

Fishery Data Series No. 09-43

**2008 NSEI (Northern Southeast Inside Subdistrict)
Sablefish Mark-Tag Survey**

by

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and

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July 2009

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail-fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	e
		corporate suffixes:		catch per unit effort	CPUE
Weights and measures (English)		Company	Co.	coefficient of variation	CV
cubic feet per second	ft ³ /s	Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient (multiple)	R
inch	in	District of Columbia	D.C.	correlation coefficient (simple)	r
mile	mi	et alii (and others)	et al.	covariance	cov
nautical mile	nmi	et cetera (and so forth)	etc.	degree (angular)	°
ounce	oz	exempli gratia (for example)	e.g.	degrees of freedom	df
pound	lb	Federal Information Code	FIC	expected value	E
quart	qt	id est (that is)	i.e.	greater than	>
yard	yd	latitude or longitude	lat. or long.	greater than or equal to	≥
		monetary symbols (U.S.)	\$, ¢	harvest per unit effort	HPUE
Time and temperature		months (tables and figures): first three letters	Jan,...,Dec	less than	<
day	d	registered trademark	®	less than or equal to	≤
degrees Celsius	°C	trademark	™	logarithm (natural)	ln
degrees Fahrenheit	°F	United States (adjective)	U.S.	logarithm (base 10)	log
degrees kelvin	K	United States of America (noun)	USA	logarithm (specify base)	log ₂ , etc.
hour	h	U.S.C.	United States Code	minute (angular)	'
hour	h	U.S. state	use two-letter abbreviations (e.g., AK, WA)	not significant	NS
minute	min			null hypothesis	H ₀
second	s			percent	%
				probability	P
Physics and chemistry				probability of a type I error (rejection of the null hypothesis when true)	α
all atomic symbols				probability of a type II error (acceptance of the null hypothesis when false)	β
alternating current	AC			second (angular)	"
ampere	A			standard deviation	SD
calorie	cal			standard error	SE
direct current	DC			variance	
hertz	Hz			population	Var
horsepower	hp			sample	var
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA REPORT NO. 09-43

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SABLEFISH MARK-TAG SURVEY**

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July 2009

Development and publication of this manuscript were partially financed by the Region I Groundfish Test Fish Program.

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This document should be cited as:

Stahl, J. P., and D. D. Holum. 2009. 2008 NSEI (Northern Southeast Inside Subdistrict) Sablefish Mark-Tag Survey. Alaska Department of Fish and Game, Fishery Data Series No. 09-43, Anchorage.

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ABSTRACT

The Alaska Department of Fish and Game (ADF&G) manages the Northern Southeast Inside (NSEI) Subdistrict sablefish (*Anoplopoma fimbria*) fishery in Southeast Alaska. Mark-recapture methods are used to estimate abundance of this resource. In 2008 longlined pot gear was set to catch sablefish in the NSEI management area, which includes the waters of Chatham Strait and Frederick Sound. Forty-five sets were made with a total of 1,854 pots hauled to capture 6,409 sablefish. Healthy sablefish greater than 320 mm were tagged, finclipped, and released. A total of 5,450 sablefish were tagged, and tags were successfully distributed within and among statistical areas in similar proportion to the average 2005–2007 commercial harvest and in proportion to the depth of the 2007 commercial harvest. Every 12th sablefish was retained as a biological sample, and otoliths, length, sex, and maturity state were collected. A total of 535 biological samples were collected. In addition, temperature data were collected to determine the range of values sablefish were exposed to during the survey.

Key words: Sablefish, black cod, *Anoplopoma fimbria*, Northern Southeast Alaska Inside, Chatham Strait, Frederick Sound, tagging, mark-recapture

INTRODUCTION

Sablefish, (*Anoplopoma fimbria*), is one of the most commercially important species in Southeast Alaska. The Northern Southeast Alaska Inside (NSEI) longline fishery for sablefish occurs in the deep water fjords of Chatham Strait (between 58°19'N and 56°10'N latitude) and in Frederick Sound (approximately 134°25'W, 56°51'N to 133°54'W, 57°22'N; Figure 1). During the 2008 commercial fishery, the average price paid per round pound was \$3.15 (\$7.00 per kg) and per dressed pound was \$5.00 (\$11.11 per kg); the total ex-vessel value was \$4.7 million. Sablefish are a long-lived species with a maximum reported age of 79 years in Southeast Alaska, and with 40-year old fish commonly occurring in NSEI commercial harvests (K. Munk, ADF&G, Division of Commercial Fisheries, Juneau *personal communication*). Careful management of the NSEI commercial fishery is necessary to insure sustainability of this highly-valued resource.

The Alaska Department of Fish and Game (ADF&G) manages the NSEI sablefish commercial fishery by setting annual harvest quotas based on abundance estimates determined from mark-recapture methods. A survey is performed annually to tag and finclip sablefish as the marking portion of the study; the recapture portion occurs when port sampling sablefish landed by the NSEI sablefish longline fishery. The mark and recapture data collected for a particular year is used to set the annual harvest quota for the following year with consideration of other years of data. During past mark-tag surveys, sablefish have been marked throughout the NSEI fishing area, in proportion to the commercial harvest by statistical area for the prior year. In 2008, sablefish were marked in proportion to the average commercial harvest by statistical area for the 3 previous years. We began using the data from 3 previous years of commercial harvests, in order to best distribute marks, given the possible harvest pattern of the upcoming fishery. Another change occurred during the 2008 mark-tag survey; sablefish were marked in proportion to the depth fish were harvested during the 2007 commercial harvest. For mark recovery, port samplers observe the majority of NSEI longline sablefish landed in the ports of Sitka, Juneau, and Petersburg. Fish are carefully examined for tail clips, and the total number of fish with and without tail clips, along with marking information, is used to calculate a Petersen estimate of abundance. The sablefish mark-tag survey occurs during June, ending approximately a month and a half before the NSEI longline fishery begins on August 15. This time frame was chosen to allow adequate mixing of marked and unmarked fish within Chatham Strait, while minimizing fish movement in and out of Chatham Strait between the mark and recapture phases of the study. Sablefish have been tagged and/or finclipped in the NSEI Subdistrict since 1997. In 2004, sablefish were given Passive Integrated Transponder (PIT) tags; in all other years, sablefish were

tagged with floy tags. From 1997 to 1999, sablefish were tagged and/or marked during the annual longline survey; catch per unit effort and biological data were also collected during this annual survey. The pattern of recaptures by the longline fishery in 1997 and 1998 provided evidence that fish were gear shy, due to their initial capture by longline gear for marking (Carlile et al. 2002). As a consequence, in 1999 no marking or recapture phase occurred. However, fish were still captured with longline gear and tagged on the 1999 survey. In 2000, both the mark and recapture phases of the project were reinstated and capture of sablefish for marking shifted to longlined pots. An annual longline survey to collect catch-per-unit effort and biological data was continued, but was now conducted separately from the mark-tag survey. Pot dimensions for the 2000 survey are unknown. In 2001 both 1.5 m (5 ft) and 1.8 m (6 ft) cone-shaped pots were used; since 2002, only 1.5 m (5 ft) cone-shaped pots have been used to capture sablefish on the survey (Richardson 2001; Richardson 2002; Richardson 2003; O'Connell and Holum 2007; Stahl and Holum 2008; ADF&G *unpublished reports*). The annual survey also provides tagging and biological information used to study sablefish movement and biological parameters. This report summarizes the results from the 2008 NSEI sablefish mark-tag survey.

OBJECTIVES

1. Capture, tag, finclip, and release at least 6,000 sablefish greater than 320 mm, in order to estimate population abundance based on a Petersen mark-recapture estimate.
2. Capture, measure, and release any sablefish 320 mm or smaller.
3. Mark and tag sablefish among statistical areas in proportion to the average of the 2005-2007 NSEI commercial harvest by statistical area.
4. Mark and tag sablefish throughout statistical areas to insure complete mixing.
5. Mark and tag sablefish by depth in proportion to the 2007 NSEI commercial harvest by depth.
6. Collect biological samples from the total size distribution of sablefish captured.
7. Record temperatures that sablefish are exposed to during capture and handling.

METHODS

OPERATIONS

The survey was performed in statistical areas within which at least 2% of the average NSEI sablefish longline harvest had occurred between 2005 and 2007 (Table 1). From May 31, 2008 through June 25, 2008, the R/V *Zolotoi*, an approximately 31 m (101 ft) research vessel, was chartered to conduct the sablefish mark-tag survey. Contract costs were \$127,500 and included fuel, food, bait, and all fishing gear. The vessel crew and scientific staff are listed in Appendix A.

The survey gear was used to capture live sablefish and consisted of pots attached to a longline to make a string or set. The pots were cone-shaped with a 1.5 m (5 ft) diameter, and had 2 opposing tunnels. Each set included about 41 pots with 73 m (approximately 240 ft) of line between each pot. Chopped bait was placed in a bait bag inside each pot. Originally, the bait mixture was 1.4 kg (3 lbs) of chopped herring to 0.5 kg (1 lb) of chopped squid; beginning with set 25, the chopped bait mixture was changed to 1.4 kg (around 3 lbs) of chopped squid to 0.9 kg (2 lbs) of chopped herring. In addition, fresh frozen pollock was hung inside each pot for sets 1 to 35; initially, 1.4 kg (about 3 lbs) of pollock was hung in each pot. Once fresh frozen pollock bait became unavailable, the crew left the remaining hanging pollock in the pots until set 39. Then all

old pollock bait was removed and fresh squid bait was hung inside each pot for each set for the remainder of the survey. In general, 2 pot strings were set and hauled per day. Pots were soaked for 10 to 43 hours. Soak time was adjusted dependent on the vessel operating schedule, distance between sets, and the history of “sand flea” (Order Amphipoda) abundance in an area; in locations with a history of high “sand flea” abundance, the soak time was minimized to prevent sablefish mortalities. Captured sablefish and bycatch were released from each pot into a live well consisting of 3 temporary holding tanks.

