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US Pacific Hake/Whiting Fishery

1st Surveillance Audit Report

Conformity Assessment Body (CAB)	MRAG Americas
Assessment team	Giuseppe Scarcella, Susan Hanna, Amanda Stern-Pirlot
Fishery client	Pacific Whiting Conservation Cooperative
Assessment type	First Surveillance
Author name	Giuseppe Scarcella, Susan Hanna, Amanda Stern-Pirlot
Date	26 October 2023

1. Contents

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2. List of Abbreviations

AP Advisory Panel

CCE California Current Ecosystem

CI Credibility Interval

DFO Department of Fisheries and Oceans Canada

EO Executive Order

EAM Ecosystem Approach to Management

EEZ Exclusive Economic Zone

EFH Essential Fish Habitat

EIS Environmental Impact Statement

ESA Endangered Species Act

ETP Endangered, Threatened and Protected species

FEP Fishery Ecosystem Plan

FMP Fishery Management Plan

IATTC Inter-American Tropical Tuna Commission

IFMP Integrated Fishery Management Plan for Groundfish

IFQ Individual Fishing Quota

ITS Incidental Take Statement

IVQ Individual Vessel Quota

IRFA Initial Regulatory Flexibility Analysis

JMC Joint Management Committee

JTC Joint Technical Committee

LOA Length Overall

LRP Limit Reference Points

MMPA Marine Mammal Protection Act

MSE Management Strategy Evaluation

MSFCMA Magnuson-Stevens Fishery Conservation & Management Act

MSY Maximum Sustainable Yield

mt Metric tons

nm Nautical miles

NMFS National Marine Fisheries Service

NOAA National Oceanic & Atmospheric Administration

NOAA OLE NOAA Office of Law Enforcement

NRC National Research Council

OTC Oregon Trawl Commission

PFMC Pacific Fishery Management Council

PRI Point where Recruitment would be Impaired

PSARC Pacific Scientific Advice Review Committee

PWCC Pacific Whiting Conservation Cooperative

RCA Rockfish Conservation Areas

SAFE Stock Assessment and Fishery Evaluation

SFD Sustainable Fisheries Division

SFF Sustainable Fisheries Framework

SPR Spawning Potential Ratio

SRG Scientific Review Group

SS Stock Synthesis

STAL Short-tailed Albatross

TAC Total Allowable Catch

USCG United States Coast Guard

WCGOP West Coast Groundfish Observer Program

WDFW Washington Department of Fish and Wildlife

3. Executive summary

3.1. Introduction and description of surveillance process

This report contains the findings of the 1st surveillance cycle in relation to the US Midwater Trawl Pacific Hake/Whiting Fishery and contains an update on the fishery since the initial certification audit (Stern-Pirlot *et al*., 2022). Meetings were held remotely on July 6th, 2023 during which new information pertaining to conformity of this fishery with the RFM fisheries standard was reviewed. The assessment team remains the same with Amanda Stern-Pirlot as team lead and with expertise in Section D; Susan Hannah with expertise in Sections A and C, and Giuseppe Scarcella with expertise in section B.

3.2. Recommendation with respect to continuing certification

MRAG Americas confirms that this fishery continues to meet the RFM Fisheries Standard and shall remain certified.

4. Audit details

4.1. Surveillance information

Table 1: Surveillance information

1	**Fishery name**	
Pacific Hake Midwater Trawl Fishery		
2	**Unit(s) of Certification (UoC)**	
Mid-water trawl fishing in the US Pacific EEZ waters off Washington, Oregon, and California		
3	**Date certified**	**Date of expiry**

July 26, 2022	July 25, 2027
4	**Audit type and number**
1st Surveillance Audit	
5	**Surveillance team leader**
Amanda Stern-Pirlot	
6	**Surveillance team members**
Drs Giuseppe Scarcella and Susan Hanna	
7	**Audit time and location**
A surveillance audit occurred the week of July 5, 2023 remotely.	
8	**Assessment and review activities**
The surveillance audit reviewed any changes in science and management relevant to the conformity of this fishery to the RFM standard.	

4.2. Version details

Table 2: RFM program documents versions

Document/Assessment Tree	Version number/Type
RFM Procedure 2: Application to Certification Procedures for the RFM Fishery Standard	Version 6, September 2020
Responsible Fisheries Management Certification Program Fisheries Standard	Version 2.1, September 2020
Responsible Fisheries Management Certification Program Guidance to Performance Evaluation for the Certification of Wild Capture and Enhanced Fisheries in North America	Version 2.1, January 2021

4.3. Client contact details

Table 3: Client contact information

Applicant Information	
Organization/Company Name	Pacific Whiting Conservation Cooperative (PWCC) and Oregon Trawl Commission (OTC)
Applicant Key Contact Information	Mike Lucino (PWCC) and Yelena Nowak (OTC) mikel@TridentSeafoods.com ; yelena@oregontrawl.org

4.4. Update on the fishery

4.4.1. Update on topics that trigger immediate failure

There are no changes or updates on the following topics:

- Dynamiting, poisoning, and other comparable destructive fishing practices
- Significant illegal, unreported, and unregulated (IUU) fishing activities in the country jurisdiction
- Shark finning
- Slavery and slave labor on board fishing vessels
- Any significant lack of compliance with the requirements of an international fisheries agreement to which the U.S. is signatory. A fishy will have to be formally cited by the international governing body that has competence with the international treaty in question, and that the U.S. has been notified of that citation of non-compliance.

4.4.2. Changes in the management regime and processes

In continuing coordination with the PFMC and NMFS the whiting fleet voluntarily avoided Chinook salmon, widow rockfish, canary rockfish, darkblotched rockfish, and Pacific ocean perch; as well as sablefish, yellowtail rockfish, and

the emergent biomass of shortbelly rockfish. Catch of incidental species followed similar patterns as previous years, with the fleets focusing avoidance efforts on rockfish and Chinook salmon. Incidental catch of warmer water species, like jack and Pacific mackerels, were lower than amounts observed in 2021 but encounters were still higher than normal, despite the colder water temperatures. Large concentrations of small sablefish were again reported by all sectors and had to be actively avoided, especially early in the season. At least two young, very abundant year classes of sablefish were higher in the water column, and vessels would sometimes move from productive fishing grounds in order to avoid them. In general, fishing at deeper depths allowed for cleaner fishing on larger fish for the vessels that were capable of doing so (Waldeck 2023; PWCC 2023; McQuaw 2023a; 2023b).

Regulatory measures in 2022 were largely unchanged from 2021 with the use of set-asides (soft caps) for prevalent bycatch species (50 CFR 660 2022b). The suite of management measures adopted in recent years continued to be used to mitigate salmon bycatch, fulfilling the terms and conditions of a 2017 National Marine Fisheries Service Biological Opinion (NOAA Fisheries 2017; NOAA Fisheries 2023c).

FMP Amendment 30 proposed new groundfish harvest specifications and management measures for 2023-2024. It was published in October 2022 (50 CFR 660 2022a), followed by the final rule in December 2022 (50 CFR 660 2022b). The revised management measures are intended to keep the total annual catch of each groundfish stock or stock complex within the annual catch limits (NOAA Fisheries 2023d). A correction to depth contour coordinates listed in the final rule was subsequently published on December 30, 2022 (50 CFR 2022c).

Amendment 30 also specified a 2,000 mt shortbelly rockfish catch threshold that, when exceeded or projected to be exceeded, would trigger Council review of the fishery. In addition it extends the length of the limited entry fixed gear sablefish primary season, clarifies boundaries of Rockfish Conservation Areas, corrects the definitions of Block Area Closures and expands their use to control groundfish catch (50 CFR 660 2022b).

In September 2022 the Council initiated planning for the second review of the Cost Share Program. In recognition that one intended outcome of catch share programs is a reduction in management costs and in response to constituent concerns about the level of TRat program costs, NMFS provided the Council with funding to examine the level and distribution of program costs. The cost project proceeded in 2022 and into 2023 (Phillips 2023). Updates on both the cost project and the catch share program review will be included in the 2023 Surveillance report.

In 2022 electronic monitoring (EM) was used as an alternative to observers to meet the at-sea monitoring requirement for 100% observer coverage. EM may be deployed on vessels participating in the IFQ program, including whiting and non-whiting groundfish trawl and non-trawl vessels and MS/CV participating in the at-sea whiting fishery. Non-catch share observers provided by the West Coast Groundfish Observer Program (WCGOP) may be deployed to a vessel participating in EM to collect the biological samples and other data that cannot be obtained from using EM systems alone, specifically when there is potential for sorting and discarding at sea. Catch monitors are used to verify retained species and collecting samples at the dock (PFMC 2022k). In 2022, 25 shorebased IFQ whiting vessels (863 trips) and 18 mothership catcher vessels (27 trips) participated in the EM Program (NOAA Fisheries OLE 2023).

4.4.3. Changes to organizational responsibility of the main management agencies

The organizational responsibilities of the Pacific Whiting Treaty, Pacific Fishery Management Council and NOAA Fisheries remain unchanged.

4.4.4. New information on the status of stocks

The following stock assessment summary was adopted from the 2023 Stock Assessment of Pacific Hake in U.S. and Canadian Waters prepared by the International Joint Technical Committee for Pacific hake (Berger *et al.* 2023). The assessment uses a Bayesian estimation approach, sensitivity analyses, and retrospective in-vestigations to evaluate the potential consequences of parameter uncertainty, alternative structural models, and historical performance of the assessment model, respectively. The Bayesian approach combines prior knowledge about natural mortality, stock-recruitment steepness (a parameter for stock productivity), and several other parameters, with likelihoods for the acoustic survey biomass index, acoustic survey age-composition data, the relative age-1 index, and fishery age-composition data. Integrating the joint posterior distribution over model parameters provides probabilistic in-ferences about uncertain model parameters and forecasts derived from those parameters; this is done via Markov chain Monte Carlo sampling using the efficient No-U-Turn Sampler (NUTS) that was successfully tested in 2020 and used in subsequent assessments. Sensitivity analyses are used to identify alternative model assumptions that may also be consistent with the data. All models, including bridging, sensitivity, and retrospective models, use a Bayesian framework for estima-tion. Retrospective analyses identify possible poor performance of the assessment model with respect to future predictions. Past assessments have conducted closed-loop simulations that pro-vide insights into how alternative combinations of survey frequency, assessment model selectivity assumptions, changes in hake distribution, and harvest

control rules affect expected management outcomes given repeated application of these procedures over the long-term. The results of past (and ongoing) closed-loop simulations help inform decisions made for this assessment.

This 2023 assessment retained the same general population dynamics structure as the base assess-ment model from 2022 and again is configured using Stock Synthesis. This includes the continued use (since 2014) of time-varying (rather than fixed) selectivity to maintain flexibility with fish-ing dynamics given variability in Pacific Hake distribution patterns. The Dirichlet-multinomial estimation approach to weighting composition data was retained, and sensitivity to an alternative data-weighting approach was investigated. Time-varying fecundity, which was introduced in 2019, was retained. Assumptions for the forecast period for weight at age and selectivity continue to be based on conditions during the last five years, as done since the 2020 assessment. The main change from the 2022 assessment is the addition of 2022 data.

Results from the base model indicate that since the 1960s, Pacific Hake female spawning biomass has ranged from well below to above unfished equilibrium (Figure 1). Model estimates suggest that it was below the unfished equilibrium in the 1960s, at the start of the assessment period, due to lower than average recruitment. The stock is estimated to have increased rapidly and was above unfished equilibrium in the mid-1970s and mid-1980s (after two large recruitment events in the early 1980s). It then declined steadily to a low in 1999. This was followed by a brief increase to a peak in 2002 as the very large 1999 year class matured. The 1999 year class largely supported the fishery for several years due to relatively small recruitment events between 2000 and 2007. With the aging 1999 year class, median female spawning biomass declined throughout the late 2000s, reaching a time-series low of 0.619 million t in 2010. Median female spawning biomass is estimated to have peaked again in 2013 and 2014 due to a very large 2010 year class and an above-average 2008 year class. The subsequent decline from 2014 to 2016 is primarily from the 2010 year class surpassing the age at which the gains in weight from growth are greater than the losses in weight from mortality (growth-mortality transition). The 2014 year class is estimated to be large, though not as large as the 1999 and 2010 year classes, increasing the biomass in 2017. The estimated biomass was relatively steady from 2017 to 2019 and then declined in 2020 and 2021 due to the 2014 and 2016 year classes moving through the growth-mortality transition during a period of high catches. The increase in female spawning biomass since 2021 is due to the expected above average 2020 cohort entering maturity and the recent declining trend in catch.

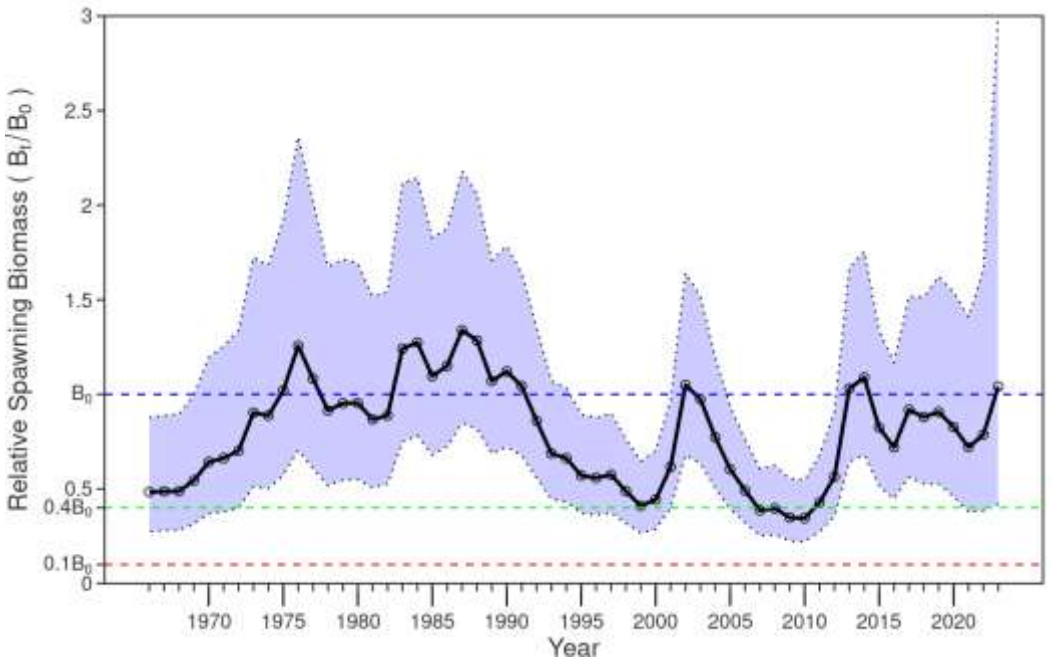

Figure 1. Median (solid line) of the posterior distribution for relative spawning biomass (Bt/B0) through 2023 with 95% posterior credibility intervals (shaded area). Dashed horizontal lines show 10%, 40%, and 100% of the unfished equilibrium (B0; Berger *et al.* 2023).

The median estimate of the 2023 relative spawning biomass (female spawning biomass at the start of 2023 divided by that at unfished equilibrium, B0) is 104%. However, the uncertainty is particularly large this year, with a 95% posterior credibility interval from 42% to 300% (Table 4), due to high uncertainty about the size of the 2020 cohort, which has not yet been sampled in the acoustic survey biomass index of age-2+ fish. The median estimate of the 2023 female spawning biomass is 1.910 million t (with a 95% posterior credibility interval from 0.757 to 5.610 million t).

The current estimate of the 2022 female spawning biomass is 1.424 (0.716–3.081) million t. This is higher than the 1.171 (0.584–2.585) million t estimated in the 2022 assessment. The increase appears to be due to the addition of 2022 fishery age-composition data, which suggests the 2020 cohort may be larger than the age-1 index alone was indicating in the last assessment.

Table 4. Recent trends in estimated beginning of the year female spawning biomass (thousand t) and spawning biomass level relative to estimated unfished equilibrium (Berger *et al.* 2023).

