

MEMORANDUM

State of Alaska DEPARTMENT OF FISH AND GAME

TO: Scott Kelley, Regional Supervisor
Region I - CF

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SUBJECT NSEI sablefish
assessment for 2009

Following is a summary of conclusions, data, and other information considered for determining the NSEI/Chatham Strait sablefish allowable biological catch (ABC) and annual harvest objective (AHO) for 2009.

The recommended ABC for 2009 is 1,290,868 round pounds. This represents a 20% decrease from the 2007 ABC (1,623,219 round pounds), where:

- 2007 ABC was based on an $F_{40\%}$ harvest rate (=0.116) applied to the lower bound of the 90% confidence interval (LCI) of the 2007 forecasted biomass (15,591,896 round pounds).
- 2009 ABC was based on an $F_{45\%}$ harvest rate (=0.104) applied to the point estimate of the 2009 forecasted biomass (13,775,900 round pounds).

The recommended AHO for 2009 is 1,071,000 round pounds and the Equal Quota Share (EQS) is 12,170 round pounds. This represents a 22% decrease from the 2008 EQS (15,710 round pounds), where:

- 2008 AHO included two types of decrements: 1) estimated sablefish mortality in the halibut fishery and 2) 3% of the ABC to represent harvest from subsistence, sport fishing, and personal use and mortality in non halibut fisheries.
- 2009 AHO included the two types of decrements used for the 2008 AHO and a third: 3) sablefish anticipated to be caught in the testfish fishery in NSEI, based on an average of the last 3 years.
- The number of permit holders decreased from 2008 (96) to 2009 (88).

General Information

It is the department's goal to determine the annual quota for NSEI based on a harvest rate applied to an estimate of biomass.

- Data from a mark-recapture survey, a longline survey, port sampling, fish tickets, logbooks

- from permit holders, and ageing of otoliths were used to evaluate stock status.
- The population size in 2008 was estimated using mark-recapture methods and the Petersen estimator. From this a forecast of biomass was developed by decrementing for natural mortality, adding for recruitment, and converting to biomass.
 - The ABC was determined by applying an $F_{45\%}$ harvest rate to the forecast point estimate.
 - The reduced ABC for 2009 is a result of four factors (Table 1):
 - 1) an 18% decrease in the ABC due to the difference between the 90% LCI of the 2007 forecasted population biomass and the 90% LCI of the 2009 forecasted population biomass,
 - 2) a 9% increase in the ABC due to the difference between the 2007 $F_{40\%}$ harvest rate (0.116) and the 2009 $F_{40\%}$ harvest rate (0.127),
 - 3) an 18% decrease in the ABC due to the difference between the 2009 $F_{40\%}$ harvest rate (0.127) and the 2009 $F_{45\%}$ harvest rate (0.104), and
 - 4) an 8% increase in the ABC due to the difference between the 90% LCI of the 2009 forecasted population biomass and the point estimate of the 2009 forecasted population biomass. These are discussed in detail below.
 - The ABC was considered within the context of both long and short term trends in catch-per-unit-effort (CPUE) observed in the longline survey and the commercial fishery. ADF&G harvest rate was compared to that used by NMFS for the GOA/BSAI sablefish fishery.
 - The AHO was calculated by subtracting estimated harvest from the subsistence, sport, and personal use fisheries, mortality in the halibut and NSEI sablefish directed fisheries, and the anticipated 2009 test fish fishery harvest (average of previous three years harvest, Table 2) in NSEI.
 - In 2008, a stock assessment was foregone so that methods and results of the stock assessment for 2007 could be documented in a published form. In addition to the publication of current stock assessment methods and stock status, results from a recent contracted review of the stock assessment will be published. These works will be published to document the stock assessment and explain the need for the large reduction of the quota in 2007.

Table 1. Iterative policy changes from 2007 to 2009 (and within 2009) and their effect on the resulting acceptable biological catch (ABC) for 2009.

