C.A.R.E. 2024 Agenda

Twenty-third Biennial Meeting of the Committee of Age Reading Experts

Working Group of the Canada – US Groundfish Committee TSC
Hatfield Marine Science Center
2030 SE OSU Drive, Newport, OR, USA
Guin Library Seminar Room
April 2–4 , 2024

Tuesday, April 2, 2024

I. Call to Order [8:30 am (Guin Library Hours 8:00am-5:00pm)] – CARE Chair (Patrick McDonald)

II. Host Statement

1. Welcome statements & host info: safety/security orientation, refreshments, social. etc.

III. Introductions

1. Round-table intro (name, agency, location)
2. Attendance-address, phone, email (written list distributed)
   Attendance list appended to end of minutes

IV. Approval of 2024 Agenda - Unanimous

V. Working Group Reports [9:00 – 9:40] Activity since CARE 2023 (~ 5 min each)

1. TSC Meeting 2023 (Andrew Claiborne)
   Nanaimo, BC. Updated about the CARE report – new officers, change in meeting schedule, Newport venue, working group updates
2. Age Structure exchanges (Mark Terwilliger)
   Only one year, so only 5 exchanges. All were rougheye & blackspotted. No results in from those yet.
3. Website (Jamie Hale)
   Website still stable, charter edited for formatting, added old age reading manual from 1984. Back end of the site is being updated.
4. CARE Forum (Nikki Paige)
   Not much daily use by members, but still potentially useful. Perhaps use to post exchanges again.
5. CARE Manual (Barb Campbell and Kevin McNeel)
   Updates and additions meant to be collected and then one big revamp, but that's taking a while. Maybe shifting to updating sections at a time, so the new information is reflected sooner.

Working group will meet Wednesday afternoon to discuss.

6. Charter Committee
   Only member was Elisa. Kevin McNeel volunteered to be the new Charter Committee, and James Hale volunteered to assist as he has been cleaning up the formatting for posting on the website. They will work together to clean up the charter and propose any edits that need to be made.
7. Lingcod Working Group (Mark Terwilliger/Leif Rasmuson)
   Oversampling of small and large fish attempted, to fill out the curve, but it was difficult.
   ODFW, oto age overestimated compared to fins. 36% agreement, minus bias. 47% younger than 5
   NWFSC more balanced skew, 50% agreement, younger cohort
   WDFW minus bias, 30% agreement
   How many MORE otos could you get done over fins?

VI. CARE & TSC Recommendations [9:40 – 10:15]

1. CARE to CARE 2023
   a. Manual working group - sections - if want to vote on, should have been submitted by July 2023, but did not happen. Submit whatever you have by end of week and we can vote to add it. Provide additional time line for those that still need to be submitted in Wed working group.
   b. Care manual - update age validation list in manual? Discuss with other items on Wed working group. Sections to postpone or discuss on Wed - Google drive access (additional cost for other agencies to use Google drive). Post old manuals to website - done by Julie Pearce (AFSC) – accomplished
   c. Production numbers biannually around meetings. Didn't ask for it this year, Send numbers to Jon Short or wait until next year? Production numbers to find someone to contact if there are questions about aging species. Send to Vice-Chair to make sure scientific names are good etc. Production numbers are by the calendar year they are read, not when they are collected.
   d. Lingcod - objective 1 - work with manual to include LCOD otolith methods - document comments on line, objective 2 - ID expert on fins and otoliths, name them - to be discussed.
   e. Max age info - REYE has been listed - References from other agencies. Ages published by Chris Monk. Age only 95, but maybe older, validate agreement for multiple people.
   f. Care moved to even years, but Western Groundfish conference is moving back to evens as well. Discuss to switch back to odd years - another back to back or wait 3 yrs.? (Feb 2026 - next WGFC)

2. Care to TSC 2023
   a. Morphological data- support across agencies, scales, calipers, FT-NIRS, software, etc.). Summary this afternoon.
   b. Travel costs? Funding for non-Federal to TSC possible, but may be more convoluted than needed. May not be available in future for that. Cover 1 person for each agency to come to CARE?

3. TSC to Care 2023
   a. Methods to advance communication between CARE and TSC. Have TSC attend CARE meeting
   b. Recognize recommendations to use LCOD structure with FTNIRS

c. Library of video instructional videos to be housed on CARE website. AFSC - have a number of videos already done, have to make sure they can post on CARE website. AFSC - Prep for gadids, etc. SABL, Pollock, PCOD, DOVR, POP, Yellowfin, Greenland Turbot, planning to add REYE and blackspotted in 2025-2026. NWFSC - QLBK, PTRL, WDFW, BLCK; ODFW - LCOD fin prep video - rudimentary. Discuss making agreements between labs for videos or just for lab. Or listing a personal contact to see if you want a copy, as only have in house copy of item. Standardizing videos so that you can make changes. Question on how to do this? Should Delsa's sablefish instructional video be the standard? .

Break 10:15 – 10:30

VII. Agency Reports [10:30 – 11:30] Activity since CARE 2023 (~ 5 min each)

1. CDFO – (Steve Wischniowski/Audrey Ty)

Since CARE 2023 Aged:

Common Name	Scientific Name	Group	2023-24
Dover sole	Microstomus pacificus	flatfish	2833
		subtotal	2,833
Pacific ocean perch	Sebastes alutus	rockfish	627
Yellowtail rockfish	Sebastes flavidus	rockfish	797
Bocaccio	Sebastes paucispinis	rockfish	303
Yelloweye rockfish	Sebastes ruberrimus	rockfish	50
		subtotal	1,777
Sablefish	Anoplopoma fimbria	roundfish	1088
Lingcod	Ophiodon elongatus	roundfish	459
Hake	Merluccius productus	roundfish	3016
		subtotal	4,563
Total Groundfish		Total	9,173
Herring	Clupea harengus pallasi	pelagics	17687
Total Pelagics			17,687
Chum	Oncorhynchus keta	salmonids	6078
Coho	Oncorhynchus kisutch	salmonids	9049
Sockeye/Kokanee	Oncorhynchus nerka	salmonids	17981
Chinook	Oncorhynchus tshawytscha	salmonids	32178
Total Salmonids			65,286
Geoduck	Panopea abrupta	shellfish	268
Total Shellfish			268

Total Ages Produced		92,414
Number of Agers	(Full-time Equivalent)	6

Since August 4th 2022, Steve Wischniowski has continued in a research role and Audrey Ty has continued as acting manager.
One experienced ager retired end of May 2023. We hired a new ager in August 2023.
Promoted two staff members to Trainers. Added a standardized training evaluation to the training plan developed in August 2022. Already showing an increase of about a thousand fish aged per month compared to 2021 fiscal year

Kali Stone/Winnipeg
East and west coast species across Canada. Beaufort Sea, freshwater arctic char & lake trout (2-3000). Dolly Parton char 1000 Age up to 56 different species. Greenland halibut (3000/yr.) Total ages for the year ~15,000 structures. Team of 5 in the lab.

2. IPHC – (Joan Forsberg)

The number of full-time age readers was reduced from three to two in 2023. Therefore, the usual goal of having all current-year otoliths from fishery-independent setline survey and commercial catch samples aged for the stock assessment was modified to fit production capabilities.
In previous years, readers aged a combined total of 25,000 to 30,000 otoliths annually. In 2023, a total of 14,243 otoliths were aged for the stock assessment.

Modified plan for 2023 included:

- reading all setline survey otoliths prior to assessment,
- reducing number aged from commercial samples by prioritizing otoliths from select catch areas (WA/OR/CA and BS/AI) for assessment,
- not aging the NMFS trawl survey samples or the ADF&G recreational samples
- Aging the remaining otoliths from the 2023 commercial catch collection in the early 2024, followed by QA/QC on the 2023 setline survey and commercial samples.

Age reading plan for 2024 involves:

- reading all setline survey otoliths plus all commercial samples from the Bering Sea/Aleutians but aging a 50% subsample of commercial samples from all other areas for the 2024 stock assessment
- reading the 2024 recreational and trawl survey otoliths in the winter/spring of 2024/2025.
- Training of two part-time readers is ongoing with goal of having them participate in the 2024 production aging.

IPHC is also investigating the use of artificial intelligence (AI) for aging Pacific halibut from otolith images. The AI model uses deep learning through a convolutional neural network (CNN). Age group staff have been photographing previously broken-and-baked and aged otoliths for input into the AI. The AI code was adapted from the DeepOtolith open-source AI platform https://www.mdpi.com/2410-3888/7/3/121.

- A total of 2000 images have been generated so far from otoliths from the 2019 setline survey collection.
- Plan for 2024 is to collect photos of whole otoliths before break/bake as well as ‘after’ photographs, to test AI accuracy on whole oto images. Would be more efficient, eliminate

need for B&B

- AI doesn't eliminate need for trained readers, intent is for it to be used in supplemental capacity
- Using Amscope camera, TIFF format, same magnification for all images
- No annotation of image to mark rings; inputs to model for training currently include image and age. The model decomposes the image into so-called convolutional layers and identifies itself the features that are informative for age determination. Other data such as date and area of catch, length, sex, etc. can also be added
- PowerPoint presentation will be added to google docs
- Interested in hearing from others using AI
- IPHC may be able to offer work on AI project as part of internship program

Video showing Pacific halibut age reading techniques as requested by the TSC: postponed.