Year	Spawning biomass (thousand t)			Relative spawning biomass (B_t/B_0)		
	2.5th percentile	Median	97.5th percentile	2.5th percentile	Median	97.5th percentile
2014	1,435.6	1,947.1	3,124.9	67.9%	108.8%	175.6%
2015	1,090.6	1,476.7	2,361.0	51.5%	82.4%	133.7%
2016	950.3	1,286.9	2,077.9	44.7%	71.9%	116.8%
2017	1,178.4	1,640.3	2,752.4	56.3%	91.9%	151.6%
2018	1,081.2	1,576.0	2,765.0	52.7%	88.0%	151.3%
2019	1,060.6	1,622.7	2,978.6	52.5%	90.6%	162.3%
2020	910.0	1,482.8	2,853.2	46.0%	82.7%	154.1%
2021	724.2	1,291.8	2,634.7	37.9%	72.1%	140.8%
2022	716.0	1,423.7	3,081.4	38.5%	78.7%	165.8%
2023	757.0	1,909.6	5,609.8	42.0%	104.1%	300.2%

The addition of 2022 data does not substantially change estimates of historical recruitment but recent recruitment estimates have changed substantially. For example, this assessment's median estimate of the 2020 recruitment is 6.2 billion fish higher than in the last assessment (a 118% in-crease). Similarly, estimates for 2019 and 2021 recruitments have changed by -39% (-0.4 billion fish) and -52% (-0.5 billion fish), respectively, but the general notion remains that recent recruit-ment is highly uncertain. Pacific Hake have low to moderate recruitment with occasional large year classes. Large year classes in 1980, 1984, and 1999 supported much of the commercial catch from the 1980s to the mid-2000s. From 2000 to 2007, estimated recruitment was at some of the lowest values in the time series but this was followed by an above average 2008 year class. The strong 2010 year class comprised 64% of the coast-wide commercial catch in 2014, 32% of the 2016 catch, 23% of the 2018 catch, 15% of the 2020 catch, and 6% of the 2022 catch. The decline from 2014 to 2016 was partly due to the large influx of the 2014 year class (51% of the 2016 catch was age-2 fish from the 2014 year class; this was larger than the proportion of age-2 fish, 41%, from the 2010 year class in 2012). Since 2010, the model currently estimates small 2011, 2012, 2013, 2015, 2018, 2019 and 2021 year classes (median recruitment well below the mean of all median recruitments).

The 2014 and 2016 year classes are both larger than average, with 2014 larger than 2016 but smaller than 2010. With the inclusion of the relative age-1 index, there is information beyond just fishery encounters in the data to estimate the size of the 2020-year class. Collectively, these data indicate that the 2020-year class is likely well above average. The much smaller 2019-year class is informed by the 2021 biomass index and fishery data but is not informed by the relative age-1 index, and the 2021-year class is informed only by 2022 fishery data. There is no information in the data to estimate the sizes of the 2022 and 2023-year classes. Retrospective analyses of year-class strength for young fish have shown the estimates of recent recruitment to be unreliable prior to at least a model age of three (i.e., fish observed at age two) without a survey in the most recent year and two (i.e., fish observed at age one) with a survey. While the 2020 cohort was observed by the relative age-1 index in 2021, it will not be observed by the acoustic survey until 2023.

The default $F_{SPR=40\%}$–40:10 harvest policy prescribes the maximum rate of fishing mortality to equal $F_{SPR=40\%}$. This rate gives a spawning potential ratio (SPR) of 40%, meaning that the female spawning biomass per recruit with $F_{SPR=40\%}$ is 40% of that without fishing. If female spawning biomass is below $B_{40\%}$ (40% of B0), the policy reduces the TAC linearly until it equals zero at $B_{10\%}$ (10% of B0). Relative fishing intensity for fishing rate F is $(1-SPR(F))/(1-SPR_{40\%})$, where $SPR_{40\%}$ is an SPR of 40%; it is reported here interchangeably as a proportion or a percentage. A relative fishing intensity above 1.0 means fishing at a rate above $F_{SPR=40\%}$.

The median estimated relative fishing intensity on the stock is below the management level of 1.0 for all years (Figure 2). Median exploitation fraction (catch divided by biomass of fish of age-2 and above) peaked in 2006 and reached similar levels in 1999 and 2008. Over the last five years, the median estimated exploitation fraction was the highest in 2020 followed closely by 2021 before dropping by nearly half in 2022.

Median relative fishing intensity is estimated to have declined from 91.0% in 2010 to 43.8% in 2015. It then leveled off around 70% from 2016 to 2019 before declining to 50.7% in 2022. The median exploitation fraction has, on average, increased from a recent low of 0.05 in 2012 to 0.12 in 2020 before dropping back to 2012–2015 levels in 2022. There is a considerable amount of uncertainty around estimates of relative fishing intensity, with the 95% posterior credibility interval reaching above the FSPR=40% management level (of 1.0) in 2017 and 2018 over the past decade (Figure 2). Exploitation and fishing intensity rates do not always track well due to a combination of changing age distributions and changing selectivities over time.

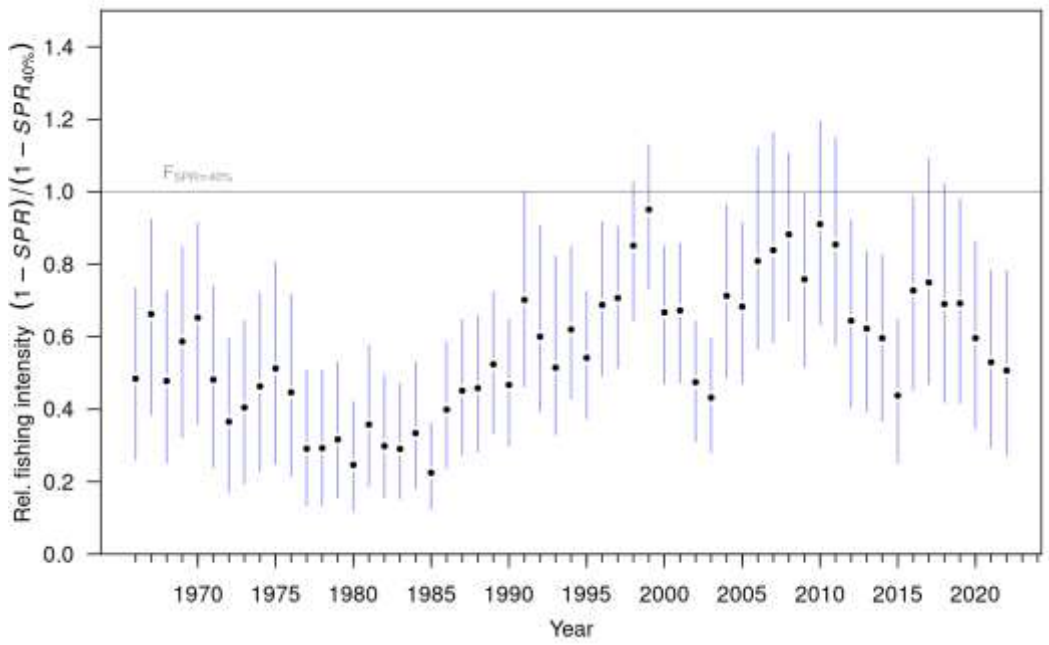

Figure 2. Trend in median relative fishing intensity (relative to the FSPR=40% management level) through 2022 with 95% posterior credibility intervals. The FSPR=40% management level defined in the Joint U.S.-Canada Agreement for Pacific Hake is shown as a horizontal line at 1.0 (Berger *et al.* 2023).

Over the last decade (2013–2022), the mean coast-wide utilization rate (proportion of catch target removed) has been 67.1% (Table 5). Over the last five years (2018 to 2022), the mean utilization rates were 71.4% for the United States and 57.1% for Canada. While relatively stable during this time in the United States, the utilization rate in Canada has been declining since 2020 to a time-series low of 20.3% in 2022. Country-specific quotas (or catch targets) in 2020 and 2021 were specified unilaterally, due to the lack of an agreement on coast-wide 2020 and 2021 TACs. The usual 73.88% and 26.12% allocation of coast-wide TAC, as specified in the Joint U.S.-Canada Agreement for Pacific Hake, was once again implemented in 2022. Total landings last exceeded the coast-wide quota in 2002 when utilization was 112%, though the fishing intensity was relatively low that year due to the appearance of the 1999-year class.

The median relative fishing intensity was below 1.0 in all years (Figure 2 and Figure 3). The median relative spawning biomass was above the $B_{40\%}$ reference point in all years except 2007–2010, and the median relative fishing intensity was below 1.0 (Figure 3). The benchmark quantities, $F_{SPR=40\%}$ and $B_{40\%}$, result in different median population sizes, highlighting that there are subtle differences in these conceptual reference points. Between 2007 and 2010, median relative fishing intensity ranged from 76% to 91% and median relative spawning biomass between 0.34 and 0.40. Biomass has risen from the 2010 low with the 2008, 2010, 2014, 2016, and 2020 recruitments, and median relative spawning biomass has been above the reference point of 40% since 2011.

While there is large uncertainty in the estimates of relative fishing intensity and relative spawning biomass, the model estimates a 0.1% joint probability of being both above a relative fishing intensity of 1.0 in 2022 and below the $B_{40\%}$ relative spawning biomass level at the start of 2023.

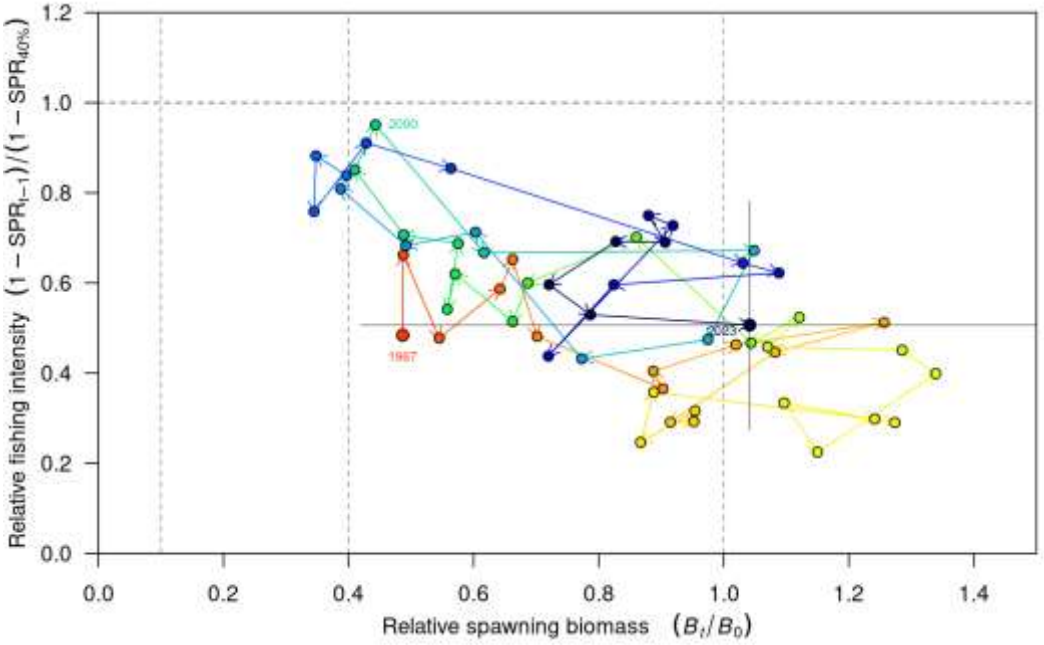

Figure 3. Estimated historical path of median relative spawning biomass in year t and corresponding median relative fishing intensity in year t−1. Labels show the time series start and end years and the year after the highest relative fishing intensity; labels correspond to year t (i.e., year of the relative spawning biomass). Gray bars span the 95% credibility intervals for 2023 relative spawning biomass (horizontal) and 2022 relative fishing intensity (vertical; Berger et al. 2023).

Table 5. Recent trends in Pacific Hake landings and management decisions. Catch targets in 2020 and 2021 were specified unilaterally (Berger et al. 2023).

Year	U.S. landings (t)	Canada landings (t)	Total landings (t)	U.S. proportion of total catch	Canada proportion of total catch	U.S. catch target (t)	Canada catch target (t)	Coast-wide catch target (t)	U.S. proportion of catch target removed	Canada proportion of catch target removed	Total proportion of catch target removed
2013	233,578	52,249	285,828	81.7%	18.3%	269,745	95,367	365,112	86.6%	54.8%	78.3%
2014	264,141	35,118	299,259	88.3%	11.7%	316,206	111,794	428,000	83.5%	31.4%	69.9%
2015	154,160	39,662	193,822	79.5%	20.5%	325,072	114,928	440,000	47.4%	34.5%	44.1%
2016	262,327	69,733	332,060	79.0%	21.0%	367,553	129,947	497,500	71.4%	53.7%	66.7%
2017	354,229	86,721	440,950	80.3%	19.7%	441,433	156,067	597,500	80.2%	55.6%	73.8%
2018	318,306	95,413	413,719	76.9%	23.1%	441,433	156,067	597,500	72.1%	61.1%	69.2%
2019	317,002	95,013	412,015	76.9%	23.1%	441,433	156,067	597,500	71.8%	60.9%	69.0%
2020	287,908	92,489	380,397	75.7%	24.3%	424,810	104,480	529,290	67.8%	88.5%	71.9%
2021	269,473	57,076	326,549	82.5%	17.5%	369,400	104,480	473,880	72.9%	54.6%	68.9%
2022	291,337	28,887	320,224	91.0%	9.0%	402,646	142,354	545,000	72.4%	20.3%	58.8%

Coast-wide catch in 2022 was 320,224 metric tons, 6% below the average over the most recent 10 years (340,482 t), out of a total allowable catch (TAC), adjusted for carryovers, of 545,000 t. The U.S. caught 291,337 t (72.4% of their quota) and Canada caught 28,887 t (20.3% of their quota). Based on the default harvest rule, the estimated median catch limit for 2023 is 778,008 t (with 95% credible interval from 301,205 to 2,136,434 t).

Projections were conducted across a wide-range of catch levels due to high uncertainty in estimates of recent and forecasted recruitment. Projections setting the 2023 and 2024 catches equal to the 2022 coast-wide TAC of 545,000 t show the estimated median relative spawning biomass decreasing from 104% in 2023 to 93% in 2024 to 77% in 2025, with a 16% chance of the female spawning biomass falling below $B_{40\%}$ in 2025. There is an estimated 88% chance of the female spawning biomass declining from 2023 to 2024, and an 85% chance of it declining from 2024 to 2025 for these constant catches.

4.4.1. Update on fishery catches

Coast-wide fishery landings of Pacific Hake averaged 242,873 t from 1966 to 2022, with a low of 89,930 t in 1980 and a peak of 440,950 t in 2017 (Figure 4). Prior to 1966, total removals were negligible compared to the modern fishery. Over the early period (1966–1990) most removals were from foreign or joint-venture fisheries. Across the time series, annual catch in U.S. waters averaged 185,086 t, (76.2% of the total catch) while catch from Canadian waters averaged 57,788 t. Over the last 10 years, 2013–2022 (Table 6), the average coast-wide catch was 340,482 t with U.S. and Canadian catches averaging 275,246 t and 65,236 t, respectively. Since 2017, the coast-wide catch has been declining annually through 2022, when it was 320,224 t out of a total allowable catch (TAC, adjusted for carryovers) of 545,000 t.

