

OVERVIEW OF THE STATUS OF AGE READING TO SUPPORT PLANNED 2023 GROUND FISH ASSESSMENTS

As part of the National Marine Fisheries Service (NMFS) Groundfish Science Report at the March meeting, the Northwest Fisheries Science Center (NWFSC) presented evidence of strong incoming sablefish recruitment; and the potential for conducting an unplanned, limited update of the last sablefish assessment was discussed. At the conclusion of that discussion, the Council requested that NMFS provide the Council with an overview of completed and ongoing age-reading activities, in order to better assess whether new sablefish ageing might jeopardize support for the groundfish assessments previously scheduled for this year. As detailed below, review of age-reading activities indicates that a high percentage of planned ageing has already been completed and that remaining high-priority ageing for other species can be completed without staff who would be engaged in conducting ageing for a sablefish update.

Age Reading to Support Planned 2023 Assessments

This report contains a series of tables that summarize age reading conducted or planned by the NWFSC and the Cooperative Ageing Project (CAP), which is funded through a grant from NWFSC to Pacific States Marine Fisheries Commission. Since CAP would be conducting all of the sablefish ageing that would support an Update assessment for sablefish, this report does not summarize age reading that has been conducted by age readers within the Washington Department of Fish and Wildlife or the Oregon Department of Fish and Wildlife to support this year's assessments.

Table 1 presents an overview of CAP age reading, by species, that has been completed between June 1, 2022 and roughly March 20, 2023. A total of nearly 22,000 production age reads have been completed for species that are being assessed this year. In most cases, production ages are included directly in assessment models to characterize the age structure of catch by surveys or fishing fleets. In the case of rex sole, the production ages are used to estimate a growth curve, whose parameters are then included in the length-based data-moderate assessment model. For a subsample of nearly 4,500 otoliths, Double Reads were conducted. These are additional reads by a different, trained person which provide the assessment authors with valuable information about the consistency of age determinations. These are used to inform assessment models about the precision and potential for bias in the production age data. The 27,600 age reads over the past 9 ½ months is an outstanding achievement, and truly reflects the tremendous dedication and commitment of all CAP staff and their leader, Patrick McDonald. The fact that three of the staff also had to be trained on ageing new species during this period underscores their remarkable accomplishment.

Table 2 is the first of five tables which summarize the ageing status for the five species scheduled for Full or Data-Moderate assessments in 2023, beginning with black rockfish. CAP is only reading otoliths from California, as the State agencies in Oregon and Washington are ageing otoliths collected from their own fisheries. Most of CAP age reading has focused on otoliths collected from fisheries since 2020, though a limited number of structures collected during California Collaborative Fisheries Research Program (CCFRP) cruises have also be aged. After finishing otoliths from the 2022 commercial fishery, 1,000 ages will be read from other research cruises conducted in 2010-11.

Age reading for canary rockfish is summarized in Table 3, which extends over two pages. The first page shows ageing of structures collected by NMFS. From the 2021 and 2022 bottom trawl surveys, 960 new ages have been read, along with 100 collected in the 2021 at-sea hake fishery. We are also planning to read roughly 350 otoliths from the 1986 Triennial survey, from a total of 600 previously-unread samples. The second page of Table 3 reports on the ageing of fishery samples from Oregon and California. All of the new ageing has focused on samples collected since 2013 from the commercial fishery in California and both recreational and commercial fisheries in Oregon. The major remaining task is to age 600 samples from the 2022 California commercial fishery, and we expect this will be completed before the May 1 data deadline.

Significant amounts of age reading for copper rockfish were completed in the year preceding the 2021 assessment, and continuing into the following winter. Consequently, all of the new ageing for California copper rockfish has involved samples collected since 2018, and most from 2021-22. Nearly half of the new ages were derived from samples collected through a cooperative program of otolith collection between the Sportfishing Association of California and the Southwest Fisheries Science Center. No further age reading for copper rockfish is planned, as we are now beyond the data deadline for that assessment.

Ageing of petrale sole, summarized in Table 5, was also focused on recent years in which trawl survey samples and commercial samples from Oregon and California had not previously been aged. A lesser amount of ‘catch-up’ ageing was conducted for samples collected in the 1999 and 2000 Oregon trawl fisheries. All planned ageing of petrale has been completed, and one of the staff who had been working on these would serve as the principal ager for sablefish, if an update assessment is recommended by the Council in April.

No age reading of west coast rex sole had previously been conducted. Since the 2013 Data-Moderate assessment made use of a published growth curve based on samples from Alaska, new age reading to support estimation of a west coast growth curve was prioritized following selection of rex sole for assessment in 2023. Random samples were selected from throughout much of the size range of fish collected during the 2017-19 surveys, and then these were augmented by additional fish from the upper and lower tails of the observed length distribution from the 2007-19 surveys, yielding a total of 629 ages, as reported in Table 6.

