MEMORANDUM

State of Alaska

DEPARTMENT OF FISH AND GAME

TO: Lowell Fair, Regional Supervisor
Region I – CF

DATE: June 14, 2018

FILE NO:

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SUBJECT: 2018 NSEI sablefish AHO

Overview

This memo describes stock status and summarizes methods used to establish the acceptable biological catch (ABC) and annual harvest objective (AHO) for the 2018 Northern Southeast Inside (NSEI) Subdistrict sablefish fishery. Data from the Alaska Department of Fish and Game (ADF&G) mark-recapture experiment, ADF&G longline survey, port sampling of NSEI commercial harvest, commercial fishery landings, and commercial fishery logbooks were used to evaluate the NSEI sablefish stock. Status of neighboring sablefish stocks- Southern Southeast Inside (SSEI) Subdistrict, Gulf of Alaska, and British Columbia - were also reviewed to evaluate coastwide trends in sablefish abundance.

The recommended ABC for the 2018 NSEI sablefish fishery is 965,354 round lbs, a 13.6% increase from the 2017 ABC of 850,113 round lbs. In 2017 we used the mark-recapture point estimate of abundance to forecast abundance and biomass for the 2018 fishery using updated biological data from the fishery and survey. The harvest rate was updated using new biological information. Increases were observed between the 2017 and 2018 forecasted abundance and biomass, with a decrease in the $F_{50\%}$ harvest rate:

- A 0.2% increase for exploited abundance from 1,927,382 lbs in 2017 to 1,931,191 lbs in 2018;
- A 1.2% increase for the exploited biomass from 16,265,597 lbs in 2017 to 16,454,232 lbs in 2018; and
- A decrease in the $F_{50\%}$ harvest rate from 6.83% in 2017 to 6.35% in 2018.

General trends from the fishery and survey CPUE data reflected between 2016 and 2017:

- A 10.0% decrease in NSEI commercial longline fishery CPUE in round lbs per hook; and
- A 15.0% increase in longline survey CPUE in fish per hook.

Forecasted biomass, ABC, and AHO for 2018:

Since 2003, the NSEI sablefish fishery stock assessment has been based on mark-recapture methodology to estimate sablefish abundance using Chapman's modification of the Petersen estimator. ADF&G conducts an annual sablefish pot survey from June–May to mark and release fish in the NSEI Subdistrict. The recapture event occurs during the longline survey and commercial fishery season (August 15–November 15). Results from the 2017 marking survey were used to forecast a 2018 total exploitable abundance estimate of 1,931,191 individuals, an increase of 0.2% from 1,927,382 in 2017 (Figure 1). Similarly, total exploitable biomass for 2018 (16,454,232 round lbs) is 1.2% higher than the estimated 2017 exploitable biomass (16,265,597 round lbs).

The recommended 2018 NSEI ABC is a 13.6% increase from the 2017 ABC (850,113 round lbs), which is based on an $F_{50\%}$ biological reference point (BRP) of 6.35%. We've continued to recommend an $F_{50\%}$ BRP since 2010. Fishery and survey CPUE trends increased in 2017 after a period of decline from 2012–2015. A large year class from 2014 has been recruiting to the fishery in NSEI and surrounding geographic areas with signs of improvement observed since 2016. The 2014 sablefish year class is estimated to be 2.5 times higher than any other year class on record; however, there remains uncertainty and concern in spawning biomass due to the lack of older mature fish (Hanselman et al. 2017). Due to the high degree of uncertainty in recent recruitment events, the ABC was adjusted to the 15th-percentile from the median abundance estimate as the input for the yield per recruit model and resulting calculation of ABC. A different approach was taken by the Federal assessment, where the 2014 recruitment was fixed to the highest recruitment event on record in 1977 (Hanselman et al. 2017). Both adjustments are precautionary measures that provide stabilization to the fishery and buffer against impacts of overfishing if the 2014-year class is smaller than expected.

In previous years, we did not consider discard mortality of small fish. However, with the large influx of small, immature sablefish currently recruiting into the fishery, concerns have been raised about the mortality associated with discarding these fish. To address this issue, discard mortality was incorporated directly into the population dynamics model and calculation of the 2018 ABC by modeling the probability of discarding a fish as a function of size and price (Figure 2). A 16% discard mortality rate was applied from the Pacific halibut fishery (Gilroy and Stewart 2013), which serves as a proxy for sablefish as similar gear is used. Discard mortality for sablefish was investigated by Stachura et al. (2012) from a sablefish longline survey, which estimated discard mortality at 11.7%. Because discard mortality is likely higher in a fishery than on the survey due to careful handling of fish, a 16% discard mortality rate is a more realistic estimate of true mortality in a fishery. Permit holders must retain all visibly injured or dead sablefish but may release live uninjured sablefish to the water and record all releases in a logbook (5 AAC 28.170. (g)). Recruitment in recent years has resulted in a narrowing of age distributions in the NSEI population; the lack of larger older female fish and resulting loss of fecundity could have significant effects on

the reproductive potential of the population over time. We continue to monitor these trends closely and to manage the fishery conservatively ($F_{50\%}$ harvest rate).

The recommended commercial AHO for 2018 is 855,416 round lbs. The Equal Quota Share (EQS) is 10,967 round lbs. This represents a 18.8% increase from the 2017 EQS (9,234 round lbs). In 2017, there were 78 permit holders that participated in the fishery and the same amount will participate in 2018.

