

Fishery Data Series No. 13-29

**2012 NSEI (Northern Southeast Inside Subdistrict)
Sablefish Mark-Tag Survey**

by

Jennifer Stahl

and

Aaron Baldwin

June 2013

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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This document should be cited as:

Stahl, J. and A. Baldwin. 2013. 2012 NSEI (Northern Southeast Inside Subdistrict) sablefish mark-tag survey. Alaska Department of Fish and Game, Fishery Data Series No. 13-29, 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 2012 longlined pot gear was set to catch sablefish in the NSEI management area, which includes the waters of Chatham Strait and Frederick Sound. Twenty-nine sets were made with a total of 1,092 pots hauled capturing 11,463 sablefish. Healthy sablefish with fork lengths 430–1090 mm were finclipped, tagged, and released. A total of 7,582 sablefish were marked and released in statistical areas and within depth zones proportional to the average 2009–2011 commercial sablefish harvest. In addition, temperature measurements were collected to monitor the temperature range sablefish were exposed to over the survey period during capture and handling.

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

INTRODUCTION

Sablefish (*Anoplopoma fimbria*) are one of the most commercially valuable species in Southeast Alaska. The Northern Southeast Inside Subdistrict (NSEI) longline fishery occurs in the deep waters of Chatham Strait (between 58°19'N and 56°10'N latitude) and Frederick Sound (approximately 134°25'W, 56°51'N to 133°54'W, 57°22'N; Figure 1). During the 2012 commercial fishery, the average price paid for sablefish was \$3.75 per round pound¹; total ex-vessel value was \$3.6 million. Sablefish are a long-lived species with a maximum reported age of 91 years in Southeast Alaska, and with 40-year old fish commonly occurring in NSEI commercial harvests (K. Munk, Alaska Department of Fish and Game, Division of Commercial Fisheries, personal communication). Careful management of the NSEI commercial fishery is necessary to ensure sustainability of this highly-valued resource.

The Alaska Department of Fish and Game (ADF&G) obtains abundance estimates for sablefish in NSEI from mark-recapture methods. A marking survey is performed annually to tag and finclip sablefish; the recapture portion occurs by sampling sablefish landed during the NSEI sablefish longline fishery. ADF&G uses these survey results and other fishery and biological data to set the annual NSEI sablefish acceptable biological catch. The survey goal is to mark sablefish among statistical areas in proportion to sablefish population abundance; however, sablefish abundance by statistical area is not known. Consequently, fish are marked among statistical areas in proportion to commercial fishery harvest based on the assumption that population abundance is proportional to commercial harvest (Dressel 2009). Prior to the 2009 survey, sablefish were marked in proportion to the depth and statistical area where fish were commercially harvested during the preceding year only. Beginning in 2009, sablefish were marked in proportion to the average commercial harvest by statistical area and by depth of capture for the previous three years to better distribute marked fish according to the potential harvest patterns of the upcoming fishery.

For mark recovery, port samplers observe the majority of NSEI commercial sablefish landings occurring in 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 determine abundance using a Peterson estimator. The sablefish mark-tag survey occurs annually

¹ The unit of measurement for processing sablefish are recorded in round pounds and were used in lieu of their metric equivalent to coincide with this industry standard.

in May/June, ending approximately a month and a half before the NSEI longline fishery begins (August 15). This time frame allows adequate mixing of marked and unmarked fish within NSEI while minimizing fish emigration and immigration before the recapture phase of the study.

Sablefish are marked with tags or clips during a marking survey which has occurred since 1997. With the exception of 2004, when Passive Integrated Transponder (PIT) tags were implanted in sablefish, sablefish have been implanted with external T-bar anchor tags; in addition, sablefish have been clipped on their caudal fin with the exception of 1999 when only tagging was performed. From 1997 to 1999 sablefish were marked during the annual longline survey; catch per unit effort (CPUE) and biological data were also collected during this survey. However, fishery recapture data indicated that fish were hook-shy due to their initial capture by longline gear for marking (Carlile et al. 2002). As a result, the mark-recapture study was not performed in 1999 but was reinstated in the following year using longlined pots to avoid hook-shyness. The longline survey was continued to collect CPUE and biological data only. In 2011 the marking survey was cancelled due to mechanical problems with the contract vessel; as a result, the survey was transitioned to an ADF&G vessel (R/V *Medeia*) in 2012.

Sablefish tagged on the mark-tag survey provide the opportunity for tag recoveries; fish release and recovery data allow the study of sablefish movement. Age, length, and maturity data were collected between 2000 and 2009 on the mark-tag survey. Since 2010 sablefish have not been sacrificed to collect age, sex, or maturity data since this information is collected during the annual NSEI longline survey. However, length data are still collected for all captured fish during the mark-tag survey.

This report summarizes the marking and tagging activities from the 2012 NSEI sablefish mark-tag survey. The results of the 2012 mark-recapture experiment including the population abundance estimate will not be presented in this report.

OBJECTIVES

1. Capture, tag, finclip, and release at least 7,500 sablefish greater than 320 mm fork length 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 sablefish among statistical areas in proportion to the average of the 2009–2011 NSEI commercial harvest by statistical area.
4. Mark sablefish throughout each statistical area to assist with mixing of marked and unmarked fish.
5. Mark and tag sablefish by depth in proportion to the 2009–2011 NSEI commercial harvest by depth in each statistical area.
6. Record various temperatures that sablefish are exposed to during capture and handling.

METHODS

OPERATIONS

The survey was performed in statistical areas where at least 2% of the average NSEI sablefish commercial fishery harvest occurred during the 2009–2011 fishing seasons (Table 1). The ADF&G research vessel, R/V *Medeia*, was used to conduct the 2012 sablefish mark-tag survey. Vessel crew and scientific staff are listed in Appendix A.

Survey gear was used to capture live sablefish and consisted of pots attached to a longline to make a set. Pots were conical and had the following dimensions: 1.5 m bottom diameter, 1.1 m total vertical height, and 0.65 m top diameter. Each pot weighed 36 kg and had two opposing tunnels for sablefish to enter. Each set included 31 to 41 pots with approximately 91 m of line between each pot. A total of 4 kg of bait were placed in each pot with 2 kg chopped and 2 kg hanging. In general, two pot strings were set and hauled per day. Pots were soaked for 3.4 to 66.4 hours. Chopped bait was placed in a bait bag inside each pot. The bait mixture consisted of 50% squid and 50% walleye pollock. Soak time was adjusted dependent on the vessel operating schedule, distance between sets, weather and the history of “sand flea” (Amphipoda: Uristidae) abundance; in locations with a history of high “sand flea” abundance, soak time was minimized to prevent sablefish mortalities. Contents of each pot were released on to a sorting table. Non-sablefish catch was released overboard and sablefish were funneled into a live well.

DATA COLLECTION

One of the 2012 mark-tag survey objectives was to finclip, tag, and release all healthy sablefish with fork lengths greater than 320 mm. Fish were tagged dorsally using orange T-bar tags numbered between 050513 and 058113. Tagged fish were also marked with a finclip on the lower lobe of their caudal fin and sampled for length (Figure 2).

Fish were not tagged or finclipped if they were 320 mm or less in fork length or if they were determined to have reduced survivability due to flea bites, injuries, or a lack of vigor. All discarded and released fish were measured for fork length.

Fish that were previously tagged with an ADF&G tag and were in good health were released after recording the tag number and fork length (to the nearest cm). Fish that were previously tagged by an agency other than ADF&G were retained or released according to agency instructions. Non-sablefish catch was identified and enumerated, and released.

Temperature data were collected during sablefish capture and handling to determine if any elevated temperatures or differences in temperature between bottom, surface, or holding tanks occurred during the survey that could contribute to sablefish mortality. 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 2005; Lupes et al. 2006). Temperatures that sablefish were exposed to during capture and handling, including sea surface, ocean bottom, and holding tank temperatures were recorded and monitored. TidbiT^{®2} v2 Temp Loggers were used to record bottom and surface temperatures at 30-minute intervals. To collect bottom temperature measurements, a TidbiT[®] was attached to one pot per set string; for the surface temperature, a

² Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

TidbiT[®] was placed in the water at the stern of the vessel during each pot string haul. Holding tank temperatures were recorded on a digital water resistant thermometer at the beginning, middle, and end of each haul, along with time, and weather conditions.

