Committee of Age Reading Experts

2021 Committee Report

Prepared for the Sixty-first Annual Meeting of the

Technical Subcommittee of the Canada-USA Groundfish Committee

April 20 – 21, 2021

Prepared by
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2019-2022 CARE Chair

National Oceanic Atmospheric Administration
National Marine Fisheries Service
Resource Ecology and Fisheries Management
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A. CARE Overview

1. History

The Committee of Age-Reading Experts (CARE) is a subcommittee of the Canada-USA Groundfish Committee's Technical Subcommittee (TSC) charged with the task to develop and apply standardized age determination criteria and techniques and operate within the Terms of Reference, approved by the TSC in 1986, and the CARE Charter, developed in 2000 and approved by the CARE in 2004.

2. Report Period

This report covers the work period of January 1, 2020 – April 6, 2021. This interim reporting period was prepared by current CARE Chair Delsa Anderl. Current officers through June 30, 2022 (elected at April CARE 2019 Meeting) are:

- Chair – Delsa Anderl (AFSC-Seattle)
- Vice-Chair – Andrew Claiborne (WDFW-Olympia)
- Secretary – Nikki Atkins (NWFSC-Newport)

3. CARE Conference

CARE meets biennially for a conference that usually lasts three days. However, with prior approval from the current TSC Chair to bring the matter to a vote, CARE membership voted to postpone the April 2021 CARE conference until April 2022 due to COVID-19 concerns and restrictions. CARE biennial meetings will thereafter be held on even-numbered years. Conferences typically consist of one and a half "business" days and one and a half days for a hands-on calibration workshop at microscopes to review and standardize age reading criteria with any extra time scheduled for a specific focus group or workshop.

i. CARE Check-in

In place of a CARE meeting, a 2-hr virtual check-in was held on April 6. Forty-seven members participated and 9 agency leads provided summary reports that included their ageing lab status under pandemic restrictions.

The list of recommendations outlined by the TSC to CARE, CARE to CARE, and CARE to TSC were not addressed at the check-in but will be addressed at the April 2022 meeting. This list of recommendations can be found in the CARE 2020 report to the TSC.

ii. Agency Reports:

A. Alaska Department of Fish & Game (ADF&G) – (Kevin McNeel)

There are four main groundfish age programs within the Alaska Department of Fish and Game that operate autonomously: the Kodiak ADF&G Age Lab, the Homer Commercial and Homer Sport Age Labs, and the Age Determination Unit (ADU, based in Juneau).

ADF&G-Kodiak

Sonya El Mejjati supervises the ADF&G-Kodiak Age Lab, which is made up of three age readers: Mike Knutson, Jessica Horn (started 2020) and herself. The lab mainly processed Pacific Cod as well as Black and Dark Rockfish during their three to four-month production ageing season.

Working through the pandemic, they wear masks anytime there is more than one person in the lab. They try to have no more than two people in the lab and Mike was

able to telework. Mike came in every 2-3 weeks to resolve age discrepancies.

If any personnel traveled, they would quarantine for 5 days and take a COVID-19 test before returning to the lab (following the borough school district travel protocols for returning students).

ADF&G-Homer Sport

Martin Schuster supervises the ADF&G-Homer Sport Age Lab, but Marian Ford attended the CARE update meeting to represent the lab. Their lab is made up of three age readers: Martin, Tim Blackmon, and Marian. The lab has focused on Black, Yelloweye, Dark, and Dusky Rockfish otoliths and Lingcod fin rays.

To produce ages during the pandemic, Marian has been successfully teleworking from home for the majority of the time, and Martin and Tim processed Black Rockfish at the office. While in the office, they used vacant offices to maintain social distance and wore masks.

ADF&G- Age Determination Unit (ADU, Juneau)

Kevin McNeel supervises the ADU and their lab is made up of three groundfish age readers: Chris Hinds, Cathy Mattson, and himself. Jodi Neil and Mollie Dwyer processed samples in 2020, but Jodi has a separate, full-time position and Mollie just accepted another position this month (April 2021). During this past fall and winter, the ADU was supported by technicians from the other Mark Tag and Age Lab programs to process samples and estimate ages. During the last year, the lab focused on Sablefish, mixed rockfish, Pacific Cod, and Lingcod.