3. ADFG
    a. Kodiak, Commercial (Sonya Elmejjati)
    There are 2 age readers in the Kodiak ADFG age lab who work seasonally for 4 months, typically from January through April. Sonya Elmejjati has been age reading since 2008 (17 seasons) and Jessica Horn started in 2020 (5 seasons). In the summer, Jessica works out of Chignik sampling sockeye smolt for AWL, taking limnology data, and entering commercial fisheries data for the sockeye fishery. Outside of the age lab, Sonya leads the Kodiak port sampling program in collecting biological samples from State managed groundfish and shellfish species that are harvested in the Kodiak, Chignik, and South Alaska Peninsula areas. Species of sampled groundfish include Pacific cod, black rockfish, dark rockfish, lingcod (opportunistic sampling) and a few miscellaneous rockfish spp. Pollock are also occasionally sampled from the commercial Prince William Sound fisheries for the Homer ADFG office and otoliths are sent to the Homer office.

    Otoliths collected by Kodiak port samplers (except Pollock) are processed and aged in the Kodiak lab and typically amount to 2000 Pacific cod otoliths, 1000 black rockfish, and 500 dark rockfish annually. We production age only. Precision testing is completed on 20-40% of all samples and on 100% of samples that are aged by new age readers at the beginning of the season. All differences are resolved. The lab uses the break and burn method for rockfish. For Pacific cod, one otolith is cut with an Isomet saw and both otolith halves are baked rather than burned for 12 min at 400F using a standard toaster oven to prevent otoliths from bursting. The baking process is time consuming but saves time during age reading. Otoliths are stored dry.

    Starting in 2017, morphometric measurements have been collected for all species (otolith length, width, and weight, excluding crystalized or broken otoliths). This information helps find outliers, age errors, misdeed species, and data entry errors.

    b. Juneau, ADU – (Kevin McNeel)
    The ADF&G Age Determination Unit (ADU) is the statewide groundfish and invertebrate age reading program based out of Juneau, AK. The ADU currently has two permanent staff, two seasonal staff, and interim personnel borrowed from adjacent ADF&G projects. The ADU has had turnover and had one biologist, Chris Hinds, leave

the program. Josh Dore, Mason Emery, Mark Plumb, and Kevin McNeel are the primary groundfish age readers for the lab.

During 2023, the ADU received 11,258 otolith sets from Central and Southeast Alaska commercial and survey sampling (representing 14 groundfish species). The ADU focused on processing sablefish, rougheye rockfish, yelloweye rockfish, shortraker rockfish, lingcod, and black rockfish, as well as weathervane scallops. The lab plans to process Pacific cod and thornyhead again soon, but those were not processed in 2023 due to training and targeted species. Annually, the ADU distributes approximately 10,000 ages to regional managers.

During processing, personnel measure and weigh 100% of otoliths and shell for quality control. Age estimates are compared to growth model intervals in addition to random subsets of second reads. Growth models consist of estimated fish length and otolith weight at age ranges for lingcod, black rockfish, yelloweye rockfish, rougheye rockfish, shortraker rockfish, shortspine thornyhead, sablefish, and scallops. Estimated size-at-age values were developed from Ludwig von Bertalanffy and exponential growth models, and reasonable error ranges per size were entered into a database table. Further, personnel develop Shiny apps to look at fishery data to flag and address outliers. In 2023, personnel conducted an Age and Growth workshop at the Western Groundfish conference with AFSC personnel and look forward to working with others on lingcod, sablefish, rougheye, Pacific cod, otolith measurement, and the CARE manual.

For age related research, ADU personnel participated in the following projects:
In collaboration with NOAA Alaska Fishery Science Center, Little Port Walter staff, and University of Alaska faculty and students ADU staff continue to support a long-term Pacific cod and walleye Pollock rearing study. This research includes studying daily marks and otolith growth through fluorescent stains and near infrared spectroscopy as well as testing blood, tissue, and bone samples across ontogeny to study changes in chemistry and hormones across life stages. In 2023, a University of Alaska Fairbanks graduate student started work processing otoliths to reconstruct larval life history, and AFSC, ADU, and UAF personnel processed plasma samples to get estimated hormone activity. ADU and program staff are looking to apply lifetime hormone reconstructions to other species and validate the method.

In collaboration with the ADF&G Gulf of Alaska Bottomfish Program (GOAB), ADU staff presented comparisons between fin spine and otolith age estimation methods using paired structures at the 2023 Western Groundfish Conference.

In collaboration with the AFSC, Auke Bay Laboratories, ADU staff aided an investigation of age-0 lapillar and sagittal otoliths to infer daily growth in juvenile sablefish in the Gulf of Alaska. This study used laboratory reared fish in temperature and feed treatments and the manuscript is in internal review. The results of the study were published in Fisheries Research

In collaboration with Allen Andrews, ADU and program personnel are analyzing historically collected shortspine thornyhead and black rockfish bomb radiocarbon data for age validation and to make the data available.

ADU personnel concluded age validation work using bomb radiocarbon, species identification using otolith shape, and biochronologies for shortraker rockfish in Prince William Sound. The results of that will be presented later.
Strasburger, W. W., D. Nicolls, C. M. Hinds, and K. W. McNeel. 2023. The utility of juvenile sablefish otoliths in reconstructing life history and growth in the Gulf of Alaska. Fisheries Research 268:106841.

c. Homer, Commercial (Andrew Pollack)
(No report submitted)

d. Homer, Sportfish (Marian Ford)
The ADF&G-Homer sportfish aging lab is part of the Southcentral Alaska Halibut and Groundfish Harvest Assessment program. The port sampling program collects biological samples including age structures (otoliths and fin rays) from groundfish species harvested by the sport fishery in Cook Inlet and Prince William Sound management areas. Samples are collected by field technicians in the ports of Homer, Anchor Point, Ninilchik, Seward, Kodiak, Whittier, and Valdez. The lab also receives black rockfish otoliths to age from the Southeast Alaska port sampling program collected from Elfin Cove, Ketchikan, and Sitka.

The majority of production age reading is done by program biologist Marian Ford, with additional sample preparation and aging done by one seasonal technician, Tim Blackmon. Our program is supervised by Clay McKean out of the Anchorage office.

In 2023, the Homer lab prioritized the aging of black and yelloweye rockfish in response to an ADF&G Statewide Rockfish Initiative, but also aged dark, dusky, quillback, and other rockfish species as time allowed. A total of 2,992 otoliths were aged this season. Lingcod fin rays are cross-sectioned and mounted on slides for aging. A total of 496 fin ray slides were prepared for the 2023 season but have not yet been aged. All halibut otoliths collected by our project are sent to the IPHC for aging.

Each season agers do calibration testing for each species before moving on to production age reading. Precision testing is done on 20% of all samples. In the last couple years, the Homer lab participated in an interagency black rockfish otolith exchange and participated in a lingcod otolith/fin ray exchange with the ADU lab. We also recently sent the ADU mounted lingcod finray slides from previous seasons to assist them with training.

4. NWFSC – (Patrick McDonald)
Staff/New Hires: We currently have 7 people in our lab that includes 5 full-time traditional age readers, 1FT-NIRS scanning lead and 1 team lead. Betty Kamikawa, our most experienced rockfish age reader retired in September of 2023. Due to funding concerns, we did not backfill that position.

With respect to our traditional age reading capacity – we are where we were in 2002 when we had 5 full time age readers.

On the FT-NIRS side we hired Emily Wallingford our newest addition. She began on

November 6th, 2023. We are planning on backfilling Meredith's position this Spring/early summer.

We supported the following assessments in 2023 – canary rockfish, Petrale sole, copper rockfish, black rockfish, Pacific hake and sablefish. The sablefish assessment was done to better evaluate potentially historic back-to-back year classes from 2020 and 2021. We also keep tracking a strong 2016 year class. In terms of ageing totals, we production aged 23,183 otoliths and double read 5,547.

Despite no assessments on lingcod or Pacific spiny dogfish, we did allocate time to processing structures to move them out of the buildings walk-in freezer which is very space limited. We pinned and glued 1,123 lingcod fin rays. The more time-consuming stage is cutting and we were able to cut 213 of those 1,123. We also de-fleshed 1,178 dogfish spines.

Projects that we have worked on the past year include a few things. We aged lingcod otoliths as part of the lingcod structure comparison study. We also have a set of genetically confirmed rougheye and blackspotted rockfish that are part of a maturity study. Liz has been exploring OSA on that species complex.

The NWFSC Ageing Lab in Newport, OR sent two age readers (Tyler Johnson and Nikki Paige) to the 2024 Spiny Dogfish (DSRK) Workshop held in Raleigh, NC. The Newport Age Lab has been preparing specimens and seeking guidance on ageing techniques ahead of a likely 2025 assessment. This spine is a unique ageing structure with a high degree of difficulty in interpretation. This workshop allowed Newport age readers an opportunity to discuss and learn preparation and ageing techniques with multiple different agencies in attendance. Funding for this trip was provided by the Mid-Atlantic Fishery Management Council.