SAMPLE DESIGN

The target marking goal was initially set at 6,250 sablefish prior to the start of the 2012 survey; however, this goal was adjusted after initial sablefish catches were observed at the beginning of the survey. Sablefish were finclipped and tagged among statistical areas in proportion to the average 2009–2011 commercial harvest from each area based on the target tagging goal set. In addition, sablefish marks and tags were distributed by depth in proportion to the 2009–2011 NSEI commercial harvest by depth in each statistical area. Depths ranging from 50 to 500 fathoms³ were considered for set placement. Obtaining 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 commercial harvest occurred (Table 1; Table 2; Table 3). To obtain marking goals by depth for each statistical area, we used bathymetric charts and depth information recorded from the vessel depth sounder from previous years' survey sets.

Once the approximate tagging goal was reached for a statistical area, the next statistical area was sampled. If the tagging goal was reached in the middle of a set and a large quantity of fish were left in the pots, sablefish catch in the remaining pots was estimated and the fish were released without marking, tagging, or sampling.

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 history of previous sets for an area. Numbers of sablefish captured, tagged, and marked during previous mark-tag surveys were used to determine placement of sets. In addition, placement of survey gear was avoided at established set locations for the NSEI longline survey and for areas where there were problems with gear damage or retrieval in the past (Appendix F).

RESULTS

SCHEDULE

The 2012 NSEI mark-tag survey occurred from May 22 to June 12. The R/V *Medeia* left Juneau on May 21, and the crew set the first gear on that day. The survey began in northern Chatham Strait north of the entrance to Icy Strait (Figure 1). Generally the survey progressed in a southerly direction through Chatham Strait with an east-west progression into Frederick Sound. The following sets were performed in the northern and central statistical areas from May 22–29: sets 1–3 in statistical area 345803, sets 4–6 in statistical area 345731, and sets 7 to 14 in statistical area 345701. After completion of statistical area 345701, the survey progressed east into Frederick Sound to perform sets 15 to 17 in statistical areas 345702 and 335701 from May 30 to June 1. On June 1 the R/V *Medeia* arrived in Petersburg for the end of the first leg of the

³ Fathoms were used in lieu of their metric equivalent to coincide with data collected and recorded by the research vessel's depth measurement equipment.

survey; the vessel was docked in Petersburg June 1–3. Bait and supplies were restocked, and ADF&G scientific staff were transferred. The R/V *Medeia* left the port of Petersburg at 5:00 p.m. on June 3 to begin the second leg of the survey. On June 3, set 17 was hauled in Frederick Sound and the R/V *Medeia* returned to Chatham Strait to conduct the remainder of the survey which progressed in a southerly direction until the survey headed back north to perform the last three sets. The following sets were performed in the southern statistical areas of Chatham Strait from June 3–11: sets 18–24 and 28–29 in statistical area 345631 and sets 25–27 in statistical area 345603. Following the haul of sets 28–29 on June 11, the R/V *Medeia* steamed to Juneau, arriving at 5:30 a.m. on June 12.

SET INFORMATION

A total of 1,092 pots were deployed and successfully recovered in 29 sets during the 2012 NSEI mark-tag survey. The sets were deployed in depths from 195 to 464 fathoms. Soak time averaged 20.2 hours and ranged from 3.4 to 66.4 hours, and haul time averaged 2.4 hours and ranged from 1.5 to 4.4 hours (Appendix B). Set 17 had a long soak time of 66.4 hours, because it was set prior to travel to Petersburg for the 2-day break in the survey and hauled after this break. Extreme tides caused other sets to be difficult to locate due to buoys being pulled under the surface. Crew found it easier to locate buoys during slack (before low or high) tide. One pot string parted during the survey (set 7) and one was badly entangled (set 11); these sets were on rocky bottoms and have been noted as areas to avoid in the future.

CATCH AND TAGGING INFORMATION

The target marking goal was adjusted to 7,500 sablefish after high numbers of sablefish were captured at the beginning of the survey. The number of marked fish approximated the marking goal by statistical area (Table 3). Marked fish were generally distributed throughout statistical areas and in proportion to the depths that sablefish were caught in the commercial harvest (Table 1; Table 2; Table 4). However, there were a few statistical areas where it was not possible to completely distribute marks in proportion to the 2009–2011 commercial fishery harvest by depth (Table 1; Table 2; Table 4). In statistical areas where the overall marking goal was low and only a few survey sets contributed to the statistical area were particularly difficult to approximate marking proportions by depth class. In addition, it was difficult to meet marking goals by depth due to the limitations in predicting depth before a pot string was in the water. Even though the number of fish marked by depth class was not entirely proportional by statistical area for all areas, the total number of fish marked for each depth class was similar to the total marking goal for each depth class; the difference between the number marked and the marking goal for each depth class was $\leq 6\%$ (Table 2 and 4). In addition, all fish marked in Chatham Strait were captured from depths deeper than 250 fathoms, a depth range which accounted for 97% of the 2009–2011 commercial harvest for Chatham Strait; conversely, all marked fish captured in Frederick Sound were from depths shallower than 250 fathoms, a depth range which accounted for 96% of the 2009–2011 commercial harvest for Frederick Sound.

A total of 12 species of fish and two species of commercially important crab were caught and identified during the survey in 2012 (Appendix C), and a total of 12,432 individual fish and commercially important crab were caught. Sablefish was the dominant species of fish caught, followed by arrowtooth flounder (*Atheresthes stomias*), Pacific halibut (*Hippoglossus stenolepis*), Dover sole (*Microstomus pacificus*), and rougheye rockfish (*Sebastes aleutianus*) (Appendix D). Four fish were not identifiable due to sand flea damage. A total of 290 golden

king crab (*Lithodes aequispinus*) and one Tanner crab (*Chionoecetes bairdi*) were captured and identified. 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: coral (Order Alcyonacea), brittle stars (class Ophiuroidea), heart urchins (*Brisaster latifrons*), giant barnacles (*Chirona evermanni*), hermit crabs (Superfamily Paguroidea), weathervane scallops (*Patinopecten caurinus*), whelks (family Buccinidae), and tritons (*Fusitriton oregonensis*).

A total of 11,463 sablefish were caught during the 2012 survey; 7,582 of these fish were tagged, finclipped, and released. Fourteen healthy fish were captured and then accidentally released before tagging; one of these fish was clipped before release. An additional 711 sablefish were captured and then discarded or released without tagging because they were not healthy due to sand flea damage or other injuries, such as pot abrasions or a torn mouth. One fish was determined dead. In addition, an estimated 3,040 sablefish were released without marking because the marking quota was reached for a statistical area. The catch included 111 fish previously tagged by ADF&G that were re-released with their original tag. In addition, three fish were captured that were previously tagged by the Department of Fisheries and Oceans (DFO) in Canada. These fish were retained, biological information was collected, and the tag and otoliths were returned to DFO. A single fish was captured with a National Marine Fisheries Service (NMFS) tag; this fish was measured and released. The release condition of all sablefish captured during the 2012 mark-tag survey is summarized by set in Appendix E.

BIOLOGICAL INFORMATION

A total of 7,554 sablefish were marked and measured, and an additional 837 sablefish were measured but not marked. Average length for all measured fish was 650 mm and length ranged from 430 to 1,090 mm (Figure 3). The 2012 length distribution for captured sablefish appears to be normally distributed with a slight trailing tail at larger lengths (Figure 3).

In 2012 small-sized sablefish (≤ 650 mm) composed the majority of the catch (54%). The contribution of small-sized sablefish to the catch increased from 37% in 2009 to 45% in 2010. Mid- to large-sized sablefish (660–1,090 mm) composed a greater proportion of the catch in southern Chatham Strait (statistical areas 345631 and 345603), and small-sized sablefish (430–650 mm) contributed a larger proportion of the catch in north and central Chatham Strait (statistical areas 345803, 345731, and 345701) and in Frederick Sound (statistical area 335701 and 345702) with high proportions ($>85\%$) of small fish around Baranof Warm Springs (Table 5, Figure 4).