DATA COLLECTION

Sablefish greater than 320 mm were finclipped, tagged, and released. Fish were tagged dorsally using orange T-bar tags numbered between 029540 and 035028. Tagged fish were also marked with a finclip on the lower lobe of their caudal fin (Figure 2) and sampled for length.

Fish were not tagged or finclipped if they were less than 321 mm long or if they were determined to have reduced survival ability due to flea bites, injuries, or a lack of vigor. All discarded and released fish were measured for fork length.

Biological samples were collected from the entire size distribution of fish captured. Otoliths, length, sex, and a maturity state were sampled from the first fish of every pot string and every 12th fish thereafter. Maturity state was determined by macroscopic visual examination of the gonads according to a six-stage scale (Table 2).

Fish that were previously tagged with an ADF&G tag and were in good health were re-released after recording the tag number and fork length (to the nearest cm). Fish that were captured that were previously tagged but were not in good health or dead, were retained and sampled for length, sex, and maturity. Fish that were previously tagged by an agency other than ADF&G were retained or released dependent on the instructions of that agency (see 2008 pot survey standard operating procedures for details).

Bycatch was identified and counted by species. Rockfish of the genus *Sebastes* were retained, whereas shortspine thornyhead rockfish (*Sebastolobus alascanus*) were released because they generally do not exhibit visible signs of barotraumas. All other bycatch species were released.

The temperatures that sablefish were exposed to during capture and handling were recorded, including surface, bottom, and holding tank temperatures. Tidbit data loggers were used to record bottom temperature, date, and time at 30 minute intervals. Tidbits were attached to 3 pots in a string, each end and a middle pot, and deployed each time the gear was set. When the gear was hauled, the pot each tidbit was located on was recorded and later used to match each tidbit to a bottom depth, which was recorded for each pot as it was set. The surface temperature was recorded by a tidbit data logger at 30-minute intervals placed in the water at the stern of the vessel during each haul. The holding tank temperature was measured in the center and right holding tanks using a digital water resistant thermometer. This information was recorded at the beginning, middle, and end of each haul, along with time, and weather conditions.

The duration of exposure of the captured sablefish to the elevated water temperature of the holding tank and the air temperature was determined. The time required to process 13 of the pots, along with the number of sablefish tagged, discarded, previously tagged, and sampled for that pot was recorded.

SAMPLE DESIGN

The target tagging goal was set at 6,000 sablefish. Sablefish were marked and tagged among statistical areas in proportion to the average 2005–2007 commercial harvest from each area based on the target tagging goal set (Table 1; Table 3). Once the approximate quota was reached for a statistical area, the next statistical area was sampled. If the quota was reached in the middle of a set and a large quantity of fish were left in the pots, the sablefish in the remaining pots were estimated and released without marking, tagging, or sampling. If the tagging goal for an area was not met in the time frame available, the area was left and the next statistical area was sampled.

In addition, sablefish marks and tags were distributed by depth in proportion to the 2007 NSEI commercial harvest by depth in each statistical area (Table 1; Table 3). Depths ranging from 50 to 480 fathoms were considered for set placement. However, meeting the tagging goal for a particular statistical area was considered a priority over tagging and marking fish from depths where only a small proportion of the 2007 commercial harvest occurred.

In order to distribute marked/tagged fish throughout a statistical area, no overlapping sets were performed within a statistical area, and sets were performed both over the latitudinal and longitudinal range of a statistical area.

Another consideration to set placement was the marking history of an area. The number of sablefish captured, tagged, and marked during previous mark-tag surveys was used to help determine placement of sets. In addition, the placement of survey gear was avoided at established set locations for the NSEI longline survey.

DATA ANALYSIS

In order to determine the range of temperatures sablefish were exposed to, the bottom, surface, and holding temperatures were graphed by date. For bottom temperature, the last time and temperature logged while the pot was located on the bottom was graphed (as the pot is brought to the surface an obvious jump in temperature was recorded). The surface temperature was matched to a particular pot by the time closest to the last bottom temperature recorded for a pot. This surface temperature was plotted versus time as a comparison to the bottom temperature and holding tank temperatures. The center holding tank was most often used to hold sablefish. Consequently, more care was taken to flush this tank, and the water flow was maintained at a higher level than the right holding tank. As a result, we plotted the temperature for only the center holding tank.

RESULTS AND DISCUSSION

SCHEDULE

The 2008 NSEI mark-tag survey occurred from June 1 to 25. The R/V *Zolotoi* left Sitka on June 1st, and the crew set the first gear on that same day. During most days of the survey, 2 strings of gear were set, and the 2 strings of gear set the previous day were hauled (Appendix B). The survey began in central Chatham Strait near the entrance to Peril Strait and moved northward to just north of the entrance to Icy Strait. Sets were then performed from northern Chatham Strait in a southerly direction to Frederick Sound. Sets 1 to 20 were made June 1 to 10 in central and northern Chatham Strait, in statistical areas 345803, 345731, 345701, and the northern tip of 345631. Sets 21 to 24 were made on June 11 and 12, in Frederick Sound in a northwesterly direction, in statistical areas 345702 and 335701. The R/V *Zolotoi* docked in Petersburg on June

12 and 13. We obtained additional bait and supplies and switched crew while in Petersburg. The vessel returned to Frederick Sound and hauled sets 23 to 26 on June 14. Sets 27 to 45 were performed in the southern end of Chatham Strait from June 15 to 24 (statistical areas 345631, 345603 and southern tip of 345701) and were generally set in a southward direction (Figure 1). The survey was completed in statistical area 345603 on June 25.

SET INFORMATION

A total of 1,856 pots were deployed in 45 sets, with 1,854 pots successfully recovered during the 2008 NSEI mark-tag survey. The sets were made in depths from 180 to 429 fathoms. Soak time averaged 20.3 hours and ranged from 9.5 to 43.1 hours. Sets 23 and 24 soaked for over 40 hours while the crew travelled to and back from Petersburg. Haul time averaged 1.5 hours and ranged from 1.0 to 2.9 hours (Appendix B).

CATCH AND TAGGING INFORMATION

At least 16 different species of fish and 2 species of commercially important crab were caught during the survey in 2008 (Appendix C); a total of 9,425 individual fish or commercially important crab species were caught. Sablefish was the dominant species of fish caught, followed by arrowtooth flounder (*Atheresthes stomias*), dover sole (*Microstomus pacificus*), halibut (*Hippoglossus stenolepis*), and roughey rockfish (*Sebastes aleutianus*) (Appendix D). A total of 32 fish were not identifiable due to sand flea damage, and at least 3 fish that were considered bycatch (set 15) were thrown overboard by the crew before they were identified. A total of 131 golden king (brown) crab (*Lithodes aequispina*) and one tanner crab (*Chionoecetes bairdi*) were captured and identified. In addition, numerous other invertebrates were entangled or captured in the pot gear; the following are some of the organisms observed; however, this list is not exhaustive: octopus (Order Octopoda); coral (*Primnoa pacifica* and *Stylaster campylecus*); basket and brittle stars (Class Ophiuroidea), mud stars (*Ctenodiscus crispatus*), heart urchins (*Brisaster latifrons*), hermit crabs (Superfamily Paguroidea), and tritons (*Charonia* sp.).

A total of 6,409 sablefish were caught during the 2008 survey; 5,450 of these fish were tagged, finclipped, and released (Appendix E). No sablefish were captured below the minimum tagging size of 320 mm. The catch included 121 fish previously tagged by ADF&G; 4 of these fish were tagged during the 2008 survey. All but one fish previously tagged by ADF&G were re-released with their original tag. One fish was retained after crew erroneously clipped the tail. In addition, one fish was captured that had been previously tagged by the Department of Fisheries and Oceans (DFO) in Canada. This fish was retained, biological information collected, and the tag and otoliths were returned to DFO. An additional 137 sablefish were captured and then discarded or released without tagging, because they were dead or not healthy due to sand flea damage or other injuries (e.g., pot abrasions or a torn mouth). In addition, an estimated 165 sablefish were released without tagging because the quota was reached for an area. A total of 535 sablefish were retained for biological sampling.

The target tagging goal of 6,000 sablefish was not met in 2008. The tagging goal by statistical area was met only in Statistical area 345603. Extreme tides may have contributed to low catches during the survey (John Jorgenson, skipper R/V *Zolotoi*, *personal communication*); negative low tides and greater than 15-foot high tides occurred on June 1 to 8 and on June 17 to 23 June, more than half of the survey days. In addition, attempting to capture fish from a particular depth class so as to distribute tags and marks in proportion to the 2007 NSEI harvest by depth may have contributed to difficulty in meeting the tagging goals by statistical area. Sets may have been

made in less favorable locations in order to reach tagging goals by depth. The number of sablefish discarded without tagging and marking due to sand flea damage was low compared to past years (O'Connell and Holum 2007; Stahl and Holum 2008; Appendix E). Therefore, sand flea damage did not prevent us from reaching our tagging goal. In 2008, we had trouble meeting our tagging goal even though more sets were made and a larger range of lengths was available for tagging and marking, compared to previous years (Stahl and Holum 2008; O'Connell and Holum 2007). Although the overall tagging goal was not met, we were close to the goal of 6,000 tags (9% difference). In addition, tags and marks were generally distributed consistent with the average proportion of the 2005 to 2007 harvest by statistical area. The difference between percent tagged in a statistical area and percent of the average 2005 to 2007 harvest in that area was 3% or less (Table 4).

