Fishery Management Report No. 16-27

Northern Southeast Inside Commercial Sablefish Fishery and Survey Activities in Southeast Alaska, 2015

by

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and

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY MANAGEMENT REPORT NO. 16-27

NORTHERN SOUTHEAST INSIDE COMMERCIAL SABLEFISH FISHERY AND SURVEY ACTIVITIES IN SOUTHEAST ALASKA, 2015

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ABSTRACT

This report summarizes the biological and catch per unit effort data (CPUE) for the 2015 sablefish (*Anoplopoma fimbria*) longline survey and commercial fishery in the Northern Southeast Inside (NSEI) Subdistrict of Southeast Alaska. The longline survey and commercial fishery data are used to evaluate the stock status of sablefish in NSEI, along with other information including an abundance estimate based on a mark-recapture experiment. The NSEI fishery and survey CPUE indices have been declining in the last 4 years with the 2015 CPUE estimates below the 5- and 10-year averages. From 2014 to 2015, the longline survey CPUE declined 7.5% from 1.47 round lb per hook to 1.36 round lb per hook, and the fishery CPUE declined 16.5% from 0.85 round lb per hook to 0.71 round lb per hook. Declines in survey and fishery CPUE, along with declines in fishery and survey weight-at-age, harvest rate, and forecasted exploited abundance contributed to management decisions to reduce the annual harvest objective (AHO) by 17.3% in 2016. Conservative management of this stock is warranted at this time due to lack of recruitment and projected declines in spawning biomass into the near future for Alaska waters.

Key words: Northern Southeast Inside, NSEI, Chatham Strait, sablefish, black cod, Anoplopoma fimbria, longline, fishery, longline survey

INTRODUCTION

Sablefish (*Anoplopoma fimbria*), also known as "black cod," are found throughout the western and eastern North Pacific Ocean and support valuable commercial fisheries in Southeast Alaska. The Alaska Department of Fish and Game (ADF&G) manages commercial fisheries in the inside waters in the Southern Southeast Inside (SSEI) and Northern Southeast Inside (NSEI) Subdistricts (Figure 1). In the NSEI Subdistrict, ADF&G annually collects biological data during the commercial fishery and the longline survey. Abundance estimates are derived using a mark-recapture estimate where fish are marked during a pot survey and recaptures occur during the longline survey and commercial fishery by examination of landed fish for marks. Information derived from the stock assessment model, along with survey and fishery catch per unit effort (CPUE) and biological data (length, weight, age, sex, and maturity) are used to evaluate the stock annually and to obtain an annual harvest objective (AHO). This report summarizes the survey and fishery biological and CPUE data through 2015 for the NSEI Subdistrict. Details on the marking survey can be found in Baldwin and Stahl 2014 and on the stock assessment in Dressel 2009 and in the annual news release, which announces the AHO[1].

HISTORY OF THE FISHERY

The harvest of sablefish in the internal waters of Southeast Alaska began in the early 1900s. Prior to the 1940s, sablefish were primarily caught in the halibut fishery as incidental catch (Bracken 1983). Sablefish harvest fluctuated until the 1970s due to product demand and other fishing opportunities with high harvest levels occurring during World War I and World War II (Bracken 1983). Since the 1970s, large harvest rates for sablefish have been supported by high market prices (Bracken 1983).

Seasonal limitations have been imposed in the NSEI management area since 1945 to protect spawning fish and to manage the fishery harvest within the guideline harvest range (GHR) (Bracken 1983). As fishing effort increased in the 1970s and 1980s fishing seasons were shortened to reduce annual harvest (Green et al. 2014). A limited entry program was implemented in 1985; however, managing the fishery to remain within the GHR was still

[1] These data were derived from the stock assessment model and were presented in the June 6, 2016 ADF&G News Release, issued by groundfish project leader Andrew Olson

difficult due to the number of participating vessels and improvements in the operating efficiency of the fleet. Consequently, the number of annual fishing days continued to decrease to as low as 1 day. In order to stay within the GHR, an equal quota share (EQS) system was adopted in 1994. In addition, seasonal closures were implemented from December 1–March 15 to protect spawning sablefish after declines in CPUE and average weight were observed in the 1940s (Holum and Coonradt 2005). These closures also prevented incidental catch of halibut while they were spawning (St-Pierre 1984). Since 2003, the NSEI longline fishery has been open annually from August 15 through November 15.

The AHO is set annually based on the most up-to-date abundance estimate (derived from a mark-recapture experiment) and from longline survey and fishery dependent data collected from previous years. Prior to 1997, AHOs were set for the NSEI fishery after the longline survey was completed just before the fishery opener (Green et al. 2014). Since 2003, AHOs have been set based on the forecasted biomass with a harvest rate applied that accounts for biological characteristics of the population and mortality in sablefish and other fisheries (Dressel 2009). Biomass estimates are obtained using mark-recapture methods with the marking occurring during the May–June pot survey and the recapture phase occurring during the NSEI survey and fishery landings (Green et al. 2016). Historically the pot survey occurred annually; however, since 2013 the survey has occurred on a biannual schedule due to reductions in funding (Baldwin and Stahl 2014). The most recent mark-recapture estimate is included in the annual stock assessment model.

The AHO for NSEI has declined since the EQS system was established in 1994 with the 2015 AHO 84% lower than the peak AHO in 1997 and 1998 (Table 1; Figure 2). The largest interannual decrease in AHO occurred from 1998 to 1999 (35% reduction) followed by another decrease from 2000 to 2001 (30% reduction). The AHO reached a historical low in 2014 at 745,774 round lb, followed by a slight increase to 786,748 round lb in 2015 (Table 1; Figure 2).

NSEI REGULATIONS AND FISHERY PARTICIPATION REQUIREMENTS

In the NSEI sablefish longline fishery, fishermen have an allowable overage of 5% for sablefish and bycatch allowances for other species. A personal quota share (PQS) is generated annually for each permit holder based on the annual EQS with a ±5% adjustment for the pounds of sablefish landed in the previous year that were greater than or less than their PQS in that year and were within the allowable overage/underage. This overage/underage allowance has been in regulation since 2003 in an effort to reduce discard mortality (Green et al. 2014). Proceeds from sablefish overages that exceed 5% are forfeited to the State of Alaska [5 AAC 28.170(j)]. Full retention and reporting of rockfish (*Sebastes*), excluding thornyheads, is required for internal waters (5 AAC 28.171). All demersal shelf rockfish in excess of 10 percent, round weight, of all target species on board the vessel are weighed and reported as bycatch overage on a fish ticket. All proceeds from the sale of excess rockfish bycatch must be surrendered to the state [5 AAC 28.171(f)].

Permit holders in the NSEI fishery are required to register prior to fishing in NSEI. To register, a vessel owner or owner's agent must complete a NSEI sablefish longline fishery registration document with the vessel's name, owner's name, ADF&G number, and Commercial Fisheries Entry Commission (CFEC) permit number for each permit holder who will be on board the vessel. Registrations are signed by the vessel owner or agent and an ADF&G representative. A copy of the registration along with the original PQS form documenting the permit holder's PQS

for the fishing season and logbooks are provided at the time of registration. During each NSEI sablefish delivery, permit holders must record on their PQS form, the round pounds of sablefish landed on their fish ticket. Once a permit holder has completed fishing, a copy of their PQS form must either be turned into the processor with their last logbook or to an ADF&G office.

NSEI fishery data are currently collected through a mandatory logbook program and fish tickets from each landing. A logbook is required to be turned in at the time of each landing. Generally permit holders turn in their logbooks to processing plant staff who return both the logbook and fish ticket to ADF&G; however, logbooks may be directly given to ADF&G as well. Processing plant staff are required to enter delivery data into the eLandings database which generates the fish ticket. Fish tickets must be signed, finalized, and submitted to a local ADF&G representative no later than 7 days after a delivery or partial delivery [5 AAC 39.130(c)]. Voluntary logbooks and interviews with skippers were initially used in the late 1980s to collect fishery data (Stahl et al. 2015). In 1997, logbooks became mandatory and include the following information by set: date, gear (type, hook spacing, number of hooks), location (start and end latitude and longitude), depth, estimated number or weight of target species, and incidental catch (5 AAC 28.175). Sablefish that are not visibly injured or dead may be released unharmed, and the permit holder must record in the logbook the number of live sablefish released from each set [5 AAC 28.170(f)]. Additionally, the tag number of any landed tagged sablefish must be recorded on the logbook by set [5 AAC 28.175(5)]. Skippers should document in their logbook any occurrence that could affect CPUE, including whale depredation and sightings by species[2].

HISTORY OF THE LONGLINE SURVEY

Annual longline surveys are conducted by ADF&G in the NSEI Subdistrict to assess sablefish stock status. The longline survey has been conducted since 1988 and was designed as a random stratified survey with fixed stations placed in sablefish habitat (depths greater than 200 fathoms) in areas where the majority of the commercial NSEI fishery harvest occurred (Green et al. 2014). Stations are located in 4 statistical areas: 345731, 345701, 345631, and 345603 (Figure 1).

Changes to longline survey stations have occurred over time, but in 1997 became standardized (Vaughn 2010). Initially there were 24 survey stations within Chatham Strait; as years passed, stations were added in order to increase spatial coverage (Carlile et al. 2002). In 1988, one-thousand hooks were fished at each station; this was reduced to 500 hooks in 1989 to allow for the addition of more survey stations while maintaining the original time frame for the survey. At least 38 stations were fished annually from 1989 through 1992. Some survey stations have been eliminated over time; however, survey stations were standardized in 1997, and the same 44 stations have been fished annually.

In most years, the longline survey has been conducted by chartered commercial fishing vessels. However from 1993 to 1995, the survey was performed solely by the state research vessel the *R/V Medeia*. In 1996, parallel surveys were conducted with the *R/V Medeia* and a chartered commercial vessel. After examination of the CPUE between vessels and factors such as cost and time at sea were evaluated, the survey was moved back to chartered vessels in 1997. Since then, three chartered commercial fishing vessels have been used to fish concurrently in order to

[2] Example 1: Sperm whales were observed taking fish from the longline on set 2. Some sablefish came up on the line with only lips on set 3. Example 2: Killer whales were observed in area during setting on set 3, but no noticeable damage to fish was observed.

conduct the annual NSEI longline survey with the exception of 1999 when two vessels were used (Carlile et al. 2002).

In 2000, to facilitate comparisons between sablefish stocks in federal and state waters, standardization occurred to the specifications used on the federal longline survey for hook spacing, gear soak time, and bait type and size (Carlile et al. 2002). Hook spacing was 1.6 m to 1.8 m from 1997 to 1999; in 2000 spacing was standardized to 2 m. Survey gear retrieval time was originally 1 hour after deployment, but in 1997, a 3- to 11-hour soak time was implemented to match the minimum 3-hour soak time used on the federal longline survey (Cartwright 2000). Additionally, bait was switched from herring to squid due to the concern that herring disintegrates with longer soak times (Cartwright 2000).

NSEI SURVEY PARTICIPATION REQUIREMENTS

To reduce the impact of the annual longline survey on the stock, up to 9 NSEI EQS permit holders may participate in the survey. Permit holder's participating in the survey may sell sablefish up to the weight equivalent to their PQS for that year. Excess harvested sablefish are sold by ADF&G once the PQS is met for all participating permit holders. Permit holders can also sell bycatch taken during the survey within the bycatch allowances with any overages being sold by ADF&G.