TEMPERATURE DATA

Temperature data were collected during the period sablefish capture and handling occurred on the 2012 NSEI mark-tag survey. Bottom temperature varied less than 1°C over the entire survey with an average bottom temperature of 5 °C (Figure 5). Surface temperature ranged from 7 °C to 9 °C with an average of 8 °C, and holding tank temperature ranged from 8 °C to 12 °C with an average temperature of 10 °C. However, there were problems with the digital thermometers used to measure temperatures in the holding tank; thus, it is unknown if the measurements taken were accurate. On June 6 the digital thermometer was changed due to a low battery and holding tank temperature was much lower after this change (Figure 5). It is uncertain whether temperature recordings prior to set 22 or after were inaccurate. The 2010 bottom temperature was similar to measurements collected in 2012. However, the average surface temperature was 2.2°C colder in 2012.

Sablefish were exposed to a range of temperatures during capture, tagging, and release. There was about a 2.4°C difference between the average surface and bottom temperatures and 4.5°C difference between the average holding tank and bottom temperatures. Over the course of a day, the surface and holding tank temperatures varied up to 1.8°C and 1.3°C, respectively (Figure 5); daily surface and holding tank temperature variability was dependent on weather conditions. Temperature of the holding tank was generally warmer than the surface temperature recorded during a day (Figure 5).

DISCUSSION

The 2012 mark-tag survey was a success with the marking goal of 7,500 sablefish exceeded and fish marked in proportion to commercial fishery harvest by statistical area and depth. Some factors that may have led to the success of this survey and other recent surveys were the replacement of herring in the bait mixture with walleye pollock, replacement of aging pot gear, availability of bathymetric data, availability of more sablefish for marking due to the halt of the collection of biological samples and an influx of small fish first observed in the 2010 mark-tag survey that may have recruited more to the population (Figure 3).

Gear operations were successfully performed on the first mark-tag survey to occur on the ADF&G R/V *Medeia*. Time devoted to obtaining the necessary survey gear and preparing the vessel for survey operations helped make this survey a success. However, gear operational differences between the contract vessel used in the past and the ADF&G vessel used in 2012 resulted in a need for additional vessel staff. The smaller deck space on the R/V *Medeia* resulted in the need to stack pots during hauling and un-stack pots during setting; this caused a greater physical demand on vessel staff. In addition, a winch was used on the R/V *Medeia* to move pots across the deck during gear hauling; as a result, there was a need for an additional winch operator. As a consequence to these increased demands, an additional vessel crew member was added for the second half of the 2012 survey. For future surveys, five vessel staff in addition to a cook will be needed in order to operate the vessel and perform deck operations safely. In addition, some gear problems occurred, including some tangled gear and one pot string line parting. Extreme tides, uneven terrain, and rocky bottom may have contributed to these problems. However, no gear was lost. A list of sets that had problems and may need to be avoided altogether or during extreme weather or tides, has been compiled for the 2010 and 2012 mark-tag surveys (Appendix F). While catch numbers were high enough to mark more than 7,500 fish, a higher marking goal may contribute to vessel and scientific staff fatigue and may make it more difficult to distribute marked fish among statistical areas and across depth zones in proportion to the commercial fishery harvest within the time available for the survey.

Sablefish were exposed to a range of temperatures as they were moved from the bottom of the ocean to the surface and then into the holding tank. Sablefish generally appeared healthy and unaffected by these changes in temperature exposure.

The average length of sablefish captured during the 2012 mark-tag survey (650 mm, SE 0.96) was slightly smaller than the average length observed in 2010; however, no survey was performed in 2011 for comparison to this year (660 mm, SE 0.92; Stahl and Holum 2011). Both the 2010 and 2012 average lengths represent a decrease from 2009 (Stahl and Holum 2010). The 2010 and 2012 mark-tag surveys went against the trend of an increase in average length with each survey year since the survey began in 2000 (Stahl and Holum 2011; O'Connell and Holum 2007; Richardson 2001; Richardson 2003a; Richardson 2003b; Stahl and Holum 2008; Stahl and

Holum 2009; Stahl and Holum 2011; *unpublished ADF&G data*⁴). However, there was still an overall increase ($p < 0.001$; $R^2 = 0.85$) in the average length of captured sablefish since the mark-tag survey began using pot gear in 2000. A decrease in the average length of sablefish has also been observed in the NSEI longline survey and fishery since 2009 (Figure 6). It is likely that this decrease in the size of sablefish in Southeast Alaska inside waters in recent years is due to an influx of small fish to the area which may be related to one or more strong recruitment events, including fish from the 2008 year class (Hanselman et al. 2012). Because survey selectivity has been consistent over years, we conclude that the decrease in survey average length was due to this pulse of small fish. Before 2010, a compressed age distribution and low recruitment had been observed in Chatham Strait (Dressel 2009) and in the Gulf of Alaska (Hanselman et al. 2008) with few strong year classes apparent in the Gulf of Alaska since the 2000 year class (Hanselman et al. 2009). The influx of small fish was first observed during the Southern Southeast Inside (SSEI) longline survey in May of 2010. These small fish were also observed in the 2010 NSEI mark-tag survey and the 2010 SSEI commercial fishery and in the following year in the 2011 NSEI longline survey; however, this influx of fish was not as predominant in areas outside of SSEI or in the commercial fishery possibly due to discards by fishermen of small fish (Figure 5; Figure 7; Figure 8). In 2012, another influx of small fish was observed in the SSEI survey length distribution (Figure 7). This increase of small fish was not observed in the length distribution for the NSEI fishery or surveys or the SSEI fishery (Figure 7; Figure 8), but may be contributing to the lower average length in the 2012 mark-tag survey. It is possible that these small fish sampled in the SSEI 2012 longline survey will be observed in other areas in Southeast Alaska and recruit to the commercial fisheries in future years.

ACKNOWLEDGEMENTS

The dedication of the vessel and scientific staff helped to make this a successful survey. Special thanks to the vessel crew for their extra hard work and flexibility during the first mark-tag survey performed on the R/V *Medeia*. Thanks also to the scientific staff, and to all staff who were involved in the purchasing, building, and modification of survey gear which was necessary for the operation of this survey.

⁴ Data for 2004-2006 is available through ADF&G, Division of Commercial Fisheries, Douglas.

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TABLES AND FIGURES

Table 1.—Average proportion of 2009–2011 NSEI sablefish harvest by statistical area and by depth class for each statistical area.

Statistical area	All depth ranges	Depth range (fathoms)								
		50–100	101–150	151–200	201–250	251–300	301–350	351–400	401–450	451–500
335701	3%	4%	3%	46%	39%	8%	0%	0%	0%	0%
345603	10%	0%	1%	2%	6%	23%	32%	35%	1%	0%
345631	37%	0%	0%	0%	1%	3%	37%	59%	0%	0%
345701	31%	0%	0%	0%	1%	7%	42%	33%	12%	6%
345702	3%	0%	1%	97%	2%	0%	0%	0%	0%	0%
345731	9%	0%	0%	1%	8%	47%	27%	17%	0%	0%
345803	7%	0%	0%	0%	13%	18%	63%	4%	0%	2%

Table 2.—Marking goals by NSEI statistical area and depth based on a total goal of 7,500 marks and tags.

Statistical area	All depth ranges	Depth range (fathoms)								
		50–100	101–150	151–200	201–250	251–300	301–350	351–400	401–450	451–500
335701	257	10	9	117	101	21	0	0	0	0
345603	734	0	7	17	43	171	233	259	4	0
345631	2789	1	1	8	23	92	1026	1638	0	0
345701	2303	0	0	1	14	164	960	750	283	132
345702	248	1	3	240	5	0	0	0	0	0
345731	677	2	0	4	52	319	184	116	0	0
345803	491	0	0	1	65	87	311	19	0	8
All areas	7,499	14	20	388	303	854	2,714	2,782	287	140
Percent of total	100%	0%	0%	5%	4%	11%	36%	37%	4%	2%

Table 3.—Marking goals and actual number of tagged and marked sablefish released by statistical area for the NSEI mark-tag survey, 2012.

Statistical area	Average percent of 2009–2011 NSEI commercial harvest	Goal based on 7,500 marks and tags	Number marked and tagged
335701	3%	257	270
345603	10%	734	772
345631	37%	2,789	2,797
345701	31%	2,303	2,330
345702	3%	248	229
345731	9%	677	690
345803	7%	491	494
Total		7,499	7,582

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Table 4.—Number of sablefish marked and tagged by NSEI statistical area and depth class for a total goal of 7,500 marks/tags.