Attainment in the U.S. was 72.4% of its quota and in Canada it was 20.3%. Estimates of discard within the target fishery are included, but discarding of Pacific Hake in non-target fisheries is not. Discard from all fisheries, including those that do not target hake, is estimated to be less than 1% of landings in recent years. During the last five years, catches were considerably above the long-term average catch (242,873 t), but have been in decline over that period (especially in Canada). Landings between 2001 and 2008 were predominantly comprised of fish from the very large 1999 year class, with the cumulative removal (through 2022) from that cohort estimated at approximately 1.29 million t. Through 2022, the cumulative catch of the 2010, 2014, and 2016 year classes is estimated to be about 1.25 million t, 0.80 million t, and 0.53 million t, respectively. In the 2022 catch, the 2020 cohort was the largest (33%), followed by the 2016 cohort (24%), and then the 2014 cohort (16%). 2022 US allowable Catch (TAC) and US catch data for 2022 and 2021 are reported in Table 7

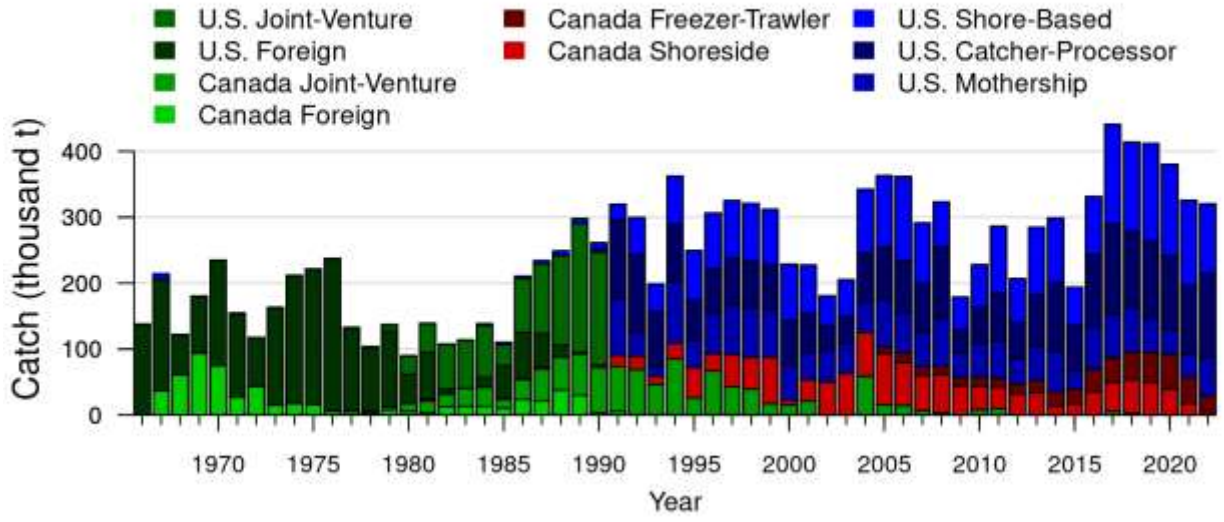

Figure 4. Total Pacific Hake catch used in the assessment by sector, 1966–2022. U.S. tribal catches are included in the sectors where they are represented (Berger *et al.* 2023).

Table 6. Recent commercial fishery catch (t). Tribal catches are included in the sector totals. Research catch includes landed catch associated with certain research-related activities. Catch associated with surveys and discarded bycatch in fisheries not targeting hake is relatively small and not included in the table or model (Berger *et al.* 2023).

Year	US Mother-ship	US Catcher-Processor	US Shore-Based	US Research	US Total	CAN Joint-Venture	CAN Shoreside	CAN Freezer-Trawler	CAN Total	Total
2013	52,470	77,950	102,141	1,018	233,578	0	33,665	18,584	52,249	285,828
2014	62,102	103,203	98,640	197	264,141	0	13,326	21,792	35,118	299,259
2015	27,665	68,484	58,011	0	154,160	0	16,775	22,887	39,662	193,822
2016	65,036	108,786	87,760	745	262,327	0	35,009	34,724	69,733	332,060
2017	66,428	136,960	150,841	0	354,229	5,608	43,427	37,686	86,721	440,950
2018	67,121	116,073	135,112	0	318,306	2,724	50,747	41,942	95,413	413,719
2019	52,646	116,146	148,210	0	317,002	0	49,275	45,738	95,013	412,015
2020	37,978	111,147	138,688	95	287,908	0	39,077	53,412	92,489	380,397
2021	35,208	104,030	129,319	917	269,473	0	16,952	40,123	57,076	326,549
2022	59,152	126,247	105,938	0	291,337	0	5,050	23,837	28,887	320,224

This Joint Technical Committee (JTC) assessment depends on the fishery landings (1966–2022), an acoustic survey biomass index of age-2+ fish and age compositions (1995–2021), a relative index of age-1 fish (1995–2021), fishery age compositions (1975–2022), and mean weight-at-age data (1975–2022). In 2011 the survey biomass index was the lowest in the time series and was followed by the index increasing in 2012, 2013, and again in 2015 before decreasing to near the time series average in 2017. The 2019 estimate is the fourth highest of the series, and the 2021 estimate is near the time series average. Age-composition data from the aggregated fisheries and the acoustic survey, along with the age-1 index, provide data that facilitates estimating relative cohort strength, i.e., strong and weak cohorts. The age-1 index suggests particularly large numbers of age-1 fish in 2009, 2011, 2015, and 2021 (2008, 2010, 2014, and 2020 year classes, respectively), and is not available for most even years (odd year classes). There is not data to inform the size of the 2022-year class (Berger et al. 2023).

Table 7: Allowable Catch (TAC) and catch data

TAC / Catch Data	Year	Amount
TAC – USA	2022	402,646 mt
UoA share of TAC	2022	291,337 mt
Total catch by UoC (most recent year)	2022	291,337 mt
Total catch by UoC (second most recent year)	2021	269,473 mt

4.4.2. Significant changes in the ecosystem effects of the fishery

An updated catch composition for the most recent five complete years for the US offshore hake fishery is given below (source data from NWFSC FRAM Data Warehouse, 2023). The target species, Pacific hake, continues to make up the vast majority of catches in this fishery (Table 8). One notable change in the catch composition is the anomalously high catch of jack mackerel in 2021, relative to previous years. This was due to a few "lightning strike" hauls in fall of 2021 and does not indicate the beginning of a trend as the number came back down in 2022 (Daniel Waldeck pers. com). This amount of catch is also still a small contribution to the annual catch limit of 31,000 mt for this stock.

Table 8. Catch composition in the US Pacific hake offshore midwater trawl fishery from 2017-2021, including percentages of each species in the catch. The full catch composition for which there was at least 1 kg of catch in one of the 5 years comprises 192 species. This table comprises only those species making up at least 0.01% of the catch on average. Quantities are given in metric tons of fish. The target stock is given in green. There are no main or minor associated species, or ETP species in this table, and several of the rockfish and other groundfish stocks appearing in small quantities in this catch are separately MSC certified.

Species	2017	2018	2019	2020	2021	Total	% of Total
Pacific Hake	349,302	312,638	312,879	287,627	265,379	1,527,825	97.88%
Yellowtail Rockfish	1,583	1,279	1,605	1,746	1,024	7,238	0.46%
Jack Mackerel	878	271	1,102	562	2,541	5,354	0.34%
Widow Rockfish	1,449	1,075	1,106	754	621	5,005	0.32%
Spiny Dogfish Shark	242	1,349	987	291	191	3,060	0.20%
American Shad	439	352	435	714	297	2,237	0.14%
Shortbelly Rockfish	294	472	598	388	299	2,050	0.13%
Sablefish	252	190	258	105	247	1,051	0.07%
Pacific Mackerel	159	128	178	164	266	894	0.06%
Squid Unid	217	158	122	158	195	851	0.05%
Splitnose Rockfish	121	206	133	26	148	634	0.04%
Canary Rockfish	81	200	93	87	117	578	0.04%
Darkblotched Rockfish	73	146	149	109	91	567	0.04%
Pacific Ocean Perch	74	103	161	110	113	559	0.04%
Rougheye/Blackspotted Rockfish	41	164	135	71	59	469	0.03%
Pacific Herring	42	96	210	64	33	445	0.03%
Brown Cat Shark	36	141	80	32	32	321	0.02%
King of the Salmon	33	45	106	60	34	277	0.02%
Shortspine Thornyhead	29	71	59	24	79	262	0.02%
Arrowtooth Flounder	24	62	50	11	25	172	0.01%
Walleye Pollock	22	12	82	11	0	128	0.01%
Chilipepper Rockfish	64	13	26	0	1	105	0.01%
Ragfish	16	36	12	16	11	93	0.01%
Rex Sole	9	31	34	6	11	91	0.01%

Protected species

Updated reports are available, reporting seabird, marine mammal, eulachon, green sturgeon and leatherback turtle bycatch in U.S. West Coast fisheries through 2021 (PFMC 2023).

There was zero observed bycatch of **green sturgeon, leatherback turtles**, and **short-tailed albatross** in 2020 and 2021.

Regarding short-tailed albatross specifically, since the conclusion of the Sea Grant work by Amanda Gladics showing interactions between hake trawl vessels and albatrosses (and seabirds generally) is lower than estimated in the most recent Biological Opinion, management attention has shifted to the surface longline fleet.

Regarding **marine mammals**, there has not been any published update to mammal interactions overall since 2018 (Jannot et. al. 2018), which includes data through the 2016 fishing year. However, the west coast groundfish trawl fishery, including offshore and shoreside whiting/hake, continues to be "category III" on the MMPA List of Fisheries, indicating a remote likelihood of or no interactions with marine mammals. In addition, regarding endangered humpback whales (the only endangered marine mammal in the area) there have been zero observed mortalities in the hake fishery (PFMC 2023).

Regarding endangered **eulachon smelt**, a new ESA 5-year review was published in 2022 (NOAA Fisheries 2022), the conclusion of which was that eulachon shall remain ESA listed as "threatened." In addition, information available since the previous 5-year review suggests that bycatch of eulachon in the west coast groundfish fishery and the ocean shrimp trawl fishery has slightly decreased, therefore the risk to eulachon persistence because of bycatch has slightly decreased. The Columbia Basin eulachon Spawning Stock Biomass (SSB) has rebounded such that the estimate in 2021 is 96.4 million spawners, which is nearly equivalent to the 97.9 million spawners estimated as the 2011-2015 annual mean. The lowest annual mean estimate since 2016 was 4.1 million spawners in 2018. This rebounding abundance is likely to explain the large increase in eulachon bycatch in all groundfish sectors, including the hake catcher/processor fleet in 2019-2021. This also coincides with elimination of minimum trawl mesh sizes in the bottom and midwater trawl fisheries in 2019 (83 FR 62269, December 3, 2018), however it is not possible to evaluate if changes to mesh size in the fleet have actually occurred, and if they have, whether they are a cause for higher bycatches of eulachon. In 2021, bycatch was about 61 percent of the precautionary and 30 percent of the reinitiation thresholds. However, in 2022, the precautionary threshold might be exceeded based on the preliminary forecast of 2022 Columbia River abundance as the very high 2021 bycatch comes into the 5-year geometric mean used for threshold calculations.

Overall, the increase in eulachon bycatch, given other factors such as increasing abundance and declining catch rates (of eulachon relative to target species) in the groundfish and ocean shrimp fisheries, is not a cause for concern (PFMC (2023).

Regarding **pacific salmon** bycatch, the 2021 and 2022 fishing seasons have been cleaner, shorter trips, with less salmon bycatch. In 2021, total chinook salmon bycatch in the hake fishery was lower than in all previous years except 2009 (Richerson et. al. 2022). This may be partially due to the ability for the fleet to begin fishing earlier in the year, because they finished their pollock fishing season in Alaska earlier than usual.

There are no updates to report relative to habitat or ecosystem interactions, management or information since the full assessment report.

4.4.3. Violations and enforcement information

Enforcement data continue to be summarized in the annual "TRat" (Trawl Rationalization) report presented to the PFMC by the NMFS Office of Law Enforcement (OLE) (NOAA Fisheries OLE 2023). In 2022 OLE began reporting sector-specific data on compliance assistance and enforcement investigations that for the first time allows data on whiting fisheries data to be isolated (NOAA Fisheries OLE 2023).

The whiting fleet represented in the TRat Enforcement data includes catcher vessels delivering to both mothership and shorebased IFQ first receiver sites, mothership vessels, and catcher processor vessels. For this fleet, 43 enforcement incidents were identified in 2022, 34 of which were attributed to west coast catcher vessels.

The categories of violations among the whiting sector catcher and catcher processor vessels with multiple occurrences were:

- Vessel Monitoring System (VMS) Issue: 7
- Fishing in Deficit: 4
- Observer - Failure to Provide Reasonable Assistance: 2.

A number of incidents did not result in enforcement actions beyond compliance assistance - such as a written warning, notice of violation and assessment (NOVA), summary settlement, or settlement agreement. The compliance rate is calculated as the ratio of incidents not resulting in enforcement actions to the total number of settled complaints and closed investigations conducted by OLE.

The 2022 compliance rate for the whiting catcher vessel fleet is 97%; for the catcher processor vessels it is 100%. The three enforcement incidents recorded for the mothership vessel category in 2022 are open and ongoing investigations, and are therefore not included as part of the compliance rate estimation (NOAA Fisheries OLE 2023).

The 2022 OLE enforcement data for the whiting sector shows the following:

Contacts

- Complaints/Referrals 6
- Investigations/Dockside Boardings 27

Incidents

- Enforcement Incidents 33
- 2021 Carry-Over Enforcement Incidents 1

Actions

- No Violation (Nolle Prossed) 19
- Compliance Assistance 11
- GCES Settlement Agreement 1
- Summary Settlement 0
- Ongoing Investigation 3

Violations

- Vessel Monitoring System (VMS) issue 5
- Fishing in Deficit 4
- Observer – Failure to Provide Reasonable Assistance 1
- Observer – Impede/Retain Prohibited Species 0
- Catch Monitor Not Present During Offload 0
- Closed Area 1
- Permit Not Onboard 1

Disposition

- Closed Whiting Enforcement Incidents 31
- No Violation/Nolle Prossed 19
- Compliance Assistance 11

Compliance Rate 97%

(NOAA Fisheries OLE 2023)

4.4.4. Other information that may affect the outcome of certification

5. Update on consistency to the fundamental clauses of the RFM Fishery Standard

5.1. Section A: the Fisheries Management System

5.1.1. Fundamental Clause 1: Structured and legally mandated management system

1. *There shall be a structured and legally mandated management system based upon and respecting International, National and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment.*

1.1 There shall be an effective legal and administrative framework established at international, State and local l levels appropriate for fishery resource conservation and management. The management system and the fishery operate in compliance with the requirements of international, State, and local laws and regulations, including the requirements of any regional and/or international fisheries management agreement.	
1.2 Management measures shall consider (1) stock status and genetic diversity over its entire area of distribution, and (2) other biological characteristics of the fish stock including age of maturity and reproductive potential.	
1.3 Previously agreed management measures established and applied in the same region shall be taken into account by management. **1.3.1** Conservation and management measures established for the stock under consideration within the jurisdiction of the relevant States for transboundary, shared, straddling, highly migratory or high seas stocks, shall be compatible in a manner consistent with the rights, competence and interests of the States concerned.	
1.4 A State's fishery management organization not member or participant of a sub-regional or regional fisheries management organization shall cooperate, in accordance with relevant international agreements and law, in the conservation and management of the relevant fisheries resources by giving effect to any relevant measures adopted by such organization or arrangement. 1.4.1 A fishery management organization seeking to take any action through a non-fishery organization which may affect the conservation and management measures taken by a competent sub-regional or regional fisheries management organization or arrangement shall consult with the latter, in advance to the extent practicable, and take its views into account.	
1.5 The applicant fishery's management system, when appropriate for the stock under consideration, shall actively foster cooperation between States with regard to (1) information gathering and exchange, (2) fisheries research, (3) fisheries management, and (4) fisheries development.	
1.6 A fishery management organization and sub-regional or regional fisheries management organizations and arrangements, as appropriate, shall agree on the means by which the activities of such organizations and arrangements will be financed, bearing in mind, inter alia, the relative benefits derived from the fishery and the differing capacities of States to provide financial and other contributions. Where appropriate, and when possible, such organizations and arrangements shall aim to recover the costs of fisheries conservation, management, and research. 1.6.1 Without prejudice to relevant international agreements, States or fishery management organizations shall encourage banks and financial institutions not to require, as a condition of a loan or mortgage, fishing vessels or fishing support vessels to be flagged in a jurisdiction other than that of the State of beneficial ownership where such a requirement would have the effect of increasing the likelihood of non-compliance with international conservation and management measures.	
1.7 Within the fishery management system, procedures shall be in place to keep the efficacy of current conservation and management measures and their possible interactions under continuous review, and to revise or abolish them in the light of new information.	
1.8 The management arrangements and decision-making processes for the fishery shall be organized in a transparent manner.	
1.9 Management organizations not party to the Agreement to Promote Compliance with International Conservation and Management Measures by Vessels Fishing on the High Seas shall be encouraged to accept the Agreement and to adopt laws and regulations consistent with the provisions of the Agreement.	
Summary of relevant changes	The Pacific Hake Treaty remains an active US-Canada management collaboration and is unchanged in structure and function (NOAA Fisheries 2023a). Similarly, the Pacific Fishery Management Council remains unchanged with regard to its structure and legal responsibilities for domestic management of Pacific hake (PFMC 2022a; 2023c). There is no evidence of noncompliance with federal law or international agreements (Busch 2023). Management measures continue to consider the entire range of the stock, and procedures for taking into account previous management measures are well established.