BIOLOGICAL DATA

Since the annual longline survey began in 1988, biological data have been collected for sablefish in the NSEI management area. Sablefish samples have been collected from the NSEI commercial fisheries opportunistically since 1998 and annually from the longline fishery since 2000. Sablefish are currently sampled for length, weight, sex, age, and maturity.

METHODS

LONGLINE SURVEY

Survey Operations

The chartered commercial longline vessels F/V *Masonic*, F/V *Magia*, and F/V *Kaia* were used to complete the 2015 NSEI longline survey from July 22 to July 29. All 3 boats fished concurrently to survey the 44 stations (Figure 3). The F/V *Masonic* fished 14 stations in southern Chatham Strait, the F/V *Magia* fished 15 stations in mid Chatham Strait (primarily statistical area 345701), and the F/V *Kaia* fished 15 northern stations (primarily statistical area 345731). The F/V *Kaia* had 3 permit holders that fished their PQS; 2 permits of 10,087 lb and 1 of 10,192 lb.

In 2015, a longline set was performed at each of the survey stations. Each set was placed in the same direction as the tidal current; haul direction was determined by the tide, wind direction, and currents. Sets consisted of 25 skates each with 45 hooks (#13/0 Mustad circle hooks with 2 m hook spacing) and were soaked for 3 to 11 hours. Hooks were attached to gangions that were secured to beckets tied to the groundline and placed 15 in from the groundline (the length of the gangion plus becket). At the end of each set was 200 fathoms of running line with a 60 lb longline anchor, buoys, and a "high flyer" attached. At the end of each skate was 5 m of bare groundline with a 6.6 lb lead ball attached. Gear was composed of gangions of medium lay #60 nylon round braided twine, beckets of medium lay #72 nylon becket twine, and groundline of medium lay 1 cm nylon American Line SSR 100. Prior to the survey, new hooks were attached

to each skate, and during the survey, bent, straightened, and missing hooks were replaced while baiting. Hooks were baited with squid (*Illex argentinus*) cut into 1.5 to 2 in pieces. Bait was thawed within 24 hours of use and only the squid body was used (head and tentacles discarded).

Survey Data Collection

Information was collected for each survey set, including: the date and time of gear deployment and haul back, start and end latitude and longitude, deployment depth of each anchor and skate, haul back direction, wind direction and speed, and bottom substrate (Appendices A and B). Substrate was evaluated based on the skipper's interpretation of sounder information and whether any substrate was attached to the fishing gear (i.e., mud on the anchors). Problems with gear or other factors potentially impacting CPUE (i.e., presence of sharks or whales) were also recorded.

At each set, an observer performed accounting of all hooks as they broke the surface of the water. Fish were tallied by species, and hooks without fish were recorded as "bare," "bait," or "invalid," which included hooks that were bent, broken, missing, or associated with a snarl. Fish breaking the water surface attached to a hook were identified to the lowest possible taxonomic group and tallied. All species other than sablefish, rockfish (*Sebastes* spp.), and arrowtooth flounder (*Atheresthes stomias*) were released with minimum injury. *Sebastes* spp. of rockfish were retained due to a high probability of mortality as a result of barotrauma. Typically, shortspine thornyhead rockfish (*Sebastolobus alascanus*) were released if they appeared healthy. The genus *Sebastolobus* lack a swim bladder and therefore do not suffer the effects of barotrauma as do most other rockfish. However, in 2015 1 survey vessel, the F/V *Kaia*, retained shortspine thornyhead rockfish to sell until their bycatch allowance was met. In 2015, arrowtooth flounder were retained for a University of Alaska Fairbanks graduate project; these fish are typically released. Additional information was noted for captured sablefish. If sablefish were not landed, but broke the water surface attached to a hook, they were recorded as "lost." Sablefish considered unfit for sale were released with the discard reason reported as "flea," "shark," "whale," or "not marketable." In NSEI, shark depredation has only been recorded for Pacific sleeper sharks (*Somniosus pacificus*); it is possible that depredation could occur for other species, such as spiny dogfish (*Squalus suckleyi*). Whale damage may be distinguished from shark damage in cases where whales remove the entire torso, leaving the fish head and lips. Other types of damage may be difficult to distinguish. Whales use canine-shaped teeth to rip flesh whereas sleeper sharks use small teeth to rasp flesh; sometimes whale damage is indicated by tooth marks. If whales are spotted in the area and depredation occurs, then the discard code is reported as "whale." Fish with tumors, wrapped in the groundline, or showing other signs of damage not already described were reported as "not marketable."

BIOLOGICAL DATA (SURVEY AND FISHERY)

In 2015, sablefish biological samples were collected at-sea during the NSEI longline survey and from longline fishery landings in Sitka, Petersburg, and Juneau. Random samples were collected throughout the fishery landings and systematically on the survey (first sablefish of each set and every 20th fish thereafter for the first 20 skates of each set) for fork length (nearest cm), weight (nearest 0.1 kg), sex, maturity, and otoliths. At-sea Marel motion compensation scales were used to obtain accurate weights; if seas were too rough to obtain a reliable weight then fish were not weighed. During the NSEI survey, additional fork lengths were collected from every 21st sablefish from the first 20 skates for each set. Visual observations of the gonads were used to

assess sex and maturity of male and female sablefish. Maturity of sablefish was based on a 6-stage macroscopic maturity key for the survey (Table 2) and for the fishery prior to 2015; for the 2015 fishery, a 2-stage macroscopic maturity key with the stages of immature and mature fish was used to simplify maturity assessment (Table 3). Immature fish included fish that had not spawned the previous season and would not likely develop in time for the upcoming spawning season and were formerly classified as immature and maturing juvenile. Mature fish included fish that had spawned previously or appeared they would spawn in the upcoming season and were formerly classified as mature/developing, spawning, spent/post spawning, and resting. Otoliths were cleaned, hand-dried, and sent to the ADF&G Age Determination Unit in Juneau for aging using the break-and-burn technique (Williams and Bedford 1974).

CPUE (SURVEY AND FISHERY)

In 2015, CPUE was calculated for both the NSEI longline survey and the fishery. Fishery and survey CPUE were standardized for the number of hooks in order to account for variable hook spacing because sablefish catch per hook increases with hook spacing (Sigler and Lunsford 2001). Hook spacing can be standardized with the asymptotic function developed by Skud and Hamley (1978). The National Oceanic and Atmospheric Administration (NOAA) has adapted this function for sablefish using hook spacing experiments conducted in Chatham Strait and the Gulf of Alaska (GOA; Sigler and Lundsford 2001). To directly compare NSEI fishery and survey CPUE, hook spacing for the fishery was standardized using the following formula:

$$N_{std} = N_{unstd} C_{\infty}(1 - \exp(-kh))$$

where C∞ = relative maximum catch per hook

k = measure of the rate at which the maximum is reached; and

h = the hook spacing (meters).

For the survey CPUE analyses, only valid skates were included that contained no more than 25% (<12) missing, bent, broken, or snarled hooks of the 45-hook skate, and both lost and released sablefish were included. The CPUE of sablefish per hook (fish per hook) for an individual station was calculated by dividing the total sablefish by the total hooks retrieved at that station. The overall fish per hook for the entire survey was calculated by dividing the sablefish captured by the total hooks retrieved. In addition, a CPUE for pounds per hook for the survey was calculated by multiplying the overall fish per hook by the mean weight in pounds of all fish sampled on the survey.

Fishery CPUE information was collected through logbooks and fish tickets. Fishery CPUE was calculated for 2015 by dividing the total biomass harvested by the total standardized number of hooks. The biomass was derived from harvest recorded by statistical area on fish tickets but was apportioned to fishing sets according to the proportion of fish harvested by set documented on the corresponding logbook. The total weight of fish landed is more accurate on the fish ticket, because this is an actual weight and not an estimated value as is recorded on logbooks.

Longline sets were excluded from CPUE analyses if permit holders were targeting halibut or if sablefish were targeted but only halibut were caught on the set. However, if sablefish were caught on halibut target sets during a sablefish trip, then those sets were included when calculating CPUE. In addition, another CPUE index was calculated for comparison that included

only sets performed at depths greater than 450 m. This criterion was selected to potentially exclude sets targeting halibut because target by set was not consistently recorded on logbooks.

For the fishery, the reported CPUE values were not adjusted for variability that may occur between fishing sets due to soak time, hook size or type, bait type, gear type (conventional, mixed, snap-on, or autobaiter), vessel, or area fished.

RESULTS

SURVEY

A total of 12,793 sablefish were captured during the 2015 NSEI longline survey; of these, 12,274 sablefish were retained and sold. Approximately 4% of sablefish were lost before landing, and <1% were discarded because they were considered unfit for sale due to sharks or sand flea damage. No sablefish were discarded due to whale depredation in 2015.

On 1,062 valid skates, out of a total of 48,158 hooks, 65% the hooks without fish had bait attached to the hook as it broke the water surface. Bare hooks composed 30% and 5% of hooks that did not capture fish were invalid hooks. The proportion of total hooks that were bare in valid skates ranged from 7% to 38% by station.

A total of 3,485 fish and 1,332 other marine species were caught and noted during the 2015 survey. Shortspine thornyhead rockfish were the most abundant non-targeted species and comprised 13% of the total catch followed by skates (*Raja rhina* and *Bathyraja* spp.) composing 7% of the total catch. Halibut (*Hippoglossus hippoglossus*) comprised 2% of the total catch. Other species comprised ≤1% of the total catch and included, in descending order of catch (in numbers), dover sole (*Microstomus pacificus*), Pacific cod (*Gadus microcephalus*), arrowtooth flounder, shortraker rockfish (*S. borealis*), rougheye rockfish (*S. aleutianus*), redbanded rockfish (*S. babcocki*), Pacific sleeper shark, grenadier (*Albatrossia pectoralis*), Pacific hake (*Merluccius productus*), spiny dogfish shark, walleye pollock (*Gadus chalcogrammus*), coho (*Oncorhynchus kisutch*), and golden king crab (*Lithodes aequispinus*). Proportions of incidental catch for each bycatch species has remained fairly consistent over time (2000 to 2015; Figure 4). Shortspine thornyhead rockfish and skates have composed the majority of the incidental catch each year (Figure 4).

FISHERY

A total of 78 permit holders were authorized to fish in the 2015 NSEI longline fishery (Table 1). All 78 permits were fished and a total of 91 longline landings occurred with logbooks and fish tickets collected at each landing.

In 2015, the NSEI commercial longline fishery harvested 780,615 round lb with an ex-vessel value of $3.4 million (Table 1). The fishery was distributed throughout Chatham Strait and Fredrick Sound (Table 4) with 94% of the harvest in Chatham Strait, 63% of which occurred in statistical areas 345701 and 345631; the remaining 6% of the total harvest occurred in Frederick Sound.

BIOLOGICAL DATA (SURVEY AND FISHERY)

In 2015, biological data were collected from sablefish in NSEI during the longline survey and longline fishery. Length, weight, sex, and maturity data were collected from 506 sablefish during the NSEI longline survey and 1,211 sablefish from the longline fishery. Additional length data

were collected from 503 sablefish on the longline survey for a survey total of 1,009 length measurements. Otoliths were collected from 500 sablefish on the longline survey and 1,203 sablefish from the longline fishery.