To continue work during the pandemic, Chris and Cathy have moved to teleworking and at-home age reading was available for people that quarantined. The lab also made use of empty offices and space for people in the building, supported social distancing, and enforced quarantine schedules as well as mask/cleaning mandates. Age resolutions, training, and exchange work were done remotely through screensharing apps (Microsoft Teams), images, and live-microscope cameras.

The ADU recently participated in a Sablefish exchange with AFSC, CDFO, and NWFSC, two Lingcod otolith/fin ray exchanges with WDFW and ADFG-Homer-Sport, a Rougheye Rockfish exchange with AFSC, and a Yelloweye Rockfish exchange with ADF&G-Homer Commercial.

In terms of age-related research, the ADU is continuing work on a Prince William Sound (PWS) Shortraker Rockfish chronology and is starting a chronology for PWS Yelloweye Rockfish. The ADU is finishing a North Pacific Research Board funded project on reconstructing reproductive histories of Yelloweye Rockfish (as well as other species) through hormone profiles extracted from bone. Further, the ADU is collaborating with other labs to compare age criteria for Lingcod fin rays and otoliths to evaluate and support methods.

B. **Alaska Department of Fish & Game Commercial – (Elisa Russ)**

In 2020 the Homer ADF&G Commercial Groundfish Age Lab had three age readers:

Elisa Russ (project leader), Andrew Pollak (primary production reader), and Kerri Foote (Black Rockfish). The port sampling program collects biological samples including age structures (primarily otoliths) from state managed groundfish and shellfish species harvested in Cook Inlet and Prince William Sound management areas (Central Region). Sampling goals are 550 otoliths collected from primary groundfish species – Pacific Cod, Sablefish, Lingcod, Walleye Pollock, and Rockfish. Groundfish sampling occurs in the ports of Homer, Seward, Whittier, Cordova, Kenai, and Kodiak.

Groundfish species aged in Homer include demersal shelf rockfish (primarily Yelloweye and Quillback), pelagic shelf rockfish (primarily Black Rockfish), and Walleye Pollock. In 2020, in response to an ADF&G Statewide Rockfish Initiative (SRI) focusing on assessment of keystone species Black and Yelloweye Rockfish, the Homer Age Lab accelerated age work on those two species in order to catch up on a backlog of unread otoliths. A total of 4,160 ages were produced in 2020, with age data current through 2019 for Black and Yelloweye Rockfish. As part of the SRI, a Yelloweye Rockfish exchange was done between the Homer Commercial and Sport Fish (Martin Schuster – lead) Age Labs.

Precision testing is done on 20% of all samples and on 100% of samples that are aged by new readers. All differences beyond 1 year are resolved, unless there is bias and then all differences are resolved. Otoliths are stored dry, cut using an Isomet saw, and baked; burning is used during precision testing to refresh otoliths and reduce pattern-obscuring glazing that may occur following preservation in storage media after the initial baking. Morphometric measurements (otolith length, width, and weight, excluding crystalized or broken otoliths) have been collected for all species since 2018. This information is analyzed to help identify outliers and errors in the age, species ID, or data entry.

