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US Pacific Hake/Whiting Fishery

2nd RFM Surveillance Audit Report

Conformity Assessment Body (CAB)	MRAG Americas
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Fishery client	Pacific Whiting Conservation Cooperative
Assessment type	Second Surveillance
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Date	2 January 2025

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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 2nd surveillance cycle in relation to the US Midwater Trawl Pacific Hake/Whiting Fishery and contains an update on the fishery since the first surveillance audit (Stern-Pirlot *et al*., 2023). Meetings were held remotely on October 14th and 15th 2024 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 on 14 and 15 October 2024, 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	Aja Szumylo (PWCC) and Yelena Nowak (OTC) aja@pacificwhiting.org ; yelena@oregontrawl.org

4.4. Update on the fishery

4.4.1. Update on topics that trigger immediate failure

No changes on topics that trigger immediate failure

4.4.2. Changes in the management regime and processes

Voluntary Management Measures

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.

Whiting Mothership Cooperative (WMC): As it has done in previous years, the WMC board delegated authority to Sea State, Inc. to impose “in-season hot spot closures” if they perceive a problem. The Coop agreement provides for dividing the whiting allocation into five pools with various start dates. Each pool receives a share of the bycatch allocations pro-rata to whiting. If a pool reaches its share of the bycatch prior to harvesting its whiting allocation, members of the pool must cease fishing. In the event that a pool closes because of bycatch, if a member of that pool has a cumulative bycatch amount exceeding their pro-rata share by 25%, that vessel is restricted from harvesting additional whiting in a subsequent seasonal pool. The WMC suspended fishing November 1, 2023. There were no violations of the WMC Bycatch Agreement (McQuaw 2024a).

Catcher/Processor Cooperative (C/PC): As it has done in previous years, the C/PC contracted with Sea State, Inc. to process the observer program catch data and to provide in-season management support. Sea State and the C/P Cooperative manager provide catch reports to each C/P vessel, the C/P fleet, and the C/P Cooperative. The reports may include cumulative fleet-wide and vessel-level catch data as well as tow-by-tow summaries. Fleet managers can reconcile the tow-by-tow catch information provided by Sea State against their own catch records to identify possible data errors and ensure accurate catch accounting throughout the fishing season. Sea State reports also help vessels to identify and avoid fishing areas where incidental catch of species of concern is occurring. Generally, this information can also be shared with the other whiting sectors to ensure fishery-wide transparency (PWCC 2024).

For 2023, each C/PC member agreed to employ bycatch avoidance techniques recommended by the PWCC Board of Directors and Sea State, Inc. None of the vessels in the C/PC exceeded their allowed whiting catch. Year-end catch of darkblotched rockfish was 89.96 t, exceeding the at-sea set-aside amount of 76.4 t. Total C/P sablefish catch was 130.23 t, exceeding the at-sea set-aside of 100 t. Total C/P shortspine thornyhead catch was 73.8 t, compared to the at-sea set aside of 70 t. The overall Chinook salmon cap of 11,000 fish established for the whiting sector was not exceeded. C/P bycatch was 3,354; total Chinook bycatch by all whiting sectors was 5,998 fish (PWCC 2024).

Higher C/P Chinook and set-aside bycatch occurred predominantly during the spring season. As a result, vessels in the C/P sector implemented several provisions in the spring and fall seasons to limit additional incidental catch of rockfish set-aside species and Chinook salmon. The additional measures included: 1. additional information about test tows and bycatch avoidance measures in C/P daily reports; 2. test tows when entering new areas; 3. closures in high bycatch areas and night fishing restrictions; 4. additional movement rules when encountering high rates or numbers of Chinook salmon or constraining rockfish species; 5. additional communication within and between whiting sectors (PWCC 2024). These measures limited bycatch and ensured that higher spring bycatch did not negatively impact other sectors’ participation in the whiting fishery or other West Coast groundfish fisheries. Although bycatch of set-aside species and Chinook was higher in 2023 due to unprecedented conditions on the fishing grounds, particularly in the spring, Chinook salmon bycatch for all whiting sectors ended slightly above the 2011-2023 average bycatch of 5,660 Chinook. Several at-sea set asides were exceeded, but total attainment for these species was below the annual catch limits (ACLs) established for these species (PWCC 2024).

Shorebased Whiting Cooperative (SWC): The SWC relied on timely information sharing, hot spot closures and salmon excluders to minimize Chinook salmon encounters in 2023. Near real-time catch data were shared among all SWC members. Trip data allowed vessels to identify when and where Chinook salmon migrations overlapped whiting grounds. Additionally, near real-time catch data were distributed to the other at-sea sectors. On two occasions in 2023 the SWC manager used the hot spot closure authority to temporarily close areas of high seasonal Chinook bycatch. One catcher vessel encountered a Chinook lightning strike and withing 8 hours of offloading, a hot spot closure was implemented. The second closure was implemented in response to chronic elevated chinook bycatch that accumulated over the course of a week. Both closures were located off northern Washington and remained in place

for the duration of the season in order to redistribute fishing effort away from high bycatch areas. The SWC also used salmon excluders to reduce incidental Chinook catch. The excluders are designed with mesh panels that allow Chinook, which are stronger swimmers than whiting, to escape before moving back into the codend (McQuaw 2024b; Szumylo 2024).

Regulatory Measures

Salmon Bycatch

Regulatory measures in 2023 were largely unchanged from 2020, with the use of set-asides (soft caps) for prevalent bycatch species (50 CFR 660 2020a). 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). These include:

- Automatic closure authority for NMFS to (1) close the whiting fishery when it exceeds (or is projected to exceed) 14,500 Chinook or close the non-whiting fishery when it exceeds (or is projected to exceed) 9,000 Chinook; and (2) after (1) happens, the sector that remains open is closed if that sector exceeds (or is projected to exceed) it's threshold (that is, 11,000 Chinook for whiting or 5,500 Chinook for non-whiting). The goal is to ensure that the 20,000 Chinook threshold is not exceeded by the groundfish fishery.
- Bycatch reduction area (BRA) at the 200-fm depth contour available for use in season for any midwater trawl sector – whiting IFQ fishery, CP sector, MS sector, and non-whiting midwater trawl sector. If a 200-fm BRA is implemented, vessels would be prohibited from using midwater trawl gear to target either whiting or non-whiting groundfish in waters shoreward of the 200-fm depth contour, but would still be allowed to fish in waters seaward of 200-fm. This action only applies to non-tribal midwater trawl vessels.
- Block Area Closures (BACs) are available for in-season use – if NMFS determines a sector of the whiting fishery is catching too much salmon relative to the various fishery thresholds then NMFS may implement a sector-specific spatial closure that is more discrete than closing at 200 fm coastwide.
- Fishery cooperative annual Salmon Mitigation Plans (SMP) are required to be submitted to NMFS and detail measures used to manage salmon bycatch. The SMP provides a nexus to a NMFS management action (i.e. approval of the SMP) that is necessary for a sector to use the Chinook salmon reserve amount (the 3,500 Chinook available above the 11,000 Chinook threshold for the whiting fishery) (50 CFR 660.140 2022; 660.150 2022; 660.160 2022; Waldeck 2023).

The final rule that establishes additional management tools to minimize incidental Chinook and coho salmon bycatch to keep fishery sectors within guidelines, establishes rules to allow industry to access the Chinook salmon bycatch reserve, and creates Chinook salmon bycatch closure thresholds for the trawl fishery has been in effect since March 25, 2021 (NOAA Fisheries 2023a).

Each component of the whiting sector (MS Coop, C/P Coop, and the Pacific whiting shorebased IFQ fishery) continues to operate under rules that allow access to the Chinook salmon bycatch reserve only if NMFS has implemented a management measure to minimize Chinook salmon bycatch for that component. This requirement may be satisfied through the implementation of a BRA, BAC, or Salmon Mitigation Plan (SMP). Those vessels with an approved SMP will have access to the reserve without further action by NMFS. Vessels not party to an SMP may access the reserve only if NMFS has implemented a routine management measure (e.g., BRA or BAC) to minimize Chinook salmon bycatch for those vessels (50 CFR 660 2021b).

NMFS will automatically close the MS Coop Program, C/P Coop Program, and the Pacific whiting shore-based IFQ fishery if NMFS has not implemented a routine management measure to minimize Chinook salmon bycatch (i.e. BRAs or BACs) for that specific component of the whiting sector prior to the whiting sector exceeding its Chinook salmon bycatch guideline of 11,000 fish. Those vessels with an approved SMP will be exempt from the 11,000 Chinook salmon bycatch guideline closure threshold condition that requires NMFS to close a specific component of the whiting sector if NMFS has not implemented a routine management measure to minimize Chinook salmon bycatch. Therefore, these vessels will have access to the reserve without further action by NMFS. If the whiting sector has caught 11,000 Chinook salmon, NMFS will close the entire whiting sector, including those with an approved SMP, if the non-whiting sector has caught its 5,500 Chinook salmon bycatch guideline and 3,500 Chinook salmon from the bycatch reserve (50 CFR 660 2021a; 2021b).

Groundfish Bycatch

Closures of BRAs may be implemented in-season through automatic action when NMFS projects that a Pacific whiting sector will exceed an allocation for a non-whiting groundfish species specified for that sector before the sector's whiting allocation is projected to be reached (50 CFR 660 2024a).

Shortbelly Rockfish Bycatch

Shortbelly rockfish is a small highly abundant species that is typically located off central California but has recently expanded its range to waters of the Pacific Northwest. As a result, high-bycatch ("lightning-strike") tows of shortbelly rockfish have occurred with increasing frequency. In 2019 the PFMC considered a range of management measures to address the problem and in 2020 increased the ACL from 500 t to 3,000 t. In 2020 as part of FMP Amendment 29 the Council classified shortbelly rockfish as an Ecosystem Component (EC) species (50 CFR 660 2020a; 2020b; PFMC 2023a). The FMP defines an EC species as not "in the fishery:" not targeted, not generally retained for sale or personal use, and not actively managed. EC species are those that are not subject to overfishing, approaching an overfished condition, or overfished, nor are they likely to become subject to overfishing or overfished in the absence of conservation and management measures (PFMC 2023a). Amendment 30, approved in 2022, set a catch threshold to trigger Council review (NOAA Fisheries 2023b). Recordkeeping and reporting requirements have been maintained to continue to monitor shortbelly rockfish bycatch (50 CFR 660.113 2024).

