MSC 4th Annual Surveillance Report
On-site Surveillance

for

US and Canada Pacific Hake/Whiting Mid-water Trawl Fishery

January 2019

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Certificate No.:

US EEZ Waters	MRAG-F-011
Canadian EEZ waters	MRAG-F-012

MSC reference standards:
MSC Standards Version 1.1
MSC Certification Requirements Version 1.3
MSC Guidance for Certification Requirements Version 1.3
MSC Process Certification Requirements Version 2.0

Contents

Glossary of Abbreviations

AMR	Archipelago Marine Research Ltd. (Canada)
AP	Advisory Panel (Pacific Hake Treaty)
ASOP	At-Sea Observer Program (US)
BiOp	Biological Opinion (US)
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CP	Catcher/Processor
DFO	Department of Fisheries and Oceans (Canada)
DMP	Dockside Monitoring Program (Canada)
DVS	Departmental Violations System (Canada)
EFP	Exempted Fishing Permit (US)
EM	Electronic Monitoring
ESA	Endangered Species Act (US)
GDA	Groundfish Development Authority (Canada)
GDQ	Groundfish Development Quota (Canada)
IVQ	Individual Vessel Quota (Canada)
JMC	Joint Management Committee (Pacific Hake Treaty)
JTC	Joint Technical Committee (Pacific Hake Treaty)
JV	Joint Venture
MS	Mothership
MSE	Management Strategy Evaluation
NMFS	National Marine Fisheries Service (US)
NOAA	National Oceanographic and Atmospheric Administration (US)
NPDES	National Pollution Discharge Elimination System (US)
NWFSC	Northwest Fisheries Science Center (US)
OLE	Office of Law Enforcement (US)
PCGF	Pacific Coast Groundfish Fishery (Canada)
PFMC	Pacific Fisheries Management Council (US)
RCA	Rockfish Conservation Area
RPM	Reasonable and Prudent Measures (Canada)
SARA	Species At Risk Act (Canada)
SPERA	Strategic Program for Ecosystem-Based Research and Advice (Canada)
SRG	Scientific Research Group (Pacific Hake Treaty)
SS	Shore Side
TAC	Total Allowable Catch

1. General Information

Fishery name	US and Canada Pacific Hake/Whiting Mid-water Trawl Fishery		
Unit(s) of Assessment (UoA)	Mid-water Trawl fishing in US Pacific EEZ waters off Washington, Oregon and California, and Canadian Pacific EEZ waters		
Date certified	25 November 2014	Date of expiry	24 November 2019
Surveillance level and type	Surveillance level 2, remote surveillance [see FCR v2.0 7.23.1-7.23.4]. No change in proposed surveillance level		
Date of surveillance audit	6,7 and 10 December, 2018		
Surveillance stage	1st Surveillance		
	2nd Surveillance		
	3rd Surveillance		
	4th Surveillance	X	
	Other (expedited etc.)		
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1. Background

Table 1. TAC and Catch Data for US Canada Pacific Hake Fishery

TAC	**Year**	**2017**	**Amount**	**597,500 t[1]**
US UoC share of TAC	**Year**	**73.88%**	**Amount**	**441,433 t[1]**
Canada UoC share of TAC	**Year**	**26.12%**	**Amount**	**156,067 t[1]**
Total green weight catch by US UoC	**Year**	**80.33%**	**Amount**	**354,231 t[2]**
Total green weight catch by Canada UoC	**Year**	**19.67 %**	**Amount**	**86,713 t[2]**
Total green weight catch by UoC	**Year (most recent)**	**2017**	**Amount**	**440,944 t[2]**
	Year (second most recent)	**2016**	**Amount**	**332,330 t[2]**

[1]JMC (2017)
[2] Edwards *et al*. (2018: Table e)

This report contains the findings of the 4th surveillance cycle in relation to the US-Canada Midwater Trawl Pacific Hake/Whiting Fishery and contains an update on the fishery since the 2017 surveillance. In summary, the two remaining conditions on bycatch species in the Canadian fishery have been closed, and MRAG Americas concludes that the fishery continues to meet the MSC Fishery Standard.

Coast-wide catch in 2017 was 440,944 t, out of a TAC (adjusted for carryovers) of 597,500 t (Table 1). Attainment in the U.S. was 80.2% of its share of TAC; in Canada it was 55.6%. A variety of factors influenced the attainment of the TAC (Edwards *et al*., 2018: Appendix D).

The industry in both the US and Canada noted that a primary driver in the fishery this past season has been bycatch avoidance—both of Chinook salmon and rockfish species, many of which have been rebuilt to higher abundances and potentially occur more frequently in the catch.

2.1. Changes to Management systems

US-Canada Pacific Hake Treaty

The Hake Treaty process has been fully engaged since 2012. The US side of the Joint Management Committee (JMC) (the decision making body) is Phil Anderson (PFMC), Steve Joner (Tribal), Frank Lockhart (NMFS), and Dan Waldeck (Industry). The US Advisory Panel (AP) is Joe Bersch, Mike Okoniewski, Brent Paine, Dave Smith, Tom Libby, Bob Dooley, Al Carter, and Mike Hyde. On the Canadian side, members of the JMC include Paul Ryall (Fisheries and Oceans Canada), Bruce Turris (Canadian Groundfish Research and Conservation Society), Theresa Williams (industry), and Barron Carswell (Province of British Columbia). The Canadian AP members include Kelly Andersen, Mike Buston, Dave Dawson, Brian Dickens, Wayne Elvan, Peter Knott, Shannon Mann, Joe Green, Brian Mose, and Albert Radil.

The set of management principles are the same as adopted by the JTC in 2014:

- Manage the Pacific Whiting resource utilizing the best available science in a precautionary and sustainable manner.

- Maintain a healthy stock status across a range of recruitment events and consider total allowable catch levels that spread the harvest of strong cohorts over multiple years.
- Manage the fishery resource in a manner that aims to provide the best long-term benefits to the Parties.
- Manage the fishery to ensure that each country has the opportunity to receive the intended benefits contemplated in the treaty.
- These management principles are dynamic and shall be reviewed annually by the JMC and the AP to ensure they remain valid.

The on-going Management Strategy Evaluation of the hake management process is, and will be, used to evaluate adherence to the management principles.

The results of the 2017 cycle of the Treaty Agreement process are accessible in the JMC Report, in the Scientific Review Group (SRG) Report and in the Joint Technical Committee (JTC) Stock Assessment, all of which can be found on the Pacific Whiting Treaty website at http://www.westcoast.fisheries.noaa.gov/fisheries/management/whiting/pacific_whiting_treaty.html.
The SRG meeting convened February 14-16, 2017, in Vancouver BC Canada. There were 11 points of conclusion in the report (URL:
https://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/whiting/2017-srg-meeting-report.pdf

the most notable:

The median estimate of stock biomass at the beginning of 2017 is well above the $B_{40\%}$ and $B_{10\%}$ biomass reference points, and the estimated fishing intensity in 2016 was well below the $F_{40\%}$ target. The SRG concludes that the coastal Pacific Hake stock is not overfished and that overfishing is not occurring for this stock. More information on the stock assessment and MSE is available in Section 2.4.1.

As per the JTC Stock Assessment, the catch limit based upon the median default harvest rate calculated for 2017 was 969,840t; however, after a review of the advice from the JTC, the SRG and the AP, the JMC recommended a coastwide TAC for 2017 of 597,500 t. There was a 65,999 t carry over from 2016 which resulted in an adjusted TAC for the US of 441,433 t and 156,067 t for Canada.

2.1.1 United States Fishery Management

The 2017 fishery harvest guideline (HG), or non-tribal allocation, for Pacific Hake was 362,682 t. This amount was determined by deducting from the total U.S. Total Allowable Catch (TAC) of 441,433 t, the 77251, t tribal allocation, and the 1,500 t research and bycatch set-aside. The Harvest Guideline was allocated per 50 CFR 660.55 (f)(2) among the Catcher/processor (CP) Coop (123,312 t (34%)), Mothership (MS) Coop (87,044 t (24%)), and Shoreside (SS) IFQ (152,327 t (42%)) sectors of the Pacific Hake fishery (NOAA Fisheries 2017a).

The US Treaty Tribal allocation was 77,251 t (17.5 % of the US TAC). In September 2017, after determination that an estimated 41,000 t of the tribal allocation would not be used by the end of the fishing year, NMFS reapportioned that amount to the non-tribal fishery, leaving a tribal allocation of 36, 252 t. The 41,000 t was allocated among the three non-tribal sectors (NOAA Fisheries 2017b).

After reapportionment, the revised 2017 Pacific whiting allocations were: Tribal (36,251 t); Catcher/Processor (137,252 t; Mothership (98,884 t); Shorebased (169,547 t). (NOAA Fisheries 2017b).

No new management measures were implemented in 2017. The PFMC has no formal role in the TAC setting process, but reviews the results of the JMC process annually in April and may advise NMFS on JMC recommendations. However, the PFMC controls the fishery management process, which includes:

- sector-specific bycatch limits
- rollover provision of unused bycatch between the MS and CP sectors
- 100% monitoring (i.e., observers or electronic monitoring) on MS CVs
- prohibition of discarding for MS CVs,
- 100% monitoring (i.e., observers or electronic monitoring) for SS CVs
- two NMFS-observers on all catcher-processors and mothership processors
- regulations for depth-based closures if a sector is projected to attain one of its rockfish hard caps and/or if Chinook salmon bycatch is running above levels proscribed in the BiOp

In 2016, the PFMC recommended that MS and CP sector hard caps for darkblotched rockfish and Pacific ocean perch be changed to set-asides (soft caps). Hard caps shut down a sector upon attainment; soft caps do not. The recommendation was made on the basis of the economic cost of hard caps to the at-sea sectors in the absence of a conservation need. The NMFS published a proposed rule to this effect in October 2017, with a final rule published in January 2018 (NOAA Fisheries 2017c; NOAA Fisheries 2018a).

The NMFS West Coast Region maintains a website that provides detailed information about on-going management and research activities related to the whiting fishery: http://www.westcoast.fisheries.noaa.gov/fisheries/management/whiting/pacific_whiting.html.

ESA-Salmon

In 2013, NMFS re-initiated ESA consultation about the impacts of the Pacific Coast groundfish fishery (including the Pacific hake fishery) on ESA-listed salmonids. This process will include development of a new Biological Opinion (BiOp). In 2014, the Pacific hake fishery exceeded the 11,000 Chinook salmon threshold contained in the current BiOp.

In September 2015, the PFMC provided specific guidance to NMFS about the BiOp analysis. That motion language for this guidance is provided in G6_Att1_Sept2015_motion_MAR2016BB.pdf.

Following the September PFMC action, work continued on the re-initiated consultation during the remainder of 2015 and 2016. At the November 2016 PFMC meeting, NMFS stated their intent to complete the consultation by September 2017. During 2017 the PFMC received updates on the new BiOp and opportunity to comment. In April 2017 the Council provided guidance to NMFS on the proposed action to be the basis for ESA Section 7 consultation on the take of listed salmonids in the Pacific Coast groundfish fishery.

Recommendations include: a description of the groundfish fisheries including likely future distribution of fishing, range of directed catch volumes, and range of Chinook salmon bycatch rates; Chinook salmon bycatch thresholds for whiting and groundfish fisheries; Consideration of additional bycatch mitigation measures in the next (2019-2020) biennial harvest specifications (PFMC 2017). Further details are given in the P2 update section.

Forage Fish
There have been no new changes related to forage fish management since the 3rd surveillance. As reported in the 2017 surveillance report, based on PFMC action, NMFS developed and implemented regulations to prevent new fisheries on a suite of forage fish. In line with the PFMC recommendation, the proposed prohibition published by NMFS in January 2016 states that it is prohibited to: retain and process more than 1 t of Shared Environmental Component (EC) Species other than squid species in any calendar year; or, retain and process more than 40 t of any Shared EC squid species in any calendar year.

Electronic Monitoring

The PFMC is developing an electronic monitoring (EM) program to substitute for or complement human observers on catcher vessels in the MS and SS IFQ fisheries (including whiting and non-whiting trawl and fixed gear).

In 2015, an exempted fishing permit (EFP) was issued that allowed catcher vessels to use EM. The results of the EFP fisheries informed development of alternatives for the use of EM in trawl and fixed gear fisheries. The PFMC selected a final preferred alternative for EM in the whiting fishery and during 2016 approved draft proposed regulations. Work on developing the proposed regulations into a final rule took place during 2017 and early 2018 (Waldeck 2018).

Other Issues

Sea Birds
As reported in the 2017 surveillance report (MRAG 2018), in 2016, NMFS observers conducted a special project to collect data during on-deck observations about the frequency and severity of seabird interactions with CP trawl gear. The NMFS report is included in briefing materials. The recent USFWS BiOp for non-salmon ESA-listed species interactions in the Pacific Coast groundfish fishery (PCGF) concluded that the PCGF is not likely to jeopardize the continued existence of short-tailed albatross. However, it does indicate an expectation that "takes" could occur in the PCGF (including the CP hake fishery). Therefore, the Incidental Take Statement mandates a series of Reasonable and Prudent Measures, including: "RPM 2. NMFS shall minimize the risk of short-tailed albatross interacting with trawl cables. Because short-tailed albatross are vulnerable to striking aerial trawl cables, particularly in the catcher-processor fleet."

The Terms and Conditions specific to RPM 2 states, "T&C1 for RPM2 -- To minimize the risk of short-tailed albatross interacting with trawl cables, NMFS shall:

“a) Continue to conduct research that investigates the extent of take associated with trawl gear and new or improved management actions that minimize take as a result of interactions with trawl gear in the PCGF. Management actions that should be examined include:

> “i) The use and effectiveness of streamer lines when using trawl gear;
> “ii) The degree to which minimizing the aerial extent of trawl cables affects the risk of bird strike; and
> “iii) Feasible offal management techniques that decrease attraction of short-tailed albatross to the vicinity of aerial lines.

“b) Based on the research and findings of NMFS’s investigations into trawl-associated mortality or injury, implement measures that minimize potential for short-tailed albatross interactions with trawl gear.”

In summary, the BiOp states that further research is needed to "develop an unbiased estimate of trawl-associated mortality" and requires NMFS to continue to conduct research, assess potential mitigation measures, and (based on the research) "implement measures that minimize potential for short-tailed albatross interactions with trawl gear."

The update on this issue for the most recent year is that a NMFS sponsored workshop with seabird scientists, fishery participants, and gear manufacturers was held November 7-8, 2017 in Seattle. The PFMC discussed this BiOp at their November 2017 meeting. Subsequent to the workshop, in 2018 NMFS and Oregon Sea Grant developed a cooperative research proposal for a 2019 project titled Detecting and Mitigating Cryptic Seabird Bycatch in West Coast At-Sea Hake Fisheries. The objectives of this project are to: (1) enhance seabird-cable strike data collection, (2) test candidate seabird bycatch mitigation techniques and (3) conduct effective industry outreach and engagement to advance best practices of bycatch prevention in the at-sea hake fleet. This collaborative project will take advantage of established relationships among the at-sea hake trawl fleet, NOAA Fisheries, and Oregon Sea Grant.

National Pollutant Discharge Elimination System (NPDES)

The at-sea sectors of the Pacific Hake fishery are working with EPA to develop a general NPDES permit to authorize at-sea discharge of fish processing wastes. This process was on-going in 2014-2017; implementation is likely to occur in late 2018.

Enforcement

No significant enforcement issues were documented for the 2017 US hake fishery (NOAA Fisheries OLE 2017; 2018). An increase in the number and volume of discards occurred in 2017, as observed from electronic monitoring (EM) and reported by NMFS (PFMC 2018e). The reported data are "general discards," which by definition include both permissible (unintentional) discards and those potentially in violation of Exempted Fishing Permit (EFP) stipulations. Vessels equipped with EM fish under a maximum retention rule, with only unintentional discards (not under the control of the operator) being authorized. In 2017 the NMFS Sustainable Fisheries Division (SFD) issued correction letters to 16 of the 22 vessels with discard events. Of these, the NOAA Fisheries OLE opened investigations into 14 vessels (discards of the other two vessels were determined to be *de minimus*). These investigations were subsequently referred to the NOAA General Counsel (PFMC 2018d;e).

Following a review of the 2017 discard events, representatives of the EFP sponsors (MIdwater Trawlers Cooperative and United Catcher Boats) met with the NMFS SFD to discuss compliance issues and avenues for improvement (PFMC 2018d; 2018e). One issue highlighted in these discussions is the benefit of updating and refining discard definitions in order to more easily track violations (PFMC 2018e). Definitional improvements would be consistent with NMFS recommendations (PFMC 2018e). They would also accord with support expressed by NOAA Fisheries OLE for the provision of greater detail (e.g. type and numbers of violations by fishery, notices of violations (NOVAs) issued and their disposition) in its annual compliance report (cf. Matthews 2012)

2.1.2 Canadian Fishery Management

The 2017/2018 Offshore Pacific TAC was 138,828 t. Carryover from the 2016/17 fishery was 17,239 t, yielding a total available harvest of 156,067 t. Total catch in 2017 was 86,713 t , or 55.6% of the Canadian TAC (Mann, 2018).

The 2017 Pacific hake fishing season began in mid-April and continued until late November. The shoreside component landed 43,427 t of fresh round product. The freezer trawler component, which freezes headed and gutted product at sea, landed 37,679 t. (Mann 2018; Waldeck 2018).

A joint venture (JV) fishery was conducted in 2017, the first in Pacific Canada since 2011. In this fishery Canadian trawl vessels deliver Pacific hake to licensed foreign vessels via codend transfers. A condition for the JV fishery is that its operations do not interfere with the access of hake to shoreside processing plants. The JV fishery ran from August 21 to September 19, catching a total of 5,825.25 t, delivered to a Dutch vessel (DFO 2018).