The 2018 AHO was calculated by making the following decrements from the ABC: 1) estimated sablefish bycatch mortality in the commercial halibut fishery; 2) ADF&G longline survey removals; 3) sport fishery guided and unguided harvest; 4) subsistence and personal use harvest; and 5) deadloss discard mortality (Tables 1 and 2).

AHO decrement calculations:

1) *Sablefish bycatch mortality in the halibut fishery decrement (Table 1):*
    - Sablefish caught in the NSEI in the IFQ halibut fishery prior to the sablefish fishery season opening must be released, but not all are expected to survive, so the estimated biomass of those that die are decremented from the ABC. Sablefish bycatch mortality in the halibut fishery is calculated by applying a 25% mortality rate to an estimate of the sablefish catch that is discarded. Discarded sablefish catch is calculated as the product of the 3-year average of the sablefish to halibut ratio from the International Pacific Halibut Commission annual survey and the 3-year average of the halibut catch in areas greater than 99 fathoms in NSEI. This decrement decreased in 2018. 2C catch limits for halibut decreased in 2018 and as a result a decrease in the amount of halibut estimated to be harvested in NSEI. Thus, a proportional decrease in estimated sablefish catch and the ratio of sablefish to halibut decreased from the IPHC annual longline survey causing the total decrement to decrease.
2) *ADF&G longline survey removals decrement (Tables 1 and 2):*
    - In 2018, the decrement for ADF&G survey removals will be less than ADF&G's total survey removal because 7 permit holders will participate in the NSEI longline survey and will be allowed to utilize fish caught on the survey toward their EQSs. The survey removal decrement was determined by averaging the survey total harvest taken from the previous 3 years and reducing that by 7 estimated 2018 EQS permit shares.
3) *Sport fish harvest decrement (Table 1):*
    - The 2017 sport fish charter preliminary logbook data were used to estimate the number of sablefish that will be caught by guided sport fishermen in NSEI in 2018. Effort in the guided sport fishery decreased and resulted in a decrease for this decrement in 2018.
    - Unguided preliminary sport fish harvest was estimated based on the number of sablefish harvested in NSEI from the Statewide Harvest Survey data and multiplied by the average weight of recreationally caught sablefish. There was an increase in the harvest of private anglers harvesting sablefish for 2018.
4) *NSEI Subsistence and personal use harvest (Table 1):*
    - In 2012, the Alaska Board of Fisheries adopted a proposal to require reporting of

subsistence and personal use sablefish harvest in Southeast Alaska. In 2015, personal use harvest was limited to 50 fish per household annually and beginning in 2018 participants of the personal use fishery can use pot gear with no more than 2 pots per permit and a maximum of 8 pots per vessel when 4 or more permit holders are on board the same vessel. A total of 360 permits were issued in 2017. Of these permits 319 were returned of which 114 permits fished in NSEI. Annual subsistence and personal use harvest of sablefish was estimated from these harvest permits. A 25% handling mortality was applied to discarded sablefish and added to the total number of retained sablefish. The 2017 longline survey average weight (6.7 lbs) was applied to this number to obtain a decrement total. Total harvest decreased from 2016 to 2017 resulting in a decrease in this decrement.

5) *Deadloss discard mortality in the directed sablefish fishery (Table 1):*
    - Deadloss discard mortality in the directed sablefish fishery was estimated by applying the percentage of dead sablefish (i.e., recorded as predated by sand fleas, sharks, hooking injury or other cause of mortality) caught on the NSEI longline survey using the recent 3-year average, 0.7% (2015–2017) to the NSEI sablefish commercial AHO.

Commercial fishery harvest and CPUE

- In 2017, 78 permit holders participated in the NSEI commercial sablefish fishery and harvested 714,401 round lbs (Table 3). This was below the 2017 AHO due to a portion of permit holders harvesting over their PQS in 2016. When a permit holder's harvest exceeds their current season's PQS that permit holder's PQS for the following season is reduced by 5%. When a permit holder's harvest is less than their current season's PQS that permit holder's PQS for the following season may be increased for the following season by the amount of the underage that does not exceed 5% of their PQS for the following season.
- Fishery CPUE was highest in the mid-1980s and early 1990s. Fishery CPUE declined strongly starting in 1994 through 2000 (Figure 3). Since 2000, fishery CPUE has increased, and, in recent years (2003–2011), fishery CPUE has had some variation but overall been fairly stable. Fishery CPUE decreased 10.0% in 2017 (0.82 round lbs/hook) relative to 2016 (0.91 round lbs/hook).

Longline Survey CPUE

- Longline survey CPUE in fish per hook increased 15.0% from 0.20 fish per hook in 2016 to 0.23 fish per hook in 2017 (Figure 4).
- Longline survey CPUE from 1988 to 1996 is not displayed in Figure 3 because of concern about effects regarding the 1-hr soak time used during that period and the resulting CPUE estimates. According to Sigler (1993), 1-hr soak is insufficient for gear to sink to depths of 200–400 fathoms and allow on-bottom soak time sufficient for CPUE to adequately reflect abundance. Sigler (1993) concluded that CPUE was not affected by soak times between 3–11 hours. Since 1997, ADF&G has used a minimum 3-hr soak time to allow gear to reach the bottom and fish.

Sablefish weight and age compositions

- In 2011 through 2014, evidence of recruitment was observed in the age distributions of sablefish sampled in the NSEI longline survey, the first sign of noticeable recruitment in over a decade. Evidence of new recruitment was first observed in 2016 in the NSEI longline survey and is expected to increase in future years. The 2008 year-class can be observed in the 2013 and 2014 survey data (Figure 5).
- Proportional recruitment has yet to be seen in the commercial fishery. However, recruitment to the fishery generally occurs in Chatham Strait at age 4 to 7 and may be influenced by the fact that permit holders are allowed to discard small healthy sablefish during the commercial fishery due to their harvest value (Figure 6).