Catch Shares Program Review

The Magnuson-Stevens Act requires that all limited access privilege programs such as the Catch Share Program be periodically reviewed to determine whether they are meeting their goals and objectives as well as the goals of the MSFCMA (NOAA Fisheries 2007; 50 CFR 660 2024a). The PFMC conducted the first five-year review in 2016 and approved the final review report in 2017 (PFMC and NMFS 2017). In 2022 the Council initiated planning for the second review of the program that included an examination of the level and distribution of program costs as well as a range of inter-sector allocations, including trawl/nontrawl, Pacific whiting among trawl sectors, and trawl bycatch allowances of Pacific halibut (PFMC 2023c).

In April 2023 the Council received the annual NMFS trawl cost recovery report providing an assessment of previous years' costs and a calculation of current year cost recovery fees (PFMC 2023b). NMFS provided a second report detailing the method used to determine costs and evaluate agency cost savings and efficiencies from the trawl individual fishing quota program (PFMC 2023c; 2023d). By September 2023 the Council also adopted a process and framework schedule for the proposed Catch Share and Inter-sector Allocation Review, with exact dates and processes subject to potential modification as the Council develops its future meeting plans (PFMC 2023f). As is standard practice with the PFMC the program review design included field hearings to foster public participation and input.

FMP Amendments

The Pacific Coast Groundfish Fishery Management Plan (FMP), first implemented in 1982, continues to provide the framework for federal groundfish fishery management on the West Coast (PFMC 2023a).

Amendment 31 to the FMP included a recommendation that U.S. West Coast quillback rockfish be defined as three separate stocks corresponding to waters off Washington, Oregon, and California. The 2021 stock assessment of quillback rockfish in California waters estimated that the population was below the overfished threshold level. A draft rebuilding analysis was developed to examine a range of alternative rebuilding strategies and inform harvest specification decision-making. Amendment 31 also defined 20 stocks for the following species: black, canary, copper, quillback, squarespot, vermilion, and vermilion/sunset rockfishes; Dover, petrale, and rex soles; lingcod, Pacific spiny dogfish, sablefish, and shortspine thornyhead. These species were prioritized because they had stock assessments in 2021 or 2023. Because the amendment is definitional it did not affect harvest regulations or FMP goals and objectives and did not require implementing regulations (PFMC 2023a).

Amendment 32 to the FMP removed the Cowcod Conservation Areas (CCAs) for commercial non-trawl and recreational fishing, authorized the use of Block Area Closures (BACs) for non-trawl gear, and added new fishery closures, including groundfish exclusion areas (GEAs) and new non-trawl bottom contact groundfish and non-tribal directed halibut essential fish habitat conservation area (EFHCAs) (PFMC 2023a).

Electronic Monitoring

The West Coast Groundfish Electronic Monitoring (EM) Program was developed by the PFMC and NMFS West Coast Region to provide vessel owners participating in the Catch Share Program a monitoring alternative to human observers that would enable cost savings and increase operating flexibility. Prior to 2024 the program was authorized by NMFS through an Exempted Fishing Permit (EFP) (NOAA Fisheries 2024e).

After several years of experimental use by catcher vessels fishing under EFPs, extensive consultation with stakeholders and analysis of program costs, regulations allowing EM to be used on catcher vessels in place of human observers were implemented on January 1, 2024 under rules outlined in 50 CFR 660 (2024b) and summarized on the NOAA Fisheries EM webpage (NOAA Fisheries 2024e).

In order to use EM to fulfil at-sea monitoring requirements a vessel owner must be authorized by NMFS under the new program, regardless of their EM EFP history. To receive authorization for the use of EM, vessel owners are required to prepare a vessel monitoring plan (VMP) as part of their application submitted for NOAA Fisheries review. VMPs detail how the vessel will configure and use EM systems, and how crew will handle catch (NOAA Fisheries 2024e).

The EM program establishes requirements for vessel owners and operators, standards for EM systems, and protocols for handling catch while using EM systems in the Catch Share Program. It also establishes requirements for NMFS-authorized EM Service Providers, which are 3rd party companies tasked with providing EM services to the fleet (NOAA Fisheries 2024e).

In 2023, 27 shore-based IFQ whiting vessels (814 trips) and 16 mothership catcher vessels (20 trips) participated in the EM Program (NOAA Fisheries 2024c).

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 2024 Stock Assessment of Pacific Hake in U.S. and Canadian Waters prepared by the International Joint Technical Committee for Pacific hake (Grandin *et al.* 2024). The assessment uses a Bayesian estimation approach, sensitivity analyses, and retrospective investigations 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 inferences 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 estimation. 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.

The assessment depends on fishery landings (1966–2023), an acoustic survey biomass index of age-2+ fish (Figure 1) and age compositions (1995–2023), a relative index of age-1 fish (Figure 2; 1995–2023), fishery age compositions (1975–2023), and mean weight-at-age data (1975–2023). The survey biomass index showed the lowest value in 2011, increased in 2012, 2013, and 2015, and then declined to near average in 2017. It further declined from 2019 to 2023. The assessment uses a Bayesian estimation approach, sensitivity analyses, and retrospective investigations. The Bayesian approach combines prior knowledge with likelihoods for the acoustic survey biomass index, acoustic survey age-composition data, the relative age-1 index, and fishery age-composition data. Sensitivity analyses identify alternative model assumptions consistent with the data. The 2024 assessment retained the same population dynamics structure as the 2023 base assessment model, incorporating new data from the 2023 acoustic survey, fishery catch, age-composition, and weight-at-age data.

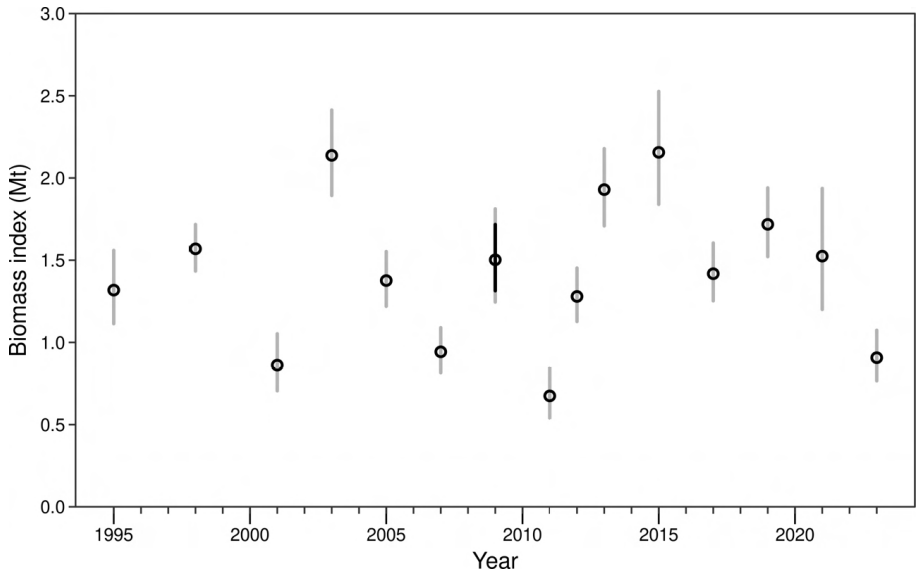

Figure 1. Acoustic survey biomass index of age-2+ fish (Mt). Approximate 95% confidence intervals are based on sampling variability (intervals without the additional squid/Pacific Hake apportionment uncertainty included in 2009, black line). Source: Grandin et al., 2024.

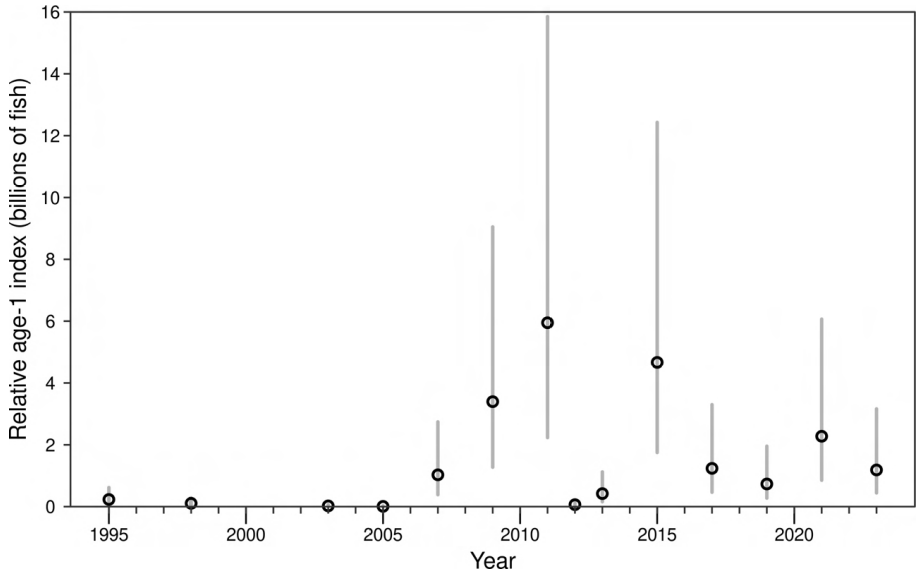

Figure 2. Relative index of age-1 fish (numbers of fish) and approximate 95% confidence intervals based on sampling variability. The index is relative because the survey does not attempt to sample all available age-1 fish and the analysis does not include kriging as is done to estimate age-2+ biomass. Source: Grandin et al., 2024.

The base model indicates Pacific Hake female spawning biomass has ranged from well below to above unfished equilibrium since the 1960s (Figure 3 and Figure 4). The stock increased rapidly in the mid-1970s and mid-1980s, declined to a low in 1999, then briefly increased to a peak in 2003. The 1999 year class supported the fishery for several years. Median female spawning biomass peaked again in 2014 due to a large 2010 year class. The biomass mostly declined from 2018 to 2022 but increased in 2023 and 2024 due to above-average 2020 and potentially large 2021 cohorts. The 2024 relative spawning biomass is estimated at 99% with a 95% posterior credibility interval from 45% to 230% (Table 4). The 2024 female spawning biomass is estimated at 1.885 Mt, with a 95% posterior credibility interval from 0.853 to 4.828 Mt.

Table 4. Recent trends in estimated beginning of the year female spawning biomass (SB; kt) and SB relative to estimated SB at unfished equilibrium (Rel. SB; %). Source: Grandin et al., 2024.