Statistical area	Number of fish tagged/marked by depth class (fathoms)							Total
	151–200	201–250	251–300	301–350	351–400	401–450	451–500	
335701	0	270	0	0	0	0	0	270
345603	0	0	0	439	333	0	0	772
345631	0	0	0	1,101	1,375	321	0	2,797
345701	0	0	275	1,086	671	144	154	2,330
345702	229	0	0	0	0	0	0	229
345731	0	0	309	381	0	0	0	690
345803	0	0	292	202	0	0	0	494
All areas	229	270	876	3,209	2,379	465	154	7,582
Percent of total	3%	4%	12%	42%	31%	6%	2%	100%

Table 5.—Proportion of sablefish captured and measured by length class in each statistical area for the NSEI mark-tag survey, 2012.

Statistical area	Number 430–650 mm	Number 660–1090 mm	Proportion 430–650 mm	Proportion 660–1090 mm
335701	181	94	0.66	0.34
345603	259	547	0.32	0.68
345631	1,395	1,501	0.48	0.52
345701	1,632	1,092	0.60	0.40
345702	126	109	0.54	0.46
345731	524	318	0.62	0.38
345803	452	161	0.74	0.26
All areas	4,569	3,822	0.54	0.46

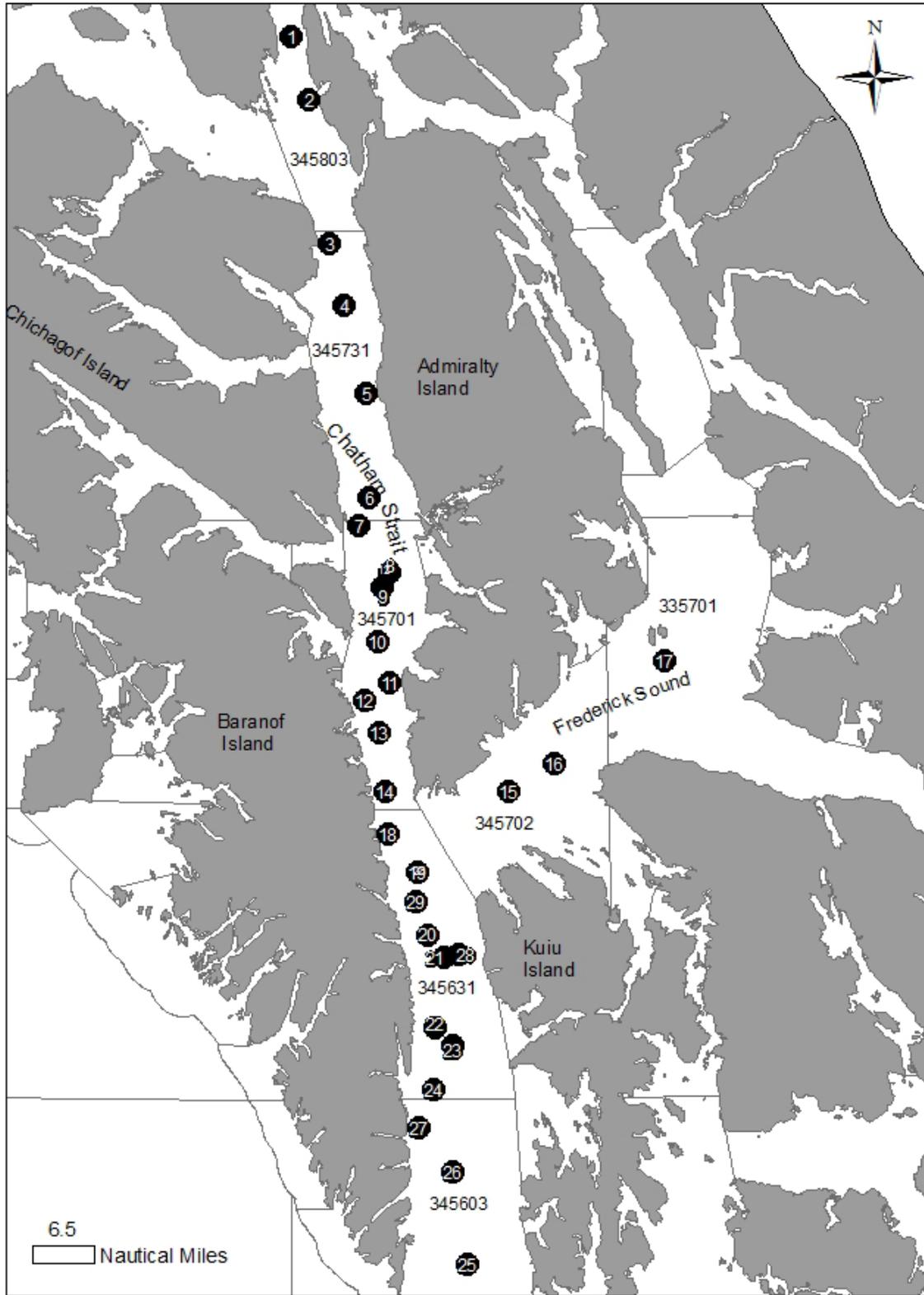


Figure 1.-Set locations for the NSEI mark-tag survey, 2012.

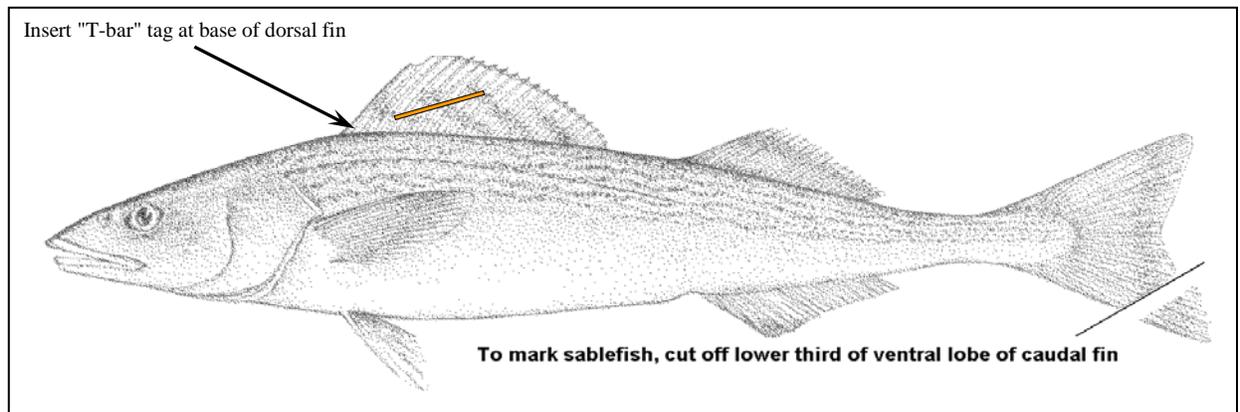


Figure 2.—Sablefish marking guidelines, NSEI mark-tag survey, 2012. Sablefish are double-marked with a lower caudal finclip and a T-bar tag.

