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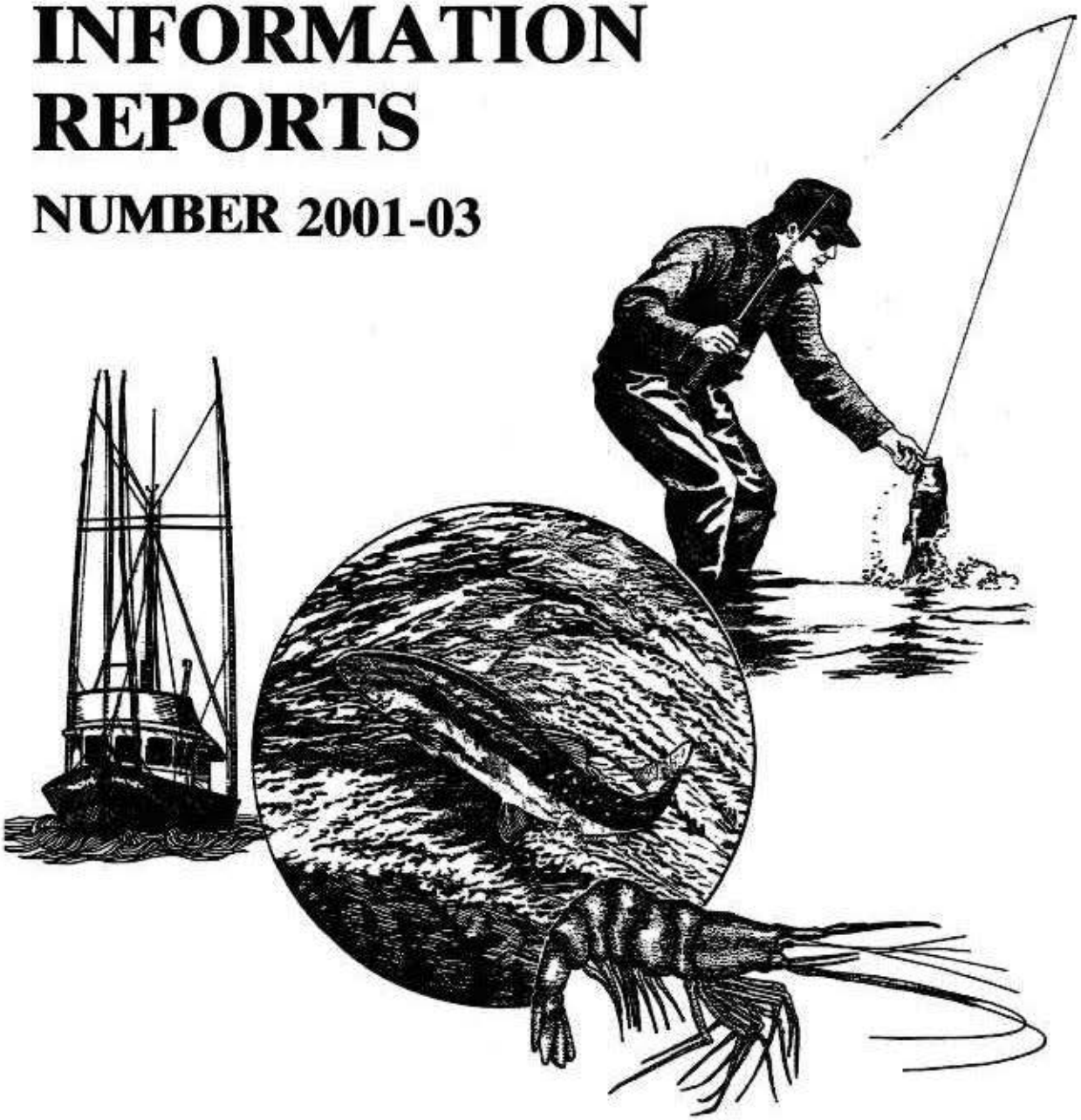

FISH DIVISION

Oregon Department of Fish and Wildlife

Evaluation of Pot and Longline Gear as Survey Tools for Sablefish

Evaluation of Pot and Longline Gear as Survey Tools for Sablefish

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ABSTRACT

To evaluate the stock status of sablefish (*Anoplopoma fimbria*) more accurately, additional indices of their abundance are needed, both in currently surveyed areas and in areas not surveyed (i.e., beyond 700 fathoms). We conducted a series of experiments to evaluate the utility of two fixed gears, pot and longline, for synoptic abundance surveys along the U.S. Pacific coast to augment the current annual National Marine Fisheries Service (NMFS) slope trawl survey. Initially, both gears were tested for fishing capability in very deep water, 600 to 1000 fathoms. We then compared gears at moderate depths (three strata centered on 200, 400, and 600 fathoms, ±50 fathoms) using a stratified systematic block design to determine catch rates and variability. Sablefish were measured and sex recorded to determine the relative selectivity of the two gears. We also tested whether different pot spacing along the groundline had an effect on catch rates. We found that both gear types were capable of fishing in very deep water with a minimum of problems, provided a strong enough groundline was used. In all depth strata, pot gear had a higher catch rate and a lower catch variance than did longline gear. Pot gear also showed a broader size selectivity range for sablefish. No consistent relationship between pot spacing and catch rate was detected. We concluded that pot gear is the preferable fixed gear survey tool off the U.S. Pacific coast because of its ability to fish very deep water, its higher catch rate, lower variability, and broader size selectivity.

PURPOSE OF THE STUDY

Sablefish are an important component of the commercial groundfish fishery off the U.S. west coast. Landings of sablefish for California, Oregon, and Washington combined have ranged from a high of 24,518 mt in 1976, declining to 7,844 mt in 1997. The ex-vessel value of the fishery was $27.5 million coastwide in 1997, and $10.2 million in Oregon alone (Pacific Fishery Management Council, 1998a).

Trawl surveys of the continental shelf and slope are performed by NMFS to evaluate groundfish stock status. Shelf surveys are performed triennially, using chartered commercial vessels, and cover depths from 30 to 250 fathoms (Wilkins et al, 1998). Slope surveys are conducted annually, using both NOAA research vessels and chartered commercial vessels, and cover depths ranging from 100 to 700 fathoms (Lauth, 1997).

Fixed gear surveys for sablefish using pot gear were performed by NMFS in 1979-81, 1983, 1985, 1987, and 1989 off Washington and Oregon, and in 1985, 1986, 1988, and 1991 off California (Pacific Fishery Management Council, 1998b). Sampling depths were typically 150-450 fathoms in the north (Parks and Shaw, 1990), and 225-525 fathoms off California (Parks and Shaw, 1989). After 1986, the sampling depth was extended to 600 fathoms in both areas.

No fixed gear surveys for sablefish have occurred since 1991. In 1997, the Oregon Department of Fish & Wildlife (ODFW) used pot gear to sample 4 sites off central Oregon, for the purpose of determining the success or failure of recent sablefish recruitment (Barss, 1997). Other objectives were to describe the total catch at specific depths, and to determine the best method of conducting pot surveys from commercial vessels.

In July of 1998, planning for this project began with the recognition that recent sablefish assessments recommend immediate action be taken to improve the fishery-independent data available. Current surveys provide data out to 700 fathoms, but it is known that sablefish inhabit waters in excess of 1000 fathoms (Matsui et al, 1990). If fixed gear could be used to survey waters outside the depth range of current survey trawl gear, valuable data on an unsurveyed segment of the population could be obtained.

The purpose of this project was to learn more about various fixed gears that could be used to conduct abundance surveys for sablefish. Two gears were identified as potentially useful; pot gear and longline gear. This project set out to test and compare the two gear types, to identify one for survey use, and to develop that gear type for use off the U.S. west coast.

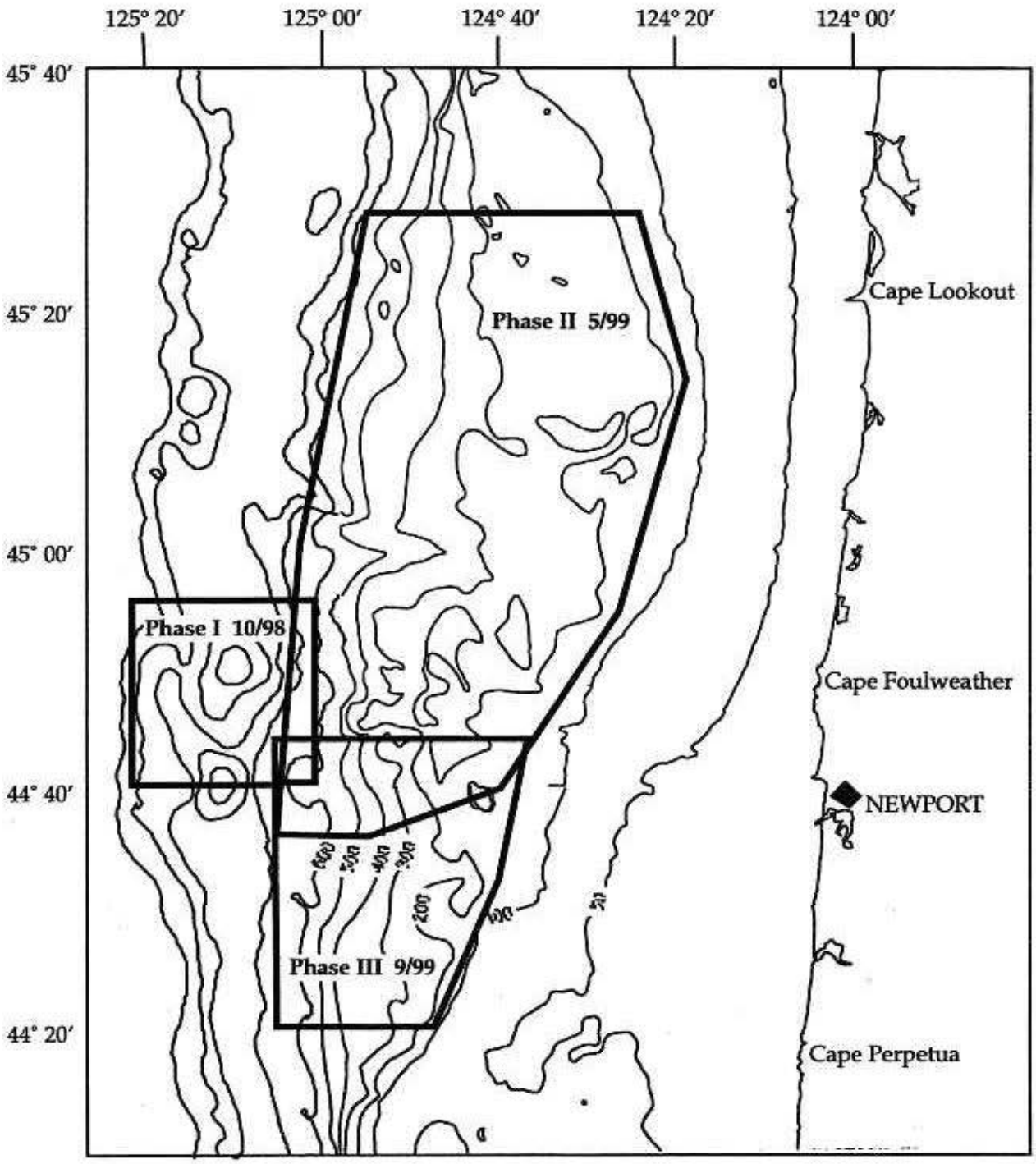

Figure 1. Study area for the fixed gear work between October 1998 and September 1999.

Phase I – Deep Slope Tests, Pot and Longline Gear

INTRODUCTION

A pilot project was conducted in October 1998 to begin exploring the type of gear appropriate for a fixed-gear survey of sablefish. This pilot project was part of a larger project by the Oregon Department of Fish & Wildlife (ODFW), in conjunction with the National Marine Fisheries Service (NMFS), to test fixed-gear survey methodology for sablefish on the U.S. Pacific continental slope. The primary objectives were to:

- Test the ability of both pot and longline gear to fish properly and consistently to 1000 fathoms.
- Explore the maximum depth range of sablefish.
- Learn the logistical problems of each gear type.
- Determine the relative cost of operating each gear type versus the offsetting sale of the fish caught (net cost per day of fishing).

METHODS

Two cruises were conducted in May 1999. Two vessels were chartered, F/V Michele Ann, a 66-foot pot boat, and F/V Pearl J, a 68-foot longliner, allowing the two gear types to be fished simultaneously. A "Letter of Acknowledgement" (LOA) from NMFS authorized ODFW to capture fish outside of the regular commercial sablefish season and in excess of normal limits, and the fish did not count against regular season quotas. All fish caught and retained during the trips were sold to a processor for market price by the vessel, with the proceeds offsetting the costs of the charter.

Gear

Pot

A 5/8-inch poly hard-lay groundline was rigged with 25 trapezoidal pots spaced 40 fathoms apart, and buoyed at one end using 9/16-inch buoy line marked with a strobe, flag, and radar reflector. Each pot was constructed of half-inch steel rod framing, and covered with 3.5-inch mesh webbing. Base dimensions were 72 by 43 inches, tapering to 60 by 32 inches at the top, with a 24-inch height. Each pot was rigged with a four-line bridle running from each of the four top corners up to a stainless steel snap hook which attached to a becket eye spliced into the groundline. The bridle lines from one end of the pot were shorter than those from the opposite end. This stabilized the pot as it descended through the water, and helped ensure that the pot landed in the correct position on the bottom. Each pot was baited with two plastic jars containing approximately 2 pounds of *Illex* squid and 11 pounds of Pacific whiting (*Merluccius productus*). One jar was hung in the center of the pot; the other floated free inside, along with a fine mesh "potato" sack containing whiting. Each set of pot gear was marked with a buoy at one end of the groundline.