Jamie developed a Shiny App, based on some R scripts he had been using to plot length-at-age curves to identify outliers. It fits a von Bertalanffy growth model to the data and highlights any points that fall farther than 2 or 3 standard deviations from the curve. It's quick and convenient. You just upload ages and associated biodata into the app, and it shows a growth curve along with a table of outliers that might need re-examination.

NWFSC FT-NIRS Update (Emily Wallingford)
Emily was hired on with PSMFC back in November 2023 to help continue FT-NIRS efforts while Meredith, was on leave. Although Meredith resigned recently she was absolutely integral to the start-up of the FT-NIRS initiative here in Newport along with our SIDT partners, especially at the AFSC. We started with an MPA machine in January of last year, which Meredith set up and designed a scanning protocol for over the next few months. Unfortunately, it was determined that the MPA machine was faulty and could not produce reliable scans. It had been used as a travel demo machine for several years before making its way to Hatfield, and it was no longer production worthy. After debate and discussion, the NWFSC decided to purchase a TANGO which was delivered on September 27th.

We've been focusing on scanning NWFSC COMBO sablefish samples, and so far have scanned years 2023-2017. We will be adding data from 2015 and 2016 to give us an 8 year range. John Wallace at the NWFSC will be analyzing the data and the plan is to present the data in June to the SSC to approve the incorporation of FT-NIRS age estimates in a likely 2025 sablefish stock assessment. In addition to sablefish, we have also scanned several years of

rougheye and blackspotted rockfish (a lot of those were genetically confirmed). In total, we've scanned over 9,000 sablefish, over 3,000 hake, 500 rougheye, and about 100 blackspotted rockfish, totaling at just over 13,000 production scans. We also complete a monthly stability test on Hake otoliths where half are stored in ethanol and half are stored in dry trays. At the completion of the yearlong study in October 2024, we hope to determine if there is any difference in scanning data between wet and dry structure storage over time. FT-NIRS aging work is a fascinating new initiative and I as well as the whole Newport team are excited to see where it leads.

5. WDFW – (Andrew Claiborne)

Personnel Update:
WDFW has the same team in the Fish Ageing Lab since CARE last met in 2023.

Jenny Topping- Lead Groundfish Age Reader
Merrie Schultz- Groundfish Age Reader
Austin Anderson-Salmon Age Reader
Christina Jump-Freshwater Age Reader and Database
Andrew Claiborne-Team Lead and Salmon Age Reader

Research Update:
The WDFW Fish Ageing Lab has participated in one exchange (dogfish) since 2023. WDFW is collaborating on a study with Oregon State University looking at the potential of using Petrale sole otolith chemistry as an indicator of ocean hypoxia. WDFW is working with the lingcod working group to compare age estimates from fin rays versus otoliths and we have completed our age estimates. Four WDFW staff attended the spiny dogfish ageing workshop in Raleigh, North Carolina in January of 2024. WDFW is continuing to research the use of spiny dogfish stained vertebrae for age estimation.

Production Age Reading Update since 2023 CARE:

Common Name	Scientific Name	Year	N	Agency
black rockfish	*Sebastes melanops*	2022	1318	WDFW
canary rockfish	*Sebastes pinniger*	2018	356	WDFW
canary rockfish	*Sebastes pinniger*	2019	1619	WDFW
canary rockfish	*Sebastes pinniger*	2020	791	WDFW
canary rockfish	*Sebastes pinniger*	2021	1700	WDFW
canary rockfish	*Sebastes pinniger*	2022	1931	WDFW
Pacific sardine	*Sardinops sagax*	2022	430	WDFW
Pacific sardine	*Sardinops sagax*	2023	624	WDFW
spiny dogfish	*Squalus suckleyi*	2014	53	WDFW
spiny dogfish	*Squalus suckleyi*	2016	36	WDFW
yellowtail rockfish	*Sebastes flavidus*	2018	3	WDFW
yellowtail rockfish	*Sebastes flavidus*	2019	210	WDFW
yellowtail rockfish	*Sebastes flavidus*	2020	646	WDFW
yellowtail rockfish	*Sebastes flavidus*	2021	2446	WDFW
yellowtail rockfish	*Sebastes flavidus*	2022	1513	WDFW
steelhead	*Oncorhynchus mykiss*	2023	2867	WDFW
chum salmon	*Oncorhynchus keta*	2023	20074	WDFW
coho salmon	*Oncorhynchus kisutch*	2023	1014	WDFW

sockeye salmon	*Oncorhynchus nerka*	2023	1293	WDFW
Chinook salmon	*Oncorhynchus tshawytscha*	2023	37575	WDFW

6. SWFSC –
    a. (Melissa Monk) Santa Cruz
    Quillback mostly, still working with FT-NIRS and chillipepper
    Rachel Brooks has come on board, hoping she can production age for upcoming cycle
    Don't have any aging capacity at the moment, hoping to build it back up.
    b. (Brittany Schwarzkopf) La Jolla
    This update includes information from 2020 through 2024 since our group is new to CARE (or it has been a long time since we participated). Also included is a short overview of our group and program since not much may be known about our group.

    Overview
    The SWFSC - La Jolla conducts invaluable research on coastal pelagic species (CPS) and highly migratory species (HMS) in the eastern Pacific Ocean.

    The Life History group at the SWFSC - La Jolla lab studies age & growth, reproduction, foraging ecology, habitat, spatial distribution, and stock structure of CPS and HMS. CPS species include Northern Anchovy, Pacific Sardine, Pacific Mackerel, and Jack Mackerel. HMS species include North Pacific Albacore, Pacific Bluefin Tuna, Swordfish, Opah, and several shark species. Our group is also in charge of biological sampling on the CPS survey, where our biological samples come from. Although we provide ages for stock assessments, we are not a production ageing lab. We will do research work

    For CPS stock assessments, age readers at SWFSC age samples collected from the CPS trawl survey as the fishery-independent data source, and CDFW ages samples collected from port sampling as the fishery-dependent data source. Both CDFW and SWFSC work together on inter-lab ageing consistency. Brand new training and test sets have been developed for each CPS to improve training. Otolith sample exchanges among CDFW, SWFSC, ODFW, CDFW, DFO and CICIMAR have been also conducted in the past in order to standardize CPS age data provided these agencies to stock assessment.

    Northern Anchovy
    Prior to 2021, Northern Anchovy had not been assessed since 1995, nor had any otoliths from the SWFSC survey been aged. CDFW had historically aged northern anchovy otoliths from the fishery but they had also stopped ageing anchovy otoliths a while back since no stock assessments were occurring. The Pacific Fisheries Management Council had called for a Central Subpopulation of Northern Anchovy benchmark stock assessment to occur in 2021, so both ageing labs had a large volume of ages to catch up on.

    Amongst two readers, 5,965 otoliths collected from 2015-2021 were aged in 2020 and 2021 from the CPS summer survey for the 2021 anchovy stock assessment, which include both single and double reads. To increase the number of double reads, an

experienced CDFW age reader read an additional 950 otoliths.

Since the assessment, amongst two readers, an additional 1,008 otoliths collected in 2021 and 2022 were read in 2022 and 2023, with ageing of the samples collected in 2023 to occur this year.

As of now, only one age reader is trained and certified to age northern anchovy, but the new ageing technician should hopefully be trained and certified this year to help.

Northern Anchovy are only assessed every 8 years, but biomass check-ins occur every 2 years, and an assessment could be triggered if biomass from the CPS survey drastically declines.

Pacific Sardine
Annual ages are needed for Pacific Sardine assessments (updates or benchmarks depending on the year). Benchmark assessments occurred in 2020 and 2024. Since 2021, all northern stock Pacific Sardine have been aged every year. That's been 271 in 2021, and 205 in 2022 amongst two age readers. In 2023 it was 283 by one reader.

Pacific Mackerel
Pacific Mackerel had not been aged during the 2003-2017 period, so in 2022 we had to play catch up for the 2023 benchmark assessment. Because all of the age readers were new and there were issues with Pacific Mackerel ages from the CPS survey in the 2019 stock assessment, we read previously aged otoliths from 2012-2017 and then brand-new otoliths from 2018-2022. Amongst three readers, 3,552 otoliths were aged, which include both single and double reads.

Pacific Mackerel benchmark stock assessments (when ages are needed) occur every 4 years. No ageing has occurred since the 2023 benchmark assessment.

Three age readers are currently trained and certified for Pacific Mackerel, with another age reader planned to be trained next year.

Albacore Tuna
In 2013 the SWFSC assessed the length-at-age of North Pacific albacore by examining annual growth increments in sagittal otoliths from 486 fish of unknown sex collected in different regions of the North Pacific Ocean.

North Pacific Albacore growth is sex-specific and regional differences in the age-length relationship have been documented. To examine sex-specific growth of Northern Albacore 393 otoliths with known sex will be aged by the SWFSC in 2024. These were collected from 2013 to 2023 from the eastern and central Pacific.

The International Scientific Committee Albacore Working Group will meet in early 2025 to compare age data from the US and Japan, and then decide to either estimate growth within the assessment model or put together a new growth curve in late 2025.

Bluefin Tuna

Our post-doc, Travis Richards, has been working hard to determine the best method to age Bluefin Tuna, which included a trip to Tasmania to meet with scientists at Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) Fisheries Laboratory in Tasmania. He has recently embedded and sectioned 70 otoliths from 2019 and has begun preliminary aging. Additionally, Travis and other members of the LHP program are working collaboratively with scientists at the Nation Taiwan University to parameterize a machine learning-based age estimation model for Pacific Bluefin Tuna.