Year	SB 2.5th percentile	SB Median	SB 97.5th percentile	Rel. SB 2.5th percentile	Rel. SB Median	Rel. SB 97.5th percentile
2015	1,105.1	1,447.8	2,310.3	50.0%	76.9%	119.8%
2016	940.3	1,223.3	1,954.2	42.2%	65.0%	101.5%
2017	1,248.0	1,646.4	2,720.8	56.4%	87.5%	139.1%
2018	1,259.3	1,711.2	2,948.4	57.8%	90.9%	148.5%
2019	1,004.3	1,402.1	2,500.9	46.5%	74.5%	125.4%
2020	911.0	1,349.6	2,566.1	43.3%	71.5%	125.4%
2021	699.4	1,118.3	2,268.8	34.3%	58.9%	110.0%
2022	627.0	1,116.3	2,453.2	31.7%	58.6%	118.5%
2023	652.5	1,335.5	3,224.8	34.2%	69.9%	154.7%
2024	853.2	1,884.9	4,828.4	45.0%	98.7%	229.8%

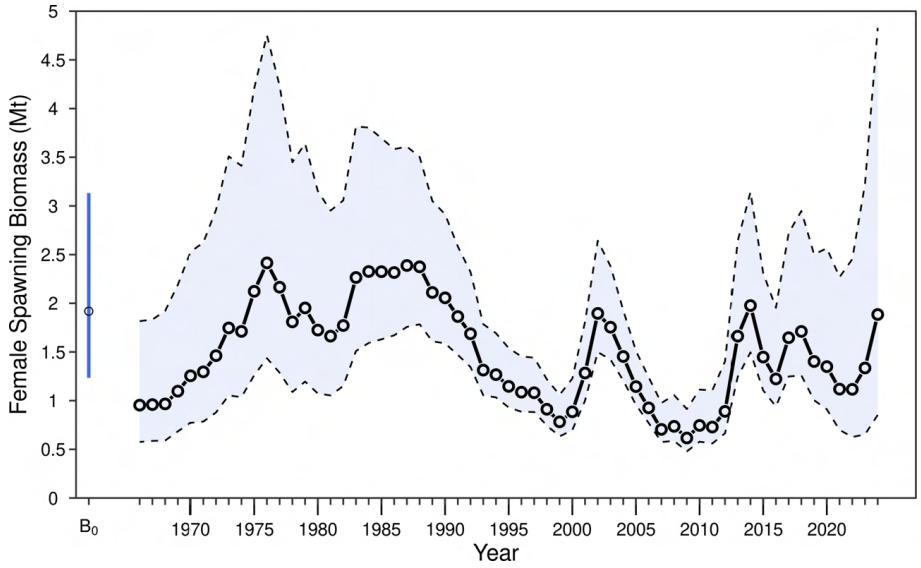

Figure 3. Median (solid line) of the posterior distribution for beginning of the year female spawning biomass (Bt in year t; Mt) through 2024 with 95% posterior credibility intervals (shaded area). The left-most circle with a 95% posterior credibility interval is the estimated unfished equilibrium biomass, B0. Source: Grandin et al., 2024.

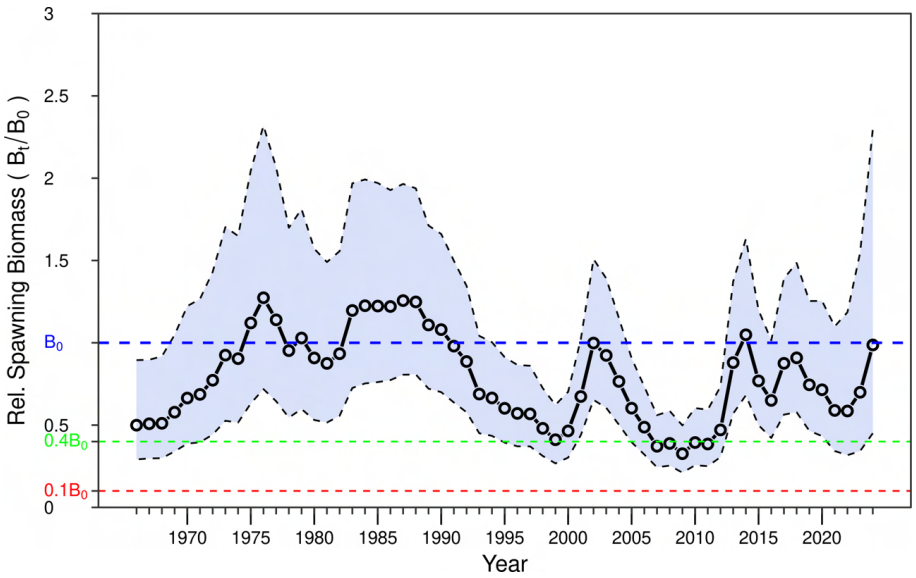

Figure 4. Median (solid line) of the posterior distribution for relative spawning biomass (Bt/B0) through 2024 with 95% posterior credibility intervals (shaded area). Dashed horizontal lines show 10%, 40%, and 100% of the unfished equilibrium (B0). Source: Grandin et al., 2024.

The addition of 2023 data changes the estimates of absolute recruitments for the most recent years, while the improved methods for modelling temporal weight-at-age and spatio-temporal maturity have slightly changed some historical estimated recruitments. The estimate of 2020 recruitment in last year's assessment was based on only two years of data and thus was highly uncertain. It suggested the 2020 cohort could potentially be huge (95% credible interval: 2.9–47.6 billion fish), but now with information from the age-2+ biomass index and survey age-composition data the 2020 cohort looks to be less but still above average (95% interval: 2.1–12.7 billion fish). The median has consequently fallen from 11.4 to 4.7 billion fish between the two assessments. The 2021 recruitment is estimated to be potentially large, whereas it was estimated to be below average in last year's assessment (with very limited data); the median has increased by 9.7 billion fish. The general notion remains that recent Pacific Hake recruitment is highly uncertain, and estimates for recent years (based on limited data) can change substantially.

Pacific Hake have low to moderate recruitment with occasional large year classes (Figure 5). Very 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 and a very strong 2010 year class. Above average year classes occurred in 2014 and 2016, which have been sustaining the fishery in recent years, with small year classes for all other years from 2011–2019 (median recruitment well below the mean of all median recruitments). The 2020 cohort is estimated to be above average, and the 2021 cohort is estimated to be potentially large from limited fishery data and the 2023 survey. The 2022 cohort was observed by the age-1 index in 2023, suggesting it is average to below average in size.

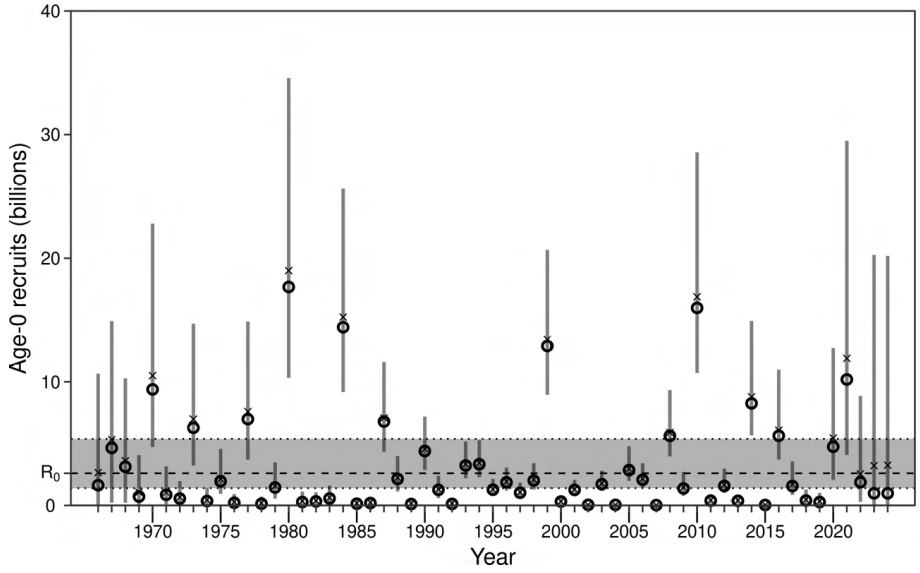

Figure 5. Medians (solid circles) and means (X) of the posterior distribution for recruitment (billions of age-0 fish) with 95% posterior credibility intervals (vertical lines). The median of the posterior distribution for mean unfished equilibrium recruitment ($R0$) is shown as the horizontal dashed line with the 95% posterior credibility interval shaded between the dotted lines.). Source: Grandin et al., 2024.

The median estimated relative fishing intensity is below the management level of 1.0 for all years (Figure 6). Over the last five years, it was highest in 2019 at 80.3%, dropped to 62.5% in 2020, and remained stable for 2021 and 2022. It dropped to 55.1% in 2023. The median exploitation fraction has decreased from a high in 2021 of 0.15 to 0.07 in 2023, similar to levels 10 years ago (Figure 7 and Figure 8).

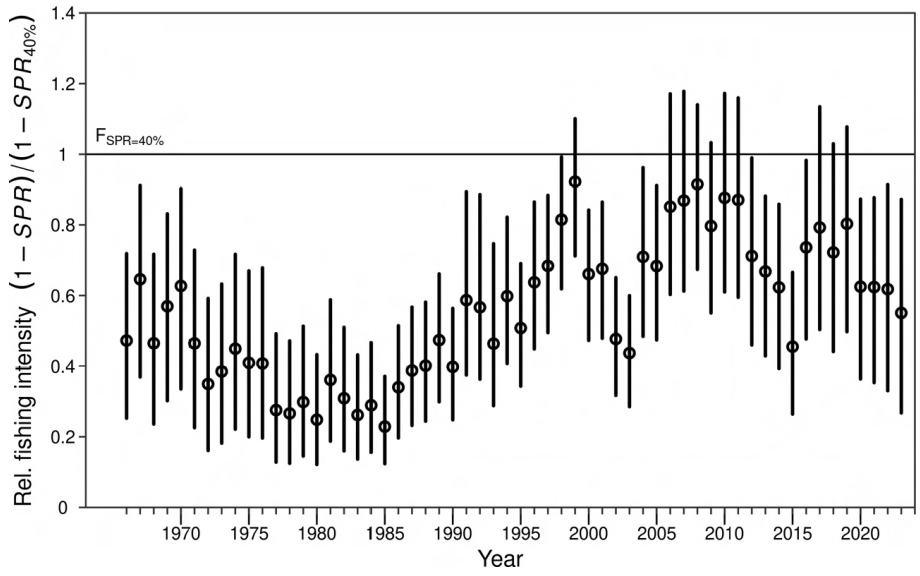

Figure 6. Trend in median relative fishing intensity (relative to the FSPR=40% management level) through 2023 with 95% posterior credibility intervals. The FSPR=40% management level defined in the Joint U.S.-Canada Agreement for Pacific Hake is shown as a horizontal line at 1.0. Source: Grandin et al., 2024.