Longline

Each longline was marked at both ends with a buoy, strobe, and radar reflector. Each groundline consisted of seven 150 fathom skates, made of 5/16-inch nylon line. An 8 inch (tied length) gangion was attached directly to the groundline every 42 inches,

with a 13/0 circle hook at the end of each gangion. Each hook was baited with *Illex* squid mantle, approximately a 2-3 inch piece.

Sampling Design

Two depth strata were identified for sampling, the "shallow" strata being 600-800 fathoms, and the "deep" being 800-1000 fathoms. Four sets were to be made each day, two sets in each stratum. The pot gear was soaked for a minimum of 24 hours. The longline gear was soaked a minimum of 6 hours. Soak time began when setting of the gear was finished and ended when retrieval began.

Test fishing took place approximately fifty to sixty nautical miles due west of Cape Foulweather on the central Oregon coast (Figure 1). Exact sites to be sampled were left to the discretion of the vessel operators. They were instructed to make sets entirely within the assigned strata, with no more than 50 fathoms of depth variation allowed within a set. On the second day, the gear was moved to a new site, within the same strata, no more than 4 nautical miles away from the first set of the gear.

Three scientific personnel were used on both cruises. Upon gear retrieval, all species were counted into baskets and weighed on an electronic platform scale, and as many lengths as possible were taken. Sablefish lengths were measured as fork length to the nearest centimeter. Data was recorded by pot or skate of gear. As time allowed, counts, lengths and weights were taken on other bycatch species. A subsample of sablefish from each depth strata was sampled dockside for fork length, sex and maturity, and otoliths were removed for age determination.

The catch of sablefish (in pounds) per pot or skate for each set, strata and gear type were compared. The coefficient of variation (CV) was calculated for each set of gear and averaged across sets within a gear type and depth stratum. Lengths were averaged by set, and were compared by set, strata and gear type.

RESULTS

Eight sets of the gear, four in each depth stratum, were successfully deployed and retrieved for each gear type. Counts and weights were obtained on all species encountered (Table 2). No difficulties or malfunctions were encountered with the pot gear. The extreme depth overstressed the longline gear, and the groundline parted during retrieval on three of the eight sets. Due to the second buoy at the opposite end of the set, no gear was lost. The effect that the parting of the longline may have had on the catch rate is unknown.

Both gear types caught more sablefish in the shallow strata (Figure 2; Table 3). The ratios (shallow:deep) were 4.1:1 for pot gear and 8.7:1 for longline. The coefficient of variation was higher for longline gear in both strata (Tables 5 & 6).

The data suggest pot gear may have been selective for larger sablefish (Figure 3; Table 4). However, without knowledge of the size composition available to the gear, this cannot be resolved. Comparison of both average lengths and average weights by strata and gear type show that the pot gear caught larger sablefish (Table 4).

Table 1. Vessels, personnel, and activities during the October 1998 deep slope test.

	Pot Gear	Longline Gear
Vessel	F/V Michele Ann	F/V Pearl J
Dates	10/14 - 10/18/98	10/27 - 10/30/98
Personnel	Keith Matteson[1]	Keith Matteson[1]
	Paul Crone[2]	Jim Golden[1]
	Joe O'Malley[3]	Jennifer Menkel[4]
Catch (all)		
Sablefish (lbs)	18,934	2,921
Sablefish (count)	2,065	414
Sets Completed:		
600-800 f stratum	4	4
800-1000 f stratum	4	4

[1] Oregon Dept. of Fish & Wildlife, Marine Resources Program
[2] National Marine Fisheries Service
[3] Oregon State University
[4] Pacific States Marine Fisheries Commission

Table 2. Species encountered during the October 1998 deep slope test.

Common name	Scientific name	Gear
Sablefish	*Anoplopoma fimbria*	Pot,LL
Pacific grenadier	*Coryphaenoides acrolepis*	Pot,LL
Giant grenadier	*Albatrossia pectoralis*	Pot,LL
Blob Sculpin	*Psychrolutes phrictus*	Pot,LL
Blacktail snailfish	*Careproctus melanurus*	Pot
Shortspine thornyhead	*Sebastolobus alascanus*	Pot,LL
Blue shark	*Prionace glauca*	LL
Black skate	*Raja trachura*	LL
Pacific flatnose	*Antimora microlepis*	Pot,LL
Pacific hagfish	*Eptatretus stoutii*	Pot

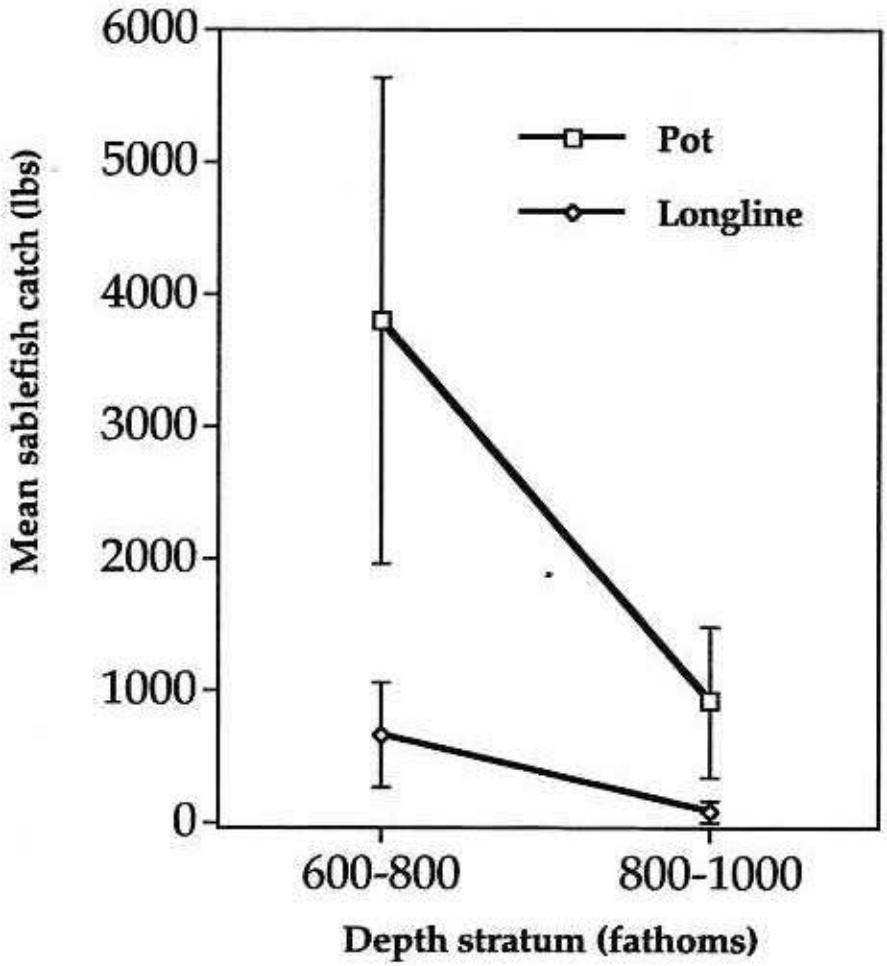

Figure 2. Mean catch weights (lbs) per set for pot and longline gear, with 95% confidence intervals shown.

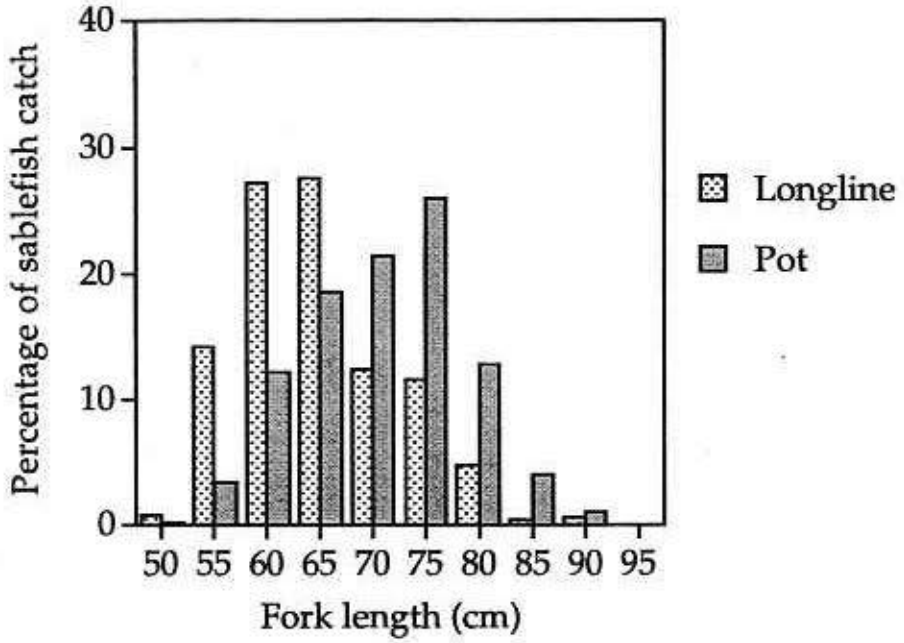

Figure 3. Length distributions (fork length, cm) for all fish caught for both gear types.

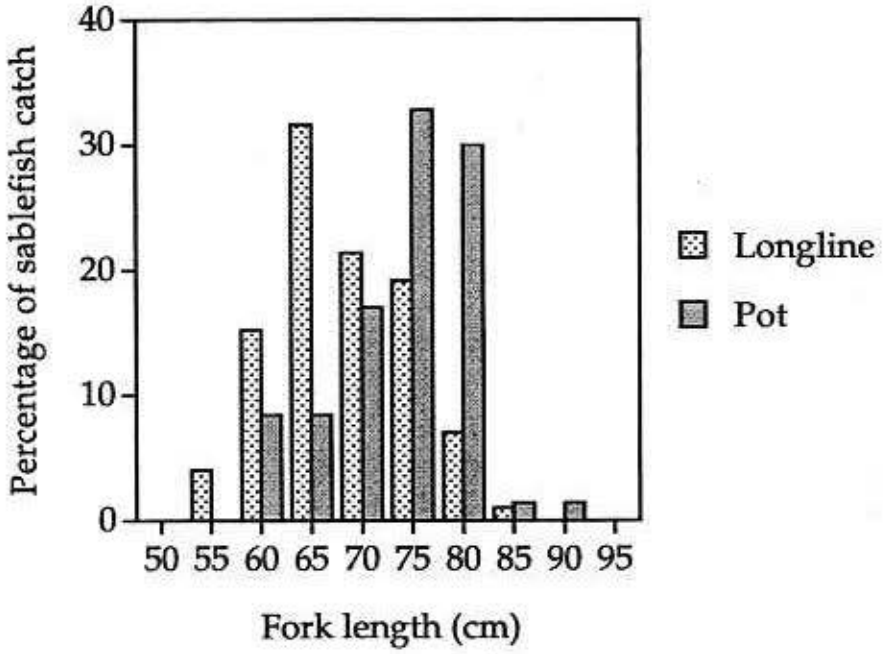

Figure 4. Length distributions (fork length, cm) for pot set 7 and longline set 4.

Table 3. Count and weight of sablefish (lbs) for each gear type by strata and set. Bold type denotes pairs of confounded pot and longline sets (see text).

Depth	Pot Gear			Longline Gear		
Stratum	Set	Count	Weight (lbs)	Set	Count	Weight (lbs)
600-800 fm	3	541	4,564	7	136	822
600-800 fm	**4**	**545**	**4,922**	**1**	**26**	**276**
600-800 fm	7	328	3,325	4	97	778
600-800 fm	8	276	2,413	8	123	741
800-1,000 fm	**1**	**136**	**1,362**	**5**	**7**	**67**
800-1,000 fm	2	49	530	2	4	35
800-1,000 fm	5	98	1,025	3	5	53
800-1,000 fm	**6**	**86**	**744**	**6**	**16**	**149**

Table 4. Average weight (lbs) and average length (cm) of sablefish for each gear type by strata and set. Bold type denotes pairs of confounded pot and longline sets (see text).

Depth	Pot Gear			Longline Gear		
Stratum	Set	Ave. wt.	Ave. len. (cm)	Set	Ave. wt.	Ave. len. (cm)
600-800 fm	3	8.4	69.0	7	6.0	61.8
600-800 fm	**4**	**9.0**	**70.3**	**1**	**10.6**	**71.1**
600-800 fm	7	10.1	73.8	4	8.0	68.2
600-800 fm	8	8.7	69.3	8	6.0	61.9
800-1,000 fm	**1**	**10.0**	**72.1**	**5**	**9.6**	**73.7**
800-1,000 fm	2	10.8	75.7	2	8.8	68.2
800-1,000 fm	5	10.5	74.9	3	10.5	73.8
800-1,000 fm	**6**	**8.7**	**69.3**	**6**	**9.3**	**70.1**

Table 5. Catch (lbs) and count per pot for sablefish captured using pot gear in two depth strata. Also shown are the averages across sets within each depth strata.