The onset of COVID-19 in March 2020 in Alaska created new challenges for the ADF&G project, as it did for everyone. All travel to other ports (primarily Seward and Whittier) was halted during spring and early summer due to severe outbreaks of COVID-19 in seafood processing companies. All port sampling and age reading staff voluntarily submitted to regular testing and any exposure was handled using State of Alaska protocols similar to CDC guidelines for quarantining. Safety vests stating to keep a distance of 6 feet and masks were ordered and worn by port sampling staff. Most staff at ADF&G Homer office began teleworking and for those who continued to work in the office, masks, frequent hand sanitizing, and social distancing were required in all public areas. Beginning in March 2020, primary age reading staff took microscopes home and scheduled time to be the sole person in the lab for cutting and baking otoliths. Unexpectedly, age reading efficiency actually improved when staff were working from home, likely because time was dedicated solely to age reading without office distractions and also because port sampling had been curtailed until safer conditions were present. Port sampling and travel to other ports resumed in mid- to late summer, with staff driving in separate vehicles and undergoing frequent COVID-19 testing. Some staff returned to working in the office in the fall, including Andrew Pollak who trained a new age reader on Walleye Pollock; the teaching scope was used while wearing masks and only after negative COVID-19 test results were confirmed by both trainer and trainee. Some staff including Elisa Russ continue to primarily telework as ADF&G agreements remain in effect through 2021. Adaptation is quite impressive – ADF&G managed to implement multiple measures to keep staff safe and were successful in continuing to achieve project goals.

C. Sclerochronology Lab (SCL) – (Stephen Wischniowski)
Pacific Biological Station (PBS), Fisheries and Oceans Canada (CDFO), Nanaimo BC

PBS shut down due to COVID-19 in mid-March 2020. Since SCL staff do not have individual computers it was difficult for staff to work at home as they had no connectivity, and were communicating via personal emails and texting. Staff had health and safety concerns about burning alcohol within family homes, especially with children present. Thus a decision was made to focus on Return to Work (RTW) instead of how to set up ageing stations within individual homes.

The IT department provided SCL staff with temporary laptops in May 2020. During this time SCL leads developed RTW protocols and specific standard working procedures for every aspect of age estimation for all SCL spaces. Once all protocols, procedures, and safety precautions were established and personal protective equipment was obtained, the SCL team was given Essential Status and returned to work in mid-July 2020. Currently PBS is still in lockdown with only 20% occupation for critical and essential services.

SCL staff dynamics
- Ten staff
- Two new hires
- Three senior staff to retire 2022 and 2023

Species of focus upon SCL RTW March 2020 to March 2021
- *Atheresthes stomias* - Arrowtooth Flounder
- *Clupea pallasii* – Pacific Herring
- *Sebastes maliger* – Quillback Rockfish
- *Sebastes flavidus* – Yellowtail Rockfish
- *Sebastes pinniger* – Canary Rockfish
- *Oncorhynchus tschawytscha* – Chinook Salmon
- *Oncorhynchus keta* – Chum Salmon
- *Oncorhynchus nerka* – Sockeye Salmon
- *Oncorhynchus kisutch* – Coho Salmon

The SCL is down in numbers of fish aged compared to pre-COVID numbers
- Groundfish down 4,000
- Salmon down 6,000
- Herring down 6,000

The SCL Structure Library was completed to house 1.6 million otoliths, 3 million salmon scales, and assorted fin-ray collections. This space is an assortment of static and mobile shelving units with an otolith washing and scale press station. This space is approximately 1400 sq. ft. and should provide 15 years of future capacity.

The SCL Direct Data Entry application for groundfish is ready for beta testing. Direct Data Entry (DDE) has been a historic priority for the SCL that dates back to the previous program manager, Shayne MacLellan. Efforts over the last ~20 years have been unsuccessful, mainly because of the historical lack of technology and recent lack of funding. The vision of DDE has changed since its original conception; the main objectives were to:
- increase work throughput and efficiencies

- eliminate paper usage
- eliminate/reduce transcriptional errors
- eliminate client key punching
- add real time statistical analysis for increased QA/QC
- provide immediate access to historical data

These attributes are foundational in the implementation of DDE and will play a key role. However the hidden advantage of computerized workstations is the increased capacity to record data that historically were too cumbersome and time consuming to collect. Computerized age workstations will provide the ability to record otolith weights and take images, supplemental data that will facilitate real-time quality control measures within the daily routine of producing age estimates.