	Normal Treaty functioning was reestablished in 2022 with the establishment of a joint US - Canada Coastwide TAC (NOAA Fisheries 2023a). No changes were made to management funding in 2022. The PFMC initiated planning for the second review of the Catch Share Program in 2022 and with NMFS funding contracted a cost study of the Program, which continues to be financed through a cost recovery system (PFMC 2022b; 2022c; 2022d; 2022e; 2022f; 2022g; 2022h; 2022i; 2022j). Analytical products and management measures continue to be reviewed at both the PFMC and Treaty levels (cf. NOAA Fisheries 2023a; PFMC 2022w). No changes have been made to the transparency of management, either through the availability of information or access to decision processes.
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause	The fishery continues to conform to the RFM Fishery Standard Fundamental Clause 1. There continues to be a structured and legally mandated management system based upon and respecting international, State, and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment.

5.1.2. Fundamental Clause 2: Coastal area management frameworks

2. Management organizations shall participate in coastal area management, decision-making processes and activities related to the fishery and its users, supporting sustainable and integrated resource use, and conflict avoidance.
2.1 Within the fisheries management organization's jurisdiction, an appropriate policy, legal, and institutional framework shall be adopted in order to achieve sustainable and integrated use of living marine resources, (1) taking into account the fragility of coastal ecosystems and finite nature of their natural resources, (2) allowing for determination of the possible uses of coastal resources and governing access to them, and (3) recognizing the rights and needs of coastal communities and their customary practices to the extent compatible with sustainable development. In setting policies for the management of coastal areas, States shall take due account of the risks and uncertainties involved. 2.1.1 States shall establish mechanisms for cooperation and coordination in planning, development, conservation, and management of coastal areas. 2.1.2 The fisheries management organization shall ensure that the authority or authorities representing the fisheries sector and fishing communities in the coastal management process have the appropriate technical capacities and financial resources.
2.2 Representatives of the fisheries sector and fishing communities shall be consulted in the decision-making processes involving activities related to coastal area management planning and development. The public, as well as others affected, shall also be kept aware of the need for protection and management of coastal resources, and shall participate in the management process.
2.3 Fisheries practices that avoid conflict among fishers and other users of the coastal area (e.g., fisheries enhancement facilities, tourism, energy) shall be adopted, and fishing shall be regulated in such a way as to avoid risk of conflict among fishers using different vessels, gear, and fishing methods. Procedures and mechanisms shall be established at the appropriate administrative level to settle conflicts that arise within the fisheries sector and between fisheries resource users and other coastal users.
2.4 States' fisheries management organizations and sub-regional or regional fisheries management organizations and arrangements shall give due publicity to conservation and management measures and ensure that laws, regulations, and other legal rules governing their implementation are effectively disseminated. The bases and purposes of such measures shall be explained to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures.
2.5 The economic, social, and cultural value of coastal resources shall be assessed by the appropriate fisheries management organization in order to assist decision making on their allocation and use.

2.6	States shall cooperate to support and improve coastal area management, and in accordance with capacities, measures shall be taken to establish or promote (1) systems for research and monitoring of the coastal environment, and (2) multidisciplinary research of the coastal area using physical, chemical, biological, economic, social, legal, and institutional capabilities.
2.7	In the case of activities that may have an adverse environmental effect on coastal areas of other States, States shall provide timely information and if possible, prior notification to potentially affected States, and consult with those States as early as possible.

Summary of relevant changes	No changes were made in 2022 to Coastal Zone legislation, programs, National Standards for fishery management, Executive Orders or processes for information dissemination and stakeholder inclusion. State-Federal collaborations remained ongoing and the PFMC continued to be regularly engaged in habitat issues, as required by statute. The annual California Current Ecosystem Status Report was submitted to the PFMC in March 2023 (PFMC 2023b; 2023c) As part of routine management adjustments, the PFMC adopted FMP Amendment 30 that included a clarification of boundaries of Rockfish Conservation Areas, corrected the definitions of Block Area Closures and expanded their use to control groundfish catch (50 CFR 660 2022b). Offshore wind Offshore wind energy development remained an active issue in the Pacific EEZ. Subsequent to the issuance of Executive Order 14008 in January 2021, planning and development of offshore wind energy (OSW) was accelerated (E.O.14008 2021). The Bureau of Ocean Energy Management (BOEM), lead federal agency in offshore energy development, has been engaged in efforts to identify areas suitable for OSW development and to award development leases to those areas. Potential OSW areas have been identified off California and Oregon. The PFMC and West Coast Congressional delegations remained engaged with BOEM and other federal agencies to identify potential impacts to fishing, marine habitats and coastal communities (DeFazio and Wyden 2022; DeFazio and Graves 2022; PFMC 2022r). In June 2022 the BOEM issued a standardized process for identifying reasonable alternatives for evaluation in its draft Environmental Impact Statements (EISs) for all offshore wind Construction and Operations Plans (COPs) received from lessees. The process incorporated feedback from federal agencies who participate in BOEM's environmental reviews (BOEM 2022). In September 2022 the Council considered several marine planning issues related to offshore wind energy development. It acted on recommendations of its Marine Planning Committee (MPC) to communicate with California offshore wind lessees, requesting that the Council be included in outreach and reporting. The MPC also recommended that communication between the Council, lessees, and BOEM be maintained in order to identify concerns related to energy siting surveys and fishing gear interactions. The Council received briefings from BOEM on plans to maintain engagement as well as from the West Coast Ocean Alliance (WCOA) on its strategic planning process that includes states and tribes (PFMC 2022p; 2022t). Also during its September 2022 meeting the Council approved the draft offshore wind guidance document for use as an inward-facing tool to help support the Council, staff, and advisory bodies with consideration of and response to future offshore wind energy development activity. The Council directed the MPC to discuss the Pacific Port Access Route Study and to engage in the suitability modeling being developed by the National Ocean Service to inform wind energy area identification in Call Areas off Oregon (PFMC 2022p). Aquaculture An Aquaculture Opportunity Area (AOA) is a defined geographic area that has been evaluated to determine its potential suitability for commercial aquaculture (NOAA Fisheries 2023e). In 2022 NOAA Fisheries published a notice of intent to prepare programmatic environmental impact statements to consider identifying one or more AOAs in U.S. federal waters of Southern California and the Gulf of Mexico (NOAA 2023e). In response the PFMC wrote to NOAA Fisheries West Coast Region with detailed comments and recommendations on 12 issues most relevant to Council mandates and authorities. These issues included potential impacts to biological, physical, social, cultural, and economic resources and potential interactions with protected species, essential fish habitat, and other sensitive habitats (PFMC 2022s). In 2022 NOAA Fisheries developed a draft National Strategy on Equity and Environmental Justice and invited the public and regional fishery management councils to comment. The Strategy is in response to three related Executive Orders and identifies a number of barriers to achieving equity and environmental justice in fisheries and other areas of NMFS' responsibility. Once the Strategy is final NMFS will develop regional implementation plans. At its September 2022 meeting the Council was briefed on the Strategy and agreed to write a letter in support. Council staff was directed to work with NMFS staff on the regional implementation plan (PFMC 2022m; 2022n; 2022o; 2022p).

	Post-pandemic, the Council returned to limited in-person meetings in March 2022 with a subsequent expansion of in-person participation. In April 2022 the Council directed staff to prepare a white paper identifying lessons learned from the pandemic that might inform future Council operations (PFMC 2022l). The white paper was motivated by an overarching objective of improving Council decision making, interpreted to mean changes in information quality, information flow, public input, or Council procedure that enhance its decisions on West Coast fisheries. The paper reviewed Council operations and identified possible areas for improving the efficiency of process and decision-making (PFMC 2022l). In September 2022 the Council reviewed the white paper, reports of advisory bodies and public comments. It directed staff to further evaluate tradeoffs associated with meeting formats (in person, hybrid, and remote) as well as possibilities for improving communications, team functions, and public accessibility. The Council was scheduled to revisit the topic at the April and June 2023 Council meetings (PFMC 2022p).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 2	Management organizations continue to participate in coastal area management, decision-making processes and activities related to the fishery and its users, supporting sustainable and integrated resource use, and conflict avoidance. The fishery continues to conform to RFM Fishery Standard Fundamental Clause 2.

5.1.3. Fundamental Clause 3: Management objectives and plan

3. Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.
3.1 Long-term management objectives shall be translated into a plan or other management document (taking into account uncertainty and imprecision) and be subscribed to by all interested parties. 3.1.1 There shall be management objectives seeking to ensure that ETP species are protected from adverse impacts resulting from interactions with the unit of certification and any fisheries enhancement activity, including recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible. 3.1.2 There shall be management objectives seeking to avoid, minimize, or mitigate impacts of the unit of certification on the stock under consideration's essential habitats, and on habitats that are highly vulnerable to damage by the unit of certification's fishing gear. 3.1.3 There shall be management objectives seeking to minimize adverse impacts of the unit of certification (including any fishery enhancement) on the structure, and function of the ecosystems that are likely to be irreversible or very slowly reversible.
3.2 Management measures shall provide, *inter alia*, that: 3.2.1 Excess fishing capacity shall be avoided and exploitation of the stocks shall remain economically viable. 3.2.2 The economic conditions under which fishing industries operate shall promote responsible fisheries. 3.2.3 The interests of fishers, including those engaged in subsistence, small-scale, and artisanal fisheries shall be taken into account. 3.2.4 Biodiversity of aquatic ecosystems shall be conserved and ETP species shall be protected. Where relevant, there shall be pertinent objectives, and as necessary, management measures.

Summary of relevant changes	Planning for the second periodic review of the trawl Catch Shares Program was initiated in 2022 with a review design that includes field hearings to foster public participation and input. Concurrent with the catch share program review will be a NMFS funded study examining the

	level and distribution of program costs (PFMC 2022b; 2022c; 2022d; 2022e; 2022f; 2022g ;2022h; 2022i; 2022j). Management mechanisms such as TACs and quota allocations regulate the catch and amount of fishing effort applied to Pacific hake. The Pacific Coast Groundfish Fishery Management Pan is a framework plan, enabling the PFMC to routinely make adjustments to management measures as conditions change throughout a season, for example monitoring total catch information throughout the season to determine the relationship between catch at a given point in time and an ACL/ annual OY (PFMC 2022a). In addition, a number of bycatch control measures apply to participants in the Pacific whiting fishery work in conjunction with the ITQ program elements to promote sustainable exploitation of the resource. FMP Amendment 30 proposed new groundfish harvest specifications and management measures for 2023-2024. It was published in October 2022 (50 CFR 660 2022a), followed by the Final Rule in December 2022 (50 CFR 660 2022b). The revised management measures are intended to keep the total annual catch of each groundfish stock or stock complex within the annual catch limits (NOAA Fisheries 2023d). A correction to depth contour coordinates listed in the Final Rule was subsequently published on December 30, 2022 (50 CFR 2022c). Amendment 30 also specified a 2,000 mt shortbelly rockfish catch threshold that, when exceeded or projected to be exceeded, would trigger Council review of the fishery. In addition, it extended the length of the limited entry fixed gear sablefish primary season, clarified boundaries of Rockfish Conservation Areas, corrected the definitions of Block Area Closures and expanded their use to control groundfish catch (50 CFR 660 2022b).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 3	The fishery continues to conform to RFM Fishery Standard Fundamental Clause 3. Management objectives are based on the best available science and have been adopted by the the JMC of the Treaty, the PFMC groundfish FMP and the PFMC Fishery Ecosystem Plan. Statutes, regulations and processes protecting ETP species are unchanged. Management measures continue to be in place to control excess capacity; the trawl rationalization program addressing capacity in the whiting fleet remains unchanged, and planning for a program performance review has begun. Interests of fishers continue to be taken into account through regulations and procedures.

5.2. Section B: Science & Stock Assessment Activities, and the Precautionary Approach

5.2.1. Fundamental Clause 4: Fishery data

4. There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes. .
4.1 All significant fishery removals and mortality of the target species (shall be considered by management. Specifically, reliable and accurate data required for assessing the status of fishery(ies) and ecosystems— including data on retained catch, bycatch, discards, and waste— shall be collected. Data can include relevant traditional, fisher, or community knowledge, provided their validity can be objectively verified. These data shall be collected, at an appropriate time and level of aggregation, by relevant management organizations connected with the fishery, and provided to relevant States regional, and international fisheries organizations. 4.1.1 Timely, complete, and reliable statistics shall be compiled on catch and fishing effort and maintained in accordance with applicable international standards and practices, and in sufficient detail to allow sound statistical analysis for stock assessment. Such data shall be updated regularly and verified through an appropriate system. The use of research results as a basis for setting management objectives, reference points, and performance criteria, as well as for ensuring adequate linkage between applied research and fisheries management (e.g., adoption of scientific advice) shall be promoted. Results of analysis shall be distributed accordingly as a contribution to fisheries conservation, management, and development. 4.1.2 In the absence of specific information on the stock under consideration, generic evidence based on similar stocks can be used. However, the greater the risk of overfishing, the more specific evidence is necessary to ascertain the sustainability of intensive fisheries.
4.2 An observer scheme designed to collect accurate data for research and support compliance with applicable fishery management measures shall be established. 4.2.1 Where necessary, fisheries management organizations and regional fisheries management organizations and other such arrangements should strive to achieve a level and scope of observer programs sufficient to provide quantitative estimates of total catch, discards, and incidental takes of living aquatic resources.
4.3 A fisheries management organization, regional fisheries management organizations or arrangements shall compile data and make them available, in a manner consistent with any applicable confidentiality requirements, in a timely manner and in an agreed format to all members of these organizations and other interested parties in accordance with agreed procedures.
4.4 States shall stimulate the research required to support national policies related to fish as food.
4.5 There shall be sufficient knowledge of the economic, social, marketing, and institutional aspects of fisheries collected through data gathering, analysis, and research, as well as comparable data generated for ongoing monitoring, analysis, and policy formulation.
4.6 The fisheries management organization shall investigate and document traditional fisheries knowledge and technologies—in particular those applied to small-scale fisheries—in order to assess their application to sustainable fisheries conservation, management, and development.
4.7 If a fisheries management organization is conducting scientific research activities in waters of another State, it shall ensure that their vessels comply with the laws and regulations of that State and international law.
4.8 Adoption of uniform guidelines governing fisheries research conducted on the high seas shall be promoted and, where appropriate, support the establishment of policies that include, inter alia, facilitating research at the international and sharing the research results with affected States.
4.9 If appropriate, the fisheries management organization and relevant international organizations shall promote and enhance the research capacities of developing countries, inter alia, in the areas of data collection and analysis, information, science and technology, human resource development, and provision of research facilities, in order for them to participate effectively in the conservation, management, and sustainable use of living aquatic resources.
4.10 Competent national organizations shall, where appropriate, render technical and financial support to States upon request and when engaged in research investigations aimed at evaluating stocks which have been previously unfished or very lightly fished.