SSEI, Gulf of Alaska and British Columbia sablefish stock trends

- The 2018 SSEI AHO increased 12% from 516,763 round lbs in 2017 to 578,774 round lbs. This was due to continued increases in the longline survey CPUE index, signs of recruitment in the length and age-class distributions in the survey and fishery, introduction of two 4.0-inch escape rings for pot gear to reduce harvest of immature individuals and increasing trends in biomass from adjacent areas including the Gulf of Alaska (GOA), British Columbia, Canada (BC), and NSEI.
- The GOA federal longline survey abundance index increased 14% from 2016 to 2017 and the recommended federal ABC for 2018 is 14% higher than 2017 (Figure 7; Hanselman et al. 2017).
- Female spawning biomass in the GOA is projected to increase rapidly from 2018–2022 and then stabilize (Figure 8; Hanselman et al. 2017).
- The Department of Fisheries and Oceans (DFO) Canadian sablefish stock assessment showed an increase of 94% in CPUE (kg/trap) from their annual pot survey and an increase of 18% in sablefish estimated biomass from 2016 to 2017 (Brendan Connors, DFO Canada, personal communication). Regulations require two 3.5-inch escape rings on pot gear and a 55 cm minimum size limit for sablefish in all Canadian waters.

2018 field work status and outlook to 2019:

A sablefish pot mark-recapture survey will be conducted annually and is tentatively scheduled for May 13–June 7, 2018. The most recent point estimate of abundance will be used in years when a survey is not conducted.

The ADF&G longline survey is tentatively scheduled to occur July 29–August 4, 2019. ADF&G has chartered 3 longline vessels to fish fixed longline survey stations in the northern, central and southern areas of NSEI. Since 2010, we have implemented a program to have permit holders participate in the longline survey and harvest their EQS during the survey, thus reducing the department's overall survey removals. Seven permit holders will use this option in the 2018 longline survey. An increase in the number of permit holders who choose to take their EQS as part of the survey translates directly into a lower ADF&G survey decrement to the ABC.

Literature Cited

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Sigler, M.F. 1993. Stock assessment and management of sablefish *(Anoplopoma fimbria)* in the Gulf of Alaska. Ph.D. Dissertation. University of Washington. 376 pp.

Stachura, M. M., Lunsford, C. R., Rodgveller, C.J. and Heifetz, J., 2012. Estimation of discard mortality of sablefish (*Anoplopoma fimbria*) in Alaska longline fisheries. Fish. Bull. 110.2: 271-279.

Table 1.–Decrement types and amounts for 2013–2018. Estimated catch is in round lbs of sablefish. Notation is as follows: ADF&G = Alaska Department of Fish and Game, EQS = equal quota share, AHO = annual harvest objective.

Year	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***
Acceptable Biological Catch (ABC)	1,207,282	952,538	986,481	807,559	850,113	965,354
Decrement type	***Estimated Mortality***					
Bycatch mortality in halibut fishery	52,114	47,514	38,963	27,915	26,136	19,583
ADF&G longline survey removal decrement (excluding catch retained by permit holders for their EQS)	77,261	80,814	74,689	53,914	29,290	15,875
Guided sport harvest	29,601	35,944	51,910	44,509	43,656	41,179
Unguided sport harvest	7,076	7,076	5,212	7,015	3,911	5,872
Deadloss discard mortality in the directed sablefish fishery	12,533	5,081	9,218	6,719	4,250	5,699
Subsistence and personal use	26,535	30,335	19,741	16,734	22,621	21,730
Total Decrements	**205,120**	**206,764**	**199,733**	**156,805**	**129,863**	**109,938**
AHO	1,002,162	745,774	786,748	650,754	720,250	855,416
Permit Holders	78	78	78	78	78	78
EQS	12,848	9,561	10,087	8,343	9,234	10,967

Table 2.–Sablefish harvest (round lbs) from the NSEI ADF&G longline survey ,1988 to 2017. Survey removal decrement (survey harvest minus the combined harvest allocated to the EQSs of permit holders aboard the survey vessels), and the number of permit holders participating in the survey is shown from 2010 to 2018.

Year	ADF&G total survey harvest (round lbs)	Survey removal decrement (average survey harvest minus participating permit holders' EQS harvest)	Number of permit holders participating in longline survey
1988	25,135		
1989	20,602		
1990	32,513		
1991	24,692		
1992	18,902		
1993	30,992		
1994	24,016		
1995	53,041		
1996	48,066		
1997	51,005		
1998	79,471		
1999	58,924		
2000	88,940		
2001	116,998		
2002	101,873		
2003	111,545		
2004	98,254		
2005	128,042		
2006	105,830		
2007	111,067		
2008	116,816		
2009	111,610		
2010	108,907	76,654	3
2011	117,894	50,866	6
2012	120,505	77,499	3
2013	95,393	77,261	3
2014	97,318	80,814	3
2015	92,888	74,689	3
2016	82,100	53,914	5
2017	92,922	29,290	7
2018		15,875	7

Table 3. Annual harvest objective (round lbs), equal quota share (round lbs), reported harvest (round lbs), ex-vessel value, number of permits, and effort (days) for the directed commercial NSEI sablefish fishery, 1985 through 2016.