		Weight in lbs per Pot				
Stratum	Set	Mean	Std. Dev.	Std. Error	CV	Set Totals
600-800 fm	3	182.6	52.5	10.5	29%	4,564
600-800 fm	4	196.9	68.2	13.6	35%	4,922
600-800 fm	7	133.0	57.3	11.5	43%	3,325
600-800 fm	8	96.5	40.0	8.0	41%	2,413
Average		**152.2**	**54.5**	**10.9**	**37%**	**3,806**
800-1,000 fm	1	56.8	38.9	7.9	69%	1,362
800-1,000 fm	2	21.2	17.0	3.4	80%	530
800-1,000 fm	5	41.0	33.8	6.8	82%	1,025
800-1,000 fm	6	29.8	14.4	2.9	48%	744
Average		**37.2**	**26.0**	**5.2**	**70%**	**915**

		Count per Pot				
Stratum	Set	Mean	Std. Dev.	Std. Error	CV	Set Totals
600-800 fm	3	21.6	6.4	1.3	29%	541
600-800 fm	4	21.8	7.7	1.5	36%	545
600-800 fm	7	13.1	5.8	1.2	44%	328
600-800 fm	8	11.0	4.1	0.8	37%	276
Average		**16.9**	**6.0**	**1.2**	**36%**	**422.5**
800-1,000 fm	1	5.7	3.7	0.8	66%	136
800-1,000 fm	2	2.0	1.7	0.3	87%	49
800-1,000 fm	5	3.9	3.2	0.6	83%	98
800-1,000 fm	6	3.4	1.6	0.3	48%	86
Average		**3.7**	**2.6**	**0.5**	**71%**	**92.3**

Table 6. Catch (lbs) and count per skate for sablefish captured using longline gear in two strata. Also shown are the averages across sets within each depth strata.

		Weight in lbs per Skate				
Stratum	Set	Mean	Std. Dev.	Std. Error	CV	Set Totals
600-800 fm	1	39.4	34.4	13.0	87%	276
600-800 fm	4	111.1	39.9	15.1	36%	778
600-800 fm	7	117.5	43.0	16.2	37%	822
600-800 fm	8	123.5	39.8	16.2	32%	741
Average		**97.9**	**39.3**	**15.1**	**48%**	**654**
800-1,000 fm	2	5.0	7.6	2.9	151%	35
800-1,000 fm	3	7.5	11.0	4.2	146%	53
800-1,000 fm	5	9.6	12.1	4.6	127%	67
800-1,000 fm	6	21.3	17.3	6.5	81%	149
Average		**10.8**	**12.0**	**4.5**	**126%**	**76**

		Count per Skate				
Stratum	Set	Mean	Std. Dev.	Std. Error	CV	Set Totals
600-800 fm	1	3.7	2.7	1.0	72%	26
600-800 fm	4	13.9	5.0	1.9	36%	97
600-800 fm	7	19.4	7.2	2.7	37%	136
600-800 fm	8	20.5	6.7	2.7	33%	123
Average		**14.4**	**5.4**	**2.1**	**45%**	**95.5**
800-1,000 fm	2	0.6	0.8	0.3	138%	4
800-1,000 fm	3	0.7	1.1	0.4	156%	5
800-1,000 fm	5	1.0	1.2	0.4	115%	7
800-1,000 fm	6	2.3	1.7	0.6	75%	16
Average		**1.1**	**1.2**	**0.4**	**121%**	**8.0**

Three of the longline sets were inadvertently set very near to locations where pot sets had been made two weeks earlier. Comparisons of average lengths or weights from these three pairs of confounded sets were not made due to very low longline catch numbers (Tables 3 & 4). Comparison of length distributions for pot set seven and longline set four (Figure 4), which were approximately one-half nautical mile apart and caught sufficient fish for comparison, also shows the pot gear catching larger sablefish.

Initial analysis revealed no clear difference in average weight or average length between the shallow and deep strata when data from both gear types were combined.

The catch for both gear types was predominantly female. A sample of 200 pot caught sablefish taken from the 600-800 fathom stratum showed only 11 males, and 200 more taken from the 800-1000 fathom stratum showed only 1 male. A similar pattern was obtained with longline gear, with 14 males in a sample of 58 sablefish in the shallower stratum, and zero males in a 32 fish sample from the deep stratum.

DISCUSSION

Both the pot and longline gears showed significant amounts of sablefish in 600-800 fathoms and much lower numbers of fish, with higher CVs, in 800-1000 fathoms. The higher CVs in deeper water suggest that further gear comparisons should be conducted in depths inside of 700 fathoms. Our results also show that extending the existing surveys beyond 700 fathoms would be useful in determining the appropriate boundaries of the sablefish unit stock for assessment purposes.

The different size distributions seen for each gear type could be a result of different gear selectivity, or simply variation caused by sample location. We could not resolve one from the other based on the data from this pilot experiment. A larger, randomized or systematic block design would eliminate the possibility of confounding sets by placing the gear at predetermined sites within an area where the sablefish population is assumed homogeneous.

Longline gear for the larger experiment must be constructed using heavier groundlines than were used in this pilot cruise. A stronger 3/8-inch groundline with 18-inch gangions attached to the groundline with a becket, not directly, should eliminate breakage, and prevent fish loss resulting from the fish "rolling up" on the gangion and pulling the hook free. Three crewmembers are required to keep up with the baiting of longline skates for the next day. The two-person crew worked 48 hours straight on this short cruise, and exhaustion could be a major safety concern on a trip of any longer duration.

Phase II – Systematic Stratified Comparison of Pot and Longline Gear

INTRODUCTION

Phase II was designed to test pot and longline gear in more moderate depth ranges, to directly compare the catch rate and variability of each gear type. Both pot and longline gears showed that there were sablefish at extreme depths, and that, with some modifications, each gear could fish at those depths. Based on our findings in Phase I, requests for bids were distributed which contained exact gear specifications for both types of gear. Specifically, our objectives were to:

- Compare the relative selectivity of each gear type.
- Determine the gear type with the lowest average coefficient of variation.
- Determine which gear type was more practical from a logistical standpoint.
- Determine the relative costs associated with each gear type.

METHODS

Two cruises were conducted in May 1999. Two vessels were chartered, F/V Michele Ann, a 66-foot pot boat, and F/V Pearl J, a 68-foot longliner, allowing the two gear types to be fished simultaneously. A "Letter of Acknowledgement" (LOA) from NMFS authorized ODFW to capture fish outside of the regular commercial sablefish season and in excess of normal limits, and the fish did not count against regular season quotas. All fish caught and retained during the trips were sold to a processor for market price by the vessel, with the proceeds offsetting the costs of the charter.

Gear

Pot

A 5/8-inch poly hard-lay groundline was rigged with 25 trapezoidal pots spaced 40 fathoms apart, and buoyed at one end using 9/16-inch buoy line marked with a strobe, flag, and radar reflector. Each pot was constructed of half-inch steel rod framing, and covered with 3.5-inch mesh webbing. Base dimensions were 72 by 43 inches, tapering to 60 by 32 inches at the top, with a 24-inch height. Each pot was rigged with a four-line bridle running from each of the four top corners up to a stainless steel snap hook which attached to a becket eye spliced into the groundline. The bridle lines from one end of the pot were shorter than those from the opposite end. This stabilized the pot as it descended through the water, and helped ensure that the pot landed in the correct position on the bottom. Each pot was baited with two plastic jars containing approximately 2 pounds of *Illex* squid and 11 pounds of Pacific whiting (*Merluccius productus*). One jar was hung in the center of the pot; the other floated free inside, along with a fine mesh "potato" sack containing whiting. Each set of pot gear was marked with a buoy at one end of the groundline.

Longline

Each longline was marked at both ends with a buoy, strobe, and radar reflector. Each groundline consisted of five 200-fathom skates, made of 3/8-inch nylon line. A 15-inch (tied length) gangion was attached directly to the groundline every 2 meters, with a

13/0 circle hook at the end of each gangion. The construction brought the gear into conformance with that used on the Alaska sablefish surveys. (Rutecki et al, 1997) Each hook was baited with *Illex* squid, approximately a 2-3 inch piece.

Sampling Design

Three different depth strata were identified, centered on 200, 400, and 600 fathoms, ±50 fathoms (Figure 5). Six sets were made in each stratum for a total of 18 sets per gear type. Pot gear was soaked for a minimum of 24 hours, and longline gear soaked for a minimum of 6 hours. Soak time began when the setting of the gear was finished, and ended when the retrieval of the gear began.

The gear comparison took place in an area roughly bounded by Tillamook Bay in the north, down to Newport, and ranging from 124° 20′ W longitude, westward to 125° 20′ W, encompassing an area of roughly 2200 square miles. The survey area was separated into the three depth strata, then further divided into blocks which were 4 miles wide north to south, giving twelve sites in each stratum. Gear type was assigned to each site on an alternating basis. An exact sampling location was marked for each site, with the goal of laying the gear directly over the chosen spot. The skipper of each vessel was provided with the precise latitude and longitude of each target site.

Each vessel made a two-leg cruise to complete its assigned 18 sets of the gear. Three scientific personnel were used on each cruise. Upon retrieval of the gear, all fish were sorted by species, counted into baskets, and weighed on an electronic platform scale. Seventy-five sablefish were selected from each set at random. Sex and fork length (cm) was recorded. With longline gear, hook condition was recorded as the gear was hauled, with each hook being classified as occupied, tangled, missing, baited, or empty. On the second leg, fish that surfaced on the hook but dropped off into the water before they could be brought aboard ("dropoffs") were also recorded.

The catch of sablefish per pot or skate for each set, strata, and gear type were compared. The coefficient of variation (CV) was calculated for each set of gear. We then averaged the CVs across sets within each gear type and depth stratum to allow us to make comparisons by gear and depth.

RESULTS

Thirty-six sets, eighteen of each gear type, were successfully completed (Table 7). One set had to be abandoned, when the buoy line to the pot string set in block 9 of the 1097 m stratum parted after becoming fouled under the boat shortly after finishing the set. A substitute set was made at the same depth in block A5 (the lost gear was later successfully recovered). The longline gear used in this experiment had been constructed with a heavier groundline than the one that parted in our October work, and no difficulties were encountered. On average, only 2.6% of hooks were tangled upon retrieval, and 1% were broken or missing. Tables containing detailed catch information by individual pot or skate are included in the Appendix.

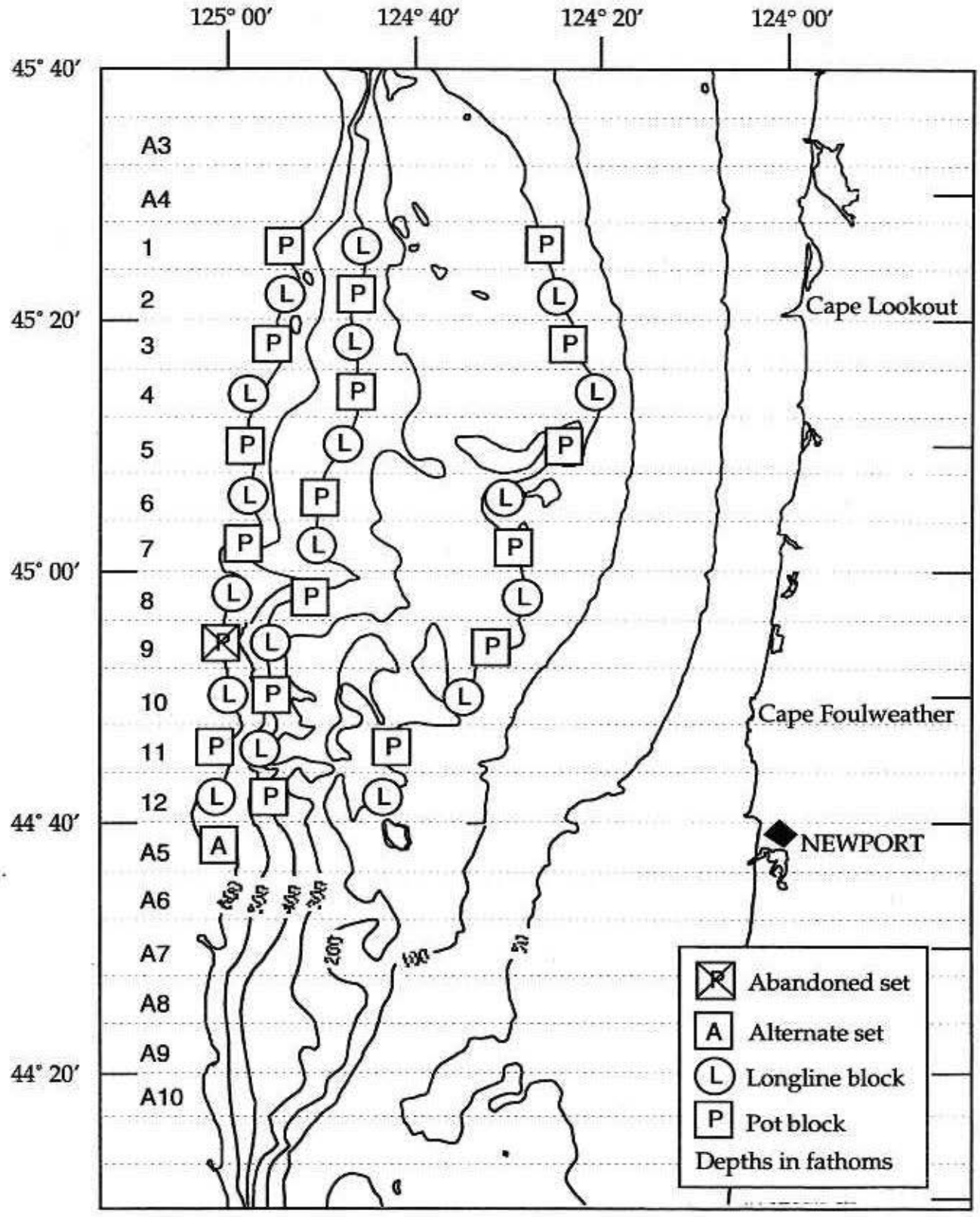

Figure 5. Phase II sampling sites.