Biomass forecast year	Harvest rate year	Biological reference point	Estimate Type	ABC (round pounds)	Change (%)
2007	2007	$F_{40\%}$	90% LCI	1,623,219	
2009	2007	$F_{40\%}$	90% LCI	1,332,661	-18%
2009	2009	$F_{40\%}$	90% LCI	1,459,074	9%
2009	2009	$F_{45\%}$	90% LCI	1,199,508	-18%
2009	2009	$F_{45\%}$	Point	1,290,868	8%

Table 2. Northern Southeast Inside sablefish test fishery harvest in pounds of whole fish, 1988-2008.

Year	ADFG Test Fishery
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
2006- 2008 Average	111,238

Biomass Estimate

- The 2009 ABC was based on the 2008 Petersen-estimated number of fish. Uncertainty in the estimate is considered to be underestimated due to the relatively simple estimator used and heavy reliance on assumptions. This is reflected in the narrow confidence intervals that have surrounded estimates for the past six years (Figure 1).

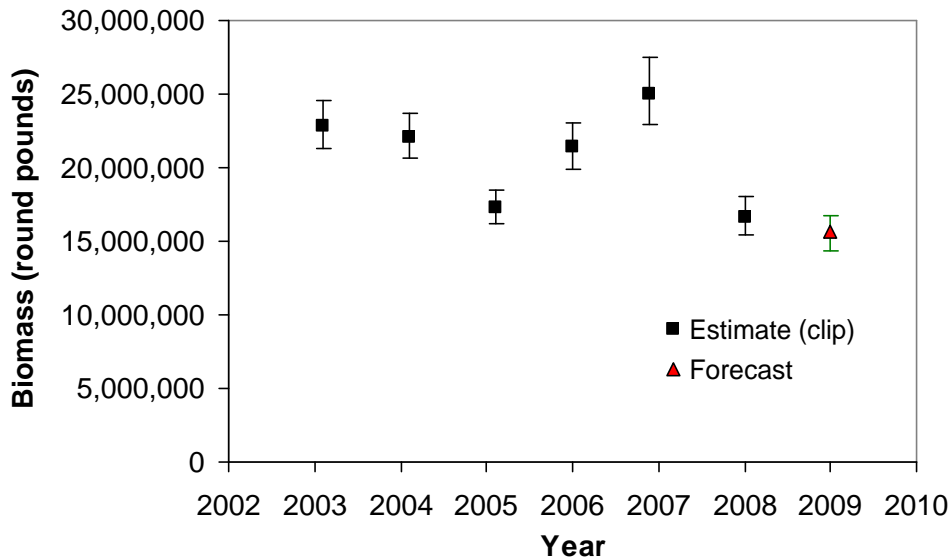


Figure 1. Petersen estimates of exploitable biomass with the 2009 forecast and 90% confidence intervals.

Evaluation of assumptions for the Petersen abundance estimator

- It was assumed that the behavior of the Chatham sablefish population, Chatham fishery, and survey crews deviated from the assumptions of the Petersen estimator in a similar manner and to a similar extent as past years. In 2007, through our assessment and the additional contract work, deviations from these assumptions (equal catchability, closure, selectivity, etc.) were examined in detail, and though some deviations were found, the estimator was believed to be useful for Chatham Strait sablefish.
- Additional attention to distribution of marks by depth was conducted in 2008 to help reduce deviations from the constant catchability assumption of the Petersen estimator. Like previous years, marking of fish during the 2008 pot survey was distributed across statistical areas in proportion to harvest (which was assumed to be approximately proportional to abundance) and spread out across regions within each statistical area. Unlike previous years, it was based upon average harvest from the three previous years (2005-2007) rather than just the previous year (this was done in response to a suggestion from the sablefish contract work). In addition and unlike previous years, marking within a statistical area during 2008 was distributed across depths in approximate proportion to 2007 harvest.

Harvest Rate

- Compared to the harvest rate calculated in 2007 (and implemented in 2007 and 2008), length at age has increased for female fish under 27 years of age and for male fish under 24 years of age, whereas weight at length, maturity at length, and selectivity at age have remained approximately the same. Because of the increase in length at age, fish are maturing at a younger age than in 2007 while they are being selected at approximately the same age as in

2007. As a result, the harvest rate for a given biological reference point (e.g. $F_{40\%}$) has increased since 2007 (Table 2).