Year	Annual harvest objective	Equal quota share	Harvest	Ex-vessel value	No. of permits	No. of Days
1985	2,380,952	–	2,951,056	$2,005,394	105	3
1986	2,380,952	–	3,874,269	$2,866,959	138	2
1987	2,380,952	–	3,861,546	$3,514,006	158	1
1988	2,380,952	–	4,206,509	$4,543,029	149	1
1989	2,380,952	–	3,767,518	$2,900,988	151	1
1990	2,380,952	–	3,281,393	$3,543,904	121	1
1991	2,380,952	–	3,955,189	$6,882,028	127	1
1992	2,380,952	–	4,267,781	$4,907,948	115	1
1993	2,380,952	–	5,795,974	$5,622,094	120	1
1994	4,761,905	38,889	4,713,552	$9,144,290	121	30
1995	4,761,905	38,889	4,542,348	$7,721,991	121	30
1996	4,761,905	38,889	4,673,701	$9,908,246	121	61
1997	4,800,000	39,300	4,753,394	$11,550,747	122	76
1998	4,800,000	41,700	4,688,008	$7,360,172	116	76
1999	3,120,000	28,000	3,043,273	$6,634,335	112	76
2000	3,120,000	28,600	3,082,159	$7,394,890	111	76
2001	2,184,000	19,600	2,142,617	$4,563,774	111	76
2002	2,005,000	18,400	2,009,380	$4,814,718	109	76
2003	2,005,000	18,565	2,001,643	$4,809,492	108	93
2004	2,245,000	20,787	2,229,956	$4,532,611	108	93
2005	2,053,000	19,400	2,026,131	$5,027,393	106	93
2006	2,053,000	19,550	2,033,786	$5,066,320	105	93
2007	1,488,000	14,500	1,501,478	$3,754,847	103	93
2008	1,508,000	15,710	1,513,040	$4,873,176	96	93
2009	1,071,000	12,170	1,071,554	$3,550,253	88	93
2010	1,063,000	12,218	1,054,276	$4,399,622	87	93
2011	880,000	10,602	882,779	$4,943,667	83	93
2012	975,000	12,342	969,535	$3,629,887	79	93
2013	1,002,162	12,848	971,499	$2,881,461	78	93
2014	745,774	9,561	772,260	$3,152,106	78	93
2015	786,748	10,087	780,534	$3,383,048	78	93
2016	650,754	8,343	646,238	$3,222,355	78	93
2017	720,250	9,234	714,401	$3,897,453	78	93
2018	855,416	10,967			78	93

Note: Equal quota share was implemented in 1994.

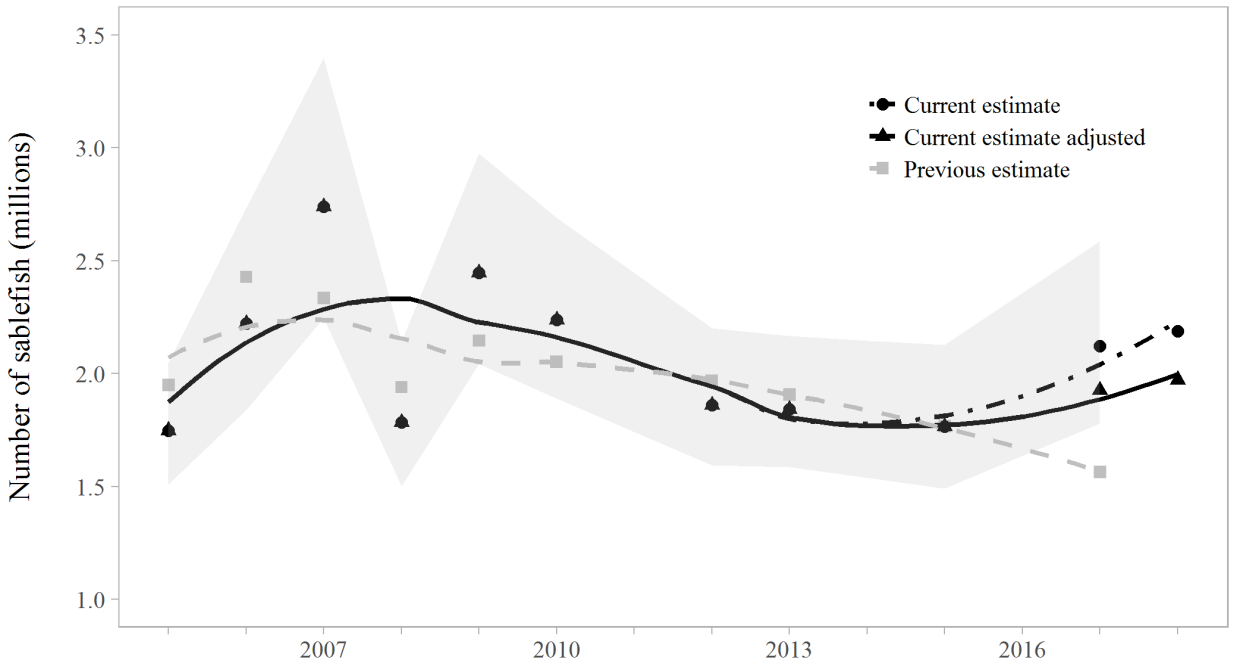

Figure 1.–Number of sablefish from the standard abundance model (black points), adjusted (using the 15th percentile) standard abundance model due to the high degree of uncertainty with the recent recruitment events (black triangles), and previous forecasts of abundance (grey squares) from 2005–2017. Shaded areas are 95% credible intervals from the current estimates. The grey square in 2017 is the forecasted abundance from last year, which was poorly estimated due to a lack of a tagging survey in 2016.