Potential Sablefish Age Reading

If the Council desires a limited Update for sablefish to be developed between April and August, new age reading would be needed. Because of the limited amount of time for age reading, which would likely need to be concluded by early/mid-June, ageing would focus exclusively on otoliths collected by the bottom trawl survey since the last update, which total nearly 3,900. At this time, we are unsure how we would partition ageing effort between the two surveys, owing to some technical considerations and uncertainty about how much overall ageing time will be available.

This age reading could commence by mid-April, and our best estimate is that roughly 1,800-2,000 production ages could be completed by the end of May. Additional ageing time in June would allow more of the 3,900 survey structures to be aged, but when ageing would need to be cut off would depend upon when the Update would be reviewed by the Scientific and Statistical Committee’s Groundfish Sub-committee (SSC-GFSC), along with further consideration of the

modeling and documentation time that will be needed after age reading has ended. During the March meeting, the SSC-GFSC identified two likely meeting times (August 14-15 and August 28), during which they planned to review new stock assessments, but that discussion preceded presentation of information related to recent sablefish recruitment. If a sablefish Update were to be reviewed during the latter meeting, it could afford valuable additional ageing time, however, later review would also reduce the options available for the SSC-GFSC to request and review additional model runs/exploration.

As noted above, we do not anticipate that assigning CAP staff with sablefish ageing experience to work on this project would have any impact on planned ageing to support other scheduled assessments/reviews this year. Additionally, one of our assessment staff, Dr. Kelli Johnson, was being held in reserve, without being assigned to work on a particular species, with the intent that she could assist with other assessments as needed. Kelli led the 2015 Update assessment for sablefish, which was conducted by members of the University of Washington course taught by NWFSC staff, and was 2nd author on the last Full assessment in 2019. With this previous experience, we believe that she is very well-suited to lead a limited, expedited 2023 Update for sablefish, and that her focus on that would not jeopardize the quality of other ongoing assessments, nor present them with undue workload challenges. This winter's pre-assessment workshops and frequent meetings between STAT members and State agency staffs have helped build shared understanding and resolve potential issues early in the assessment process for these other species.

Table 1.--Overview of age reading conducted by the Cooperative Ageing Project (Pacific States Marine Fisheries Comm.), in cooperation with the NW Fisheries Science Center, since June 1, 2022

Species	Production ¹	Double Read ²	Total Reads
2023 Assessments			
Black RF	2,137	487	2,624
Canary RF	8,237	1,103	9,340
Copper RF	1,258	511	1,769
Petrale sole	5,729	1,352	7,081
Rex sole	629	130	759
Pacific Hake	3,731	889	4,620
sub-total for 2023	21,721	4,472	26,193
Other species			
Quillback RF ³	827	192	1,019
Rougheye RF	0	82	82
Lingcod	0	296	296
Grand Total	22,548	5,042	27,590

¹ Production ages are used to inform growth and/or characterize survey or fishery catch in an assessment model

² Double reads are multiple reads of the same otolith that inform estimates of age-reading consistency, which are included in assessment models

³ These were aged between June, 2022, and the 'final' selection of species for 2023 assessments in September, 2022

Table 2.--Overview of NWFSC age-reading for the 2023 assessment of black rockfish

New age reads since 6/1/2022

Production 2,137
 Double Read 487
Total 2,624

Ageing key

XXX Previously aged otoliths
 XXX Otoliths aged since 6/1/2022
 XXX Planned for completion by data deadline

	California								Total	
	Commercial		Recreation		Research		CCFRP			
	# of oto's	# of ages								
1979					67	67			67	67
1980	28	28	67	67	42	42			137	137
1981	129	129	68	68	30	30			227	227
1982	16	16	165	165	39	39			220	220
1983					6	6			6	6
1984	227	227	12	12	4	4			243	243
1985	172	144							172	144
2001	32	32							32	32
2002	13	13							13	13
2003	19	19							19	19
2004	9	9			7	7			16	16
2005	1	1			7	7			8	8
2007	28	28							28	28
2008									0	0
2009	97	96							97	96
2010					987	558			987	558
2011	44	44			897	444			941	488
2012	44	44							44	44
2013	1	1							1	1
2015	12	0							12	0
2016	9	0							9	0
2017							65	65	65	65
2018	39	0					23	23	62	23
2019	375	0					36	36	411	36
2020	466	457					27	27	493	484
2021	592	467	8	8			12	12	612	487
2022	318	258	582	579			53	52	953	889
Total	2,671	2,013	902	899	2,086	1,204	216	215	5,875	4,331

