis needs to be evaluated on the test sample and reader error to see what differences can be detected. Recently, their laboratory looked at bomb radiocarbon for harlequin rockfish, northern rockfish, and longnose skate. Helser described ^{18}O sampling and analysis to identify individual annuli. They were able to estimates probabilities of individual biases: 60% no bias, 25% overaged 1, and 10% underage by 1. AFSC has also used the ion microprobe to get better otolith sampling resolution. This work has been applied to Pacific cod survey otoliths, and those found in midden heaps. They found that for large otoliths, the micro milling produced similar quality data to the ion probe, but with smaller otoliths, the probe may be necessary. In addition to the validation and temperature work, they also looked at stock connectivity. They evaluated several trace chemicals (lithium, magnesium, strontium, barium, manganese, boron, and lead) using eulachon and cod. With eulachon, they found strong separation between the Bering Sea and Oregon, and they found that they could validate some age estimates using nearshore migration trends. For juvenile Pacific cod, there was a lot of variation temporally in a location. They also did work with Korean researchers using genetics (RADs) and trace elements analyses; they found that the genetic differences mirrored the microchemistry with value added. Helser reviewed the otolith chemistry in relationship to oceanography and runoff and suggested relationships but emphasized that water samples be collected for any study to compare. Helser overviewed statistical analysis of geoduck chronology data and proposed a way to include measurement error. They are also working on Pacific Ocean perch chronologies in the Bering; Helser noted some interesting temperature trends and trends related to the 1980 climate shift. AFSC also looked at Arctic cod and saffron cod using break and burn and thin sectioning. They found that ^{18}O sampling supported that annuli counts corresponded with chemical peaks. Helser also mentioned that they have been working with Ben Laurel in Newport, Oregon looking at temperature optimums in cod, establishing otolith ^{18}O relationships, and comparing laboratory growth experiments with wild caught fish to evaluate climate conditions. Finally, Tom Helser

overviewed their use of the Bruker TANGO FT-near infrared spectrometer. Helser overviewed the machine, went over their use and comparisons of wet and dry otoliths. He mentioned that the machine hits the otolith with energy and the excitation is scanned in the infrared spectrum. The machine then interprets the signal as an age using Fourier transformations and an age calibration based on previous age. They investigated walleye pollock age estimates and precision with reader assigned ages and found that there was a +/- 1-year agreement with the reader (RNS^2 of 0.5) and have also assessed otoliths from arrowtooth flounder and Pacific cod.

Break 2:15 – 2:30

XII. Workshops, working groups, hands-on microscope work (continued) [2:00-5:00]

C. Longnose Skate Workshop (Imaging Room 1110)

The goal of this workshop was for standardizing age determination protocols across multiple ageing labs through investigating a reference collection of vertebra thin sections and images from a validated ageing method. Chris Gburski and Beth Matta from the AFSC described images of thin sections and pointed out defining features as well as growth zones. They showed annotated images and specimens (under stereo scopes) to demonstrate hematoxylin-staining effects. Chris explained how water helps reduce glare of thin sections under reflected light but oil, while it reduces glare, tends to blur the pattern with time. Beth described how "birth marks" or "birth bands" (emergence from the egg case) are indicated by a slight change in the angle of the thin section. The current maximum age for longnose skate (18 years) was given. For validation efforts, Chris and Beth showed bomb radiocarbon data with a cluster of data suggesting potential issues with the analysis. Regarding precision efforts, they mentioned that structures were exchanged for ageing between AFSC, Pacific Shark Research Center/Moss Landing Marine Laboratories, and DFO. Both Chris and Beth mentioned they were trained on criteria at Moss Landing. The group looked at specimens and attempted band counts, and then Chris and Beth lead the group on a tour of the processing lab (showing saws, resins, and molds). Individuals took turns at the microscopes and imaging stations (including looking at 1-year-old specimens). Beth described life history events and biological differences between regional populations. Finally, Beth mentioned it might be worth trying the Mutvei's staining solution (that Bethany Stevick-WDFW mentioned earlier in the CARE meeting) to improve pattern clarity. Individual discussion included graduate work with Morgan Arrington (AFSC, University of Washington-Seattle) and lighting conditions (Morgan, Chris, Beth, and Tyler Johnson-NWFSC. There were 6 participants from AFSC, ADF&G, NWFSC, and ODFW.