In 2015, sablefish sampled during the longline fishery were, on average, larger and older (71.2 ± 8.5 cm, 4.3 ± 1.7 kg, 16.5 ± 8.9 years) than fish sampled from the survey (66.7 ± 8.4 cm, 3.4 ± 1.3 kg, 12.1 ± 7.6 years; Table 5; Table 6). Length of sablefish varied by sex and between the survey and fishery with females having both a larger average and maximum size than males for both the fishery and survey (Figure 5). The average size of males (66.6 ± 5.4 cm, 3.5 ± 0.9 kg) and females (73.9 ± 8.8 cm, 4.8 ± 1.8 kg) in the longline fishery was greater than for males (62.8 ± 6.8 cm, 2.8 ± 0.9 kg) and females (69.3 ± 8.5 cm, 3.8 ± 1.4 kg) in the longline survey. In addition, the sex ratio differed between the longline survey and the fishery with a higher proportion of females captured in the fishery than in the survey. In both the survey (59%) and fishery (63%), a larger proportion of females were captured.

Fish sampled in the 2015 NSEI longline fishery had similar length and age distributions compared to previous years with no new large year classes visible for 2015 (Figure 6). The length distribution for the 2015 survey was similar to previous years for most lengths and ages (Figure 7). However, a larger proportion of small, young fish were observed in the age and length histogram compared to the previous year: ages 3 to 5 years composed 15% in 2015 compared to 3% in 2014 and lengths <520 mm composed 4% in 2015 compared to 1% in 2014 (Figure 7).

There is little variability in the distribution of sablefish by size annually or interannually within the NSEI Subdistrict (Figure 8); in all years examined (2012 to 2014), the majority (75%) of the sablefish sampled during the survey were large (>620 mm) with most stations catching a greater percentage of these larger fish. Northern survey stations caught a slightly higher percentage of smaller fish (34%, <620 mm) compared to the southern stations (19%, Figure 8) with the exception of the station furthest south (station 55), which had a higher percentage (34%─49%) of smaller fish (<620 mm). In 2012 (30%) and 2013 (31%), slightly higher proportions of smaller fish (<620 mm) were caught compared to the 2014 (23%) and 2015 (25%) surveys. There are few other notable differences between years with the exception of 2012 when stations in northern Chatham had a slightly higher proportion of small fish sampled (45%) compared to the rest of Chatham Strait than in other years (28% to 35%).

Macroscopic maturity data indicated that the majority of sablefish harvested in the 2015 NSEI survey and fishery were mature (Figure 9). During the NSEI survey, 78% of females and 73% of males were classified as mature. Of these mature fish, 43% of females and 45% of males had gonads classified in the inactive state of "spent" or "resting." One percent of the females and none of the males were classified as "spawning" for those fish sampled on the survey (Figure 10). During the longline fishery, 93% of females and 95% of males were classified as "mature" (Figure 9; Table 3).

CPUE (SURVEY AND FISHERY)

During the 2015 NSEI longline survey, less than 2% of skates were considered invalid and were removed from the CPUE analyses.

Longline survey CPUE has varied among years, with the lowest values occurring prior to 2002 and since 2013 (Table 7; Figure 11). In the last 4 years, survey CPUE has generally been

declining (Figure 11) with the 2015 CPUE (lb and fish/hook) below the 5- and 10-year averages (Table 7). Survey CPUE in fish per hook generally follows the same trend as survey CPUE in round lb per hook with the exception of 2001 when there was a much higher CPUE in fish per hook than in CPUE in round lb per hook.

Fishery CPUE has varied among years, with the highest values occurring in 2007 and 2008 and from 2011 to 2014 (Table 7; Figure 12). In the last 4 years, CPUE has generally declined (Figure 12) with the 2015 CPUE the lowest since 2004 (Table 7). The 2015 CPUE was well below the 5- and 10-year means (Table 7). Fishery CPUE generally shows similar trends for indices that include sets performed at all depths and that only include sets performed at depths >450 m (Figure 12).

DISCUSSION

The NSEI sablefish stock is comprised of older and more mature individuals compared to the GOA and SSEI. Seventeen percent of the females captured during the NSEI longline survey were immature (2005 to 2015 average of 4% immature females), compared to 40% in adjacent federal waters in the GOA (D. Hanselman, 2015, personal communication) and 61% in state waters in the SSEI Subdistrict, which is located in Clarence Strait and Dixon entrance (2004 to 2014 average of 47% immature females; Stahl et al 2015). In addition, on average, older fish are captured in the NSEI fishery (16.0 ± 9.9) and survey (14.4 ± 9.4) (Table 6) compared to the SSEI fishery (10.0) and survey (8.5; Stahl et al. 2015).

The average size and age of sablefish differs among the NSEI survey and longline fishery, with older and larger fish captured in the longline fishery (Table 5; Table 6). Longline fishermen are likely discarding small fish or targeting fishing locations with larger sablefish. One factor motivating this behavior is the substantially higher price paid for large fish. In 2015, processors paid an average $8.03 for fish over 7 pounds and $4.27 for fish less than 5 pounds, a 47% difference in price. This price difference was even greater in 2012 with processors paying 55% more for large fish (>7 lb). Targeting larger fish may lead to a disproportionate harvest of females to males due to size differences between sexes (i.e., females are generally larger than males).

The age distribution of the NSEI sablefish stock is compressed with fewer older and smaller fish. A lack of recruitment has occurred since the late 1990s with few strong year classes since 2000. The 2008 year class initially appeared to be the largest year class since 2000 (Dressel 2009) with larger than average proportions of young fish first emerging in surveys and fisheries across Southeast and the GOA in 2010 and 2011 (Hanselman et al. 2013; Stahl et al. 2015). However, by 2015 the 2008 year class was of average size in the NSEI and federal fisheries (Hanselman et al. 2015). In addition to the general lack of recruitment of young fish to the NSEI stock, there has been a decline in the proportion of sablefish older than 20 years of age since the early 2000s causing a narrowing of the age distribution for this stock (Figure 6; Figure 7). This decline in older fish may reduce the reproductive potential of the population, because older fish are generally larger and more fecund (Dressel 2009).

For the 2016 NSEI fishery, the department decreased the AHO to 650,754 round lb, which was a 17.3% reduction from the 2015 AHO (786,748 round lb). The 2016 AHO was reduced primarily due to decreases in the forecasted exploited abundance, the fishery and survey weight-at-age, and

the harvest rate[3]. Declines in the survey (7.2% round pounds per hook) and fishery (15.5% round pounds) CPUE between 2014 and 2015 (Table 7) also contributed to the reduced AHO. In addition, decreases were observed in the federal longline survey abundance indices in the adjacent GOA waters from 2014 to 2015 (Hanselman et al. 2015). It is projected that the spawning biomass will continue to decline across the GOA in the near future with general lack of recruitment (Hanselman et al. 2015); consequently, conservative management of the NSEI fishery is warranted. A new mark–recapture survey to estimate abundance is scheduled for 2017.

[3] See June 6, 2016 ADF&G News Release, issued by groundfish project leader Andrew Olson.

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TABLES AND FIGURES

Table 1.–Annual harvest objective (AHO), equal quota share (EQS), reported harvest (round lb), ex-vessel value, and effort for the directed commercial NSEI sablefish fishery, since the equal quota share was established in 1994.

Year	AHO	EQS	Harvest	Ex-vessel value	No. of permits
1994	4,761,905	38,889	4,713,552	$9,144,290	121
1995	4,761,905	38,889	4,542,348	$7,721,991	121
1996	4,761,905	38,889	4,676,701	$9,908,246	121
1997	4,800,000	39,300	4,753,394	$11,550,747	122
1998	4,800,000	41,700	4,688,008	$7,360,172	116
1999	3,120,000	28,000	3,043,273	$6,634,335	112
2000	3,120,000	28,600	3,082,159	$7,394,890	111
2001	2,184,000	19,600	2,142,617	$4,563,774	111
2002	2,005,000	18,400	2,009,380	$4,814,718	109
2003	2,005,000	18,565	2,001,643	$4,809,492	108
2004	2,245,000	20,787	2,229,956	$4,532,611	108
2005	2,053,000	19,400	2,026,131	$5,027,393	106
2006	2,053,000	19,550	2,033,786	$5,066,320	105
2007	1,488,000	14,500	1,501,478	$3,754,847	103
2008	1,508,000	15,710	1,513,040	$4,873,176	96
2009	1,071,000	12,170	1,071,554	$3,550,253	88
2010	1,063,000	12,218	1,054,276	$4,399,622	87
2011	880,000	10,602	882,779	$4,943,667	83
2012	975,000	12,342	969,535	$3,629,887	79
2013	1,002,162	12,848	971,499	$2,881,461	78
2014	745,774	9,561	772,260	$3,152,106	78
2015	786,748	10,087	780,615	$3,400,000	78

Table 2.–Macroscopic maturity stages used to classify male and female sablefish in Southeast Alaska from 1994 to 2015 during the NSEI longline survey and from 1994 to 2014 during the NSEI fishery.

Maturity stage	Male description	Female description
Immature	Testes very narrow, parallel, flat and ribbon-like, almost clear in color. Longitudinal creases are easily discernable.	Ovaries appear as 2 narrow (slender) ovoids. May be veined.
Maturing Juvenile	Testes enlarging, not ribbon-like, with 4 discernable creases running full length. Light pink in color. Has not spawned before.	Ovaries enlarging, translucent and pinkish to clear; eggs not yet discernable. Has not spawned before. Will spawn coming year. More veined. Cloudy, but not necessarily throughout.
Mature/Developing	Testes large and white, each with 4 distinct lobes. No milt present	Ovaries large and becoming white to yellowish white with developing eggs discernable and firmly attached.
Spawning	Testes very large and white, extruding milt freely under slight pressure of when cut.	Ovaries very large with large translucent eggs loose within ovary or extruding from the oviduct.
Spent/Post Spawning	Testes large, shriveled, often wrinkled and bloodshot. No milt present.	Ovaries shriveled and opaque, soft and flaccid, often reddish in color.
Resting	Testes large and firm, light brown to off-white in color. No milt present. Has spawned previously. May have wrinkles.	Ovaries large, firm and opaque, not shriveled. No eggs discernable. Has spawned previously. Noticeable follicle structure.

Table 3.–Macroscopic maturity stages used to classify male and female sablefish in Southeast Alaska during the 2015 NSEI fishery.

Maturity stage	Male description	Female description
Immature	Testes can be narrow and ribbon-like or slightly enlarged; clear to light pink in color with discernible longitudinal creases. Has not spawned before.	Ovaries are 2 narrow (slender) ovoids or small lobes; translucent and pinkish to clear in color; eggs not yet discernable. May be veined. Has not spawned before.
Mature	Large, off-white to white in color. Four distinct lobes extruding milt when spawning. After spawning testes will become shriveled, wrinkled, and eventually firm with a light brown to off-white color.	Ovaries are large, white to yellowish white in color; during spawning, eggs are loose or extruding from oviduct. After spawning ovaries will shrivel, become opaque, and are often reddish in color. At resting, ovaries will be large, firm, opaque, and have a noticeable follicle structure.