For the 2017/2018 fishing year the 157,067 t TAC set for Pacific hake shoreside delivery was allocated in three separate releases (DFO 2017b):

The first shoreside quota release was made February 21st, 2017 as follows:

- 80% (23,998 t) was allocated directly to groundfish trawl licensed vessels as IVQ based on the percentage of the permanent IVQ holdings of Pacific Hake Offshore - for shoreside delivery held respectively by each license holder and
- 10% (2,999.8 t) was allocated to individual groundfish trawl licensed vessels by DFO, taking into consideration advice from the Groundfish Development Authority (GDA) as Code of Conduct Quota (CCQ) and
- The remaining 10% (2,999.8 t) was allocated but released in-season to individual groundfish trawl licensed vessels by DFO, taking into consideration advice from the GDA as Groundfish Development Quota (GDQ).

The second shoreside quota release was made March 15th, 2017 of the eligible carryover fish from the 2016 season. A total of 14,704 t. of shoreside quota was assigned to eligible trawl licenses.

The third shoreside quota release was made June 8th, 2017 as follows:

- 80% (53,001 t) was allocated directly to groundfish trawl licensed vessels as IVQ based on the percentage of the permanent IVQ holdings of Pacific Hake Offshore - for shoreside delivery held respectively by each licence holder and
- 10% (6,625 t) was allocated to individual groundfish trawl licensed vessels by DFO, taking into consideration advice from the Groundfish Development Authority (GDA) as Code of Conduct Quota (CCQ) and
- The remaining 10% (6,625 t) was allocated but released in-season to individual groundfish trawl licensed vessels by DFO, taking into consideration advice from the GDA as Groundfish Development Quota (GDQ).

For the 2016/2017 fishing year, the 15,000 t TAC set for offshore Pacific hake for the Joint Venture program was allocated in two separate releases

The first JV quota release was made March 15th of the eligible carryover fish from 2016 season. A total of 1,580 t JV quota was assigned to eligible trawl licenses.

The second JV release was made June 9th, 2017, allocated as follows:

- 89% (11,944 t) was allocated directly to groundfish trawl licensed vessels as IVQ based on the percentage of the permanent IVQ holdings of Pacific Hake - Offshore Joint Venture held respectively by each licence holder and
- 11% (1,476 t) was allocated to individual groundfish trawl licensed vessels as CCQ based on the percentage of the permanent IVQ holdings of Pacific Hake - Offshore Joint Venture held respectively by each licence holder and taking into consideration advice from the GDA.

A reserve allocation of 30,112 t was allocated in-season. There was no specific provision for a reduction fishery (DFO 2017b).

For the 2017 Pacific Hake fishery comprehensive catch monitoring requirements were in effect, with no changes from the 2016 requirements.

Enforcement.

Priorities for fishery officers continue to be the following: investigate all incidents of Closed Area fishing such as RCAs, sponge reef protection areas, and other Closed Areas; enforce compliance with hail-out, hail-in and other elements of the DMP and at-sea observer program; conduct investigations and enforcement actions in response to the retention of groundfish caught, retained or possessed without licence authority. Priority will be placed on occurrences where retention for the purpose of sale is indicated; investigate incidents of unauthorized dual fishing; enforce compliance with Electronic Monitoring (EM) Licence Conditions, especially Time Gaps that are reported; investigate false and misleading or obstruction of at-sea and dockside observers (DFO 2017a)

Thirty-six vessels participated in the commercial hake fishery in 2017, making 11,152 landings (Bussel 2018)

All commercial mid-water trawl vessels fishing for hake in British Columbia were subject to 100 percent at-sea monitoring, through either the At Sea Observer Program (ASOP) or electronic monitoring (EM). Additionally, all shoreside hake offloads were subject to 100% coverage by the Groundfish Trawl Dockside Monitoring Program (DMP). These monitoring systems identify incidents and generate occurrence reports for DFO, based on a pre-established criteria and reporting protocol.

All occurrence reports are maintained in an exclusive database by the industry-contracted monitoring service provider, Archipelago Marine Research Ltd (AMR). DFO fishery officers access occurrence reports through the AMR database in order to conduct investigations. After reviewing EM and observer data or consulting other sources of information, fishery officers can generate additional occurrence reports to record further incidents of interest. DFO's Conservation and Protection (C&P) Branch maintains the Departmental Violations System (DVS) for managing occurrences, violations and all past and present case files (investigations). The DVS database contains occurrences generated by fishery officers as well as occurrences reported by AMR that are under investigation by fishery officers.

There were 5 DVS reports for the hake fishery in 2017 (Bussel 2018):

- One inspection of a hake groundfish trawler where the majority of the crew could not produce Fisher Registration Cards. Tickets were issued and fines were paid in this case.
- Two minor retentions of prohibited Chinook salmon.
- Two unconfirmed reports of two separate juvenile Pacific hake kills.

There were 8 AMR occurrences for the shoreside Pacific hake fishery in 2017 (Bussel 2018):

- Five offload incidents, 4 related to inability to sort walleye Pollock from Pacific hake; 1 related to a crew member retaining a prohibited species. No enforcement action taken.
- Two hold check issues – vessels left before the dockside observer was able to check the holds as part of the 100% DMP. No enforcement action taken.
- One hail or notification incident: vessel did not hail prior to offload due to a problem with a satellite phone. No enforcement action taken.

Fishers observed larger numbers of juvenile sablefish in 2017 compared to previous years. The largest 5 offloads of juvenile (1-2 lbs) sablefish ranged from 1033 – 5040 lbs. Two offloads of herring totalled 1708 lbs. and three tope sharks. No enforcement action taken (Bussel 2018).

2.2. Changes to Relevant regulations

2.2.1 US Regulation Changes

There were no new management measures initiated in 2017.

Work continued on the issue of hard vs. soft caps for two species. In 2016 the PFMC recommended that MS and CP sector hard caps for darkblotched rockfish and Pacific ocean perch be changed to set-asides (soft caps). Hard caps shut down a sector upon attainment; soft caps do not. The recommendation was made on the basis of the economic cost of hard caps to the at-sea sectors in the absence of a conservation need. The NMFS published a proposed rule to this effect on October 0f 2017, with a final rule published in January 2018 (NOAA Fisheries 2017c; NOAA Fisheries 2018a).

Re- apportionment of tribal fishery hake to the non-tribal sectors also took place to promote full utilization of the 2017 US hake TAC (NOAA Fisheries 2017b).

At-sea sectors of the Pacific hake fishery continued to work with the EPA to develop a general NPDES (National Pollutant Discharge Elimination System) permit to authorize at-sea discharge of fish processing wastes (Waldeck 2018).

2.2.2 Canada Regulation Changes

No significant changes were made in 2017 to management objectives, advisory processes, regulations, observer programs or enforcement coverage (Mann 2018).

All regulations for the 2017 Hake fishery are found in the 2017 Offshore Pacific Hake Harvest Plan (DFO 2017b), addendum to the 2017 Integrated Fisheries Management Plan for Groundfish (DFO 2017a).

2.3. Changes to personnel involved in science, management or industry

The US and Canadian systems have a robust means of maintaining high levels of competence in science and management personnel. Both countries have a deep bench, so as key personnel retire, receive promotions, or otherwise leave, qualified replacements take over the roles. No substantive changes occurred that would adversely affect the quality of science or management in either country.

On the US side personnel shifting has occurred in the treaty committees. Kellie Johnson replaced Ian Taylor on the JTC, and Jim Hastie replaced Michelle McClure in the SRG. At the NWFSC, NOAA Fisheries appointed Kirstin Marshall as Management Strategy Evaluation (MSE) coordinator, and the MSE workis supported by a postdoctoral fellow (Dr. Nis Jacobs).

Dayna Mathews from the NOAA Fisheries Office of Law Enforcement (OLE) has retired and his position has not been filled yet. Mr. Greg Busch, Assistant Director of the West Coast Division. OLE, participated in the audit.

DFO Science appointed Dr. John Holmes as Division Manager in the Stock Assessment and Research Division at the Pacific Biological Station.

The BC Ministry of Agriculture have hired Michael Turner and Kevin Romanin to add capacity in the fisheries sector.

In the US industry sector, the Oregon Trawl Commission appointed Yelena Nowak as its Director to replace the retired Brad Pettinger.

2.4. Changes to scientific base of information – including stock assessments

2.4.1 Principle 1

Fishery Observations

The coast-wide landings of the Pacific Hake fishery averaged 230,250 t for the period 1966 - 2017, with a low of 89,930 t in 1980 and a high of 440,944 t in 2017 (Figure 1). The 440,944 t coastwide catch in 2017 was the largest on record (Table 2). Prior to 1966, total removals were very small compared to the modern fishery. Over the early period, 1966–1990, most removals were from foreign or joint-venture fisheries. Over all years, the fishery in U.S. waters averaged 174,349 t, or 75.7% of the average total landings. In comparison catch from Canadian waters averaged 55,901 t or 24.3%. Over the last 10 years, 2008–2017 (Table 2), the average coast-wide catch was 276,288 t with U.S. and Canadian catches averaging 220,094 t and 56,194 t, respectively (Edwards *et al.*, 2018).

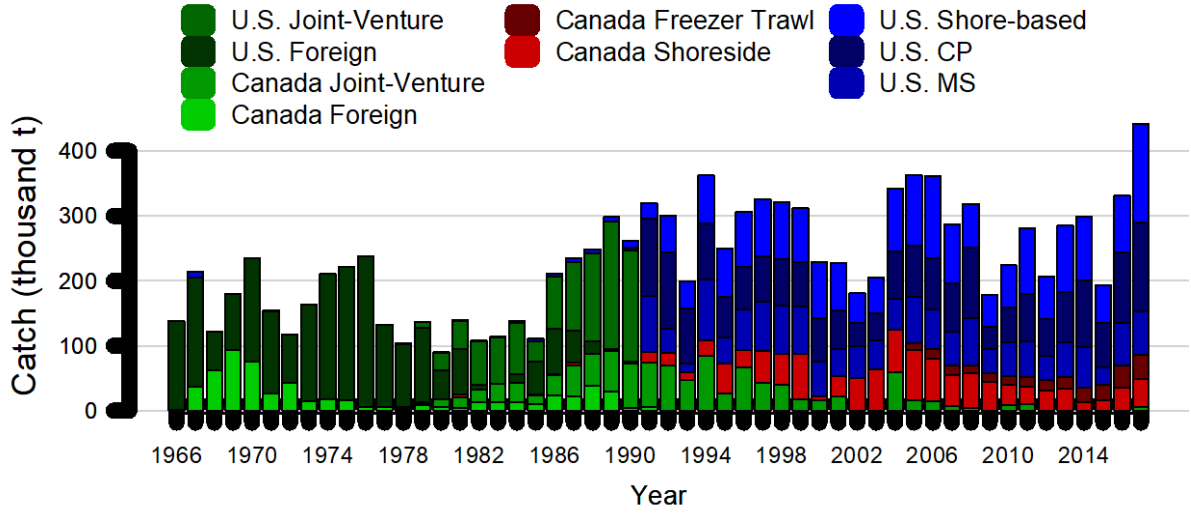

Figure 1. Total Pacific Hake catch used in the assessment by sector, 1966–2017. U.S. tribal catches are included in the sectors where they are represented (Edwards *et al.*, 2018).

Table 2. Recent commercial fishery catch (t). Tribal catches are included in the sector totals. Research catch includes landed catch associated with certain research-related activities. Catch associated with surveys and discarded bycatch in fisheries not targeting hake are not currently included in the model (Edwards *et al*., 2018).

Year	US Mother-ship	US Catcher-processor	US Shore-based	US Research	US Total	CAN Joint-Venture	CAN Shore-side	CAN Freezer Trawlers	CAN Total	Total
2006	60,926	78,864	127,165	0	266,955	14,319	65,289	15,136	94,744	361,699
2007	52,977	73,263	91,441	0	217,682	6,780	48,075	14,121	68,976	286,658
2008	72,440	108,195	67,861	0	248,496	3,592	53,444	13,214	70,251	318,746
2009	37,550	34,552	49,222	0	121,324	0	44,136	13,223	57,359	178,683
2010	52,022	54,284	64,736	0	171,043	8,081	31,418	13,573	53,072	224,115
2011	56,394	71,678	102,146	1,042	231,261	9,717	26,827	14,593	51,137	282,398
2012	38,512	55,264	65,919	448	160,144	0	31,718	14,909	46,627	206,771
2013	52,447	77,950	102,143	1,018	233,558	0	33,665	18,584	52,249	285,807
2014	62,102	103,203	98,640	197	264,141	0	13,326	21,787	35,113	299,254
2015	27,661	68,484	58,011	0	154,156	0	16,775	22,903	39,678	193,834
2016	65,036	108,786	88,023	745	262,590	0	35,012	34,729	69,740	332,330
2017	66,428	136,960	150,843	0	354,231	5,608	43,427	37,679	86,713	440,944

In 2017 the US midwater trawl hake fishery began on May 15 for the shore-based and at-sea fisheries. The overall catch in US waters was substantially greater than in 2016, reaching an all-time high of 354,231 t. Tribal fisheries landed 6,012 t in 2017. The catcher-processor, mothership, and shore-based fleets caught 99.8%, 68.6%, and 89.0% of their final reallocated quotas, respectively (Waldeck., 2018).

In the CP and MS sectors, the most common cohort in the spring fishery were age-7 and age-3 fish associated with the 2010 and 2014 year-classes. By the fall, both at-sea sectors were catching a majority of age-3 fish from the 2014 cohort. In total, 44% of the CP catch was age-3 and 33% was age-7. For the MS sector, 47% was age-3 and 33% was age-7 (Waldeck, 2018).

The at-sea sectors maintained relatively high catch rates throughout 2017, averaging around 30 t/hr in the spring and 20 t/hr in the fall. Relative to 2016, considerably higher catch rates were observed in the spring and fall fisheries. The shore-based fishery had the largest monthly catches during June, July and August. Due to high catch-rates throughout 2017 (for all U.S. fleets), the U.S. utilization (i.e., US Catch/US TAC) rate went up to 79% from 47% in 2015 (Waldeck, 2018).

In 2017 the Canadian hake fishery began in April. The domestic fishery caught 86,713 t. This amounted to 55.6% of the Canadian TAC of 156,067 t. The shoreside vessels landed 43,427 t, whereas the freezer trawlers landed 37,679 t. In 2017, for the first time since 2011, there was a Joint Venture (JV) from August 21 to September 19. A total of 5,608 t of hake was delivered to the Dutch registered vessel *Annelies Ilena* (Edward *et al*., 2018).

Fish were continuously present throughout the season along the shelf break and on the shelf off the west coast of Vancouver Island. In 2017 as in 2016, there appeared to be a larger hake biomass in Canada compared to previous years, which is one reason why overall fleet participation was up from 2016 (Edwards *et al*., 2018).

In the Canadian Freezer trawler catch, the most abundant year classes (numbers) were age-7 at 47.4%, age-8 at 14.3%, age-9 at 9.4%, and age-3 at 7.8%. The most abundant year classes in the Canadian Shoreside catch were age-7 at 46.4%, age-8 at 14.8%, age-6 at 7.9%, and age-1 at 7.7% (Edwards *et al*., 2018).

2017 Stock Assessment

As this is the 4th surveillance cycle only a short summary of the 2017 Pacific hake stock assessment (Berger *et al*., 2017) is provided here:

The stock assessment model for 2017 (Berger *et al*., 2017) is similar in structure to the 2016 model (Grandin *et al*., 2016). Data were updated to include addition of fishery catch and age compositions from 2016, and other minor refinements such as catch estimates from earlier years. As previously, the stock assessment model was fit to the acoustic survey index of abundance, and annual commercial catch, as well as age compositions from the survey and the U.S. and Canadian commercial fisheries.

The stock was estimated to be at its highest biomass level since the 1980s as a result of estimated large 2010 and 2014 cohorts. The 2014 cohort has not yet been observed by the survey and only twice by the commercial fishery, thus its absolute size is highly uncertain. The median estimate of 2017 relative spawning biomass (spawning biomass at the start of 2017 divided by that at unfished equilibrium, B_0) is 89.2% but is highly uncertain (with 95% credible interval from 37.1% to 270.8%). The median estimate of 2017 female spawning biomass was 2.129 million t (with 95% credible interval from 0.763 to 7.445 million t).

Based on the default harvest rule, the median catch limit for 2017 was estimated at 969,840 t (with 95% credible interval from 293,697 to 3,710,305 t). However, forecasts are highly uncertain due to uncertainty in estimates of recruitment for recent years. Forecasts were conducted across a range of catch levels.

Projections setting the 2017 and 2018 catch equal to the 2016 TAC of 497,500 t showed the estimated median relative spawning biomass decreasing from 89% in 2017 to 85% in 2018 and 79% in 2019. However, due to uncertainty there is an estimated 16% chance of the spawning biomass falling below 40% of B_0 in 2019. There was an estimated 63% chance of the spawning biomass declining from 2017 to 2018, and a 80% chance of the biomass declining from 2018 to 2019 under this constant catch level (Berger *et al*., 2017).

The SRG recommended that the 2017 stock assessment base model as the best available science information on Pacific hake (SRG, 2017). The SRG provided seven assessment recommendations for research and development in 2018 (SRG, 2017). The JTC responded to all seven of the recommendations in the 2018 Pacific hake stock assessment report (Edwards *et al*., 2018)

2018 Stock Assessment

The following brief stock assessment summary was adopted from the 2018 Stock Assessment of Pacific Hake in U.S. and Canadian Waters prepared by the International Joint Technical Committee for Pacific hake (Edwards *et al*., 2018). The 2018 assessment is the seventh annual stock assessment conducted under the Joint US-Canada Agreement for Pacific hake. The 2018 base model is an updated version of the 2017 stock assessment base model (Berger *et al*., 2017). The model was fit to the acoustic survey abundance index, annual commercial catch data, and survey and commercial fisheries age-composition data. Data were updated to include the biomass estimate and age-composition from the 2017 acoustic survey:
http://pacificwhiting.org/images/msc_audit_8/P1_1_2017_survey_whiting_biomass_estimate.pdf,
catch and age-composition data from the commercial 2017 fisheries, and weight, and 2017 weight-at-age data. In 2018 Stock Synthesis (SS) (Method and Wetzel, 2013) version 3.30

was used for the first time. SS version 3.30 (Method *et al*., 2018) is a significant update to the software used in previous hake assessments (Edwards *et al*., 2018)

The hake stock assessment uses Bayesian methods to incorporate prior information on natural mortality (*M*), steepness of the stock-recruit relationship (*h*), and several other parameters with likelihoods for acoustic survey biomass indices and age-composition, as well as fishery age composition data. The assessment provides results that can be probabilistically interpreted. The exploration of uncertainty is not limited to parameter uncertainty as structural uncertainty is investigated through sensitivity analyses. Sensitivity analyses are used to identify alternative structural models that may also be consistent with the data. Past assessments have used closed-loop simulations to provide an assessment of how alternative combinations of survey frequency, assessment model selectivity assumptions, and harvest control rules affect expected management outcomes. The results of past closed-loop simulations influenced the decisions made for the 2018 assessment (Edwards *et al*., 2018).