Table 7. Vessels, personnel, and activities during the May 1999 fixed gear comparison experiment.

	Pot Gear		Longline Gear	
	Leg 1	Leg 2	Leg 1	Leg 2
Vessel	----------F/V Michele Ann----------		----------F/V Pearl J----------	
Dates	5/3 - 5/8/1999	5/10 - 5/15/1999	5/3 - 5/6/1999	5/10 - 5/13/1999
Personnel	John Seaborne[1] Gary Hettman[1] Lara Hutton[2]	Keith Matteson[1] Jean McCrae[1] Dan Kamikawa[3]	Keith Matteson[1] Steve Parker[1] Dan Kamikawa[3]	John Seaborne[1] Erica Fruh[2] Steve Kupillas[1]
Catch:				
All spp (lbs)	31,021	28,588	11,088	7,410
Sablefish:				
- pounds	30,890	28,554	10,669	3,812
- count	6,778	6,640	2,710	921
Sets:				
200 fm	6	0	6	0
400 fm	3	3	3	3
600 fm	0	6	0	6

[1] Oregon Department of Fish & Wildlife, Marine Resources Program
[2] Pacific States Marine Fisheries Commission
[3] National Marine Fisheries Service

Table 8. Statistical values for pot and longline gear by strata for sablefish catch

	Weight in lbs of sablefish per set, pot gear				
Stratum	Mean	Std. Dev.	Std. Error	CV	Total lbs.
200 fm	3,757.9	540.9	312.3	14.7%	22,547
400 fm	2,829.5	336.8	194.4	11.9%	16,977
600 fm	3,321.7	387.7	223.8	11.6%	19,930
Average	**3,303.0**	**421.8**	**243.5**	**12.7%**	**19,818**

	Number of sablefish per set, pot gear				
Stratum	Mean	Std. Dev.	Std. Error	CV	Total fish
200 fm	762.7	219.9	127.0	28.9%	4,576
400 fm	757.0	106.1	61.3	13.9%	4,542
600 fm	716.7	61.2	35.3	8.5%	4,300
Average	**745.5**	**129.1**	**74.5**	**17.1%**	**4,473**

	Weight in lbs of sablefish per set, longline gear				
Stratum	Mean	Std. Dev.	Std. Error	CV	Total lbs.
200 fm	1,535.9	411.6	237.6	27.6%	9,215
400 fm	538.8	142.5	82.3	25.6%	3,233
600 fm	338.9	108.2	62.5	36.0%	2,033
Average	**804.5**	**220.8**	**127.5**	**29.7%**	**4,827**

	Number of sablefish per set, longline gear				
Stratum	Mean	Std. Dev.	Std. Error	CV	Total fish
200 fm	386.7	71.9	41.5	18.8%	2,320
400 fm	142.5	36.0	20.8	24.6%	855
600 fm	76.0	24.8	14.3	38.6%	456
Average	**201.7**	**44.2**	**25.5**	**27.3%**	**1,210**

Table 9. Species encountered during the May 1999 fixed gear comparison experiment.

Common name	Scientific name	Gear
Sablefish	*Anoplopoma fimbria*	Pot, LL
Pacific grenadier	*Coryphaenoides acrolepis*	Pot, LL
Giant grenadier	*Albatrossia pectoralis*	Pot, LL
Longnose skate	*Raja rhina*	Pot, LL
Rougheye rockfish	*Sebastes borealis*	Pot, LL
Shortspine thornyhead	*Sebastolobus alascanus*	Pot, LL
Pacific spiny dogfish	*Squalus acanthias*	Pot, LL
Arrowtooth flounder	*Atheresthes stomias*	Pot, LL
Rosethorn rockfish	*Sebastes helvomaculatus*	Pot, LL
Tiger rockfish	*Sebastes nigrocinctus*	LL
Darkblotch rockfish	*Sebastes crameri*	LL
Pacific flatnose	*Antimora microlepis*	LL
Sandpaper skate	*Raja kincaidii*	LL
Dover sole	*Microstomus pacificus*	Pot
Longspine thornyhead	*Sebastolobus altivelis*	Pot
Redbanded rockfish	*Sebastes babcocki*	Pot

Table 10. Catch in pounds and percentage by depth strata for pot gear.

Species (common name)	Pot Gear					
	200 f stratum		400 f stratum		600 f stratum	
	Pounds	Percent	Pounds	Percent	Pounds	Percent
Sablefish	22,547	99	16,977	100	19,930	100
Pacific grenadier	0	0	0	0	17	(<0.5)
Giant grenadier	0	0	0	0	13	(<0.5)
Rougheye rockfish	35	(<0.5)	0	0	0	0
Shortspine thornyhead	0	0	4	(<0.05)	0	0
Pacific spiny dogfish	13	(<0.5)	0	0	0	0
Arrowtooth flounder	68	(<0.5)	0	0	0	0
Rosethorn rockfish	1	(<0.05)	0	0	0	0
Dover sole	1	(<0.05)	0	0	0	0
Longspine thornyhead	0	0	0	0	0	0
Redbanded rockfish	5	0	0	0	0	0
Totals	**22,668**	**100**	**16,981**	**100**	**19,960**	**100**

Table 11. Catch in pounds and percentage by depth strata for longline gear.

Species (common name)	Longline Gear					
	200 f stratum		400 f stratum		600 f stratum	
	Pounds	Percent	Pounds	Percent	Pounds	Percent
Sablefish	9,215	96	3,233	97	2,033	37
Pacific grenadier	0	0	1	(<0.05)	2,783	50
Giant grenadier	0	0	90	3	713	13
Longnose skate	200	2	0	0	0	0
Rougheye rockfish	58	1	0	0	0	0
Shortspine thornyhead	2	(<0.05)	25	1	20	(<0.5)
Pacific spiny dogfish	42	(<0.5)	0	0	0	0
Arrowtooth flounder	40	(<0.5)	0	0	0	0
Tiger rockfish	17	(<0.5)	0	0	0	0
Darkblotch rockfish	14	(<0.5)	0	0	0	0
Pacific flatnose	0	0	0	0	9	(<0.5)
Sandpaper skate	2	(<0.05)	0	0	0	0
Rosethorn rockfish	1	(<0.05)	0	0	0	0
Totals	**9,591**	**100**	**3,348**	**100**	**5,559**	**100**

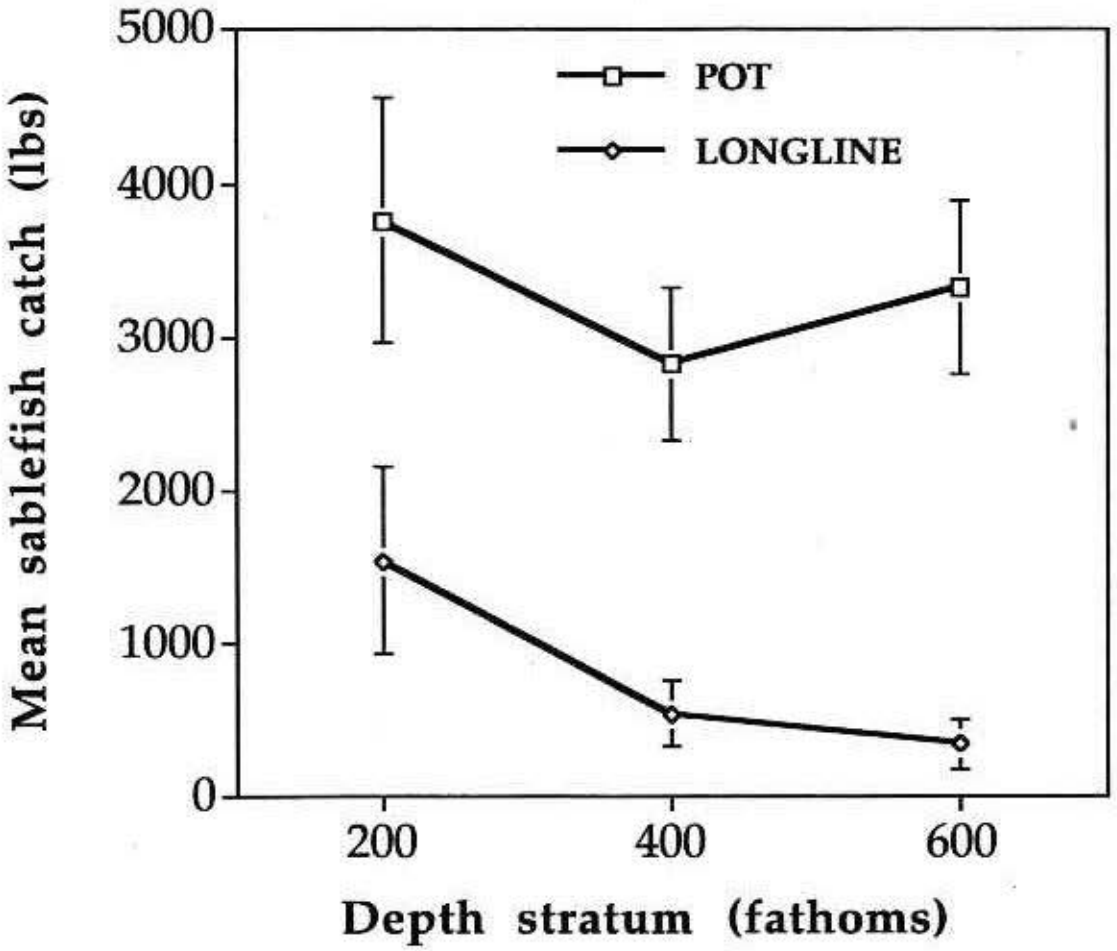

Figure 6. Mean sablefish catch by gear and stratum, with 95% confidence intervals.

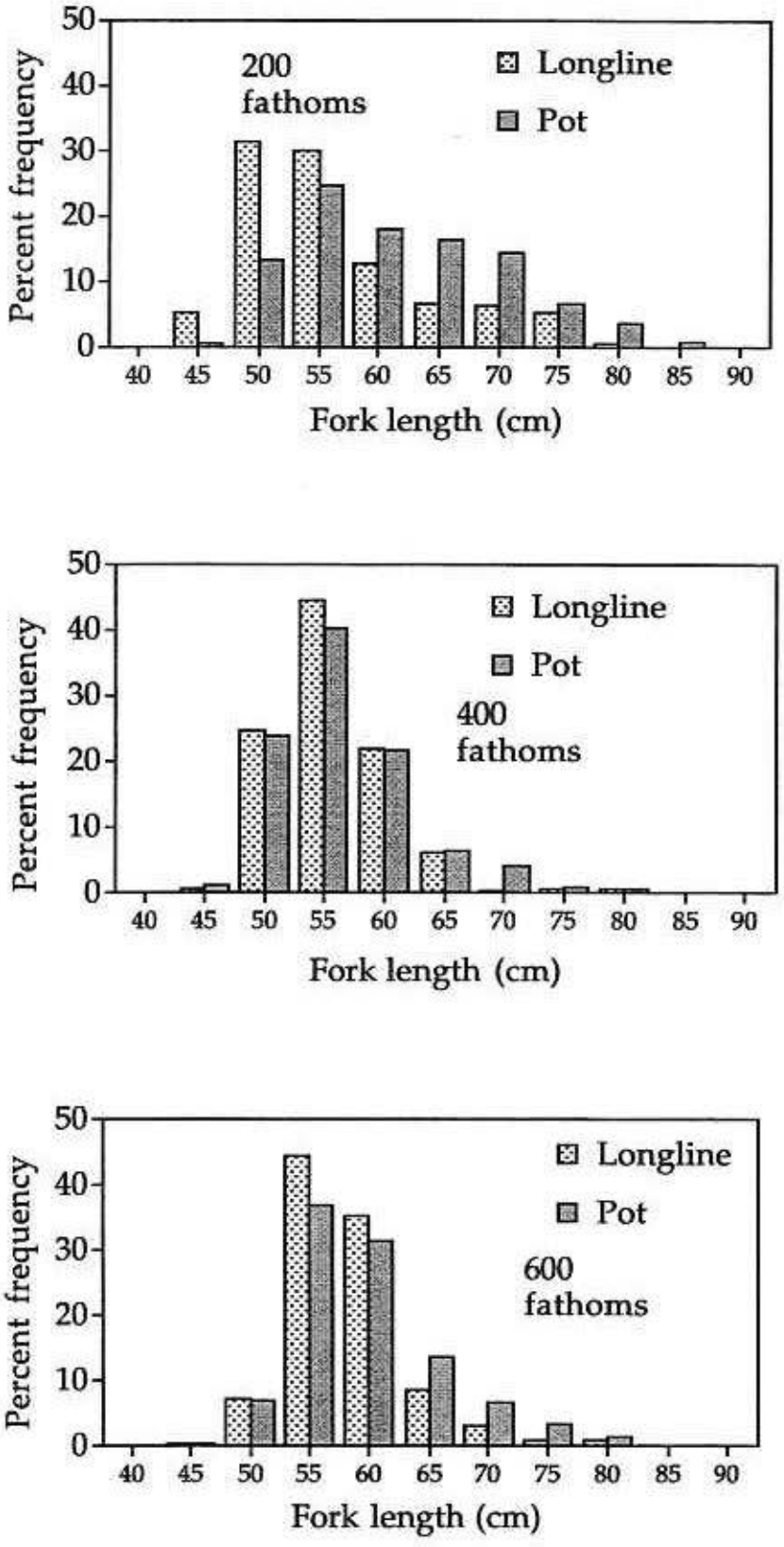

Figure 7. Length distribution comparison for sablefish for each stratum.