Table 4.–Distribution of sablefish harvest by statistical area and depth (± standard deviation, SD) caught during the 2015 NSEI commercial fishery.

Statistical area	Harvest (round lb)	Average depth (fathom)
335701	25,860	189.5 ± 66.6
345603	65,065	310.6 ± 69.8
345631	168,891	356.5 ± 38.6
345701	327,721	376.6 ± 59.4
345702	17,672	189.9 ± 9.4
345731	100,178	287.7 ± 43.3
345803	75,229	308.0 ± 66.8

Table 5.–Average fork length (cm ± SD) of sablefish sampled in NSEI.

Year	NSEI survey	NSEI longline fishery
1997	69.1 ± 8.8	No data
1998	68.5 ± 9.4	No data
1999	63.1 ± 11.1	No data
2000	64.9 ± 10.4	65.9 ± 9.5
2001	64.4 ± 9.8	65.2 ± 9.3
2002	65.8 ± 9.6	67.2 ± 8.7
2003	65.3 ± 9.1	68.2 ± 8.0
2004	65.6 ± 9.0	69.9 ± 9.1
2005	68.6 ± 9.2	71.8 ± 9.5
2006	67.7 ± 7.1	70.0 ± 7.8
2007	66.9 ± 7.6	70.8 ± 7.8
2008	68.0 ± 7.6	71.1 ± 7.8
2009	68.5 ± 7.3	71.3 ± 7.3
2010	68.0 ± 8.1	70.8 ± 7.4
2011	66.3 ± 8.6	70.7 ± 7.6
2012	65.6 ± 7.7	70.1 ± 7.3
2013	65.8 ± 7.9	68.8 ± 7.9
2014	66.8 ± 7.8	70.9 ± 8.1
2015	66.7 ± 8.4	71.2 ± 8.5
Mean	66.6 ± 8.7	69.6 ± 8.2

Table 6.–Average age in years (age ± SD) of sablefish sampled in NSEI.

Year	NSEI survey	NSEI longline fishery
1997	19.4 ± 10.3	No data
1998	17.7 ± 10.0	No data
1999	13.8 ± 10.6	No data
2000	13.6 ± 10.8	No data
2001	11.9 ± 8.2	No data
2002	15.0 ± 10.5	15.8 ± 10.5
2003	14.7 ± 10.3	14.1 ± 10.4
2004	13.7 ± 9.7	14.5 ± 10.9
2005	15.4 ± 11.0	15.5 ± 11.0
2006	13.8 ± 7.6	14.0 ± 8.8
2007	12.0 ± 8.6	15.3 ± 9.9
2008	13.8 ± 7.8	15.6 ± 9.7
2009	14.7 ± 9.5	17.7 ± 9.6
2010	16.4 ± 9.6	17.5 ± 10.6
2011	15.1 ± 10.5	18.1 ± 9.9
2012	12.4 ± 8.6	16.1 ± 9.6
2013	13.7 ± 8.5	16.5 ± 9.3
2014	14.3 ± 8.4	17.0 ± 9.1
2015	12.1 ± 7.6	16.5 ± 8.9
Mean	14.4 ± 9.4	16.0 ± 9.9

Table 7.–CPUE for the longline survey and fishery in round lb/hook from 1997 to 2015.

Year	Survey CPUE	LL Fishery CPUE
1997	1.49	0.68
1998	1.59	0.50
1999	1.40	0.48
2000	1.23	0.46
2001	1.27	0.51
2002	1.51	0.64
2003	1.65	0.76
2004	1.51	0.71
2005	2.10	0.74
2006	1.66	0.72
2007	1.61	0.82
2008	1.74	0.90
2009	1.69	0.72
2010	1.69	0.75
2011	1.81	0.84
2012	1.84	0.91
2013	1.42	0.82
2014	1.47	0.85
2015	1.36	0.71
5-year mean (11-15)	1.58	0.83
10-year mean (06-15)	1.63	0.80

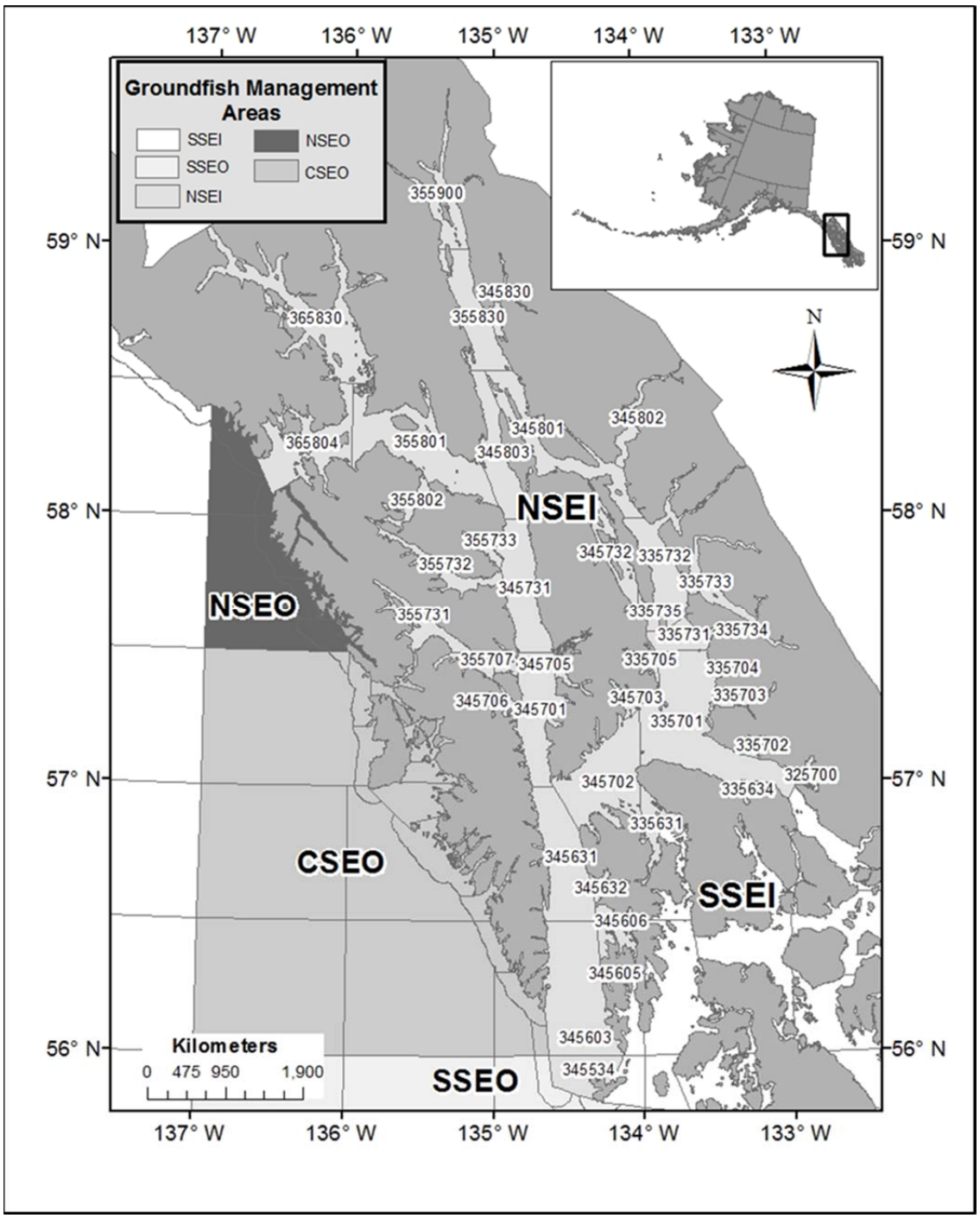

Figure 1.–NSEI Subdistrict with groundfish statistical areas open to fishing.

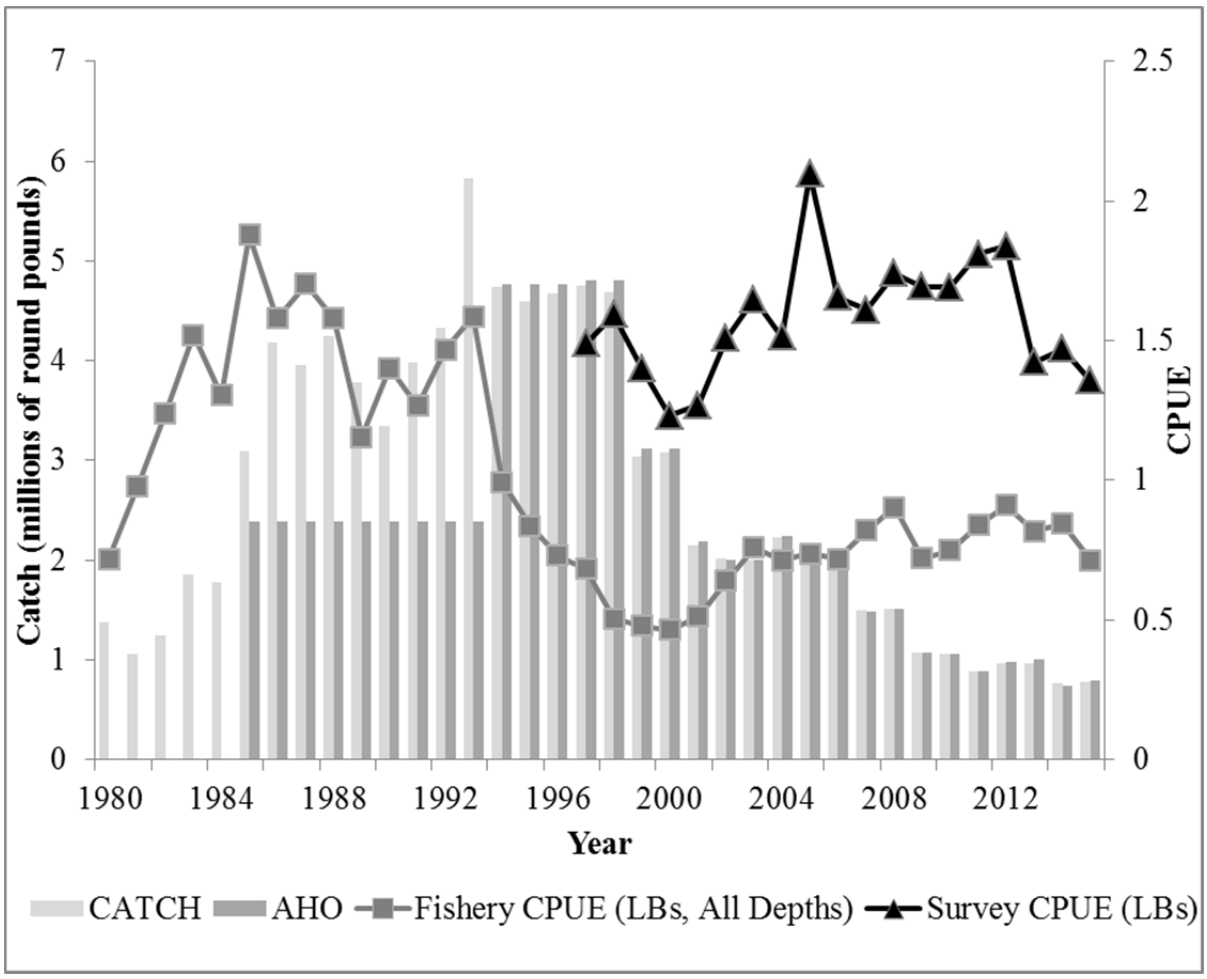

Figure 2.–NSEI longline fishery and survey catch per unit effort (CPUE), longline fishery harvest, and annual harvest objective (AHO). Survey CPUE is presented since 1997, when survey soak times were standardized.