4.11 Relevant technical and financial international organizations shall, upon request, support States in their research efforts, devoting special attention to developing countries—in particular the least developed among them and small developing island countries.	
Summary of relevant changes	The catch for 1966–2022 is summarized by country-specific sectors (Figure 4) and modeled as annual coast-wide catches. Catches in U.S. waters prior to 1978 are available only by year from Bailey et al. (1982) and historical assessment documents. Canadian catches prior to 1989 are also unavailable in disaggregated form. The U.S. shore-based landings are from the Pacific Fishery Information Network (PacFIN) database. Foreign and Joint-Venture catches for 1981–1990 and U.S. domestic at-sea catches for 1991–2022 are calculated from the Alaska Fisheries Science Center's North Pacific Groundfish and Halibut Observer (NORPAC) database, which also stores data from the At-Sea Hake Observer Program. Canadian Joint-Venture catches from 1989 are from the Groundfish Biological (GFBio) database. Canadian shore-based land-ings are from the Groundfish Catch (GFCatch) database for 1989–1995, the Pacific Harvest Trawl (PacHarvTrawl) database for 1996–March 31, 2007, and the Fisheries Operations System (FOS) database for April 2007–present. Vessels in the U.S. shore-based fishery carry observers and are required to retain all catch and by-catch for sampling by plant observers. All catches from U.S. at-sea vessels, Canadian Joint-Venture vessels, and Canadian freezer trawlers were monitored by at-sea observers from 1996–2019. In 2020 and 2021 there were no observers on Canadian freezer trawlers due to staffing issues. Due to the ongoing staffing issues, the decision was made to stop providing observers on board all Canadian vessels, for 2022 and all future groundfish trawl trips. This means there is not currently and will not be in the future, any at-sea sampling on board Canadian vessels. Canadian managers, scientists, and the sampling contractor, Archipelago Marine Research Ltd. (AMR) met in early 2022 to solidify a plan to ensure the ongoing sampling of Pacific Hake for Canadian trips. The sampling plan was agreed upon by all parties and consisted of employees aboard Freezer trawlers freezing two bags of approximately 50 whole fish from two tows per trip and delivering them to AMR on return to shore. The bags are stored by AMR until enough have accumulated to sample in bulk, and they sample them over the period of a day or two. This plan ensures that there are individual weights taken for fish from the freezer trawlers, something that was not happening during the at-sea sampling. These weight data give more Canadian input into the weight-at-age matrix. The shoreside vessels continue to make landings with sampling happening on shore at the time of landing. Canadian trawl catches are monitored autonomously at-sea by cameras onboard vessels. Catch is recorded by dockside samplers within the Groundfish Trawl Dockside Monitoring Program using total catch weights provided by processing plants. Discards are negligible relative to the total fishery catch for all sectors. For recent catches with haul- or trip-level information, removals by month during the fishing season allowed for the estimation of monthly bycatch rates from observer or dockside information. This information has also allowed a detailed investigation of shifts in fishery timing (Taylor et al. 2014). Minor updates to catches used in previous assessments were made based on the best available information extracted from the aforementioned databases. Tribal catches were available in PacFIN for the U.S. tribal fishery at the time the data were extracted and were cross-checked with numbers based on information provided by the Makah Tribe. The Makah Tribe is also working on providing historical catches such that shore-based catches can be summarized separately from tribal catches since the onset of the fishery. Biological information from the U.S. at-sea fishery are available from the NORPAC database. This included sex, length, weight, and age information from the foreign and Joint-Venture fish-eries from 1975–1990 and from the domestic at-sea fishery since 1990. Observers collect data by selecting fish randomly from each haul. The number of otoliths collected per haul has varied over time but is currently three fish every third haul. Biological samples from the U.S. shore-based fishery since 1991 were collected by port samplers located where there are substantial landings of Pacific Hake, primarily Eureka, Newport, Astoria, and Westport. Port samplers routinely take one sample per offload (or trip) consisting of 100 randomly selected fish for individual length and weight, and, from these, typically 20 fish are randomly subsampled for otolith extraction. When there were observers (1996–2019) aboard Canadian freezer trawler vessels, they collected 50 otoliths and 300 lengths per sample, sampling once per day during trips that on average last approximately seven days. For 2022 and onwards, there are no longer observers on freezer trawlers, so the frozen samples that are delivered for each trip are all sampled for length, weight, sex, and otoliths are taken. There are approximately 100 fish per trip, in two bags of 50. There have been some exceptions to this; due to unforeseen circumstances while at sea, some trips did not bring any samples back and some only brought single bags.

For electronically observed Canadian shoreside trips, port samplers obtain biological data from the landed catch. For each sampled trip, 50 ages and 300 lengths are sampled from the catch. Observed domestic haul-level information is then aggregated to the trip level to be consistent with the unobserved trips that are sampled in ports.

When there has been a Canadian Joint-Venture fishery, length samples are collected every second day of fishing operations, and otoliths are collected once per week. Length and age samples are taken randomly from a given codend. The sampled weight from which biological information is collected must be inferred from length-weight relationships.

The sampling unit for the shore-based fisheries is the trip, while the haul is the primary unit for the at-sea fisheries. There is no least common denominator for aggregating at-sea and shore-based fishery samples because detailed haul-level information is not recorded for trips in the shore-based fishery and hauls sampled in the at-sea fishery cannot be aggregated to a comparable trip level. As a result, initial sample sizes are simply the summed hauls and trips for fishery biological data.

Biological data were analyzed based on the sampling protocols used to collect them and expanded to estimate the corresponding statistic from the entire landed catch by fishery and year when sampling occurred. A description of the analytical steps for expanding the age compositions can be found in earlier stock assessment documents (Hicks et al. 2013; Taylor et al. 2014).

The aggregate fishery age-composition data (1975–2022) confirm the well-known pattern of large cohorts born in 1973, 1977, 1980, 1984, 1987, 1999, 2008, 2010, 2014 and 2016.

The Joint U.S. and Canadian Integrated Acoustic and Trawl Survey (Stewart et al. 2011) has been the primary fishery-independent tool used to assess the distribution, abundance, and biology of coastal age-2+ Pacific Hake along the west coasts of the U.S.A. and Canada. The acoustic surveys performed in 1995, 1998, 2001, 2003, 2005, 2007, 2009, 2011, 2012, 2013, 2015, 2017, 2019, and 2021 were used in this assessment. The acoustic survey samples transects that represent all waters off the coasts of the U.S.A. and Canada thought to contain all portions of the age-2+Pacific Hake stock. Observations of age-0 and age-1 Pacific Hake are excluded from the age-2+ index due to largely different schooling behavior relative to older Pacific Hake, concerns about their catchability by the trawl gear, and differences in expected location during the summer months when the survey takes place. Observations of age-1 Pacific Hake are recorded during the survey, and additional analyses, described below, are conducted to develop a relative age-1 index.

The 2021 survey covered U.S. and Canadian waters from Point Conception to north of Haida Gwaii using 108 transects. In the U.S.A., transects were mostly separated by 10 nmi, except 20 nmi spacing was used north of San Francisco Bay to Cape Mendocino and again in northern Washington to account for available ship days at sea. In Canada, transects were separated by 10 nmi along Vancouver Island and then 20 nmi further north. The Bell M. Shimada and the F/V Nordic Pearl worked collaboratively to complete the full extent of the survey in 2021.

Distributions of the backscatter of Pacific Hake plotted for each acoustic survey since 1995 illustrate the variable spatial patterns of age-2+ fish across years. This variability is due in part to changes in the composition of the age-2+ population because older Pacific Hake tend to migrate farther north and partly due to environmental and/or climatic factors. The 1998 acoustic survey is notable because it shows an extremely northward distribution that is thought to be related to the strong 1997-1998 El Niño. In contrast, distribution of Pacific Hake during the 2001 acoustic survey was compressed into the lower latitudes off the coast of Oregon and Northern California. There was a strong La Niña event in 2000. In 2003, 2005, and 2007 the distribution of Pacific Hake did not show an unusual coast-wide pattern despite 2003 and 2007 being characterized as El Niño years. In 2009, 2011, 2012, and 2013 the majority of the distribution of Pacific Hake was again found in U.S. waters, which is more likely due to age-composition than the environment, although 2013 showed some warmer than average sea-surface temperatures. In 2015, sea-surface tempera-tures were warmer again, resulting in a northern shift in the overall distribution. The distribution of Pacific Hake in 2017 was more latitudinally uniform than observed in 2015. This is likely a result of having large proportions of two cohorts (2010 and 2014 year-classes) in 2017 as opposed to many other years when a single cohort is dominant in the observed samples. Weak 2019 El Niño conditions decreased in their prevalence starting in March of that year, leading to neutral conditions by July. Consequently, the 2019 survey saw Pacific Hake on all survey transects from just north of Morro Bay, California to the northern end of Vancouver Island, with the greatest offshore extent found off of Cape Mendocino. The 2021 survey saw the majority of Pacific Hake in U.S. waters and a continuation of conditions moving towards higher productivity La Niña con-ditions in the California Current from 2020 to 2021. Ongoing research is looking into relationships between environmental conditions and Pacific Hake distribution and recruitment,,that will help to inform the mechanisms behind observations (Malick et al. 2020; Phillips et al. 2023).

During the acoustic surveys, mid-water trawls are made opportunistically to determine the species composition of observed acoustic sign and to obtain the length data necessary to scale the acoustic backscatter into biomass (see Table 12 for the number of trawls in each survey year). Biological samples collected from these trawls are post-stratified, based on similarity in size composition, and the composite length frequency is used to characterize the size distribution of Pacific Hake along each transect and to predict the expected backscattering cross section for Pacific Hake based on the fish-size target-strength (TS) relationship. Any potential biases that might be caused by factors such as alternative TS relationships are partially accounted for in catchability. But, variability in the estimated survey biomass due to uncertainty in TS is not explicitly accounted for in the assessment.

Data from the acoustic survey are analyzed using kriging, which accounts for spatial correlation, to provide an estimate of total biomass as well as an estimate of the year-specific sampling variability due to patchiness of schools of Pacific Hake and irregular transects (Petitgas, 1993; Rivoirard et al. 2000; Mello and Rose, 2005; Simmonds and MacLennan, 2006). Advantages to the kriging approach are discussed in the 2013 stock assessment (Hicks et al. 2013).

For the 2016 assessment (Grandin et al. 2016), the data from all surveys since 1998 were scru-tinized and reanalyzed using consistent assumptions, an updated version of the EchoPro soft-ware, and a common input-file structure because some previously generated files had spurious off-transect zeros because of how the data were exported. The same analytical procedure was car-ried out during the reanalysis of 1995 survey data (Berger et al. 2017) and during the preparation of survey data collected since 2017. The assumptions are as follows:

- fixed minimum (kmin=3) and maximum (kmax=10) number of points used to calculate the value in a cell;
- search radius is three times the length scale that is estimated from the variogram; and
- biomass decays with distance from the end of the transect when extrapolating biomass be-yond the western end of a transect, which was refined and supported by the SRG starting with the 2016 assessment (Grandin et al. 2016).

The 2021 survey estimate was scaled by factor of 1.06 to convert EK 80 acoustic data (2021 survey only) to EK 60 acoustic data to standardize the survey time series. The survey team will eventually be converting all pre-2021 EK 60 data to an equivalent EK 80 format. Thus, a full time series of consistently analyzed survey biomass and age compositions since 1995 are used to fit the stock assessment model. These data contain many sources of variability (see Stewart et al. 2011) but results from research done in 2010 and 2014 on their representativeness show that trawl sampling and post-stratification is only a small source of variability. Specifically, repeated trawls at different depths and spatial locations on the same aggregation of Pacific Hake were similar and analyses regarding the method used to stratify the data led to similar overall conclusions. Estimates of country-specific age-2+ biomass are also provided.

Estimated age-2+ biomass in the survey increased steadily over the four surveys conducted in 2011-2013 and 2015. It decreased in 2017 to 1.42 million t and then increased to 1.72 million t in 2019 before decreasing again to 1.52 million t in 2021. The 2021 survey age composition was made up of 28%, 21%, 14%, 10%, and 8% from the 2016, 2014, 2017, 2010, and 2019 year classes, respectively. Note that the estimate of biomass does not include age-1 fish and the age compositions used to estimate selectivity of the survey also exclude age-1 fish.

A separate relative age-1 index (numbers of fish) was included in the base model in 2022 and was previously explored as a sensitivity since 2013 (Edwards et al. 2022). The relative index of age-1 fish in this assessment was estimated similarly to previous years, except the estimate of 2021 numbers of age-1 fish was scaled by a factor of 1.06 to account for differences between the EK 60 and EK 80 echosounders (the same approach used for the esti-mate of age-2+ biomass). The index (numbers of fish) indicates relative changes between years, not absolute values. The age-1 index confirms the large year classes in 2008, 2010, 2014, 2016, and 2020. In 2021, some age-1 fish were found in isolated homogeneous pockets but they were more so found to be mixed in with older fish. That same general pattern has occurred since 2015, with the exception of 2019 where age-1 fish were mostly in isolated pockets.

Incorporating the relative age-1 index results in estimates of recruitment strength that are informed on average one year earlier than models without the index. The suite of sensitivity models related to the relative age-1 index explored over the past decade indicate that its use typically provides the model with the correct direction of cohort strength (weak, strong, or neutral). The utility of an informed recruitment signal is far greater than an uninformed recruitment assumption. Whereas the assumption for uninformed recruitment is currently limited to the mean estimated recruitment over a specified range of years. Finally, the Joint U.S. and Canadian Integrated Acoustic and Trawl Survey team supports its use for stock assessment, and the team is committed to continually evaluating and refining approaches to improve survey estimates and related uncertainty. A model without the age-1 index was explored as a sensitivity.

Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 4	There is no change in the way catch, biological data and abundance indexes of Pacific Hake are monitored. Therefore, there is no material change in compliance with any of the previous supporting clauses and the fishery continues to fully conform.

5.2.2. Fundamental Clause 5: Stock assessment

5. There shall be regular stock assessment activities appropriate for the fishery, its range, the species biology, and the ecosystem, undertaken in accordance with acknowledged scientific standards to support its optimum utilization.
5.1 An appropriate institutional framework shall be established to determine the applied research required and its proper use (i.e., assess/evaluate stock assessment model/practices) for fishery management purposes. 5.1.1 Less elaborate stock assessment methods are frequently used for small-scale or low-value capture fisheries resulting in greater uncertainty about the status of the stock under consideration., A more precautionary approach to managing fisheries on such resources shall be required, including, where appropriate, a lower level of resource utilization. A record of good management performance may be considered as supporting evidence of the adequacy of the management system. 5.1.2 The fisheries management organization shall ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, and fishery enhancement. Analysis results shall be distributed in a timely and readily understandable fashion in order that the best scientific evidence available contributes to fisheries conservation, management, and development. The fisheries management organization shall also ensure the availability of research facilities and provide appropriate training, staffing, and institution building to conduct the research.
5.2 There shall be established research capacity necessary to assess and monitor (1) the effects of climate or environment change on stocks and aquatic ecosystems, (2) the state of the stock under State jurisdiction, and (3) the impacts of ecosystem changes resulting from fishing activity, pollution, or habitat alteration.
5.3 Management organizations shall cooperate with relevant international organizations to encourage research in order to ensure optimum utilization of fishery resources.
5.4 The fishery management organizations shall directly, or in conjunction with other States, develop collaborative technical and research programs to improve understanding of the biology, environment, and status of transboundary shared, straddling, highly migratory and high seas stocks.
5.5 Data generated by research shall be analysed and the results of such analyses published in a way that ensures confidentiality is respected, where appropriate.