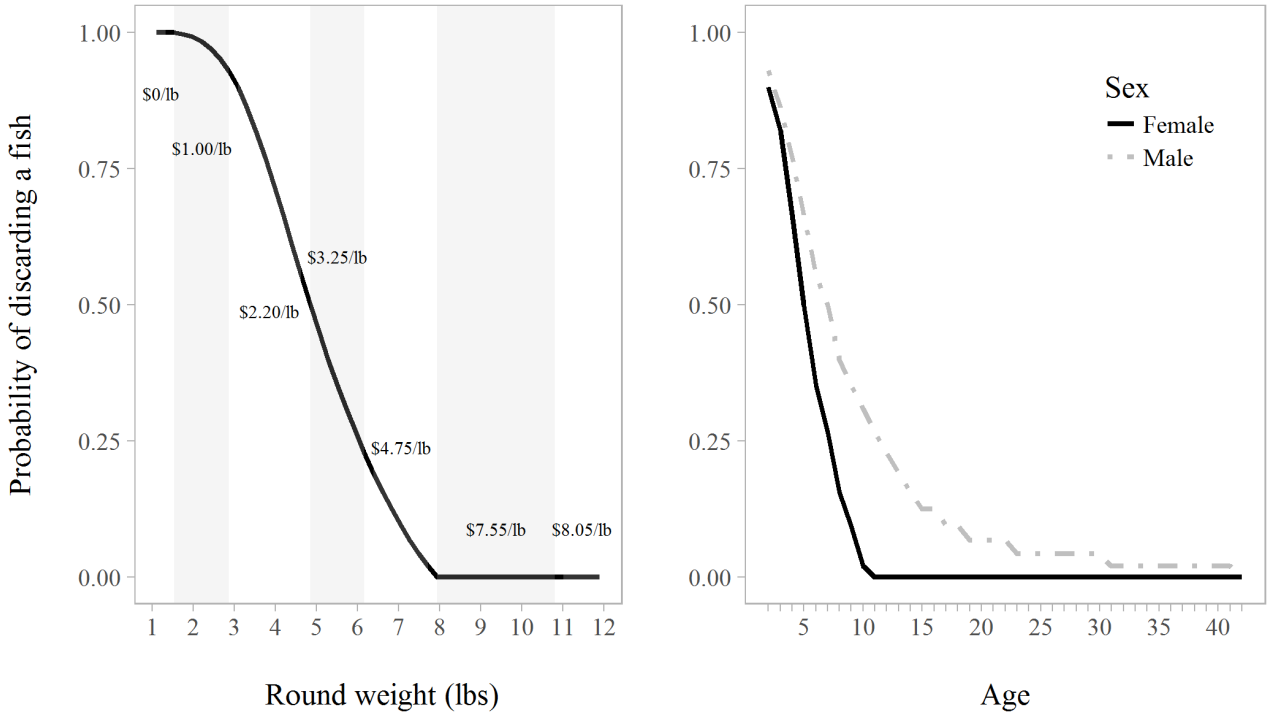

Figure 2.–The probability of discarding a fish as a function of weight, price (left panel), sex, and age (right panel).

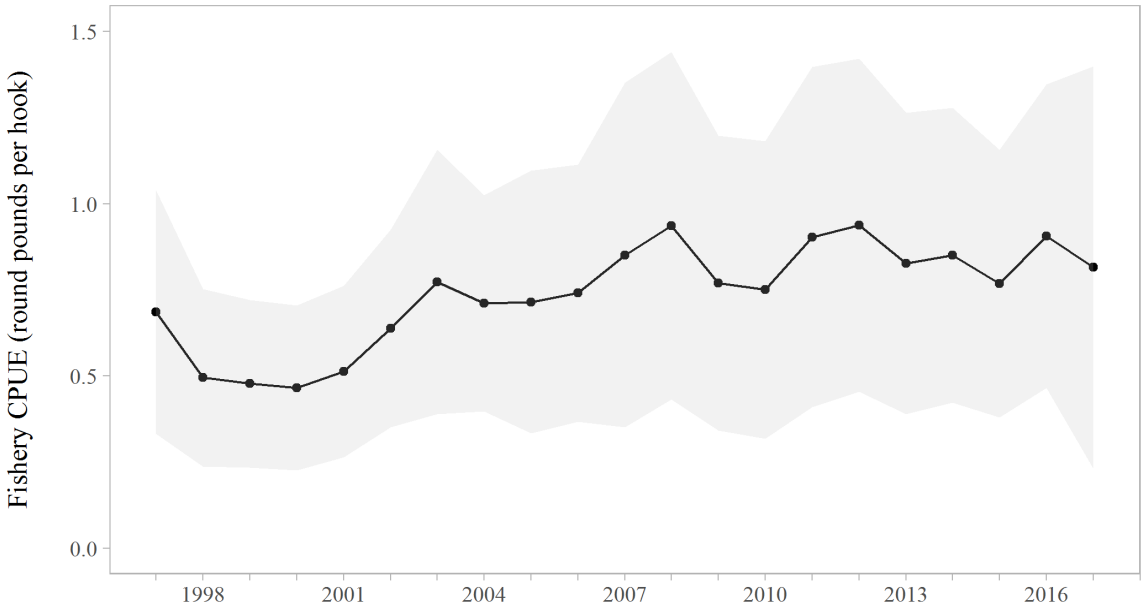

Figure 3.–Commercial longline fishery CPUE in round lbs per hook (the grey shading is +/- 1 standard deviation), 1997 - 2017.