1. Working Groups (Traynor Room and Room 2079)
2. Hands-on microscope work and calibration (Traynor Room)

A total of seven readers reviewed four species during the hands-on workshop at microscopes, mainly for calibration between age readers and agencies. Members aged black rockfish, yelloweye rockfish, eulachon, and Pacific Ocean perch. A demonstration for preparing (pinning and drying) lingcod fin rays was demonstrated by Nikki Atkins (PSFMC). See species aged, participating members, and agencies in Table 2.

CARE Social at the Wedgwood Ale House and Café-see sign-up sheet and directions (5:30-9:00)

Thursday, April 6, 2017

XIII. Recommendations [8:30 – 9:00]

Chris Gburski (AFSC) 2017 CARE Chairperson (Chris Gburski) called the meeting to order at 8:37 am. He thanked Delsa Anderl and Craig Kastelle for organizing the social and provided an updated schedule to the group. Elisa Russ summarized updates to CARE recommendations.

CARE to CARE 2017

A. Recommends the CARE Manual working group finalize and add the following sections to the CARE Manual on Generalized Age Determination and distribute the updated version of the manual to the CARE membership by June 1, 2017 with the finalized version to be submitted to the website working group by June 30, 2017 for posting on the CARE website:
    1. Lingcod Otolith Ageing Procedures section;
    2. Sablefish Ageing Procedures section;
    3. Thin Sectioning Method section – add a section under the General Ageing Procedures;
    4. Add section on baking otoliths under General Otolith Ageing Procedures;
    5. Ergonomics section including equipment checklist as appendix;

B. Recommends the Manual working group continue the revision and expansion of the CARE Manual on Generalized Age Determination with the following sections drafted or revised by May 1, 2018 for review and addition of edits to the manual by the 2019 CARE meeting:
    1. Walleye Pollock Ageing Procedures section (use AFSC manual as starting point);
    2. Spiny Dogfish Ageing Procedures section – summary of spiny dogfish age determination paper by Dr. Cindy Tribuzio;
    3. Rockfish Ageing Procedures section;
        a. Edit to avoid redundancy with Thin Sectioning section;
        b. Revise/move some information to General Otolith Ageing Procedures section where appropriate;
    4. Remove documentation sections regarding changes to CARE Manual
        a. See Recommendation C to post archived editions.
        b. Remove 2015 recommendation to add Acknowledgements section.

C. Recommends the CARE Manual working group submit archived editions of the CARE Manual to the website working group for posting on the CARE website to preserve historical records.

D. Recommends that the CARE Forum be continued.

E. Recommends the website working group continue to refine the searchable publication database to be housed at ADF&G, Juneau, so that relevant information is more accessible to the age reading community and stock assessors. Recommend CARE members enter publications into the database using the online form to populate the database. Recommend publications page includes full list of all publications with searchable feature at the top of page with a link to the publication entry form by CARE 2019. Verify online publication permissions prior to adding publication or abstract; may add abstract if not allowed to post full publication.

F. Additional recommendations for the website to be completed prior to the 2019 meeting are as follows:

    1. Add information at the top of the Species Information page to "Check with specific agency about changes in historical techniques"; report that "Methods listed are for most recent reporting year," or adjust in conjunction with changes incorporated in Recommendation G;

    2. Add table for agency contacts with e-mail address of agency leads and information on age readers and species (to be completed by April 30, 2017);

    3. Update agency production numbers annually (update website with current production numbers by April 30, 2017), and

        a. Include methods for current year and use appropriate codes (B&BN = Break- and-burn, B&BK = Break-and-bake);

        b. Update Species Information page to include new codes;

        c. Edits such as consistent capitalization on the Species Information page;

G. Recommends the Website subcommittee continue to research the possibility of converting the CARE website and CARE Forum to a different technology (Joomla is out-of-date and it requires a major undertaking to update to new version). The website working group will research software options and make a recommendation (e.g., WordPress, Drupal, or new version of Joomla).

H. Recommends that an Otolith Storage Ad-Hoc working group be created to address the issues of short and long-term storage of otoliths with a complete report reviewed by membership for CARE 2019. This is in response to prior TSC to CARE recommendations and due to the issue of otolith storage becoming a 2017-2021 research priority for the North Pacific Fishery Management Council. It is imperative that the historical archive of age structures is preserved.

I. Recommends the Charter Working Group revise the charter and submit it to CARE membership for approval by 2019 meeting; changes to include:

    1. Information on timelines including preparation of TSC report following same year CARE meeting;

    2. Submission of production numbers (species aged table); and

    3. Chair coordination with host agency regarding meeting logistics.

J. Recommends that the Sablefish Ad-Hoc working group produce a final report summarizing their work to be published on the CARE website by the 2019 meeting with possible publication as a formal report.