The stock assessment model for 2018 retains the structural form of the base assessment model from 2017 as well as many of the previous elements configured in Stock Synthesis. The 2018 JTC assessment depends primarily on the fishery landings (1966–2017), acoustic survey biomass estimates, and age-compositions (1998–2017), as well as fishery age-compositions (1975–2017). While the 2011 survey index value was the lowest in the time series, the index increased steadily over the four surveys conducted in 2011, 2012, 2013, and 2015, and then declined in 2017. Age-composition data from the aggregated fisheries and the acoustic survey contribute to the assessment model's ability to resolve strong and weak cohorts. A new age-based maturity ogive was developed for the 2018 assessment. This new ogive replaced the previous ogive that was based on estimates of maturity-at-length from 1997 and weight at length from 2011. The fecundity relationship was also updated. The 2018 assessment incorporated new approaches for weighting composition data and for parameterizing time-varying selectivity. The Dirichlet-Multinomial (D-M) likelihood approach (Thorson, *et al*., 2017) was used to estimate weights associated with age-composition data. Simulations per- formed by Kuriyama *et al*. (2016) showed that, in general, using empirical weight-at-age when many observations are available resulted in more accurate estimates of spawning biomass (Edwards *et al*., 2018).

Results of the base case stock assessment model indicates that since the 1960s, Pacific Hake female spawning biomass has ranged from well below to near (and above) unfished equilibrium (Figure 2). The model estimated that the female spawning biomass was below the unfished equilibrium in the 1960s and 1970s (due to low recruitment). The stock was estimated to have increased rapidly after two or more large recruitments in the early 1980s to near unfished equilibrium, and then declined steadily after a peak in the mid- to late-1980s to a low in 2000. This long period of decline was followed by a brief increase to a peak in 2003 as the very large 1999 year- class matured. The 1999 year-class largely supported the fishery for several years due to relatively small recruitments between 2000 and 2007 entering the fishery to replace catches being removed during this period. With the aging 1999 year-class, median female spawning biomass declined throughout the late 2000s, reaching a time-series low of 0.568 million t in 2010. The assessment model estimated that spawning biomass then peaked again in 2013 and 2014 due to a very large 2010 year-class and an above average 2008 year-class. The 2018 median posterior spawning biomass is estimated to be 66.7% of the unfished equilibrium level (B_0) (with 95% posterior credibility intervals ranging from 32.7% to 136.1%. The median estimate of the 2018 female spawning biomass (Table 3) was 1.357 million t (with a 95% posterior credibility interval from 0.610 to 3.161 million t) (Edwards *et al*., 2018).

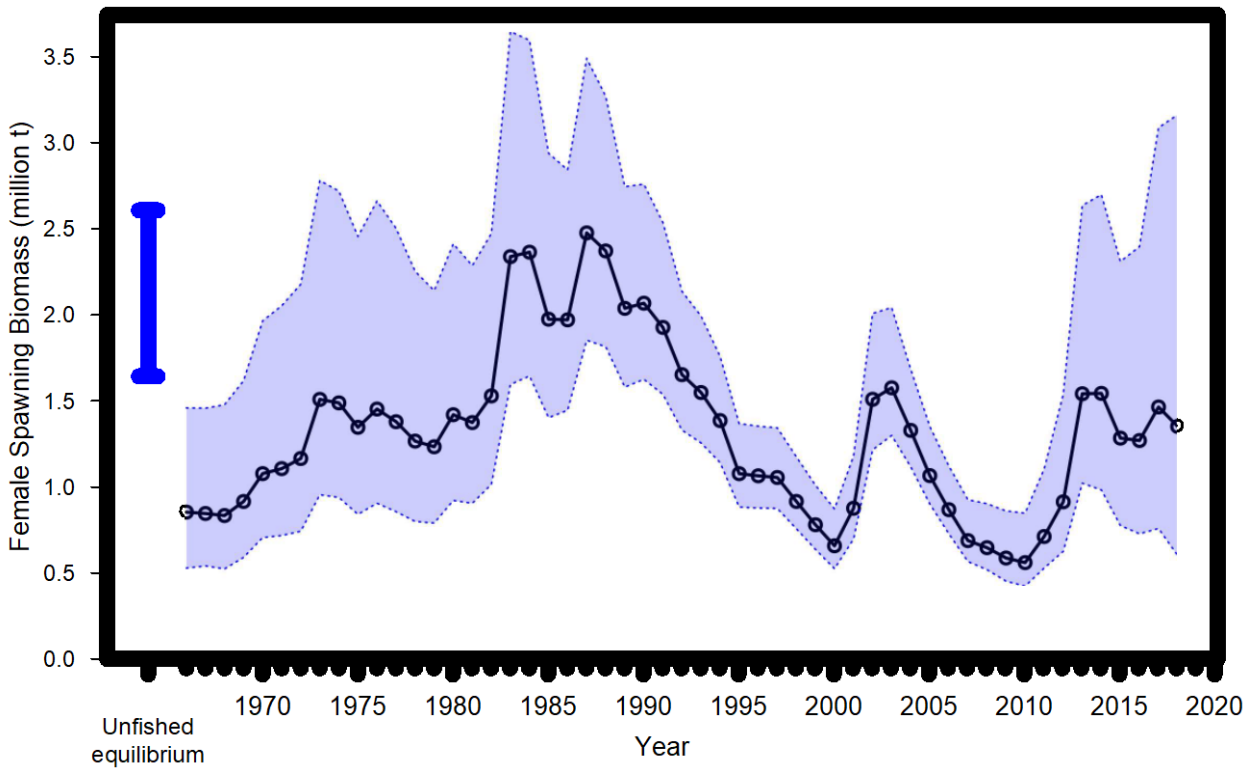

Figure 2. Median of the posterior distribution for beginning of the year female spawning biomass through 2018 (solid line) with 95% posterior credibility intervals (shaded area). The solid circle with a 95% posterior credibility interval is the estimated unfished equilibrium biomass (Edwards *et al.*, 2018).

Table 3. Recent trends in estimated beginning of the year female spawning biomass (thousand t) and spawning biomass level relative to estimated unfished equilibrium (Edwards *et al.*, 2018).

Year	Spawning Biomass (thousand t)			Relative spawning Biomass (B_t/B_0)		
	2.5th percentile	Median	97.5th percentile	2.5th percentile	Median	97.5th percentile
2009	460.6	594.8	867.3	23.0%	29.3%	38.0%
2010	432.4	568.3	854.5	21.9%	28.0%	37.2%
2011	536.6	719.3	1,110.0	27.3%	35.6%	47.9%
2012	633.3	920.0	1,541.7	32.8%	45.4%	65.7%
2013	1,028.0	1,545.7	2,635.7	53.2%	76.1%	113.9%
2014	989.0	1,547.9	2,698.1	52.0%	76.1%	116.1%
2015	782.6	1,288.9	2,311.2	41.4%	63.2%	99.0%
2016	735.1	1,275.0	2,397.1	39.0%	62.4%	102.6%
2017	765.8	1,469.0	3,085.6	40.6%	72.1%	130.6%
2018	610.1	1,356.5	3,160.8	32.7%	66.7%	136.1%

New data available for the 2018 assessment did not significantly change the estimated patterns of recruitment previously estimated. Pacific Hake by and large exhibit low average recruitment with occasional large year-classes. 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 a relatively large 2008 year-class. The 2018 assessment estimates a very strong 2010 year-class comprising 71% of the coast-wide commercial catch in 2013, 65% of the 2014 catch, and 71% of the 2015 catch and 33% of the 2016 catch. The model estimated smaller than average 2011, 2012, 2013 and 2015 year-classes. The 2014 year-class was estimated to be likely larger than average). The 2014 year-class is likely larger than average (Table 4) (Edwards *et al*., 2018).

Table 4. Estimates of recent recruitment (millions of age-0) and recruitment deviations, where deviations below (above) zero indicate recruitment below (above) that estimated from the stock-recruit relationship (Edwards et al., 2018).

Year	Absolute recruitment (millions)			Recruitment deviations		
	2.5th percentile	Median	97.5th percentile	2.5th percentile	Median	97.5th percentile
2008	3,607.8	5,096.0	8,117.0	1.481	1.715	1.988
2009	734.9	1,274.2	2,490.3	-0.097	0.353	0.815
2010	8,282.3	13,368.6	24,883.0	2.403	2.703	3.043
2011	153.9	427.0	998.1	-1.711	-0.798	-0.099
2012	628.2	1,415.6	3,395.2	-0.253	0.381	1.047
2013	110.8	431.6	1,327.2	-2.134	-0.890	0.070
2014	4,137.1	8,582.7	20,561.7	1.543	2.123	2.786
2015	20.9	154.6	785.6	-3.828	-1.878	-0.413
2016	360.9	3,235.8	31,932.6	-0.912	1.185	3.341
2017	62.3	1,036.5	16,490.6	-2.714	0.025	2.709

Median fishing intensity on the stock is estimated to have been below the target ($F_{40\%}$) except for the years 2008 and 2010 when spawning biomass was low (Table 5). Exploitation fraction (catch divided by biomass of fish of age 2 and above) peaked in 1999 (Figure 3 and Table 5). Median fishing intensity is estimated to have declined from 94.3% in 2010 to 86.2% in 2017, while the exploitation fraction has decreased from 0.13 in 2010 to 0.14 in 2017. There is a considerable amount of uncertainty around these recent estimates, with the 95% posterior credibility interval reaching above the SRP management target for 2017 (Edwards *et al*., 2018).

Table 5. Recent estimates of fishing intensity, (1-SPR)/(1-SPR40%), and exploitation fraction (catch divided by age 2+ biomass) (Edwards et al., 2018).

Year	Relative fishing intensity			Exploitation fraction		
	2.5th percentile	Median	97.5th percentile	2.5th percentile	Median	97.5th percentile
2008	0.753	0.973	1.179	0.137	0.192	0.239
2009	0.582	0.801	1.012	0.099	0.144	0.186
2010	0.689	0.943	1.206	0.090	0.134	0.176
2011	0.631	0.908	1.159	0.113	0.177	0.238
2012	0.446	0.706	0.965	0.039	0.066	0.097
2013	0.446	0.681	0.897	0.048	0.082	0.124
2014	0.447	0.695	0.962	0.047	0.084	0.132
2015	0.273	0.486	0.754	0.040	0.073	0.119
2016	0.444	0.740	1.062	0.051	0.102	0.179
2017	0.556	0.862	1.178	0.066	0.142	0.271

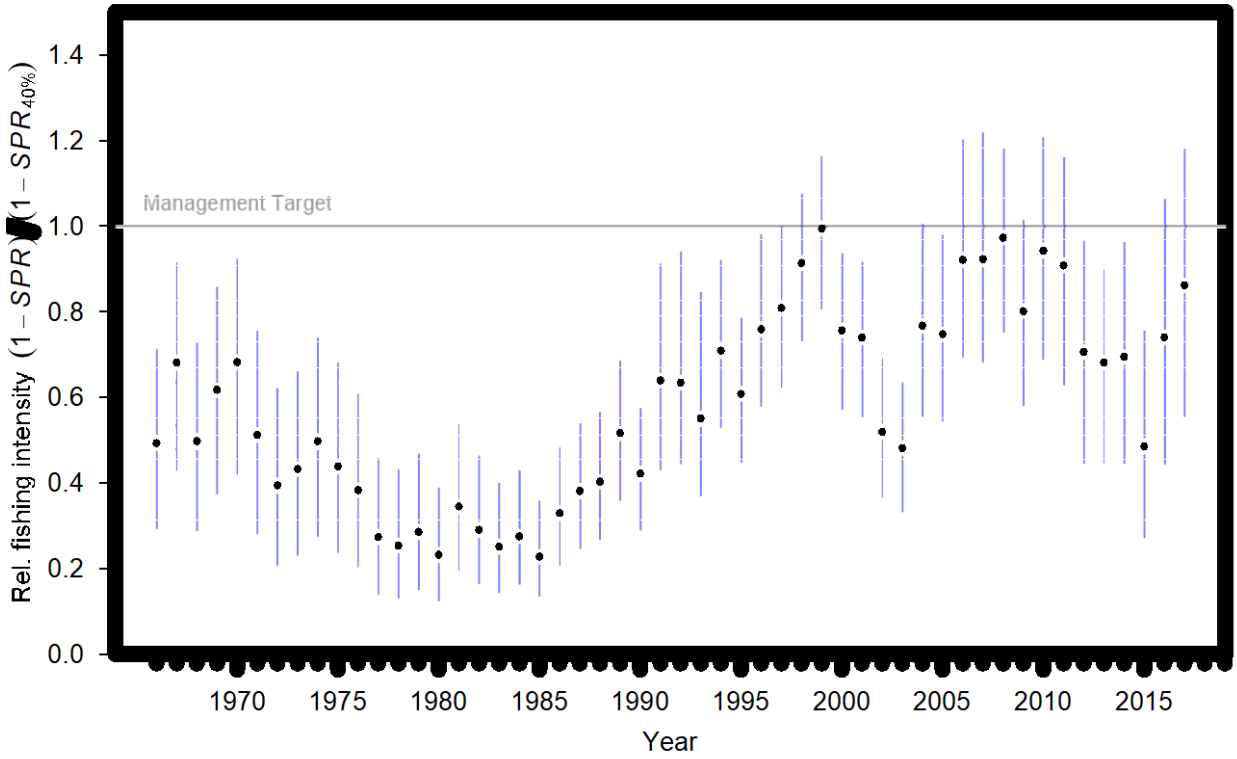

Figure 3. Trend in median relative fishing intensity (relative to SPR management target) through 2017 with 95% posterior credibility intervals (Edwards *et al.*, 2018).

The joint exploitation history of the median estimates of relative spawning biomass and relative fishing intensity shows that the median relative fishing intensity has never been above the target of 1.0 when the female spawning biomass is below the reference point of $B_{40\%}$ (Figure 4). Between 2007 and 2011, median relative fishing intensity ranged from 80% to 97% and median relative spawning biomass between 0.28 and 0.36. Biomass has risen from the 2010 low with the 2008, 2010 and 2014 recruitments, and median relative spawning biomass has been above the reference point of 40% since 2012. The model

estimated a 5.7% joint probability of being both above the target relative fishing intensity in 2017 and below the $B_{40\%}$ relative spawning biomass level at the start of 2018 (Edwards *et al.*, 2018).

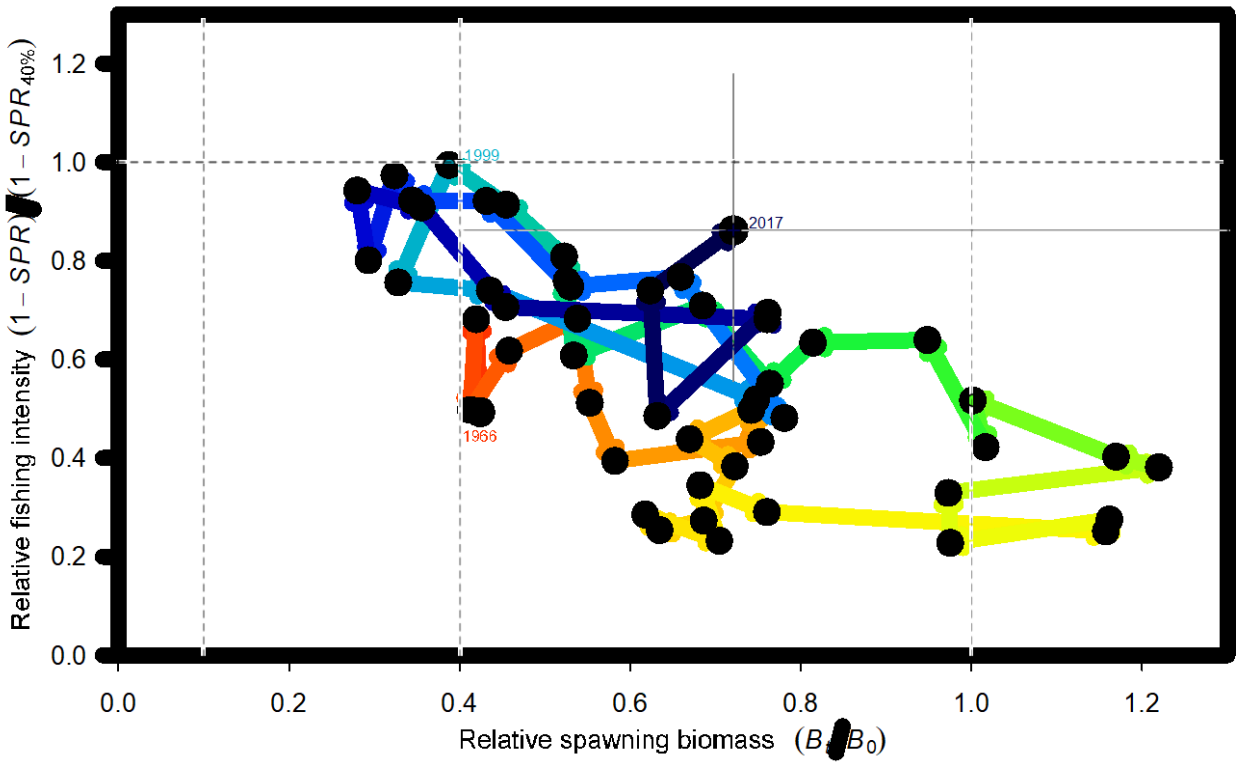

Figure 4. Estimated historical path followed by medians of relative fishing intensity and relative spawning biomass for Pacific Hake with labels on the start and end years (and 1999(. Grey bars span the 95% credibility intervals for 2017 relative fishing intensity (vertical) and relative spawning biomass (horizontal) (Edwards *et al.*, 2018).