Generally, the proportion of tagged fish by depth was similar to the proportion of the 2007 commercial harvest by depth. There was 6% or less difference between the fish tagged from a particular depth range in 2008 and the proportion of fish harvested in a particular depth range in the 2007 NSEI fishery (Table 1; Table 5). During the 2008 survey, fish were tagged from the depth class of 151 to 450 fathoms; most fish in Chatham Strait were captured from depths greater than 200 fathoms (Table 5). No fish were captured and tagged from the shallowest depth classes of 50 to 150 fathoms, or the deepest depth class of 451 to 480 fathoms (Table 5); commercial catches from these depths made up only 1% of the 2007 harvest (Table 3).

BIOLOGICAL INFORMATION

A total of 5,449 of the 5,450 sablefish marked and tagged were sampled for fork lengths. Sablefish were marked and tagged from a similar length distribution as all fish sampled for lengths during the survey; the average length of sablefish tagged and released was 653 mm only 2 mm difference from all fish sampled for lengths (Figure 3). Of the 535 biological samples, otoliths and fork lengths were collected from 533 fish with an average length of 659 mm (Figure 4). Females had a greater average length of 684 mm compared to an average male length of 621 mm (Figure 5); females accounted for 60% of the sampled fish compared to 40% for males, similar to the sex ratio sampled in 2007 (Stahl and Holum 2008).

Smaller to mid-sized sablefish (390–650 mm) composed a greater proportion of the fish captured in central (345731 and 345701) and southern (345603) Chatham Strait, whereas mid-sized to larger fish (660–1090 mm) composed a greater proportion of the fish captured in Frederick Sound (345702 and 335701), the adjacent statistical area (345631), and northern Chatham Strait (345803) (Figure 6; Table 6). Over 40% of the larger fish of 660–1040 mm lengths were captured in statistical area 345631; over 43% of the smaller fish were captured in statistical area 345701 (Table 6).

The average length of all sablefish caught during the 2008 mark-tag survey increased from 2007, continuing a trend that has occurred since the mark-tag survey began using pot gear in 2000. The average length for the 6,241 sablefish fork lengths (Stahl and Holum 2008) collected in 2008 was 655 mm, an increase of 10 mm from 2007 and 107 mm from 2000 (Richardson 2001; Richardson 2002; Richardson 2003; O'Connell and Holum 2007; Stahl and Holum 2008; unpublished ADF&G data). The larger average length in recent years supports the idea that sablefish recruitment in Southeast Alaska has been low (S. Dressel, ADF&G, *personal communication*) as observed in the Gulf of Alaska (Hanselman et al. 2008). Few strong year classes have been apparent in the Gulf of Alaska since the 1997 and 2000 year classes

(Hanselman et al. 2008). In 2008, the sablefish lengths ranged from 410 mm to 1,040 mm (Figure 7), and the length histogram exhibits a trailing tail at large lengths. This pattern is not matched at small fish lengths, possibly due to smaller fish differentially recruiting to pot gear, and fish less than 400 mm rarely recruiting to the pot gear (J. Stahl, ADF&G, *unpublished data*; Figure 7).

During the timing of the mark-tag survey (June), the majority of females sampled were mature (maturity stages 3–6) and at the early stages of preparation for the upcoming spawning season (Jan.–April)¹. Seventy-one percent of females were classified into a post-spawning condition (stage 5 or 6); these fish did not have eggs visible to the “naked eye”. However, many of these fish probably have some yolk development in their oocytes¹. Only one female was considered to be ripe (stage 3) and none were considered to be spawning (stage 4). In addition, 8% of females were classified as immature (stage 1) and 21% as maturing juvenile (stage 2; Figure 8). Immature fish are not expected to spawn in the approaching season, but some of the maturing juvenile would be expected to spawn in the approaching season¹. The majority of male sablefish were classified into an inactive maturity state; 49% were classified as post-spawning (stage 5 or 6) and 43% as either immature (stage 1) or maturing juvenile (stage 2). Only a small percentage of male sablefish were considered to be ripe (stage 8; 10%) and none were considered to be spawning (stage 4; Figure 8).

TEMPERATURE DATA

Temperature was successfully measured at the times and locations that sablefish were exposed during capture and handling during the 2008 NSEI mark-tag survey. Bottom temperature ranged from 4.8°C to 5.5°C with an average bottom temperature of 5.0°C and was measured throughout the depth range that sablefish were captured (182 to 429 fathoms). The bottom temperature varied less than 1°C over the entire survey (Figure 9). The surface temperature ranged from 6.9°C to 9.6°C with an average of 8.4°C. The holding tank temperature of the center tank ranged from 9.7°C to 13.7°C with an average temperature of 11.7°C. There was about a 3.4°C difference between the average surface and bottom temperatures and 6.7°C difference between the average holding and bottom temperatures. The surface temperature varied 2.7°C and the holding tank temperature 4.0°C over the entire survey, and over the course of a day, the surface and holding tank temperatures varied up to 2.2°C and 3.4°C degrees, respectively, dependent on the weather conditions (Figure 9).

The total time required to process a pot of sablefish, including tagging, measuring, clipping, sampling, and discarding, was recorded for 13 different pots. The maximum time to process the sablefish in a pot was 438 seconds (7 minutes and 18 seconds) for 20 fish. On average it took 20 seconds to process a fish (3 fish per minute).

Sablefish captured during the NSEI mark-tag survey may be vulnerable to delayed mortality unless exposure to elevated holding tank temperatures and handling time are limited. During the 2008 NSEI mark-tag survey, sablefish were exposed to elevated water and air temperatures for a maximum of 7 minutes. Delayed mortality or immunological suppression was observed in experiments where capture of sablefish was simulated with gear (hook or trawl) contact and elevated air and/or water temperature exposure of 15 minutes or more (Davis et al. 2001; Davis

¹ J. Stahl, ADF&G fisheries biologist, unpublished results

2005; Lupes et al. 2006). However, the minimum length of exposure that may contribute to immunological suppression is currently unknown.

Sablefish captured and released during the NSEI mark-tag survey were exposed to elevated temperatures of up to 14°C, 9°C degrees higher than the bottom temperatures from which they were captured. In experiments conducted by Davis and others, fish that were exposed to temperatures similar to the average temperature (12°C) observed in the holding tanks during our survey did not have delayed mortality unless those fish were also first subjected to towing (33%). During the mark-tag survey, exposure to air is minimal and limited to the time required to dump the fish from pots into the holding tank and to the handling time when fish are tagged, clipped, measured, and examined.

AKNOWLEDGEMENTS

Special thanks to the crew of the R/V *Zolotoi* for their at-sea accommodations. We are grateful to the other groundfish staff for their hard work on the 2008 pot survey, including Becky Knight, Cleo Brylinksy, and Allison Sayer. We also want to thank Allison Sayer for helping to gather literature for this report.

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TABLES AND FIGURES

Table 1.—Average proportion of 2005–2007 NSEI sablefish harvest by statistical area and the proportion of 2007 sablefish harvest by depth class and statistical area.

Statistical area	Average proportion 2005–2007 NSEI harvest	Average proportion 2007 NSEI harvest by depth class (fathoms)								
		50–100	101–150	151–200	201–250	251–300	301–350	351–400	401–450	451–480
335701	2.0%	0%	0%	1%	1%	0%	0%	0%	0%	0%
345603	11.8%	0%	0%	0%	1%	2%	3%	5%	0%	0%
345631	31.6%	0%	0%	0%	0%	2%	8%	22%	0%	0%
345701	31.6%	0%	0%	0%	0%	3%	15%	8%	5%	1%
345702	3.8%	0%	0%	4%	0%	0%	0%	0%	0%	0%
345731	12.0%	0%	0%	0%	1%	5%	6%	0%	0%	0%
345803	7.2%	0%	0%	0%	0%	1%	4%	1%	0%	0%
Total	100.0%	0%	0%	5%	3%	13%	36%	36%	5%	1%

Table 2.–Sablefish maturity condition using a six-stage scale for macroscopic examination of gonads.

Maturity code	Condition	Macroscopic examination	
		Males	Females
1	Immature	Testes very narrow, parallel, flat and ribbon-like, almost clear in color. Longitudinal creases are easily discernible.	Ovaries appear as 2 narrow ovoids. May be veined.
2	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.
3	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.
4	Spawning	Testes very large and white, extruding milt freely under slight pressure or when cut.	Ovaries very large with large translucent eggs loose within ovary or extruding from the oviduct.
5	Spent/Post spawning	Testes large, shriveled, often with wrinkles, and bloodshot. No milt present.	Ovaries shriveled and opaque, soft and flaccid, often reddish in color.
6	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 follicular structure.

Table 3.—Number of sablefish to mark and tag by NSEI statistical area and depth for a total tagging goal of 6,000 marks and tags.