- Otolith weight. There is a direct and linear relationship between otolith weight and age. Measuring otolith weight facilitates the real-time identification and examination of outliers that do not fit this relationship before data is released to the client.
- Otolith images. The utility of Otolith Shape Analysis (OSA) has in recent years become a powerful tool for the identification of species based on morphometric measures of the otolith. A recent SCL/GF pilot study has had great success in identifying species within the *S. aleutianus/melanostictus* complex based on OSA, otolith weight, fish length, and age. More recently its utility has been implemented in the identification of populations within species that reveal no genetic disparity. Climate change is certain to increase the difficulty of estimating fish age. The SCL has observed in several species an increasingly "noisier" pattern; based on the timing of these occurrences this change can potentially be attributed to the onset of a changing climate. To reduce ageing error and provide more certainty in the data produced will require the SCL to move away from a single subjective determiner of age. Otolith weight and shape can be considered analogues to age and when used synergistically will deliver a more robust, higher quality set of data.

D. International Pacific Halibut Commission (IPHC) – (Joan Forsberg)

The IPHC currently has four age readers on site. We age an average of 25,000 to 30,000 otoliths per year.

Pandemic issues:

Most IPHC staff, including the age lab staff, have been working from home since late March 2020. Anyone needing to come to the office must request permission in advance. Depending on the phase Washington State was in at the time, number of staff at the office have been limited to 5 or 10 at a time and masks are worn while in the office.

The age lab supervisor would be notified when samples were ready to pick up and would request permission to come into the office, pick up the samples and deliver them to the other readers. As readers finished reading a batch of otoliths, they would arrange to drop the samples off with the age lab supervisor or have them picked up. Age sheets were picked up along with the aged otoliths and delivered to the office for data-entry staff to pick up. Otoliths were distributed for second reads in a similar manner.

Fewer otoliths were collected on the setline survey in 2020 because of late start and reduced number of stations fished.

Projects:
IPHC genetics staff looked into obtaining DNA from blood and tissue adhering to otoliths. Good results were obtained from otoliths stored dry with visible blood on the surface (n=7); no DNA was obtained from cleaned otoliths stored in glycerin solution (n=10).

The IPHC photographed and measured ~1900 baked otolith sections for an increment study.

E. Washington Department of Fish and Wildlife (WDFW) – (Andrew Claiborne)

WDFW's Fish Ageing Lab

- Christina Jump—Age Reader (freshwater), salmon data entry
- Austin Anderson—Age Reader (salmon and trout), research projects
- Sandra Rosenfield—Age Reader (groundfish lead)
- Jenny Topping—Age Reader (groundfish), groundfish data entry
- Andrew Claiborne—Age Lab Team Lead and Age Reader (salmon and trout)

COVID-19 and Ageing Activities
WDFW currently has two age readers that focus on groundfish. Prior to 2020, our groundfish age readers partially worked remotely coupled with days in the lab together each week. As such, remote working has been relatively easy except for looking at samples together at our teaching double-microscope, which would violate social distancing mandates. We have used images of otoliths and fin rays and frequent discussions to mitigate our inability to double-scope. We are purchasing cameras for all our scopes that do not already have them to facilitate more streamlined collaboration.

In the spring of 2020, we were able to return to the lab on a regular basis. That marked an improvement in our production of salmon and freshwater species and preparation of lingcod fin rays. Those of us with small children welcomed this return to our usual lab space.

Species and Numbers Aged Since 2019 CARE

Species Name	n
Black Rockfish	1,088
Copper Rockfish	729
Lingcod	2,613
Northern Anchovy	148
Pacific Sardine	12
Petrale Sole	281
Quillback Rockfish	1,527
Vermilion Rockfish	628
Widow Rockfish	1,480
Yelloweye Rockfish	731

Yellowtail Rockfish	3,508
Total	12,745
Salmon, Trout, Freshwater	~75,000

F. Alaska Fisheries Science Center (AFSC) – (Delsa Anderl)

AFSC staff includes 16 full-time employees, of which half are age readers and half are responsible for research studies and database management and support. Three more staff members are contract employees.

AFSC went into mandatory telework on March 23, 2020. Access to campus was highly restricted in those early days, so otolith boxes for estimated work through the following June were removed from campus and stored in all eight age reader's homes along with microscopes, low-speed saws, toaster ovens and anything else that age readers needed to continue work in their temporary home work stations. Makeshift work stations were set up on dining room tables, available counters, and in home offices.