- In 2008 industry was notified of our decision to change from an $F_{40\%}$ to an $F_{45\%}$ harvest rate in 2009 (2008 NSEI Sablefish quota news release dated June 11, 2009). As a result, the harvest rate used for the 2009 ABC is lower than that used in 2007 and 2008 (Table 2).
- As was the case for the harvest rate used in 2007 and 2008, only recent years of age data that relied on the same otolith pattern interpretation were used for the 2009 harvest rate calculations.
- Selectivity can only be estimated with an age-structured model (NMFS uses; ADF&G does not), so NMFS estimates are used. As for the harvest rate used in 2007 and 2008, selectivity at age was adjusted to reflect the differences between NMFS and ADF&G aging.
- As for the 2007-2008 harvest rate, synchronized years of data were used to determine length at age, weight at length, and maturity at length for the 2009 harvest rate. The harvest rate used from 2004 to 2006 was based on data that were not synchronized, which could have led to invalid comparisons if changes had occurred in the population during the different time periods when data was collected.

Other considerations regarding the harvest rate are:

- The 2009 $F_{45\%}$ harvest rate is still above what NMFS considers its overfishing rate, and is well above its current $F_{40\%}$ adjusted =0.085 (Table 2, Figure 2).
- DFO has done analyses that suggest that its stock will, on average, decline at harvest rates greater than 0.08 and will hold or build at harvest rates lower than that (pers. comm.).
- ADF&G harvest rate was elevated to $F_{40\%}=0.138$ in 2004 as a result of combining data from inconsistently aged otoliths due to not being aware of changes in aging patterns. While this was below NMFS overfishing level and near NMFS $F_{40\%}$ adjusted harvest rate in 2004, it was greater than those used in 2005 and 2006. This rate was maintained during 2004-2006 due to lack of updating data during staffing turnover (2005) and a decision by management staff to defer stock assessment recommendations in 2006. The harvest rate used during 2004-2006 is now considered to have been inappropriately high (Figure 2).
- Harvest rates were recalculated for 2004-2006 in the same manner as for 2007 (using only years of consistently aged otoliths, adjusting selectivity at age, and synchronizing years of length, weight and maturity data). This resulted in $F_{40\%}$ harvest rates of approximately 0.101, 0.103, and 0.112, respectively, which further suggests that harvest rate was set too high in those years.
- For future years, consideration will be given to using a more conservative harvest rate strategy (one more closely aligned with NMFS which uses female maturity only and decreases harvest rate when spawning biomass approaches $B_{40\%}$ and one that accounts for bias in the population estimate as a result of differential selectivity by fishermen based on fish size).

Year(s) applied to ABC	Biological reference point	Years of longline survey data used	Harvest rate
2004-2006 calculated but not applied for 2006	$F_{40\%}$	Different years of data used for different parameters	13.77%
2007-2008 calculated but not applied for 2009	$F_{40\%}$	2002-2005	11.18%
2009	$F_{45\%}$	2002-2006	11.57%
	$F_{40\%}$	2007-2008	12.74%
	$F_{45\%}$	2007-2008	10.36%