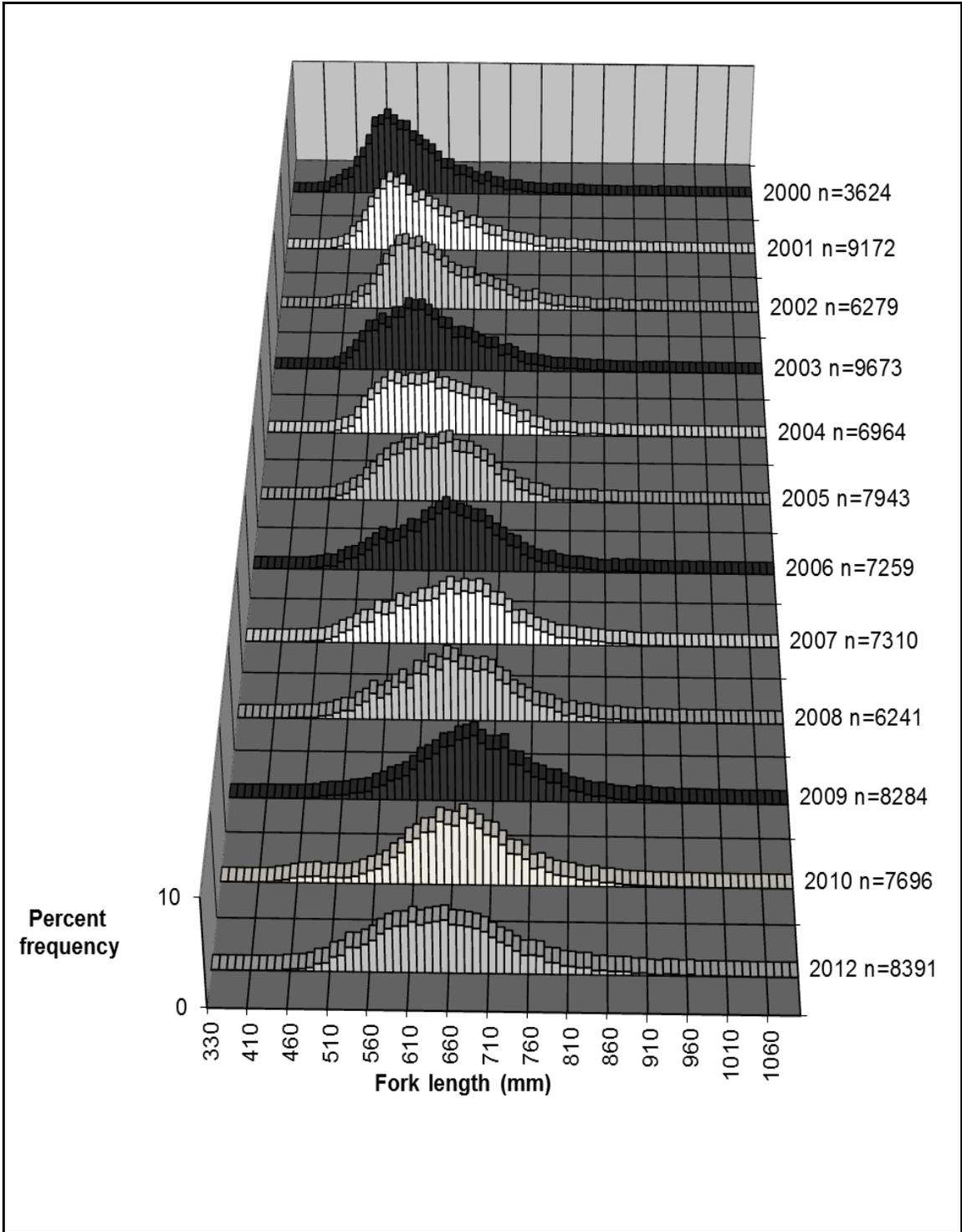


Figure 3.—Length frequency of all sablefish captured and measured during the 2000 to 2012 NSEI mark-tag surveys.

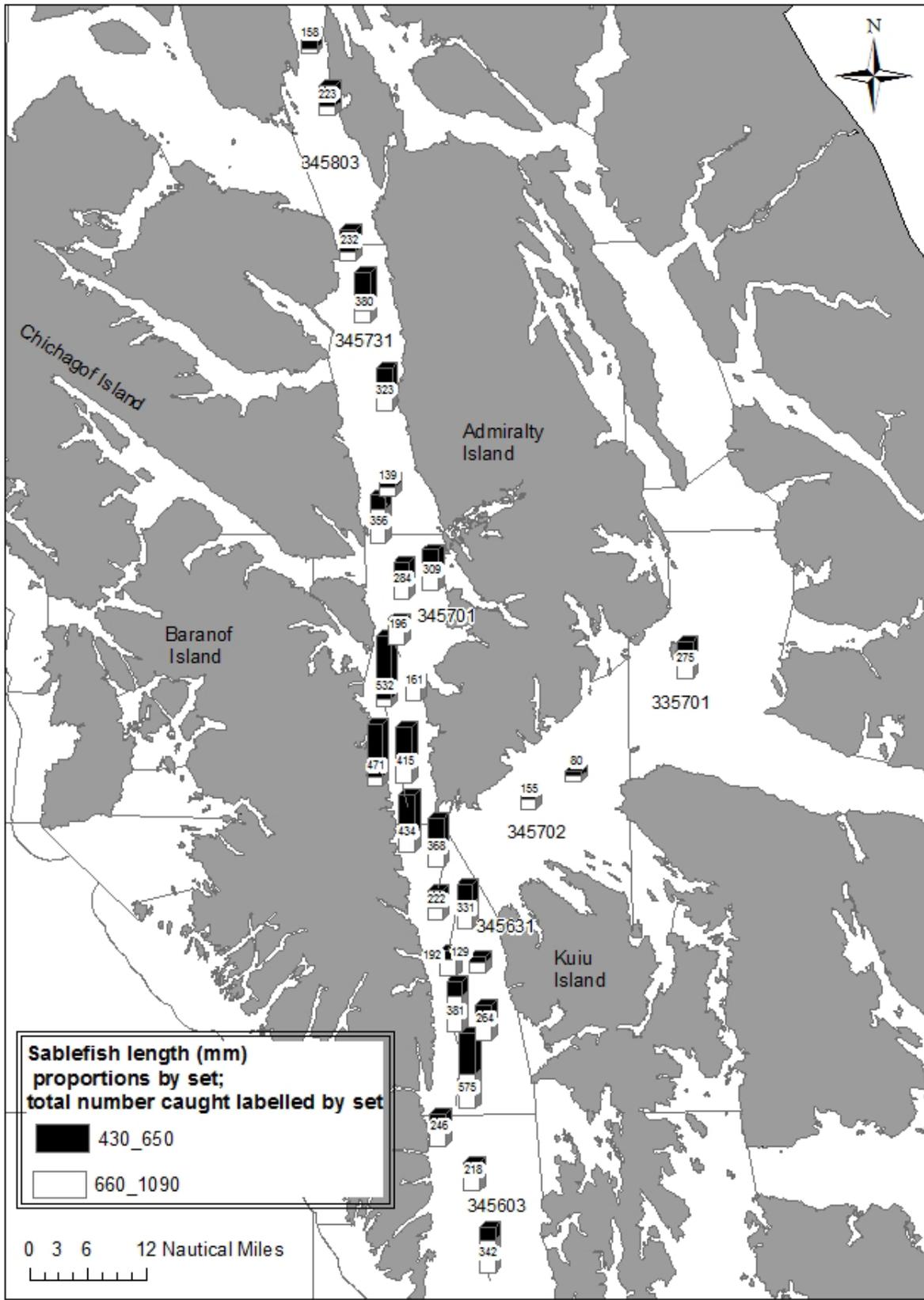


Figure 4.–Sablefish length distribution mapped by set, NSEI mark-tag survey, 2012.

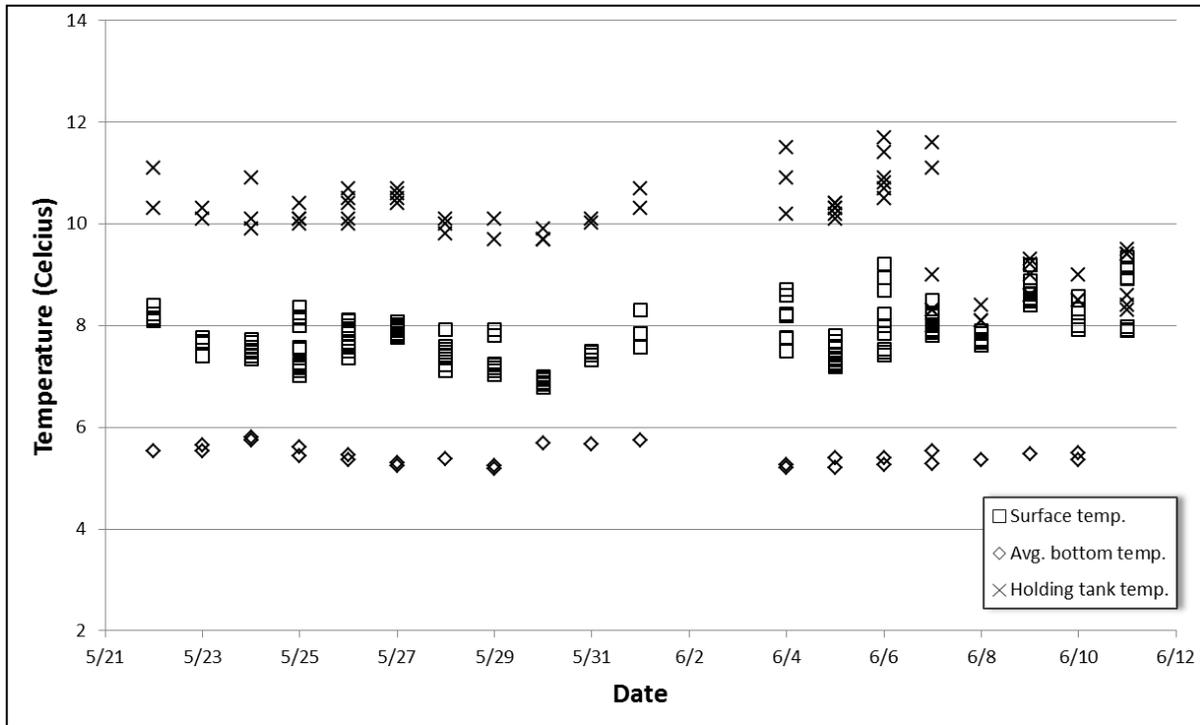


Figure 5.—Temperatures that sablefish were exposed to during their capture and handling on the NSEI mark-tag survey, 2012.