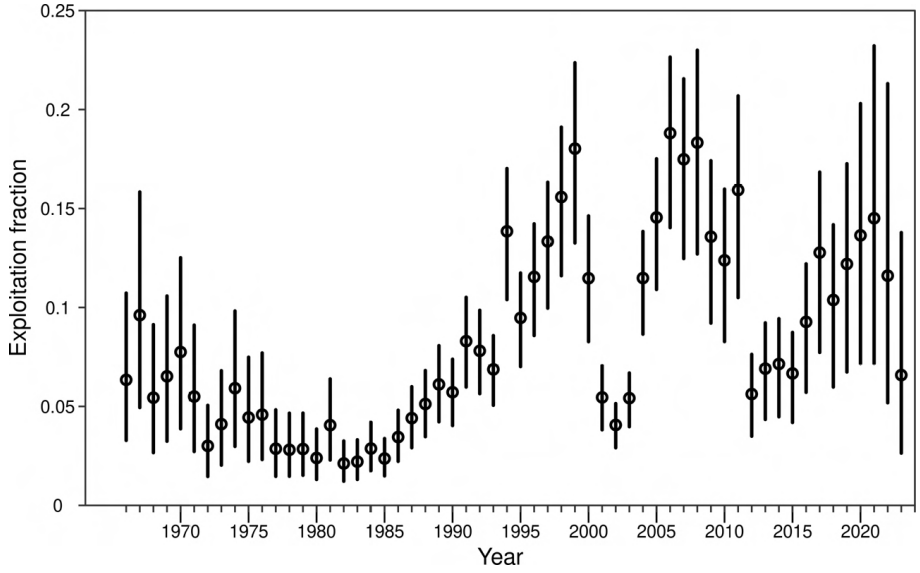

Figure 7. Trend in median exploitation fraction (catch divided by age-2+ biomass) through 2023 with 95% posterior credibility intervals. Source: Grandin et al., 2024.

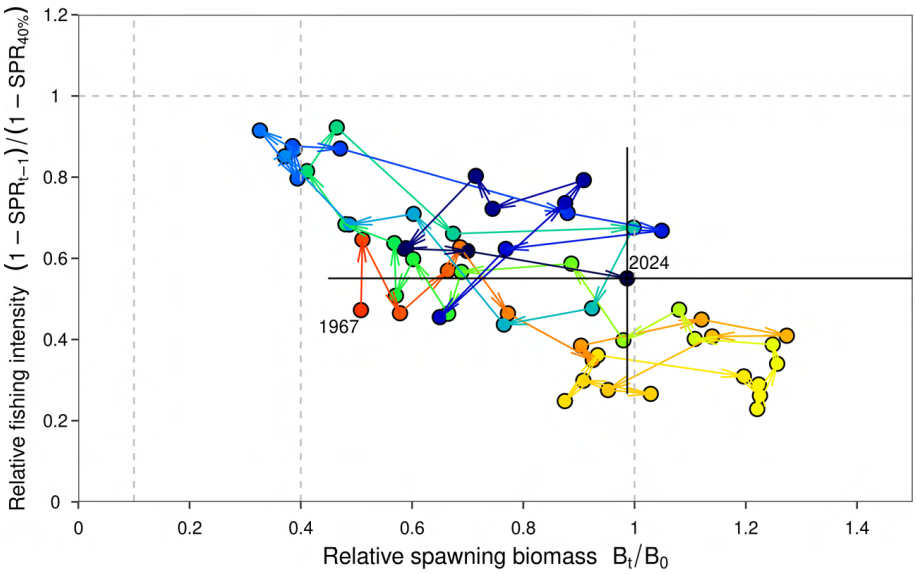

Figure 8. Estimated historical path of median relative spawning biomass in year t and corresponding median relative fishing intensity in year $t-1$. Labels show the time series start and end years; labels correspond to year t (i.e., year of the relative spawning biomass). Gray bars span the 95% credibility intervals for 2024 relative spawning biomass (horizontal) and 2023 relative fishing intensity (vertical). Source: Grandin et al., 2024.

Over the last decade (2014–2023), the mean coast-wide utilization rate has been 63.5%, with catches below coast-wide targets (Table 5). From 2019 to 2023, mean utilization rates were 67.4% for the U.S. and 48.1% for Canada. Canada's rate declined to 14.4% in 2023, while the U.S. rate fell to 52.1%. The 73.88% and 26.12% allocation of coast-wide TAC was implemented in 2022 and 2023.

Table 5. Recent trends in Pacific Hake landings and management decisions. Catch targets in 2020 and 2021 were specified unilaterally. All landings and catch targets are given in tonnes. Source: Grandin et al., 2024.

Year	U.S. landings	Canada landings	Total landings	U.S. prop. of total catch	Canada prop. of total catch	U.S. catch target	Canada catch target	Total catch target	U.S. prop. of catch target removed	Canada prop. of catch target removed	Total prop. of catch target removed
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	39,684	193,844	79.5%	20.5%	325,072	114,928	440,000	47.4%	34.5%	44.1%
2016	262,327	69,743	332,070	79.0%	21.0%	367,553	129,947	497,500	71.4%	53.7%	66.7%
2017	354,129	86,721	440,849	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	291,702	31,671	323,372	90.2%	9.8%	402,646	142,354	545,000	72.4%	22.2%	59.3%
2023	240,424	23,557	263,981	91.1%	8.9%	461,750	163,250	625,000	52.1%	14.4%	42.2%

The management of Pacific Hake specifically identifies FSPR=40% as the default harvest rate and B40% as a point where the 40:10 TAC adjustment is triggered (table). The medians of sustainable yields and biomass reference points are similar to what was reported in the 2023 assessment. The probability that female spawning biomass at the beginning of 2024 is below B40% is 1.3%, and below B25% is 0.1%. The probability that the relative fishing intensity was above the FSPR=40% level of 1.0 at the end of 2023 is 0.4%.

Table 6. Summary of median and 95% credibility intervals of equilibrium conceptual reference points for the base assessment model. Equilibrium reference points were computed using 1975–2023 averages for mean weight-at-age and baseline selectivity-at-age (1966–1990; prior to time-varying deviations). Dashes (–) indicate values that are static at one value and do not have a credible interval associated with them. Source: Grandin et al., 2024.

Quantity	2.5%	Median	97.5%
Unfished female spawning biomass (B_0, kt)	1,235	1,919	3,132
Unfished recruitment (R_0, millions)	1,394	2,600	5,383
Reference points (equilibrium) based on $F_{SPR=40\%}$			
Female spawning biomass at $F_{SPR=40\%}$ ($B_{SPR=40\%}$, kt)	409	681	1,127
SPR at $F_{SPR=40\%}$	–	40%	–
Exploitation fraction corresponding to $F_{SPR=40\%}$	16.3%	19.1%	22.0%
Yield associated with $F_{SPR=40\%}$ (kt)	180	317	594
Reference points (equilibrium) based on $B_{40\%}$ (40% of B_0)			
Female spawning biomass ($B_{40\%}$, kt)	494	767	1,253
SPR at $B_{40\%}$	40.7%	43.5%	50.8%
Exploitation fraction resulting in $B_{40\%}$	12.9%	16.8%	20.2%
Yield at $B_{40\%}$ (kt)	177	309	580
Reference points (equilibrium) based on estimated MSY			
Female spawning biomass (B_{MSY}, kt)	297	490	867
SPR at MSY	22.8%	29.6%	45.1%
Exploitation fraction corresponding to SPR at MSY	15.8%	27.0%	36.5%
MSY (kt)	188	336	639

The measures of uncertainty in the base model underestimate the total uncertainty due to alternative structural models for hake population dynamics and fishery processes. The Pacific Hake stock displays high recruitment variability, resulting in large and rapid biomass changes and high uncertainty in stock status and projections. The 2023 acoustic survey provided additional information on the 2020 and 2021 cohorts, lessening uncertainty around female spawning biomass estimates. The interactions among variance parameters governing fishery selectivity and recruitment parameters through time are not well understood and could propagate uncertainty.

The catch limit for 2024 based on the default F40%–40:10 harvest policy has a median of 747,588 t with a 95% credibility interval of 298,355–2,124,832 t. Decision table gives projected population status and fishing intensity under different catch alternatives (Table 7). For a 2024 catch similar to 2023, the probability of female spawning biomass dropping below B10% is 0.0% and below B40% is 6.7% (Figure 9). The estimated above-average 2020 and 2021 cohorts will play a significant role in determining female spawning biomass during the forecast years.

Table 7. Forecast quantiles of Pacific Hake relative spawning biomass at the beginning of the year. Catch alternatives are defined by letters a-o and are a constant value across all forecasted years unless otherwise defined in the first column. Source: Grandin et al., 2024.

Catch alternative	Catch year	Catch (t)	Biomass at start of year	Relative spawning biomass 5%	50%	95%
			Start of 2024	0.51	0.99	2.01
a:	2024	0	Start of 2025	0.57	1.11	2.23
	2025	0	Start of 2026	0.59	1.13	2.35
	2026	0	Start of 2027	0.57	1.12	2.45
b:	2024	180,000	Start of 2025	0.53	1.06	2.18
	2025	180,000	Start of 2026	0.50	1.04	2.26
	2026	180,000	Start of 2027	0.46	1.00	2.32
c:	2024	225,000	Start of 2025	0.52	1.05	2.16
	2025	225,000	Start of 2026	0.48	1.02	2.23
	2026	225,000	Start of 2027	0.43	0.97	2.29
d:	2024	320,000	Start of 2025	0.50	1.02	2.14
10% reduction	2025	288,000	Start of 2026	0.45	0.98	2.20
each year	2026	259,200	Start of 2027	0.39	0.93	2.24
e:	2024	264,000	Start of 2025	0.51	1.04	2.15
2023 catch	2025	264,000	Start of 2026	0.47	1.00	2.21
	2026	264,000	Start of 2027	0.41	0.94	2.26
f:	2024	350,000	Start of 2025	0.49	1.01	2.13
	2025	350,000	Start of 2026	0.42	0.96	2.17
	2026	350,000	Start of 2027	0.35	0.88	2.20
g:	2024	350,000	Start of 2025	0.49	1.01	2.13
10% reduction	2025	315,000	Start of 2026	0.43	0.97	2.18
each year	2026	283,500	Start of 2027	0.37	0.91	2.23
h:	2024	380,000	Start of 2025	0.49	1.01	2.12
	2025	380,000	Start of 2026	0.41	0.94	2.16
	2026	380,000	Start of 2027	0.33	0.86	2.17
i:	2024	380,000	Start of 2025	0.49	1.01	2.12
10% reduction	2025	342,000	Start of 2026	0.42	0.95	2.17
each year	2026	307,800	Start of 2027	0.36	0.89	2.21
j:	2024	430,000	Start of 2025	0.47	0.99	2.11
	2025	430,000	Start of 2026	0.39	0.92	2.14
	2026	430,000	Start of 2027	0.30	0.83	2.13
k:	2024	545,000	Start of 2025	0.45	0.96	2.08
2022 TAC	2025	545,000	Start of 2026	0.33	0.86	2.08
	2026	545,000	Start of 2027	0.22	0.75	2.05
l:	2024	625,000	Start of 2025	0.43	0.94	2.06
2023 TAC	2025	625,000	Start of 2026	0.30	0.83	2.03
	2026	625,000	Start of 2027	0.18	0.70	1.99
m:	2024	875,262	Start of 2025	0.37	0.88	1.99
Fishing intensity	2025	861,614	Start of 2026	0.22	0.71	1.91
at 100%	2026	782,426	Start of 2027	0.13	0.57	1.86
n:	2024	747,588	Start of 2025	0.40	0.91	2.02
Default HR	2025	772,111	Start of 2026	0.24	0.76	1.97
($F_{SPR=40\%}$–40:10)	2026	717,464	Start of 2027	0.14	0.62	1.91
o:	2024	767,382	Start of 2025	0.39	0.90	2.02
Equal catch	2025	767,382	Start of 2026	0.24	0.76	1.96
($C_{2024} \approxeq C_{2025}$)	2026	712,782	Start of 2027	0.14	0.62	1.91