Statistical area	Number of fish to tag/mark	Number of fish to tag/mark by depth range (fathoms)								
		50-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-480
335701	122	0	4	87	31	0	0	0	0	0
345603	710	3	7	0	81	124	188	307	0	0
345631	1,893	0	4	5	3	120	462	1,299	0	0
345701	1,897	0	0	5	12	179	904	464	274	60
345702	228	0	0	210	0	18	0	0	0	0
345731	721	0	0	5	35	272	384	25	0	0
345803	429	0	0	0	24	83	241	81	0	0
Total	6,000	3	15	312	186	796	2,178	2,175	274	60

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Table 4.—Marking goals and actual number of tagged and marked sablefish released by statistical area for the NSEI mark-tag survey, 2008.

Statistical area	Goal based on 6,000 marks & tags	Average proportion of 2005–2007 NSEI harvest	Number marked & tagged	Percent marked & tagged
335701	122	2%	115	2%
345603	710	12%	712	13%
345631	1893	32%	1,669	31%
345701	1897	32%	1,872	34%
345702	228	4%	69	1%
345731	721	12%	660	12%
345803	429	7%	353	6%
Total	6,000		5,450	

Table 5.—Number of sablefish marked and tagged by NSEI statistical area and depth class for a total goal of 6,000 marks/tags.

Statistical area	Number of fish to tag/mark by depth class (fathoms)									Total
	50-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-480	
335701	0	0	36	48	31	0	0	0	0	115
345603	0	0	0	63	19	144	479	7	0	712
345631	0	0	0	0	191	452	1,022	4	0	1,669
345701	0	0	0	0	186	1,063	518	105	0	1,872
345702	0	0	51	18	0	0	0	0	0	69
345731	0	0	0	37	289	308	26	0	0	660
345803	0	0	0	0	0	347	6	0	0	353
Total	0	0	87	166	716	2,314	2,051	116	0	5,450
Percent of total	0%	0%	2%	3%	13%	42%	38%	2%	0%	100%

Table 6.—Number and proportion of sablefish by length class in each statistical area for the NSEI mark-tag survey, 2008.

Statistical area	Number		Proportion	
	410–650 mm	660–1040 mm	410–650 mm	660–1040 mm
335701	42	85	0.33	0.67
345603	463	336	0.58	0.42
345631	697	1,207	0.37	0.63
345701	1,385	733	0.65	0.35
345702	24	55	0.30	0.70
345731	445	339	0.57	0.43
345803	201	229	0.47	0.53

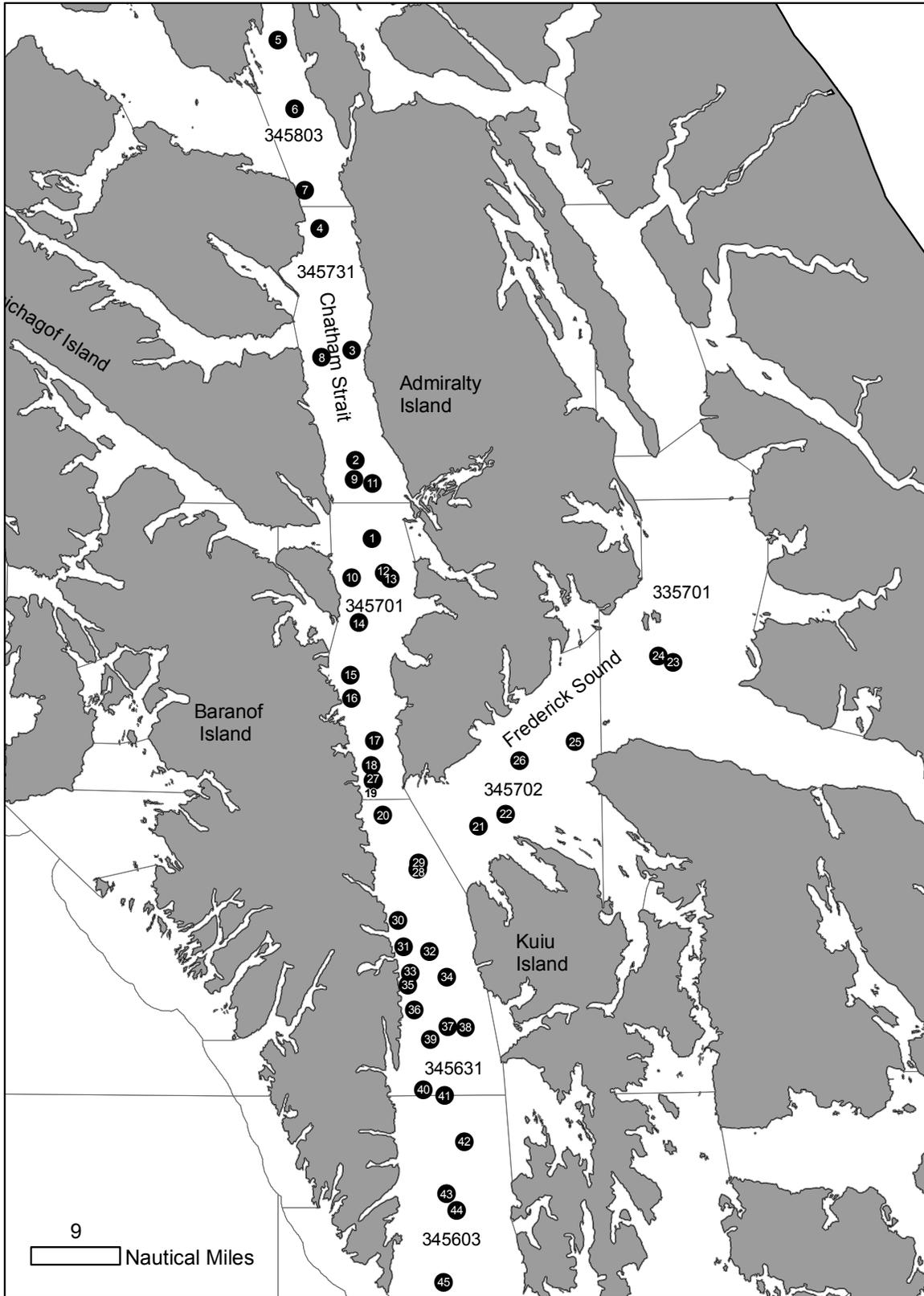


Figure 1.—Set locations for the NSEI mark-tag survey, 2008.

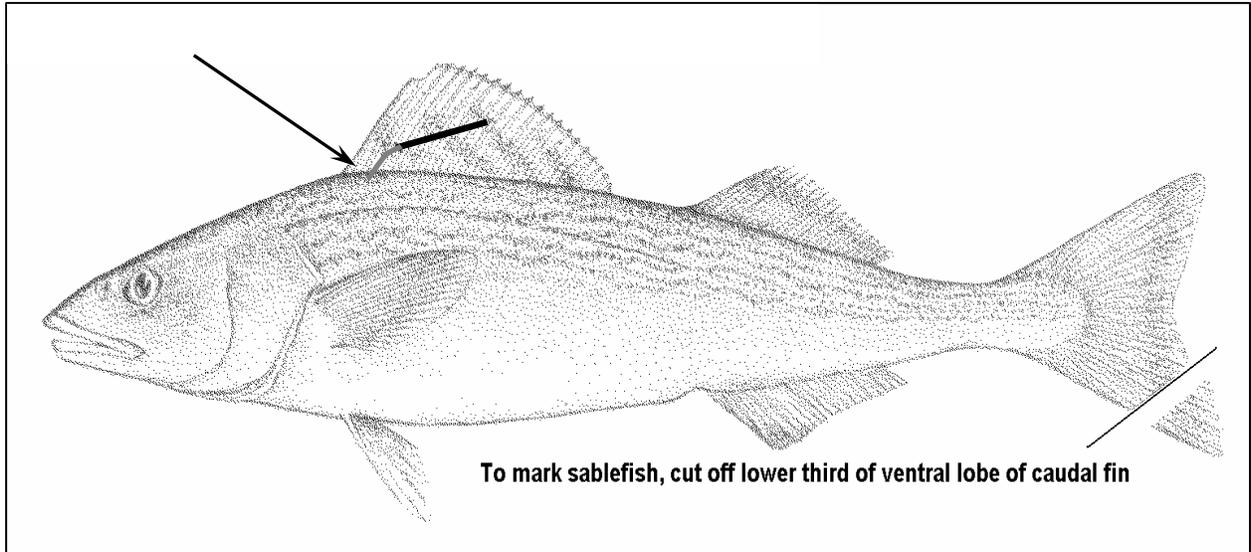


Figure 2.—Sablefish marking guidelines, NSEI mark-tag survey, 2008. Sablefish are double-marked with a lower caudal finclip and a T-bar tag.