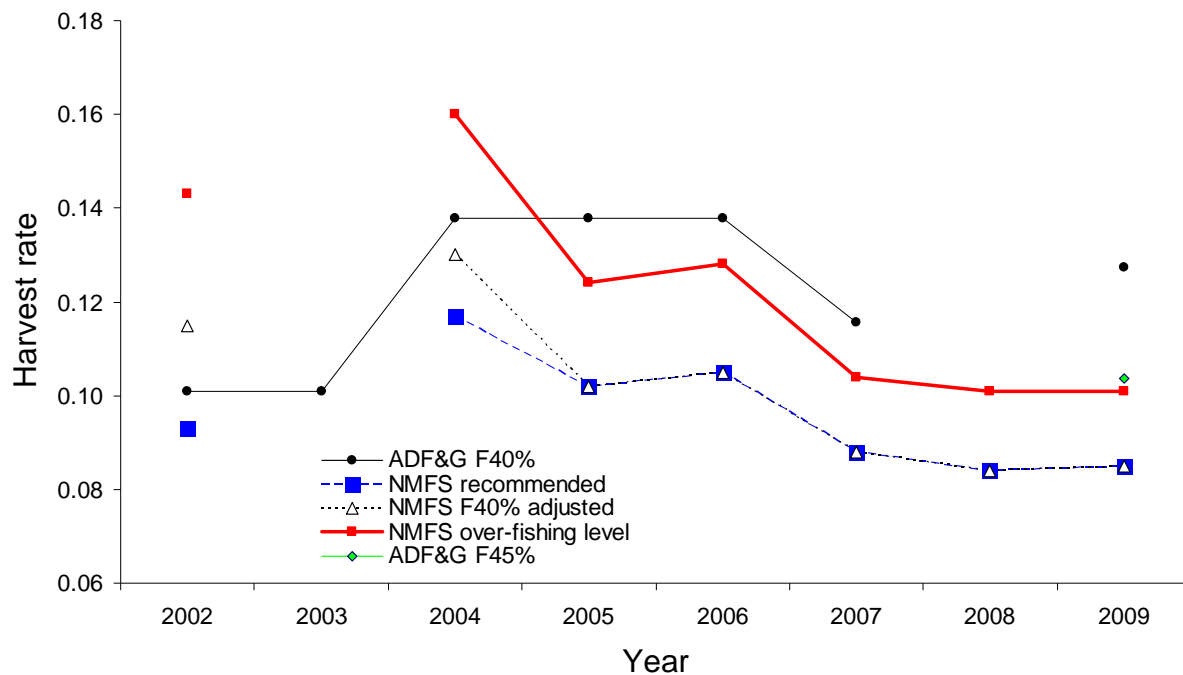


Figure 2. Comparison of sablefish harvest rates among years and between agencies. ADF&G has used an $F_{40\%}$ harvest rate for calculating quotas prior to 2009 and an $F_{45\%}$ harvest rate in 2009. NMFS has recommended either an $F_{40\%}$ adjusted or more conservative harvest rate, depending on the year. NMFS overfishing definition is equal to a $F_{35\%}$ adjusted harvest rate.

Fishery and Survey CPUE

- Survey CPUE is currently at a moderate level and has been relatively stable over the past eight years. The average weight of sablefish sampled in the survey has slowly but steadily increased since 2001. When survey CPUE is expressed in round pounds per hook this increasing trend is evident. This index is considered to be useful, but less informative than the abundance estimate (Figure 3).
- Less weight was given to the fishery CPUE, because of lack of standardization (soak times, locations fished, target species, etc.) and lack of confidence in CPUE accurately tracking

trends in abundance (Figure 4).

- Long term patterns in the fishery suggest that CPUE is at low levels relative to the 1980s through mid-1990s, and generally increasing since 1998. Maximizing commercial production may mask downward trends.
- NMFS average fishery catch rate (lbs/hook) from logbook and observer fishery data sets increased after a low in 1998-2000 in response to the above average 1997 and 2000 year classes, and then decreased in 2006 in nearly all areas. Logbook data catch rates either stabilized or decreased in 2007 for all areas except East Yakutat/Southeast where the catch rate increased (Hanselman et al., 2008 SAFE).
- NMFS survey relative abundance has decreased substantially since 1988 and has decreased faster in the Eastern Bering Sea, Aleutian Islands, and Western Gulf of Alaska than in the Central and Eastern Gulf. In the East Yakutat/Southeast area, sablefish abundance decreased to its lowest level for the domestic survey. The long-term decline in relative abundance for this area, which is considered a part of the main spawning area (central and eastern Gulf of Alaska), is being monitored closely by NMFS (Hanselman et al., 2008 SAFE).
- DFO fall standardized trap survey catch rates have declined by about 39% since 2003. The 2008 stratified random survey CPUE has decreased approximately 60% since 2006 (DFO 2008 TSC report, excerpts from Brylinsky 4/23/09 email).