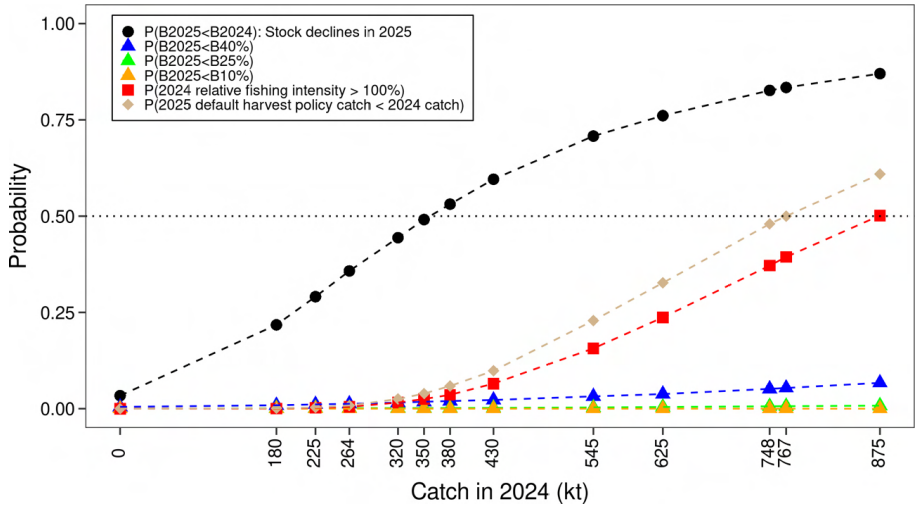

Figure 9. Graphical representation of the probabilities related to spawning biomass, relative fishing intensity, and the 2025 default harvest policy catch for alternative 2024 catch options (explained in Table 7). The symbols indicate points that were computed directly from model output and lines interpolate between the points. Source: Grandin et al., 2024.

4.4.1. Update on fishery catches

Coast-wide fishery landings of Pacific Hake averaged 243,288 t from 1966 to 2023, with a low of 89,930 t in 1980 and a peak of 440,849 t in 2017 (Figure 10). Before 1966, total removals were negligible. From 1966–1990, most removals were from foreign or joint-venture fisheries. Annual catch in U.S. waters averaged 186,041 t (76.5% of total catch) and 57,247 t in Canadian waters. From 2014–2023, the average coast-wide catch was 338,606 t, with U.S. and Canadian catches averaging 275,957 t and 62,648 t, respectively. Since 2017, coast-wide catch declined annually to 263,981 t in 2023 from a total allowable catch (TAC) of 625,000 t. U.S. attainment was 52.1% of its quota and Canada's was 14.4%.

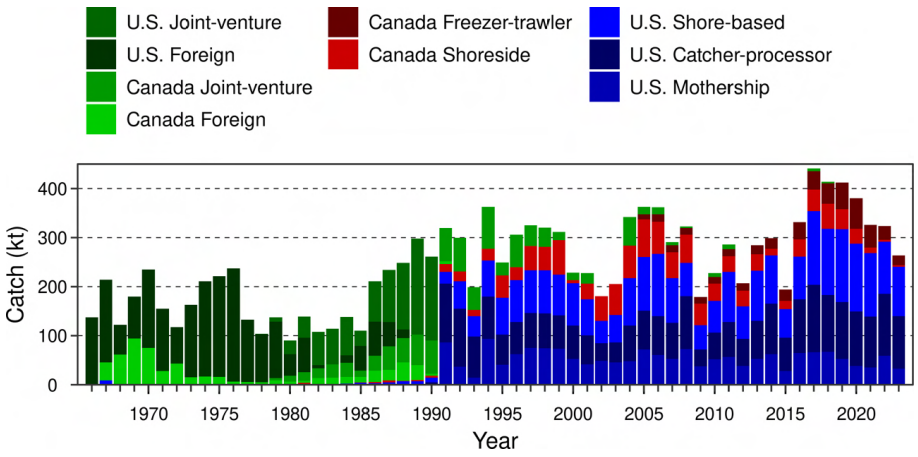

Figure 10. Total Pacific Hake catch used in the assessment by sector, 1966–2023. U.S. tribal catches are included in the sectors where they are represented. Source: Grandin et al., 2024.

Catch and landings are used interchangeably in this document. Discard within the target fishery is included, but discarding in non-target fisheries is not. Discard from all fisheries is estimated to be less than 1% of landings in recent years. From 2001–2008, landings were mainly from the large 1999 year class, with a cumulative removal of 2.13 Mt through 2023. The cumulative catches of the 2010, 2014, and 2016 year classes through 2023 were 2.56 Mt, 1.76 Mt, and 1.13 Mt, respectively. In 2023, the largest catch cohort was from 2021 (35%), followed by 2020 (25%) and 2016 (13%).

Table 8: Allowable Catch (TAC) and catch data

TAC / Catch Data	Year	Amount
TAC	2023	461,750 t
UoA share of TAC	2023	298,500 t
Total catch by UoC (most recent year)	2023	263,981 t
Total catch by UoC (second most recent year)	2022	290,114 t

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, 2024). 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 9. Catch composition in the US Pacific hake offshore midwater trawl fishery from 2019-2023, 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		Year					
Common name	Scientific name	2019	2020	2021	2022	2023	% of total
Pacific Hake	*Merluccius productus*	312,879	287,627	265,379	290,572	240,650	97.59%
Yellowtail Rockfish	*Sebastes flavidus*	1,605	1,746	1,024	1,211	1,303	0.48%
Jack Mackerel	*Trachurus symmetricus*	1,102	562	2,541	1,582	976	0.47%
Widow Rockfish	*Sebastes entomelas*	1,106	754	621	1,125	694	0.30%
American Shad	*Alosa sapidissima*	435	714	297	430	305	0.15%
Spiny Dogfish Shark	*Squalus acanthias*	987	291	191	231	322	0.14%
Shortbelly Rockfish	*Sebastes jordani*	598	388	299	335	138	0.12%
Sablefish	*Anoplopoma fimbria*	258	105	247	596	276	0.10%
Pacific Mackerel	*Scomber japonicus*	178	164	266	506	284	0.10%
Squid Unid	*Unidentified squid species*	122	158	195	358	219	0.07%
Walleye Pollock	*Gadus chalcogrammus*	82	11	0	86	766	0.07%
Pacific Ocean Perch	*Sebastes alutus*	161	110	113	123	185	0.05%
Pacific Herring	*Clupea pallasii*	210	64	33	145	151	0.04%
Splitnose Rockfish	*Sebastes diploproa*	133	26	148	157	126	0.04%
Darkblotched Rockfish	*Sebastes crameri*	149	109	91	109	125	0.04%
Canary Rockfish	*Sebastes pinniger*	93	87	117	112	147	0.04%
Shortspine Thornyhead	*Sebastolobus alascanus*	59	24	79	255	117	0.04%
Rougheye/Blackspotted Rockfish	*Sebastes aleutianus/melanostictus*	135	71	59	84	65	0.03%
Brown Cat Shark	*Apristurus brunneus*	80	32	32	70	48	0.02%

King of the Salmon	*Trachipterus altivelis*	106	60	34	16	24	0.02%
Arrowtooth Flounder	*Atheresthes stomias*	50	11	25	82	72	0.02%
Rex Sole	*Glyptocephalus zachirus*	34	6	11	50	26	0.01%
Bocaccio Rockfish	*Sebastes paucispinis*	39	10	11	13	35	0.01%

Protected species

NOAA's Office of Protected Resources (OPR) is the program responsible for protecting endangered/threatened marine life. The OPR works in cooperation with NOAA regional offices and science centers. Responsibilities of the program include listing species under the ESA and designating critical habitat, developing and implementing recovery plans for listed species; consulting on any Federal actions that may affect a listed species to minimize the effects of the action; investigating violations of the ESA and authorizing research on protected species.

There are several ETP species that overlap with the UoA. Additionally, in the recent report, *Groundfish Endangered Species Workgroup* (GESW) *Report* (PFMC, 2023b), further detail was discussed on the endangered species on the West Coast area and possible overlap with hake fishing. Species of concern were noted to be eulachon smelt, green sturgeon, humpback whales, leatherback sea turtles, and short-tailed albatross. The other marine mammals included in the table come from the MMPA List of Fisheries (LOF), 2023. Because marine mammals are all protected under the MMPA, marine mammals are treated as ETP species for this MSC assessment.

The most recent report on seabird mortalities in west coast fisheries (Jannot et. al, 2021),records seabird mortalities by fishing sector between 2012 and 2018 (Table 17). Seabirds are generally caught in low numbers relative to their population sizes, with only shearwaters, norther fulmar and unidentified gulls being caught in double-digit quantities annually. None of the birds in Table 17 are endangered or threatened.

Table 10. Estimated seabird mortality in U.S. West Coast at-sea catcher processor and catcher vessels fishing with midwater gear from 2012-2018. Units are numbers of individual birds, representing a full census due to 100% observer or EM coverage. Source: Tables 13 and 14 in Jannot et. al. 2021.

Table 13. Estimated seabird mortality (number of birds) in U.S. West Coast at-sea hake catcher–processor vessels fishing with midwater trawl gear, 2012–18. Estimates include both randomly and opportunistically sampled birds (see text for full explanation). Estimates for the entire time series can be found in the Supplemental Tables. Confidence limits are not given because at-sea fisheries are 100% observed and therefore represent a complete census of seabird mortality.