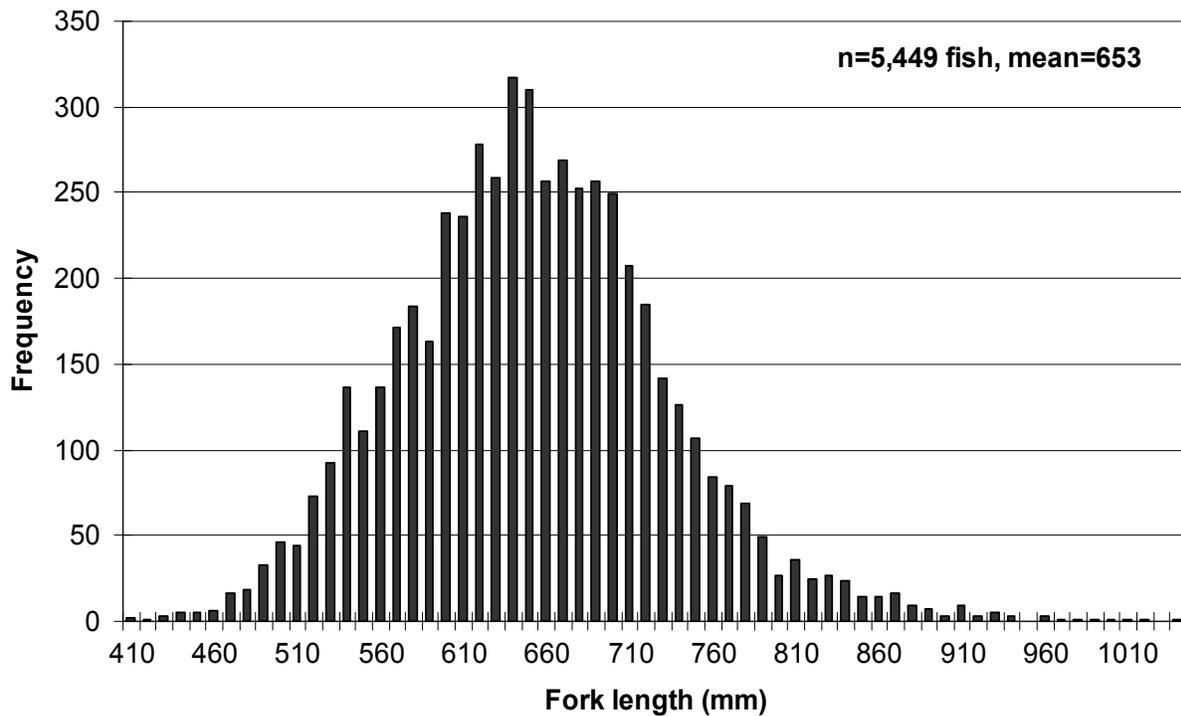


Figure 3.—Length frequency distribution for sablefish marked and released during the NSEI mark-tag survey, 2008.

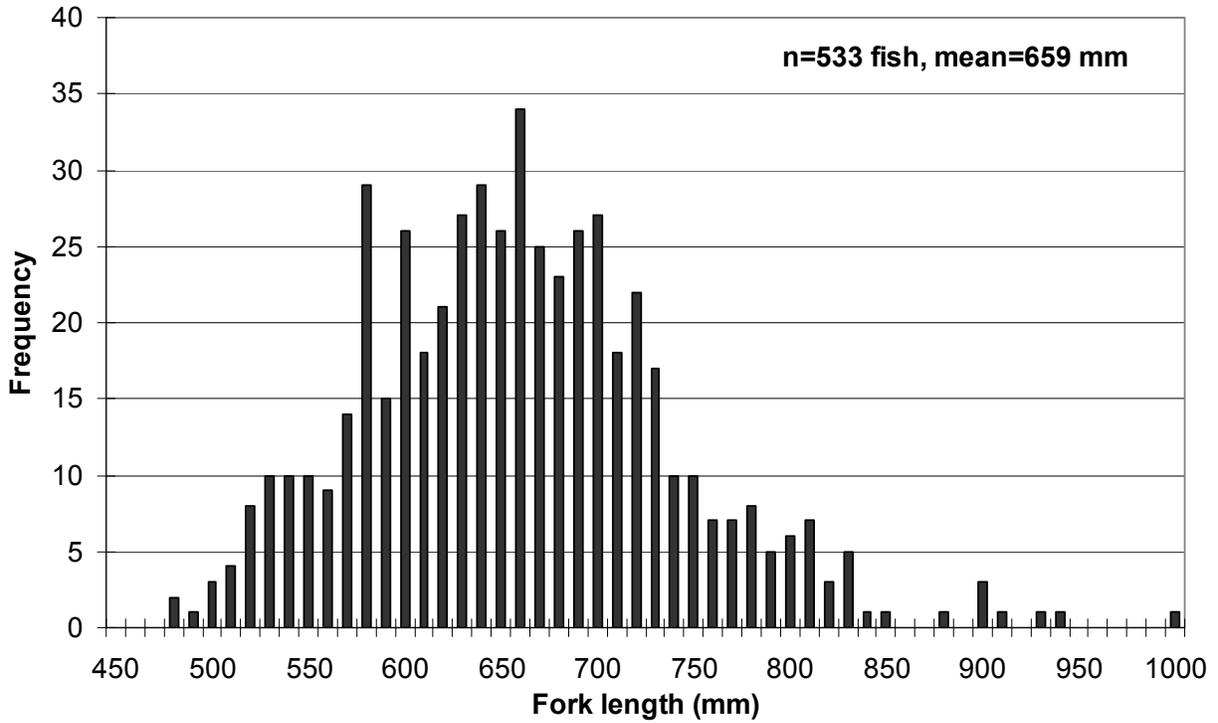


Figure 4.—Sablefish length frequency distribution for biological samples collected during the NSEI mark-tag survey, 2008.

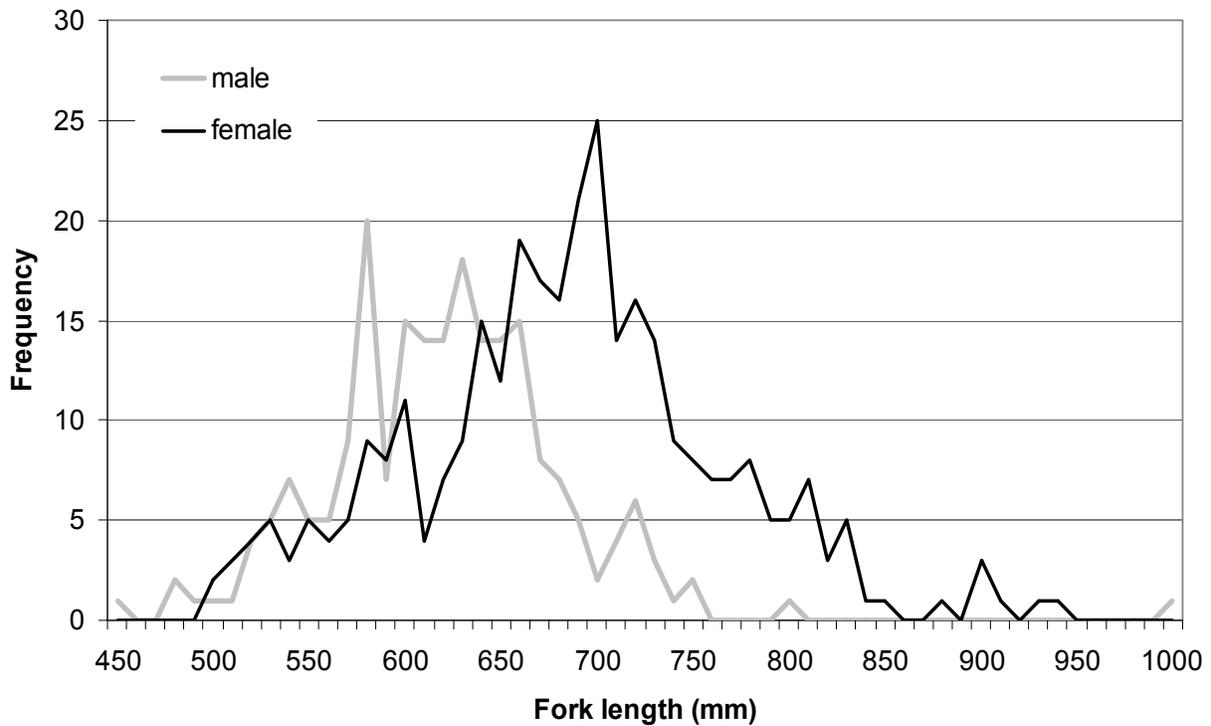


Figure 5.—Sablefish length frequency distributions, by sex, for biological samples collected during the NSEI mark-tag survey, 2008.