As in the 2017 assessment, the 2018 assessment estimated reference points for Pacific hake using the base-case model (Table 6). The estimates are slightly different than those in the 2017 assessment, with slightly smaller sustainable yields and reference biomasses estimated in the 2018 assessment. The estimated unfished equilibrium spawning biomass estimate was 2,032,000 t (95% posterior credibility interval ranges from 1,641,000 to 2,608,000 t). The spawning biomass that is 40% of the unfished equilibrium spawning biomass ($SB_{40\%}$) was estimated to be 813,000 t (with 95% posterior credibility interval ranges from 657,000 t to 1,043 t). This is slightly larger than the equilibrium spawning biomass implied by the $F_{40\%}$ default harvest rate target which is 730,000 t or 36% of SB_0 (Edwards *et al.*, 2018).

Table 6. Summary of median and 95% credibility intervals of equilibrium reference points for the Pacific Hake base assessment model. Equilibrium reference points were computed using 1966–2017 averages for mean size-at-age and selectivity-at-age (Edwards *et al.*, 2018).

Quantity	2.5th percentile	Median	97.5th percentile
Unfished female spawning biomass (B_0, thousand t)	1,641	2,032	2,608
Unfished recruitment (R_0, millions)	1,828	2,773	4,607
Reference points (equilibrium) based on $F_{SPR=40\%}$			
Female spawning biomass at $F_{SPR=40\%}$ (thousand t)	538	730	929
SPR at $F_{SPR=40\%}$	–	40%	–
Exploitation fraction corresponding to $F_{SPR=40\%}$	16.0%	18.3%	20.6%
Yield associated with $F_{SPR=40\%}$ (thousand t)	243	340	484
Reference points (equilibrium) based on $B_{40\%}$ (40% of B_0)			
Female spawning biomass ($B_{40\%}$, thousand t)	657	813	1,043
SPR at $B_{40\%}$	40.6%	43.5%	50.6%
Exploitation fraction resulting in $B_{40\%}$	12.8%	16.1%	19.0%
Yield at $B_{40\%}$ (thousand t)	242	332	474
Reference points (equilibrium) based on estimated MSY			
Female spawning biomass (B_{MSY}, thousand t)	377	518	795
SPR at MSY	22.5%	29.9%	45.3%
Exploitation fraction corresponding to SPR at MSY	15.4%	25.5%	34.5%
MSY (thousand t)	250	358	528

A set of management metrics was identified as important to the Joint Management Committee (JMC), and Advisory Panel (AP). These metrics summarize the probability of various outcomes from the base case model given each potential management action (Table 7).

Table 7. Probabilities related to spawning biomass, fishing intensity, and 2019 default harvest policy catch for alternative 2018 catch options (Edwards *et al*., 2018).

Catch in 2018	Probability $B_{2019}<B_{2018}$	Probability $B_{2019}<B_{40\%}$	Probability $B_{2019}<B_{25\%}$	Probability $B_{2019}<B_{10\%}$	Probability 2018 relative fishing intensity >100%	Probability 2019 default harvest policy catch <2018 catch
a: 0	37%	5%	0%	0%	0%	0%
b: 180,000	55%	9%	1%	0%	0%	1%
c: 350,000	64%	13%	2%	0%	9%	10%
d: 440,000	68%	15%	2%	0%	19%	21%
e: 597,500	73%	20%	4%	0%	44%	46%
f: 639,000	75%	21%	5%	0%	50%	52%
g: 725,984	77%	24%	7%	0%	61%	62%
h: 626,954	74%	20%	5%	0%	49%	50%

The median catch for 2018 based on the default harvest policy (F40% – 40:10) is 725,984 t, but has a wide range of uncertainty. The 95% posterior credibility interval ranges from 270,948 t to 1,881,590 t. The probability of the spawning biomass decreasing from 2018 to 2019 is less than 50% for only the 0 t catch level (Table 7). The highest probability of decrease is 77%, which is for the default harvest policy (row g in Table 7). The predicted probability of the spawning biomass dropping below $B_{10\%}$ at the start of 2019 is less than 1% and the maximum probability of dropping below $B_{40\%}$ is 24% for all catches explored. The model estimated below-average recruitment for the 2011, 2012, 2013, and 2015 cohorts, but above-average 2014 and 2016 cohorts that may result in increases to the spawning biomass as they mature and increase in weight (Edwards *et al*., 2018).

Acoustic and trawl survey

The joint U.S. and Canadian integrated acoustic and trawl survey has been the primary fishery-independent tool used to assess the distribution, abundance and biology of coastal Pacific hake along the west coasts of the United States and Canada.

The 2011 survey index value was the lowest in the time series, and was followed by the index increasing in 2012, 2013, and 2015, and then declining in 2017. The 2017 survey took place from 22 June to 13 September 2017. Two vessels conducted the survey: *Bell Shimada* and *Nordic Pearl*. The 2017 survey biomass index declined from the 2015 index to 1.42 million metric tons, which is 0.66 times the 2015 index (Figure 5). The 2017 survey age composition was made up of 26.0% age-7 fish from the 2010 year-class and 52.7% age-3 fish from the 2014 year-class (Edwards *et al*., 2018).

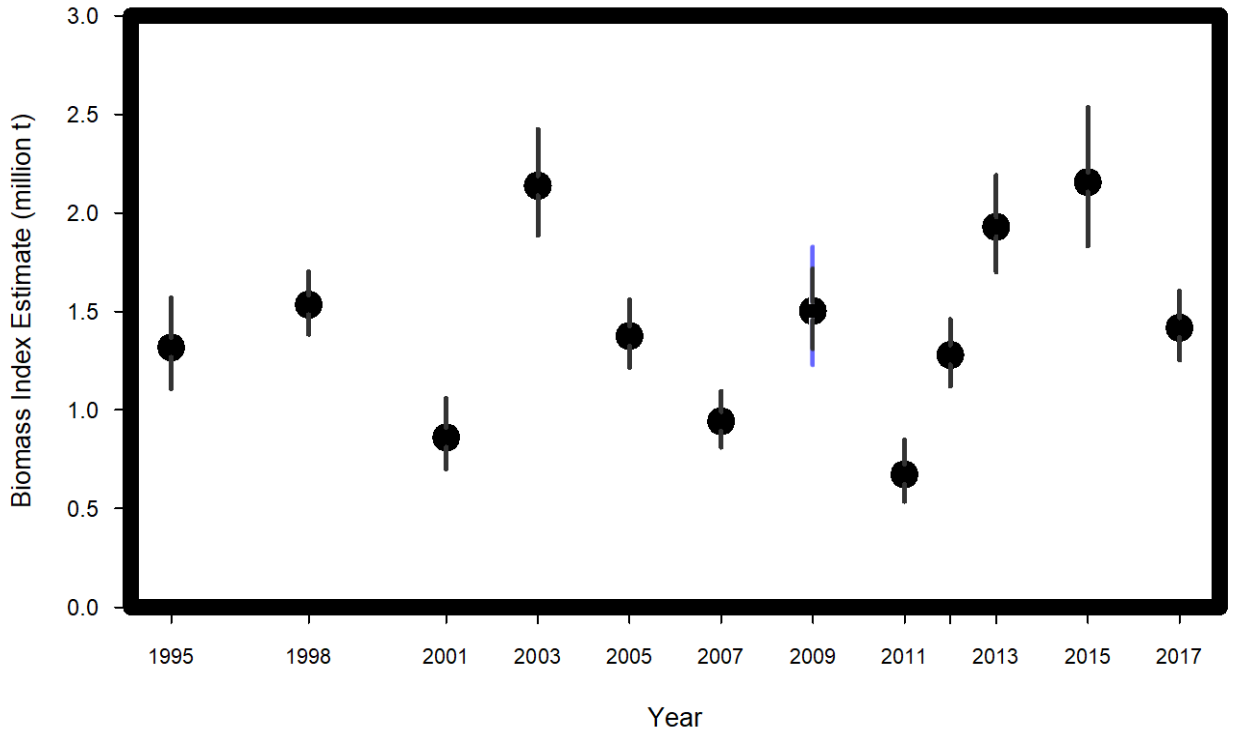

Figure 5. Acoustic survey biomass index (millions of metric tons). Approximate 95% confidence intervals are based on only sampling variability (1995–2007, 2011–2017) in addition to squid/hake apportionment uncertainty (2009, in blue) (Edwards *et al*., 2018).

The assessment team noted that the NOAA acoustic survey team conducted a winter research cruise on the NOAA Research Vessel *Bell M. Shimada* in 2016 and 2017 (Parker-Stetter, 2018). Sampling was aimed at characterizing the distribution of adult hake during the spawning season, understanding between-year variability in distribution, and collecting biological information during the winter. A large amount of valuable information was collected in 2016, resulting in several new insights into winter-season hake distribution and catch composition (SRG, 2017).

Scientists of the NWFSC conducted a detailed review of the Pacific hake integrated acoustic and trawl survey methods in 2017 9 (Chu *et al*., 2017).

The assessment team learned that NOAA Fisheries was conducting acoustic survey experiments using sail drones for the purpose of estimating hake biomass.

Scientific Review Group

The 2017 SRG meeting was held at the Morris J. Wosk Centre for Dialogue in Vancouver BC from February 14–16. The SRG endorsed and commended the work of the JTC and the survey team. Many recommendations were made by the SRG and are summarized in their 2017 report (SRG, 2017).

The SRG had several requests for further model sensitivities, model convergence diagnostics, and data summary tables which were addressed (Berger *et al*., 2017).

The SRG recommended the base model in the 2017 assessment (Berger *et al*., 2017) as the best available science information on Pacific hake (SRC, 2017). The median estimate of female spawning biomass at the beginning of 2017 is 2.129 million t, with a 95% credibility interval of 0.763 to 7.445 million t. The 2017 median biomass estimate increased slightly from 2016 due to above average recruitment in 2014. The 2014 year class is estimated to be among the largest observed and is likely to be important to stock dynamics for many years. In contrast, the influence of the 2010 year class has declined and will continue to do so because losses of biomass through natural mortality are greater than gains from growth, but it remains the dominant cohort in Canadian catches. The 2017 median estimate of stock biomass in the base model is well above the $B_{40\%}$ and $B_{10\%}$ biomass reference points, and fishing intensity is well below the $F_{40\%}$ reference point. The SRG concludes that the coastal Pacific Hake/Whiting stock is not overfished and that overfishing is not occurring (SRG, 2017).

The 2018 SRG meeting was held at the Lynnwood Convention Center in Lynnwood WA from February 26–March 2. The SRG considered the 2018 Pacific hake assessment report and appendices to present the best available scientific information. Many recommendations were made by the SRG and are summarized in their 2018 report (SRG, 2018). However, during the 2018 SRG meeting, the SRG requested the JTC to conduct an additional model run to examine sensitivity to fecundity. The alternative run estimated the probability that 2018 spawning biomass is below the B_{40} reference point at 48%, whereas the base-case predicted the probability that the 2018 spawning biomass is below B_{40} to be only 7%. The SRG was unable to resolve the issue of which model is more plausible and requested the JTC to conduct additional work in the coming year (SRG, 2018).

2017 and 2018 Harvest Recommendations

The fifth annual Joint Management Committee meeting was held in Lynnwood Washington on February 28-March 2, 2017, to consider the stock assessment provided by the JTC (Berger *et al*., 2017) and the findings and recommendations of the SRG. Following consideration of the presented information and recommendations from the Advisory Panel (AP, 2017), the Joint Management Committee (JMC, 2017) approved the following recommendation for the coast-wide Pacific hake total allowable catch.

Consistent with Article II 3.(e) of the Agreement, and after reviewing the advice of the JTC, the SRG, and the Advisory Panel (AP, 2017), the JMC recommends a coast-wide TAC of 531,501 t for the 2017 season. Based on Article III 2 of the Agreement, the Canadian share of the coast-wide TAC is 26.12 percent, or 138,828 t, and the U.S. share is 73.88 percent, or 392,673 t. Consistent with Article II 5.(b) of the Agreement, an adjustment (carryover from 2016) of 17,239 t is added to the Canadian share, for an adjusted Canadian TAC of 156,067 t. In the same manner, an adjustment of 48,760 t is added to the United States share, for an adjusted United States TAC of 441,433 t. This results in a coast-wide adjusted TAC of 597,500 t for 2017.

The JMC (2017) had extensive discussion about how to advance development of the Management Strategy Evaluation (MSE). The MSE Steering Committee, which includes hake scientists, fishery managers, and industry stakeholders, has been tasked with developing an MSE process that will inform and assist the JMC when formulating management advice for consideration of the parties on management of the Pacific Hake resource.

The JMC recommendation was transmitted via letter to the Parties on March 2, 2017. Subsequently NMFS and DFO formally implemented the JMC's recommended 2017 TAC.

The sixth annual Joint Management Committee meeting was held in Lynnwood Washington on March 5-6, 2018, to consider the stock assessment provided by the JTC (Edwards *et al*., 2018) and the findings and recommendations of the SRG. Following consideration of the presented information and recommendations from the Advisory Panel, the Joint Management Committee (JMC, 2018) approved the following recommendation for the coast-wide Pacific hake total allowable catch.

Consistent with Article II 3.(e) of the Agreement, and after reviewing the advice of the JTC, the SRG, and the Advisory Panel (AP, 2018), the JMC recommends a coast-wide TAC of 517,775 t for the 2018 season. Based on Article III 2 of the Agreement, the Canadian share of the coast-wide TAC is 26.12 percent, or 135,243 t, and the U.S. share is 73.88 percent, or 382,532 t. Consistent with Article II 5.(b) of the Agreement, an adjustment (carryover from 2017) of 20,824 t is added to the Canadian share, for an adjusted Canadian TAC of 156,067 t. In the same manner, an adjustment of 58,901 t is added to the United States share, for an adjusted United States TAC of 441,433 t. This results in a coast-wide adjusted TAC of 597,500 t for 2018 (JMC, 2018).

The JMC (2018) had extensive discussion about how to advance development of the Management Strategy Evaluation (MSE).

The JMC recommendation was transmitted via letter to the Parties on March 7, 2018. Subsequently NMFS and DFO formally implemented the JMC's recommended 2018 TAC.

Management Strategy Evaluation (MSE)

SRG (2017) provided guidance to JMC on the MSE process as it was stalled. Recently NOAA Fisheries has provided renewed support to move the MSE process forward. The MSE work is supported through an MSE Coordinator position at the NWFSC and a scientist to develop a spatially explicit operating model and conduct the Pacific hake MSE (SRG, 2018). A draft Pacific whiting MSE Work Plan (Marshall, 2018) was presented to the SRG in 2018. The work plan describes thirteen steps that are expected to provide results that will inform discussion on management choices by December 2019. The SRG (2018) noted that the draft MSE work plan seems to address the major points of guidance provided in 2017 (SRG, 2017).

With regard to Pacific hake MSE the SRG (2018) recommended:

- That the performance of assessment models be tested against the more complex reality of the MSE operating model (OM) scenarios to evaluate assessment accuracy and the confidence that can be placed in the annual tactical advice (e.g., TAC) arising from stock assessment
- That operating model scenarios representing a world experiencing climate change be developed to test the robustness of current and future management procedures.

Conclusion

No significant changes in fisheries operations are expected in 2018 that would substantially alter the impact of the fishery on the resource. Because Pacific hake is not subjected to overfishing, and is not in an overfished condition, no concerns with continued compliance with P1 criteria and benchmarks were found or are expected in the near future.

2.4.2 Principle 2

There are no concerns with compliance of P2 requirements in the US and Canada Pacific Hake/Whiting Mid-water Trawl Fishery based on the review of new information.

United States

Retained species and bycatch

Detailed information on the nature and amount of retained species and bycatch in the mid-water hake fisheries under certification, including marine mammals and seabirds, is collected by the At-Sea Hake Observer Program (A-SHOP) and the West Coast Groundfish Observer Program (WCGOP) operated by the NMFS. There is 100% observer coverage. A-SHOP sectors include the at sea catcher-processor and mothership catcher-vessels, while WCGOP covers the shoreside trawlers. No tribal fishing in the at-sea hake fishery occurred in 2017 or 2018.

The total non-hake catch by all sectors is less than 0.5 percent of the weight of hake catch in the fishery. Appendix 4 Table 1 presents the 2016 observed bycatch and discard rates of key species for the US Pacific hake fishery sectors: yellowtail rockfish (552 t – 155% increase over of 2015), widow rockfish (427 t –20% increase over 2015), spiny dogfish (378 t – 36% increase over 2015), splitnose rockfish (74 t – 26% decrease from 2015), and rougheye rockfish (45 t – nearly triple 2015) are the top five species in the bycatch, most (61-94%) of which were retained. The shoreside sector had a bycatch rate about double that of the other two sectors.

ETP Species

Salmon

Table 8 shows the bycatch of Chinook salmon by year for the US whiting fishery by sector (PFMC 2018b) since 2002. The fishery as a whole has remained below the 11,000 Chinook salmon threshold in all but 2005 and 2014, and in all years remained below the threshold plus reserve amount (total of 14,500 Chinook). In 2017 the at-sea sector caught 3,769 Chinook, with the shoreside and tribal sectors catching 1,394 and 577, respectively.

Table 8. Bycatch of Chinook salmon (#) by year for the whiting fisheries in relation to the 11,000Chinook threshold for the whiting sector (from PFMC 2018b).

Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
At-sea	1,679	2,648	805	3,963	1,209	1,321	722	319	714	3,990	4,232	3,737	6,685	1,808	3,051	3,769
Shorebased	1,062	425	4,206	4,018	839	2,462	1,962	378	2,997	3,727	2,333	1,313	7,554	2,424	733	1,394
Tribal	1,018	3,439	3,740	3,985	1,940	2,404	697	2,147	678	906	17	1,025	154	1	200	577
Total	3,759	6,512	8,751	11,966	3,988	6,187	3,381	2,844	4,389	8,623	6,582	6,075	14,393	4,233	3,984	5,740
% 11k threshold	34%	59%	80%	109%	36%	56%	31%	26%	40%	78%	60%	55%	131%	38%	36%	52%

In 2013, NMFS re-initiated ESA consultation about the impacts of the Pacific Coast groundfish fishery (including the Pacific hake fishery) on ESA-listed salmonids. In September 2015, the PFMC provided guidance to NMFS about the groundfish fishery to

inform the analysis for and development of the new BiOp. In December 2017, NMFS published the new ESA salmon BiOp.

Under the previous BiOp, exceeding the Chinook thresholds required re-consultation. The new BiOp explicitly states that NMFS will act to avoid exceeding the threshold, including fishery closure. Moreover, the new BiOp states that the Council and NMFS will review and develop mechanisms to prevent exceeding the coho salmon thresholds of 474 coho salmon for the whiting sector and 560 coho for the non-whiting sector, which are the historical maximums. Unlike the exceedance of the Chinook salmon thresholds and reserve, exceedance of the coho salmon guidelines alone will result in re-consultation.

At the March, April, and June 2018 PFMC meetings, the PFMC considered and adopted a range of mitigation measures in response to the BiOp to be implemented as part of the 2019-2020 groundfish specifications and management process. Subsequently, NMFS and the GMT reported at the November 2018 PFMC about additional management measures that could be considered for future implementation to ensure compliance with the BiOp's Incidental Take Statement (ITS) (PFMC 2018).

Pacific Halibut

A total of 0.81 t of Pacific halibut were taken by the three US sectors (Jannot *et al*. 2017). See Appendix 4 Table 1 for the break out by sector. This small bycatch will not influence the stock productivity.

Eulachon

Gustafson *et al* (2017) report extremely small numbers of eulachon caught during the period 2002-2015 from all at-sea hake sectors. Most years record only a few fish out of thousands of tows. The largest occurrence was 1,268 fish seen in 1,530 catcher/processor tows during 2011, the next largest was 277 fish seen in 1,249 mothership trawler tows during 2013. The total 2014 catch in all sectors was 267 fish in 2,971 tows while in 2015, all hake sectors combined, including shoreside, caught 56 individual eulachon. No data for 2016, 17 or 18 is available at the time of this report, however eulachon catch in the mid-water hake fleet not considered a recovery threat (NMFS 2017a).

Forage Fish

As reported in the 3rd surveillance report, based on PFMC action, NMFS developed and implemented regulations to prevent new fisheries on a suite of forage fish. In line with the PFMC recommendation, the proposed prohibition published by NMFS in January 2016 states that it is prohibited to: retain and process more than 1 mt of Shared EC Species other than squid species in any calendar year; or, retain and process more than 40 mt of any Shared EC squid species in any calendar year. In spring 2016, NMFS published a final rule implementing the new regulations and a compliance guide to detail the new regulations and requirements for industry. There are no new updates on this since the 3rd surveillance report.

Seabirds

Seabirds of conservation concern, including the endangered short-tailed albatross (STAL), occur on the WA-OR-CA coasts and interact with groundfish fisheries. To date, the at-sea hake fishery has never documented a STAL mortality, but if it were to occur, a STAL mortality could have negative impacts on the fishery.

Seabird mortalities caused by striking trawl warps or the data transponder cable (a.k.a. 3rd wire) have been recorded in similar at-sea hake processing fleets in both Alaska and the Southern Hemisphere. Observations of seabird cable strikes by fisheries observers are rare because observer duties prevent them from being present for the majority of strikes. Seabird carcasses are rarely recovered from such strikes because the carcass sinks to the ocean floor or the injured bird leaves the area, and thus carcasses are not captured by the net or cables.

Black-footed albatross were the only species observed taken on at-sea catcher processor vessels with between one and five BFALs recorded during 2010-2016. The most frequently caught non-albatross species on these vessels were northern fulmars, followed by gulls. Very rarely, one to a few individuals of nine other taxa were observed taken annually on at-sea catcher processor vessels (Jannot *et al* 2018a).

Since 2016, observers have spent 15 minutes per day observing cables for seabird strikes on at-sea hake catcher-processor vessels. Observers monitored over 500 hauls for almost 150 hours of observation time, during which they observed 120 strikes. Observers classified 30/120 strikes as "hard" meaning they had the potential to cause mortality. There were 12 observed hard strikes of black-footed albatross (BFAL), a species of conservation concern similar to STAL. When expanded to the total amount of daytime towing in the fleet, NMFS estimated that there were likely 738 hard strikes of BFAL in the fleet in 2016. Using a conservative estimate of 12% mortality for hard strikes obtained from the scientific literature, NMFS estimated that of the 738 hard strikes of BFAL, 85 resulted in mortality. Observers only recovered two BFAL carcasses in 2016 that could be verified as cable strikes, indicating the cryptic nature of cable strike mortality. In 2017 and 2018, observers continued to collect data on seabird cable strikes and NMFS is collaborating with industry to develop workable solutions to reduce cable-strike mortality (Jannot *et al*. 2017).

The recent USFWS BiOp for non-salmon ESA-listed species interactions in the Pacific Coast Groundfish Fishery (PCGF) concluded that the PCGF is not likely to jeopardize the continued existence of short-tailed albatross (USFWS 2017). However, it does indicate an expectation that "takes" could occur in the PCGF (including the CP hake fishery). Therefore, the Incidental Take Statement (page 48) mandates a series of Reasonable and Prudent Measures, including: "RPM 2. NMFS shall minimize the risk of short-tailed albatross interacting with trawl cables. Because short-tailed albatross are vulnerable to striking aerial trawl cables, particularly in the catcher-processor fleet, The Terms and Conditions specific to RPM 2 states, "T&C1 for RPM2 --To minimize the risk of short-tailed albatross interacting with trawl cables, NMFS shall: a) Continue to conduct research that investigates the extent of take associated with trawl gear and new or improved management actions that minimize take as a result of interactions with trawl gear in the PCGF. Management actions that should be examined include: i) The use and effectiveness of streamer lines when using trawl gear; ii) The degree to which minimizing the aerial extent of trawl cables affects the risk of bird strike; and iii) Feasible offal management techniques that decrease attraction of short-tailed albatross to the vicinity of aerial lines. b) Based on the research and findings of NMFS's investigations into trawl-associated mortality or injury, implement measures that minimize potential for short-tailed albatross interactions with trawl gear." In essence, the BiOp states that further research is needed to "develop an unbiased estimate of trawl-associated mortality" and requires NMFS to continue to conduct research, assess potential mitigation measures, and (based on the research) "implement measures that minimize potential for short-tailed albatross interactions with trawl gear.

A NMFS sponsored workshop with seabird scientists, fishery participants, and gear manufacturers was held November 7-8, 2017 in Seattle (Jannot *et al* 2018c). The PFMC discussed this BiOp at their November 2017 meeting

Marine Mammals

The latest available report covers the period 2002 – 2016, and shows fishery interactions with California sea lions, Steller sea lions, elephant seals, harbor seals, and Dall's porpoise (Jannot *et al*. 2018b). It suggests marine mammals are rarely taken incidentally in the US mid-water trawl Hake fishery with no observed mortality of any marine mammal in the midwater hake fishery since the last update of this report.

Habitat

There were no changes in 2017 to the US fishery that would affect habitat impacts.

Ecosystem

Section 1.4 of the 2013 Fishery Ecosystem Plan (FEP) outlines a reporting process wherein NOAA provides the Council with a yearly update on the state of the California Current Ecosystem (CCE), as derived from environmental, biological and socio-economic indicators. NOAA's California Current Integrated Ecosystem Assessment (CCIEA) team is responsible for this report. The highlights of the team's 5th report (PFMC 2018c), which covers 2017 is shown in the following box (directly excerpted from the CCIEA report):

- **Climate, oceanographic and streamflow indicators suggest that the physical system is transitioning toward average or even La Niña conditions, following the marine heat wave ("Blob") and major El Niño events of 2014-2016**
- **Several ecological indicators in 2017 also point toward more average conditions:**
  - The copepod community off Newport saw an increase in cool-water, lipid-rich species that are better for production of salmon
  - Some important forage species increased in the central and southern CCE
  - Sea lion pup growth at San Miguel Island was normal
  - There were no mass seabird mortality events
- **However, there was lingering evidence of unfavorable conditions in 2017:**
  - Persistent deep warm water remains in the northern portion of the system
  - Pyrosomes (warm-water salps) were extremely abundant in the northern and central CCE
  - Juvenile salmon catches were poor, and other indicators suggest that Chinook and coho salmon returns to the Columbia Basin will be below average in 2018
  - A major hypoxic event occurred on the shelf of the northern CCE in August-September
  - Reports of whale entanglements in fixed fishing gear were high for the fourth straight year; most reports involved crab gear, but some involved sablefish gear
- **For the first time, the report includes highly migratory species indicators, related to biomass, recruitment, and management of protected species bycatch**
- **Social vulnerability can now be compared with the dependence of coastal communities on commercial fishing and on recreational fishing**
- **We find some evidence of threshold relationships (between sea lions and upwelling), but no support yet for an "early warning index" of major ecosystem state changes**

Several changes in indicators tracked in the 2018 report were made on the basis of feedback on the 2016 and 2017 reports. These changes are summarized in Appendix C of

PFMC 2018a and demonstrate the responsiveness of science to management and stakeholder interests.

Canada

Retained species and bycatch

The Canadian Coastal hake fishery is also a targeted mid-water trawl fishery that generally has a very low catch rate of non-hake species. In 2017, this was 3.25% of the total catch, which is consistent with previous years. The highest single non-hake species caught in 2017 was Alaska pollock at 915 t, or just over 1% by weight. The catch of non-hake species taken by the Canadian fishery is presented in Appendix 4. No species meet the criteria for main retained or bycatch species. Specific updates pertaining to open conditions on rougheye rockfish, redstripe rockfish, and walleye pollock are given in the results section of this report. A detailed report of primary and secondary species, and rockfish of specific concern will be given in the full re-assessment report.

ETP Species

The following species are prohibited by the conditions of the groundfish trawl license: Pacific halibut, all salmon species, green and white sturgeon, Pacific herring, basking shark, tope shark, sixgill shark, wolf-eels and eulachon. Prohibited species cannot be retained and must be returned to the water from which caught, unharmed if possible (DF0 2017b).

Salmon

Incidental catch of salmonids in the 2017 fishery is summarized in Table 9.

Table 9. Incidental catch of salmonids in the offshore Canadian Pacific hake fishery for 2017.

Salmon species	Catch weight (released+landed; kg)
Chinook	6,383
Chum	1,354
Coho	342
Pink	72
Sockeye	105
Misc salmonids	54

A representative from the David Suzuki Foundation, Dr Scott Wallace, registered specific concerns about the status of several Chinook salmon stocks and the potential impact of fisheries, including the hake fishery. A full report of concerns raised is given in Appendix 2. Regarding Chinook salmon, Dr Wallace reported that there have recently been twelve new Fraser River Chinook stocks listed under the Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to be submitted to and considered by the Federal Minister of the Environment and Climate Change for potential listing under the Species At Risk Act (SARA), eight as endangered and four as threatened. None are listed under SARA to date. He noted that Chinook of Fraser River origin are known to occur as bycatch in both the US and Canadian hake fisheries. The assessment team will fully investigate these issues as part of the re-assessment process.

Eulachon
Incidental catch of eulachon is very low in the Canadian mid-water trawl hake fishery, accounting for just 8kg in total catch for 2017.

Pacific Halibut
Catch of Pacific halibut was approximately 3.6 t during 2017, which is a marked increase over 2016, however still quite low.

Pacific Herring
Incidental catch of Pacific herring is very low in the Canadian mid-water trawl hake fishery, accounting for 5.8 t in total catch for 2017, all of which was released as required.

Tope Shark
Catch of tope shark is very low in this fishery. Total catch was 184kg in 2017 (Appendix 4).

Other Species
11kg of green sturgeon and 45kg of basking shark were caught and released in the 2017 fishery. No white sturgeon, sixgill shark or wolf eel were recorded for the 2017 fishery.

Seabirds
Relatively few seabirds are taken in the Canadian mid-water trawl hake fishery.

Marine Mammals
Marine mammals are rarely taken incidentally in the Canadian mid-water trawl hake fishery, and none were recorded in 2017.

Habitat

Canada's Pacific groundfish trawl habitat agreement, an ecosystem approach to bottom trawl impacts in a precedent setting ecosystem-based management plan, continues to address the habitat impacts of bottom trawling in Canada's Pacific waters. This plan was developed through a negotiated agreement between the fishing industry and ENGOs in British Columbia and then brought to the regulator, the DFO, to implement through the Integrated Fisheries Management Plan (DFO 2017a). It is shown that measures implemented have resulted in an immediate change to fisher behavior and consequently reduced impacts to sensitive benthic habitat features such as coral and sponge complexes.

Ecosystem

The Strategic Program for Ecosystem-Based Research and Advice (SPERA) continues to support research projects and scientific tool development that support national priorities for managing ecosystems in our domestic waters (DFO 2017a). Projects address key issues, such as scientific guidance on the avoidance of benthic impacts; science support for mitigating by-catch and tools to help manage biological diversity in Canadian waters.

The SPERA funds projects by DFO researchers which:

1. Assess the ecosystem impacts of human activities;
2. Assess and report on ecosystems and
3. Develop tools to implement the ecosystem approach to management.

Ongoing research supported by SPERA during 2016 (DFO 2017a) includes:

- Understanding the impact of a changing climate on interactions between Pacific sardine and Pacific herring populations in British Columbia

- Rapid screening tool for marine fish based on the Australian Ecological Risk Assessment for the Effects of Fishing (ERAEF).

- Canada's Pacific groundfish trawl habitat agreement: A global first in an ecosystem approach to bottom trawl impacts.

- Future hypoxia in British Columbia. This project will provide graphs of oxygen concentration and use historical data to assess the relative contributions of the two regions to predict future oxygen concentration trends in BC.

- Evaluation of historical multivariate datasets to identify changes in biodiversity, species distribution, behaviour, abundance, and interaction in response to environmental forcing in a marine ecosystem.

Application of an Ecological Risk Assessment Framework for Oceans Management of Large Ocean Management Areas and Marine Protected Areas: Case study for the Pacific North Coast Integrated Management Area and Oceans Act Marine Protected Area of British Columbia.

2.5. Any developments or changes within the fishery which impact traceability or the ability to segregate between fish from the Unit of Certification (UoC) and fish from outside the UoC (non-certified fish)

No changes have occurred that affect the traceability of product from the fishery. The fishery monitoring system remains robust and well suited to confirming traceability.

2.6. Conditions

The client's responses to the conditions of certification were set out in the Client Action Plan (CAP). Progress associated with the actions set forth in the CAP was examined as a part of this surveillance audit. For each condition, the report sets out progress to date. This progress has been evaluated by MRAG Americas Audit Team (set out below as "Progress on Condition") against the commitments made in the CAP. This assessment includes a re-evaluation of the scoring allocated to the relevant Performance Indicators (PIs) in the original MSC assessment under "Status of Condition" in Table 10 below. Where the requirements of a condition are met, the PI is re-scored at 80 or more, and the condition is "closed". **For this surveillance, the remaining two open conditions (for the Canadian fishery; the US fishery had no conditions) were closed and PIs 2.1.3 and 2.2.3 were rescored (see Appendix 1. Rescoring** evaluation tables

Table 10. Summary of Assessment Conditions, Canadian Fishery

Condition number	Performance indicator (PI)	Status	PI original score	PI revised score
1	PI 2.1.3 b,d	Closed	75	85
2	PI 2.2.3 b,d	Closed	75	90

2.7. Recommendations

There were no recommendations.

3. Assessment Process

This audit followed the surveillance audit process as defined in the MSC Fishery Certification Requirements v2.0.

Information supplied by the clients and management agencies was reviewed by the assessment team ahead of the on-site meetings, and discussions with the clients and management agencies centered 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 meetings.

Thirty days prior to the surveillance audit, all stakeholders from the full assessment and previous surveillance audits were informed of the meeting and the opportunity to provide information to the auditors in advance of, or during, the meeting. As a result, we welcomed a request from a representative of the David Suzuki Foundation/Marine Conservation Caucus to meet with the team as part of the site visit. A summary of the meeting held is given in Appendix 2.

The MRAG Americas surveillance team received from the clients a list of relevant links to documents for P1, P2, and P3. The clients further provided a summary of the key information from those documents. The Public Certification Report used 2013 and 2014 data depending on availability. This surveillance uses data/information through 2018 (e.g., 2018 sock assessment), but reports management changes implemented through July 2017.

The MRAG Americas surveillance team carried out the following as part of this surveillance audit:

- Audited public claims made by the client regarding its certified status (including but not restricted to those made on printed material such as brochures).
- Reviewed any potential or actual changes in management systems.
- Reviewed any changes or additions/deletions to regulations.
- Reviewed any personnel changes in science, management or industry to evaluate impact on the management of the fishery.
- Reviewed any potential changes to the scientific base of information, including stock assessments.
- Evaluated progress against any conditions placed on the certificate, as well as for continued compliance with the *MSC's Principles and Criteria for Sustainable Fishing* as specified in the Public Certification Report.

The surveillance team has the responsibility, if it identifies an issue requiring further investigation, to:

- Report and record the existence of the issue, and/or
- Immediately conduct a limited assessment to determine if a full re-assessment of the fishery is warranted to continue the certification status, and/or
- Raise further conditions.

The surveillance audit was conducted on-site and by teleconference on 6, 7 and 10 December 2018.

Table 11. Attendees at the 4th audit and reassessment site visit in 2018.