Species	2012	2013	2014	2015	2016	2017	2018
Black-footed albatross	3.00	4.00	3.00	3.00	4.00	3.00	4.00
Leach's storm-petrel	0.00	2.00	0.00	2.00	2.00	2.00	0.00
Sooty shearwater	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Shearwater, unidentified	18.00	21.00	18.00	18.00	20.00	18.00	18.00
Northern fulmar	7.00	57.00	7.00	17.00	14.01	6.00	7.00
Tubenose, unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Common murre	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Cassin's auklet	0.00	2.00	0.00	0.00	0.00	2.00	0.00
Alcid, unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arctic herring gull	0.00	4.00	0.00	0.00	0.00	0.00	0.00
Gull, unidentified	10.00	11.00	10.00	14.00	14.00	12.00	10.00
Seabird, unidentified	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Warbler, unidentified	0.00	0.00	0.00	0.00	0.00	0.00	4.00
Bird, unidentified	0.00	1.00	1.00	0.00	0.00	0.00	0.00

Table 14. Estimated seabird mortality (number of birds) in U.S. West Coast at-sea hake catcher vessels fishing with midwater trawl gear and delivering to motherships, 2012–18. Estimates include both randomly and opportunistically sampled birds (see text for full explanation). Estimates for the entire time series can be found in Table 10. Confidence limits are not given because at-sea fisheries are 100% observed and therefore represent a complete census of seabird mortality.

Species	2012	2013	2014	2015	2016	2017	2018
Northern fulmar	2.00	0.00	0.00	0.00	0.00	0.00	0.00
Common murre	0.00	0.00	0.00	2.00	0.00	0.00	0.00
Cassin's auklet	0.00	0.00	2.00	0.00	1.00	0.00	0.00
Bird, unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 11. Estimated marine mammal mortality in U.S. West Coast at-sea catcher processor and catcher vessels fishing with midwater gear from 2015-2019. Units are numbers of individual birds, representing a full census due to 100% observer or EM coverage. Source: Tables 7 and 8 in Jannot et. al. 2022.

Table 7. Estimated marine mammal mortality among the U.S. West Coast at-sea hake catcher–processor (CP) vessels fishing with midwater trawl (MT) gears, 2015–19. Because vessels in this fishery are monitored 100%, we assume that error around the values presented here is zero (0), so confidence intervals and coefficients of variation are not estimated.

Sector	Gear	Species	2015	2016	2017	2018	2019
At-sea hake CP	MT	California sea lion	0.00	49.00	21.00	5.00	6.00
At-sea hake CP	MT	Harbor seal	0.00	0.00	0.00	0.00	0.00
At-sea hake CP	MT	Northern elephant seal	1.00	1.00	0.00	0.00	1.00
At-sea hake CP	MT	Pacific white-sided dolphin	0.00	0.00	1.00	0.00	0.00
At-sea hake CP	MT	Steller sea lion	0.00	21.00	1.00	4.00	0.00

Table 8. Estimated marine mammal mortality among the U.S. West Coast at-sea hake catcher vessels (CV) delivering to motherships and fishing with midwater trawl (MT) gears, 2015–19. Because vessels in this fishery are monitored 100%, we assume that error around the values presented here is zero (0), so confidence intervals and coefficients of variation are not estimated.

Sector	Gear	Species	2015	2016	2017	2018	2019
At-sea hake CV	MT	California sea lion	0.00	3.00	9.00	2.00	0.00
At-sea hake CV	MT	Dall's porpoise	0.00	0.00	0.00	0.00	0.00
At-sea hake CV	MT	Harbor seal	0.00	0.00	0.00	0.00	0.00
At-sea hake CV	MT	Northern elephant seal	1.00	0.00	2.00	0.00	0.00
At-sea hake CV	MT	Northern fur seal	0.00	1.00	0.00	0.00	0.00

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 for the hake fishery.

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.

Small numbers of **California Sea Lions** (*Zalophus californianus)* are caught in the hake fishery each year. The California sea lion range extends north through the Gulf of Alaska and south around the end of the Baja California Peninsula to the Gulf of California. Five geographic populations have been identified based on mitochondrial DNA: 1) Pacific temperate, from California to northern Baja California; 2) Pacific subtropical, along the west coast of Baja California; 3) southern Gulf of California; 4) central Gulf of California; and 5) northern Gulf of California (Schramm *et*

al., 2009). Population size in 2014 was estimated at 257,606, which corresponded with a pup count of 47,691 animals along the U.S. west coast (Lowry et al. 2017, Laake et al. 2018). The PBR for this stock is 14,011 sea lions per year. Although the UoA did have observed interactions, the take was only in small amounts. Therefore likely there is a negligible impact on the population. (https://media.fisheries.noaa.gov/dam-migration/ca_sea_lion_final_2018_sar.pdf, Jannot et al 2022).

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 (including hake) 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. For 2023, each C/PC member agreed to employ bycatch avoidance techniques recommended by the PWCC Board of Directors and Sea State, Inc. None of the vessels in the C/PC exceeded their allowed whiting catch. The overall Chinook salmon cap of 11,000 fish established for the whiting sector was not exceeded. C/P bycatch was 3,354; total Chinook bycatch by all whiting sectors was 5,998 fish (PWCC 2024).

The Ecosystem Work Group continued its initiative to identify possible ways to integrate changes in environmental conditions into the biennial stock assessment and management process (PFMC 2024a; 2024b).

There are no other updates to report relative to habitat or ecosystem interactions, management or information since the previous surveillance audit.

4.4.3. Violations and enforcement information

Enforcement data continue to be summarized in the annual "TRat" (Trawl Rationalization) report presented annually to the PFMC by the NMFS Office of Law Enforcement (OLE) (NOAA Fisheries 2024c). OLE has continued the practice it began in 2022 of reporting sector-specific data on compliance assistance and enforcement investigations, allowing whiting fishery information to be identified.

The whiting fleet represented in the TRat Enforcement data includes catcher vessels delivering to both mothership and shore-based IFQ first receiver sites, mothership vessels, and catcher processor vessels. For this fleet, 49 enforcement incidents were identified in 2023, 35 of which were attributed to west coast catcher vessels.

The categories of violations among the whiting sector catcher, mothership and catcher processor vessels with multiple occurrences in 2023 were:

Catcher vessels
Economic Data Collection Issue: 5
Vessel Monitoring System (VMS) Issue: 2
Observer – Impede/Retain Prohibited Species: 2
Vessel Monitoring Plan: 2

Mothership
Observer – Impede/Retain Prohibited Species: 2

Catcher Processor
Observer – Impede/Retain Prohibited Species: 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 2023 compliance rates for the three whiting fleets are: catcher vessel 81%; mothership 80%; and catcher processor 100% (NOAA Fisheries 2024c).

The 2023 OLE enforcement data for the entire whiting sector are the following:

Contacts
Complaints/Referrals: 23
Investigations/Dockside Boardings: 22

Incidents
Enforcement Incidents: 49
2022 Carry-Over Enforcement Incidents:1

Actions
No Violation / Dismissed: 21
Compliance Assistance:15
Written Warning: 2
GCES Settlement Agreement:1
Summary Settlement: 0
Ongoing Investigation: 9

Violations
Economic Data Collection Issue: 5
Vessel Monitoring System (VMS) issue: 2
Fishing in Deficit: 0
Observer – Failure to Provide Reasonable Assistance:1
Observer – Impede/Retain Prohibited Species: 6
Catch Monitor Not Present During Offload: 1
Closed Area: 0
Vessel Monitoring Plan: 2
Permit Not Onboard: 1

Disposition
Closed Whiting Enforcement Incidents: 43
No Violation/ Dismissed: 21
Compliance Assistance: 15

(NOAA Fisheries 2024c)

The US Coast Guard (USCG) reported 2023 data for all commercial and recreational West Coast fisheries. It reported having made 1,564 total boardings of which approximately 20% were on commercial fishing vessels. For all vessels, the USCG found 23 fisheries violations, 82 commercial safety violations and 17 commercial fishing voyages terminated. In total, the USCG applied 8,693 hours of combined boat, aircraft and cutter enforcement time (USCG 2024).

Federal law enforcement views the west coast trawl rationalization whiting fishery as a well-monitored and sufficiently compliant commercial fishery. Overlapping at-sea and shoreside surveillance practices (100+% observer coverage or electronic monitoring, and VMS), as well as monitoring processes and systems currently in place to detect catch overages, discards, and other potential violations, enable comprehensive and effective enforcement oversight of the whiting trawl fishery (Busch 2024).

Enforcement of the groundfish trawl fishery is also conducted cooperatively among other federal and state partners: the U.S. Coast Guard (USCG) Districts 11 and 13, Washington Department of Fish and Wildlife Police (WDFW),

Oregon State Patrol Fish and Wildlife Division (OSP), and California Department of Fish and Wildlife Enforcement Division (CDFW). As authorized under the Magnuson-Stevens Act (MSA), OLE's Cooperative Enforcement Program (CEP) uses Cooperative Enforcement Agreements (CEAs) as a force multiplier by facilitating the deputation and annual funding of state marine conservation law enforcement officers to perform limited and specific law enforcement provisions of the MSA, which includes coverage of the limited entry trawl fisheries. The CEAs are an important component of OLE's MSA enforcement strategy and are typically effective for a five-year period (Busch 2024).

4.4.4. Other information that may affect the outcome of certification

No other information identified for this category.