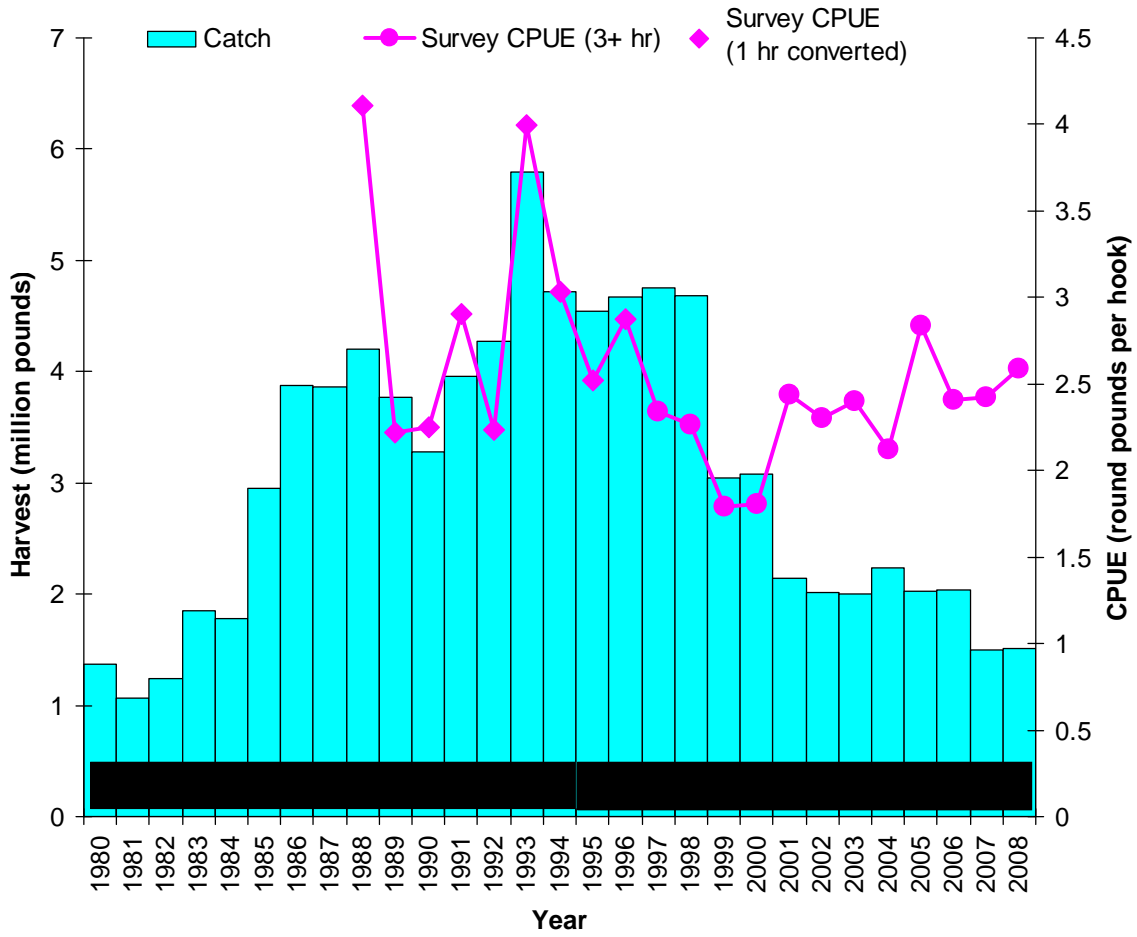


Figure 3. NSEI sablefish long line survey catch per unit effort in round pounds per hook and harvest over time.