Age related projects

– Evaluation of somatic growth patterns as supporting evidence of Pacific Sardine subpopulations (Erisman et al. in prep)
– Determining appropriate sample sizes for ageing of CPS for inclusion in stock assessments (Schwartzkopf et al. in prep)
– Variability in age and growth of Pacific Sardine in US waters during the recent period of low population biomass, 2012-2021 (James et al. in prep)
– Exploration of variations in length-at-age to inform stock structure of Pacific sardine off the U.S. West Coast (James et al. in prep)
– Relationships between somatic growth, recruitment, climate, and stocks using otolith biochronologies (James & Erisman)

FT-NIRS

Our group is a part of the FT-NIRS NOAA strategic initiative. We have been developing methods to gather spectral data for CPS (Pacific Sardine, Northern Anchovy, Pacific Mackerel), which can be difficult due to the small size of their otoliths throughout their life compared to other species. We just published a methods technical memorandum (see publication section below), and are working on a peer-reviewed manuscript evaluating the age estimation ability for Pacific Sardine and Pacific Mackerel.
For the project, we have scanned around 2,500 Pacific Sardine otoliths, 500 Northern Anchovy otoliths, and 800 Pacific Mackerel otoliths.
Our FT-NIRS technician is leaving at the end of this week, so our FT-NIRS project will be wrapping up shortly and a determination will be made if FT-NIRS is a worthwhile investment for ageing CPS. As of now, we will likely not continue with FT-NIRS for CPS ageing.

Publications

- FT-NIRS method for estimating CPS ages published
- Saas et al. 2024. Development of methods for collecting spectral data from fourier transform near-infrared spectroscopy to age three small coastal pelagic species. NOAA Tech Memo.
- CSNA growth model including seasonality
- Schwartzkopf et al. 2023. Modeling somatic and otolith growth of the central subpopulation of northern anchovy by incorporating seasonality. Fishery Bulletin 121:172-187.
- Sardine growth validation
- James et al. 2024. Validation of periodicity of growth band formation in Pacific Sardine from a captive growth experiment. Marine Biology 171:105.

7. ODFW – (Mark Terwilliger/Leif Rasmuson)

Personnel: Leif Rasmuson, Program Manager; Mark Terwilliger, Age Reading Specialist

Production ageing: Production activity in 2023-2024 focused on ageing China Rockfish, which at one point was high on the potential list of nearshore species to be assessed in 2025. This is no longer the case, but production ageing of China Rockfish will proceed. We have 1323 commercial samples and 835 sport samples with catch dates from 2014-2023 that will be aged. At this point, 500 commercial samples and 0 sport samples have been aged. As part of an effort to include otometric data, I have weighed 1114 commercial samples and 809 sport samples and have imaged 1127 commercial and 809 sport samples for shape analysis to differentiate possible northern and southern Oregon stocks.

Exchanges: ODFW did not participate in structure exchanges over this period.

Lingcod aging structure comparison: We have concluded ageing of paired structures for Lingcod. Ages were estimated for 365 otolith-fin ray pairs out of a total of 368 pairs of structures between commercial and recreational fleets. We collected samples over a wide size range except for younger fish < 20 cm (N=0). There was a significant negative bias in the age data, with ages from fins underestimating ages from otoliths for fish older than 8 years old. Average percent agreement of ages between structures was low at 36%. Results will be shared at the April 2024 CARE conference in Newport, OR.

Scientific presentations: Our study validating ages of Black Rockfish, Copper Rockfish, and Cabezon (published February 2023) was presented in April 2023 at the Western Groundfish Conference in Juneau, AK and in October 2023 at the 7th International Otolith Symposium in Viña del Mar, Chile.

Publications: Rasmuson, L. K, M.R. Terwilliger, E.J. Bailey, M.T.O. Blume, and K.A. Lawrence. 2023. Finding Oregon's Old Female Rockfish. Science Bulletin 2023-04. Oregon Department of Fish and Wildlife, Salem

Summary: Recent stock assessments for Black Rockfish (*Sebastes melanops*), Canary Rockfish (*Sebastes pinniger*) and Yellowtail Rockfish (*Sebastes flavidus*) have shown that there is a lack of old female rockfish in these populations from California to Alaska. This absence is based on the lack of old females in both fisheries-dependent and fisheries-independent collections, a surprising fact considering these three species live across an extreme depth range and are therefore captured by a diversity of fisheries (hook and line, long line, midwater trawl and bottom trawl). To find potential explanations, we examined commercial and recreational catch data as well as surveyed the commercial and recreational fleets for their expert knowledge. The result of both efforts was an absence of a consistent pattern or association with the lack of old females in any of the three populations. We present multiple hypotheses, each with associated arguments for, and against; as well as a short description of how each hypothesis could be tested in the future. We consider these hypotheses using the principle of parsimony, where the reason for the absence of old females in each species is assumed to be the same. Ultimately, we hypothesize that natural mortality of females is the most likely cause of their absence; the most notable fact in support of this hypothesis being that these three species occupy a wide geographic range, a diversity of habitat types, are captured in multiple fisheries, and yet, old females are consistently absent. We further consider that the question of "why aren't there old females" be reframed to ask "why are there old males" for these three species? Finally, we suggest continued use of the Big Old Fat Fecund Female (BOFFF) hypothesis, but that it be

rephrased as the Bigger Older Fatter Fecunder Female hypothesis. We feel that the original phrase causes people to only consider the oldest fish important, while the reality is reproductive output increases linearly with age, such that a middle-aged fish is increasingly more important than a younger-aged fish.

8. AFSC – (Derek Chamberlin)
9. **Personnel Changes:** Charlie Piston retired at the beginning of February after 30 years with the program and Craig Kastelle retired in May 2023. Jason Conner transferred from the Resource Assessment and Conservation Engineering group into the Age and Growth program and is working 50% in a research capacity and 50% in production ageing. Sandi Neidetcher has also joined in a production ageing capacity. She was previously part of the Age and Growth program in a research capacity but will now be production ageing in addition to her research. Kali Stone successfully defended her master's thesis in February and presented her research on the effects of a changing climate on arctic cod.

   Production Ageing: Since last CARE meeting, AFSC has produced traditional otolith 39,501 ages from 19 different species. Additionally, we have scanned a total of 19,672 otoliths in support of the FT-NIR strategic initiative and are on track to implement FT-NIR for eastern Bering Sea Pollock in 2025.

   Research: The Age and Growth team conducted a large ageing error study consisting of 7 individual readers and 6 people scanning a subset of otoliths to determine total uncertainty in FT-NIR ages. We also continued work to expand FT-NIRS into examination of soft tissues to look at energy density and fish condition and for maturity studies, Implemented deep machine learning for predictive models, and conducted an emulation of our ageing procedures using FT-NIR to streamline the scanning, tradition ageing, and subsequent QA/QC process.
   Outside of FT-NIR, we are working of research using O18 isotopes to expand Pacific cod age validation expanding on previous studies to validate age estimates for older (>5 y) P. cod and are conducting simulations to optimize the number of test ages and number of testers.

VIII. Topics for Discussion/New Business [11:30 – 12:00] continued if needed [1:30-2:00]

1. FT-NIR updates – (get updates from labs using this technology)
   Updated during agency updates
2. Western Groundfish Conference move back to even years starting 2026/TSC Discussing April 17th-18th
   Discuss on Thursday – do we want to keep on even or go back to odd so we don't conflict
3. Symposia/Conferences previous and upcoming
   International Otolith Symposium
      109 oral presentations, 104 posters
      Microchemistry is pretty well represented
      Next meeting in 2027, Portugal
   Modern Advances in Age Validation, Honolulu, September this year
      Abstracts open until April 26
4. Age data hosted on the CARE website?
   Looking at the exchanges on the website, to cut down on email. PDFs currently available but hoping to make a shiny app to make it more accessible. Will make a general recommendation by Thursday
5. What would need to happen to begin posting TSC recommended age tutorial videos on CARE website

6. Agency handling and dissemination of double read data and informing end-users
   Maintaining databases and what information is assigned; do labs send out age data and double read data from scratch? Do they wait until double read data is requested? Discussion about how different labs

handle this data.

7. Prioritization tool for US West Coast Assessments (URL Link)
   Melissa Monk – what species get assessed & priorities. An intern turned a huge spreadsheet into an R Shiny package. A good visual way to see which species might be up for assessment

Lunch 12:00 – 1:15

IX. Scientific PowerPoint Presentations [2:00 – 4:15] – 15-20 Minutes

1. Kali Stone – Use of otoliths to gain insight into overwinter survival strategies of juvenile Arctic Cod (*Boreogadus saida*) in a warming arctic.
2. Leif Rasmuson – Finding Oregon's Old Female Rockfish.
   As certain species get older, they become all male. Why is this? Dead or hiding?
3. Tracey Loewen – Age estimations of Greenland halibut: technique development and future directions (Remote Presentation).
4. Will Patterson – Eye lens-based age validation and epigenetic ageing of deepwater fishes among U.S. ocean basins (Remote Presentation).