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 2024b). Similarly, the Pacific Fishery Management Council remains unchanged with regard to its structure and legal responsibilities for domestic management of Pacific hake (PFMC 2023a). There is no evidence of noncompliance with federal law or international agreements (Busch 2024). 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 continued with the establishment of a joint US -Canada Coastwide TAC (NOAA Fisheries 2024 a;b). No changes were made to management funding in 2023. The review of the Catch Share Program continued in 2023. In April 2023 the Council received the annual NMFS trawl cost recovery report providing an assessment of previous years' costs and a calculation of current year cost recovery fees (PFMC 2023b). NMFS provided a second report detailing the method used to determine costs and evaluate agency cost savings and efficiencies from the trawl individual fishing quota program (PFMC 2023c; 2023d). By September 2023 the Council also adopted a process and framework schedule for the proposed Catch Share and Inter-sector Allocation Review, with exact dates and processes subject to potential modification as the Council develops its future meeting plans (PFMC 2023f). As is standard practice with the PFMC the program review design included field hearings to foster public participation and input. Analytical products and management measures continue to be reviewed at both the PFMC and Treaty levels (cf. NOAA Fisheries 2024a; PFMC 2023 c;d;f). No changes have been made to the transparency of management, either through the availability of information or access to decision processes (PFMC 2023e).
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 2023 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 2023h; 2023i) As part of routine management adjustments, the PFMC adopted Amendments 31 and 32 to the Pacific Coast Groundfish FMP (PFMC 2023a). Amendment 31 included a recommendation that U.S. West Coast quillback rockfish be defined as three separate stocks corresponding to waters off Washington, Oregon, and California. The 2021 stock assessment of quillback rockfish in California waters estimated that the population was below the overfished threshold level. A draft rebuilding analysis was developed to examine a range of alternative rebuilding strategies and inform harvest specification decision-making. Amendment 31 also defined 20 stocks for the following species: black, canary, copper, quillback, squarespot, vermilion, and vermilion/sunset rockfishes; Dover, petrale, and rex soles; lingcod, Pacific spiny dogfish, sablefish, and shortspine thornyhead. These species were prioritized because they had stock assessments in 2021 or 2023. Because the amendment is definitional it did not affect harvest regulations or FMP goals and objectives and did not require implementing regulations (PFMC 2023a). Amendment 32 to the FMP removed the Cowcod Conservation Areas (CCAs) for commercial non-trawl and recreational fishing, authorized the use of Block Area Closures (BACs) for non-trawl gear, and added new fishery closures, including groundfish exclusion areas (GEAs) and new non-trawl bottom contact groundfish and non-tribal directed halibut essential fish habitat conservation area (EFHCAs) (PFMC 2023a). Ecosystems The Ecosystem Work Group continued its initiative to identify possible ways to integrate changes in environmental conditions into the biennial stock assessment and management process (PFMC 2024a; 2024b). Offshore wind In 2022-2023 NMFS conducted a study of the socioeconomic characteristics of West Coast fisheries in relation to offshore wind development. The study had two objectives: 1. To enable BOEM to better understand socioeconomic characteristics of West Coast fisheries in relation to offshore wind (OSW) development; 2. To provide additional information to enable BOEM to conduct a more thorough analysis of potential impacts from OSW activities (including siting characterization, leasing, construction and operations, and decommissioning) on fishing sectors and communities (BOEM 2023). The PFMC Marine Planning Committee continued to advise the PFMC on wind energy development and its implications for fishery management (PFMC 2023g).
Statement whether the fishery	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

continues to conform to the RFM Fishery Standard Fundamental Clause 2	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	The review of the Catch Share Program continued in 2023. In April 2023 the Council received the annual NMFS trawl cost recovery report providing an assessment of previous years' costs and a calculation of current year cost recovery fees (PFMC 2023b). NMFS provided a second report detailing the method used to determine costs and evaluate agency cost savings and efficiencies from the trawl individual fishing quota program (PFMC 2023c; 2023d). By September 2023 the Council also adopted a process and framework schedule for the proposed Catch Share and Inter-sector Allocation Review, with exact dates and processes subject to potential modification as the Council develops its future meeting plans (PFMC 2023f). As is standard practice with the PFMC the program review design included field hearings to foster public participation and input. 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 2023a).

	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 (McQuaw 2024a; 2024b; PWCC 2024). Amendment 31 to the FMP included a recommendation that U.S. West Coast quillback rockfish be defined as three separate stocks corresponding to waters off Washington, Oregon, and California. The 2021 stock assessment of quillback rockfish in California waters estimated that the population was below the overfished threshold level. A draft rebuilding analysis was developed to examine a range of alternative rebuilding strategies and inform harvest specification decision-making. Amendment 31 also defined 20 stocks for the following species: black, canary, copper, quillback, squarespot, vermilion, and vermilion/sunset rockfishes; Dover, petrale, and rex soles; lingcod, Pacific spiny dogfish, sablefish, and shortspine thornyhead. These species were prioritized because they had stock assessments in 2021 or 2023. Because the amendment is definitional it did not affect harvest regulations or FMP goals and objectives and did not require implementing regulations (PFMC 2023a). Amendment 32 to the FMP removed the Cowcod Conservation Areas (CCAs) for commercial non-trawl and recreational fishing, authorized the use of Block Area Closures (BACs) for non-trawl gear, and added new fishery closures, including groundfish exclusion areas (GEAs) and new non-trawl bottom contact groundfish and non-tribal directed halibut essential fish habitat conservation area (EFHCAs) (PFMC 2023a).
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 1966–2023 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 1991–2023 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% (Grandin et al. 2024).
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 (Berger et al. 2023). The Scientific Review Group (SRG) reviewed the stock assessment and provided advice to the JMC (Hamel et al. 2023). The JMC unanimously agreed to recommend to the Parties a joint Canada/U.S. coastwide Pacific Hake Treaty TAC for 2023. The AP met to review the advice of the JTC and SRG. It reviewed the 2022 management of the U.S. and Canada fisheries and made recommendations to the JMC regarding the overall TAC for 2023 (NOAA Fisheries 2024b). The Treaty's management strategy evaluation (MSE) process continued in 2023, looking at the performance of alternative management actions in

	meeting prespecified objectives. In February 2023 the MSE Working Group (MSEWG) briefed the JMC and SRG on 2022 progress. The briefings included updates on stakeholder engagement, personnel, projections for recruitment, growth and weight-at-age, research on dynamic reference points, MSE technical documentation and the 2023 work plan (Marshall et al. 2023 a;b). 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 31 included a recommendation that U.S. West Coast quillback rockfish be defined as three separate stocks corresponding to waters off Washington, Oregon, and California. The 2021 stock assessment of quillback rockfish in California waters estimated that the population was below the overfished threshold level. A draft rebuilding analysis was developed to examine a range of alternative rebuilding strategies and inform harvest specification decision-making. Amendment 31 also defined 20 stocks for the following species: black, canary, copper, quillback, squarespot, vermilion, and vermilion/sunset rockfishes; Dover, petrale, and rex soles; lingcod, Pacific spiny dogfish, sablefish, and shortspine thornyhead. These species were prioritized because they had stock assessments in 2021 or 2023. Because the amendment is definitional it did not affect harvest regulations or FMP goals and objectives and did not require implementing regulations (PFMC 2023a). FMP Amendment 32 removed the Cowcod Conservation Areas (CCAs) for commercial non-trawl and recreational fishing, authorized the use of Block Area Closures (BACs) for non-trawl gear, and added new fishery closures, including groundfish exclusion areas (GEAs) and new non-trawl bottom contact groundfish and non-tribal directed halibut essential fish habitat conservation area (EFHCAs) (PFMC 2023a). The West Coast Groundfish Electronic Monitoring (EM) Program was developed by the PFMC and NMFS West Coast Region to provide vessel owners participating in the Catch Share Program a monitoring alternative to human observers that would enable cost savings and increased operating flexibility. Prior to 2024 the program was authorized by NMFS through an Exempted Fishing Permit (EFP) (NOAA Fisheries 2024e). After several years of experimental use by catcher vessels fishing under EFPs, extensive consultation with stakeholders and analysis of program costs, regulations allowing EM to be used on catcher vessels in place of human observers were implemented on January 1, 2024 under rules outlined in 50 CFR 660 (2024b) and summarized on the NOAA Fisheries EM webpage (NOAA Fisheries 2024e). In order to use EM to fulfil at-sea monitoring requirements a vessel owner must be authorized by NMFS under the new program, regardless of their EM EFP history. To receive authorization for the use of EM, vessel owners are required to prepare a vessel monitoring plan (VMP) as part of their application submitted for NOAA Fisheries review. VMPs detail how the vessel will configure and use EM systems, and how crew will handle catch (NOAA Fisheries 2024e). The EM program establishes requirements for vessel owners and operators, standards for EM systems, and protocols for handling catch while using EM systems in the Catch Share Program. It also establishes requirements for NMFS-authorized EM Service Providers, which are 3rd party companies tasked with providing EM services to the fleet (NOAA Fisheries 2024e). In 2023, 27 shore-based IFQ whiting vessels (814 trips) and 16 mothership catcher vessels (20 trips) participated in the EM Program (NOAA Fisheries 2024c).

	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 2024a). 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 2024a) 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 2024a; PWCC 2024). 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 2023 Pacific hake stock assessment (Berger et al. 2023).
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 (Nowak 2024). 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 scheduled to be conducted every two years (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 continues 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 2024b). Oregon and Washington Sea Grant Programs also continue commercial fishery safety training (Oregon Sea Grant 2024; Washington Sea Grant 2024). NOAA Fisheries continues to produce and update plain language summaries of ongoing groundfish fishery management rules and changes for West Coast groundfish and post them on a dedicated compliance guides website (NOAA Fisheries 2023f). Examples of recent updated compliance guides available on this website include: • Compliance guide: 2024 Pacific Whiting Harvest Specifications and 2024 Tribal Allocation (pdf) • 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 2024d) In 2022 the Interagency Working Group on IUU Fishing released a report to Congress responding to the directive in House Report 7776-1707 to summarize NOAA's efforts to prevent and deter the importation of seafood harvested through illegal, unreported, and unregulated (IUU) fishing, and with particular respect to seafood harvested, produced, processed, or manufactured by forced labor. The report provides an overview of seafood imports subject to NOAA's Seafood Import Monitoring Program (SIMP) in FY 2023 and associated audit findings and enforcement action associated with SIMP imports. The report also reviews NOAA's advancement in automated screening and analysis of SIMP imports, as well as the ongoing comprehensive program review (US Interagency Working Group on IUU Fishing 2024).
Statement whether the fishery continues to conform to the RFM Fishery Standard	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.

Fundamental Clause 9	Data on Pacific fishers continue to be compiled through the Pacific Fisheries Information Network (PacFIN). Information on commercial fishing permits and licenses is summarized on a dedicated webpage for West Coast groundfish commercial fisheries. Permits and licenses are the mechanism by which NOAA Fisheries maintains records of hake fishery participants (NOAA Fisheries 2024f). 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 2024c). 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). OLE reports sector-specific data on compliance assistance and enforcement investigations, allowing data on whiting fisheries data to be isolated (NOAA Fisheries 2024c). The whiting fleet represented in the TRat Enforcement data includes catcher vessels delivering to both mothership and shore-based IFQ first receiver sites, mothership vessels, and catcher processor vessels. For this fleet, 49 enforcement incidents were identified in 2023, 35 of which were attributed to west coast catcher vessels (NOAA Fisheries 2024c).

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 2023 compliance rates for the three whiting fleets are: catcher vessel 81%; mothership 80%; and catcher processor 100% (NOAA Fisheries 2024c).