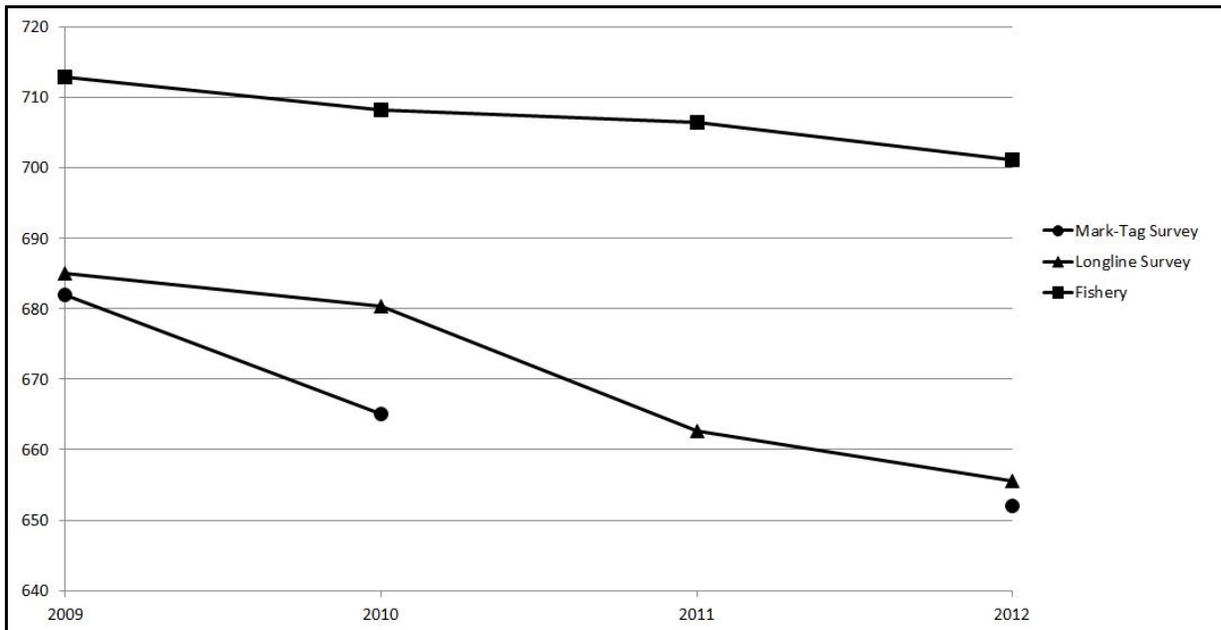


Figure 6.—Average size of sablefish sampled in NSEI Subdistrict from 2009 to 2012. No data are available for the 2011 Mark-Tag survey as the survey was canceled.

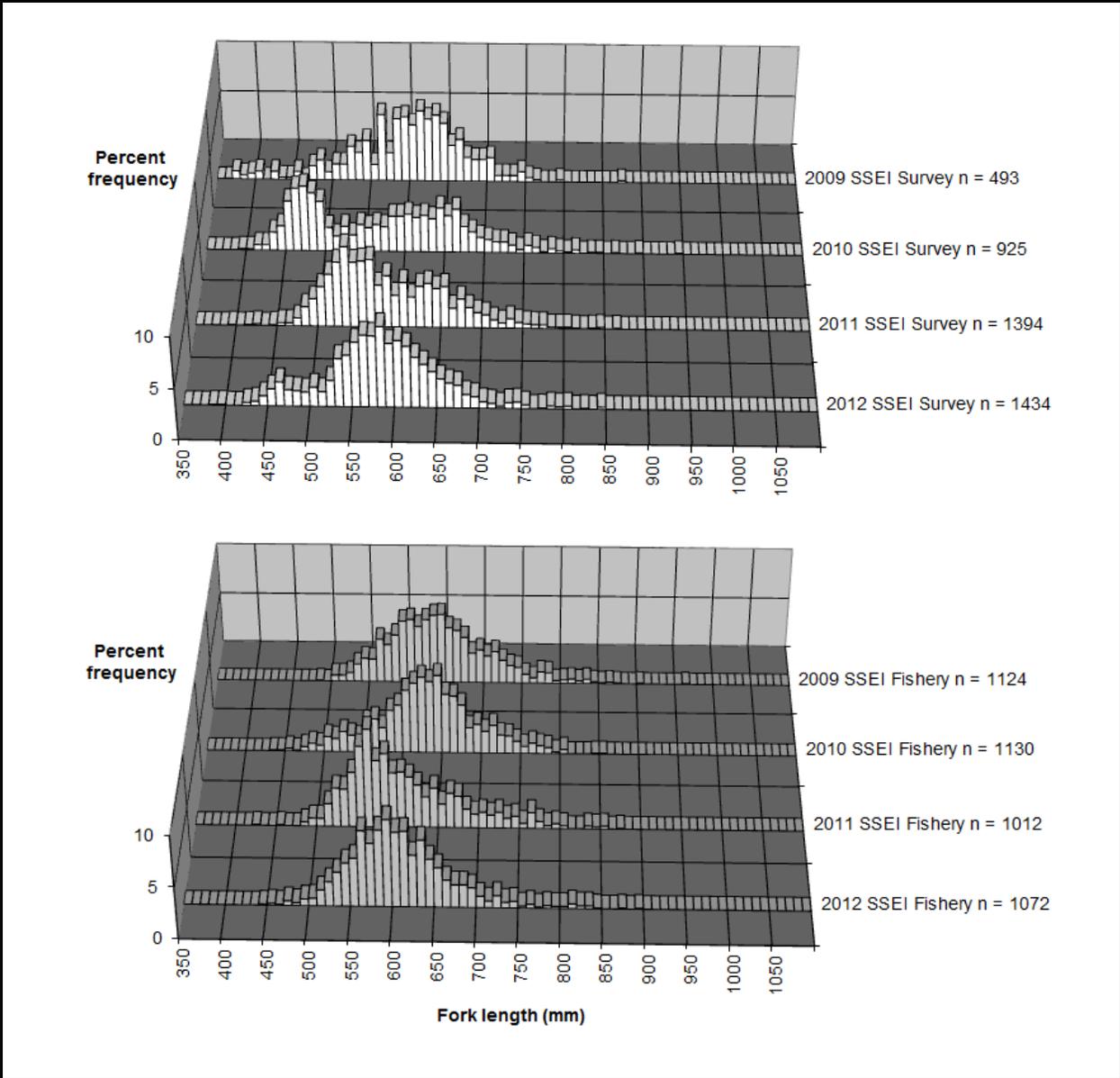


Figure 7.—Length frequency for sablefish sampled during the 2009 to 2012 SSEI longline survey (top) and commercial fishery (bottom).