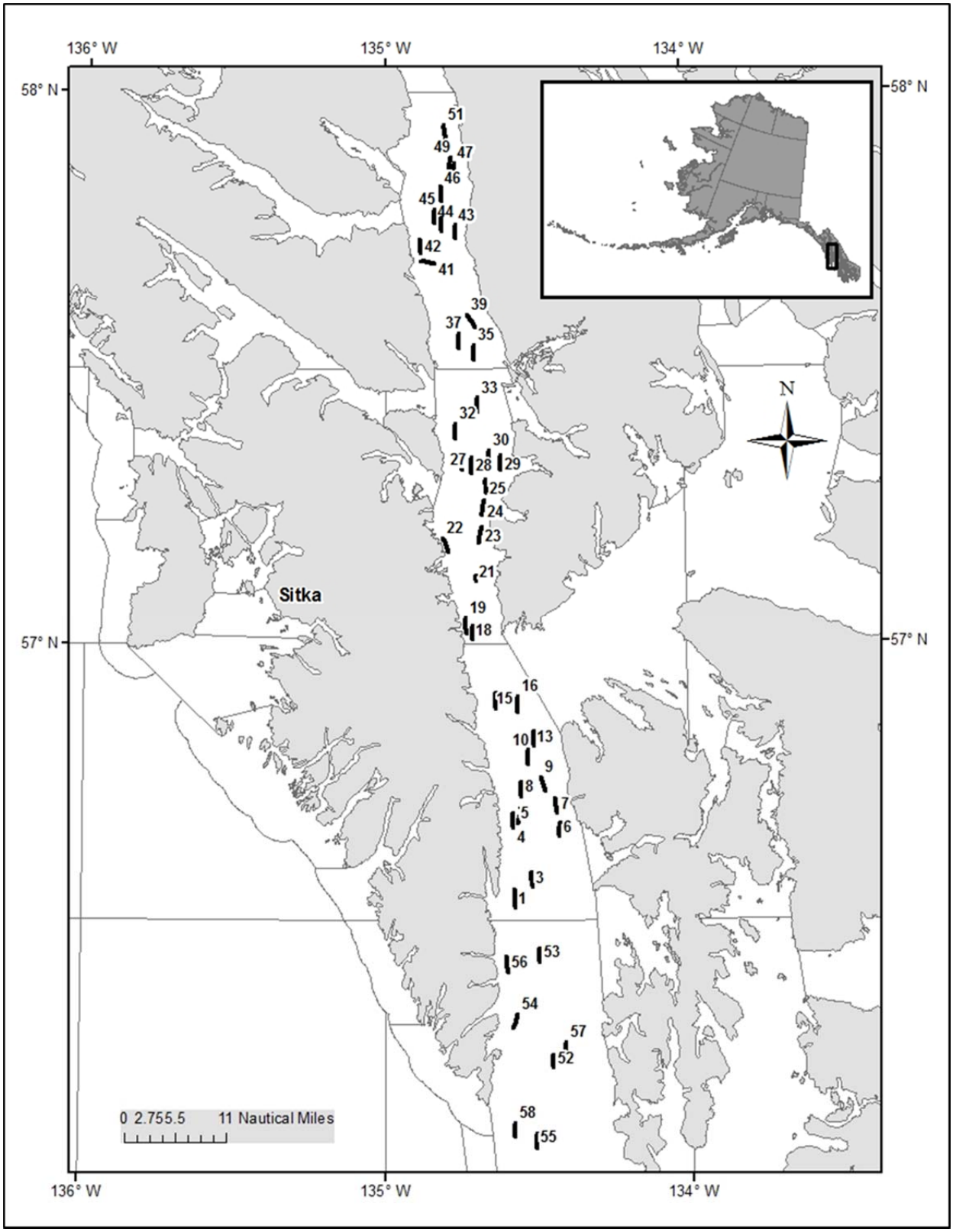

Figure 3.–Northern Southeast Inside longline survey stations fished in 2015. Survey stations are not numbered consecutively due to eliminations and additions of stations over the years.

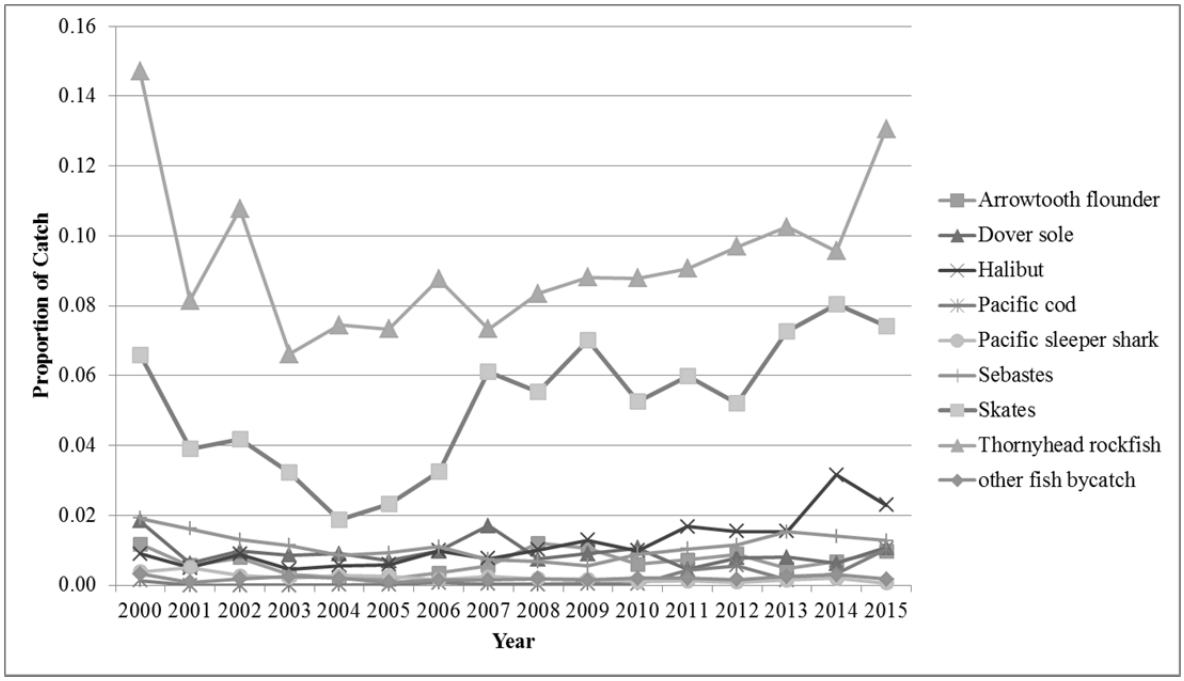

Figure 4.–Incidental catch of fish landed in the NSEI longline sablefish survey, 2000 to 2015. The proportion of each species captured was calculated from the total catch, including both incidental catch and sablefish; however, the proportion of sablefish captured is excluded in the graph due to differences in the magnitude with incidental catch species.

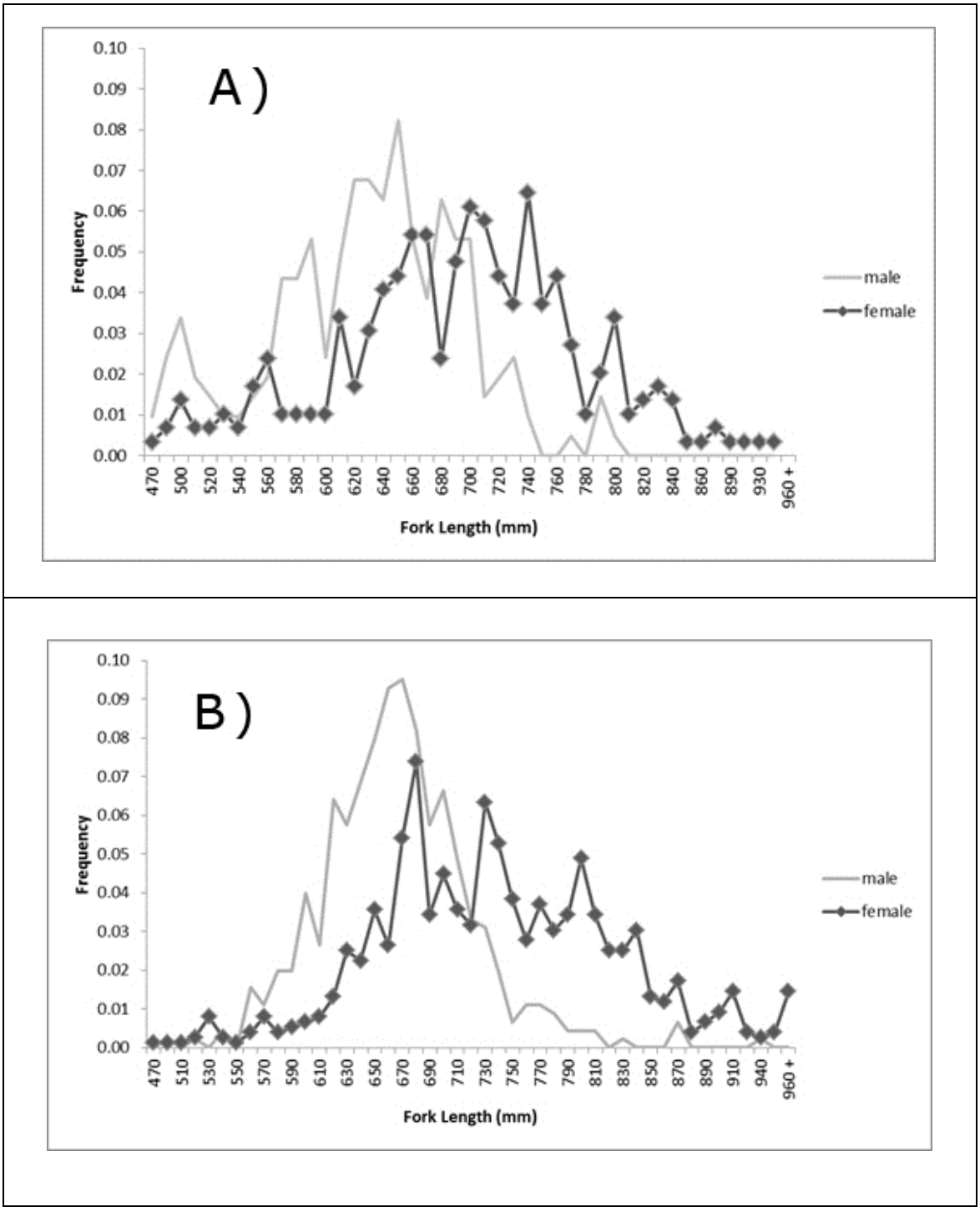

Figure 5.–Length frequency of sablefish by sex from A) longline survey, and B) longline fishery.