Break 3:10 – 3:25

5. Evan Howard - Otoliths Record Hypoxia Tolerance From Individual to Global Scales (Remote Presentation).
6. Kevin McNeel – Assessing Species Identification, Age, And Life History Information For Shortraker Rockfish (*Sebastes Borealis*) In Prince William Sound, Alaska, Using Otolith Analyses.
7. Derek Chamberlin – Ageing Error; Where does uncertainty in model predicted ages propagate?

X. **Otolith Morphometrics** [4:15 – 4:45]

1. Otometrics summary presentation
   Equipment each lab has a mix of equipment to collect otolith morphometric data. As a group we have a total of -
   45 cameras, 23 microbalances across labs
   What info does each lab collect
   Many labs collect weights, often for 100%
   Most labs photo special projects, CDFO images all aged
   Weights – 568,000 weights across labs, 17,884 images. Sablefish rank top for number of weights collected.
   Age readers are the most common collectors. Some labs have additional support
   Used as a QAQC outlier check, as well as species and stock discrimination. Also feeds into FT-NIRS

   a. Discussion for actions/working group formation.
      Do we want to add more detail? What has worked and what hasn't? Do we want a formal working group? And do we want to post any info on the care website? Add chapter to the manual? So committee will draft the chapter?

XI. Workshops, working groups, hands-on microscope work [4:45 – 5:30]

1. **Otometrics Working Group Discussion/Formation** (Guin Library Seminar Room)
   Attendees - Patrick McDonald, Derek Chamberlin, Jamie Hale, Leif Rasmuson, John Short, Audrey Ty, Jessica Horn, Chris Gburski, Mark Plumb, Kevin McNeal, Denise Parker, Mark Terwilliger, Sonya Elmejjati, Marian Ford

   Summary
   A discussion started from each lab talking about what otometrics data they collect and what they do with that data. There was variation in what gets collected and its use. For example, ADFG-Juneau tends to collect a lot of data and use it for their QA/QC by examining the new data to existing relationships. NWFSC creates relationships from the new data each time, but also uses it for QA/QC. It was agreed that we should document what gets collected and how the data are used across labs. The result of that can lead to some standardization. There was a concern that some labs do not have the resources (in terms of equipment and personnel) to collect everything. Documenting the efficiency of collecting this data is important.

   It was agreed that a formal recommendation be made to the membership.

   Running notes:

   Kevin going to work with Jamie to standardize QAQC. Kevin's group pulls directly from oracle database. No species separate in Newport's, Kevin's can pull by species.

   Oto length comparable to fish length and can be used for QAQC to compare mixed otoliths with data to save mixed samples. Length, weight, height taken by calipers. A Shiny app can be used to see if issue in measurements. If a metric falls outside standard table acceptable values, they have to reassess age. Re-reads are done without knowledge of the direction of the error (age too high or too low). Errors in data entry can be caught quickly.

   Looking at outlier ages - do you go at blind, or not? Conservation of otoliths. At discretion of reader, break as many as you need to get best age.

   Table of expertise suggested - agers, the species they age, whether they're beginners, competent, or expert. Refresh or test on reference collection before aging. A random selection, which is added to over time. Exchange samples might be good to fold into references.

   Morphometrics – what is evaluated, what works & doesn't, cautionary tales?
   Do we want to form official group to answer questions?
   Smaller labs don't have staff, time, equipment, or funding, so may not be able to meet best practices.
   Do different morphologies break out based on morphology for sablefish? Shape could indicate life history that might help out a lot.
   240 - 480 per day with measurements (8 hr.) For just weights 500 per day (8 hr.).
   Otolith weight is more useful than length - Oto wt. at age to separate out species, rather than length. Direct 1v1 comparison to fish length. Oto Height can be useful to look at the size of young otoliths (0, 1, 2, 3 yr. old). A guide for size of first year.
   Measure 1, 2, 3, use as a starting point. Have range or average to verify where these are Approx. size of known age, is break off-set. Some use micrometer, some use just ruler.

Start email change for collection and other labs not represented to see what collecting, how etc., as part of recommendation. Include standardize formatting.

FT–NIRS archived - Shapefiles, 150 KB per file, 1 file per scan, file name changed based on structure ID, some structures have been scanned multiple times up to 40X.
Biochronology data - not currently going to database, only special projects. Kev thinks bad that not being saved in database because of tracking issues. Just have as separate table, as measurement type, so can record metadata as for what things mean. Jon working on this for their FT-NIRS, as currently all FT-NIRS stored by Bruker.
Need to document all measurements and type well so someone else can come and use data.

Kevin notes:
Otolith length, width and height compare to fish size. Length vs height for accuracy.
A discussion about QC/QC started out in the meeting. This is looking at potential outliers.
Each lab will address this in a different way.
Otometrics:
Best Practices and documenting software and hardware (scopes, balances, cameras).
Standardizing and adopt the best practices. TSC as well may be interested.
Size of lab, time involved depending upon agency.
Documenting practices for CARE to CARE.
Helpful to know what is useful to collect and more efficient way.
Otolith measurements, across labs. Some agencies will record the first, second and third lengths.
Kevin will take the otolith length and width used as a guide for ageing. This is for all species.
Sonja will record 205 of the early year growth zone measurements.

2. **Hands-on Reviewing of maximum age specimens**
    a. Suggest agencies review posted maximum ages on https://mtalab.adfg.alaska.gov/ADU/analysis.aspx#/maxage

    b. **Pacific cod** – ADFG-Kodiak brought Pacific cod otoliths harvested from the South Alaska Peninsula (SAP) and Kodiak areas. Generally, SAP samples are clearer and have stronger patterns than the Kodiak samples. Sonya Elmejjati and Jessica Horn from ADFG-Kodiak and Chris Gburski and Kali Stone from AFSC set up an Amscope camera to image the otoliths and mark annuli. Overall, the age readers agreed on half the samples looked at. On most otoliths, age readers agreed on the 1st and 2nd annuli. Otoliths that were aged differently were generally 1-2 years off and the differences seemed to be the 3rd and 4th annuli that was thought to be a checky by AFSC. Some differences could be attributed to different edge type decisions. It is important to note that some of the captured images were over-exposed with bad oil reflections and look slightly different than what was seen under the scope. On the second day of the workshop Kevin McNeel, Mark Plumb, Mason Emery, Andrew Pollak, John Brogan, Derek Chamberlin, Julie Pearce, and Jessica Horn joined the same group from Wednesday to image and annotate more SAP samples.

    c. **Pacific Spiny Dogfish** - On Thursday April 4th, 2024 from 9-11:30 AM Andrew Claiborne, Merrie Schultz, and Emily Wallingford met and discussed the aging of spiny dogfish. Merrie outlined the technique used at WDFW to analyze the spine structures. The section of the spine that is ageable is between the white enamel gland

ring at the base of the spine and the wear point at the top of the spine (wear point is the first point in which the enamel begins to wear at the top of the spine). Dark bands are counted between the two points, and each band must be slightly elevated/mounded to be counted. Generally these bands are more condensed towards the most recent years laid down at the base of the spine, and are more spaced and less consistent moving up towards the wear point. Measurements of the spine base diameter and wear point diameter are taken to extrapolate any missed bands that have worn off the spine tip. WDFW has exchanged spiny dogfish spines with the AFSC and did not have high agreement in band counts. During the session a few of these difficult structures were displayed with annotated counts from both labs to show the wide variation of age interpretation.

3. Hands-on Reviewing Previous Exchanges

Informal social at the Bier One, 255 SW 9th St, Newport, OR 97365 on <u>Tuesday evening</u> starting at 5:30PM

<u>Wednesday, April 3, 2024</u>

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

1. **Hands-on Reviewing Continuation** – Previous Exchanges, maximum age specimens
   Rex sole max age -
   Julie Pearce, Mark Terwilliger, Andrew Chin, and John Brogan all examined a Rex sole sample brought by the NWFSC group. Nikki Paige had previously aged it as 33, with Patrick McDonald and Tyler Johnson in the same lab confirming the age within a year. The others got ages ranging from 29-33, with the general consensus being 32. This confirms that the previous maximum age of ~27 should be updated.

   REYE discussion
   205 year old REYE - need to come to consensus and republish for max age. Source with annotations, suggestion to clean up table of Max age. Anyone to add to this. Table is updated by oracle. Would be nice to redo the republication of this table.
   REYE ages might be blackspotted as well - until genetics can be confirmed. List of once looked at and ones that have concern for max age. Point at website. Curate one list - so suggesting everyone send to Kevin. Column add - that states confirmed by multiple species. Small sample size. How would you confirm you have older? New older samples should be exchanged with other agencies. Come up with final age and then can post it. Also include max depth, max range in table. Annotated image would be a good inclusion. Ability of web to include/link oracle package? Host probably would not want to do that, easy to put max age table. Kevin and Jamie discussion on what columns to include.
   How to come up with single consensus. - Exchange, agree on the resulting age. Take images and have leads confirm. Known ages? Jamie working on including the table on website.