Table 3.--Overview of NWFSC age-reading for the 2023 assessment of canary rockfish (1 of 2)

New age reads since 6/1/2022

Production 8,237
 Double Read 1,103
Total 9,340

Ageing key

XXX Previously aged otoliths
 XXX Otoliths aged since 6/1/2022
 XXX Planned for completion by data deadline

	NWFSC							AFSC		Total		
	Trawl Survey		At-Sea Hake Obs		Hook & Line		WCGOP		Shelf Survey		(both pages)	
	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages
1978											445	443
1979											7	7
1980									737	0	797	60
1981											64	64
1982											2	2
1983									1,630	1,630	1,680	1,680
1984											52	52
1985											3	3
1986									599	350	600	351
1989									256	256	256	256
1992									280	280	1,644	1,560
1995									314	314	314	314
1996											1,163	1,107
1998									238	0	238	0
1999											1,910	1,909
2000											756	754
2001									382	381	1,140	1,136
2002											1,105	1,101
2003	304	303	143	143			16	16			756	755
2004	317	315	175	174	23	23	208	208	258	257	1,331	1,324
2005	278	278	269	269	20	20	856	855			1,821	1,819
2006	251	251	231	230	11	11	4	4			872	869
2007	500	500	388	387	21	21					1,050	1,049
2008	474	473	443	442	4	4					1,117	1,114
2009	292	290	232	232	20	20					1,071	1,046
2010	398	398	241	241	16	16					1,001	996
2011	374	373	203	203	10	10					984	981
2012	706	705	108	107	12	12					1,320	1,318
2013	377	376	110	109	12	12					1,802	1,800
2014	911	902	174	164	26	26					2,510	2,487
2015	744	740	53	53	20	19					3,196	2,769
2016	605	605	123	123	11						2,483	2,226
2017	528	528	1,034	0	15						5,286	2,106
2018	475	474	525	0	41						3,890	1,712
2019	360	360	364	0	41						3,850	1,614
2020	472	470	92	0	11	11					1,984	1,519
2021	472	470	367	100	11						3,204	2,508
2022	491	490	291		58						3,090	1,694
Total	8,857	8,831	5,566	2,977	372	194	1,084	1,083	4,694	3,468	55,395	43,215

Table 3 (cont.)--Overview of NWFSC age-reading for the 2023 assessment of canary rockfish (2 of 2)

New age reads since 6/1/2022

Production 8,237
 Double Read 1,103
Total 9,340

Ageing key

XXX Previously aged otoliths
 XXX Otoliths aged since 6/1/2022
 XXX Planned for completion by data deadline

	California				Oregon						Total	
	Commercial		Recreation		Commercial		Hake Bycatch		Recreation		(both pages)	
	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages
1978	445	443									445	443
1979			7	7							7	7
1980			60	60							797	60
1981			64	64							64	64
1982			2	2							2	2
1983			50	50							1,680	1,680
1984			52	52							52	52
1985			3	3							3	3
1986			1	1							600	351
1989											256	256
1992					1,364	1,280					1,644	1,560
1995											314	314
1996					1,163	1,107					1,163	1,107
1998											238	0
1999					1,457	1,456	60	60	393	393	1,910	1,909
2000					115	115	272	272	369	367	756	754
2001	28	28			591	588	139	139			1,140	1,136
2002	98	98			899	898	108	105			1,105	1,101
2003	44	44			211	211	38	38			756	755
2004	11	11			194	193	145	143			1,331	1,324
2005	54	54			226	226	118	117			1,821	1,819
2006	32	31			129	129	214	213			872	869
2007	21	21			4	4	116	116			1,050	1,049
2008					44	44	152	151			1,117	1,114
2009	41	19			346	345	140	140			1,071	1,046
2010	5				288	288	53	53			1,001	996
2011					329	327	68	68			984	981
2012					426	426	68	68			1,320	1,318
2013	147	147			750	750	406	406			1,802	1,800
2014	76	76			947	943	376	376			2,510	2,487
2015	150	150			1,292	1,290	319	317	618	309	3,196	2,769
2016	1	1			874	874	363	363	506	260	2,483	2,226
2017	132	132			2,110	821	764	387	703	238	5,286	2,106
2018	190	190			1,500	555	600	301	559	192	3,890	1,712
2019	312	312			1,719	505	462	236	592	201	3,850	1,614
2020	198	198			905	879	202	201	587	241	1,984	1,519
2021	348	348			1,066	698	324	276	616	616	3,204	2,508
2022	601	601			1,112	512	475	243	663	449	3,691	2,295
Total	2,934	2,904	239	239	20,061	15,464	5,982	4,789	5,606	3,266	55,395	43,215