Name	Affiliation
Amanda Stern-Pirlot	MRAG Americas, Assessment Team Leader
Max Stocker	Assessment Team

Susan Hanna	Assessment Team
Michelle McClure	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Sandy Parker-Stetter	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Ian Taylor	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Aaron Berger	NOAA, NMFS Northwest Fisheries Science Center, Seattle, WA
Jim Hastie	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Kellie Johnson	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Kristin Marshall	NOAA, NMFS Northwest Fisheries Science Center, Seattle WA
Greg Busch	NOAA Office of Law Enforcement, Seattle WA
Ann Bussell	DFO Enforcement, Vancouver BC
John Holmes	DFO Pacific Biological Station, Nanaimo BC
Greg Workman	DFO Pacific Biological Station, Nanaimo BC
Andrew Edwards	DFO Pacific Biological Station, Nanaimo BC
Chris Grandin	DFO Pacific Biological Station, Nanaimo BC
Sean Cox	Simon Fraser University, Burnaby BC
Scott Wallace	David Suzuki Foundation, Vancouver BC
Robert Tadey	DFO Fisheries Management, Vancouver BC
Paul Ryall	DFO Fisheries Management, Vancouver BC
Shannon Mann	Association of Pacific Hake Fishermen, Vancouver BC
Bruce Turris	Canadian Groundfish Research and Conservation Society, Vancouver BC
Jan Jacobs	Pacific Whiting Conservation Cooperative, Seattle WA
Dan Waldeck	Pacific Whiting Conservation Cooperative, Portland, OR
Yelena Nowak	Oregon Trawl Commission, Brookings OR
Mike Luchino	Trident Seafoods, Seattle WA
Barron Carswell	BC Ministry of Agriculture, Victoria BC
Kevin Romanin	BC Ministry of Agriculture, Victoria BC
Micheal Turner	BC Ministry of Agriculture, Victoria BC
Corey Niles	Washington Department of Fish and Wildlife
Jessi Doerpinghaus	Washington Department of Fish and Wildlife

Table 12. Consultation Meetings during the 4th Surveillance of the Pacific Hake US-Canada Pacific Hake Fishery.

Organization	Present at Meeting	Meeting Type	Date/Time
Client Opening Meeting	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Dan Waldeck, Jan Jacobs, Yelena Nowak, Shannon Mann, Bruce Turris	Trident Seafoods, Seattle WA and conference call	6 Dec. 2018; 8:00 am
NOAA NMFS NWFSC	Amanda Stern-Pirlot, Max Stocker (by phone), Susan Hanna (by phone), Michelle McClure (by phone), Sandy Parker-Stetter, Jim Hastie, Kellie Johnson, Ian Taylor, Aaron Berger (by phone), Kirsten Marshall (by phone) Mike Luchino, Cassandra Donovan, Owen Hamel, Dan Waldeck	Trident Seafoods, Seattle WA	6 Dec. 2018; 8:30 am
BC Ministry of Agriculture	Amanda Stern-Pirlot (by phone), Max Stocker, Susan Hanna (by phone), Barron	Pacific Biological Station, Nanaimo BC	6 Dec. 2018; 1:00 pm

	Carswell, Michael Turner (by phone), Kevin Romanin (by phone)		
DFO Science	Amanda Stern-Pirlot (by phone), Max Stocker, Susan Hanna (by phone), John Holmes, Greg Workman (by phone), Andrew Edwards, Chris Grandin, Sean Cox (by phone)	Pacific Biological Station, Nanaimo BC	6 Dec. 2018; 2:00 pm
David Suzuki Foundation	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Scott Wallace	Conference call	6 Dec. 2018; 3:30 pm
DFO and NMFS Fisheries Enforcement	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Ann Bussell, Greg Busch	Conference call	7 Dec. 2018; 10:30 am
NOAA NMFS Fisheries Management	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Frank Lockhart	Conference call	7 Dec. 2018; 11:15 am
WDFW/PFMC	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Corey Niles, Jessi Doerpinghaus	Conference call	7 Dec. 2018; 1:00 pm
Client Closing Meeting	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Dan Waldeck, Jan Jacobs, Mike Luchino, Yelena Novak, Shannon Mann, Bruce Turris	Trident Seafoods, Seattle, WA and Conference call	7 Dec. 2018; 2:30 pm
DFO Fisheries Management	Amanda Stern-Pirlot, Max Stocker, Susan Hanna, Paul Ryall, Robert Tadey	Conference call	10 Dec. 2018; 9:30 am

Standards and Guidelines used:
MSC Certification Requirements version 2.0 (for process requirements)
MSC Certification Requirements version 1.3 (for performance requirements, including assessment tree)
Guidance to the MSC Certification Requirements version 2.0 (for process requirements)
Guidance to the MSC Certification Requirements version 1.3 (for performance requirements, including assessment tree)
MSC Surveillance Reporting Template version 1.0

4. Results

The U.S. Fishery

There were no conditions of certification for the U.S. fisheries. The clients continued, however, to develop their cooperative approach with managers, regulators, and other stakeholders to minimize bycatch, assess habitat effects, and improve management efficiency.

The Canadian Fishery

There were two conditions on the Canadian Hake fishery open at the start of this 4th surveillance audit. Progress in Year 4 has been laid out in Table 13 and Table 14, below. Both conditions are considered to be closed as of this audit. Rescoring of the respective indicators is given in Appendix I.

Table 13 Condition 1 - Canada

Performance Indicator	2.1.3 b Information is **sufficient** to estimate outcome status with respect to biologically based limits. 2.1.3 d Sufficient data continue to be collected to detect any **increase in risk level** to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)
Score	75
Rationale	DFO has a wide amount of information on fishing catch, effort, and mortality for many species suitable for assessment, as demonstrated by Bocaccio; however, acceptable assessments for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock have not been completed to determine biological reference points and status relative to reference points. It is not clear that all main species have sufficient biological parameters available for an assessment. Because acceptable assessments for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock have not been completed to determine biological reference points, it would be difficult to detect an increase in risk level other than anecdotally from fishery performance.
Condition	By the fourth year, the fishery client shall demonstrate that information is sufficient to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock and that sufficient data continue to be collected to detect any increase in risk level to Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock
Milestones	At the end of the first year, the client shall provide a plan that will achieve the condition by end of the fourth year. At the end of the second and third years, the client shall provide evidence that achieving the condition will occur by the end of the fourth year. At the end of the fourth year, the client shall provide evidence that information is sufficient to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock and that sufficient data continue to be collected to detect any increase in risk level to these species
Client action plan	There are two very similar conditions covering 4 species caught in association with Pacific hake in Canadian waters. The following action plan is in response to both conditions.

	The Canadian Client will work collaboratively with DFO to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish, Redstripe Rockfish, Rougheye Rockfish, and Walleye Pollock and to assure that sufficient data continue to be collected to detect any increase in risk level to these species. The Client will report on the progress of this work annually, and will provide evidence by the fourth surveillance audit that information exists to show if these species are within biological limits and that risk levels are monitored. This work will encompass the following action items: • annually collect valuable data on Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish through established and ongoing research surveys, bio-sampling programs, and catch monitoring programs; • undertake data analysis to assess data accuracy, completeness and representativeness in support of aging and assessment requirements; • undertake a science review of appropriate assessment methodology for groundfish species, including Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish; • through established DFO processes, consult with stakeholders on assessment requirements for groundfish, including Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish, and identify workplan and human and financial resource requirements; • undertake peer reviewed stock assessments for Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish through DFO's established CSAP (Center for Scientific Advice Pacific).
Progress on Condition [Year 1]	The client action plan is being fully implemented and this condition is being addressed. The first milestone has been met, as described below: Collection of data on groundfish species continues through the established catch monitoring programs for the commercial groundfish fisheries. Additionally, data is collected thru the various regular research surveys conducted by DFO and/or in conjunction with the industry (e.g., Annual Groundfish Trawl Synoptic Survey, IPHC setline survey, and other DFO research cruises). DFO has a regular and ongoing commitment to the undertaking of data analysis to assess data accuracy, completeness and representativeness in support of aging and assessment requirements. Already a pre-assessment evaluation has been undertaken for both Pollock and Redstripe to advise what needs to be done (surveys, data collection, ageing) in preparation for a successful assessment. An acceptable assessment has been completed and peer reviewed for Yellowtail, so it is now possible to assess risk levels. Information is now sufficient to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish. Furthermore sufficient data continue to be collected and could detect any increase in risk level to Yellowtail. Yellowtail catches are within biological limits, risk levels are monitored, it is a quota fishery with 100% at sea and dockside monitoring and as such, the client suggests this condition for Yellowtail has been met. DFO also continues to undertake a science review of appropriate assessment methodology for groundfish species including Walleye Pollock and Redstripe Rockfish and for such data deficient species, (like Walleye Pollock) work on a "Tiered Approach" is currently underway and scheduled for completion in the fall of 2016. The Tiered Approach will synthesise the most applicable approaches, methods, and tools into a framework for BC groundfish that will provide guidance on how stock assessments for different groundfish can be completed, given the varying amounts and types of data available for different stocks. It is

	intended to enable more efficient completion of assessments, support more successful completion of assessments for some of the species that are data limited, and assist in development of a better picture of the ecosystem state and health. The development of a tiered approach will draw on approaches that have been developed in Alaska and Australia for similar purposes. The Canadian Groundfish Industry, through the established processes like the Groundfish Industry Advisory Board and the Groundfish Trawl Advisory Committee, has reviewed the groundfish assessment schedule. They have shown their support for and have recommended to DFO that it ensures Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish are assessed by 2018 to ensure these conditions can be closed as per the Action Plan agreed to. All three species are scheduled for assessment through the DFO - CSAS process. The timelines for the each assessment are: • Walleye Pollock: Assessment was originally scheduled for 2014 but was deferred due to a lack of data and analytical resources, no index, limited biological data, and CPUE is unreliable as it is a targeted midwater fishery. The current approach is to assess Walleye Pollock as part of the "Tiered Approach" which will define options for providing harvest advice for data deficient species. Work on the "Tiered Approach" is underway (2015) and is scheduled for review by CSAS in the fall of 2016. • Rougheye Rockfish: Assessment is scheduled for delivery in 2017 • Redstripe Rockfish: Assessment is scheduled for delivery in 2018
Progress on Condition [Year 2]	The client action plan is being fully implemented and this condition is being addressed. The first milestone has been met, as described in the 2015 submission covering 2014: An acceptable assessment has been completed and peer reviewed for Yellowtail, so it is now possible to assess risk levels. Information is now sufficient to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish. Furthermore sufficient data continue to be collected and could detect any increase in risk level to Yellowtail. Yellowtail catches are within biological limits, risk levels are monitored, it is a quota fishery with 100% at sea and dockside monitoring and as such, **the assessment team agrees that this condition for Yellowtail has been met.** The second milestone has also been met. As outlined in the 2015 Client Submission, DFO is working on a Tiered Approach and the Pacific Biological Station (PBS) developed a project initiation document for the Tiered approach last spring. The intent was to put groundfish species into tiers based on their available data, then using closed loop simulation to evaluate the performance of a variety of assessment tools given their available data. A single approach for each tier will be settled upon, and then developed as quickly as possible with automating some of the simpler approaches, if possible. A literature review of tiered approaches used in other jurisdictions was assembled from Europe, Alaska, and Australia. A data score card was developed that would require expert judgement to determine which data were most relevant, and a provisional tiering tree was also developed that looked quite similar to the ICES tiering model. In May of 2016, PBS held a workshop and reviewed the available literature, data score card and provisional tiering tree. A presentation from Dr. Tom Carruthers was heard presenting his DLMTool software package, which appears to have potential to help select assessment approaches for data poor species and generate provisional harvest recommendations using closed loop feedback simulation. Following the meeting, PBS agreed to assess use of the DLMTool for low tier species. Proceedings from the workshop are available on the CSAS website at URL: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/Pro-Cr/2016/2016_051-eng.html.

	With regards to developments specific to the other two species under condition, Walleye Pollock is currently being assessed by Paul Star and Rowan Haigh, and should be reviewed in May 2017. Aging work is underway for Redstripe Rockfish, with the goal of conducting a formal assessment in 2017/18.
Progress on Condition [Year 3]	With regards to developments specific to the other two species under condition (besides Yelloweye rockfish which was closed after the first audit), Walleye Pollock is currently being assessed by Paul Star and Rowan Haigh, and should be reviewed in May 2017. A delayed difference production model was used that incorporated data from fishery-independent surveys, a CPUE series derived from commercial catch rates, and an annual mean weight series derived from unsorted commercial catch samples. Three publications are expected to be publicly available; a proceedings document, a Science Advisory Report (SAR) and the research document. The SAR will be available in the spring of 2018 followed by the proceedings document and a final version of the research document. Significant work toward the development of a catch at age assessment model for Redstripe has already been completed. This includes development of catch reconstructions, a growth function and mean weight analysis. The Redstripe model is expected to be reviewed at CSAP in 2018.
Progress on Condition [Year 4]	<u>Walleye Pollock:</u> A stock assessment for walleye pollock was completed and reviewed in the November 2017 CSAS cycle. Information in this stock assessment (covering two stocks; BC North and BC South) sufficient to estimate outcome status with respect to biologically based limits for both stocks as is required by PI 2.1.3 Sib and thus **the 80 SG is now met for this scoring issue for walleye pollock**. For the BC North stock, the probability that the 2018 stock biomass is greater than the LRP is 90% and the probability that it is above the Bmsy proxy of 2xLRP is 43%. For the BC South stock the probability that B2018 is greater than the LRP is 99% and the probability that it is above 2xLRP is 95%. With the stock assessment completed, peer reviewed, and the current catches supported therein, combined with future work identified and ongoing multispecies surveys, it can be concluded that sufficient data continue to be collected to detect any increase in risk level to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy; as required by PI2.1.3 SId). Therefore **the SG80 is met for this scoring issue for walleye pollock**. The assessment team also wishes to note that although the catch of this species is the largest of any non-hake incidental catches in the fishery, it still only comprises roughly 1% of the total catch and as such, does not meet the threshold as a main species and will not be considered as one in the reassessment report. <u>Redstripe Rockfish</u> A stock assessment for Redstripe rockfish was completed and reviewed as part of the 2018 CSAS cycle (DFO 2018a). The following is a summary excerpted from this document: • Two stocks of Redstripe Rockfish were identified along the British Columbia (BC) coast based on observable, consistent differences in mean length and growth models between the areas. The two stocks are called BC North (or BCN) in Pacific Marine Fisheries Commission (PMFC) 5DE and BC South (or BCS) in PMFC 3CD5ABC. • Both Redstripe Rockfish stocks were assessed using a single fishery, annual two-sex catch-at-age model, implemented in a Bayesian framework to quantify uncertainty of estimated quantities.. • The median (and 5 and 95 percentiles of the Bayesian results) female

	spawning biomass at the beginning of 2018 (B2018) is estimated to be 0.91 (0.69-1.13) of unfished female spawning biomass (B0) in BCN and 0.62 (0.47-0.81) of B0 in BCS. Also, B2018 is estimated to be 3.16 (2.02-4.00) of the equilibrium spawning biomass at maximum sustainable yield, BMSY, in BCN and 2.43 (1.51-3.79) of BMSY in BCS. • At current catch levels, there is an estimated probability of >0.99 that both B2018 > 0.4BMSYand B2018 > 0.8BMSY for both stocks (i.e. of being in the healthy zone). The probability that the exploitation rate in 2017 was below that associated with MSY is also >0.99 for both stocks • Advice to management is presented in the form of decision tables using the provisional reference points from the Fisheries and Oceans Canada Sustainable Fisheries Framework (SFF) Precautionary Approach. The decision tables provide five-year projections across a range of constant catches. • The appropriateness of the MSY based reference points for long lived low productivity species is uncertain, consequently advice to management relative to reference points based on 0.4 and 0.2 of B0 (unfished spawning biomass) is also presented as an alternative option. • It is recommended that the next assessment occur in 2023, with three new indices available from each of the four biennial synoptic trawl surveys and five additional years of ageing and catch data. No appropriate indicators for this stock are recommended that would trigger an assessment earlier than scheduled. Advice for the interim years is explicitly included in the decision tables. • Recommended future work includes the investigation of alternate reference points due to the sensitivity of BMSY based reference points to assumptions about model parameters and functions, including: catchability (q), natural mortality (M), recruitment variability (σR), and commercial and survey selectivities. It is also recommended that future assessors review the informative priors used in this stock assessment and investigate alternatives with the intent of developing more appropriate priors. On the basis of the above, it can be concluded that information is **sufficient** to estimate outcome status with respect to biologically based limits for Redstripe rockfish, and sufficient data continue to be collected to detect any **increase in risk level** to Redstripe rockfish (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy). As a result, **the SG80 is met and the condition is closed for Redstripe rockfish.** The assessment team also wishes to note that although redstripe rockfish is a more vulnerable species according to its life history, it still only comprises roughly 0.22% of the total catch in this fishery and as such, does not meet the threshold as a main species and will not be considered as one in the reassessment report.
Status of Condition	As of the 4th surveillance audit, this condition is **closed** and PI 2.1.3 has been rescored in Appendix I.