2. **Lingcod Working Group (Barry Fisher Room, Guin Library; 8:30-12pm)**
   Attendees: Marian Ford, Audrey Ty, Denise Parker, Emily Wallingford, Jessica Mai, Mark Plumb, Masan Emery, Jenny Topping, Merrie Schultz, Leif Rasmuson, Mark Terwilliger, Andrew Claiborne, Kevin McNeel, Barb Campbell, Sonya Elmejjati, Jessica Horn, Chelsea

Cooke, Nikki Paige, Tyler Johnson

Why labs want to go to otoliths: Cost and time savings (prepping fins takes a lot of manpower)
Why some labs prefer fins: Speed of collections, commercial reluctance to cut heads open, possibility for more data points as a result
Overall: Are ages comparable? Lab that does otos now find themselves short of data – adding fins to round out the numbers?
Track time for fin prep steps to validate the cost/time difference.
Possibly a grant opportunity to get funding for a formal study on comparing samples and prep times.
Validation of ages: lead radium, elemental mapping
TSC to CARE: determining experts
- Hire an intern to age **everything** so one person can be labeled "expert"?
- Or pass a ~200 sample set around to the labs to calibrate?
- Try to get the set to represent the full latitudinal range of samples
- Those who have only commercial samples are also size limited (no small samples). i.e. Alaska has nothing smaller than 35inches except for Kodiak samples
- NWFSC lab has samples from Canadian border to Mexico border, as well as a range of very small samples
- 40-50 samples per lab for exchange

Help with formatting and information of the Ling otolith ageing instructions for inclusion in the CARE manual.

Scope work

Next Steps

- Training Exchange
  - 25 pretty structures (AK)
  - 25 ugly structures (Laurel's? or Andrew?)
  - 20 older 5 younger
- Study Exchange
  - 50 paired structures from each lab
  - Figure out sampling from training exchange
- SK Grant proposal
  - Validation
  - Simulations
  - Single Reader

3. **Sablefish Working Group (Lavern Weber Room, Guin Library; 10:00-12pm; 1:30-3pm)**
4/3/24
Attendees (plus additional people coming and going):
John Brogan, Patrick McDonald, Jamie Hale, Julie Pearce, Barb Campbell, Andrew Chin, Derek Chamberlin, Jessica Mai, Denise Parker, Audrey Ty, Chelsea Cooke

Start 10:30am

Looked at many specimens projected on large monitor. Looked at known-age and annotated how each agency would identify juvenile years and checks. The participants referred to juvenile years as 'beaks' and how generally they have a large and checky pattern. The second year can often have a check or 'trailer' associated with it. We discussed as a group bringing a formal recommendation to the full membership to write up a document on the work of the Sablefish Working Group and have it as a document on the CARE website. Specimens examined are below along with some discussion for each.

1) Beaks ages 1 and 2 large take up more space, 2 doubling but might end up calling it 2, 3. Really strong trailer. Counting edge. Known 5 year old. And strong checks. Question on following top or bottom prominent band marking.

2) Known age ID Sable 3, specimen 2847. Catch date 6/2- count edge, edge type 5, or 4 plus. Annulus starting to form. Banding wide, comparing with ¾ view you can follow 1, 2 and 3, Even though 2 has wide banding pattern.

3) Sample 3090 - Surface 1, 2 wide, 3 start growing a bit slower, change at 6, can see trailer and check off of 2, Does 4 merge with 3, maybe merges, but looks distinct, 2 wide, 2 faint, 4 at lip?? Or put 3 at lip. Follow grove to 3 - puts 3 on lip. Strong check and beak on 2. $, 5, change at 6. So see that in the cross section. Which access looks the best, but usually after 4 will have moved away from the wing tip. Counted 18 together. John, Delsa counting "beak" as age 3. 18, 19 Delsa, 18, Barb. Julie 19. Expecting a lot of checks in the 1st 3 yrs, and very prominent, Barb - if follow check will go off surface for 1st 3 yrs. Known age is 19. Heel bubble starts to fan out, faint so it is difficult to count. Or count the "check/beak" as 3. Catch date. Didn't catch the date.

4) Sample 3113 - messy, looks young, strong false year, sulcus only shows 2 strong bands. Known age is 3. Catch date: Mar, Edge type 3, very small growth, Very checky.

5) Sample 3138 - Catch date: Nov, only 1 band on sulcus, edge checky, Might call it a 2 if you count check. Checky. Look at length sometimes to confirm age. Full year growth, annulus starting for form.

6) Known age, looking at 3133 - Everyone underaged -very tricky one, Change at 3. 10 plus on surface. One is wide, 2 is low. Looking at 12 or 13 in August. Known age is 12. They called it a 7, 10, 9, 11, Patrick may have gotten the 12. Surface indicated is larger than 7.

7) Known age - sample 3108; disagreement between readers. 3-4 tells you very little, Surface not helpful either. Surface looks like it could be 5 if you count, maybe 2, seeing a check, many counted as 3. March catch date. Growth is very large for 2, the beak is starting to form, check and annulus coming out of same spot. Patrick and Delsa called 2.Known age is 2.

8) Not Known-Age: Another 2 yr old. Maybe not a 2 yr old. Make comment as using groove. Debating on morphology, 1 large with wide beak, so maybe 2 also have wide beak and bottom of beak forming. Size 43 cm, seeing check as strong, J state it's a 2 based on groove, check determined as it is strong, but just fades as goes toward rostrum.

9) Not Known-Age: Another 2 year old, 1st year is very diffuse. Caught May 31, edge type 5. Check between 1 and 2. Old school type what your age, then one less plus to say you are counting edge. Discussing since 2nd annulus on this one not distinct and discussed how it would be notated on forms, depends on age reader.

10) Not Known-Age: Surface 10 - plus, pie pan shape, 3 at lip or just under, and then count down, so 10 or 11, Caught in Nov. Age 10 blends into caramel, so possibly 11. Patrick thinking it's like 11. John agrees with 11 on this. Original age was 10.

11) Not Known-Age: Caught Oct - Nov, SR 5, SR 4 or 5, But since Nov not counting edge, so probably 4 plus growth. Lots of growth between annuli, Annuli might be forming, so age consensus is 4 w/ 5 edge. But Growth is very wide. Patrick would have put 5 on the sheet.

12) General notes on the working group document; Barb Campbell brought up that our efforts as a Working Group go back to 2009 (or earlier) and maybe the products from the working group should be put on the website. Brogan and McDonald agree it should be on the website. A discussion ensued about how many images would exist, would they be known-age or not and that either way they could be used as references by all. The size of images was a concern and Andrew suggested that having a downloadable Zip file would work best. Then we could use the 'standard' 3 images per sample (1 surface, 1 ¾ angle tip, and then frontal break and burn cross section). Barb also mentioned the age 0 and 1's study done roughly 12 years ago that attempted to quantify the size of the otoliths from Alaska to California. The sample collection times was problematic for easy comparison, but it was agreed this information could be included in the overall report.

13) There was a discussion of when assessors bin and whether resolving from double reads needs to occur on specimens that are beyond the binning age.

14) NWFSC brought an estimated 88yr old specimen for other agencies to examine; the age ranges were from 83 to possibly 96.

4. **Rougheye/Blackspotted (Guin Library Seminar Room; 2:00pm-5pm)**
Attendees: Emily Wallingford, Liz Ortiz, Jessica Mai, Chris Gburski, Mark Terwilliger, Mark Plumb, Josh Dore (Virtually)

Subject Discussed: Otolith Storage
AFSC's Glycerin-Thymol storage allows for clearing of the otolith which enables their lab to surface age specimens 10-years-old or younger without breaking and baking. Follow up questions included whether this storage method would affect chemical analysis later on. In regards to FT-NIRS, it was concluded that it would be fine as long as the storage method stayed consistent.

Subject Discussed: Pattern Interpretation
Most of the labs seems to agree that following the light-dark margin on the cross section is a good strategy until about mid-twenties. At that point, following the more constricted growth somewhere in the middle region between the sulcus and wing tip seemed generally favored

rather than continuing along that light-dark boundary. Tipping the otolith in a way that shows the annulus coming into the cross section from the distal surface also seemed to be a favorable technique for younger years, although not always possible depending on the sample. Differentiating between actual annulus and split annulus was also discussed – following the annulus from all the way to the sulcus and/or to the distal surface looking for convergence as well as looking for distinct and consistent light-dark banding seemed to be the agreed upon solution. One subject we talked about without coming to a definitive solution was the micro/macro patterns often seen in which several years will be darker with following several lighter years – this results in different interpretations depending on the magnification. Josh Dore inferred it could be from environmental factors, and Mark Plumb further suggested perhaps it correlates to El Nino/La Nina events.

Subject Discussed: Methodology
Both edge type codes and readability codes were both touched on. AFSC's lab and NWFSC's lab use edge codes on a 0-5 scale, while ADFG's lab ultimately does not quantify edge type, but rather incorporates that into their final age estimate. Readability codes on a scale 1-3 are used by ODFW, AFSC and NWFSC, while ADFG uses a scale of 1-5. Some people sand/polish samples when needed, but it was noted that this can introduce lines or "wash-out" the pattern. AFSC and NWFSC bakes their REYE/BLSP otoliths between 10 - 40 min depending on the person, while ADFG burns their otoliths. 10x or 16x eyepieces are used depending on personal preference. NWFSC seemed to be the only lab using an IsoMet to cut their otoliths while other labs broke theirs with nail clippers or large nippers.