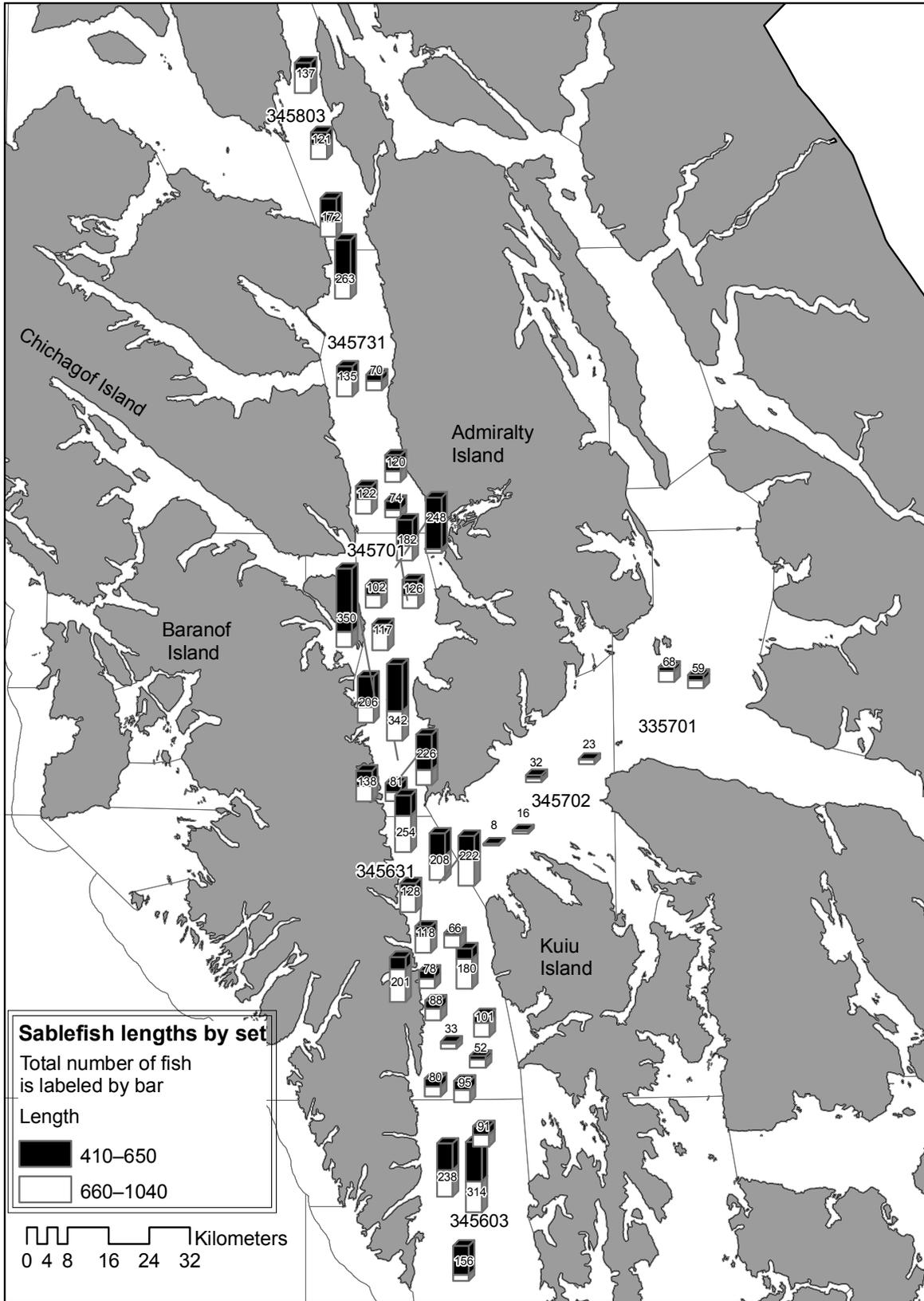


Figure 6.—Sablefish length distribution mapped by set, NSEI mark-tag survey, 2008.

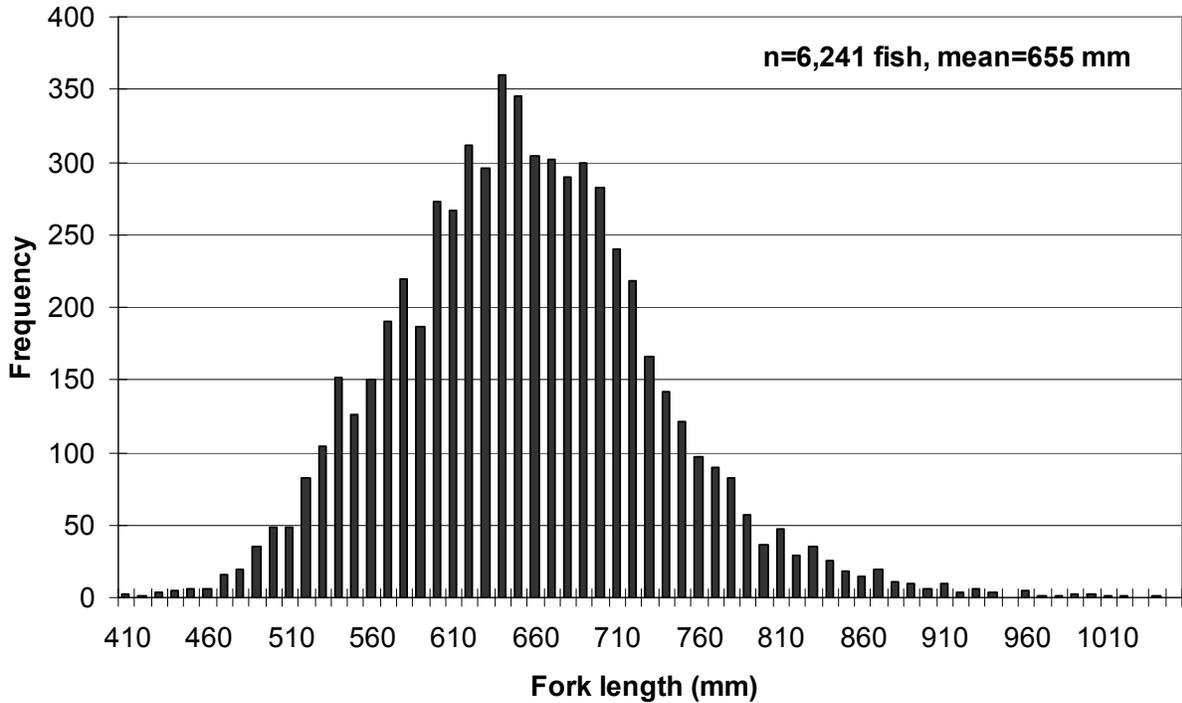


Figure 7.—Length frequency distribution for all sablefish captured and sampled for length during the NSEI mark-tag survey, 2008.

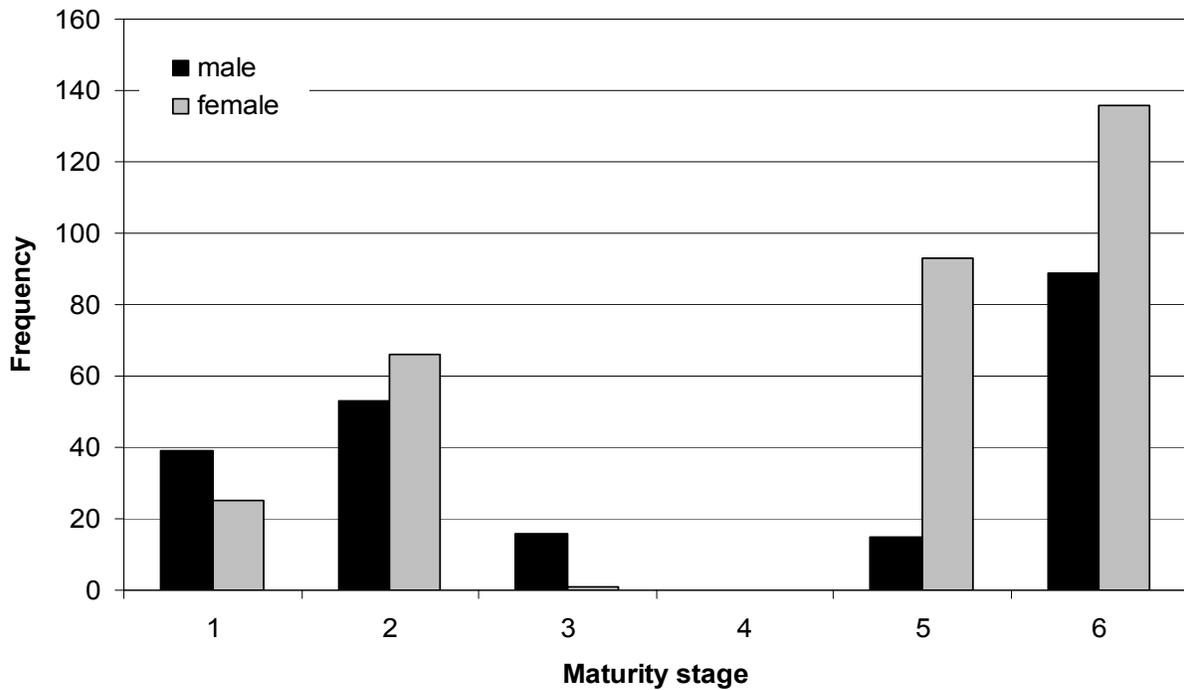


Figure 8.—Frequency of occurrence of macroscopic maturity stages, by sex, for sablefish biological samples collected during the NSEI mark-tag survey, 2008.

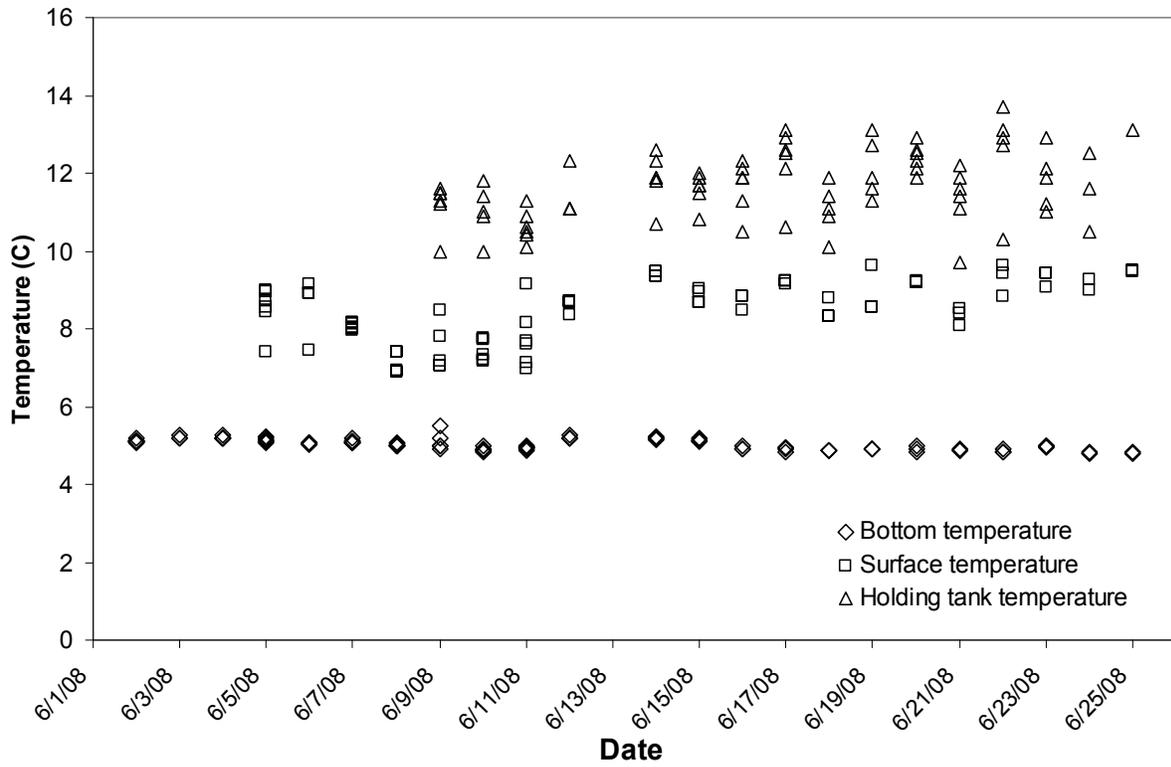


Figure 9.—Temperatures that sablefish were exposed to during their capture and handling on the NSEI mark-tag survey, 2008.