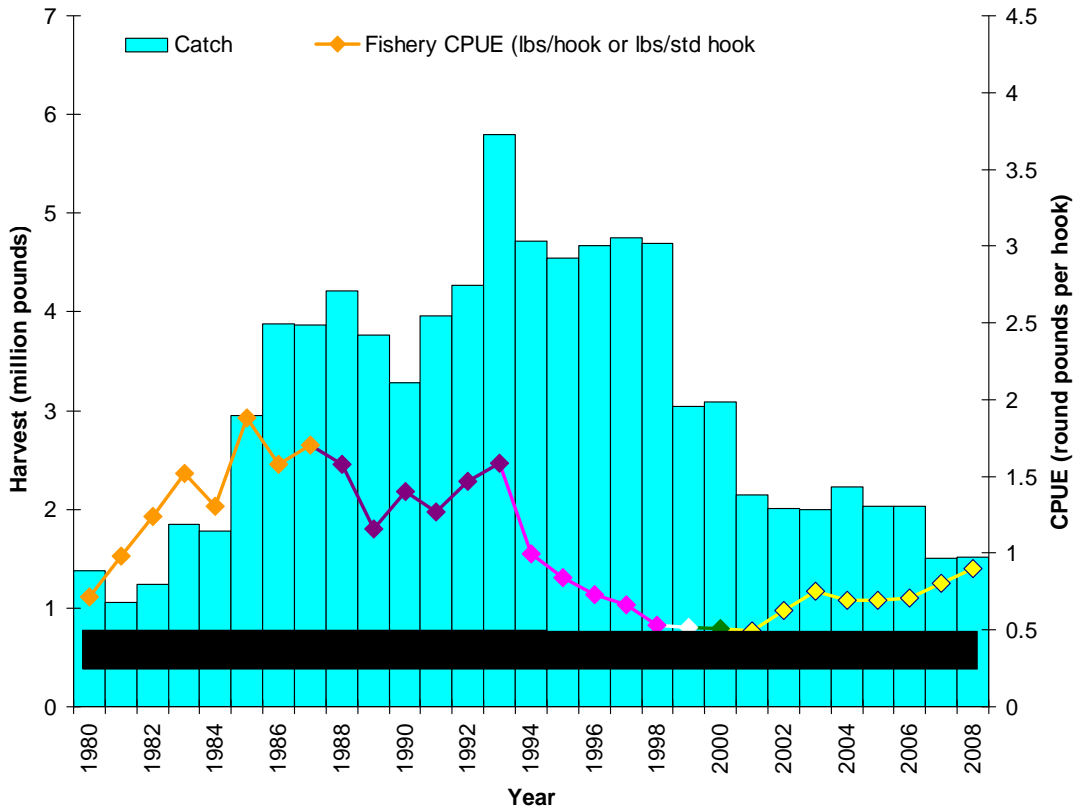


Figure 4. NSEI sablefish fishery catch per unit of effort (CPUE) in round pounds per hook or per standardized hook, depending on the year, and harvest over time. The different colors of the CPUE line indicate calculations done by different people or copied from different sources, which may have done calculations differently (e.g. hooks vs. standardized hooks, data from logbooks vs. fish tickets, from original data vs. back-calculated from numbers of fish per hook to round pounds per hook, including halibut target sets vs. excluding halibut target sets).

Age Composition

- Recruitment is generally expected to appear in Chatham Strait as four, five, six, or seven year olds.
- Recruitment appears to have improved in 2007 and 2008 (Figure 5).
- There continues to be a much narrower distribution of ages in recent years relative to preceding years and a decline in the proportion of older fish. Since older fish are generally larger and more fecund, compressing the age distribution around younger, smaller fish during a period of population decrease could reduce the reproductive potential of the population.
- The pulse of sablefish that entered the population in the early 1990s and likely supported the fishery for several years appears to have diminished.

- The 2000 year class in the North Pacific was considered to be strong based on NMFS observations and modeling of GOA/BSAI sablefish. There is no evidence of large incoming recruitment. Based on DFO observations up through spring of 2007, the 2000 year class was not as strong in British Columbia as in GOA/BSAI. In addition, as of spring 2007, DFO had observed low recruitment coast wide since the 2000 year class.