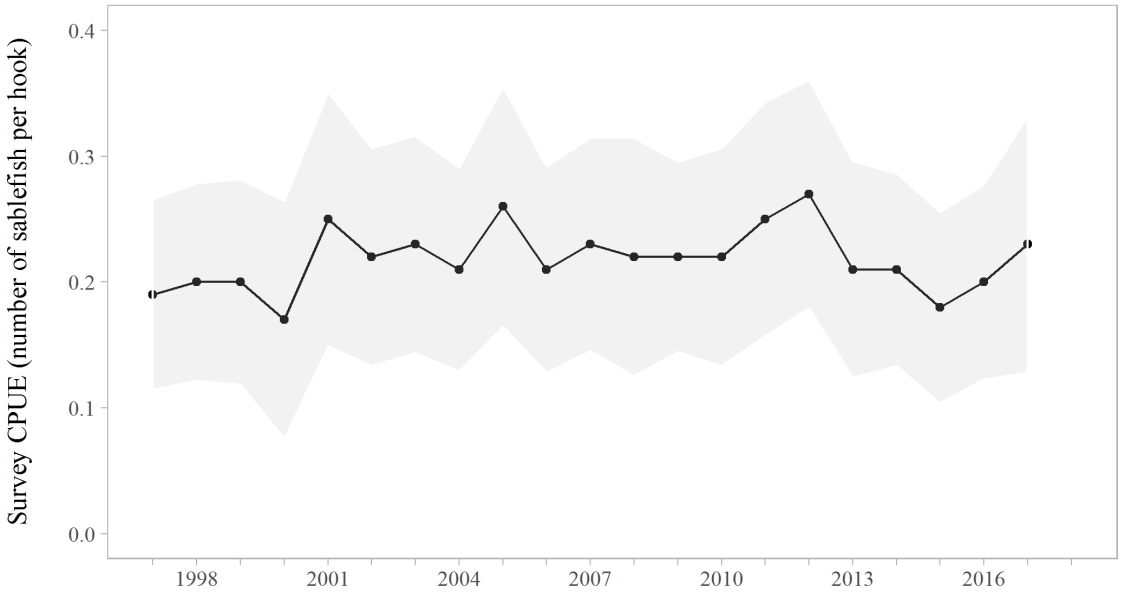

Figure 4.–Longline survey CPUE in sablefish per hook (the grey shading is +/- 1 standard deviation), 1997 - 2017.

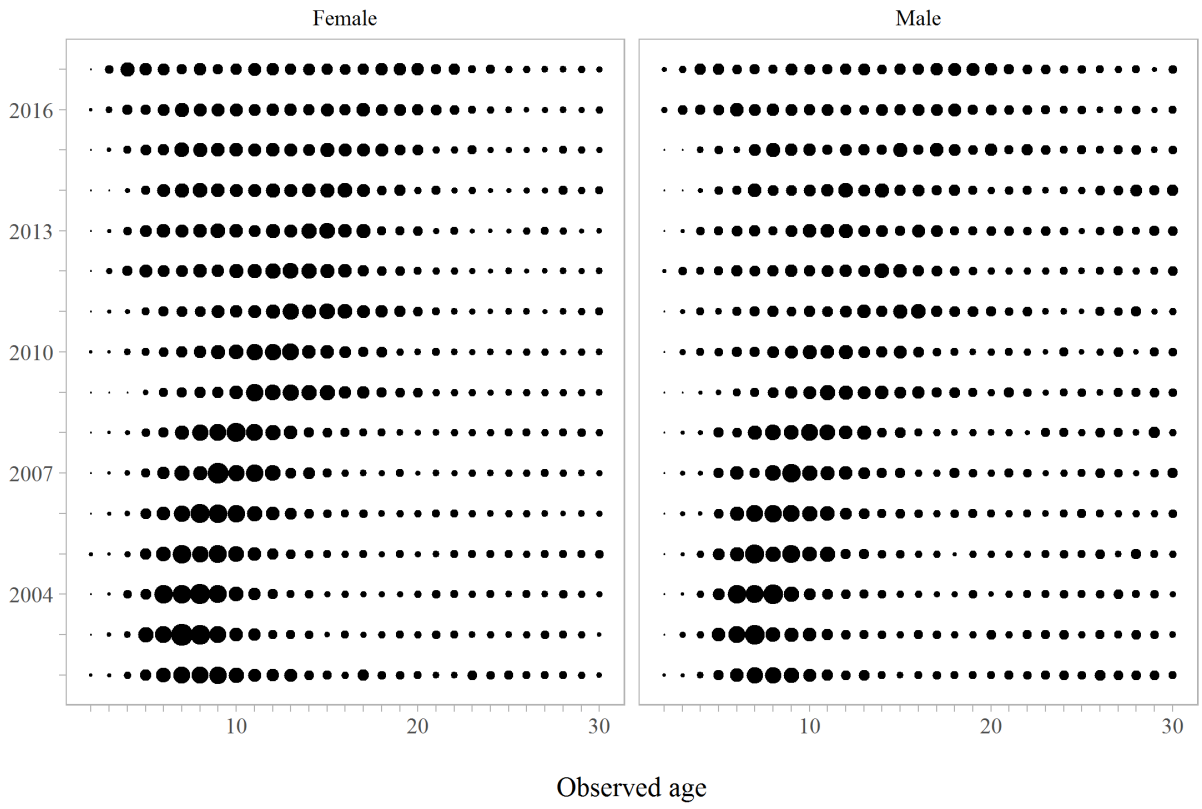

Figure 5.–Proportions-at-age for males and females in the ADF&G longline survey, 2002 - 2017.