APPENDICES

Appendix A.—Crew from the R/V Zoltoi and staff from the Alaska Department of Fish and Game on the NSEI mark-tag survey, 2008 (first leg, June 1–12; second leg, June 13–25).

Name	Position	Affiliation	Leg(s) of Survey
John Jorgenson	Skipper	R/V Zoltoi	Both
Gary Mangini	Skipper	R/V Zoltoi	Both
Alfred Willey	Engineer	R/V Zoltoi	First and Second (13-19)
Manuel Pasillas	Deck	R/V Zoltoi	Both
Andrew Higashi	Deck	R/V Zoltoi	Both
Deidra Holum	Survey leader	ADF&G	First and Second (13–19)
Allison Sayer	Scientific staff	ADF&G	First
Cleo Brylinsky	Scientific staff	ADF&G	Second
Rebecca Knight	Scientific staff	ADF&G	Second (19–25)
Jennifer Stahl	Scientific staff	ADF&G	Both

Appendix B.–Detailed set information, including location and timing, for the NSEI mark-tag survey, 2008.

Set	Stat area	Start				End				Date Set	Time set	Hours			No. Pots set	Depth (fm)			
		Lat deg	Lat min	Long deg	Long min	Lat deg	Lat min	Long deg	Long min			Soak time	Haul time	Haul direction		Start	End	Avg	Substrate
1	345701	57	26.43	-134	42.33	57	28.03	-134	40.93	6/1/08	14:10	17.33	2.50	Opposite	42	302	271	289	Mud/Gravel
2	345731	57	34.36	-134	45.40	57	32.73	-134	47.62	6/1/08	16:15	22.75	1.75	Same	42	307	335	315	Mud/Gravel
3	345731	57	45.44	-134	46.04	57	47.58	-134	46.85	6/2/08	12:50	9.50	1.58	Opposite	42	285	239	237	Mud/Gravel
4	345731	57	57.82	-134	52.04	57	59.89	-134	53.22	6/2/08	20:15	24.25	2.25	Opposite	42	268	294	272	Mud/Gravel
5	345803	58	16.89	-134	59.99	58	18.85	-135	0.85	6/3/08	17:40	15.25	1.75	Same	42	331	330	330	Mud/Gravel
6	345803	58	9.90	-134	56.79	58	11.87	-134	58.23	6/4/08	0:30	11.42	1.33	Opposite	42	343	320	320	Mud/Gravel
7	345803	58	1.69	-134	54.92	58	3.50	-134	52.87	6/4/08	15:20	16.00	1.83	Same	42	312	372	318	Mud/Gravel
8	345731	57	44.77	-134	51.71	57	46.57	-134	52.72	6/4/08	18:35	17.17	1.58	Opposite	42	304	296	302	Mud/Gravel
9	345731	57	32.38	-134	45.69	57	33.99	-134	43.80	6/5/08	16:00	15.47	1.48	Opposite	40	347	360	335	Mud/Gravel
10	345701	57	22.42	-134	46.17	57	24.17	-134	45.71	6/5/08	18:10	17.58	1.42	Same	41	343	374	357	Mud/Gravel
11	345731	57	31.98	-134	42.25	57	30.75	-134	43.16	6/6/08	10:30	20.75	1.42	Opposite	41	353	296	328	Mud/Gravel
12	345701	57	22.89	-134	40.06	57	24.07	-134	43.48	6/6/08	14:35	20.62	1.55	Same	42	338	335	318	Mud/Gravel
13	345701	57	22.34	-134	38.91	57	20.73	-134	40.88	6/7/08	10:30	20.57	1.27	Same	40	353	337	340	Mud/Gravel
14	345701	57	17.91	-134	44.89	57	19.80	-134	44.30	6/7/08	15:30	17.82	1.42	Opposite	40	429	403	410	Mud/Gravel
15	345701	57	12.57	-134	46.51	57	10.67	-134	44.52	6/8/08	11:57	19.13	2.67	Same	42	323	334	327	Mud/Gravel
16	345701	57	10.26	-134	46.35	57	8.56	-134	44.68	6/8/08	12:45	23.27	1.73	Opposite	41	328	332	333	Mud/Gravel
17	345701	57	5.99	-134	42.10	57	3.90	-134	40.64	6/9/08	10:49	19.97	2.92	Same	42	354	349	353	Mud/Gravel
18	345701	57	3.48	-134	42.67	57	5.26	-134	44.87	6/9/08	15:17	21.05	1.67	Same	40	357	342	343	Mud/Gravel
19	345701	57	1.88	-134	42.27	57	3.62	-134	40.49	6/10/08	15:29	15.52	1.40	Opposite	40	350	350	356	Mud/Clay
20	345631	56	58.41	-134	40.57	56	56.30	-134	41.90	6/10/08	11:00	22.45	2.15	Opposite	42	332	334	338	Mud/Gravel
21	345702	56	57.18	-134	22.85	56	55.55	-134	26.28	6/11/08	13:50	16.83	1.08	Same	42	188	180	183	Mud/Gravel
22	345702	56	58.39	-134	17.82	56	57.47	-134	21.42	6/11/08	15:00	17.72	1.15	Opposite	42	182	191	188	Mud/Gravel
23	335701	57	13.57	-133	46.28	57	11.38	-133	46.25	6/12/08	14:45	40.55	1.58	Opposite	42	201	192	204	Mud/Gravel
24	335701	57	14.24	-133	48.98	57	12.58	-133	52.05	6/12/08	14:40	43.05	1.28	Same	42	206	251	246	Mud/Gravel
25	345702	57	5.67	-134	4.81	57	4.77	-134	8.61	6/14/08	12:54	18.22	1.10	Same	42	199	201	202	Sand
26	345702	57	3.82	-134	15.13	57	2.02	-134	18.32	6/14/08	13:46	19.57	1.12	Same	42	194	194	196	Gravel
27	345701	57	1.91	-134	42.40	57	0.36	-134	40.02	6/15/08	14:15	16.22	1.28	Same	41	350	321	343	Mud/Gravel
28	345631	56	52.95	-134	34.15	56	52.36	-134	37.68	6/15/08	12:22	20.85	1.57	Same	42	363	367	368	Mud/Gravel
29	345631	56	53.57	-134	34.00	56	54.47	-134	37.17	6/16/08	11:46	19.07	1.58	Opposite	42	358	352	361	Mud/Gravel
30	345631	56	47.75	-134	37.88	56	47.93	-134	34.69	6/16/08	13:07	21.62	1.30	Opposite	38	395	401	394	Mud/Gravel
31	345631	56	45.09	-134	36.83	56	46.54	-134	34.46	6/17/08	10:12	20.80	1.28	Opposite	42	400	398	392	Mud/Gravel
32	345631	56	44.60	-134	32.07	56	46.25	-134	30.82	6/17/08	13:20	21.00	1.08	Opposite	38	388	375	357	Hard
33	345631	56	42.35	-134	35.72	56	43.93	-134	33.80	6/18/08	9:20	23.53	1.55	Same	42	376	386	381	Mud/Gravel
34	345631	56	42.03	-134	28.95	56	44.04	-134	28.08	6/18/08	12:35	23.82	1.52	Opposite	40	346	351	350	Mud/Gravel
35	345631	56	41.21	-134	36.11	56	42.61	-134	33.53	6/19/08	11:40	20.63	1.20	Same	42	376	379	375	Mud/Gravel
36	345631	56	38.71	-134	34.96	56	37.04	-134	33.14	6/19/08	15:05	20.42	1.00	Opposite	40	351	354	352	Mud/Gravel
37	345631	56	37.02	-134	28.80	56	38.78	-134	30.71	6/20/08	10:54	20.60	1.25	Same	42	316	371	335	Hard
38	345631	56	36.91	-134	25.62	56	39.06	-134	25.67	6/20/08	14:05	20.75	1.20	Opposite	42	284	275	272	Mud/Gravel
39	345631	56	35.66	-134	32.03	56	33.64	-134	32.06	6/21/08	9:40	21.50	1.20	Opposite	42	351	341	345	Hard
40	345631	56	30.63	-134	33.38	56	32.33	-134	31.54	6/21/08	13:50	21.28	1.22	Same	41	297	357	328	Sand
41	345631	56	30.01	-134	29.51	56	31.77	-134	27.26	6/22/08	10:18	21.15	1.38	Same	42	290	235	280	Sand
42	345603	56	25.31	-134	25.95	56	27.30	-134	27.96	6/22/08	14:15	21.75	1.25	Opposite	42	234	274	242	Rock
43	345603	56	20.01	-134	29.31	56	21.40	-134	27.01	6/23/08	10:50	20.25	1.82	Opposite	42	357	401	385	Sand
44	345603	56	18.35	-134	27.41	56	19.65	-134	24.94	6/23/08	14:55	19.67	2.00	Opposite	38	398	390	398	Sand
45	345603	56	11.10	-134	29.96	56	12.70	-134	31.94	6/24/08	14:35	13.75	1.72	Opposite	39	327	330	328	Sand

Appendix C.–Species caught and identified during the NSEI mark-tag survey, 2008.