K. Recommends that a Skate Ad-Hoc working group be created for standardization of age determination methods; this project already has funding through NOAA Fisheries.

L. Recommends that a Rougheye/Blackspotted/Shortraker Rockfish Ad-Hoc working group be created for addressing mixed sample issues involving these three, long-lived species and possibly other slope rockfish species.

M. Recommend posting list of maximum ages on CARE website (or link to lists on AFSC and ADF&G/ADU - Juneau, websites). Recommend developing a process to update maximum ages including a CARE age structure exchange between appropriate agencies (age structure exchange may be done at CARE meeting to minimize transport and maximize efficiency).

CARE to TSC 2017

A. CARE recognizes that otolith storage was approved as a 2017-2021 research priority for the North Pacific Management Council. CARE appreciates that the TSC recognizes that CARE members are experts in the field of otolith reading and storage, and are thus best suited to develop and use best practices. As requested by the TSC, CARE has initiated this process to document structures and storage methods currently in use (by species and agency) with information on their benefits and deficits. This request has been addressed by creating an ad-hoc working group to report on current procedures for short and long-term storage of otoliths by CARE agencies and produce a document to support this research priority.

XIV. Concluding CARE Business [9:00 –10:00]

1. Symposia updates

Several members reported attending the 2016 Western Groundfish Conference 2016 in Newport

2. Administration nominations

Chris Gburski and Lance Sullivan will end service as CARE Chair and Vice Chair on June 30. The group nominate and voted in Kevin McNeel as Chair, Barb Campbell as Vice Chair, and Nikki Atkinson as Secretary for the 20th meeting.

3. Schedule and location of 2019 meeting

The group could not meet a consensus on the next location for the 2019 CARE meeting. Several agencies offered to potentially host, but the group decided to send out a list of possible meeting locations by December 2017 and see if there are current travel and building limitations.

XV. CARE Business Meeting Adjourns [10:03]

Table 1. Attendees of the CARE Conference, April 4-7, 2017, Seattle, Washington, U.S.A.

Last name	First name	Agency	Location	Country	Email
Pollak	Andrew	ADF&G	Homer	USA	andrew.pollak@alaska.gov
Russ	Elisa	ADF&G	Homer	USA	elisa.russ@alaska.gov
McNeel	Kevin	ADF&G	Juneau	USA	kevin.mcneel@alaska.gov
Rebert	April	ADF&G	Juneau	USA	april.rebert@alaska.gov
El Mejjati	Sonya	ADF&G	Kodiak	USA	sonya.elmejjati@alaska.gov
Anderl	Delsa	AFSC	Seattle	USA	delsa.anderl@noaa.gov
Arrington	Morgan	AFSC	Seattle	USA	morgan.arrington@noaa.gov
Benson	Irina	AFSC	Seattle	USA	irina.benson@noaa.gov
Brogan	John	AFSC	Seattle	USA	john.brogan@noaa.gov
Gburski	Chris	AFSC	Seattle	USA	christopher.gburski@noaa.gov
Goetz	Betty	AFSC	Seattle	USA	betty.goetz@noaa.gov
Harris	Jeremy	AFSC	Seattle	USA	jeremy.harris@noaa.gov
Helser	Thomas	AFSC	Seattle	USA	thomas.helser@noaa.gov
Hutchinson	Charles	AFSC	Seattle	USA	charles.hutchinson@noaa.gov
Kastelle	Craig	AFSC	Seattle	USA	craig.kastelle@noaa.gov
Matta	Beth	AFSC	Seattle	USA	beth.matta@noaa.gov
Neidetcher	Sandi	AFSC	Seattle	USA	sandi.neidetcher@noaa.gov
Pearce	Julie	AFSC	Seattle	USA	julie.pearce@noaa.gov
Piston	Charlie	AFSC	Seattle	USA	charlie.piston@noaa.gov
Short	Jon	AFSC	Seattle	USA	jon.short@noaa.gov
TenBrink	Todd	AFSC	Seattle	USA	todd.tenbrink@noaa.gov
Williams	Kali	AFSC	Seattle	USA	kali.williams@noaa.gov
Campbell	Barbara	CDFO	Nanaimo	Canada	barbara.campbell@dfo-mpo.gc.ca
Groot	Joanne	CDFO	Nanaimo	Canada	joanne.groot@dfo-mpo.gc.ca
Wischniowski	Stephen	CDFO	Nanaimo	Canada	stephen.wischniowski@dfo-mpo.gc.c
Forsberg	Joan	IPHC	Seattle	USA	joan@iphc.int
Johnston	Chris	IPHC	Seattle	USA	chris@iphc.int
Planas	Josep	IPHC	Seattle	USA	josep@iphc.int
Rudy	Dana	IPHC	Seattle	USA	dana@iphc.int