Status of the Condition and milestones:

Table 14 Condition 2 - Canada

Performance Indicator	2.2.3 b Information is **sufficient** to estimate outcome status with respect to biologically based limits. 2.2.3 d Sufficient data continue to be collected to detect any **increase in risk level** to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)
Score	75

Rationale	DFO has a wide amount of information on fishing catch, effort, and mortality for many species suitable for assessment, as demonstrated by Bocaccio; however, an acceptable assessment for Rougheye Rockfish not been completed to determine biological reference points and status relative to reference points. It is not clear that this species has sufficient biological parameters available for an assessment. Because an acceptable assessment for Rougheye Rockfish has not been completed to determine biological reference points, it would be difficult to detect an increase in risk level other than anecdotally from fishery performance.
Condition	By the fourth year, the fishery client shall demonstrate that information is sufficient to estimate outcome status with respect to biologically based limits for Rougheye Rockfish and that sufficient data continue to be collected to detect any increase in risk level to this species.
Milestones	At the end of the first year, the client shall provide a plan that will achieve the condition by end of the fourth year. At the end of the second and third years, the client shall provide evidence that achieving the condition will occur by the end of the fourth year. At the end of the fourth year, the client shall provide evidence that information is sufficient to estimate outcome status with respect to biologically based limits for Rougheye Rockfish and that sufficient data continue to be collected to detect any increase in risk level to this species.
Client action plan	There are two very similar conditions covering 4 species caught in association with Pacific hake in Canadian waters. The following action plan is in response to both conditions. • The Canadian Client will work collaboratively with DFO to estimate outcome status with respect to biologically based limits for Yellowtail Rockfish, Redstripe Rockfish, Rougheye Rockfish, and Walleye Pollock and to assure that sufficient data continue to be collected to detect any increase in risk level to these species. The Client will report on the progress of this work annually, and will provide evidence by the fourth surveillance audit that information exists to show if these species are within biological limits and that risk levels are monitored. annually collect valuable data on Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish through established and ongoing research surveys, bio-sampling programs, and catch monitoring programs; • undertake data analysis to assess data accuracy, completeness and representativeness in support of aging and assessment requirements; • undertake a science review of appropriate assessment methodology for groundfish species, including Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish; • through established DFO processes, consult with stakeholders on assessment requirements for groundfish, including Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish, and identify workplan and human and financial resource requirements; • undertake peer reviewed stock assessments for Yellowtail Rockfish, Walleye Pollock, Rougheye Rockfish and Redstripe Rockfish through DFO's established CSAP (Center for Scientific Advice Pacific).
Progress on	The client action plan is being fully implemented and this condition is being

condition [Year 1]	addressed. The first milestone has been met, as described below: Collection of data on groundfish species continues through the established catch monitoring programs for the commercial groundfish fisheries, as described above relative to Condition 1. DFO also continues to undertake a science review of appropriate assessment methodology for groundfish species including Rougheye Rockfish. The Canadian Groundfish Industry, through the established processes like the Groundfish Industry Advisory Board and the Groundfish Trawl Advisory Committee, has reviewed the groundfish assessment schedule. The industries have shown their support for and have recommended to DFO that it ensures Rougheye Rockfish are assessed by 2018 to ensure this condition can be closed as per the Action Plan agreed to. Rougheye Rockfish are scheduled for assessment through the DFO - CSAS process. The Rougheye Rockfish assessment is scheduled for delivery in 2017.
Progress on condition [Year 2]	The client action plan is being fully implemented and this condition is being addressed. The first milestone has been met, as described in the 2015 submission covering 2014. The second milestone has also been met, as described below: Collection of data on groundfish species continues through the established catch monitoring programs for the commercial groundfish fisheries, as described above relative to Condition 1. DFO also continues to undertake a science review of appropriate assessment methodology for groundfish species including Rougheye Rockfish. PBS has entered in to a contract to have Dr. Tom Carruthers put two of the COSEWIC species put through his DLMtool software to evaluate alternative assessment approaches for these data poor COSEWIC species (Canary/Rougheye) and develop performance metrics within DLMTool that are consistent with COSEWIC's criteria. Similarly, using partnership funds, PBS has an agreement with UBC to have Dr. Carruthers build a customized version of DLMTool, which can be used to develop harvest strategies and advice for a suite of data poor groundfish species. This list includes Rougheye Rockfish, Shortraker Rockfish, Widow Rockfish, and several others, for which they have no advice and there is little prospect of performing a formal assessment in the near term. A Pre-COSEWIC assessment (review of available information) for Rougheye Rockfish types I and II is being put together by staff at PBS for review by the Marine Fish Species Specialist Subcommittee of COSEWIC in 2017. They have been collecting and processing tissue samples since 2010 for DNA analysis to differentiate the two species of Rougheye (Blackspotted Rockfish and Rougheye Rockfish (RE/BS)). A synopsis of those results will be included in the Pre-COSWIC report along with updated catch and biological data. They state it will not be possible to conduct a formal assessment for RE/BS until the catches, biology and distribution of each species is sorted. Samples are collected for DNA during surveys, as sampling aboard commercial vessels is of the aggregate (observers are not sorting the two species as it is very difficult to tell them apart).
Progress on condition [Year 3]	The client action plan is being fully implemented and this condition is being addressed. The first milestone has been met, as described in the 2015 submission covering 2014. The second milestone (for 2015 and 2016) has also been met, as described below: Collection of data on groundfish species continues through the established

	catch monitoring programs for the commercial groundfish fisheries, as described above relative to Condition 1. The Canadian Groundfish Industry, through the established processes like the Groundfish Industry Advisory Board and the Groundfish Trawl Advisory Committee, has reviewed the groundfish assessment schedule. The industries have shown their support for and have recommended to DFO that it ensures Rougheye Rockfish are assessed by 2018 to ensure this condition can be closed as per the Action Plan agreed to. Rougheye Rockfish are scheduled for assessment through the DFO - CSAS process. The Rougheye Rockfish assessment is scheduled for delivery in 2017.
Progress on condition [Year 4]	The assessment team received an update on the status of the Rougheye Rockfish type I/II stock assessment from DFO in October of 2018 (DFO 2018b). The following progress was reported (direct excerpt in grey): A draft assessment of the Black-spotted/Rougheye rockfish complex has been done and a presentation of the draft results was made to the Technical Working Group in September 2018. Upon review of the draft, the Technical Working Group provided direction on components of the assessment. Specifically, • the addition of existing synoptic survey data to increase observations, and improve depth and spatial coverage; • revising the size-at-age analysis to reconcile anomalies between combined and species-specific analysis; and, • the choice of age composition data to include because fitting the model to length data alone may lead to bias due to differing growth rates between Rougheye type I and type II. The Technical Working Group was is scheduled to meet again with the analysts in December 2018 to review progress on this additional work and review the changes, model fit and performance, with the intention of scheduling a formal DFO CSAS peer review in mid 2019. This Technical Working Group meeting has occurred as planned. Once the science advice has been peer- reviewed it is considered at DFO fisheries management advisory processes which meet regularly throughout the year. Fisheries managers and stakeholders consider the science advice received at these meetings and management changes are made, if needed. Fisheries and Oceans Canada strives to align processes for delivery of science advice and implementation of management measures. This however does not preclude the implementation of interim advice or in-season management measures when deemed necessary. For example, science advice on the Yelloweye Rockfish (Outside population) was received in September 2015 and, as a result, a rebuilding plan was implemented for the 2016 season. There have also been cases where, based on the advice received, in-season changes have been made (e.g. Pacific cod). This history of implementation of in-season management measures where necessary enables the assessment team to be confident that if the results of the science advice show any issue with this stock complex, management can act immediately while formal regulations are finalized. In reviewing the catch composition in the hake fishery over the past five years, the assessment team noted that the proportion of rougheye rockfish in the catch is very low (0.03% in 2017), and as such no longer qualifies as a main bycatch species in this fishery. With the progress made toward a stock assessment and

	with evidence of swift management action when issues are found, and in light of the fact that this is no longer a main bycatch species, the assessment team considers this condition closed. The PI has been rescored in Appendix I. However, the team wishes to note that due to it's vulnerable life history and lack of updated stock assessment, the rougheye rockfish complex is now listed as "special concern" under the Canadian Species At Risk Act (SARA), and as such should be considered under the ETP component of the assessment and will be considered as such in the full reassessment currently underway.
Status of Condition	As of the 4th surveillance audit, this condition is **closed** and PI 2.2.3 has been rescored in Appendix I.

5. Conclusion

MRAG Americas confirms that the West Coast Mid-Water Trawl Fishery for Pacific Hake remains certified following the completion of this surveillance. The two conditions open at the beginning of this 4th audit have now been closed and the respective Performance Indicators rescored in Appendix I. The fishery is concurrently undergoing full reassessment, therefore there is no surveillance schedule yet available for the coming years.

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Appendices

Appendix 1. Rescoring evaluation tables

PIs 2.1.3 and 2.2.3 have been rescored for the Canadian fishery as a result of this surveillance audit. The updated rationales and scores are given below with additions in red and deletions in ~~strikethrough~~.

Evaluation Table: PI 2.1.3

PI 2.1.3		**Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Yes	Yes	US: Yes Can: No
	Justification	US SG60 – see SG100 SG80 – see SG100 SG100 – the U.S. maintains 100% observer coverage on at-sea processor and catcher-processor Hake vessels and 100% dockside monitoring of shore plants (PFMC 2011f). The U. S. had a wide amount of high quality information on fishing catch, effort, and mortality, and biological parameters with which to determine consequences for affected (and more) populations. The populations without sufficient information are affected to a minor degree by the Hake fishery. See Sections 3.4.2 and 3.5.11 for details. Canada SG60 – see SG80 SG80 – Canada maintains 100% at sea monitoring via either observer or electronic monitoring and 100% dockside monitoring of shore plants (DFO 2013b). All retained catch is accurately determined to species. DFO has a wide amount of high quality information on fishing catch, effort, and mortality, and biological parameters for many species but it is unclear how well DFO can determine consequences for affected populations. Most populations of minor retained species without sufficient information are affected to a minor degree by the Hake fishery. See Sections 3.4.2 and 3.5.11 for details.		
b	**Guidepost**	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Yes	US: Yes Can: ~~Partial~~ Yes	US: Yes Can: No

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	Justification	U.S. SG60 – see SG100 SG80 – see SG100 SG100 – The U.S. maintains 100% observer coverage on all trawl, including Hake, vessels (PFMC. 2011f). The PFMC documents the key information in The Stock Assessment and Fishery Evaluation (SAFE) documents, Stock Assessment Review (STAR) panel reports (PFMC 2014a) and PFMC and NMFS 2013. See Section 3.5.11 for details. Resulting data are used, or will be used, by scientists in the respective countries to quantitatively estimate outcome status of retained species with a high degree of certainty for affected populations. Canada SG60 – See SG80 SG80 – Outcome status for non-assessed stocks are estimated based on average catch history, trends in survey results, and expert opinion. 100% on board observer coverage and fish tickets account for all catch. If data indicate any resource concerns management mechanisms are in place to address them (DFO 2113b). Canada maintains 100% at sea coverage on Hake vessels. Canadian monitoring data are evaluated through the annual IFMP process (DFO 2013b). DFO has a wide amount of information on fishing catch, effort, and mortality for many species suitable for assessment, as demonstrated by Bocaccio. ~~however, acceptable assessments for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock have not been completed to determine biological reference points and status relative to reference points. It is not clear that all main species have sufficient biological parameters available for an assessment.~~ Walleye Pollock: A stock assessment for walleye pollock was completed and reviewed in the November 2017 CSAS cycle. Information in this stock assessment (covering two stocks; BC North and BC South) sufficient to estimate outcome status with respect to biologically based limits for both stocks as is required by PI 2.1.3 Sib and thus the 80 SG is now met for this scoring issue for walleye pollock. For the BC North stock, the probability that the 2018 stock biomass is greater than the LRP is 90% and the probability that it is above the Bmsy proxy of 2xLRP is 43%. For the BC South stock the probability that B2018 is greater than the LRP is 99% and the probability that it is above 2xLRP is 95%. Redstripe Rockfish A stock assessment for Redstripe rockfish was completed and reviewed as part of the 2018 CSAS cycle (DFO 2018). The following is a summary excerpted from this document: • Two stocks of Redstripe Rockfish were identified along the British Columbia (BC) coast based on observable, consistent differences in mean length and growth models between the areas. The two stocks are called BC North (or BCN) in Pacific Marine Fisheries Commission (PMFC) 5DE and BC South (or BCS) in PMFC 3CD5ABC. • Both Redstripe Rockfish stocks were assessed using a single fishery, annual two-sex catch-at-age model, implemented in a Bayesian framework to quantify uncertainty of estimated quantities.

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
		• The median (and 5 and 95 percentiles of the Bayesian results) female spawning biomass at the beginning of 2018 (B2018) is estimated to be 0.91 (0.69-1.13) of unfished female spawning biomass (B0) in BCN and 0.62 (0.47-0.81) of B0 in BCS. Also, B2018 is estimated to be 3.16 (2.02-4.00) of the equilibrium spawning biomass at maximum sustainable yield, BMSY, in BCN and 2.43 (1.51-3.79) of BMSY in BCS. • At current catch levels, there is an estimated probability of >0.99 that both B2018 > 0.4BMSYand B2018 > 0.8BMSY for both stocks (i.e. of being in the healthy zone). The probability that the exploitation rate in 2017 was below that associated with MSY is also >0.99 for both stocks • Advice to management is presented in the form of decision tables using the provisional reference points from the Fisheries and Oceans Canada Sustainable Fisheries Framework (SFF) Precautionary Approach. The decision tables provide five-year projections across a range of constant catches. • The appropriateness of the MSY based reference points for long lived low productivity species is uncertain, consequently advice to management relative to reference points based on 0.4 and 0.2 of B0 (unfished spawning biomass) is also presented as an alternative option. • It is recommended that the next assessment occur in 2023, with three new indices available from each of the four biennial synoptic trawl surveys and five additional years of ageing and catch data. No appropriate indicators for this stock are recommended that would trigger an assessment earlier than scheduled. Advice for the interim years is explicitly included in the decision tables. • Recommended future work includes the investigation of alternate reference points due to the sensitivity of BMSY based reference points to assumptions about model parameters and functions, including: catchability (q), natural mortality (M), recruitment variability (σR), and commercial and survey selectivities. It is also recommended that future assessors review the informative priors used in this stock assessment and investigate alternatives with the intent of developing more appropriate priors. On the basis of the above, it can be concluded that information is sufficient to estimate outcome status with respect to biologically based limits for Redstripe rockfish. As a result, the SG80 is met. The assessment team also wishes to note that although redstripe rockfish is a more vulnerable species according to its life history, it still only comprises roughly 0.22% of the total catch in this fishery and as such, does not meet the threshold as a main species and will not be considered as one in the reassessment report.		
c	Guidepost	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Yes	Yes	US: Yes Can: ~~No~~ Yes

PI 2.1.3		**Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species**		
	Justification	U.S. SG60 – see SG100 SG80 – see SG100 SG100 – The U.S. maintains 100% observer coverage on Hake vessels and 100% monitoring of shore side processors (PFMC. 2011f). Fishery monitoring demonstrates that fishermen comply with regulations. Assessments show the status of most species. Therefore, Information is adequate to support a strategy to manage affected populations, and evaluate with a high degree of certainty whether the strategy is achieving its objective. See Sections 3.4.2 and 3.5.11 for details. Canada SG60 – see SG100 SG80—see SG100 SG100 –Canada maintains 100% at sea coverage on Hake vessels and 100% monitoring of shore side processors (DFO 2013b). Fishery monitoring demonstrates that fishermen comply with regulations. Assessments show the status of many species. ~~Because acceptable assessments for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock have not been completed to determine biological reference points, there is not a high degree of certainty whether the strategy is achieving its objective.~~ Assessments show the status of most species. Therefore, Information is adequate to support a strategy to manage affected populations, and evaluate with a high degree of certainty whether the strategy is achieving its objective.		
d	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess on-going mortalities to all retained species.
	Met?		US: Yes Can: Yes ~~Partial~~	US: Yes Can: No

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	Justification	U.S. SG60 – NA SG80 – see SG100 SG100 – The US maintain 100% observer coverage on Hake vessels and assessments demonstrate stock status such that changes in risk are evident. See Sections 3.4.2 and 3.5.11 for details. As a result, monitoring of retained species is conducted in sufficient detail to assess on-going mortalities to all retained species. Canada SG60 – NA SG80 – Canada maintains 100% at sea coverage on Hake vessels and for those species with assessments, demonstrates stock status such that changes in risk are evident for those species. ~~Because acceptable assessments for Yellowtail Rockfish, Redstripe Rockfish, and Walleye Pollock have not been completed to determine biological reference points, it would be difficult to detect an increase in risk level other than anecdotally from fishery performance.~~ Walleye pollock With the stock assessment completed, peer reviewed, and the current catches supported therein, combined with future work identified and ongoing multispecies surveys, it can be concluded that sufficient data continue to be collected to detect any increase in risk level to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy; as required by PI2.1.3 SId). Therefore the SG80 is met for this scoring issue for walleye pollock. The assessment team also wishes to note that although the catch of this species is the largest of any non-hake incidental catches in the fishery, it still only comprises roughly 1% of the total catch and as such, does not meet the threshold as a main species and will not be considered as one in the reassessment report. Redstripe Rockfish A stock assessment for Redstripe rockfish was completed and reviewed as part of the 2018 CSAS cycle (DFO 2018).Importantly for this scoring issue: • It is recommended that the next assessment occur in 2023, with three new indices available from each of the four biennial synoptic trawl surveys and five additional years of ageing and catch data. No appropriate indicators for this stock are recommended that would trigger an assessment earlier than scheduled. Advice for the interim years is explicitly included in the decision tables. • Recommended future work includes the investigation of alternate reference points due to the sensitivity of BMSY based reference points to assumptions about model parameters and functions, including: catchability (q), natural mortality (M), recruitment variability (σR), and commercial and survey selectivities. It is also recommended that future assessors review the informative priors used in this stock assessment and investigate alternatives with the intent of developing more appropriate priors. As such, sufficient data continue to be collected to detect any increase in risk level to Redstripe rockfish (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy), and the SG80 is met for this scoring issue. SG100 – NA

PI 2.1.3	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
References	DFO 2013b; PFMC. 2011f; PFMC 2014a; DFO 2017a; DFO 2018a
OVERALL PERFORMANCE INDICATOR SCORE: The U.S. fishery meet all SG 60, SG 80, and SG 100 issues, so a score of 100 is given. The Canadian fishery meets scoring issues a, b, c and d of the SG 80 ~~and partially met scoring issues b and d of the SG80 so a score of 75 is warranted~~	U.S. 100 Can ~~75~~ 85
CONDITION NUMBER	~~1~~