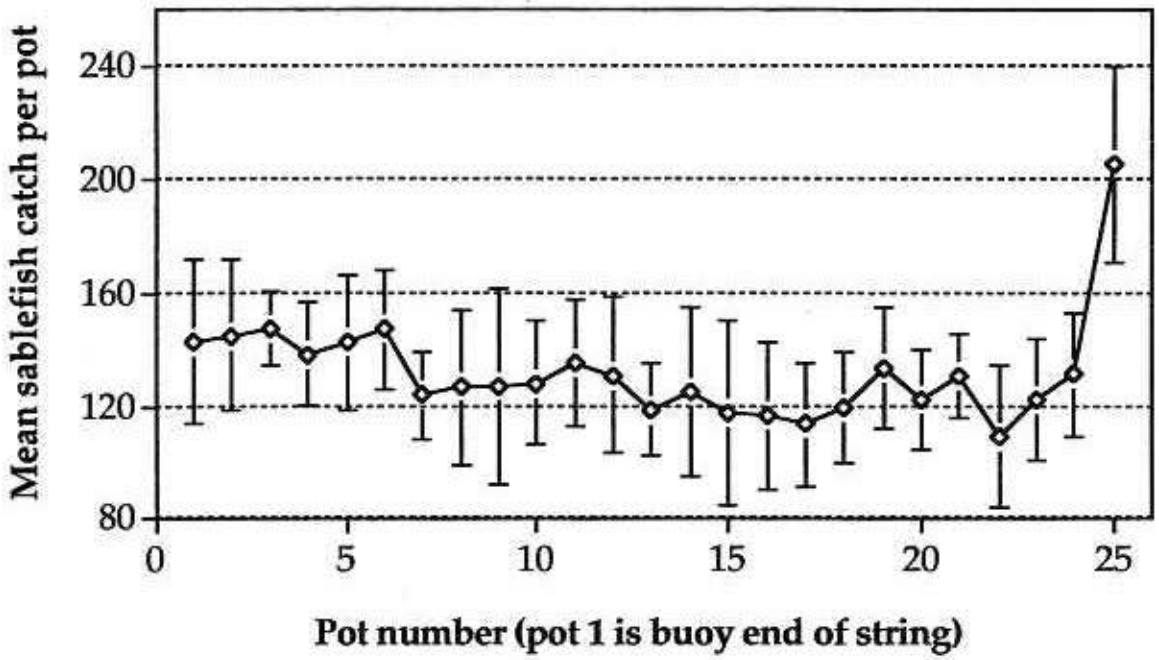

Figure 8. Mean sablefish catch in pounds per pot for all pot sets combined. Error bars denote 95% confidence interval.

The pot gear displayed less variation between strata than did longline gear. Figure 6 shows the decline in the sablefish catch rate with increasing depth for longline gear, while the pot gear showed no trend.

Analysis of the data collected reveals several differences in the catch for each gear. Figure 7 shows the length frequency distribution for the three depth strata. In the 400-fathom stratum, the length frequency distributions were similar, but at 200 and 600 fathoms, the pot gear caught more large fish.

The coefficient of variation was lower for pot gear in all three strata when calculated for pounds of sablefish caught by set (Table 8). The CV for pot gear decreased slightly with depth, while it increased with depth for longline gear. When examined by the number of sablefish caught, the pot gear showed a higher CV than the longline gear did in the 200 fathom stratum.

For the gear configuration used in this study, pot catch per set outperformed longline catch per set. Pot gear caught 2.4 to 9.8 times as much fish in each stratum (Table 8). However, other longline configurations (closer hook spacing, longer groundlines, etc.) might provide somewhat higher catch rates.

We observed a much higher bycatch rate for longline gear in the 600 fathom stratum (Tables 10 & 11). This higher bycatch rate suggests the potential for hook competition, particularly by Pacific grenadier. At 600 fathoms, grenadier made up 63% of the catch by weight.

The number of occupied longline hooks declined from 45% to 17% between the 200- and 400-fathom depth stratum. At 600 fathoms, the percentage of occupied hooks rose to 41%, but this was due to the increased bycatch of grenadier.

An *end-pot effect* was observed for the last pot in each string for six of the 18 pot sets. Pots 1 to 24 in each string were spaced 40 fathoms apart, but pot 25 was given an 80 fathom space. The average catch rate of this pot was significantly higher than the other 24 (Figure 8).

The pot gear operated at a much lower cost because of the higher catch rate. At present market prices, sale of the fish caught during the pot gear cruise completely offset the cost of the cruise.

DISCUSSION

Both gear types fished in all three depth strata without problems. No groundlines parted during this experiment for either gear type, there were no lost pots and a minimum of longline tangles and broken or missing hooks. The hook breakage and entanglement rates were comparable to those experienced in the Alaska sablefish longline surveys (personal communication, Michael F. Sigler, NMFS, Alaska Fisheries Science Center, Juneau, AK).

The lack of larger sablefish in the pot gear at 400 fathoms, when compared to the longline gear, suggests that these larger fish were not available at that depth, but were present at 200 and 600 fathoms where they were caught by the pot gear. This suggests that the pot gear captures a wider size range of sablefish, and thus a broader section of the true population.

We believe the opposing trend in variation with depth for the two gear types is a result of the broader size selectivity range of the pot gear, whose catch rate may be less affected by variation in the size of the fish available in a particular area. Another factor in the increasing variation with depth for longline gear may be the increase in the catch of Pacific grenadier in the 600 fathom strata.

A possible explanation for the higher CV for pot gear in the 200 fathom stratum may be that the pot gear was catching a wider size range of sablefish. The length frequency distribution (and the weights of the fish) narrows in the 400 and 600 fathom strata, reducing the CV.

Between 400 and 600 fathoms the bycatch rate of Pacific and giant grenadier rose to 63% of the catch. The longline gear shows an abrupt rise in CV at the deepest stratum, which could be related to the sharp increase in grenadier bycatch. In combination, these findings suggest the possibility of hook competition at the 600 fathom stratum.

The lower CV for the pot gear, as well as the apparent broader size selectivity range, the higher catch rate, and the lower bycatch rate indicate that pot gear may be the preferable fixed-gear survey tool for sablefish off the US west coast.

The end-pot effect that we observed suggested that the pot at the end of the string, with its 80-fathom spacing, was less susceptible to competition from the other pots in the string. Put another way, the area fished by pot 25 seemed to overlap less with the fished area of the neighboring pot than did the fished areas of pots 1 to 24. This information led to an investigation of various pot spacings in an effort to

determine the point at which pots stop competing with one another. This would provide information on the area fished by an individual pot, as well as allow construction of a survey gear with varied pot spacing, possibly allowing information on catchability to be obtained with every set of the gear.

Phase III – Pot Spacing Experiment

INTRODUCTION

A persistent problem with survey gear has been assessing the variation in performance of the gear. Knowledge of the area fished and what portion of the total population is being caught is critical if accurate population estimates are to be made. A given survey gear may be biased by selecting fish of a narrower size range than the total population, or it may not catch all of the fish within a given area. These biases may be corrected or compensated for if known.

In our May 1999 fixed gear comparison experiment, we concluded that pot gear was the preferable gear for surveys of sablefish off the US west coast. A field error resulted in pot number 25, one of the end pots, being spaced 80 fathoms from the next pot, while all others were spaced 40 fathoms apart. All 18 sets were made in this manner. Though the error had no consequences for the comparison study, it did reveal that the catch rate of the pots spaced at 80 fathoms apart was significantly higher than the pots spaced 40 fathoms apart.

The higher catch rate for the 80-fathom pots suggested that competition between pots was occurring at a spacing of 40 fathoms, and that the more widely spaced pots were catching more fish because of this. Our final experiment was designed to test different spacing intervals of pots along a groundline to determine where the catch rate leveled off, in the manner of Eggers et al (1980). We assumed that this would be the point at which competition between pots was no longer occurring.

We hypothesized that if the spacing where competition between pots stopped could be determined on a set by set basis, then valuable information about the performance of the gear could be obtained with every set. Thus, if survey gear were constructed using pots variably spaced along a groundline, the catch area per pot for each survey set could be gauged, allowing for more accurate estimates of sablefish density in a given area. The catchability of the gear would be known for each survey set.

METHODS

Gear

This experiment was designed to determine the relative catch rates of sablefish pots at five different spacing intervals from 40 to 120 fathoms apart. We assumed from our findings in Phase II that gear competition was occurring at a 40-fathom spacing. We chose spacings of 40, 60, 80, 100, and 120 fathoms.

A 5/8-inch poly hard-lay groundline was used, and buoyed at one end using 9/16-inch buoy line marked with a strobe, flag, and radar reflector. Each pot was constructed of half-inch steel rod framing, and covered with 3.5-inch mesh webbing. Base dimensions were 72 by 43 inches, tapering to 60 by 32 inches at the top, with a 24-inch height. Each pot was rigged with a four-line bridle running from each of the

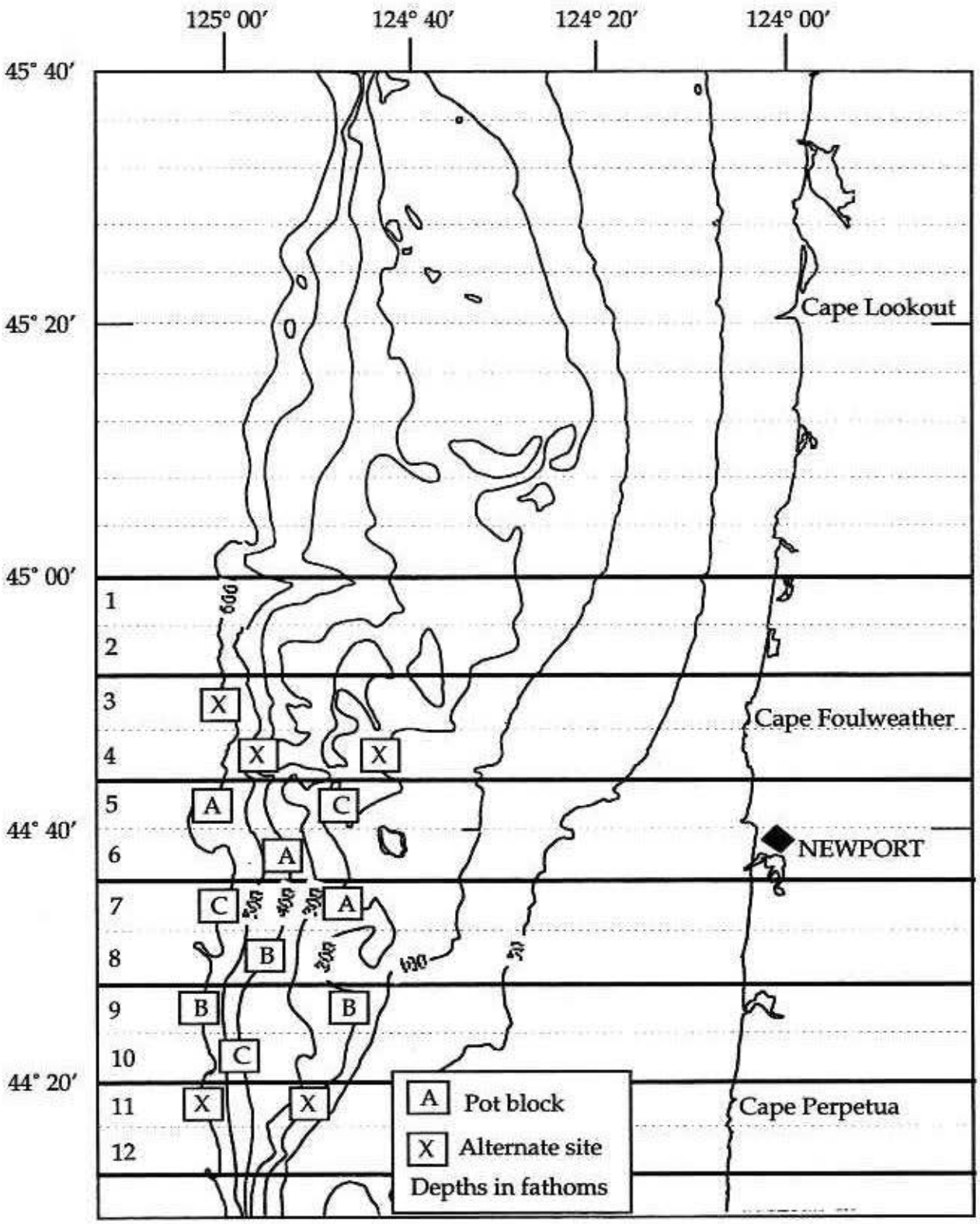

Figure 9. Phase III sampling sites. The letter inside each square denotes which groundline arrangement was fished at that site. No alternate sites were used.

four top corners up to a stainless steel snap hook which attached to a becket eye spliced into the groundline. The bridle lines from one end of the pot were shorter than those from the opposite end. This stabilized the pot as it descended through the water, and helped ensure that the pot landed in the correct position on the bottom. Each pot was baited with two plastic jars containing approximately 2 pounds of *Illex* squid and 11 pounds of Pacific whiting (*Merluccius productus*). One jar was hung in the center of the pot; the other floated free inside, along with a fine mesh "potato" sack containing whiting.