The biggest challenge faced was how to maintain the process of quality control that includes exchanging samples so a second reader (tester) is able to age 20% of an ageing sample and resolving discrepancies. A best-practice protocol of exchanging otolith boxes between homes was designed and is maintained to this day. Initially, the team lead was the sole runner for transporting boxes between homes. Now, all age readers run between their homes and their tester's homes. Then, there was the challenge of resolving reader-tester discrepancies, which under normal circumstances is most frequently undertaken by viewing structures together at a double-headed teaching microscope. Eventually the lab was able to purchase microscope cameras for all age readers to allow discrepancies to be resolved through photo images to inform discussions towards resolved ages via online sharing platforms.

For the AFSC, mandatory telework is still currently in effect. While working through the pandemic, AFSC age readers were able to release a total of nearly 34,000 ages prior to the assessment cycle that ended on Sept 30. This number of ages is comparable to a normal year. The breakdown of species includes:

Common_Name	Number Aged
Alaska Plaice	258
Arrowtooth Flounder	708
Atka Mackerel	1,702
Blackspotted Rockfish	300
Dover Sole	332
Dusky Rockfish	1,079
Flathead Sole	2,786
Greenland Turbot	110
Kamchatka Flounder	448
Northern Rock Sole	2,187

Northern Rockfish	1,606
Pacific Cod	4,072
Pacific Ocean Perch	3,666
Sablefish	2,333
Southern Rock Sole	673
Walleye Pollock	9,975
Yellowfin Sole	1,421

The summer surveys for 2020 were canceled, so in place of ageing summer survey samples, AFSC age readers aged archived Pacific Cod samples that had been lower on the priority list. Also, time was available to train 3-4 age readers to learn to age Sablefish, Greenland Turbot, Pacific Ocean Perch, Rougheye Rockfish, Blackspotted Rockfish, Atka Mackerel and Pacific Cod.

As part of a NOAA funded 5-year strategic initiative (SI), scientists at the AFSC are investigating the use of Fourier transform near infrared (FT-NIR) spectroscopy. The strategic initiative entitled, "A revolutionary approach for improving age determination efficiency in fish using Fourier transform near infrared (FT-NIR) spectroscopy" led by Dr. Thomas Helser is a nation-wide effort that involves seven biological labs focused on operationalizing this technology within the NOAA Fisheries age estimation enterprise. The FT-NIR spectrometer measures the absorption of near infrared energy by material when it directs near infrared light onto a sample and records how light is modified according to the composition of the sample. The spectral information most meaningful for otoliths are in the regions related to the functional groups in proteins such as carbon-hydrogen (C-H), oxygen-hydrogen (O-H) and nitrogen-hydrogen (N-H) groups. As such, the chemical properties of the otoliths, such as the quantity of the absorbed energy within those specific regions, are a proxy for fish age.

Among the case studies to be illustrated, FT-NIR spectra of eastern Bering Sea Walleye Pollock otoliths explained 90% - 95% of the variation in traditional age estimates, predicted fish age within ± 1.0 year 90% of the time, and achieved better precision and less bias. In addition to Walleye Pollock, we are collecting spectra for a variety of other groundfish species. Moreover, pilot data suggests FT-NIR spectroscopy holds promise for rapid assessment of other life history properties such as reproductive status from ovaries and energy density (condition) from muscle/liver scans. Some of the FT-NIR projects in development right now are:

- age prediction of long-lived species such as Northern Rockfish and Pacific Ocean Perch
- using known-age data to improve model predictions using tagged Sablefish
- exploring the use of NIR spectral and biological data fusion using deep learning neural network models to improve prediction
- development of a simulation framework to evaluate: 1) impacts of ageing uncertainty in reference data on model predictions, 2) stock assessment model outcomes from FT-NIR vs. traditional age data products
- species discrimination using otolith FT-NIR spectra
- rapid estimation of reproductive status from ovaries and energy density from muscle or liver
- using Raman spectroscopy as complementary to FT-NIR data analysis