Table 4.--Overview of NWFSC age-reading for the 2023 assessment of copper rockfish

New age reads since 6/1/2022

Production 1,258
 Double Read 511
Total 1,769

Ageing key

XXX Previously aged otoliths
 XXX Otoliths aged since 6/1/2022
 XXX Planned for completion by data deadline

	NWFSC				California												Total	
	Trawl Survey		Hook & Line		Comm-ercial		Recre-ation		CPFV-SWFSC		Rec. Bio. GF Proj.		Re-search		CCFRP			
	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages
1975							84	84									84	84
1978							203	203									203	203
1981							65	63									65	63
1984							93	91									93	91
2001													3	3			3	3
2002													68	68			68	68
2003													262	260			262	260
2004	76	76	33	33									84	83			193	192
2005	43	43	69	68									16	16			128	127
2006	10	10	59	59									10	10			79	79
2007	13	13	76	75									21	21			110	109
2008	65	65	68	68													133	133
2009	27	27	101	101													128	128
2010	18	18	23	23									29	29			70	70
2011	12	12	53	53									48	48			113	113
2012	103	103	62	57													165	160
2013	51	51	46	46													97	97
2014	33	33	48	48			1	0									82	81
2015	39	39	98	96													137	135
2016	78	78	108	108													186	186
2017	102	101	74	69											8	8	184	178
2018	53	53	107	106	5	5									20	12	185	176
2019	30	30	63	63	74	74									27	27	194	194
2020	92	92	31	31	40	40									13	13	53	53
2021	92	92	31	31	72	72	1	0			6	5			4	4	206	204
2022	61	61	59	59	87	87	98		759	759	166	139			97	97	1,327	1,202
Total	906	905	1,178	1,163	278	278	545	441	759	759	172	144	541	538	169	161	4,548	4,389

Note: 255 otoliths collected from refugia from 1978 to 1993 were not aged or included in this table for conciseness.

Table 5.--Overview of NWFSC age-reading for the 2023 assessment of petrale sole

New age reads since 6/1/2022

Production 5,729
 Double Read 1,352
Total 7,081

Ageing key

XXX Previously aged otoliths
 XXX Otoliths aged since 6/1/2022
 XXX Planned for completion by data deadline

	NWFSC		California		Oregon		Total	
	Trawl Survey		Commercial		Commercial		# of oto's	# of ages
	# of oto's	# of ages	# of oto's	# of ages	# of oto's	# of ages		
1985					600	592	600	592
1986			1,000	989	1,001	912	2,001	1,901
1987			550	533			550	533
1988			399	394			399	394
1989					803	690	803	690
1990			227	224	802	395	1,029	619
1991			245	245	633	630	878	875
1992					745	744	745	744
1993					532	532	532	532
1994					629	628	629	628
1995					296	295	296	295
1996					237	237	237	237
1997					748	744	748	744
1998					555	554	555	554
1999					395	393	395	393
2000					750	386	750	386
2001					426	12	426	12
2002					781	484	781	484
2003	1,661	796	96	96	1,017	635	2,774	1,527
2004	2,013	934	153	153	873	269	3,039	1,356
2005	1,984	802	274	272	810	233	3,068	1,307
2006	1,018	804	206	206	1,634	801	2,858	1,811
2007	1,049	737	176	175	1,629	455	2,854	1,367
2008	1,050	766	403	398	1,959	453	3,412	1,617
2009	1,079	788	78	78	1,670	536	2,827	1,402
2010	1,406	807	3	0	1,950	507	3,359	1,314
2011	1,371	807	212	211	1,592	527	3,175	1,545
2012	1,271	793	154	152	1,793	619	3,218	1,564
2013	851	848	143	141	2,312	716	3,306	1,705
2014	1,231	766			3,195	750	4,426	1,516
2015	1,158	754			2,586	720	3,744	1,474
2016	913	906	122	0	1,795	525	2,830	1,431
2017	895	888	150	0	2,654	771	3,699	1,659
2018	818	812	276	276	1,970	755	3,064	1,843
2019	623	622	843	440	2,005	797	3,471	1,859
2020	1,241	798	881	782	1,175	584	2,056	1,366
2021	1,241	798	415	415	1,051	624	2,707	1,837
2022	775	768	241	241	1,425	597	2,441	1,606
Total	22,407	15,196	7,247	6,421	45,028	20,102	74,682	41,719

Table 6.--Overview of NWFSC age-reading of rex sole to support a new growth curve for use in the 2023 Data-Moderate assessment

XXX Otoliths aged since 6/1/2022

	NWFSC Trawl Survey
2007	9
2008	20
2009	24
2010	38
2011	47
2012	27
2013	10
2014	8
2015	5
2016	9
2017	167
2018	176
2019	89
Total	629