Three different groundlines were assembled. Each groundline was made up of the five different spacing treatments randomly arranged along each groundline and was labeled groundline A, B, or C. Five pots were assigned to each spacing, plus a "placeholder" pot in between each spacing. The placeholder pots were necessary so that all five pots within a treatment had the correct spacing on both sides. The placeholder pots were not included in the catch analysis. There were also two endpots at each end of the groundline which were not included in the analysis. There were 31 pots total on each groundline.

Each groundline was color coded to identify which groundline it was, and colored flagging was placed along the groundline to mark the becket where each pot was to be attached while setting the gear. This aspect was crucial to the success of the experiment, as a single misplaced pot would affect the spacing of either two or three pots in the sequence. Each pot was also assigned a number code, and a steel tag with that number code was clipped to each pot as it was deployed. This tag, plus the color coding along the groundline, allowed the deck and scientific crew to deploy and retrieve the gear while recording the catch data pot-by-pot.

Table 12. Spacing order for the three groundline arrangements.

Groundline	Spacing Order				
A	40	120	100	80	60
B	80	120	40	100	60
C	100	60	80	40	120

Sampling Design

As in Phase II, three different depth strata were sampled. These strata were centered on 200, 400, and 600 fathoms, ±50 fathoms (Figure 9). Each groundline was fished once in each strata for a total of nine sets of the gear.

The study area was located between Cape Perpetua and Cape Foulweather, and ranged from 124° 50'W longitude westward to 125° 20'W. This area was selected because the bottom profile was of similar complexity throughout and because both the skipper and the scientific crew were familiar with the grounds. Use of this site also allowed the gear to be spread over a minimal area while still maintaining at least 4 miles between any two sampling blocks.

Data collected included the set location, depth, and set and haul times for each string of pots. As each string was retrieved, the pot number codes were checked, and the count and weight of all fish by species was recorded.

Data from each of the five pots within a spacing treatment were grouped and compared to other spacings within that string. Spacing treatments were also grouped by depth strata and compared to other spacing treatments within that stratum.

RESULTS

Nine sets of the gear were successfully completed. The gear performed without difficulty, breakage, or pot loss. The color coding and serial number system for marking pots and tracking treatments within a given groundline worked well, and all pots were accounted for. Tables containing detailed catch information by individual pot or skate are included in the Appendix.

In the 200-fathom sets we encountered halibut, and were concerned about effects on the sablefish catch rate. We compared pots catching halibut to pots not catching halibut within the same set and spacing treatment. The means of the catches, when compared show that pots which caught halibut caught significantly less sablefish (Figure 10). The means differed by 62.6 fewer pounds in pots containing halibut (paired t-test, $p<0.01$). Because of this difference in catch rate due to the influence of halibut bycatch, the catch data from pots containing halibut were not included in subsequent analysis (Table 13).

No consistent pattern was observed between pot spacing and catch rate. The expected rise and leveling off of catch rate did not emerge (Figures 11, 12 & 13). Catch rates in the 600-fathom depth strata came closest to the expected pattern of the catch rate rising and leveling off as spacing increased. Inspection of the data (Figure 14) where all sets were combined into a single mean catch rate per treatment suggested that the catch rate may stop rising at about the 80-fathom spacing.

Results of ANOVA comparing mean catch rates suggested that spacing had no significant effect on the catch rate per pot. Catch rates showed a significant difference with depth between 200 and 400 fathoms, and between 200 and 600 fathoms ($p<0.01$) (Table 14).

DISCUSSION

While the spacing treatments showed no consistent effect on the catch rate for combined strata, a weak effect was seen at the 600-fathom depth between catch rates at the 40- and 60-fathom spacing, and those at the 80- and 120-fathom spacing. More repetitions in each of the depth strata may have provided a better ability to discern differences in the catch rates with spacing. Adding a 20-fathom spacing may have helped reveal an increase in competition at closer spacings, accentuating our suspected reduction in competition at around the 80-fathom spacing treatment.

Other properties of the gear may also be contributing to the variability in the catch rates. An end-pot effect was seen in phase II, but that effect may or may not be due to the different spacing of that pot (80 fathoms instead of the usual 40). That pot was always first into the water and last out, first onto the bottom and last off. It was also, of course, at the end of the string, and could simply be the first pot encountered if the current were running parallel to the groundline and that pot was down current of the rest of the pots.

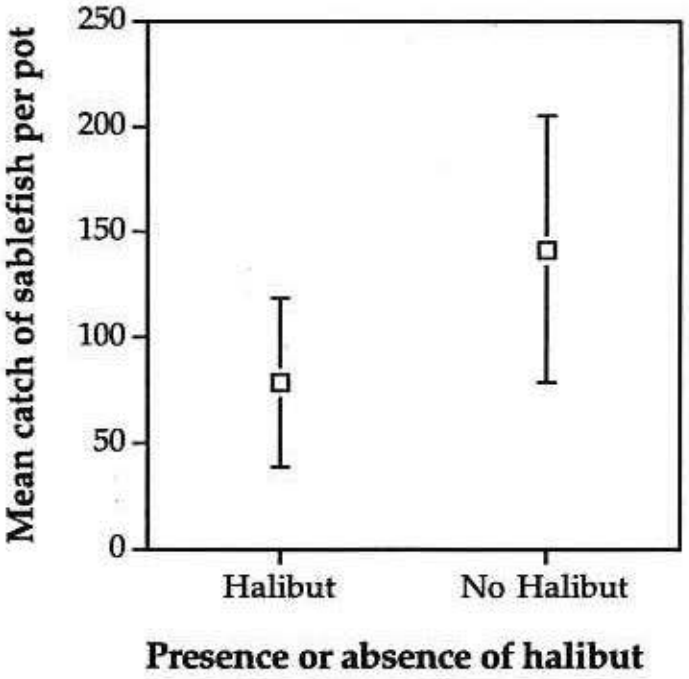

Figure 10. Mean catch per pot in sets where halibut were caught, comparing pots capturing halibut to those not capturing halibut. Error bars show a 95% confidence interval.

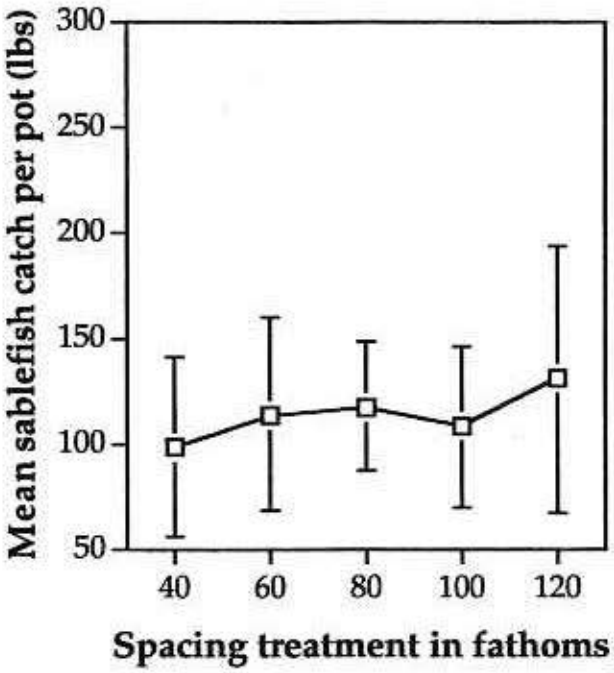

Figure 11. Mean catch per pot for each spacing treatment at the 200 fathom depth stratum. Error bars denote one standard error.

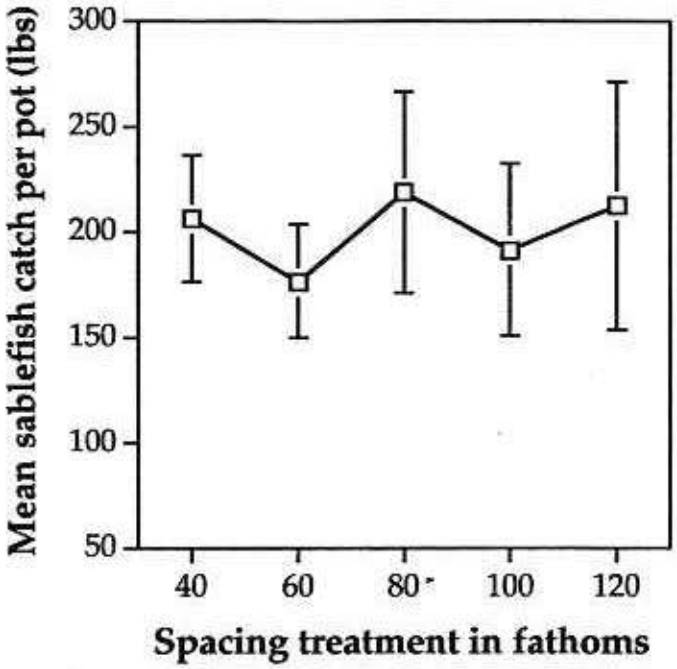

Figure 12. Mean catch per pot for each spacing treatment at the 400 fathoms depth stratum. Error bars denote one standard error.

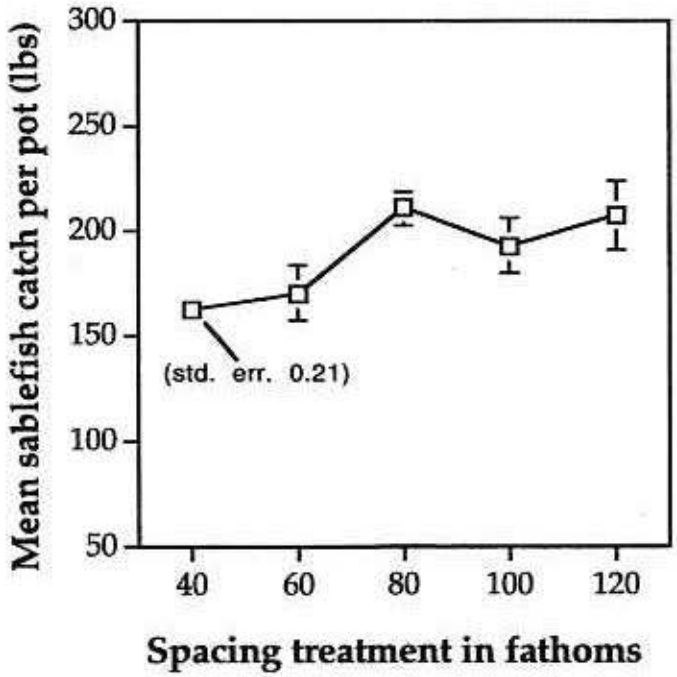

Figure 13. Mean catch per pot for each spacing treatment at the 600 fathoms depth stratum. Error bars denote one standard error.

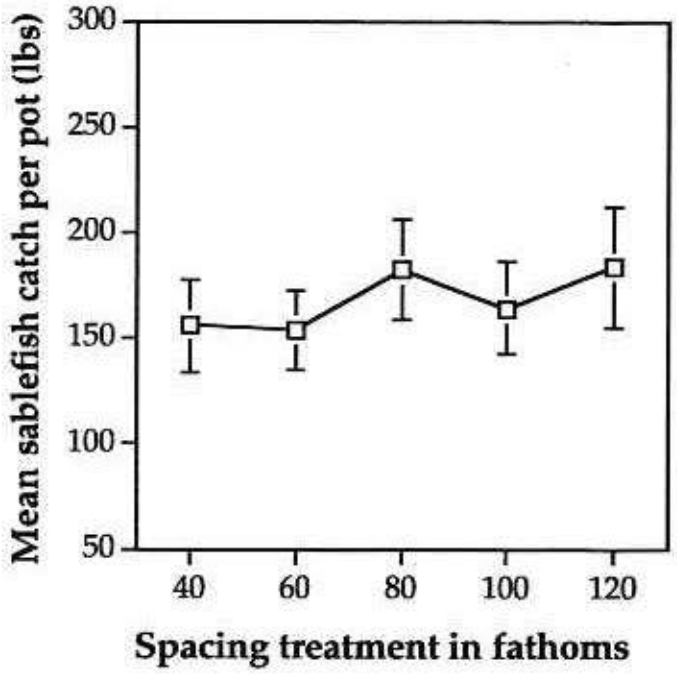

Figure 14. Mean catch per pot for each spacing treatment for all depths combined. Error bars denote one standard error.