Summary of relevant changes	In spite of the relatively short history of fishing, Pacific Hake have surely been subject to a larger number of stock assessments than any marine species off the west coast of the U.S.A. and Canada. These assessments have included a large variety of age-structured models. Initially, a cohort analysis tuned to fishery CPUE was used (Francis et al. 1982). Later, the cohort analysis was tuned to National Marine Fisheries Service (NMFS) triennial acoustic survey estimates of absolute biomass at age (Hollowed et al. 1988). Since 1989, Stock Synthesis models (or base versions of it) fit to fishery catch-at-age data and acoustic survey estimates of population biomass and age composition have been the primary assessment method. While the general form of the age-structured assessment has remained similar since 1991, modeling procedures have been modified in a variety of ways. There have been alternative data choices, post-data collection processing routines, data-weighting schemes, structural assumptions for the stock assessment model, MCMC sampling algorithms, and control rules. Analysts are constantly trying to improve the caliber and relevance of the assessment by responding to new scientific developments related to statistics and biological dynamics, policy requirements, and dif-ferent or new insights brought up during the peer review process to ensure a robust stock assess-ment. Data processing, filtering, and weighting choices have been modified several times since the first assessment. For example, modifications to the target-strength relationship used to scale acoustic

	data changed in 1997 (Dorn and Saunders 1997), and kriging was implemented to account for the spatial correlation in the acoustic data in 2010 (Stewart and Hamel 2010). While survey data have been the key index for biomass since 1988, surveys that have been used have varied considerably. The Alaska Fisheries Science Center/Northwest Fisheries Science Center West Coast Triennial Shelf Survey was used from 1988 before being discarded from the 2009 assessment (Hamel and Stewart 2009). Acoustic surveys from the years prior to 1995 were used for assessments in the early 1990s, but Stewart et al. (2011) reviewed these early surveys and deemed that sampling was insufficient to be comparable with more recent data. Several recruitment indices have been considered but ultimately none were identified as adding appreciable contribution to model results (Stewart and Hamel 2010), except for the fishery-independent acoustic-based age-1 index which has been included in the base model since the 2022 assessment. The process for generating fecundity-at-age from weight-at-age data changed in 2019 from using time-invariant to year-specific values. Even where data have been consistently used, the weighting of these data in the statistical likelihood has changed through the use of various emphasis factors (e.g., Dorn et al. 1999), a multinomial sample size on age compositions (e.g., Stewart et al. 2011), internal estimations of effective sample size using the Dirichlet-multinomial distribution (Edwards et al. 2018), and assumptions regarding year-specific survey variance. Since 2021, a more computationally efficient Bayesian MCMC sampler was used to estimate posterior distributions (Monnahan et al. 2019), a change from previous assessments that used the random walk Metropolis Hastings (rwMH) sampler. The list of changes discussed above is for illustrative purposes only and represents a small fraction of the different choices analysts have made and that reviewers have required. Several harvest control rules have been explored for providing catch limits from stock assessment output. Pacific Hake stock assessments have presented decision makers with constant F, vari-able F, and the following hybrid control rules: FSPR=35%, FSPR=40%, FSPR=40%–40:10, FSPR=45%, FSPR=45%–40:10, and FSPR=50% (e.g., Hicks et al. 2013). Changes to policies such as the United States' National Standards Guidelines in 2002 and the FSPR=40%–40:10 harvest control rule in the Agreement have required specific changes to control rules. In addition to the examples given above and changes documented in stock assessments, there have been many more investigations conducted at review panel meetings. Starting in 2013, the addition of the MSE (Hicks et al. 2013; Jacobsen et al. 2021) facilitated investigating changes to the modeling procedure in terms of pre-specified objectives that aim for a sustainable coast-wide fishery.
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 5	There is no change in the way stock assessment were carried out. Therefore, there is no material change in compliance with any of the previous supporting clauses and the fishery continues to fully conform.

5.2.3. Fundamental Clause 6: Biological reference points and harvest control rule

	6. The current state of the stock shall be defined in relation to reference points, relevant proxies, or verifiable substitutes that allow effective management objectives and targets to be set. Remedial actions shall be available and taken where reference points or other suitable proxies are approached or exceeded.
6.1	The fishery management organization shall establish safe target reference point(s) for management. Management targets are consistent with achieving maximum sustainable yield (MSY), a suitable proxy, or a lesser fishing mortality—if that is optimal in the circumstances of the fishery (e.g., multispecies fisheries) or is needed to avoid severe adverse impacts on dependent predators.
6.2	The fishery management organization shall establish appropriate limit reference point(s) for exploitation (i.e., consistent with avoiding recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible; Appendix 1, Part 1). When a limit reference point is approached, measures shall be taken to ensure that it will not be exceeded. For instance, if fishing mortality (or its proxy) is above the associated limit reference point, actions should be taken to decrease the fishing mortality (or its proxy) below that limit reference point.
6.3	Data and assessment procedures that measure the position of the fishery in relation to the reference points shall be established. Accordingly, the stock under consideration shall not be overfished (i.e., above limit reference point or proxy) and the level of fishing permitted shall be commensurate with the current state of the

fishery resources, maintaining its future availability, and taking into account that long-term changes in productivity can occur due to natural variability and/or impacts other than fishing (Appendix 1, Part 1).	
6.4 Management actions shall be agreed to in the eventuality that data sources and analyses indicate that these reference points have been exceeded. Accordingly, contingency plans shall be agreed in advance to allow an appropriate management response to serious threats to the resource as a result of overfishing, adverse environmental changes, or other phenomena that may have adverse e on impacts on the fishery resource (Appendix 1, Part 2). Such measures may be temporary and shall be based on best scientific evidence available.	
6.5 Measures shall be introduced to identify and protect depleted stocks and those stocks threatened with depletion, and to facilitate the sustained recovery/restoration of such stocks. Also, efforts shall be made to ensure that resources and habitats critical to the well-being of such stocks, which have received adverse impacts by fishing or other human activities, are restored.	
Summary of relevant changes	The Joint U.S.-Canada Agreement specifically identifies FSPR=40% as the default harvest rate and B40% as a point where the 40:10 TAC adjustment is triggered. The medians of sustainable yields and biomass reference points are similar to what was reported in the previous assessment. The probability that female spawning biomass at the beginning of 2023 is below B40% is P(B2023<B40%)=1.9%, and of being below B25% is P(B2023<B25%)=0.1%. The probability that the relative fishing intensity was above the FSPR=40% level of 1.0 at the end of 2022 is 0.1% (Berger et al. 2023).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 6	There is no change in the way the state of the stock is defined in relation to reference points. Therefore, there is no material change in compliance with any of the previous supporting clauses and the fishery continues to fully comply with the RFM fisheries standard.

5.2.4. Fundamental Clause 7: Precautionary approach

7. Management actions and measures for the conservation of stock and the ecosystem shall be based on the precautionary approach. Where information is deficient a suitable method using risk management shall be adopted to consider uncertainty.	
7.1 The precautionary approach shall be applied widely to conservation, management, and exploitation of ecosystems to protect them and preserve the ecosystem. This should take due account of fishery enhancement procedures, where appropriate. Absence of scientific information shall not be used as a reason for postponing or failing to take conservation and management measures. Relevant uncertainties shall be taken into account through a suitable method of risk management, including those associated with the use of introduced or translocated species. 7.1.1 In implementing the PA, the fishery management organization shall take into account, inter alia, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality, the impact of fishing activities (including discards) on non-target and associated or dependant predators, and environmental and socioeconomic conditions. 7.1.2 In the absence of adequate scientific information, appropriate research shall be initiated in a timely fashion.	
7.2 In the case of new or exploratory fisheries, the fishery management organization shall adopt, as soon as possible, cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures should remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment should be implemented. Management measures should, if appropriate, allow for the gradual development of the fisheries.	
Summary of relevant changes	Since the implementation of the Magnuson-Stevens Fishery Conservation and Management Act in the U.S. and the declaration of a 200-mile fishery-conservation zone in the U.S. and Canada in the late 1970s, annual quotas (or catch targets) have been used to limit the catch of Pacific Hake in both countries' zones. Scientists from both countries historically collaborated through the Tech-nical Subcommittee of the Canada-U.S. Groundfish Committee (TSC), and there were informal agreements on the adoption of annual fishing policies. During the 1990s, however, disagreements between the U.S. and Canada on the allotment of the catch limits between U.S. and Canadian

	fisheries led to quota overruns; the 1991–1992 national quotas summed to 128% of the coast-wide limit, while the 1993–1999 combined quotas were an average of 112% of the limit. The Agreement establishes U.S. and Canadian shares of the coast-wide total allowable catch (TAC) at 73.88% and 26.12%, respectively, and this distribution has largely been adhered to since 2005. However, a bilateral agreement on the coast-wide TAC could not be reached in 2020 or 2021; so, catch targets were set unilaterally during these years for the first time since the inception of the Agreement. Catch allocations as specified in the Agreement were once again applied in 2022 (Berger et al. 2023). Since 1999, an upper limit on catch has been calculated using an FSPR=40% default harvest rate with a 40:10 adjustment. This decreases the catch linearly from the catch at a relative spawning biomass of 40% to zero catch at a relative spawning biomass values of 10% or less (called the default harvest policy in the Agreement); relative spawning biomass is the female spawning biomass divided by that at unfished equilibrium. Further considerations have almost always resulted in catch targets being set lower than the recommended catch limit. Total catch has not exceeded the coast-wide quota since 2002, and harvest rates are likely to have never exceeded the FSPR=40% target.
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 7	There is no change in the way management actions and measures for the conservation of stock and the ecosystem are carried out on the base of precautionary approach. Therefore, there is no material change in compliance with any of the previous supporting clauses and the fishery continues to fully conform.

5.3. Section C: Management Measures, Implementation, Monitoring, and Control

5.3.1. Fundamental Clause 8: Management measures

8. Management shall adopt and implement effective management measures designed to maintain stocks at levels capable of producing maximum sustainable yields, including harvest control rules and technical measures applicable to sustainable utilization of the fishery, and based upon verifiable evidence and advice from available objective scientific and traditional sources.
8.1 Conservation and management measures shall be designed to ensure the long-term sustainability of fishery resources at levels which promote optimum utilization, and are based on verifiable and objective scientific and/or traditional, fisher, or community sources. 8.1.1 When evaluating alternative conservation and management measures, the fishery management organization shall consider their cost-effectiveness and social impact. 8.1.2 Responsible fisheries management organizations shall adopt and implement measures necessary to ensure the management of bycatch and reduction of discards as part of fisheries management (1) in accordance with the PA, as reflected in Article 6 of the UN Fish Stocks Agreement, and as set out in Article 6.5 and 7.5 of the Code; (2) in accordance with the responsible use of fish as set out in the Code; and (3) based on the best scientific evidence available, taking into account fishers' knowledge.
8.2 The fishery management organization shall prohibit dynamiting, poisoning, and other similar destructive fishing practices.
8.3 The fishery management organization shall seek to identify domestic parties having a legitimate interest in the use and management of the fishery. When deciding on use, conservation, and management of the resource, due recognition shall be given, where relevant, in accordance with national laws and regulations, to the traditional practices, needs, and interests of indigenous people and local fishing communities which are highly dependent on these resources for their livelihood. Arrangements shall be made to consult all the interested parties and gain their collaboration in achieving responsible fisheries.
8.4 Where excess capacity exists, mechanisms shall be established to reduce capacity to levels commensurate with sustainable use of the resource. Fleet capacity operating in the fishery shall be measured and monitored. The fishery management organization shall maintain, in accordance with recognized international standards and practices, statistical data, updated at regular intervals, on all fishing operations and a record of all authorizations to fish allowed by them.

8.4.1 Studies shall be promoted that provide an understanding of the costs, benefits, and effects of alternative management options designed to rationalize fishing, especially options relating to excess fishing capacity and excessive levels of fishing effort.	
8.5 Technical measures regarding the stock under consideration shall be taken into account, where appropriate, in relation to fish size, mesh size, gear, closed seasons or areas, areas reserved for particular (e.g., artisanal fisheries), and protection of juveniles or spawners. 8.5.1 Appropriate measures shall be applied to minimize catch, waste, and discards of non-target species (both fish and non-fish species), and impacts on associated, dependent, or endangered species.	
8.6 Fishing gear shall be marked in accordance with the State's legislation in order that the owner of the gear can be identified. Gear marking requirements shall take into account uniform and internationally recognizable gear marking systems.	
8.7 The fishery management organization and relevant groups from the fishing industry shall measure performance and encourage the development, implementation, and use of selective, environmentally safe, and cost-effective gear, technologies, and techniques that are sufficiently selective as to minimize catch, waste, discards of non-target species (both fish and non-fish species), and impacts on associated or dependent predators. The use of fishing gear and practices that lead to discarding the catch shall be discouraged, and the use of fishing gear and practices that increase survival rates of escaping fish shall be promoted. Inconsistent methods, practices, and gears shall be phased out accordingly.	
8.8 Technologies, materials, and operational methods or measures—including, to the extent practicable, the development and use of selective, environmentally safe, and cost effective fishing gear and techniques—shall be applied to minimize the loss of fishing gear, the ghost fishing effects of lost or abandoned fishing gear, pollution, and waste.	
8.9 The intent of fishing selectivity and fishing impacts-related regulations shall not be circumvented by technical devices. Information on new developments and requirements shall be made available to all fishers.	
8.10 Assessment and scientific evaluation shall be carried out on the impacts of habitat disturbance on the fisheries and ecosystems prior to the commercial-scale introduction of new fishing gear, methods, and operations. Accordingly, the impacts of such introductions shall be monitored.	
8.11 International cooperation shall be encouraged for research programs involving fishing gear selectivity, fishing methods and strategies, dissemination of the results of such research programs, and the transfer of technology.	
8.12 The fishery management organization and relevant institutions involved in the fishery shall collaborate in developing standard methodologies for research into fishing gear selectivity, fishing methods and strategies, and on the behavior of target and non-target species regarding such fishing gear—as an aid for management decisions and with a view to minimizing non-utilized catches.	
8.13 Where appropriate, policies shall be developed for increasing stock populations and enhancing fishing opportunities through the use of artificial structures. The fishery management organization shall ensure that, when selecting the materials to be used in the creation of artificial reefs, as well as when selecting the geographical location of such artificial reefs, the provisions of relevant international conventions concerning the environment and the safety of navigation are observed.	
Summary of relevant changes	Following its standard process, the Treaty's Joint Technical Committee (JTC) authored the annual Pacific hake stock assessment to inform harvest management decisions of the JMC. The Scientific Review Group (SRG) reviewed the stock assessment and provided advice to the JMC (NOAA Fisheries 2023a). The JMC unanimously agreed to recommend to the Parties a joint Canada/U.S. coastwide Pacific Hake Treaty TAC for 2022. The AP met to review the advice of the JTC and SRG. It reviewed the 2021 management of the U.S. and Canada fisheries and made recommendations to the JMC regarding the overall TAC for 2022. (NOAA Fisheries 2023a) The Treaty's management strategy evaluation (MSE) process continued in 2022, examining the performance of alternative management actions in

meeting prespecified objectives. In March and July 2022 the MSE Working Group briefed the JMC on 2021 progress, the 2022 work plan, and feedback from the SRG in 2022 (Marshall et al, 2022a; 2022b; Hastie et al. 2022).

The PFMC has no formal role in the TAC setting process but continues to review the results of the JMC process annually in April and may advise NMFS on JMC recommendations. The PFMC continues to control the management of the U.S. hake fleet to ensure that the fishery stays within conservation limits for both directed and incidental catch.

FMP Amendment 30 proposed new groundfish harvest specifications and management measures for 2023-2024. It was published in October 2022 (50 CFR 660 2022a), followed by the Final Rule in December 2022 (50 CFR 660 2022b). The revised management measures are intended to keep the total annual catch of each groundfish stock or stock complex within the annual catch limits (NOAA Fisheries 2023d). A correction to depth contour coordinates listed in the Final Rule was subsequently published on December 30, 2022 (50 CFR 2022c).

Amendment 30 also specified a 2,000 mt shortbelly rockfish catch threshold that, when exceeded or projected to be exceeded, would trigger Council review of the fishery. It also extends the length of the limited entry fixed gear sablefish primary season, clarifies boundaries of Rockfish Conservation Areas, corrects the definitions of Block Area Closures and expands their use to control groundfish catch (50 CFR 660 2022b).

In 2022 electronic monitoring (EM) was used as an alternative to meet the at-sea monitoring requirement for 100% observer coverage. EM may be deployed on vessels participating in the IFQ program, including whiting and non-whiting groundfish trawl and non-trawl vessels and MS/CV participating in the at-sea whiting fishery. Non-catch share observers provided by the West Coast Groundfish Observer Program (WCGOP) may be deployed to a vessel participating in EM to collect the biological samples and other data that cannot be obtained from using EM systems alone, specifically when there is potential for sorting and discarding at sea. Catch monitors also verify retained species and collecting samples at the dock (PFMC 2022k). In 2022, 25 shorebased IFQ whiting vessels (863 trips) and 18 mothership catcher vessels (27 trips) participated in the EM Program (NOAA Fisheries OLE 2023).