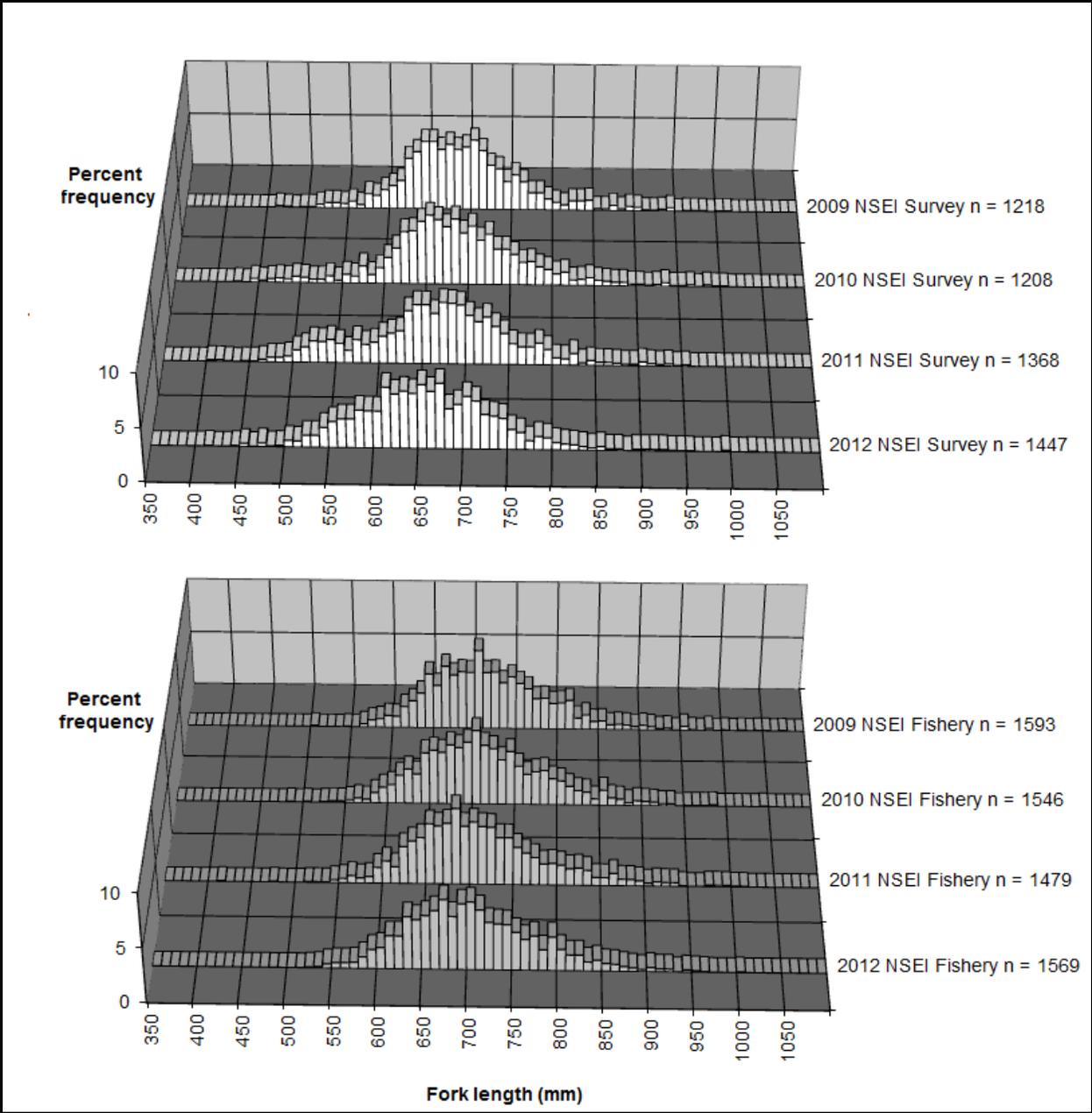


Figure 8.—Length frequency for sablefish sampled from the 2009 to 2012 NSEI longline survey (top) and commercial fishery (bottom).

APPENDICES

Appendix A.–The Alaska Department of Fish and Game scientific and vessel staff on the NSEI mark-tag survey, 2012 (first leg, May 21– June 1 and second leg, June 4–12).

Name	Position	Leg(s)
Jim deLaBruere	Vessel (Skipper)	1 and 2
Craig Conger	Vessel	1 and 2
Cedar Stark	Vessel	1 and 2
Rick Gottwald	Vessel	1 and 2
Penny Sadler	Vessel	1 and 2
Andrew Olsen	Vessel	2
Kristen Green	Survey leader	1
Jennifer Stahl	Survey leader	2
Martina Kallenberger	Scientific staff	1
Deidra Holum	Scientific staff	1
Kevin McNeel	Scientific staff	2
Rhea Ehresmann	Scientific staff	2

Appendix B.—Detailed set information, including location and timing, for the NSEI mark-tag survey, 2012.

Set	Stat area	Start				End				Date Set	Time set	Soak time (h)	Haul time (h)	Haul direction	# Pots set	Depth (fathoms)			
		Lat deg	Lat min	Long deg	Long min	Lat deg	Lat min	Long deg	Long min							Start	End	Avg	Substrate
1	345803	58	20.04	135	0.25	58	22.02	135	0.69	5/22/12	13:17	3.4	2.2	Same	40	277	289	274	Mud/Hard
2	345803	58	13.59	134	56.73	58	14.86	134	59.18	5/23/12	10:38	5.4	2.4	Opposite	40	336	340	328	Mud/Gravel
3	345803	57	58.62	134	52.71	58	0.67	134	53.53	5/23/12	13:58	18.4	3.3	Same	40	263	305	290	Mud/Soft
4	345731	57	52.23	134	49.87	57	54.10	134	50.06	5/24/12	14:17	18.2	3.1	Same	40	285	282	283	Mud
5	345731	57	43.12	134	45.74	57	41.50	135	46.44	5/24/12	17:12	20.4	1.6	Same	40	309	321	309	Mud/Soft
6	345731	57	32.35	134	45.23	57	30.78	134	46.83	5/25/12	18:22	14.2	2.2	Opposite	40	351	308	308	Mud/Soft
7	345701	57	29.47	134	47.10	57	27.68	134	46.74	5/25/12	19:50	18.2	3.7	Same	38	352	375	375	Mixed
8	345701	57	24.47	134	41.14	57	26.30	134	40.59	5/26/12	12:51	19.5	2.9	Same	40	339	282	298	Mud
9	345701	57	23.01	134	42.63	57	21.42	134	42.77	5/26/12	20:36	19.0	2.4	Same	35	328	306	327	Mud/Hard
10	345701	57	17.33	134	43.53	57	18.86	134	43.71	5/27/12	13:40	18.7	2.1	Same	33	461	465	464	Hard
11	345701	57	13.06	134	41.44	57	11.56	134	41.34	5/27/12	20:41	18.8	4.4	Same	31	393	432	443	Hard
12	345701	57	11.33	134	46.01	57	9.54	134	45.35	5/28/12	12:23	25.6	2.6	Same	38	326	336	333	Mud
13	345701	57	7.89	134	43.32	57	6.19	134	42.34	5/29/12	12:32	19.9	2.7	Opposite	35	350	357	350	Mud/Soft
14	345701	57	1.87	134	42.28	57	3.79	134	42.99	5/29/12	18:43	18.2	2.3	Same	40	351	353	358	Mud
15	345702	57	1.81	134	18.83	57	3.40	134	16.75	5/30/12	18:14	14.8	1.9	Opposite	41	196	196	195	Mud/Soft
16	345702	57	4.64	134	10.15	57	6.12	134	7.87	5/31/12	11:00	21.7	1.8	Same	41	197	198	198	Gravel
17	335701	57	15.09	133	48.75	57	13.34	133	50.44	6/01/12	13:28	66.4	2.8	Same	41	200	267	222	Mud/Hard
18	345631	56	57.48	134	41.75	56	55.31	134	41.45	6/04/12	16:19	17.3	2.8	Opposite	41	340	335	338	Mud
19	345631	56	53.44	134	36.34	56	51.79	134	34.98	6/04/12	17:54	21.8	2.2	Opposite	35	364	378	371	Mud
20	345631	56	46.96	134	34.40	56	48.91	134	35.29	6/05/12	14:53	19.3	2.5	Same	40	402	400	402	Unknown
21	335631	56	44.59	134	31.44	56	42.78	133	31.85	6/05/12	20:06	20.2	1.6	Opposite	35	350	397	382	Coral
22	345631	56	37.39	134	33.05	56	39.06	134	31.63	6/06/12	15:04	19.5	2.1	Same	39	358	375	367	Coral
23	345631	56	35.46	134	29.76	56	33.58	134	30.43	6/06/12	19:38	21.7	1.7	Same	33	354	356	352	Cobble
24	345631	56	30.92	134	33.36	56	33.03	134	32.76	6/07/12	14:50	20.6	2.7	Same	39	302	331	319	Hard
25	345603	56	12.86	134	27.22	56	11.44	134	27.18	6/08/12	17:38	12.8	1.9	Same	39	382	370	357	Rock
26	345603	56	22.40	134	30.00	56	20.81	134	28.85	6/07/12	21:14	37.7	1.7	Same	33	277	395	333	Hard

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Set	Stat area	Start				End				Date Set	Time set	Soak time (h)	Haul time (h)	Haul direction	# Pots Set	Depth (fathoms)			
		Lat deg	Lat min	Long deg	Long min	Lat deg	Lat Min	Long deg	Long min							Start	End	Avg	Substrate
27	345603	56	27.08	134	36.21	56	28.95	134	35.84	6/09/12	15:00	18.1	2.0	Opposite	35	318	257	309	Hard
28	345631	56	44.91	134	28.62	56	46.47	134	27.93	6/10/12	16:36	20.4	1.5	Opposite	33	346	250	303	Hard
29	345631	56	50.48	134	36.44	56	51.68	134	38.83	6/10/12	17:33	15.2	1.9	Same	35	386	369	379	Mud/Shell

Appendix C.—Species caught and identified during the NSEI mark-tag survey, 2012.