- ground-truth spectral data with target life history properties such age fish age, reproductive status, and condition using lab-based and captive rearing studies

Published FT-NIR research:

A transformative approach to ageing fish otoliths using Fourier transform near infrared spectroscopy: a case study of eastern Bering Sea walleye pollock (*Gadus chalcogrammus*). Helser, T. E., I. Benson, J. Erickson, J. Healy, C. Kastelle, and J.A. Short. 2018. Can. J. Fish. Aquat. Sci. https://doi.org/10.1139/cjfas-2018-0112

Proceedings of the research workshop on the rapid estimation of fish age using Fourier Transform Near Infrared Spectroscopy (FT-NIRS). Helser, T. E., I. M. Benson, and B. K. Barnett (editors). 2019. AFSC Processed Rep. 2019-06, 195 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Classification of fish species from different ecosystems using the near infrared diffuse reflectance spectra of otoliths. Benson, I. M., B. K. Barnett and T. E. Helser. 2020. J. Near Infrared Spec. https://doi.org/10.1177/0967033520935999

Age estimation of red snapper *(Lutjanus campechanus*) using FT-NIR spectroscopy: feasibility of application to production ageing for management. Passerotti, M. S., T. E. Helser, I. M. Benson, B. K. Barnett, J. C. Ballenger, W. J. Bubley, M. J. M. Reichert and J. M. Quattro. 2020. ICES J. Mar. Sci. 77:2144-2156. https://doi.org/10.1093/icesjms/fsaa131

Recently accepted papers:

Aging Fish at the Molecular Level using Fourier Transformed Near-Infrared Spectroscopy (FT-NIRs): A Case Study on Pacific Cod (*Gadus macrocephalus*) Stocks in the Eastern Bering Sea. J. Healy, T. Helser, I. Benson, L. Tornabene

Recently submitted papers:

Rapid age estimation of longnose skate (*Raja rhina*) vertebrae using near infrared spectroscopy. M. Arrington, T. Helser, I. Benson, T. Essington, M. Matta, A. Punt

Rapid and reliable assessment of fish physiological condition for fisheries research and management using Fourier transform near-infrared spectroscopy. E. Goldstein, T. Helser, J. Vollenweider, A. Sreenivasan, F. Sewall

G. Oregon Department of Fish & Wildlife (ODFW) – (Mark Terwilliger)

Production Aging: In 2020, emphasis was placed on species up for assessment in 2021. Initially, it was believed that there might be a full assessment on Oregon Copper Rockfish, so I produced break-and-burn age estimates for 363 Copper Rockfish from the commercial fishery (73 tested; captured from 2002-2019) and 2,298 from the recreational fishery (459 tested, captured from 2005-2019). These ages were used to inform an externally estimated growth curve for a data-moderate assessment.

Due to some uncertainty over the next species to focus on for 2021 assessments, I moved to aging Black Rockfish in preparation for a 2023 assessment. Break-and-burn

age estimates were generated for 648 Black Rockfish (0 tested) captured in the 2017 commercial fishery.

In September 2020, I began generating ages for a full 2021 Vermilion Rockfish assessment. To that end, I produced break-and-burn estimates for 896 Vermilion Rockfish from the commercial fishery (180 tested; captured from 2004-2020) and 621 from the recreational fishery (0 tested; captured from 2009-2019). Aging of samples from the recreational fishery would continue into 2021.

Aging activities affected by COVID-19 in 2020 included the preparation of Lingcod fin ray sections. Typically, agers from Pacific States Marine Fisheries Commission (PSMFC) cut and mount fin ray sections from our recreational catch. Standard practice requires the use of a fume hood for mounting the sections to slides with Cytoseal. Due to COVID-19, PSMFC agers were not able to access their lab, so sections were cut by ODFW personnel and affixed to slides using Crystalbond (a non-toxic thermoplastic resin), and nail polish was used to elucidate annual marks. This method produced clear sections that were able to be read and served as a good alternative to the standard mounting method described in the CARE aging manual.