The NMFS West Coast Region continues to maintains a website that provides detailed information about on-going management and research activities related to the hake fishery (NOAA Fisheries 2023b).

Bycatch control measures continue to apply to participants in the Pacific whiting fishery. These work in conjunction with the ITQ program elements to reduce waste and discard of non-target species. The offshore fleets (CP and MS coops) continue to use measures designed to further restrict bycatch, including:

- precautionary closures of past bycatch hotspots
- night fishing restrictions
- fleet relocation triggers and fleet to fleet reporting
- required test tows upon relocation to a new fishing area
- in-season “hot spot” closure authority
- seasonal apportionments (pools) of whiting and bycatch allowances
- sanctions against vessels exceeding a bycatch rate within a seasonal pool (McQuaw 2023a)

Daily catch data reports continue to be produced by Sea State to provide the necessary information to assess and respond to bycatch events as they arise, for example, by identifying and avoiding hotspot areas (McQuaw 2023a; PWCC 2023).

	The MSFCMA mandates that each regional fishery management council and its SSC develop priorities for research to support management for five-year time period. The Council's next iteration of research and data needs is scheduled for 2023 and will be supported by a new database. In September 2022 the Council was briefed on the development of the new database and received comments from its advisory bodies. It adopted the proposed format of the database and approved a process for soliciting and posting new projects to the database as recommended by the SSC. New and existing research and data needs projects are scheduled to be prioritized using the database in 2023 (PFMC 2022p; 2022q). Research and data needs specific to Pacific hake are defined jointly by the U.S. and Canada as part of the annual stock assessment process. Research and data needs appear as Chapter 4 in the 2022 Pacific hake stock assessment (Edwards et al. 2022).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 8	The stock assessment and TAC setting process use the best available scientific information available The routine groundfish management cycle provides extensive points of review of groundfish fishing sustainability. Review of compliance with habitat protection measures is included in these reviews. In addition, Amendment 20 requires a regular review of the trawl ITQ program to ensure that it does not contribute to unsustainable fishing. The management system continues to use technical measures in relation to fish size, fishing gear, closed seasons, closed areas, areas reserved for particular fisheries, and protection of juveniles or spawners. There is no evidence that regulations related to any of these issues are being circumvented. There have been no changes in the type or degree of stakeholder interaction or consultations between the PFMC and other domestic parties. International cooperation in research continues through the Pacific Whiting Treaty. The jointly developed research plan continues to be reviewed once a year by the advisory committees, who provide advice to the JMC. The Joint U.S.-Canada Integrated Ecosystem and Pacific Hake Acoustic Trawl Survey is conducted every two years, with the next survey to be conducted in 2023 (NOAA Fisheries 2023a). The management of the hake fishery uses effective measures designed to maintain stocks at levels capable of producing maximum sustainable yields, including harvest control rules and technical measures applicable to sustainable utilization of the fishery, and based upon verifiable evidence and advice from available objective scientific and traditional sources. The fishery continues to conform to the RFM Fishery Standard Fundamental Clause 8.

5.3.2. Fundamental Clause 9: Appropriate standards of fishers' competence

9. Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards, guidelines and regulations.
9.1 States shall advance, through education and training programs, the education and skills of fishers and, where appropriate, their professional qualifications. Such programs shall take into account agreed international standards and guidelines.
9.2 States, with the assistance of relevant international organizations, shall endeavour to ensure, through education and training, that all those engaged in fishing operations be given information on the most important provisions of the FAO CCRF (1995), as well as provisions of relevant international conventions and applicable environmental and other standards that are essential to ensure responsible fishing operations.

9.3 The fishery management organization shall, as appropriate, maintain records of fishers which shall, whenever possible, contain information on their service and qualifications, including certificates of competency, in accordance with their State's laws.	
Summary of relevant changes	The USCG continued to provide and update various advisories on regulations, inspection requirements, Automated Identification System (AIS) requirements for vessels and gear, vessel safety and other marine safety alerts on its website fishsafewest.info (USCG 2023b). Oregon and Washington Sea Grant Programs also continued commercial fishery safety training (Oregon Sea Grant 2023; Washington Sea Grant 2023). NOAA Fisheries continued to produce and update compliance guides for West Coast groundfish and post them on a dedicated website (NOAA Fisheries 2023f) Examples of recent updated compliance guides available on this website include: • Amendment 30 and the 2023-24 Harvest Specifications and Commercial and Recreational Management Measures (pdf) • Pacific Whiting Utilization in the At-Sea Sectors (pdf) • Compliance Guide Pacific Coast Groundfish Trawl Rationalization Program (updated 2022) (pdf) • 2023 Pacific Whiting Harvest Specifications and 2023 Tribal Allocation (pdf) • Salmon Bycatch Minimization Measures 2021 (pdf) • Amendment 29 and the 2021-22 Harvest Specifications and Commercial and Recreational Management Measures (pdf) • Vessel Movement, Monitoring, and Declaration Management (pdf) (NOAA Fisheries 2023f) In October 2022 the Interagency Working Group on IUU Fishing released its National 5-Year Strategy for Combating IUU Fishing. The Plan has three strategic objectives: 1) Promote Sustainable Fisheries Management and Governance; 2) Enhance the Monitoring, Control, and Surveillance of Marine Fishing Operations; 3) Ensure Only Legal, Sustainable, and Responsibly Harvested Seafood Enters Trade. The Strategy provides a coordination framework among the relevant U.S. Government agencies for the next five years as well as partnerships with other governments and authorities, seafood industry, academia, and nongovernmental stakeholders (U.S. Interagency Working Group on IUU Fishing 2022).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 9	The USCG, NOAA and Sea Grant Programs continue to invest resources to ensure that fishing operations are carried out by fishers with appropriate standards of competence in accordance with international standards, guidelines and regulations. The management and regulatory systems of the Pacific Hake/Whiting Treaty and the Pacific Fishery Management Council have continued to be fully consistent with the principles of the FAO CCFR and other environmental standards. Records on Pacific fishers continue to be compiled through the Pacific Fisheries Information Network (PacFIN). Detailed information on the number and location of West Coast fishers, vessels, permits issued, etc. can be found in the economic section of the annual SAFE documentation (PFMC 2022u; 2022v). The records are considered accurate and are a necessary component of routine fishery monitoring for the effective functioning of the Pacific hake quota share program. Fishing operations are carried out by fishers with appropriate standards of competence in accordance with international standards, guidelines and regulations, and so the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 9.

5.3.3. Fundamental Clause 10: Effective legal and administrative framework

10. An effective legal and administrative framework shall be established and compliance ensured, through effective mechanisms for monitoring, surveillance, control, and enforcement for all fishing activities within the jurisdiction.

10.1 Effective mechanisms shall be established for fisheries monitoring, surveillance, control, and enforcement measures including, where appropriate, observer programs, inspection schemes, and vessel monitoring systems, to ensure compliance with the conservation and management measures for the fishery in question. This could include relevant traditional, fisher, or community approaches, provided their performance could be objectively verified.

10.2 Fishing vessels shall not be allowed to operate on the stock under consideration in question without specific authorization.

10.3 States involved in the fishery shall, in accordance with international law, and within the framework of fisheries management organizations or arrangements, cooperate to establish systems for monitoring, control, surveillance, and enforcement of applicable measures with respect to fishing operations and related activities in waters outside the States jurisdiction.

10.3.1 Fishery management organizations which are members of or participants in fisheries management organizations or arrangements, shall implement internationally agreed measures adopted in the framework of such organizations or arrangements and consistent with international law to deter the activities of vessels flying the flag of non-members or non- participants engaging in activities that undermine the effectiveness of conservation and management measures established by such organizations or arrangements. In that respect, port States shall also proceed, as necessary, to assist other States in achieving the objectives of the FAO CCRF (1995), and should make known to other States details of regulations and measures they have established for this purpose without discrimination for any vessel of any other State.

10.4 Flag States shall ensure that no fishing vessels are entitled to fly their flag, fish on the high seas or in waters under the jurisdiction of other States, unless such vessels have been issued with a Certificate of Registry and have been authorized to fish by the competent authorities. Such vessels shall carry on board the Certificate of Registry and their authorization to fish.

10.4.1 Fishing vessels authorized to fish on the high seas or in waters under the jurisdiction of a State other than the flag State shall be marked in accordance with uniform and internationally recognizable vessel marking systems such as the FAO Standard Specifications and Guidelines for Marking and Identification of Fishing Vessels.

Summary of relevant changes	Enforcement data continue to be summarized in the annual "TRat" (Trawl Rationalization) report presented to the PFMC by the NMFS Office of Law Enforcement (OLE) (NOAA Fisheries OLE 2023). In 2022 OLE began reporting sector-specific data on compliance assistance and enforcement investigations that for the first time allows data on whiting fisheries data to be isolated (NOAA Fisheries OLE 2023). The whiting fleet represented in the TRat Enforcement data includes catcher vessels delivering to both mothership and shorebased IFQ first receiver sites, mothership vessels, and catcher processor vessels. For this fleet, 43 enforcement incidents were identified in 2022, 34 of which were attributed to west coast catcher vessels. The categories of violations among the whiting sector catcher and catcher processor vessels with multiple occurrences were: • Vessel Monitoring System (VMS) Issue: 7 • Fishing in Deficit: 4 • Observer - Failure to Provide Reasonable Assistance: 2. A number of incidents did not result in enforcement actions beyond compliance assistance - such as a written warning, notice of violation and assessment (NOVA), summary settlement, or settlement agreement. The compliance rate is calculated as the ratio of incidents not resulting in enforcement actions to the total number of settled complaints and closed investigations conducted by OLE. The 2022 compliance rate for the whiting catcher vessel fleet is 97%; for the catcher processor vessels it is 100%. The three enforcement incidents recorded for the mothership vessel category in 2022 are open and ongoing investigations, and are therefore not included as part of the compliance rate estimation (NOAA Fisheries OLE 2023). The 2022 OLE enforcement data for the whiting sector shows the following: Contacts

• Complaints/Referrals	6
• Investigations/Dockside Boardings	27
Incidents	
• Enforcement Incidents	33
• 2021 Carry-Over Enforcement Incidents	1
Actions	
• No Violation (Nolle Prossed)	19
• Compliance Assistance	11
• GCES Settlement Agreement	1
• Summary Settlement	0
• Ongoing Investigation	3
Violations	
• Vessel Monitoring System (VMS) issue	5
• Fishing in Deficit	4
• Observer – Failure to Provide Reasonable Assistance	1
• Observer – Impede/Retain Prohibited Species	0
• Catch Monitor Not Present During Offload	0
• Closed Area	1
• Permit Not Onboard	1
Disposition	
• Closed Whiting Enforcement Incidents	31
• No Violation/Nolle Prossed	19
• Compliance Assistance	11
Compliance Rate	97%

(NOAA Fisheries OLE 2023)

The US Coast Guard (USCG) reported 2022 data for the commercial groundfish fleet as a whole. It reported 38 total boardings of which 7 were trawlers, finding zero violations among those boarded. In total, the USCG applied 11,397 hours of combined boat, aircraft and cutter enforcement time (USCG 2023a)

The USCG received reports of multiple Canadian whiting vessels operating near the U.S. EEZ off the coast of northwest Washington in 2022. Aircraft and cutters were sortied to investigate and patrol the area with no incursions identified. The USCG relayed the reports to NOAA Fisheries OLE, who in turn notified Canada Department of Fisheries and Oceans (DFO). DFO reviewed electronic monitoring data for the suspect vessels and subsequently confirmed there had been no illegal fishing (USCG 2023a).

The number of Pacific hake enforcement-related incidents rose from 15 in 2021 to 33 in 2022, primarily due to an increase the number of dockside boarding inspections of catcher vessels, as well as VMS and fishing in deficit issues attributed to this vessel category. In most cases, the dockside vessel inspections were closed with no violation detected. The VMS and fishing in deficit issues were ultimately resolved with compliance assistance provided, or responsive cooperation from the industry (Busch 2023).

The budget for the NMFS Office of Law Enforcement (OLE) West Coast Division (WCD) remained relatively stable, and the multi-year process of filling vacant special agent and enforcement officer positions will be completed pending the hiring of two more Special Agents for the California Area of Responsibility (AOR). The 'staffing snapshot' for the OLE WCD at the start of FY23 included 16 Special Agents; 13 Enforcement Officers; 6 Mission Support; 7 Investigative Support, and 1 Compliance Liaison (Busch 2023).

Enforcement coordination between federal and non-federal agencies remained active and effective. Joint Enforcement Agreements (JEA) authorizing state and U.S. territorial marine conservation law enforcement officers to execute federal laws and regulations remained in place and are fully funded for the next several years. Under a JEA, the states provided law enforcement force-multiplier services in support of OLE's federal enforcement priorities (Busch 2023).

As part of the trawl rationalization program the MS and C/P Cooperatives are required to submit an annual report of the prior year's fishery to the PFMC and NMFS. The Shoreside Whiting

	Cooperative (SWC) is required to submit an annual Salmon Mitigation Plan (SMP) (50 CFR 660 2021). Among the required elements of the MS and C/P reports are two that relate to monitoring and enforcement: 1. a description of the method used by the coop to monitor performance of cooperative vessels that participate in the fishery; 2. A description of any actions taken by the coop in response to any vessels that exceed their allowed catch and bycatch (50 CFR 660 2021). Monitoring: All cooperative vessels carry observers to monitor and account for catch of Pacific hake, non-target species and prohibited species. Observers report each vessel's catch on a daily basis to the NMFS Observer Program. In addition, both the MS and C/P cooperatives contract with the third-party Sea State Inc to monitor catch. All cooperative members provide waivers allowing Sea State access to the NMFS observer data and VMS location data. Sea State uses the data to produce daily reports to cooperative members and managers. The reports are used to monitor target catch against the sector allocation as well as to identify levels and location of bycatch by vessel and by fleet. Bycatch data are monitored to identify bycatch "hotspot" areas and ensure that species' set asides are not exceeded (McQuaw 2023a; PWCC 2023). Response to Vessel Overages: In 2022 no vessels exceeded their allowed catch or bycatch amounts to the extent that overall coop totals exceeded allowable amounts. In-season adjustments were made to individual vessel allocations as needed in both the MS and C/P sectors (McQuaw 2023a; PWCC 2023). As noted above, the SWC was required to submit an annual Salmon Mitigation Plan (SMP) Report for the 2022 season on behalf of its membership, all of whom are party to SMP-2022-02. SMP post-season reports are submitted annually to NMFS and the PFMC and include a description of Chinook salmon bycatch avoidance measures in the fishing year, an evaluation of the effectiveness of these avoidance measures, and a description of any amendments to the terms of the SMP that were made (McQuaw 2023b). In 2022 the SWC relied on timely information sharing to minimize encounters with Chinook salmon. Near real-time catch data shared with Coop members and the At-sea Coops allowed members to move away from hot-spots and mitigate further salmon encounters. The SWC also utilized salmon excluders and internal bycatch guidelines to avoid Chinook. These mitigation tools were effective as the Coop experienced very few 'lightning strikes' of accidental large bycatch (McQuaw 2023b). Recent EFP studies in the Bering Sea pollock fishery have found salmon excluders to have a 15-30% escapement rate when used by vessels with similar horsepower and gear configurations to SWC members. The effectiveness of salmon excluders is largely dependent on the individual vessel; however, these studies support the coop's use of excluders as an effective mitigation tool (McQuaw 2023b). The SWC members caught 1,810 Chinook in 2022 (16% of the Chinook cap) while landing 169,895,463 lbs. of whiting. The coop encountered more Chinook than in 2021, with the catch numbers similar to those observed in pre-COVID19 years. The increase in Chinook was primarily due to the overlap of whiting aggregations and Chinook migrations, likely driven by environmental conditions. Additionally, the coop's communication was instrumental in minimizing Chinook encounters, prompting members to move from fishing grounds when elevated Chinook were present. No amendments to the SMP were made in 2022 (McQuaw 2023b).
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 10	From the federal enforcement perspective, the Pacific hake fishery is a well-managed fishery comprised of a highly regulated and monitored fleet that continues to achieve a high level of regulatory compliance. Analysis of overlapping at-sea boarding, observer coverage, electronic monitoring, and VMS tracking statistics, together with dockside boarding, shoreside landings monitoring, and catch accounting data, indicate that the fishery presently does not require additional enforcement oversight (Busch 2023). The fishery continues to conform to the RFM Fishery Standard Fundamental Clause 10. It has an effective legal and administrative framework that ensures compliance through effective mechanisms for monitoring, surveillance, control, and enforcement for all fishing activities within the jurisdiction.