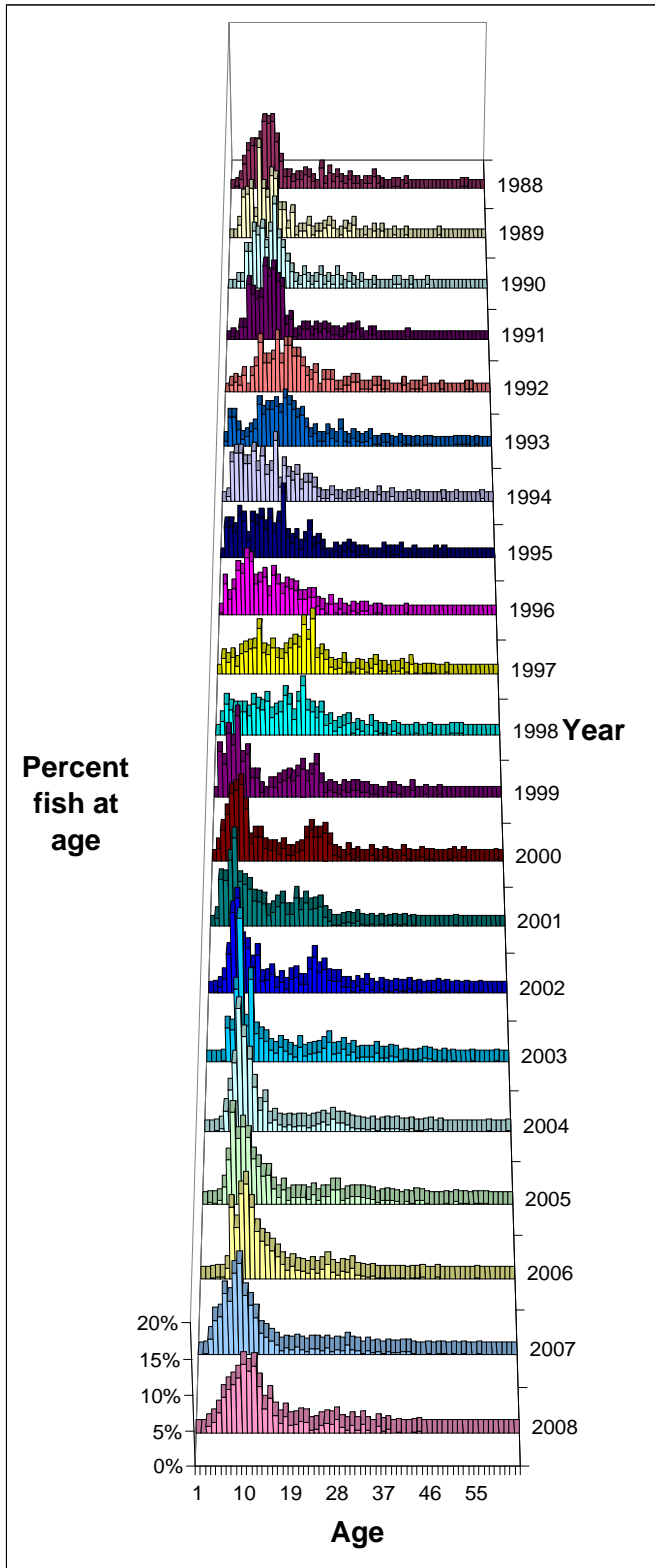


Figure 5. NSEI sablefish age distribution from longline survey. This plot does not incorporate the updated ages from the Age Determination Unit (ADU). The updated ages may change by approximately a year for younger ages in some years.

Decrements to the ABC

- Decrements in 2008 totaled 115,000 round pounds (66,232 round pounds for mortality in the halibut fishery and 48,697 round pounds for the 3% of the ABC decremented for subsistence, sport fishing, personal use and mortality in non halibut fisheries).
- Decrements for 2009 total 220,205 round pounds (70,241 round pounds for mortality in the halibut fishery, 38,726 round pounds for the 3% of the ABC decremented for subsistence, sport fishing, personal use and mortality in non halibut fisheries, and 111,238 anticipated to be caught in the testfish fishery in NSEI, based on an average of the last 3 years).

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