Subject Discussed: Morphometrics
The measurements of the first three years were discussed. It was agreed that the first year is highly variable, ranging from 1.0mm - 2.0mm, but more often closer to 1.0mm. Most participants thought the third year as more defined and easier to measure than the first and second. Although this third year more often than not is around 3.0mm, Josh Dore shared a beautifully clear image with the 4rth annulus measuring at 3.0mm, reinforcing the idea that the measurement criteria of 1st year @ 1.0mm, 2nd year @ 2.0mm, and 3rd year @ 3.0mm is a soft guideline. That being said, it was also hypothesized that perhaps the first year's annulus in this example was actually a strong nucleus check.

Specimens Reviewed:
Chris Gburski showed us a couple of young specimens, both surface reads and one break and bake. We also tried to review a couple of middle-aged samples of his, but they did not appear very clear on the screen. Tyler Johnson showed us a middle-aged sample in which the group aged between 30-36 years old. Mark Plumb showed us a middle-aged sample between 26-28 years old, and older sample about 55 years old, and a few younger samples, two clearly 2 years old and one that could be estimated between 3 and 6 depending on the interpretation.

A CARE exchange was discussed and initiated.

5. **O18 break out session and discussion (Lavern Weber Room, Guin Library 3-5pm)**
   Thursday, Apr 4, 2024
   Attendees: Kali Stone, John Brogan, Andrew Chin, Julie Pearce, Jessica Mai, Josh Dore (virtual), Sonya Elmejjati, Mason Emery, Jessica Horn, Kevin McNeel, Leif Rasmuson, Mark Terwilliger

Kali Stone began the meeting that the AFSC is expanding on Pcod age validation work started by Craig Kastelle from the age 2-5 fish to 6-8 years old. On these older otoliths, Kali used secondary ion mass spectrometry (SIMS). On some otoliths, transects from the core to the edge were obtained for both micromilling and SIMS to compare methods.

Sonya asked which axis we mill on, and Kali explained she mills on the anti-sulcus.

Kali explained that mounting otoliths is very time consuming, and most SIMS labs will do the prep for you for a little extra. If you plan to prep in house, Kali can help develop a protocol, but she strongly recommended having the lab prep them.

Kali had sent in 30 total otos and recently got the raw results from the first 5 otoliths. On the first otolith (age 8) otolith, and comparing the O18 plot (each peak=growth zone), and in early years it seems easy but becomes variable further in age. Kali said she needed to double check the criteria for a "peak" based on Craig Kastelle's notes. End goal is to put an overlay over the oto.

On the second otolith, there was a strong 1-2 check of a 6-7 aged fish. Comparing results, one part of it was cracked in the early years but the peaks seem to track a 6 year old age.

For the third otolith - an age 6 fish - its wide 2 year spacing seems more reflected in the O18 graph. Again, there are more compressed growth zones in older fish so there are some variability and unclear patterns.

The fourth otolith was an age 8 fish, with tight growth patterns. O18 remains elevated in this older zone, and reflects the growth patterns.

Sonia asked what "originally aged" fish means, and it means TMA with toasted halves.

On the last otolith, a checky age 8 fish, there is low variability around 0 but peaks tend to match the age.

After reviewing the results, Kali asked if there were other projects/applications/species that folks would be interested in testing. Jessica Horn voiced the potential for testing Kodiak cod and wondered if checky patterns they see in Kodiak fish will reflect O18 trends and pull out a pattern. Kali mentions that you can see in existing samples when the fish shift into deeper water.

John Brogan and Jessica Mai said that Greenland turbot might be interesting,

Folks are more generally interested in how Kali interprets the raw data and what will become of the data.

Kali then went over Craig's existing data as an example of an end product. Sonya asked how the 1-2 check was identified. John Brogan explained that it was found in the data by stock assessors and revealed through O18 age validation. Jessica Mai says that Arctic cod have a similar 1-2 check problem.

Some more figures were shown, and Kali explained that gaps in SIMS data could be from

hitting a crack, sampling error, etc. In addition, some peaks were very clear in many of Craig's samples, but not so in the older SIMS-tested fish she sampled.

Kevin McNeel said that he anonymously reviewed Craig's Pacific cod paper, and mentioned that a GAMS model would be easier to identify peaks.

Leif Rasmuson said that a GAMS model didn't work great on the black rockfish they sampled in a SIMS study and over identified peaks. Mark Terwilliger said that this is more of a validation of the method, and since they were dealing with older fish it was easier and more accurate to interpret the graphs qualitatively based on the observed patterns of otolith growth seen on the cross section versus a model.

Kali went back over the initial results again from the SIMS. Micromilling data will be coming in for the other transect, and Mark mentioned that the micromilling samples will probably be washed out as annuli get closer together.

Mason Emery mentioned that just zooming in on those older sections may pull out more of a pattern. There are peaks but relative to the earlier growth they look a bit more confused.

Kali reiterates suggestions for other species. McNeel mentioned that they have some scallops milling data, which seems promising but he needs to flesh out the data by management zone.

Mark and Leif pulled up their recent publication on black, copper, and Cabezon age validation study, which shows nice graphs. But there still is a ton of variation, and the read lines are measured to visual growth bands. Copper are more difficult to age, Cabezon a bit easier but there's a bit of variability across the transect, gave samples to readers to double check. Mark said he had to mark the first line to calibrate for copper rockfish, since there's a large gap between the first and second year. He hypothesized that since the fish are close to nearshore with lots of salinity/temperature variability and a protracted pelagic stage, there's a lot of stress or variability in the otolith microchemistry. Despite this, the readers estimated the ages accurately, which was reassuring. Leif mentions that the coastal environment is becoming more associated with seasonal hypoxia, with the accompanying isotopic/chemical shifts. How much can we trust these signatures when local oceanographic patterns are changing so quickly?

McNeel asked for the potential of tracking hypoxia with the fish. Mark said they looked at the data and it was too messy. Leif showed off a graph of patchy hypoxia and the fish move around through the hypoxic zones, so they come away with a checky pattern.

Mark remarked that annulus formation corresponds to upwelling timing and cold water, and it could be useful to use archival tags to validate these O18 peaks and how they correspond to temp.

Kali mentioned that more Pacific cod and Arctic cod data are forthcoming.

Elemental mapping for Mg/Zn? UW has some data and it would be good to look at it. AFS Spokane had a good # of folks talking about the crystalline structure of the otolith on elemental composition. They said that vaterite and aragonite can be identified at a much lower rate, and the different crystalline forms have naturally different comp of otoliths regardless of

physiology and environment. This presents a huge caveat in the way we interpret these O18 data.

Leif said that on oyster aragonite, when heat waves come through they mitigate the effects of ocean acidification (OA), so when calculating OA effects we have to account for heat waves.

McNeel said that Jim Murphy was using x-ray refraction to look at otolith structure, and have a 2D elemental map may be good to have because transects can be conflicting. His takeaway is that Mg, Mn, and ZN do a good job of tracking growth potential since they are metabolites or products. Mechanistically unsure of what functions they are associated with but good to look at.

Kali expressed interest in continuing this work. Lingcod was mentioned as a potential species.

Leif is on an international OA committee, and commented how difficult it is to age structures now. In Norway, they have had to drop age structured assessments because they can't find annuli. There is potential to expand this O18 work for age validation, and also study how OA is going to impact FT-NIRS and methylation aging methodologies.

6. **Stations – PCOD Calibrations**
   Kodiak-ADFG brought Pacific cod otoliths harvested from the South Alaska Peninsula (SAP) and Kodiak areas. Generally, SAP samples are clearer and have stronger patterns than the Kodiak samples.

   Sonya Elmejjati and Jessica Horn from Kodiak-ADFG with Chris Gburski and Kali Stone and John Brogan from AFSC set up an Amscope camera to image the otoliths and mark annuli. Overall, age readers agreed on half of the samples that were looked at. On most otoliths, age readers agreed on the 1st and 2nd annuli. Otoliths that were aged differently were generally 1-2 years off and the difference seems to be at the 3rd-4th annuli that was thought to be checky by AFSC. Some differences could also be attributed to different edge type decisions. Kodiak consistently aged older on samples that were different. It is important to note that captured images were sometimes over exposed with bad oil reflections and look slightly different than what was seen under the scope; annuli may be better distinguished through the microscope lens than on screen. On Thursday, Kevin, Mark, and Masson (ADU), Andrew, Brogan, Derek, and Julie (AFSC), and Jessica (DFO) joined the same group from Wednesday to image and annotate more SAP samples. Age readers agreed more on the older fish than the younger fish. We initiated an exchange of 99 ADU Pacific cod otoliths.

7. **Charter Committee**
   Attendance: Kevin McNeel, Jamie Hale
   The charter should be updated to clarify exchange wording and voting protocol.