Table 13. Mean catch of sablefish in lbs. per pot for each groundline and each spacing treatment, with statistical values by stratum. Pots catching halibut were not included.

Groundline Treatment	Pot Spacing in Fathoms				
	40	60	80	100	120
200A	60.9	74.0	94.5	89.6	83.6
200B	52.2	64.9	80.9	54.0	54.5
200C	184.2	205.5	178.9	182.7	256.4
200 Average	**99.1**	**114.8**	**118.1**	**108.7**	**131.5**
Std Error	**42.6**	**45.4**	**30.7**	**38.4**	**63.0**
Std Dev	**73.8**	**78.7**	**53.1**	**66.4**	**109.1**
CV	**74.5%**	**68.6%**	**45.0%**	**61.1%**	**83.0%**
400A	195.7	191.8	204.3	186.9	173.5
400B	263.1	214.2	309.1	264.8	328.5
400C	160.5	125.4	145.2	124.3	138.2
400 Average	**206.4**	**177.1**	**219.5**	**192.0**	**213.4**
Std Error	**30.1**	**26.7**	**47.9**	**40.6**	**58.5**
Std Dev	**52.2**	**46.2**	**83.0**	**70.4**	**101.2**
CV	**25.3%**	**26.1%**	**37.8%**	**36.7%**	**47.4%**
600A	164.0	197.3	223.8	216.1	219.7
600B	163.3	153.6	196.7	192.7	228.6
600C	163.6	161.8	214.4	172.4	176.9
600 Average	**163.6**	**170.9**	**211.6**	**193.7**	**208.4**
Std Error	**0.2**	**13.4**	**8.0**	**12.6**	**16.0**
Std Dev	**0.4**	**23.2**	**13.8**	**21.9**	**27.6**
CV	**0.2%**	**13.6%**	**6.5%**	**11.3%**	**13.3%**

Table 14. ANOVA results examining spacing treatment and depth on mean catch per pot.

	Degrees of Freedom	Mean Square	F-value	P-value
Spacing treatment	4	1865	0.468	0.758
Depth	2	33,547	8.428	0.001
Treatment * Depth	8	427	0.107	0.999
Residual	30	3,980		

CONCLUSIONS AND RECOMMENDATIONS

Our comparison began with an exploratory trip to test the abilities of the two gear types in deep water. Both the pot and longline gear we used was the same as that normally used during the commercial fishery. Most longlining for sablefish occurs in water from 100 to 200 fathoms, while the majority of pot fishing takes place between 200 and 350 fathoms. Fixed gear surveys would be occurring in depths from 100 fathoms to as deep as 1000 fathoms. Accordingly, it was not surprising to find that the longline gear needed modification if it were to be used at that extreme depth. Pot gear was able to fish successfully at 1000 fathoms, though the strain on the gear would dictate caution in sets this deep during severe weather.

Phase I and II of this investigation demonstrated that pot gear may be preferable over longline for survey work off the U.S. west coast, in the configurations we tested. Five different depth strata were tested, from 200 to 1000 fathoms. In each of these strata, the pot gear showed a higher catch rate, as well as a lower coefficient of variation. The broader size selectivity displayed by the pot gear, particularly its ability to catch larger sablefish, is of importance in depth ranges outside those trawled by the annual slope survey. One of our original goals was to investigate potential additional spawning biomass in deep water. Phase I suggested that the majority of sablefish encountered in water from 600 to 1000 fathoms were large females. Phase II showed that the pot gear had a better ability to capture larger sablefish. This study only sampled deep water sablefish from a small area, but if this pattern were applicable for the general range of sablefish, the impact on spawning biomass estimates could be substantial.

Baiting of the gear was also done in a fashion similar to that of the fishery, though we were careful to specify that each hook or pot was baited in a uniform manner. We continued to bait each gear in the same manner throughout all three phases. While the amount of bait used on each longline hook was not varied, the hook spacing was increased in Phase II. This resulted in a reduced bait density along the groundline, but eliminated groundline breakage and greatly reduced hook tangling and any associated fish loss due to these problems. Pot gear was baited with about 13 pounds of squid and Pacific whiting. Baiting in the Canadian surveys has varied from as light as 2.2 pounds from 1990-1993, to 13 pounds at some sites in 1994 and 1995 (Smith et al, 1996; Downes et al, 1997). It is possible that our relatively heavy bait load caused the scent streams from the pots to overlap. This overlapping scent stream could cause competition between pots. If pot gear were used for survey work, research on optimum bait load would need to be performed, as well as on the area fished by a given pot.

The speed and direction of the bottom current remains an unknown factor in this set of experiments. The bottom topography of the continental slope is complex and varied along the coast of Oregon. While we always tried to set the gear along contours, the surrounding terrain could cause local currents to behave in complete opposition to currents in a nearby set. We have little knowledge of how this affects the performance of the gear, or if certain current conditions favor one type of gear over the other. If further work is done with pot gear, instrumentation attached to the pots could provide current information. The importance of this is in finding out more about how the bait scent is spread through the water, and if the current changes velocity or direction on any regular basis.

ACKNOWLEDGEMENTS

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APPENDIX

CATCH DATA FOR POT AND LONGLINE GEAR

Table A1. Pounds of sablefish per pot for each strata, Phase I, October 1998.

Pot Number	Pounds of sablefish per pot for each set							
	600-800 fathom stratum				800-1000 fathom stratum			
	3	4	7	8	1	2	5	6
1	143.9	289.2	171.8	211.1	145.2	54.3	130.6	43.2
2	145.2	194.7	205.3	121.6	45.3	66.4	48.7	22.3
3	128.5	269.2	157.8	84.5	63.2	29.7	17.8	35.9
4	181.8	254.1	113.6	178.5	9.2	27.7	16.1	45.2
5	86.8	208.0	113.5	109.6	90.8	39.1	19.2	39.7
6	219.1	243.1	94.6	101.0	23.6	10.3	9.6	28.1
7	170.6	68.7	166.2	98.5	30.3	9.8	20.6	16.4
8	108.5	166.4	145.7	155.5	41.0	10.8	29.6	5.2
9	171.0	273.4	169.3	82.1	29.3	12.0	9.5	46.9
10	112.8	170.7	165.7	90.6	34.1	30.8	14.9	43.0
11	214.3	266.8	84.5	106.3	64.0	15.3	19.9	9.5
12	217.5	108.4	132.1	74.2	52.3	56.5	29.9	49.6
13	136.7	164.1	86.0	86.4	9.0	24.2	41.6	38.1
14	260.3	194.0	113.4	85.7	6.3	20.5	63.5	34.8
15	195.7	265.9	106.6	117.1	47.2	15.9	11.7	30.4
16	173.6	234.3	126.4	77.1	34.1	9.0	18.6	30.4
17	128.3	147.9	340.3	87.4	127.2	10.1	29.9	50.8
18	265.7	253.2	161.9	79.6	92.5	20.4	42.3	34.8
19	218.0	84.7	81.5	26.4	105.8	13.6	52.1	15.2
20	182.4	106.2	58.2	97.1	69.5	16.8	65.8	9.3
21	247.4	152.2	121.5	48.0	107.4	9.2	65.9	32.2
22	284.5	279.0	72.4	52.3	29.2	0.0	32.5	7.3
23	212.6	191.8	81.6	112.3	17.8	13.5	48.9	28.6
24	148.2	91.7	101.3	49.8	88.1	14.0	42.7	7.1
25	210.7	244.3	153.5	79.8	--	0.0	143.2	40.3
Total	4564.1	4922.0	3324.7	2412.5	1362.4	529.9	1025.1	744.3

Table A2. Number of sablefish per pot for each strata, Phase I, October 1998.

Pot Number	Number of sablefish per pot for each set							
	600-800 fathom stratum				800-1000 fathom stratum			
	3	4	7	8	1	2	5	6
1	20	30	17	20	15	6	13	5
2	18	24	18	14	5	7	4	2
3	15	30	15	11	6	3	2	4
4	17	28	12	21	1	3	2	4
5	10	22	10	14	9	3	2	5
6	27	28	9	12	3	1	1	3
7	20	7	19	12	3	1	2	2
8	16	16	14	16	4	1	2	1
9	21	28	15	10	3	1	1	5
10	15	18	17	11	4	3	1	5
11	24	28	8	12	7	1	2	1
12	24	10	12	8	5	4	3	6
13	10	17	8	11	1	2	4	4
14	29	22	11	11	1	2	7	3
15	26	29	12	13	4	2	1	4
16	22	27	12	9	4	1	2	4
17	14	17	35	10	12	1	3	6
18	29	28	15	9	9	2	4	4
19	26	10	9	3	8	1	4	2
20	24	13	5	11	7	1	6	1
21	29	18	12	5	9	1	7	4
22	34	35	8	6	3	0	3	1
23	27	23	9	11	2	1	5	4
24	17	10	11	6	11	1	4	1
25	27	27	15	10	--	0	13	5
Total	541	545	328	276	136	49	98	86

Table A3. Pounds of sablefish per skate for each strata, Phase I, October 1998.

Skate Number	Pounds of sablefish per skate for each set							
	600-800 fathom stratum				800-1000 fathom stratum			
	1	4	7	8	2	3	5	6
1	57.8	118.8	193.9	72.0	0.0	29.0	0.0	0.0
2	5.5	84.3	110.5	127.9	0.0	0.0	19.2	35.4
3	107.0	156.1	88.9	128.8	0.0	0.0	0.0	43.8
4	28.5	127.3	131.2	112.8	20.2	0.0	32.1	6.8
5	40.5	77.7	59.4	106.4	6.5	12.2	0.0	8.0
6	22.7	55.1	139.2	192.8	8.4	0.0	7.2	18.3
7	14.0	158.6	99.3	–	0.0	11.5	8.5	36.6
Total	276.0	777.9	822.4	740.7	35.1	52.7	67.0	148.9

Table A4. Number of sablefish per skate for each strata, Phase I, October 1998.

Skate Number	Number of sablefish per skate for each set							
	600-800 fathom stratum				800-1000 fathom stratum			
	1	4	7	8	2	3	5	6
1	5	14	33	12	0	3	0	0
2	1	12	19	21	0	0	2	4
3	9	19	15	21	0	0	0	4
4	3	16	21	21	2	0	3	1
5	4	10	10	16	1	1	0	1
6	2	6	22	32	1	0	1	2
7	2	20	16	–	0	1	1	4
Total	26	97	136	123	4	5	7	16

Table A5. Pounds of sablefish per pot, 200 fathom stratum, Phase II, May 1999.

Pot Number	Pounds of sablefish per pot for each set, 200 fathom stratum					
	1	2	3	4	5	6
1	82.3	315.0	99.9	116.3	189.7	156.9
2	97.7	196.1	263.7	79.4	158.9	193.1
3	149.8	180.2	132.7	161.3	159.6	109.2
4	149.4	163.1	143.5	69.1	94.1	146.8
5	190.4	161.9	242.9	99.1	77.9	166.7
6	246.0	176.5	184.3	100.9	161.9	178.5
7	128.1	72.9	165.1	128.4	96.9	150.5
8	255.6	181.2	214.3	91.9	49.5	139.8
9	166.3	108.3	346.3	104.6	83.4	137.4
10	159.4	199.0	187.9	125.5	177.3	80.0
11	162.6	169.8	245.5	80.5	142.4	98.3
12	158.6	136.2	306.9	49.8	148.5	137.8
13	143.0	103.6	170.9	63.1	79.6	109.0
14	135.3	218.9	281.4	74.1	120.4	68.9
15	260.0	193.3	250.7	100.6	83.1	124.8
16	143.1	188.6	141.4	69.8	113.5	92.0
17	131.3	150.3	193.4	54.9	129.5	164.9
18	156.2	123.6	153.2	140.7	148.1	60.4
19	131.1	160.4	231.1	127.3	115.0	120.9
20	185.9	133.2	154.3	57.7	160.9	134.6
21	126.1	159.3	174.8	89.5	166.8	141.9
22	172.8	154.8	157.5	46.8	177.8	31.0
23	157.2	56.4	230.9	138.6	148.0	112.7
24	195.4	190.7	164.0	100.7	196.4	116.2
25	252.8	266.7	343.0	214.7	251.6	182.9
Total	4136.4	4160	5179.6	2485.3	3430.8	3155.2

Table A6. Pounds of sablefish per pot, 400 fathom stratum, Phase II, May 1999.