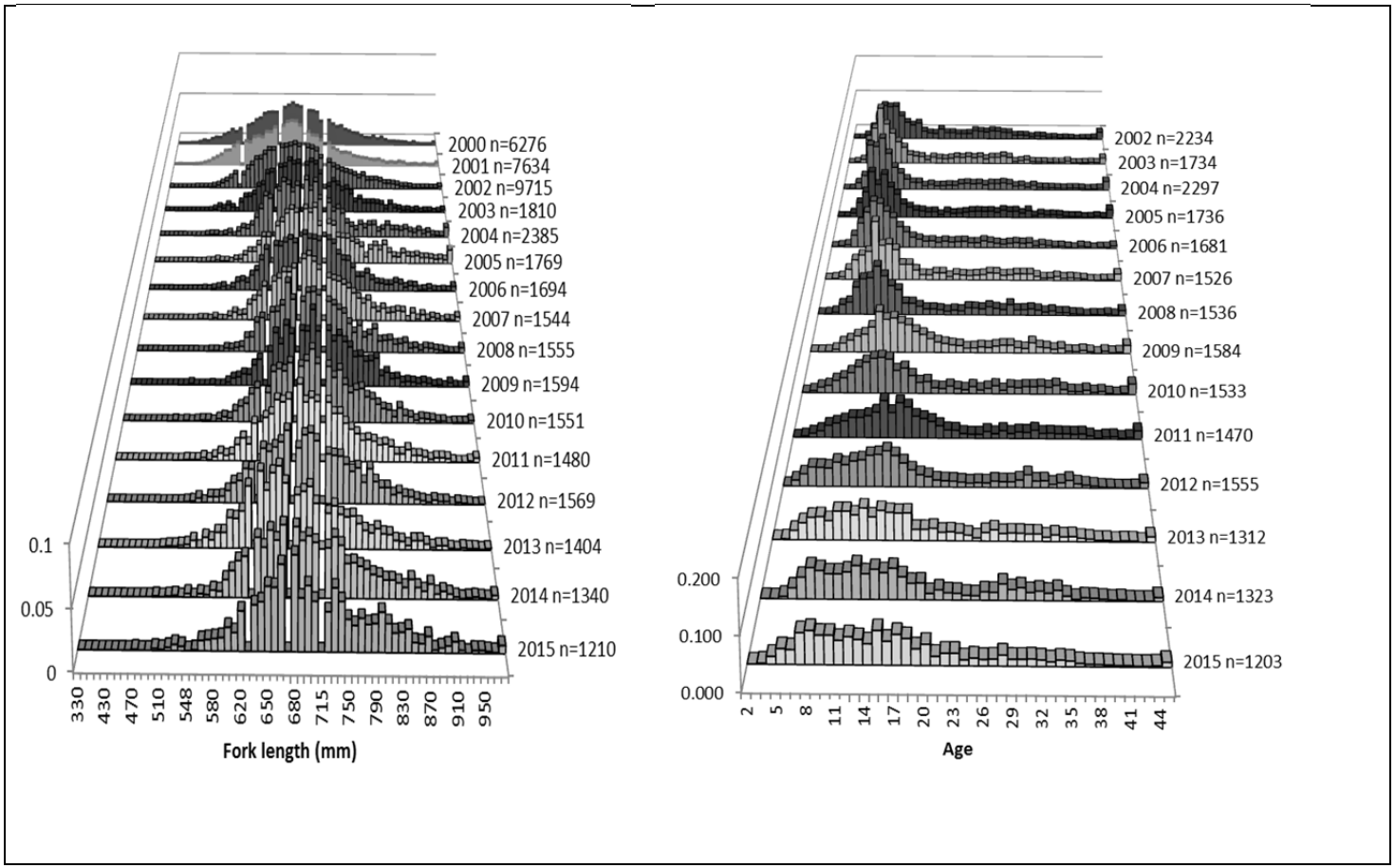

Figure 6.–Sablefish length (2000 to 2015) and age distributions (2002 to 2015) for the commercial NSEI longline fishery. Age data were not available in 2000 and 2001.

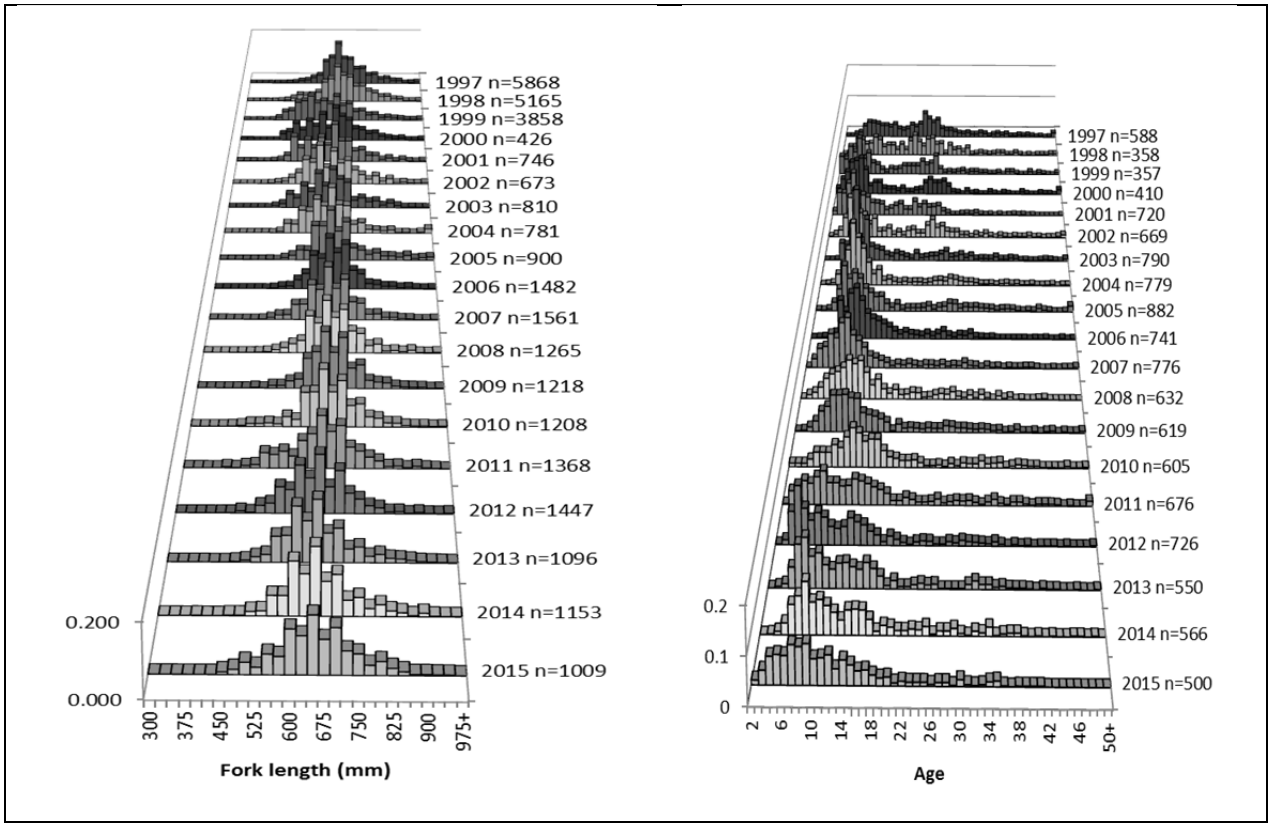

Figure 7. –Sablefish length and age distributions for the NSEI longline survey from 2000 to 201

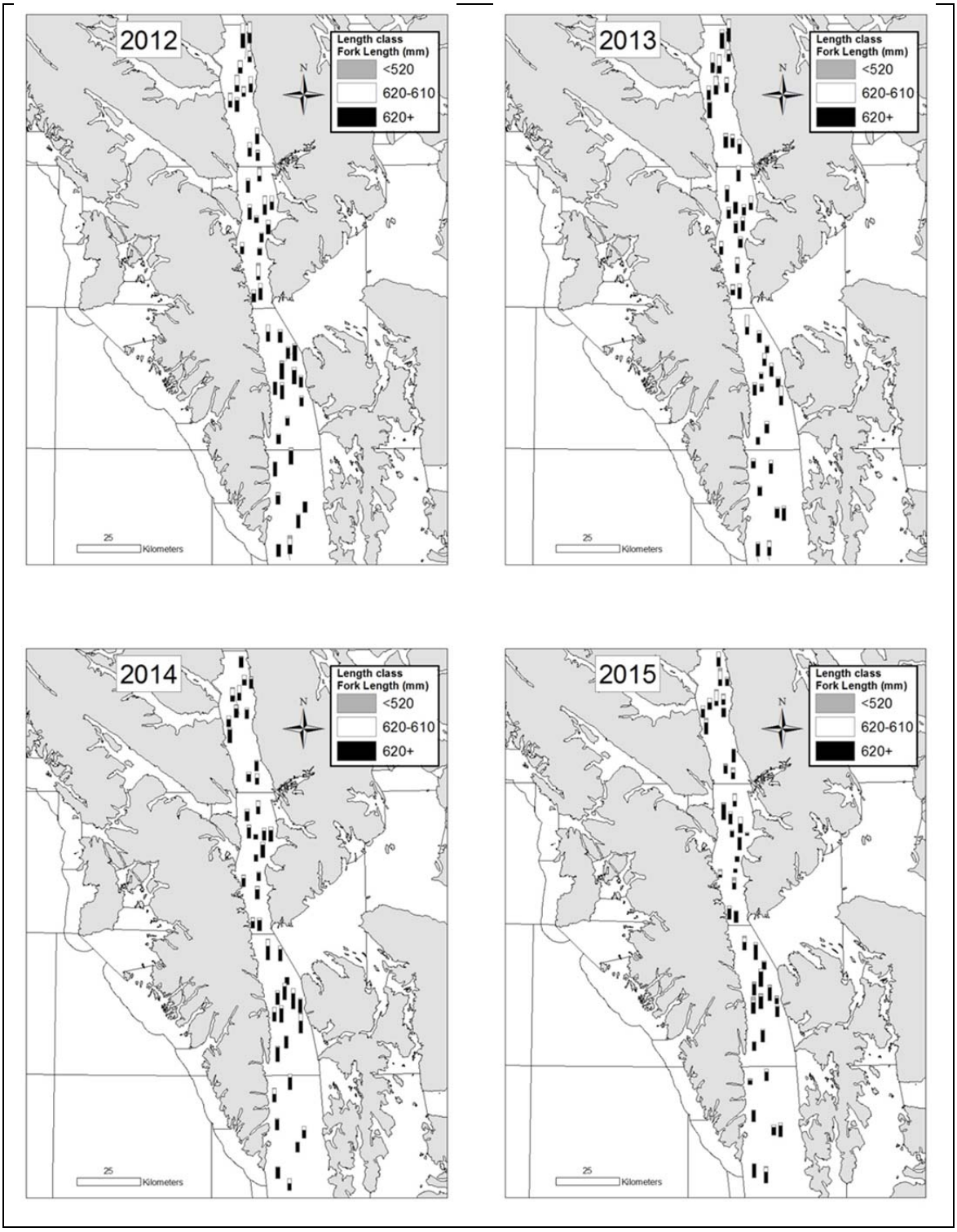

Figure 8.–Sablefish catch by set and length class for NSEI longline survey, 2012 to 2015.