8. **Manual Working Group**
   Wednesday April 3
   Attendees: Kevin McNeel (ADFG), Barb Campbell (CDFO), Leif Rasmuson (ODFW), Jamie Hale (PSMFC/NWFSC), Andrew Claiborne (WDFW), Julie Pearce (AFSC)
   Goals:
   - Adopt a section by section approach for reviewing and adding to manual
   - revamp/clean-up of general ageing procedures and incorporate new sections

- Update Images
- Remove Redundant processing notes
- Create a Template using DFO Sablefish section for new chapters for ageing methods for particular species
- Include credit for authorship/date of sections

Sections that need reviewing/adding
- Lingcod Otoliths- In review- Andrew Claiborne
- Sablefish- Done- to review
- thin sectioning- current methods reviewed by Kali
- break and bake- current methods reviewed by Kali
- Halibut - done, to review
- Skate - done, to review
- Ergonomics- In press- Julie Pearce?
- Age validation- Existing Chapter needs year reference
- Walleye Pollock- In Press- Kali
- Spiny dogfish - Recover document from Cindy- Prioritize- Reviewed by Nikki and Tyler
- Black rockfish - Liz Ortiz and Jamie in Press
- Quillback rockfish -Jamie, to be reviewed
- Otolith storage methods - done, to be added
- History synopsis – Leif

Sections Done:
- Cover update
- QA/QC, needs date
- Otolith storage method update

Comments
- Manual useful for standardizing methods for trainees and graduate students
- Investigate Historical reference
- Add comments of sections to add later as place holders
- Credit authorship and reviewers with date for each section
- Add generic manual with species specific chapters

CARE Social <u>Wednesday evening at Rogue Brewer's on the Bay, 2320 SE Marine Science Dr, Newport, OR 97365 5:30pm</u>

<u>Thursday, April 4, 2024</u>

XIII. Recommendations [8:30 – 9:00]

1. 2024 CARE to CARE
    a. **CARE Manual Working Group** - will work to update the current edition of the manual and incorporate the completed sections and add changes to reviewed sections by the next CARE. The details will be in 2024 CARE to TSC working group report (approved unanimously). See Section 8, Subsection a, of this report.
    b. CARE Website Working Group - The website committee will post a

protocol on the CARE website for members to submit agency updates and contact information (approved unanimously).

c. **Lingcod Working Group -** The Lingcod Working Group will initiate a CARE exchange of easy and difficult unpaired structures for training purposes among participating ageing labs, followed by N=50 paired structures in a subsequent exchange among participating agencies to determine ageing lab bias. Grant funds will need to be acquired for a graduate student to perform validation, simulation, and generate single reader ages for publication purposes (approved unanimously).

d. **Sablefish Working Group -** The Sablefish Working Group will provide to the website committee a summary document to go into a working group tab that outlines the accomplishments of the sablefish working group efforts since its formation. This will include a summary of exchanges, known-age images and juvenile otolith measurement data. This will be a living document (approved unanimously).

e. **CARE Charter Group -** CARE recommends the Charter Working Group review and submit to the Chair, modifications to the charter for distribution to the membership for approval by the next CARE meeting (approved unanimously).

CARE meetings are to move to odd years again to alternate with the 2026 Western Groundfish Conference, with the next meeting to be held in 2027 (approved unanimously).

f. **Otometrics Working Group-** The Otometrics Working Group recommends that CARE reports current practices for the collection and use of otolith measurements. Records should include equipment and the types of measurements, the time required to collect data, data storage, and its use in QA/QC procedures. A document describing these practices should be completed by the 2027 CARE meeting (approved unanimously).

g. **General Recommendations**

CARE recommends the next meeting in 2027 be held in Nanaimo, B.C. (approved unanimously)

CARE member agencies will submit a list of available age tutorials to the website committee to post on the CARE website. Agencies will continue explore putting the full tutorials online in the future (approved unanimously).

2. 2024 CARE to TSC
    a. CARE Recommends PSFMC fund some or all travel of age lab leads to the biennial CARE meetings (approved unanimously).
    b. CARE Recommends that lingcod age comparison and validation be added to federal research priorities to facilitate current and future age research (approve unanimously).

XIV. Working groups & Hands-on Workshop [9:00 –12:00];[1:00 – 3:15]

1. Working Groups – schedule future tasks, executive summary write-ups
2. Hands-on microscope calibrations continuation from Wednesday
3. Quillback Rockfish (9-12pm)

    The quillback working group was shelved due to lack of participants. Anyone interested in discussing quillback rockfish ageing can contact Jamie Hale
4. China Rockfish (1-3pm)

Group did not meet

5. Spiny Dogfish (9-12pm)

XV. Working groups & Hands-on Workshop [3:30 – 4:00]

1. Administration nominations

Mark Terwilliger moving up from Vice chair to Chair for 2025-2027

Nominations for Vice chair: Chelsea Cooke. Seconded, approved unanimously

Nomination for Secretary: Nikki Paige. Seconded, approved unanimously (Nikki abstained)

2. Schedule and location of next meeting

Moved to go back to odd years, and skip 2025. Next meeting 2027. Seconded, approved unanimously

Voted to hold 2027 in Nanaimo BC, seconded, approved.

XVI. CARE Business Meeting Adjourns [4:00pm]

Appendix 1
Attendance lists

In person:

Last name	First name	Agency	Location	Country	Email
Ford	Marian	ADFG	HomerDSF	USA	marian.ford@alaska.gov
Mason	Emery	ADFG	Juneau	USA	mason.emery@alaska.gov
McNeel	Kevin	ADFG	Juneau	USA	Kevin.McNeel@alaska.gov
Plumb	Mark	ADFG	Juneau	USA	mark.plumb@alaska.gov
Elmejjati	Sonya	ADFG	Kodiak	USA	sonya.Elmejjati@alaska.gov
Horn	Jessica	ADFG	Kodiak	USA	jessica.horn@alaska.gov
Brogan	John	AFSC	Seattle	USA	john.brogan@noaa.gov
Chamberlin	Derek	AFSC	Seattle	USA	derek.chamberlin@noaa.gov
Chin	Andrew	AFSC	Seattle	USA	Andrew.Chin@noaa.gov
Gburski	Chris	AFSC	Seattle	USA	Christopher.Gburski@noaa.gov
Pearce	Julie	AFSC	Seattle	USA	julie.pearce@noaa.gov
Short	Jon	AFSC	Seattle	USA	Jon.Short@noaa.gov
Stone	Kali	AFSC	Seattle	USA	kali.stone@noaa.gov
Campbell	Barbara	CDFO	Nanaimo	Canada	Barbara.Campbell@dfo-mpo.gc.ca
Cooke	Chelsea	CDFO	Nanaimo	Canada	Chelsea.Cooke@dfo-mpo.gc.ca
Ty	Audrey	CDFO	Nanaimo	Canada	Audrey.Ty@dfo-mpo.gc.ca
Mai	Jessica	CDFO	Winnipeg	Canada	jessica.mai@dfo-mpo.gc.ca
Hale	James	NWFSC	Newport	USA	jhale@psmfc.org
Johnson	Tyler	NWFSC	Newport	USA	tjohnson@psmfc.org
McDonald	Patrick	NWFSC	Newport	USA	pmcdonald@psmfc.org
Ortiz	Liz	NWFSC	Newport	USA	lortiz@psmfc.org
Paige	Nikki	NWFSC	Newport	USA	npaige@psmfc.org
Parker	Denise	NWFSC	Newport	USA	dparker@psmfc.org
Wallingford	Emily	NWFSC	Newport	USA	ewallingford@psmfc.org
Rasmuson	Leif	ODFW	Newport	USA	leif.k.rasmuson@odfw.oregon.gov
Terwilliger	Mark	ODFW	Newport	USA	mark.r.terwilliger@odfw.oregon.gov
Barnes	Cheryl	OSU	Newport	USA	cheryl.barnes@oregonstate.edu
Claiborne	Andrew	WDFW	Olympia	USA	Andrew.Claiborne@dfw.wa.gov
Schultz	Merrie	WDFW	Olympia	USA	Merrie.Schultz@dfw.wa.gov
Topping	Jennifer	WDFW	Olympia	USA	Jennifer.Topping@dfw.wa.gov

Virtual:
(those in attendance virtually often came and went; this list may not be exhaustive)

Last name	First name	Agency	Location	Country	Email
Dore	Josh	ADFG	Juneau	USA	josh.dore@alaska.gov
Byerly	Mike	ADFG			
Jung	Yeongha	CDFO	Nanaimo	Canada	Yeongha.Jung@dfo-mpo.gc.ca
Varco	Louisa	CDFO	Nanaimo	Canada	Louisa.Varco@dfo-mpo.gc.ca
Wischniowski	Stephen	CDFO	Nanaimo	Canada	Stephen.Wischniowski@dfo-mpo.gc.ca

Loewen	Tracey	CDFO	Winnipeg	Canada	tracey.loewen@dfo-mpo.gc.ca
Forsberg	Joan	IPHC	Seattle	USA	Joan.forsberg@iphc.int
Johnston	Chris	IPHC	Seattle	USA	chris.johnston@iphc.int
Sawyer Van Vleck	Kimberly	IPHC	Seattle	USA	Kimberly.sawyer.vanvleck@iphc.int
Berger	Aaron	NOAA			
Ayrea	Alycia	ODFW			
Vargas	Madison	OSU			
Brooks	Rachel	SWFSC	Santa Cruz	USA	rachel.brooks@noaa.gov
Monk	Melissa	SWFSC	Santa Cruz	USA	melissa.monk@noaa.gov
Patterson	William	UFC			
Prior Caltabellotta	Fabio	WDFW	Olympia	USA	Fabio.PriorCaltabellotta@dfw.wa.gov