5.3.4. Fundamental Clause 11: Framework for sanctions

11. There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.
11.1 State laws of adequate severity shall be in place that provide for effective sanctions.
11.2 Sanctions applicable to violations and illegal activities shall be adequate in severity to be effective in securing compliance and discouraging violations wherever they occur. Sanctions shall also be in force to affect authorization to fish and/or to serve as masters or officers of a fishing vessel in the event of non-compliance with conservation and management measures.
11.3 Fisheries management organizations shall ensure that sanctions for IUU fishing by vessels and, to the greatest extent possible, nationals under its jurisdiction are of sufficient severity to effectively prevent, deter, and eliminate IUU fishing and to deprive offenders of the benefits accruing from such fishing. This may include the adoption of a civil sanction regime based on an administrative penalty scheme. Fisheries management organizations shall ensure the consistent and transparent application of sanctions.
11.4 Flag States shall take enforcement measures towards fishing vessels entitled to fly their flag which have been found by the State to have contravened applicable conservation and management measures. The State shall, where appropriate, make the contravention of such measures an offense under national legislation.

Summary of relevant changes	No changes were made to the structure of monitoring, enforcement and sanctions in 2022. According to the Assistant Director of the West Coast Division NOAA OLE, the Pacific hake fishery is a well-managed fishery comprised of a highly regulated and monitored fleet that continues to achieve a high level of regulatory compliance. Analysis of overlapping at-sea boarding, observer coverage, electronic monitoring, and VMS tracking statistics, together with dockside boarding, shoreside landings monitoring, and catch accounting data, indicate that the fishery presently does not require additional enforcement oversight (Busch 2023). The NOAA Office of General Counsel continues to post the West Coast Region Summary Settlement and Fix-it Schedule which describes violations and penalties associated with them for all fisheries in the Region. For Pacific hake, violation categories include groundfish regulations, TRat Program, Marine Mammal Protection Act and Endangered Species Act (NOAA Fisheries 2023g)
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 11	The management system maintains a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations, and so the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 11.

5.4. Section D: Serious Impacts of the Fishery on the Ecosystem

5.4.1. Fundamental Clause 12: Impacts of the fishery on the ecosystem

12. Considerations of fishery interactions and effects on the ecosystem shall be based on the best scientific evidence available, local knowledge where it can be objectively verified, and a risk assessment-based management approach for determining most probable adverse impacts. Adverse impacts of the fishery on the ecosystem shall be appropriately assessed and effectively addressed.

12.1 The fishery management organization shall assess the impacts of environmental factors on target stocks and associated or dependent species in the same ecosystem, and the relationship among the populations in the ecosystem.

12.2 The most probable adverse impacts from human activities, including fishery effects on the ecosystem/environment, shall be assessed and, where appropriate, addressed and or/corrected, taking into account available scientific information and local knowledge. This may take the form of an immediate management response or a further analysis of the identified risk. In this context, full consideration should be given to the special circumstances and requirements in developing fisheries, including financial and technical assistance, technology transfer, training, and scientific cooperation. In the absence of specific information on the ecosystem impacts of fishing on the unit of certification, generic evidence based on similar fishery situations can be used for fisheries with low risk of severe adverse impact. However, the greater the risk, the more specific evidence shall be necessary to ascertain the adequacy of mitigation measures.

12.2.1 The fishery management organization shall consider the most probable adverse impacts of the unit of certification **on main associated species** (Appendix 1, Part 3 and 7), by assessing and, where appropriate, addressing and or/correcting them, taking into account the best scientific evidence available and local knowledge. Accordingly, these catches (including discards) shall be monitored and shall not threaten these non-target species with serious risk of extinction, recruitment overfishing, or other impacts that are likely to be irreversible or very slowly reversible. If such impacts arise, effective remedial action shall be taken.

12.2.2 The fishery management organization shall consider the most probable adverse impacts of the fishery under assessment on **minor associated species**, by assessing and, where appropriate, addressing and or/correcting them, taking into account available scientific information and local knowledge. Accordingly, these catches (including discards) shall be monitored and shall not threaten these non target stocks with serious risk of extinction, recruitment overfishing, or other impacts that are likely to be irreversible or very slowly reversible. If such impacts arise, effective remedial action shall be taken.

12.2.3 There shall be outcome indicator(s) consistent with achieving management objectives for non-target species (i.e., avoiding overfishing and other impacts that are likely to be irreversible or very slowly reversable).

12.2.4 The fishery management organization shall consider the most probable adverse impacts of the unit of certification on **ETP species** (Appendix 1, Part 4 and 7), by assessing and, where appropriate, addressing and or/correcting them, taking into account the best scientific evidence available and local knowledge.

12.2.5 There shall be outcome indicator(s) consistent with achieving management objectives seeking to ensure that **ETP species** are protected from adverse impacts resulting from interactions with the unit of certification and any associated enhanced fishery activity, including recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible.

12.2.6 The fishery management organization shall consider the most probable adverse impacts of the unit of certification on **habitats** (Appendix1, Part 5 and 7), by assessing and, where appropriate, addressing and or/correcting them, taking into account the best scientific evidence available and local knowledge.

12.2.7 There shall be knowledge of the essential habitats for the stock under consideration and potential fishery impacts on them. Impacts on essential habitats, and on **habitats** that are highly vulnerable to damage by the fishing gear involved, shall be avoided, minimized, or mitigated. In assessing fishery impacts, the full spatial range of the relevant habitat shall be considered, not just the part of the spatial range that is potentially affected by fishing.

12.2.8 There shall be outcome indicator(s) consistent with achieving management objectives for avoiding, minimizing, or mitigating the impacts of the unit of certification on essential **habitats** for the stock under consideration and on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification.

12.2.9 The fishery management organization shall consider the most probable adverse impacts of the fishery under assessment on the **ecosystem** (Appendix 1, Part 6), by assessing and, where appropriate, addressing and or/correcting them, taking into account available scientific information and local knowledge.

12.2.10 There shall be outcome indicator(s) consistent with achieving management objectives seeking to minimize adverse impacts of the unit of certification (including any fishery enhanced activities) on the structure, processes, and function of aquatic **ecosystems** that are likely to be irreversible or very slowly reversible. Any modifications to the habitat for enhancing the stock under consideration must be reversible and not cause serious or irreversible harm to the natural ecosystem's structure, processes, and function. 12.2.11 The fishery management organization shall consider the most probable adverse human impacts on the **stock/ecosystem** under consideration, by assessing and, where appropriate, addressing and or/correcting them, taking into account available scientific information and local knowledge.	
12.3 The **role of the stock under consideration in the food web** shall be considered, and if it is a key prey species 2 in the ecosystem, management objectives and measures shall be in place to avoid severe adverse impacts on dependent predators.	
12.4 There shall be outcome indicator(s) consistent with achieving management objectives seeking to avoid severe adverse impacts on **dependent predators** resulting from the unit of certification fishing on a stock under consideration that is a key prey species.	
12.5 States shall introduce and enforce laws and regulations based on the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (**MARPOL** 73/78).	
12.6 Research shall be promoted on the **environmental and social impacts of fishing gear** especially the impact of such gear on biodiversity and coastal fishing communities.	
12.7 The fishery management organization shall make use, where appropriate, of **Marine Protected Areas** (MPAs). The general objectives for establishing MPAs shall include ensuring sustainability of fish stocks and fisheries, and protecting marine biodiversity and critical habitats.	
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 12	The fishery continues to conform to the RFM Fishery Standard Fundamental Clause 12. Please see section 4.4.2 for all updates pertaining to non-target and ETP species, habitats and ecosystems.

6. Update on compliance and progress with non-conformances and agreed action plans

The hake fishery continues to fully conform to all fundamental clauses and subclauses within the RFM Fishery Standard. There are no new NCs or ongoing action plans to evaluate.

6.1. Closed non-conformances

N/A

6.2. Progress against open non-conformances

NC	Clause	Gaps in conformance	Evidence or plan for resolution	Progress

N/A No open NCs

6.3. New non-conformances

N/A No new NCs

6.4. New or revised corrective action plan

N/A No new or revised corrective action plan

6.5. Surveillance activities

7. Appendices

7.1. Evaluation processes and techniques

7.1.1. Site visits

The surveillance audit process as defined in the RFM Procedure 2: Application to Certification Procedures for the RFM Fishery Standard v6 was followed in this audit. Clients supplied the assessment team with data and documents to review relevant to the fishery's performance against the RFM Standard ahead of a client opening/closing meeting which was held on July 5th, 2023.

Information supplied by the clients and management agencies was reviewed by the assessment team ahead of the remote meeting, and discussions with the clients centred on the content within the provided documentation. In cases where relevant documentation was not provided in advance of the meeting, it was requested by the assessment team and subsequently supplied during, or shortly after the meeting.

Thirty days prior to the audit site visit, all stakeholders from the full assessment and previous surveillance audits, and newly identified stakeholders, were informed of the visit and the opportunity to provide information to the auditors in advance of, or during, the site visit. No requests for meetings or documents were provided by invited stakeholders.

The following participants were in attendance:

Name	Affiliation
Amanda Stern-Pirlot	MRAG Americas assessment team member
Giuseppe Scarcella	MRAG Americas RFM assessment team member
Susan Hanna	MRAG Americas assessment team member
Bruce Turris	Client group, Canada
Dan Waldeck	Pacific Whiting Conservation Cooperative (Client group, US)
Mike Luchino	Trident Seafoods (Client group, US)
Shannon Mann	Association of Pacific Hake Fishermen (Client group, Canada)
Trent Hartill	Glacier Fish Company (Client group member, US)
Yelena Nowak	Director of Oregon Trawl Commission (Client group)

7.1.2. Stakeholder participation

7.2. Stakeholder input

Thirty days prior to the audit site visit, all stakeholders from the full assessment (see list below) were informed of the visit and the opportunity to provide information to the auditors in advance of, or during, the site visit. We received no requests from outside stakeholders to take part in meetings, or written comments from invited stakeholders.

The following stakeholders were notified of the surveillance audit.

Name	**Organization**
Frank Lockhart	NOAA
Todd Phillips	NOAA
Stacey Miller	NOAA
Jim Hastie	NOAA
Vanessa Tuttle	NOAA
Ian Taylor	NOAA
Melissa Haltuch	NOAA
Kelly ames	NOAA
John DeVore	NOAA
Daniel Erickson	NOAA
Aaron Berger	NOAA

Kelli Johnson	NOAA
Kristin Marshall	NOAA
Keeley Kent	NOAA
Greg Busch	NOAA
Andrew Torres	NOAA
Brian Corrigan	NOAA
Joe Bersch	Premier Pacific Seafoods, Inc.
Brent Paine	United Catcher Boats
Heather Munro Mann	Midwater Trawlers Cooperative
Mike Okoniewski	Pacific Seafood
Dave Dawson	Pacific Seafood
Steve Spencer	Pacific Seafood
Timothy Horgan	Pacific Seafood
Jon Steinman	Pacific Seafood
Michael Brown	Pacific Seafood
John Moody	Pacific Seafood
John Lin	Pacific Seafood
H Calik	Pacific Seafood
Charles Kirschbaum	Pacific Seafood
Rick Harris	Pacific Seafood
Tyson Yeck	Pacific Seafood
J Baxley	Pacific Seafood
Corey Niles	WA Dept of Fish & Wildlife
Arne Fuglvog	Glacier Fish Company
Trent Hartill	American Seafoods Company
Anne Vanderhoeven	Arctic Storm Management Group
Sarah Nayani	Arctic Storm Management Group
Maggie Sommer	ODFW
Amanda Gladics	Oregon State University
Lori Steele	West Coast Seafood Processors
Don Alber	Alber Seafoods
Christa Svensson	Ilwaco Fish company Inc.
Shannon Mann	Mariner Seafoods Ltd
Jan Jacobs	American Seafoods Company
Daniel Waldeck	Pacific Whiting Conservation Cooperative
Bruce Turris	Canadian Groundfish Resource and Conservation Society
Yelena Nowak	Oregon Trawl Commission

No stakeholder input was received.

7.3. Assessment Team – biographies/summaries of CVs

Dr. Giuseppe Scarcella is an experienced fishery scientist and population analyst and modeller, with wide knowledge and experience in the assessment of demersal stocks. He holds a first degree in Marine Biology and Oceanography (110/110) from the Unversità Politecnica delle Marche, and a Ph.D. in marine Ecology and Biology from the same university, based on a thesis "Age and growth of two rockfish in the Adriatic Sea". After his degree he was offered a job as project scientist in several research programs about the structure and composition of fish assemblage in artificial reefs, off-shore platform and other artificial habitats in the Italian Research Council – Institute of Marine Science of Ancona (CNR-ISMAR, now CNR-IRBIM). During the years of employment at CNR-ISMAR he has gained experience in benthic ecology, statistical analyses of fish assemblage evolution in artificial habitats, fisheries ecology and impacts of fishing activities, stock assessment, otholith analysis, population dynamic and fisheries management.

During the same years he attended courses of uni- multivariate statistics and stock assessment. He is also actively participating in the scientific advice process of FAO GFCM in the Mediterranean Sea. At the moment he is member of the Scientific, Technical and Economic Committee for Fisheries for the European Commission (STECF).

He is author and co-author of more than 50 scientific paper peer reviewed journals and more than 150 national and international technical reports, most of them focused on the evolution of fish assemblages in artificial habitats and stock assessment of demersal species. For some years now, Dr Scarcella has been working in fisheries certification applying the Marine Stewardship Council standard for sustainable fisheries, currently concentrating on Principle 1 of the Standard. Furthermore, Dr Scarcella holds the credential as Fishery team leader (MSC v2.0) and he completed the MSC procedure training 2.1. He also holds the credential as certifier of Responsible *Fisheries* Management (RFM).

Dr. Susan Hanna. Dr. Hanna is professor emeritus of marine economics at Oregon State University. Her research and publications are in the area of marine economics and policy, with an emphasis on fishery management, ecosystem-based fishery management, property rights and institutional design. Dr. Hanna has served as a scientific advisor to the U.S. Commission on Ocean Policy, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Minerals Management Service, Northwest Power and Conservation Council and the Pacific Fishery Management Council. She served on the Ocean Studies Board of the National Research Council (NRC), National Academy of Sciences, and several NRC Committees, including the Committee to Review Individual Quotas in Fisheries and the Committee on Protection and Management of Pacific Northwest Anadromous Salmonids. She has served as a P3 assessor and peer reviewer on a number of MSC assessments, including Oregon and Washington pink shrimp and US West Coast Groundfish.

Ms. Amanda Stern-Pirlot serves as team leader for the assessment. Amanda is an M.Sc graduate of the University of Bremen, Center for Marine Tropical Ecology (ZMT) in marine ecology and fisheries biology. Ms. Stern-Pirlot joined MRAG Americas in mid-June 2014 as MSC Certification Manager (now VP—Science) and is currently serving on several different assessment teams as team leader and team member. She has worked together with other scientists, conservationists, fisheries managers and producer groups on international fisheries sustainability issues for over 15 years. With the Institute for Marine Research (IFM-GEOMAR) in Kiel, Germany, she led a work package on simple indicators for sustainable within the EU-funded international cooperation project INCOFISH, followed by five years within the Standards Department at the Marine Stewardship Council (MSC) in London, developing standards, policies and assessment methods informed by best practices in fisheries management around the globe. Most recently she has worked with the Alaska pollock industry as a resources analyst, within the North Pacific Fishery Management Council process, focusing on bycatch and ecosystem-based management issues, and managing the day-to-day operations of the offshore pollock cooperative. She has co-authored a dozen publications on fisheries sustainability in the developing world and the functioning of sustainability certification schemes as an instrument for transforming fisheries to a sustainable basis.

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