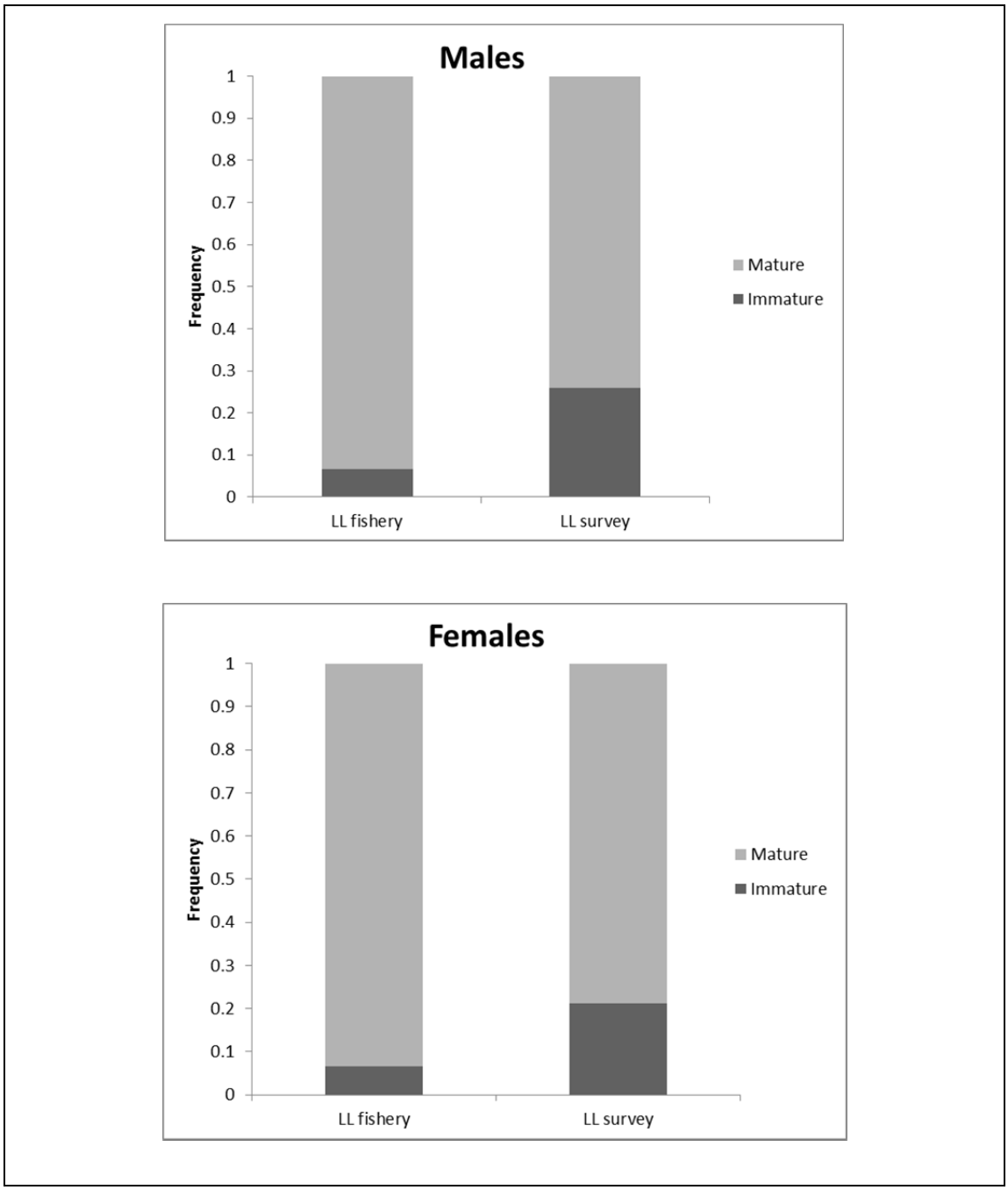

Figure 9.–Proportion of mature and immature female and male sablefish sampled from the 2015 NSEI longline survey and fishery.

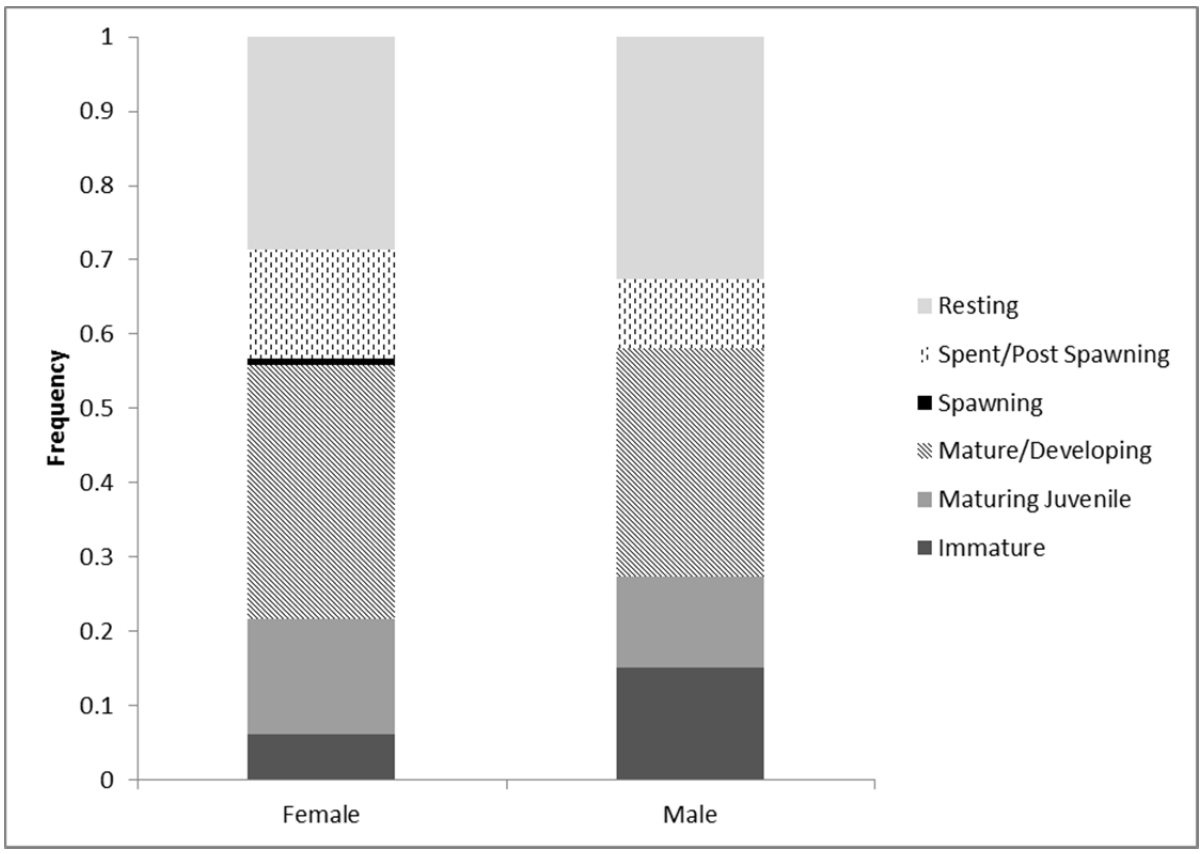

Figure 10.–Macroscopic maturity stages sampled from the 2015 NSEI longline survey by sex.

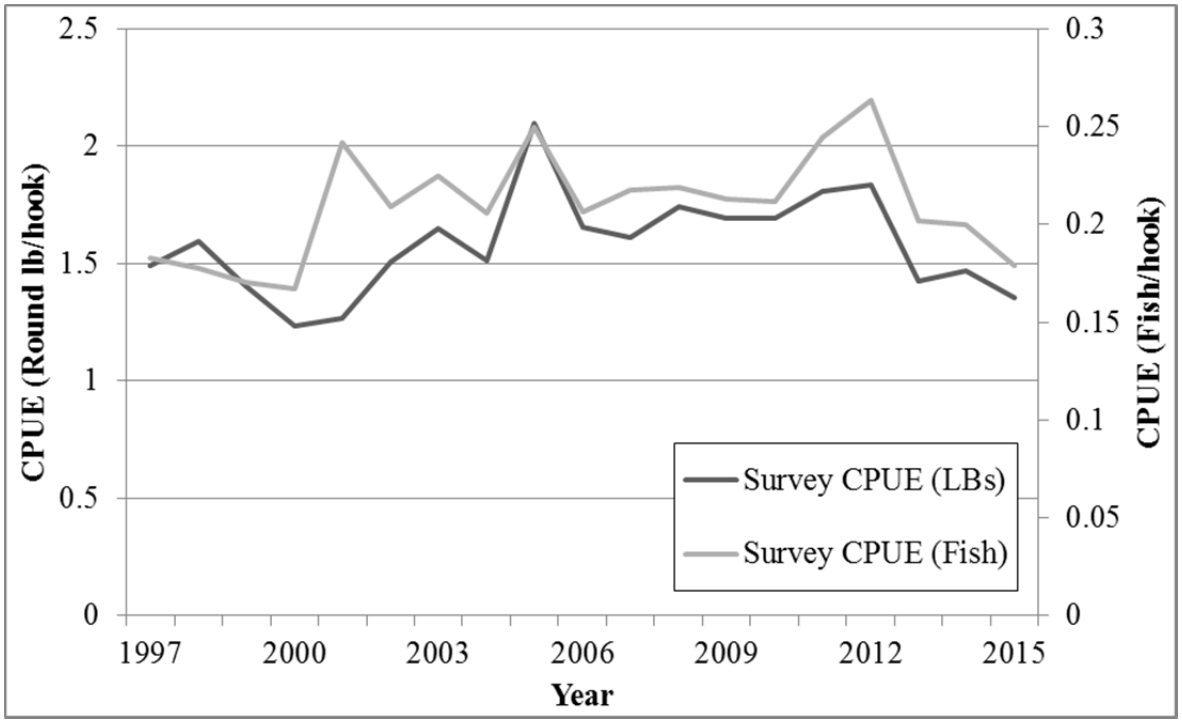

Figure 11.–NSEI survey CPUE (round lb. per hook and fish per hook) from 1997 to 2015.