Age Validation: The 2015 stock assessment for California, Oregon, and Washington stocks of Black Rockfish identified the need for validation and verification of annuli as a recommended avenue for research in order to improve future assessments. In May 2020 we began a collaborative study with the Canadian Centre for Isotopic Analysis at the University of Alberta to validate annuli on otoliths of Black Rockfish (a semi-pelagic rockfish), Cabezon (a difficult-to-age sculpin), and Copper Rockfish (a demersal rockfish) using secondary ion mass spectroscopy to measure oxygen isotope ratios ($\delta^{18}O$) in otoliths over the lifespan of the fish. Because an otolith is acellular, metabolically inert, and grows throughout the life of the fish, any elements or compounds accreted onto its surface are permanently retained. Otoliths therefore contain a complete record of the temperature and chemical composition of the ambient water a fish experienced over its lifespan. A known inverse relationship exists between water temperature and $\delta^{18}O$, so our goal is to relate peaks in the $\delta^{18}O$ signal (corresponding to cold water temperatures) to annual marks on the otolith.

H. Northwest Fisheries Science Center Newport (NWFSC) – (Patrick McDonald)

Status

We started working from home in March of 2020. We were able to meet and exchange otoliths at our off-site storage unit during the mandatory telework. We purchased some microscope eye-piece attachments to take images with our smart phone cameras. This was one way we could continue to resolve double-read specimens. We also allowed lead agers to resolve double-read specimens on their own. We are still working from home, but in late January we received approval for Return-To-Work to begin processing lingcod fin rays for the upcoming assessment.

Assessments supported –

2021

Copper Rockfish
Squarespot Rockfish
Vermilion Rockfish
Quillback Rockfish
Dover Sole

Sablefish
Hake
Lingcod

2019

Big Skate
Sablefish
Widow Rockfish
Hake
Petrale Sole

Numbers of aged otoliths for 2019 and 2020
2019: Total numbers are 30,481
2020: Total numbers are 33,651
Those numbers are production and double reads combined.

Exchanges Participated - 2019 and 2020
Vermilion – ODFW, WDFW, SWFSC
Sablefish known-age – ADFG, AFSC, DFO
Dover Sole – AFSC
Widow Rockfish – WDFW

Personnel/Staffing
We currently have 4 full-time agers and one team lead. Our staffing has been stable, but we might be hiring a part-time age reader later this year to assist on a Hake project.

I. Southwest Fisheries Science Center (SWFSC) – (Melissa Monk)

The Southwest Fisheries Science Center Santa Cruz rejoined CARE in 2019. After the retirement of our only federal production ager, we are working to rebuild ageing capacity as staff time allows. Melissa Monk is now the contact for otolith requests and manages the otolith library at the SWFSC. In preparation for the 2021 Vermilion Rockfish stock assessment, the SWFSC initiated a round-robin otolith exchange for Vermilion Rockfish among the SWFSC, ODFW, WDFC, and the NWFSC. Each lab provided 50-60 otoliths. The exchange is now complete and analyses are forthcoming. This is the first time that vermilion rockfish have been aged in large quantities for an assessment.

The SWFSC is also participating in the FT-NIRS strategic initiative led by Tom Helser at the AFSC. We received a Bruker Tango (a NIR spectrometer) in 2020, but due to COVID-19, we have not been able to install the spectrometer.

B. Age Structure Exchanges

Age structure exchanges occur periodically to assess calibration among CARE age-reading agencies. Depending on results, specimens of interest (e.g., demonstrated biases) are then reviewed and discussed. Exchanges are tracked by the CARE Vice-Chair. Data from exchanges are available on the CARE website.

There were 10 age structure exchanges initiated in 2020 and none in 2021. Seven of the 2020 exchanges have been finalized and will be added to the CARE websites 'Structure Exchange table'.