Tobin	Robert	IPHC	Seattle	USA	robert@iphc.int
Atkins	Nikki	NWFSC	Newport	USA	nikki.atkins@noaa.gov
Hale	James	NWFSC	Newport	USA	james.hale@noaa.gov
Johnson	Tyler	NWFSC	Newport	USA	tyler.johnson@noaa.gov
McDonald	Patrick	NWFSC	Newport	USA	pmcdonald@psmfc.org
Sullivan	Lance	NWFSC	Newport	USA	lance.sullivan@noaa.gov
Kautzi	Lisa	ODFW	Newport	USA	lisa.a.kautzi@state.or.us
Claiborne	Andrew	WDFW	Olympia	USA	andrew.claiborne@dfw.wa.gov
Hildebrandt	Anna	WDFW	Olympia	USA	anna.hildebrandt@dfw.wa.gov
Rosenfield	Sandra	WDFW	Olympia	USA	sandra.rosenfield@dfw.wa.gov
Stevick	Bethany	WDFW	Olympia	USA	bethany.stevick@dfw.wa.gov
Topping	Jennifer	WDFW	Olympia	USA	jennifer.topping@dfw.wa.gov

Table 2. 2015 CARE Hands-On "Scope Time" Session – Species Aged, Participants, and Agency.

Species	Participants	Agency	Comments
Black Rockfish	Sonja El Mejjati	ADF&G	Calibration
	Lisa Kautzi	WDFW	
Yelloweye Rockfish	Elisa Russ	ADF&G	Calibration
	Andrew Pollak	ADF&G	
	Patrick McDonald	NWFSC	
Eulachon		WDFW	Calibration
		DFO	
		NWFSC	
Pacific Ocean Perch	Betty Goetz	AFSC	Calibration
	James Hale	NWFSC	

Table 3. CARE age structure exchanges initiated in 2016.

Exchange ID No.	Species	Originating Agency	Coordinator	Coordinating Agency
16-001	Pacific herring	CDFO	Joanne Groot	WDFW
16-002	Pacific herring	WDFW	Andrew Claiborne	CDFO

Figure 1: Attendees of the 2017 CARE Conference, April 4-7, 2017 Group Photo.

Appendix I: 2017 CARE Oral and Poster Presentation Abstracts

Nineteenth Biennial Meeting of the
Committee of Age Reading Experts

Working Group of the Canada – US Groundfish Committee TSC
AFSC Sand Point Facility, NOAA Western Regional Center
April 4 – 6, 2017

Oral Presentations

A. Kevin McNeel, *Update on shortraker rockfish (Sebastes borealis) otolith analyses*. (20 min)

B. April Rebert, *How old is that crab? Progress on an age old question.* (20min)

C. Tom Helser - Fish Tales: isotopes, trace elements and increments, and what they tell us. (45 min)

Poster Presentations – See abstracts for author and agency info.

A. A 200 year archeozoological record of Pacific cod life history as revealed through Ion Microprobe oxygen isotope ratios in otoliths.

B. Modeling Environmental Factors Affecting Assimilation of Bomb-produced $\Delta^{14}C$ in the North Pacific Ocean: Implications for age validation studies.

C. Age validation of Pacific cod (*Gadus macorcephalus*) using high resolution stable oxygen isotope ($\delta\ ^{18}O$) signatures in otoliths.

D. What to do when dogfish lie about their age?

E. Bomb Dating and Age Estimates of Big Skate (*Beringraja binoculata*) and Longnose Skate (Raja rhina).

F. Changes in Pacific cod otolith weight over time.

G. Re-ageing of archived otoliths from the 1920s to the 1990s.

H. Preparing baked thick sections of Pacific halibut otoliths.

Type of Presentation: Oral

Title: How old is that crab? Progress on an age old question

Authors and affiliation:

April Rebert[1,2], Joel Webb[1], Kevin McNeel[1], and Gordon Kruse[2]

[1]Alaska Department of Fish and Game, Division of Commercial Fisheries, Mark, Tag and Age Laboratory, Juneau, AK 99811

[2]University of Alaska Fairbanks, College of Fisheries and Ocean Sciences, Juneau, Alaska 99801