The US Coast Guard (USCG) reported 2023 data for all commercial and recreational West Coast fisheries. It reported having made 1,564 total boardings of which approximately 20% were on commercial fishing vessels. For all vessels, the USCG found 23 fisheries violations, 82 commercial safety violations and 17 commercial fishing voyages terminated. In total, the USCG applied 8,693 hours of combined boat, aircraft and cutter enforcement time (USCG 2024a).

Enforcement of the groundfish trawl fishery is also conducted cooperatively among other federal and state partners: the U.S. Coast Guard (USCG) Districts 11 and 13, Washington Department of Fish and Wildlife Police (WDFW), Oregon State Patrol Fish and Wildlife Division (OSP), and California Department of Fish and Wildlife Enforcement Division (CDFW). As authorized under the Magnuson-Stevens Act (MSA), OLE's Cooperative Enforcement Program (CEP) uses Cooperative Enforcement Agreements (CEAs) as a force multiplier by facilitating the deputation and annual funding of state marine conservation law enforcement officers to perform limited and specific law enforcement provisions of the MSA, which includes coverage of the limited entry trawl fisheries. The CEAs are an important component of OLE's MSA enforcement strategy and are typically effective for a five-year period (Busch 2024).

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 2021b).

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 2021b).

Whiting Mothership Cooperative (WMC): As has been done in previous years, the WMC board delegated authority to Sea State, Inc. to impose "In-season Hot Spot Closures" if they perceive a problem. The Coop agreement provides for dividing the whiting allocation into five pools with various start dates. Each pool receives a share of the bycatch allocations pro-rata to whiting. If a pool reaches its share of the bycatch prior to harvesting its whiting allocation, members of the pool must cease fishing. In the event that a pool closes because of bycatch, if a member of that pool has a cumulative bycatch amount exceeding their pro-rata share by 25%, that vessel is restricted from harvesting additional whiting in a subsequent seasonal pool (McQuaw 2024a). The WMC suspended fishing November 1, 2023. There were no violations of the WMC Bycatch Agreement (McQuaw 2024a).

Catcher/Processor Cooperative (C/PC): As it has previously, in 2023 the C/PC contracted with Sea State, Inc. to process the observer program catch data and to provide in-season management support. Sea State and the C/P Cooperative manager provide catch reports to each C/P vessel, the C/P fleet, and the C/P Cooperative. These reports may include cumulative fleet-wide and vessel-level catch data as well as tow-by-tow summaries. Fleet managers can reconcile the tow-by-tow catch information provided by Sea State against their own catch records to identify possible data errors and ensure accurate catch accounting throughout the fishing season. Sea State reports also help vessels to identify and avoid fishing areas where incidental catch of species of concern is occurring. Generally, this information can also be shared with the other whiting sectors to ensure fishery-wide transparency (PWCC 2024).

For 2023, each C/PC member agreed to employ bycatch avoidance techniques recommended by the PWCC Board of Directors and Sea State, Inc. None of the vessels in the C/PC exceeded their allowed whiting catch. Several provisions were implemented in the spring and fall seasons to limit additional incidental catch of rockfish set-aside species and Chinook salmon. These included: 1. additional information about test tows and bycatch avoidance measures in C/P daily reports; 2. test tows when entering new areas; 3. closures in high bycatch areas and night fishing restrictions; 4. additional movement rules when encountering high rates or numbers of Chinook salmon or constraining rockfish species; 5. additional communication within and between whiting sectors (PWCC 2024).

	Shorebased Whiting Cooperative (SWC): The SWC relied on timely information sharing, hot spot closures and salmon excluders to minimize Chinook salmon encounters in 2023. Near real time catch data were shared among all SWC members. Trip data allowed vessels to identify when and where Chinook salmon migrations overlapped whiting grounds. Additionally, near real-time catch data were distributed to the at-sea sectors. On two occasions in 2023 the SWC manager used the hot spot closure authority to temporarily close areas of high seasonal Chinook bycatch. The SWC also used salmon excluders to reduce incidental Chinook catch. The excluders are designed with mesh panels that allow Chinook, which are stronger swimmers than whiting, to escape before moving back into the codend (McQuaw 2024b). Regulatory Measures Regulatory measures were largely unchanged in 2023 with the use of set-asides (soft caps) for prevalent bycatch species (50 CFR 660 2020a). 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). These measures, some of which also apply to groundfish bycatch, included: automatic closure authority for NMFS to close the whiting fishery when it exceeds bycatch limits; establishing bycatch reduction areas (BRAs) to close areas to midwater trawling; implementing block area closures (BACs), sector-specific spatial closures to minimize bycatch; and salmon mitigation plans (SMPs) detailing measures to minimize salmon bycatch (50 CFR 660 2021a; 2021b; 50 CFR 660 2024a). .
Statement whether the fishery continues to conform to the RFM Fishery Standard Fundamental Clause 10	Federal law enforcement views the west coast trawl rationalization whiting fishery as a well-monitored and sufficiently compliant commercial fishery. Overlapping at-sea and shoreside surveillance practices (100+% observer coverage or electronic monitoring, and VMS), as well as monitoring processes and systems currently in place to detect catch overages, discards, and other potential violations, enable comprehensive and effective enforcement oversight of the whiting trawl fishery (Busch 2024). 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 2023. According to the Assistant Director of the West Coast Division NOAA OLE, the west coast trawl rationalization whiting fishery as a well-monitored and sufficiently compliant commercial fishery. Overlapping at-sea and shoreside surveillance practices (100+% observer coverage or electronic monitoring, and VMS), as well as monitoring processes

	and systems currently in place to detect catch overages, discards, and other potential violations, enable comprehensive and effective enforcement oversight of the whiting trawl fishery (Busch 2024). 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 (NOAA Fisheries 2024g). For Pacific hake, violation categories include groundfish regulations, TRat Program, Marine Mammal Protection Act and Endangered Species Act (NOAA Fisheries 2024c)
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 October 14th and 15th, 2024.

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 site visit was conducted remotely via the MS Teams meeting platform, with meetings held on October 14 and 15, 2024.

The following participants were in attendance:

Name	Affiliation
Amanda Stern-Pirlot	MRAG Americas assessment team member
Giuseppe Scarcella	MRAG Americas assessment team member
Susan Hanna	MRAG Americas assessment team member
Aja Szumylo	Pacific Whiting Conservation Cooperative (PWCC, client group, US)

Benjamin Bale	Ocean Gold (Client group, US)
Emma Scalisi	Arctic Storm (Client group, US)
Irais Carago	Arctic Storm (Client group, US)
Mike Meyers	Trident Seafoods (Client group, US)
Natasha Flores	
Sarah Nayani	Pacific Whiting Treaty Advisory Committee
Shannon Mann	Canadian Groundfish Research and Conservation Society (Client group, Canada)
Trent Hartill	Glacier Fish Company (Client group member, US)
Yelena Nowak	Director of Oregon Trawl Commission (Client group, US)

The site visit was held remotely via videoconference according to the agenda shown below. Unless otherwise stated, "Assessment Team" comprises Amanda Stern-Pirlot, Giuseppe Scarcella and Susan Hanna.

US and Canada Pacific Hake RFM 2nd surveillance and MSC 4th surveillance audit and reassessment

Fishery Assessment Plan

Client:	Pacific Whiting Conservation Cooperative (PWCC), Oregon Trawl Commission (OTC) and Canadian Groundfish Research and Conservation Society (CGRCS)
Assessment type:	MSC fisheries RRA and RFM fisheries SA
Applicable Standards:	MSC Fisheries Certification Process: **Version 2.3** MSC Fisheries Standard: **Version 2.01** MSC General Certification Requirements: **Version 2.6** MSC Reporting Template: **Version 1.3** CSC-RFM Fishery Standard: **Version 2.1** RFM Scoring Guidance: **Version 2.1** CSC-RFM Procedures 1-8: **Version 5.0 for all RFM procedures**
Assessment Dates:	**14-15 October 2024**
Assessment Location:	Remote
Assessment Language:	English
Objective of the Assessment:	To gather remaining information to inform the reduced MSC reassessment of the US and Canada Pacific hake fishery as well as the 2nd surveillance audit for the RFM certification of the US Pacific whiting fishery (also hake).
Team leader contact email:	Amanda.stern-pirlot@mragamericas.com
Assessment Team:	Susan Hanna and Giuseppe Scarcella.

Scope

Target stock	Pacific Hake (*Merluccius productus*)
Fishing gear type(s)	Midwater trawl
Client group	PWCC, OTC, CGRCS
Other eligible fishers	See certificate
Management system	US Pacific Council and DFO Canada

Agenda

Date	Time	Activity	Location
14 Oct 2024	9:00 Pacific time	US fishery	Remote
15 Oct 2024	9:00 Pacific time	Canadian fishery and joint stock assessment/management	Remote

Agenda for each day

1. Introductions
    - Introductions of the team, their roles, and responsibilities
    - Introductions of meeting attendees
    - Screen shot/sign in sheet for attendance
2. Overview of the MSC Assessment and Surveillance Processes and RFM Surveillance process
    - Where to find more materials: Guide to the MSC process,
    - Extra training
3. Review Overall Progress on Conditions: N/A This fishery has no conditions
4. Review the following updates to the fishery:
    - Changes to the fishery and its management (Monday for US, Tuesday for CA)
    - Any developments or changes to traceability (Monday for US, Tuesday for CA)
    - Any changes in personnel relevant to science, management, or industry (Monday for US, Tuesday for CA)
    - Any potential changes to scientific information, including stock assessments
        - Review new stock assessment (**Tuesday with US and CA together**)
        - Review new catch composition information, and any management changes with respect to non-target groundfish or other species. (Monday for US, Tuesday for CA)
        - Review latest ETP interaction information, including eulachon bycatch in relation to caps and 2023 data on seabird and mammal bycatch. With CANADA, review weight-based catch comp data for mammals and birds and get info needed to convert to numbers of animals.
        - Review EFH updates (Monday for US), and habitat protections changes relevant to hake in Canada (Tuesday for Canada)
    - Any other significant changes to the fishery
5. Meetings with others for this assessment: TBD—for now it looks as though additional meetings will not be needed.
6. Review of the timeline for this audit.
7. Next steps
8. Questions/wrap up

Notes

1. Please ensure all key people and records to verify compliance with scheme requirements are readily available to the assessment team.
2. Interviews with key personnel will be conducted during each phase as need arises.
3. The agenda is preliminary and may be adapted or modified in the opening meeting as needed.

7.1.2. Stakeholder participation

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, but we did receive one written submission from Scott Wallace at the David Suzuki Foundation regarding the Canada Pacific hake fishery.

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
Bruce Turris	Canadian Groundfish Resource and Conservation Society
Yelena Nowak	Oregon Trawl Commission

7.2. Assessment Team – biographies/summaries of CVs (optional)

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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