Table 1. CARE age structure exchanges

CARE Age Structure Exchanges initiated in 2020				
Exchange ID No.	Species	Originating Agency	Coordinator	Participating Agency (Cooperators)
20-001	Dover Sole	NWFSC	Nikki Paige	AFSC
20-002	Dover Sole	AFSC	Julie Pearce	NWFSC
20-003	Sablefish	AFSC	John Brogan	NWFSC, ADFG-Juneau, CDFO
20-004	Rougheye Rockfish	ADF&G-Juneau	Cathy Mattson	AFSC
20-005	Rougheye Rockfish	AFSC	Chris Gburski	ADFG-Juneau
20-006	Yelloweye Rockfish	ADFG-Homer	Elisa Russ	ADFG-Juneau
20-007	Vermilion Rockfish	WDFW	Jenny Topping	NWFSC, ODFW, SWFSC
20-008	Vermilion Rockfish	SWFSC	Melissa Monk	WDFW, ODFW, NWFSC
20-009	Vermilion Rockfish	NWFSC-PSMFC	Patrick McDonald	WDFW, ODFW, SWFSC
20-010	Vermilion Rockfish	ODFW	Mark Terwilliger	NWFSC, WDFW, SWFSC

C. Attendees for the April 6, 2021 Virtual Check-in

Table 1. List of attendees

First name	Last name	Agency	Location	Country
Marian	Ford	ADFG	Homer	USA
Andrew	Pollak	ADFG	Homer	USA
Elisa	Russ	ADFG	Homer	USA
Chris	Hinds	ADFG	Juneau	USA
Catherine	Mattson	ADFG	Juneau	USA
Kevin	McNeel	ADFG	Juneau	USA
Sonya	Elmejjati	ADFG	Kodiak	USA
Delsa	Anderl	AFSC	Seattle	USA
Morgan	Arrington	AFSC	Seattle	USA
Irina	Benson	AFSC	Seattle	USA
John	Brogan	AFSC	Seattle	USA
Chris	Gburski	AFSC	Seattle	USA
Esther	Goldstein	AFSC	Seattle	USA
Brenna	Groom	AFSC	Seattle	USA
Jordan	Healy	AFSC	Seattle	USA
Charles	Hutchinson	AFSC	Seattle	USA
Craig	Kastelle	AFSC	Seattle	USA
Beth	Matta	AFSC	Seattle	USA
Sandi	Neidetcher	AFSC	Seattle	USA
Julie	Pearce	AFSC	Seattle	USA
Kali	Stone	AFSC	Seattle	USA
Barbara	Campbell	CDFO	Nanaimo	Canada
Chelsea	Cooke	CDFO	Nanaimo	Canada
Joanne	Groot	CDFO	Nanaimo	Canada
Mary-Jane	Hudson	CDFO	Nanaimo	Canada
Judy	McArthur	CDFO	Nanaimo	Canada
Chelsea	Rothkop	CDFO	Nanaimo	Canada
Audrey	Ty	CDFO	Nanaimo	Canada
Stephen	Wischniowski	CDFO	Nanaimo	Canada
Joan	Forsberg	IPHC	Seattle	USA
Chris	Johnston	IPHC	Seattle	USA
Dana	Rudy	IPHC	Seattle	USA
Kimberly	Sawyer	IPHC	Seattle	USA
Robert	Tobin	IPHC	Seattle	USA
James	Hale	NWFSC	Newport	USA
Betty	Kamikawa	NWFSC	Newport	USA
Patrick	McDonald	NWFSC	Newport	USA

Nikki	Paige	NWFSC	Newport	USA
Leif	Rasmuson	ODFW	Newport	USA
Mark	Terwilliger	ODFW	Newport	USA
Melissa	Monk	SWFSC	Santa Cruz	USA
Diana	Watters	SWFSC	Santa Cruz	USA
Austin	Anderson	WDFW	Olympia	USA
Andrew	Claiborne	WDFW	Olympia	USA
Christina	Jump	WDFW	Olympia	USA
Sandy	Rosenfield	WDFW	Olympia	USA
Jennifer	Topping	WDFW	Olympia	USA

Figure 1: Photo of virtual check-in attendees