Abstract:

Age information provides direct insight into rates of growth, reproduction, and survival essential to stock assessment and fishery management. Crab and shrimp have long supported vital fisheries in Alaska, but direct determination of their ages has not been possible. Structures useful for age determination (e.g. fish otoliths) are generally retained throughout the lifespan; banding patterns on these growth structures associated with seasonal growth variability are interpreted as indices of chronological age. Due to the loss of the calcified cuticle during molting, it has been presumed that age determination in crab and shrimp is impossible. However, banding patterns potentially useful for age determination were recently

identified in the gastric mill (grinding apparatus in stomachs) of snow and red king crabs and eyestalks of spot shrimp from Alaska. This study investigates whether banding patterns on these structures yield reliable indices of chronological age for crabs and shrimp by: (1) developing standardized workflows to facilitate evaluation of differences in band counts between groups of small and large individuals for each species; (2) examining whether the endocuticle layer of each structure is retained through the lifetime to describe potential band retention or formation; and (3) evaluating chemical marking methods that can be used to validate that bands form annually. Project milestones to date include: (1) production of over 2,000 thin-sections for band counts; (2) sampling of red king crab and spot shrimp before and after molting to evaluate cuticle retention; and (3) identification of calcein as an effective fluorescent marker for age validation.

Time requested: 20 min

Type of Presentation: Oral

Title: Update on shortraker rockfish (*Sebastes borealis*) otolith analyses

Authors and affiliation:

Kevin McNeel

Alaska Department of Fish and Game, Division of Commercial Fisheries, Mark, Tag and Age Laboratory, Juneau, AK 99811

Abstract:

Shortraker rockfish (*Sebastes borealis*) are a long-lived, high trophic-level fish found in the North Pacific that are caught as bycatch in longline, and trawl fisheries. Management of these fisheries is potentially constrained by limited life history and catch information for this species. Furthermore, species misidentification and limited age validation force management to use potentially conservative estimates of allowable catch. A greater understanding of species specific characteristics, current age criteria accuracy, and factors influencing productivity would provide insights helping to reduce uncertainty in stock assessments. Studies of sagittal otolith shape, chemistry, and annual increments have been used to investigate these issues. The Alaska Department of Fish and Game has a historic archive of shortraker and other rockfish otoliths and otolith measurements including otolith length, height, weight, and core ^{14}C activity. To improve life history information, I propose to (1) use available and shape measurement data to discriminate between potentially misidentified species, (2) provide a limited age criteria validation with available ^{14}C data, and (3) develop a chronology of shortraker rockfish growth using otolith annual increment measurements to compare with climate and ecosystem trends from fish caught in Prince William Sound.

Time requested: 20 min

Poster Title: Reconstructing the growth history of Pacific halibut (*Hippoglossus stenolepis*) natural population by otolith increment analysis

Poster Presenter: Dana M. Rudy

Authors: Dana Rudy, Chris Johnston, Robert Tobin, Tim Loher, Ian Stewart, Josep V. Planas, Joan Forsberg. International Pacific Halibut Commission, 2320 W. Commodore Way, Seattle, WA 98119. All email correspondence to dana@iphc.int

Abstract: The Pacific halibut (*Hippoglossus stenolepis*) is one of the largest and longest-lived flatfish in the world, reaching up to 200 kg in body weight and 2.4 m in length and with the oldest individual caught aged at 55 yrs. Although female Pacific halibut attain much larger sizes than males, the average size at age for both males and females has significantly decreased during the last 25 years, especially in the Gulf of Alaska. This has led to a decrease in the exploitable biomass of halibut stocks. Several factors, including environmental, fisheries-related and even anthropogenic, could be responsible for the observed decrease in the growth potential of this species. Here, we looked at Pacific halibut otoliths from the 1977, 1987, 1992, and 2002 cohorts from the Gulf of Alaska. Over the past few decades, which include these cohorts, the International Pacific Halibut Commission (IPHC) has observed a significant decline in halibut size at age throughout their range. However, we did not find a similar decline in otolith growth during this time period for halibut in the Gulf of Alaska. For example, in 15-year-old females sampled from the 1977 and 1992 cohorts, there was a 2.45% increase in mean otolith radius during that time period, despite a 14.97% decrease in mean body length for those fish. Additionally, we found that otolith accretion in male and female halibut does not reflect their large dimorphic size differences. Although factors regulating otolith growth in Pacific halibut are not well understood, otolith growth appears to be independent of somatic growth.