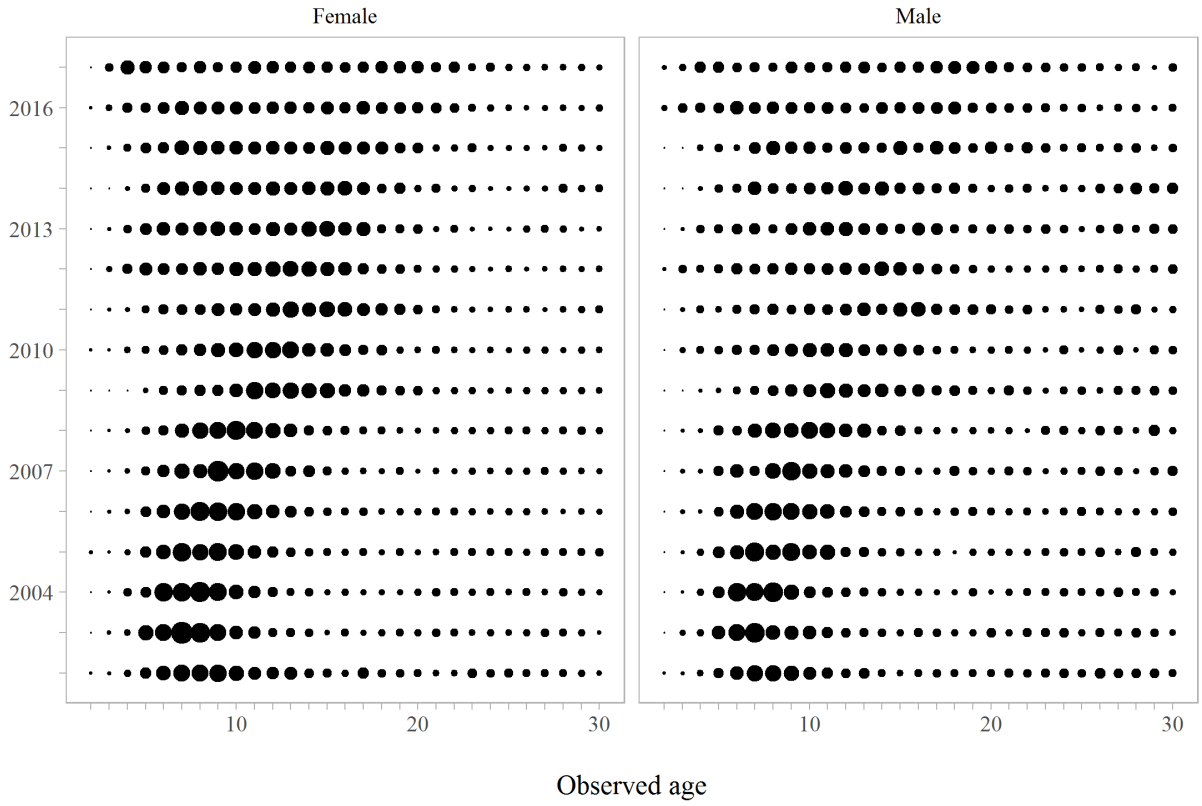

Figure 6.–Proportions-at-age for males and females in the longline fishery, 2002 - 2017.