Common name	Scientific name
Sablefish	<i>Anoplopoma fimbria</i>
Arrowtooth flounder	<i>Atheresthes stomias</i>
Dover sole	<i>Microstomus pacificus</i>
Pacific halibut	<i>Hippoglossus stenolepis</i>
Rougeye rockfish	<i>Sebastes aleutianus</i>
Shortraker rockfish	<i>Sebastes borealis</i>
Redbanded rockfish	<i>Sebastes babcocki</i>
Shortspine thornyhead rockfish	<i>Sebastolobus alascanus</i>
Pacific cod	<i>Gadus macrocephalus</i>
Pacific sleeper shark	<i>Somniosus pacificus</i>
Spotted spiny dogfish	<i>Squalus suckleyi</i>
Spotted ratfish	<i>Hydrolagus colliei</i>
Golden king crab	<i>Lithodes aequispina</i>
Tanner crab	<i>Chionoecetes bairdi</i>

Appendix D.—Fish captured by set for the NSEI mark-tag survey, 2012.

Set	Groundfish						Sharks and Ratfish			Rockfish				Total
	Sablefish	Pacific cod	Arrow-tooth flounder	Pacific halibut	Dover sole	Unknown general groundfish	Spotted spiny dogfish	Pacific sleeper shark	Spotted ratfish	Thorny-head	Rough-eye	Short-raker	Red-banded	
1	158	0	2	8	0	0	0	1	0	0	0	0	0	169
2	342	0	2	12	0	0	0	0	0	0	0	0	0	356
3	623	0	0	0	0	1	0	0	0	0	0	0	0	624
4	768	0	0	1	0	1	0	0	0	0	0	0	0	770
5	379	0	3	0	2	1	0	0	0	0	0	0	0	385
6	403	0	5	1	0	0	0	0	0	2	0	0	0	411
7	439	0	0	0	1	0	0	0	0	1	0	0	0	441
8	765	0	0	1	0	0	0	0	0	0	0	0	0	766
9	279	0	0	0	3	0	0	0	0	1	0	0	0	283
10	253	0	0	0	4	0	0	0	0	0	0	0	0	257
11	161	0	5	0	3	0	0	1	0	1	0	0	0	171
12	852	0	1	1	1	0	0	0	0	1	0	0	0	856
13	756	0	0	1	0	0	0	0	0	0	0	0	0	757
14	764	0	6	3	4	0	0	0	0	0	0	0	0	777
15	156	5	80	26	1	0	1	0	0	1	10	2	0	282
16	80	0	103	21	0	0	0	0	1	0	5	0	0	210
17	285	3	81	26	0	1	0	0	0	0	2	0	0	398
18	435	0	4	4	6	0	0	0	0	0	0	0	0	449
19	371	0	11	7	6	0	0	0	0	2	0	0	0	397
20	332	0	7	2	7	0	0	0	0	0	0	0	0	348
21	193	0	1		13	0	0	1	0	2	0	0	0	210
22	382	0	7	2	6	0	0	0	0	2	0	0	0	399
23	264	0	15	2	6	0	0	0	0	0	1	0	0	288
24	575	0	8	4	0	0	0	0	0	1	0	0	0	588
25	343	0	6	3	0	0	0	0	0	0	1	0	0	353
26	219	0	20	9	6	0	0	0	0	2	2	2	0	260

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Appendix D.–Page 2 of 2.

Groundfish							Sharks			Rockfish				
Set	Sablefish	Pacific cod	Arrow-tooth flounder	Pacific halibut	Dover sole	Unknown general groundfish	Spotted spiny dogfish	Pacific sleeper shark	Spotted ratfish	Thorny-head	Rough-eye	Short-raker	Red-banded	Total
27	342	0	4	4	1	0	0	0	0	0	1	4	0	356
28	205	0	10	7	3	0	0	0	0	1	1	0	1	228
29	339	0	1	4	12	0	0	0	0	0	0	0	0	356
Total	11,463	8	382	149	85	4	1	3	1	17	23	8	1	12,145

Appendix E.—Numbers of sablefish marked, released, retained, or discarded by set for the NSEI mark-tag survey, 2012.

Set	Released				Retained		Discarded				Total
	Tagged and marked	Previously tagged by ADF&G	Previously tagged by other agency	Clipped only	Previously tagged by other agency	Mortality	Sand fleas	Not marketable (due to injuries)	Numbers estimated	Lost	
1	157	0	0	0	0	0	0	1	0	0	158
2	202	1	0	0	0	0	0	24	115	0	342
3	135	0	0	0	0	0	41	56	391	0	623
4	309	0	0	0	0	0	2	70	386	1	768
5	250	1	0	1	0	0	0	72	55	0	379
6	131	2	0	0	0	0	0	7	263	0	403
7	300	7	0	0	0	0	2	50	79	1	439
8	275	3	0	0	0	0	3	31	453	0	765
9	230	0	0	0	0	0	11	36	2	0	279
10	154	2	0	0	0	0	0	40	57	0	253
11	144	1	0	0	0	0	0	16	0	0	161
12	446	8	1	0	1	0	2	76	315	3	852
13	410	6	0	0	0	0	0	57	282	1	756
14	371	4	0	0	0	0	0	45	344	0	764
15	153	1	0	0	0	0	0	2	0	0	156
16	76	0	0	0	0	0	0	4	0	0	80
17	270	3	0	0	0	0	1	1	9	1	285
18	416	14	0	0	0	0	0	4	0	1	435
19	358	4	0	0	0	0	0	8	0	1	371
20	321	4	0	0	0	0	0	7	0	0	332
21	187	1	0	0	0	1	0	3	0	1	193
22	364	10	0	0	0	0	0	5	0	3	382
23	252	7	0	0	1	0	0	4	0	0	264
24	560	5	0	0	0	0	0	10	0	0	575
25	333	4	0	0	0	0	0	6	0	0	343
26	201	11	0	0	0	0	2	5	0	0	219
27	238	4	0	0	1	0	0	3	96	0	342
28	125	1	0	0	0	0	0	3	76	0	205
29	214	7	0	0	0	0	0	1	117	0	339
Total	7,582	111	1	1	3	1	64	647	3,040	13	11,463

Appendix F.–Problem sets from the 2010 and 2012 NSEI mark-tag surveys.

Stat area	Year	Set #	Start				End				Problem
			Lat deg	Lat min	Long deg	Long min	Lat deg	Lat min	Long deg	Long min	
345701	2012	7	57	29.47	134	47.10	57	27.68	134	46.74	Hard substrate and barnacles caused line break – avoid area
345701	2010	9	57	19.51	134	40.09	57	17.46	134	39.40	Line break, possibly due to hard substrate
345701	2012	9	57	23.01	134	42.63	57	21.42	134	42.77	Line caught on bottom, possibly due to hard substrate
345701	2012	11	57	13.06	134	41.44	57	11.56	134	41.34	Line caught on bottom, possibly due to hard substrate
345701	2010	14	57	2.53	134	41.76	57	0.46	134	41.62	Hard substrate – sets just north may be set
345702	2010	17	56	55.34	134	26.08	56	56.77	134	22.07	Avoid during extreme tides; high rockfish numbers
345631	2010	24	56	56.22	134	35.67	56	54.52	134	34.63	Hard substrate and barnacles caused line break – avoid area
345603	2012	27	56	27.08	134	36.21	56	28.95	134	35.84	North end of set hard bottom; high rockfish numbers