Common name	Scientific name
Sablefish	<i>Anoplopoma fimbria</i>
Rougheye rockfish	<i>Sebastes aleutianus</i>
Shortraker rockfish	<i>Sebastes borealis</i>
Redbanded rockfish	<i>Sebastes babcocki</i>
Dusky rockfish	<i>Sebastes variabilis</i>
Shortspine thornyhead rockfish	<i>Sebastolobus alascanus</i>
Arrowtooth flounder	<i>Atheresthes stomias</i>
Halibut	<i>Hippoglossus stenolepis</i>
Dover sole	<i>Microstomus pacificus</i>
Pacific sleeper shark	<i>Somniosus pacificus</i>
Spotted ratfish	<i>Hydrolagus colliei</i>
Pacific cod	<i>Gadus macrocephalus</i>
Pacific viperfish	<i>Chauliodus macouni</i>
Smooth lumpsucker	<i>Aptocyclus ventricosus</i>
Tanner crab	<i>Chionoectes bairdi</i>
Golden (brown) king crab	<i>Lithodes aequispina</i>
Sculpin (unknown species)	Family Cottidae
Skate (unknown species)	Family Rajidae

Appendix D.—Fish captured by set for the NSEI mark-tag survey, 2008.

Set	Groundfish									Skates/Rays/Ratfish			Rockfish					Total
	Sable-fish	Pacific cod	Arrow-tooth flounder	Halibut	Dover sole	Smooth lump-sucker	Pacific viper-fish	Unknown sculpin	Unknown ground-fish	Pacific sleeper shark	Unknown skate	Rat-fish	Thorny-head	Rough-eye	Short-raker	Red-banded	Dusky	
1	248	—	13	1	—	—	—	—	1	—	—	—	—	—	—	—	—	263
2	120	—	17	5	1	—	—	—	2	1	—	—	—	1	—	—	—	147
3	70	—	14	7	—	—	—	2	—	1	—	—	—	9	1	3	—	107
4	263	—	8	—	1	—	—	—	—	—	—	—	—	—	—	—	—	272
5	138	—	13	4	—	—	—	—	—	—	—	1	—	—	—	—	—	156
6	121	—	9	3	1	—	—	—	—	—	2	—	—	—	—	—	—	136
7	172	—	10	4	1	—	—	—	7	—	—	—	—	—	—	—	—	194
8	135	—	7	5	1	—	—	—	2	—	—	—	2	3	2	—	—	157
9	122	—	15	5	6	1	—	—	—	—	—	5	—	—	—	—	—	154
10	102	—	10	3	40	—	—	—	3	—	—	5	—	—	—	—	—	163
11	74	—	3	5	6	—	—	—	3	—	—	3	—	—	—	—	—	94
12	182	—	1	1	3	—	—	—	3	—	—	3	—	—	—	—	—	193
13	126	—	3	1	20	—	—	—	5	—	—	—	—	—	—	—	—	155
14	117	—	7	2	34	—	—	—	1	—	—	3	—	—	—	—	—	164
15	350	—	16	5	2	—	—	—	3	—	—	—	—	—	—	—	—	376
16	206	—	20	5	60	—	—	—	3	—	—	6	—	—	—	—	—	300
17	342	—	9	3	27	—	—	—	—	—	—	—	—	—	—	—	—	381
18	226	—	17	5	42	—	—	—	—	—	—	3	—	—	—	—	—	293
19	138	—	18	6	30	—	1	—	—	—	—	3	—	—	—	—	—	196
20	255	—	15	6	21	—	—	—	1	—	—	—	—	—	—	—	—	298
21	8	2	23	20	3	—	—	—	—	—	—	1	—	16	—	2	1	76
22	16	—	49	39	—	—	—	—	—	—	—	1	8	1	—	—	—	114
23	59	—	121	107	—	—	—	—	—	—	—	2	4	—	1	—	—	294
24	68	—	75	53	2	—	—	—	—	—	—	—	18	2	—	—	—	218
25	23	—	81	12	1	—	—	—	—	—	—	2	19	—	1	—	—	139
26	32	—	33	10	—	—	—	—	—	—	—	1	11	—	—	—	—	87
27	81	—	17	3	12	—	—	—	—	—	—	4	—	—	—	—	—	117
28	222	—	100	4	45	—	—	—	—	—	—	—	—	—	—	—	—	371
29	208	—	78	1	39	—	—	—	—	—	—	3	—	—	—	—	—	329
30	128	—	45	—	68	—	—	—	—	—	—	—	—	—	—	—	—	241
31	118	—	12	1	59	—	—	—	—	—	—	1	—	—	—	—	—	191
32	66	—	22	—	11	—	—	—	—	—	—	4	—	—	—	—	—	103
33	201	—	10	3	25	—	—	—	—	—	—	1	—	—	—	—	—	240
34	180	—	30	8	6	—	—	—	—	—	—	1	—	—	—	—	—	225
35	78	—	34	5	46	—	—	—	—	—	—	1	—	—	—	—	—	164
36	88	—	23	6	20	—	—	—	—	—	—	2	—	—	—	—	—	139
37	52	—	14	4	13	—	—	1	—	—	—	1	—	2	—	—	—	87
38	101	—	36	10	17	—	—	—	—	—	—	1	1	—	—	—	—	166
39	33	—	46	7	15	—	—	—	—	—	—	5	—	—	—	—	—	106
40	80	—	63	11	51	—	—	—	—	—	—	1	—	—	—	—	—	206
41	95	—	23	3	2	—	—	—	1	—	—	1	6	1	—	—	—	132
42	91	1	62	8	—	—	—	—	—	—	—	—	43	3	—	—	—	208
43	238	—	144	—	16	—	—	—	—	—	—	2	—	—	—	—	—	400
44	314	—	54	1	22	—	—	—	—	—	—	—	—	—	—	—	—	391
45	322	—	22	3	1	—	—	—	—	—	—	2	—	—	—	—	—	350
Total	6,409	3	1,442	395	770	1	1	3	35	2	2	1	70	139	12	7	1	9,293

Appendix E.—Numbers of sablefish marked, released, retained, or discarded by set for the NSEI mark-tag survey, 2008.

Set	Released		Retained		Biological sample	Discarded			Total
	Tagged & finclipped	Previously tagged by ADF&G	Previously tagged by ADF&G	Previously tagged by other agency		Sand fleas	Not marketable	Numbers estimated	
1	220	7	—	—	21	—	—	—	248
2	96	—	—	—	10	14	—	—	120
3	63	—	—	—	6	1	—	—	70
4	220	3	—	—	21	19	—	—	263
5	119	—	—	—	13	6	—	—	138
6	103	—	—	—	10	8	—	—	121
7	131	3	—	—	15	23	—	—	172
8	118	1	—	—	11	4	1	—	135
9	105	3	—	—	11	3	—	—	122
10	91	—	—	—	9	2	—	—	102
11	58	1	—	—	7	8	—	—	74
12	153	1	—	—	16	12	—	—	182
13	109	3	—	—	11	2	1	—	126
14	105	—	—	—	10	2	—	—	117
15	310	6	—	—	30	4	—	—	350
16	185	2	—	—	17	2	—	—	206
17	305	4	—	1	29	1	2	—	342
18	198	5	—	—	19	3	1	—	226
19	122	3	—	—	11	2	—	—	138
20	227	5	—	—	22	1	—	—	255
21	7	—	—	—	1	—	—	—	8
22	14	—	—	—	2	—	—	—	16
23	54	—	—	—	5	—	—	—	59
24	61	1	—	—	6	—	—	—	68
25	21	—	—	—	2	—	—	—	23
26	27	2	—	—	3	—	—	—	32
27	74	—	—	—	7	—	—	—	81
28	195	5	—	—	19	—	3	—	222
29	184	5	—	—	18	—	1	—	208
30	114	3	—	—	11	—	—	—	128
31	102	2	—	—	10	1	3	—	118
32	53	5	—	—	6	—	2	—	66
33	176	6	1	—	17	—	1	—	201
34	159	6	—	—	15	—	—	—	180
35	67	4	—	—	7	—	—	—	78
36	72	8	—	—	8	—	—	—	88
37	45	2	—	—	5	—	—	—	52
38	91	1	—	—	9	—	—	—	101
39	30	—	—	—	3	—	—	—	33
40	68	5	—	—	7	—	—	—	80
41	86	—	—	—	8	—	1	—	95
42	82	—	—	—	8	1	—	—	91
43	210	6	—	—	20	—	2	—	238
44	276	12	—	—	26	—	—	—	314
45	144	—	—	—	13	—	—	165	322
Total	5,450	120	1	1	535	119	18	165	6,409