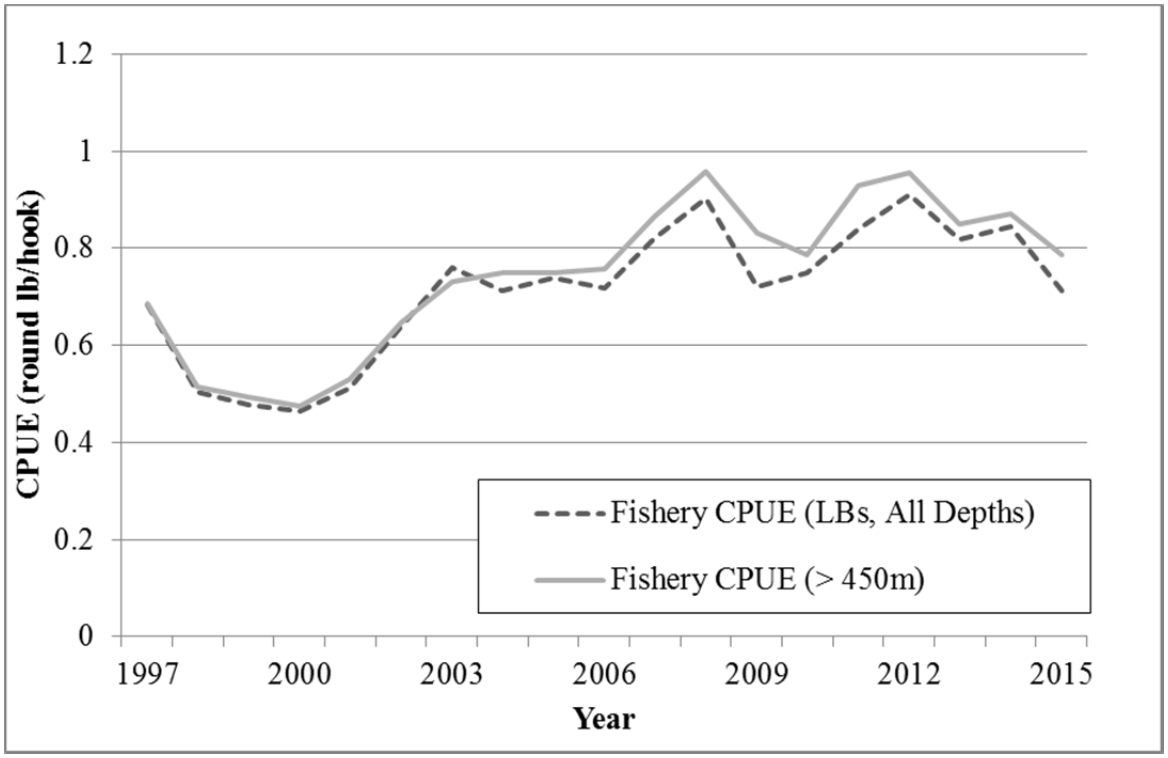

Figure 12.–NSEI longline fishery CPUE (round lb per hook) from 1997 to 2015 at all depths and depths > 450m.

APPENDICES

Appendix A.–Set location information for the 2015 Northern Southeast Inside Subdistrict sablefish longline survey; locations are presented in degrees and decimal minutes.

Station	Statistical area	General location	Area description	Start latitude	Start longitude	End latitude	End longitude
1	345631	Middle Chatham	Patterson Point	56 33.35	134 34.61	56 31.32	134 34.60
3	345631	Middle Chatham	N Patterson Point	56 35.21	134 31.29	56 33.58	134 31.11
4	345631	Middle Chatham	Mt Ada	56 41.65	134 34.82	56 40.06	134 34.81
5	345631	Middle Chatham	S Gut Bay	56 42.31	134 33.15	56 40.60	134 34.00
6	345631	Middle Chatham	S Washington Bay	56 40.69	134 25.60	56 39.13	134 25.69
7	345631	Middle Chatham	Washington Bay	56 43.23	134 26.50	56 41.61	134 26.09
8	345631	Middle Chatham	Gut Bay	56 45.07	134 33.19	56 43.46	134 33.19
9	345631	Middle Chatham	N Washington Bay	56 43.98	134 28.43	56 45.59	134 29.25
10	345631	Middle Chatham	Hoggat Bay in Middle	56 46.92	134 31.84	56 48.54	134 31.78
13	345631	Middle Chatham	Kingsmill Point	56 50.59	134 30.58	56 48.92	134 30.69
15	345631	Middle Chatham	N Red Bluff Bay	56 54.72	134 38.20	56 53.02	134 38.22
16	345631	Middle Chatham	Yasha Island	56 52.66	134 33.78	56 54.39	134 33.75
18	345701	Middle Chatham	Cascade Bay	57 0.58	134 42.64	57 02.12	134 42.78
19	345701	Middle Chatham	N Cascade Bay	57 1.24	134 43.95	57 02.99	134 43.99
21	345701	Middle Chatham	Warm Springs Bay	57 7.64	134 42.00	57 06.90	134 42.07
22	345701	Middle Chatham	White Cliff	57 10.11	134 47.39	57 11.62	134 48.57
23	345701	Middle Chatham	N Wilson Cove	57 11.15	134 41.49	57 12.90	134 40.86
24	345701	Middle Chatham	Point Caution	57 14.07	134 40.77	57 15.80	134 40.33
25	345701	Middle Chatham	Woody Point	57 16.51	134 39.88	57 18.04	134 39.93
27	345701	Middle Chatham	Point Lull	57 20.64	134 44.78	57 19.05	134 44.75
28	345701	Middle Chatham	Point Lull in Middle	57 18.68	134 42.69	57 20.46	134 42.71
29	345701	Middle Chatham	Chaik Bay	57 19.01	134 37.04	57 20.61	134 36.97
30	345701	Middle Chatham	Village Point	57 19.60	134 39.47	57 21.15	134 39.32
32	345701	Middle Chatham	S Point Thatcher	57 22.39	134 45.99	57 24.07	134 45.98
33	345701	Middle Chatham	Distant Pt. Middle	57 25.25	134 41.65	57 26.88	134 41.52
35	345731	North Chatham	N Danger Point	57 31.02	134 42.19	57 32.64	134 42.12
37	345731	North Chatham	White Rock in Middle	57 32.24	134 45.21	57 33.88	134 45.13
39	345731	North Chatham	Parker Point	57 34.53	134 42.03	57 35.91	134 43.59
41	345731	North Chatham	Basket Bay	57 41.70	134 52.85	57 41.42	134 50.07
42	345731	North Chatham	S South Passage Pt	57 44.08	134 53.06	57 42.55	134 52.86
43	345731	North Chatham	South Fishery Creek	57 44.12	134 45.85	57 45.64	134 45.98
44	345731	North Chatham	S Passage Pt Middle	57 46.41	134 48.79	57 44.89	134 48.77
45	345731	North Chatham	South Passage Point	57 45.75	134 50.14	57 47.33	134 50.12
46	345731	North Chatham	Fishery Point	57 48.18	134 48.66	57 49.77	134 48.85
47	345731	North Chatham	North Fishery Point	57 50.77	134 45.96	57 52.35	134 46.15
51	345731	North Chatham	Point Hepburn	57 54.87	134 47.77	57 56.52	134 48.14
52	345603	Lower Chatham	Port Alexander Mid	56 15.41	134 27.30	56 13.97	134 27.28
53	345603	Lower Chatham	Port Herbert Middle	56 26.97	134 29.90	56 25.44	134 29.73
54	345603	Lower Chatham	Port Alexander	56 18.34	134 35.02	56 19.83	134 34.16
55	345603	Lower Chatham	Point Howard Middle	56 5.28	134 30.51	56 06.85	134 30.58
56	345603	Lower Chatham	Port Herbert	56 26.14	134 36.28	56 24.38	134 36.01
57	345603	Lower Chatham	Port Malmsbury	56 15.10	134 24.74	56 16.77	134 24.74
58	345603	Lower Chatham	Cape Ommaney	56 6.44	134 34.90	56 08.00	134 34.80

Appendix B.–Set and haul information for the 2015 NSEI sablefish longline survey.

Trip	Station	Date set	Time Set	Soak time (h)	Haul time (h)	Haul direction	Depth (fathoms)		
							Start	End	Avg.
1	8	24-Jul	8:45:00	3.3	1.5	Same	395	392	398
1	4	24-Jul	9:39:00	5.5	1.7	Same	373	369	371
1	5	24-Jul	14:18:00	3.6	1.8	Opposite	382	372	377
1	3	25-Jul	6:12:00	3.3	1.5	Same	357	357	358
1	6	25-Jul	7:52:00	5.5	1.4	Same	276	281	296
1	7	25-Jul	13:03:00	3.3	1.5	Same	274	250	263
1	1	26-Jul	6:49:00	3.4	1.5	Same	277	285	289
1	53	26-Jul	7:56:00	6.0	1.5	Same	382	388	385
1	56	26-Jul	12:56:00	3.5	1.6	Same	311	315	305
1	54	27-Jul	6:41:00	3.3	1.5	Same	355	296	334
1	57	27-Jul	8:13:00	5.9	1.5	Opposite	365	392	378
1	52	27-Jul	12:57:00	3.7	1.4	Same	392	395	395
1	55	28-Jul	7:23:00	3.2	1.5	Same	282	292	287
1	58	28-Jul	8:25:00	6.0	1.4	Same	286	302	292
2	10	24-Jul	5:56:00	3.4	1.7	Opposite	381	368	385
2	9	24-Jul	7:15:00	6.3	1.9	Same	355	349	357
2	13	24-Jul	12:24:00	4.4	1.7	Opposite	206	236	209
2	16	25-Jul	5:43:00	3.4	1.6	Opposite	366	359	360
2	18	25-Jul	7:15:00	6.2	1.7	Opposite	337	350	344
2	15	25-Jul	11:51:00	5.0	1.6	Opposite	351	366	361
2	19	26-Jul	5:44:00	7.5	1.5	Opposite	339	357	347
2	21	26-Jul	11:59:00	4.1	1.7	Same	342	356	360
2	22	27-Jul	5:36:00	3.2	1.6	Opposite	331	316	316
2	23	27-Jul	6:55:00	5.9	2.4	Opposite	436	330	410
2	24	27-Jul	11:36:00	4.8	1.7	Opposite	260	264	226
2	25	28-Jul	6:05:00	3.4	1.8	Opposite	261	281	274
2	29	28-Jul	6:48:00	6.6	Not calculated[4]	Opposite	269	286	Not calculated[5]
2	28	28-Jul	12:30:00	4.0	1.4	Same	261	323	294
2	27	28-Jul	15:47:00	3.4	1.7	Same	368	398	374
3	49	24-Jul	4:30:00	3.4	1.9	Same	278	276	276
3	47	24-Jul	7:20:00	4.4	2.2	Opposite	255	263	263
3	51	24-Jul	10:40:00	5.3	1.9	Same	304	250	292
3	45	25-Jul	4:25:00	4.1	2.0	Opposite	287	299	291
3	46	25-Jul	7:14:0.0	5.3	1.4	Same	270	248	263
3	44	25-Jul	10:58:00	5.0	1.8	Opposite	278	279	280
3	43	26-Jul	4:08:00	3.3	1.8	Same	277	274	289
3	41	26-Jul	6:11:00	4.6	1.9	Same	303	262	289
3	42	26-Jul	10:19:00	4.5	2.0	Same	295	317	301
3	37	27-Jul	4:10:00	3.7	1.9	Same	349	320	331
3	39	27-Jul	6:43:00	5.4	2.2	Same	226	246	236
3	35	27-Jul	11:09:00	4.4	1.8	Opposite	338	299	327
3	30	28-Jul	4:57:00	4.2	1.7	Same	334	271	304
3	33	28-Jul	5:52:00	7.4	1.8	Same	297	310	297
3	32	28-Jul	11:51:00	4.8	2.0	Opposite	370	366	359

[4] Haul time was not calculated for set 29, because the longline gear separated at both ends and hauling could not be completed.

[5] The average depth was not calculated for set 29 because depths were not collected for several skates.