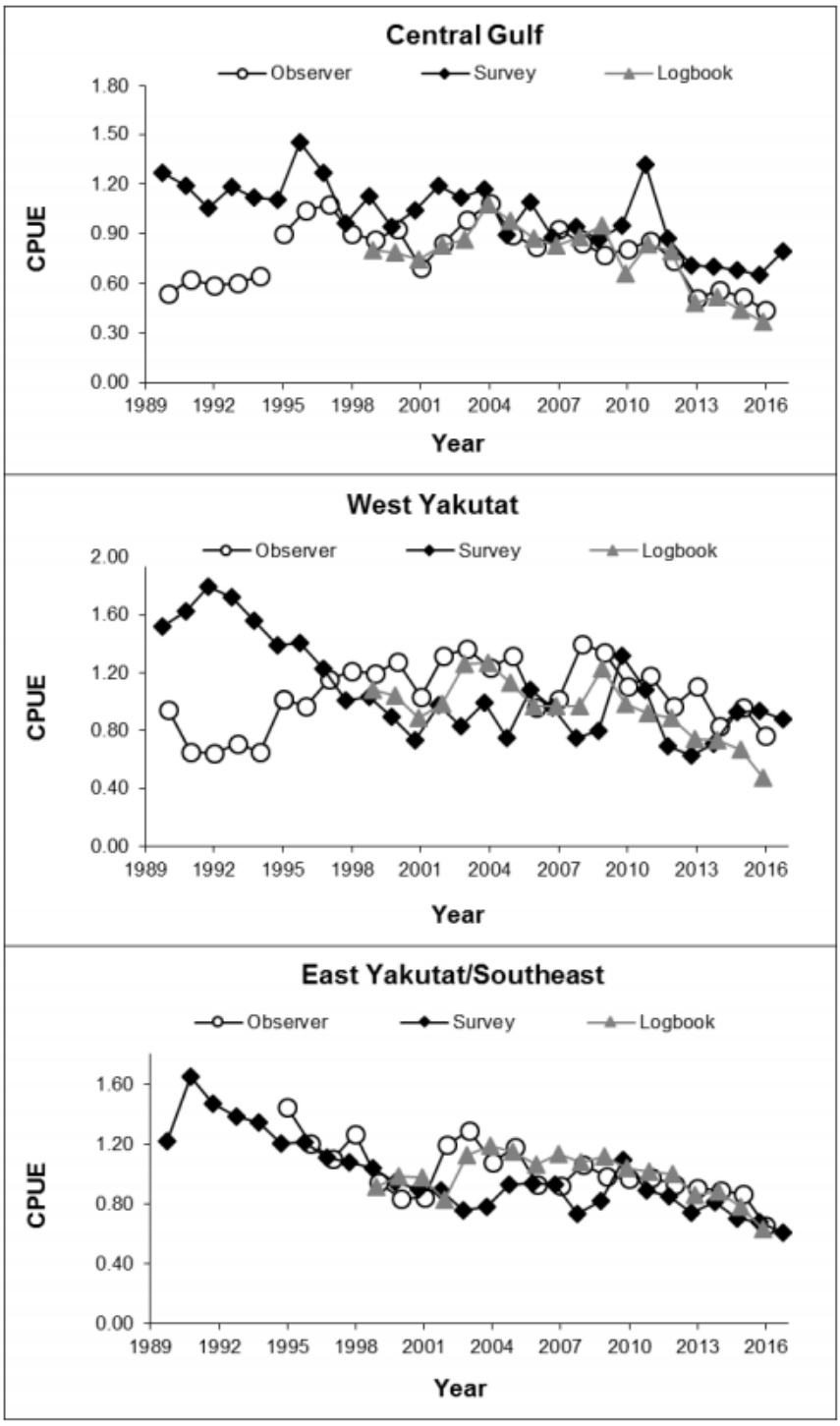

Figure 7.–NOAA Federal Sablefish Stock Assessment and Fishery Evaluation: Average fishery catch rate (lbs/hook) by region and data source for the sablefish federal longline survey and fishery. The fishery switched from open access to individual quota management in 1995. Reprinted with permission from Hanselman et al. 2017.

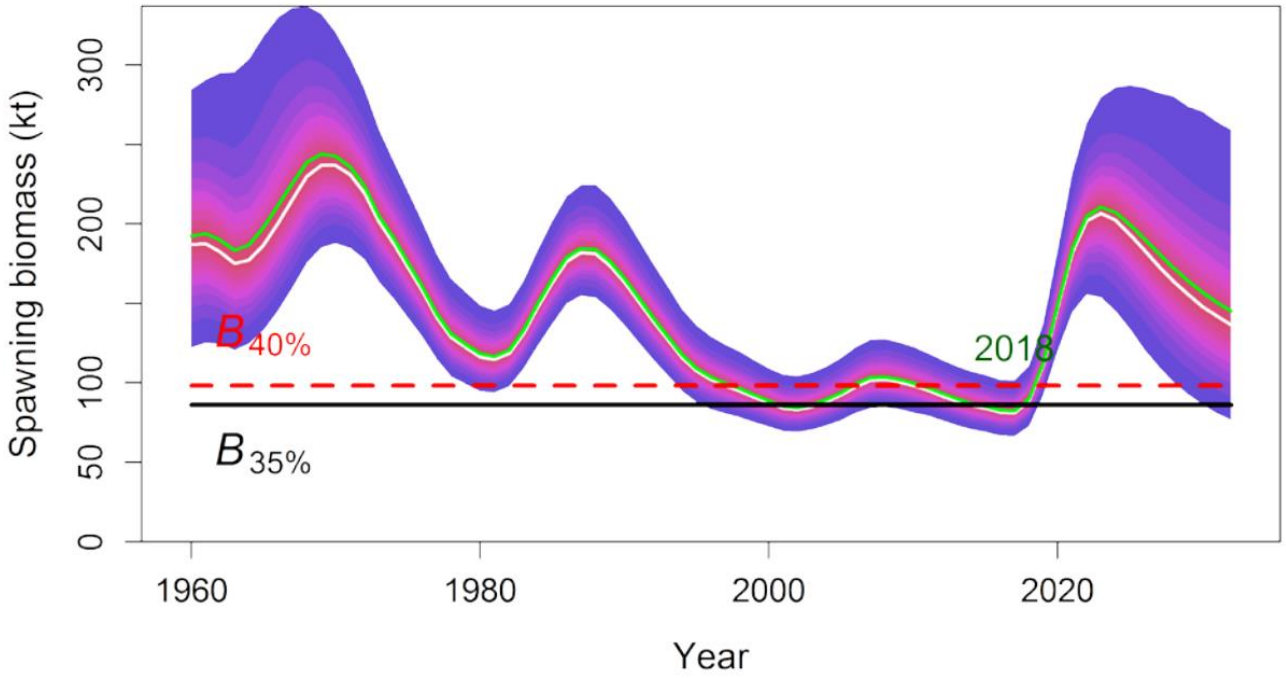

Figure 8.–Estimates of female spawning biomass (thousands of tons) for the Gulf of Alaska, Bering Sea, and Aleutian Islands and their uncertainty for the federal sablefish fisheries. White line is the median, green line is the mean spawning biomass, shaded fills are 5% increments of the posterior probability distribuion of spawning biomass based on Markov-Chain Monte Carlo simulations. Width of shaded area is the 95% credibility interval. Reprinted with permission from Hanselman et al. 2017.