Evaluation Table: PI 2.2.3

PI 2.2.3		Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main bycatch species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.	Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.
	Met?	Yes	Yes	Yes
	Justification	Both countries SG60 – See SG 100 SG80 – See SG 100 SG100- Both countries maintain 100% observer coverage on Hake vessels and 100% dockside monitoring (Al-Humadhi *et al.* 2012, 2012a, Bellman, *et al.* 2013, DFO 2013b, PFMC. 2011f) that provide a wide amount of high quality information on fishing catch, effort, and mortality. See Section 3.5.11 for details. For the many minor bycatch species the catch in the hake fisheries are insignificant.		
b	**Guidepost**	Information is adequate to broadly understand outcome status with respect to biologically based limits	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.
	Met?	Yes	US: Yes Canada: ~~No~~ Yes	No

PI 2.2.3		**Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch**
		US SG60 – See SG 80 SG80 –Both countries maintain 100% at sea coverage on Hake vessels. See Section 3.5.11 for details. Resulting data are used by scientists in the respective countries to quantitatively estimate outcome status of most, but not every bycatch species with a high degree of certainty (DFO 2013b, PFMC. 2011f). Canada SG60-See SG 80 SG 80 – There are no main bycatch species in this fishery. Outcome status for non-assessed stocks are estimated based on average catch history, trends in survey results, and expert opinion. 100% on board observer coverage and fish tickets account for all catch. If data indicate any resource concerns management mechanisms are in place to address them (DFO 2113b). Canada maintains 100% at sea coverage on Hake vessels. Canadian monitoring data are evaluated through the annual IFMP process (DFO 2013b). DFO has a wide amount of information on fishing catch, effort, and mortality for many species suitable for assessment, as demonstrated by Bocaccio.; ~~however, an acceptable assessment for Rougheye Rockfish has not been completed to determine biological reference points and status relative to reference points. It is not clear that Rougheye has sufficient biological parameters available for an assessment.~~ Regarding an acceptable assessment for Rougheye rockfish, a draft assessment of the Black-spotted/Rougheye rockfish complex has been done and a presentation of the draft results was made to the Technical Working Group in September 2018. The following is an excerpt from a document submitted to MRAG Americas from DFO in October, 2018 (DFO 2018b): Upon review of the draft, the Technical Working Group provided direction on components of the assessment. Specifically, • the addition of existing synoptic survey data to increase observations, and improve depth and spatial coverage; • revising the size-at-age analysis to reconcile anomalies between combined and species-specific analysis; and, • the choice of age composition data to include because fitting the model to length data alone may lead to bias due to differing growth rates between Rougheye type I and type II. The Technical Working Group was is scheduled to meet again with the analysts in December 2018 to review progress on this additional work and review the changes, model fit and performance, with the intention of scheduling a formal DFO CSAS peer review in mid 2019. This Technical Working Group meeting has occurred as planned. Once the science advice has been peer- reviewed it is considered at DFO fisheries management advisory processes which meet regularly throughout the year. Fisheries managers and stakeholders consider the science advice received at these meetings and management changes are made, if needed. Fisheries and Oceans Canada strives to align processes for delivery of science advice and implementation of management measures. This however does not preclude the implementation of interim advice or in-season management measures when deemed necessary. For example, science advice on the Yelloweye Rockfish (Outside population) was received in September 2015 and, as a result, a rebuilding plan was implemented for the 2016 season. There have also been cases where, based on the advice received, in-season changes have been made (e.g. Pacific cod). This history of implementation of in-season management measures where necessary enables the assessment team to be confident that if the results of the science advice show any issue with this stock complex, management can act

PI 2.2.3		**Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch**		
c	**Guidepost**	Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Yes	Yes	Yes
	Justification	Both countries SG60 – See SG 100 SG80 – See SG 100 SG100- Both countries maintain 100% at sea coverage on Hake vessels. See Section 3.5.11 for details. Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective (DFO 2013b, PFMC. 2011f).		
d	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
	Met?		US: Yes Canada: ~~No~~ Yes	US: Yes Canada: No
	Justification	US SG60 – NA SG80 – See SG 100 SG100 – The US maintains 100% observer coverage on Hake vessels. See Section 3.5.11 for details. As a result, monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species (Al-Humadhi *et al.* 2012, 2012a, Bellman, *et al*. 2013, PFMC. 2011f). Canada SG60 – NA SG80 – Canada maintains 100% monitoring coverage on Hake vessels and for those species with assessments, demonstrates stock status such that changes in risk are evident for those species (DFO 2013b). ~~Because an acceptable assessment for Rougheye Rockfish has not been completed to determine biological reference points, it would be difficult to detect an increase in risk level other than anecdotally from fishery performance.~~ There are no main bycatch species in the Canadian hake fishery. SG100 – NA		
References		Al-Humadhi *et al.* 2012, 2012a, Bellman, *et al*. 2013; DFO 2013b, PFMC. 2011f; DFO 2018b.		
OVERALL PERFORMANCE INDICATOR SCORE: Both fisheries meet all SG60 and SG80 scoring issues. The US meets all SG80 and 3 of 4 scoring issues for SG 100, so a score of 95 is given. Canada meets 2 of 4 SG80 scoring issues and 2 of 4 SG100, so a				U.S. 95 Can ~~70~~ 90

PI 2.2.3	Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch	
score of ~~70~~ 90 is given.		
CONDITION NUMBER (if relevant):		~~2~~

Appendix 2. Stakeholder submissions

A verbal stakeholder submission was received from Dr Scott Wallace, senior research scientist representing the David Suzuki Foundation and Marine Conservation Caucus, summarized as follows.

Dr Wallace brought three issues of concern to the attention of the assessment team:

1. Rougheye rockfish: Dr Wallace noted that there are still no reference points and no completed stock assessment update for this species complex (rougheye types I and II; or rougheye and blackspotted rockfish) in Canadian waters. The view of Dr Wallace was that the current catch quota is not scientifically derived, and the species has no refuge in its life history from fishing impacts. In addition, it is inherently vulnerable to fishing impacts in that it is slow growing and long lived.

   Rougheye is the subject of one open condition under the current assessment and an update on progress toward completion of a stock assessment and resulting biologically based reference points and TAC was provided to the assessment team by DFO in October of 2018. This update was shared with Dr Wallace following our meeting. In addition the team addressed the current situation with regard to Rougheye in the results table of this report.

2. Chinook salmon: Dr Wallace reported that in early December, 2018, COSEWIC designated eight new Fraser River chinook stocks as endangered and four as threatened. He noted that this is not just a concern for the Canadian fishery because genetic studies completed in 2010 for the US fishery indicated a proportion of the chinook bycatch in the US groundfish fisheries were of Fraser River origin and he questioned whether the US cap on Chinook bycatch in the hake fishery was set taking into account possible effects to Canada-bound Chinook. He also noted that although there had been a genetic analysis of the stock origin of bycaught Chinook in the US fishery, there had been no such study of Canadian Chinook bycatch in the groundfish fisheries. Lastly, although for the purposes of MSC assessment, COSEWIC-listed species are not considered under the endangered, threatened and protected species component (in Canada, only SARA-listed species are), Dr Wallace indicated that a recent change to the process of SARA listing based on COSEWIC listing bears investigation by the assessment team, as it may result in more SARA listed Chinook stocks in the near future.

3. Offal discharge from freezer vessels: Dr Wallace noted an uptick in the number of hake vessels heading, gutting and freezing at sea vs delivering to shoreside processors. He raised questions concerning the regulations for at-sea discharge of offal from these operations, particularly in the context of possible whale and bird interactions. The principle concern was regarding possible impact to seabirds in and around Scott Islands, a newly designated protected area, noting that there is fishing

for arrowtooth flounder in that area, though the amount of hake-directed fishing was unknown to him.

The team recorded these concerns and to the degree relevant to the 4th surveillance audit they are addressed in the present report. However, a more fulsome investigation and responses will be undertaken as part of the full reassessment process.

Appendix 3. Surveillance audit information

No additional audit information.

Appendix 4. Additional detail on conditions/actions/results

2017 Offshore Canadian Pacific Hake Fishery Landed and Released Weights

Appendix Table 2. 2017 Offshore Canadian Pacific Hake Fishyery Landed and Released Weights

Species	Retained (kg)	Released (kg)	Landed Wt (mt)*	% of Total Landed Weight	Released Wt (mt)**	Total Landed and Released Wt (mt)	% of Total All Species Wt	% of Total Hake Wt	2017 ACL		
									Trawl Sector (mt)	Hook and Line, and Trap Sector (mt)	Total (mt)
PACIFIC HAKE	85,269,843	1,828,562	85,270	97.59%	1,829	87,098	96.72%	100.00%		na	
AMERICAN SHAD	13,543	15,368	14	0.02%	15	29	0.03%	0.03%		na	
ARROWTOOTH FLOUNDER	4,621	2,051	5	0.01%	2	7	0.01%	0.01%	17,464	na	17,464
ASCIDIANS AND TUNICATES	0	872	0	0.00%	1	1	0.00%	0.00%		na	
BASKING SHARK	0	45	0	0.00%	0	0	0.00%	0.00%		na	
BIG SKATE	26	141	0	0.00%	0	0	0.00%	0.00%	914	118	1,032
BIGSCALES	0	0	0	0.00%	0	0	0.00%	0.00%		na	
BLACK EELPOUT	329	0	0	0.00%	0	0	0.00%	0.00%		na	
BLACK ROCKFISH	1	2	0	0.00%	0	0	0.00%	0.00%		na	
BLACKTIP POACHER	0	0	0	0.00%	0	0	0.00%	0.00%		na	
BLUE SHARK	0	140	0	0.00%	0	0	0.00%	0.00%		na	
BOCACCIO	5,202	3,847	5	0.01%	4	9	0.01%	0.01%	80	4.7*	85
BROWN CAT SHARK	0	15	0	0.00%	0	0	0.00%	0.00%		na	
CANARY ROCKFISH	48,269	10,921	48	0.06%	11	59	0.07%	0.07%	965	135	1,100
CHILIPEPPER	0	1	0	0.00%	0	0	0.00%	0.00%		na	
CHINOOK SALMON	4,477	1,906	4	0.01%	2	6	0.01%	0.01%		na	
CHUB MACKEREL	102	2	0	0.00%	0	0	0.00%	0.00%		na	
CHUM SALMON	108	1,246	0	0.00%	1	1	0.00%	0.00%		na	
COHO SALMON	31	311	0	0.00%	0	0	0.00%	0.00%		na	
DARKBLOTCHED ROCKFISH	4,618	7,951	5	0.01%	8	13	0.01%	0.01%		na	
DOVER SOLE	8	1	0	0.00%	0	0	0.00%	0.00%	3,073	na	3,073
DUSKY ROCKFISH	0	14	0	0.00%	0	0	0.00%	0.00%		na	
ENGLISH SOLE	0	2	0	0.00%	0	0	0.00%	0.00%	822	na	822
EULACHON	0	8	0	0.00%	0	0	0.00%	0.00%		na	
FLATHEAD SOLE	0	102	0	0.00%	0	0	0.00%	0.00%		na	
GIANT PACIFIC OCTOPUS	23	0	0	0.00%	0	0	0.00%	0.00%		na	
GLASS SHRIMP	0	2	0	0.00%	0	0	0.00%	0.00%		na	
GONATE SQUIDS	0	976	0	0.00%	1	1	0.00%	0.00%		na	
GREEN STURGEON	0	11	0	0.00%	0	0	0.00%	0.00%		na	
GREENSTRIPED ROCKFISH	4	0	0	0.00%	0	0	0.00%	0.00%		na	
HARLEQUIN ROCKFISH	1	0	0	0.00%	0	0	0.00%	0.00%		na	
HERRINGS	0	5,833	0	0.00%	6	6	0.01%	0.01%		na	
HUMBOLDT SQUID	156	745	0	0.00%	1	1	0.00%	0.00%		na	
INANIMATE OBJECT(S)	1	1	0	0.00%	0	0	0.00%	0.00%		na	
JACK MACKEREL	2,315	510	2	0.00%	1	3	0.00%	0.00%		na	
JELLYFISH	0	1,460	0	0.00%	1	1	0.00%	0.00%		na	
KING-OF-THE-SALMON	8	122	0	0.00%	0	0	0.00%	0.00%		na	
LAMPREYS	1	36	0	0.00%	0	0	0.00%	0.00%		na	
LANTERNFISHES	0	3	0	0.00%	0	0	0.00%	0.00%		na	
LINGCOD	2,103	661	2	0.00%	1	3	0.00%	0.00%	2,572	1,168	3,740
LONGNOSE SKATE	37	78	0	0.00%	0	0	0.00%	0.00%	195	263	458
NORTH PACIFIC SPINY DOGFISH	51,029	35,417	51	0.06%	35	86	0.10%	0.10%	4,480	9,520	14,000
OCTOPUS	0	11	0	0.00%	0	0	0.00%	0.00%		na	
PACIFIC COD	232	44	0	0.00%	0	0	0.00%	0.00%		na	
PACIFIC ELECTRIC RAY	14	5	0	0.00%	0	0	0.00%	0.00%		na	
PACIFIC HALIBUT	88	3,537	0	0.00%	4	4	0.00%	0.00%	454*	tbd	#VALUE!
PACIFIC HERRING	976	14,456	1	0.00%	14	15	0.02%	0.02%		na	
PACIFIC LAMPREY	0	14	0	0.00%	0	0	0.00%	0.00%		na	
PACIFIC OCEAN PERCH	249,400	158,454	249	0.29%	158	408	0.45%	0.47%	5,192	na	5,192
PACIFIC POMFRET	1	0	0	0.00%	0	0	0.00%	0.00%		na	
PACIFIC SLEEPER SHARK	0	45	0	0.00%	0	0	0.00%	0.00%		na	

Appendix Table 2. 2017 Offshore Canadian Pacific Hake Fishyery Landed and Released Weights

Species	Retained (kg)	Released (kg)	Landed Wt (mt)*	% of Total Landed Weight	Released Wt (mt)**	Total Landed and Released Wt (mt)	% of Total All Species Wt	% of Total Hake Wt	2017 ACL		
									Trawl Sector (mt)	Hook and Line, and Trap Sector (mt)	Total (mt)
PACIFIC TOMCOD	0	1	0	0.00%	0	0	0.00%	0.00%	na		
PINK SALMON	57	15	0	0.00%	0	0	0.00%	0.00%			
PROWFISH	0	3	0	0.00%	0	0	0.00%	0.00%	na		
RAGFISH	0	43	0	0.00%	0	0	0.00%	0.00%	na		
RAINBOW TROUT (AKA STEELHEAD)	0	5	0	0.00%	0	0	0.00%	0.00%	na		
RATFISHES	1	0	0	0.00%	0	0	0.00%	0.00%	na		
REDBANDED ROCKFISH	4	15	0	0.00%	0	0	0.00%	0.00%	295	284	579
REDSTRIPE ROCKFISH	128,379	65,963	128	0.15%	66	194	0.22%	0.22%	1,521	43*	1,523
REX SOLE	2	93	0	0.00%	0	0	0.00%	0.00%	na		
ROBUST CLUBHOOK SQUID	0	954	0	0.00%	1	1	0.00%	0.00%	na		
ROSETHORN ROCKFISH	1	1	0	0.00%	0	0	0.00%	0.00%	na		
ROUGHEYE/BLACKSPOTTED ROCKFISH COMPLEX	1,555	26,702	2	0.00%	27	28	0.03%	0.03%	636	484	1,120
SABLEFISH	16,118	46,245	16	0.02%	46	62	0.07%	0.07%	170	1,970	2,140
SALMON SHARK	0	555	0	0.00%	1	1	0.00%	0.00%	na		
SALMONIDS	0	54	0	0.00%	0	0	0.00%	0.00%	na		
SCHOOLMASTER GONATE SQUID	2	736	0	0.00%	1	1	0.00%	0.00%	na		
SHARPCHIN ROCKFISH	603	353	1	0.00%	0	1	0.00%	0.00%	na		
SHORTRAKER ROCKFISH	20	2,563	0	0.00%	3	3	0.00%	0.00%	126	111	237
SHORTSPINE THORNYHEAD	1	653	0	0.00%	1	1	0.00%	0.00%	735	34	769
SILVERGRAY ROCKFISH	37,090	12,523	37	0.04%	13	50	0.06%	0.06%	1,945	254	2,199
SKIPJACK TUNA	26	22	0	0.00%	0	0	0.00%	0.00%	na		
SOCKEYE SALMON	2	103	0	0.00%	0	0	0.00%	0.00%	na		
SPLITNOSE ROCKFISH	15,886	50,533	16	0.02%	51	66	0.07%	0.08%	na		
SPOTTED RATFISH	0	1	0	0.00%	0	0	0.00%	0.00%	na		
SQUIDS	2,464	2,548	2	0.00%	3	5	0.01%	0.01%	na		
TOPE SHARK	19	165	0	0.00%	0	0	0.00%	0.00%	na		
UNIDENTIFIED ORGANIC MATTER	0	280	0	0.00%	0	0	0.00%	0.00%	na		
VAMPIRE SQUID	0	2	0	0.00%	0	0	0.00%	0.00%	na		
VIPERFISHES	0	1	0	0.00%	0	0	0.00%	0.00%	na		
WALLEYE POLLOCK	830,919	83,813	831	0.95%	84	915	1.02%	1.05%	4,225	0	4,267
WIDOW ROCKFISH	97,873	57,455	98	0.11%	57	155	0.17%	0.18%	2,316	42*	2,358
YELLOWEYE ROCKFISH	2,257	604	2	0.00%	1	3	0.00%	0.00%	3*	101	104
YELLOWMOUTH ROCKFISH	90,069	25,621	90	0.10%	26	116	0.13%	0.13%	2,364	78	2,442
YELLOWTAIL ROCKFISH	495,283	200,299	495	0.57%	200	696	0.77%	0.80%	5,440	60*	5,496
Total	87,376,200	2,674,853	87,376	100.00%	2,675	90,051	100.00%				

*2017 Allocation to the sector only; not allocated to individual licences

Appendix 5. Revised surveillance program

No changes to surveillance level or schedule. Year four has just been completed.

Fishery Surveillance Program – Level 2

Surveillance Level	Year 1	Year 2	Year 3	Year 4
Level 2	Off-site surveillance audit	Review of information	Off-site surveillance audit	On-site surveillance audit & re-certification site visit.