Pot Number	Pounds of sablefish per pot for each set, 400 fathom stratum					
	7	8	9	10	11	12
1	81.1	136.8	226.9	97.6	128.8	105.3
2	131.8	74.4	115.9	67.8	126.3	111.7
3	126.5	131.4	100.7	124.5	177.4	150.1
4	114.3	109.9	140.5	131.2	93.6	195.8
5	72.1	130.7	85.2	165.3	96.3	165.9
6	87.5	89.5	167.4	189.5	136.2	136.4
7	92.0	188.2	121.6	120.8	121.9	82.0
8	65.8	77.5	105.4	150.1	96.8	98.0
9	92.8	53.6	72.7	98.6	87.5	95.8
10	97.9	116.2	139.6	163.8	67.1	61.4
11	87.3	190.2	122.6	153.4	84.3	186.2
12	102.0	92.1	123.8	138.9	67.0	135.4
13	99.2	110.2	87.4	132.6	78.3	121.5
14	198.0	106.8	100.2	141.2	66.2	136.3
15	117.4	135.7	107.2	102.4	47.4	102.2
16	81.3	99.0	68.9	59.3	99.3	106.9
17	116.0	54.1	86.3	88.3	37.4	156.8
18	78.7	143.0	89.6	74.9	71.8	130.9
19	134.3	151.6	86.4	100.9	128.5	176.9
20	100.4	101.4	95.2	82.8	109.6	90.3
21	137.3	112.4	97.6	167.8	76.3	130.2
22	90.8	32.9	85.0	151.9	63.5	82.9
23	93.9	182.3	148.4	104.2	79.6	88.6
24	97.8	118.5	73.4	96.6	95.0	134.4
25	83.0	245.9	141.2	267.5	95.6	138.6
Total	2579.2	2984.3	2789.1	3171.9	2331.7	3120.5

Table A7. Pounds of sablefish per pot, 600 fathom stratum, Phase II, May 1999. Set 99 is the alternate set made in substitute for set 14.

Pot	Pounds of sablefish per pot for each set, 600 fathom stratum					
Number	13	15	16	17	18	99
1	145.0	187.7	115.0	144.1	121.5	124.7
2	142.5	157.4	132.1	218.7	134.4	206.5
3	155.0	193.7	124.9	185.4	130.8	157.1
4	162.3	214.3	145.6	133.8	107.7	178.2
5	175.1	184.0	183.7	75.9	137.6	153.9
6	84.4	171.1	105.4	127.4	144.5	160.8
7	123.7	158.2	146.6	88.0	147.7	97.5
8	65.2	161.3	169.0	161.2	87.9	109.1
9	106.5	141.8	246.7	121.9	99.7	116.6
10	69.9	158.6	158.2	144.0	129.6	74.1
11	141.3	147.4	132.0	106.9	79.9	107.9
12	167.8	136.3	163.7	73.0	112.1	111.0
13	188.3	114.7	151.3	137.5	111.8	138.7
14	111.5	101.8	106.4	63.5	174.1	56.3
15	158.7	125.0	83.8	52.2	82.0	0.0
16	266.5	119.3	110.0	191.4	83.2	70.2
17	144.2	150.4	126.8	128.9	62.2	68.9
18	150.0	174.1	78.8	75.7	185.5	118.4
19	221.9	107.6	138.7	78.6	93.4	101.2
20	190.9	100.5	118.8	109.9	141.1	135.9
21	153.1	102.1	152.8	136.3	132.5	90.6
22	178.7	103.2	115.5	64.5	98.4	158.8
23	139.9	139.6	97.5	76.4	103.2	107.3
24	181.5	71.5	200.2	113.1	123.3	94.3
25	191.3	261.3	193.6	134.0	253.2	177.1
Total	3815.2	3682.9	3497.1	2942.3	3077.3	2915.1

Table A8. Number of sablefish per pot, 200 fathom stratum, Phase II, May 1999.

Pot	Number of sablefish per pot for each set, 200 fathom stratum					
Number	1	2	3	4	5	6
1	12	72	18	22	39	38
2	14	43	41	14	34	39
3	22	45	21	27	32	24
4	20	36	25	15	20	34
5	27	31	48	18	22	39
6	37	43	32	19	42	43
7	19	20	31	23	27	32
8	33	35	38	17	13	35
9	27	25	64	23	16	34
10	22	52	35	22	49	14
11	26	52	39	13	38	21
12	22	36	49	9	38	28
13	21	27	30	13	20	25
14	23	45	47	15	34	15
15	30	53	48	19	21	27
16	18	51	29	14	31	19
17	17	42	38	9	34	32
18	23	35	34	29	37	15
19	19	46	47	19	30	25
20	27	38	32	10	39	33
21	20	48	38	16	50	27
22	20	36	35	10	39	7
23	20	15	44	25	34	23
24	25	45	34	19	51	25
25	35	58	74	40	58	35
Total	579	1029	971	460	848	689

Table A9. Number of sablefish per pot, 400 fathom stratum, Phase II, May 1999.

Pot Number	Number of sablefish per pot for each set, 400 fathom stratum					
	7	8	9	10	11	12
1	16	38	46	29	34	23
2	32	22	22	18	32	30
3	34	35	24	36	44	36
4	30	28	36	40	25	51
5	19	35	22	50	25	40
6	24	24	44	52	34	38
7	18	52	34	33	31	22
8	19	22	27	39	26	29
9	21	14	19	27	25	26
10	26	35	39	48	19	17
11	25	51	35	45	23	46
12	28	28	32	36	21	37
13	26	29	25	36	22	34
14	51	27	29	41	17	33
15	33	36	32	30	15	22
16	22	28	15	16	30	28
17	31	13	24	24	12	45
18	21	40	22	23	22	39
19	33	43	24	30	38	47
20	21	28	25	25	29	23
21	37	32	25	52	21	32
22	27	9	25	43	18	20
23	26	51	37	28	17	22
24	27	31	20	28	24	30
25	20	64	37	74	28	35
Total	667	815	720	903	632	805

Table A10. Number of sablefish per pot, 600 fathom stratum, Phase II, May 1999. Set 99 is the alternate set made in substitute for set 14.

Pot	Number of sablefish per pot for each set, 600 fathom stratum					
Number	13	15	16	17	18	99
1	33	30	27	34	25	31
2	31	25	24	57	27	51
3	32	28	26	47	31	37
4	32	33	34	33	22	42
5	36	28	41	18	27	38
6	18	31	26	28	30	44
7	28	30	32	21	33	25
8	15	30	39	39	18	26
9	20	24	48	30	19	30
10	16	32	35	33	28	19
11	29	24	30	27	16	28
12	39	24	36	18	21	28
13	38	22	32	36	21	36
14	25	20	23	17	33	13
15	35	23	18	12	18	0
16	52	22	25	46	19	18
17	30	30	27	32	13	19
18	31	34	16	17	39	29
19	39	18	27	20	19	28
20	41	18	24	27	31	31
21	33	22	30	34	30	23
22	30	21	27	16	23	40
23	35	26	21	21	23	26
24	37	13	44	27	23	25
25	41	51	35	36	56	40
Total	796	659	747	726	645	727

Table A11. Pounds of sablefish per skate, 200 fathom stratum, Phase II, May 1999.

Skate Number	Pounds of sablefish per skate for each set, 200 fathom stratum					
	1	2	3	4	5	6
1	305.2	314.7	388.8	265.8	294.4	362.9
2	422.5	273.9	376.6	181.1	346.8	326.4
3	452.2	246.4	353.6	158.7	372.9	296.6
4	373.5	245.6	331.2	133.2	358	336.3
5	394.8	208.5	350.8	113	383.5	247.5
Total	1948.2	1289.1	1801	851.8	1755.6	1569.7

Table A12. Pounds of sablefish per skate, 400 fathom stratum, Phase II, May 1999.

Skate Number	Pounds of sablefish per skate for each set, 400 fathom stratum					
	7	8	9	10	11	12
1	118.4	80.7	64	83.9	124.6	112.8
2	151.1	117.9	115	102.8	124	68.4
3	138.6	68	99.9	78.6	244	93.4
4	78.2	76.1	85.3	75.3	205.7	119.8
5	88	102.9	69.9	134.7	133.8	76.7
Total	574.3	445.6	434.1	475.3	832.1	471.1

Table A13. Pounds of sablefish per skate, 600 fathom stratum, Phase II, May 1999.

Skate Number	Pounds of sablefish per skate for each set, 600 fathom stratum					
	13	14	15	16	17	18
1	18.9	72.2	119.7	95.1	85	83.6
2	26.5	69.7	145.7	80	43.9	48.4
3	59.1	24.7	55.2	58.5	96.4	87.1
4	28.8	32.8	111.1	65.6	98.9	107.7
5	4.8	36.7	64.3	53.1	74	85.9
Total	138.1	236.1	496	352.3	398.2	412.7

Table A14. Number of sablefish per skate, 200 fathom stratum, Phase II, May 1999.

Skate Number	Number of sablefish per skate for each set, 200 fathom stratum					
	1	2	3	4	5	6
1	57	98	92	72	78	91
2	74	86	91	62	95	91
3	80	83	95	53	99	80
4	73	71	79	39	85	89
5	72	49	84	37	91	74
Total	356	387	441	263	448	425

Table A15. Number of sablefish per skate, 400 fathom stratum, Phase II, May 1999.

Skate Number	Number of sablefish per skate for each set, 400 fathom stratum					
	7	8	9	10	11	12
1	29	21	15	23	32	31
2	40	32	32	27	36	19
3	42	19	27	20	60	27
4	23	19	23	21	50	29
5	22	28	18	36	34	20
Total	156	119	115	127	212	126

Table A16. Number of sablefish per skate, 600 fathom stratum, Phase II, May 1999.

Skate Number	Number of sablefish per skate for each set, 600 fathom stratum					
	13	14	15	16	17	18
1	4	15	23	20	20	19
2	4	17	31	19	10	11
3	9	6	14	15	23	19
4	6	7	25	16	25	25
5	1	7	15	13	18	19
Total	24	52	108	83	96	93

Table A17. Catch per pot for groundline A (Figure A1), 200 fathoms, Phase III, Sept. 1999.

(A200) Potcode	Spacing Treatment	All Pots Sablefish Count	All Pots Sablefish Weight	All Pots Average Weight	All Pots Total Weight	Halibut (condition)	Pots without halibut Average Weight	Pots without halibut Total Weight
A40E	end pot	13	65.0					
401	40 fathoms	8	62.2					
402	40 fathoms	6	32.9					
403	40 fathoms	7	50.2					
404	40 fathoms	11	64.1					
405	40 fathoms	16	95.1	60.90	304.5		60.90	304.5
40120	transition	10	59.7					
1201	120 fathoms	7	39.8					
1202	120 fathoms	6	36.8			1 (dead)		
1203	120 fathoms	18	113.7					
1204	120 fathoms	9	50.2			1 (dead)		
1205	120 fathoms	18	97.3	67.56	337.8		83.60	250.8
120100	transition	19	111.0			1 (dead)		
1001	100 fathoms	24	123.6					
1002	100 fathoms	11	79.0					
1003	100 fathoms	11	84.9					
1004	100 fathoms	15	78.9					
1005	100 fathoms	13	81.4	89.56	447.8		89.56	447.8
10080	transition	17	106.7					
801	80 fathoms	21	125.5					
802	80 fathoms	3	19.6			1 (dead)		
803	80 fathoms	7	40.1			1 (dead)		
804	80 fathoms	13	72.0					
805	80 fathoms	16	85.9	68.62	343.1		94.47	283.4
8060	transition	14	63.0			1 (dead)		
601	60 fathoms	14	87.8					
602	60 fathoms	16	83.0					
603	60 fathoms	11	78.5					
604	60 fathoms	7	50.7					
605	60 fathoms	10	70.1	74.02	370.1		74.02	370.1
A60E	endpot	17	91.6					

Table A18. Catch per pot for groundline B (Figure A2), 200 fathoms, Phase III, Sept. 1999.

(B200) Potcode	Spacing Treatment	All Pots: Sablefish Count	All Pots: Sablefish Weight	All Pots: Average Weight	All Pots: Total Weight	Halibut (condition)	Pots without halibut: Average Weight	Pots without halibut: Total Weight
B80E	end pot	13	66.3					
801	80 fathoms	21	91.8					
802	80 fathoms	9	37.1			1 (excellent)		
803	80 fathoms	23	108.7					
804	80 fathoms	15	72.0			1 (excellent)		
805	80 fathoms	8	42.1	70.34	351.7		80.87	242.6
80120	transition	24	97.4					
1201	120 fathoms	4	15.5					
1202	120 fathoms	9	52.1					
1203	120 fathoms	12	48.2					
1204	120 fathoms	13	84.6					
1205	120 fathoms	16	72.2	54.52	272.6		54.52	272.6
12040	transition	4	16.4			1 (excellent)		
401	40 fathoms	18	81.1					
402	40 fathoms	5	18.9			1 (excellent)		
403	40 fathoms	12	41.7					
404	40 fathoms	9	33.5					
405	40 fathoms	10	52.4	45.52	227.6		52.18	208.7
40100	transition	6	20.1					
1001	100 fathoms	10	38.0			1 (excellent)		
1002	100 fathoms	9	43.2					
1003	100 fathoms	18	75.8			1 (excellent)		
1004	100 fathoms	21	72.7					
1005	100 fathoms	10	46.0	55.14	275.7		53.97	161.9
10060	transition	10	42.1					
601	60 fathoms	14	63.1					
602	60 fathoms	12	55.3					
603	60 fathoms	17	79.7					
604	60 fathoms	18	86.6					
605	60 fathoms	16	58.9	68.72	343.6		64.86	324.3
B60E	end pot	8	30.9					

Table A19. Catch per pot for groundline C (Figure A3), 200 fathoms, Phase III, Sept. 1999.

(C200) Potcode	Spacing Treatment	All Pots: Sablefish Count	All Pots: Sablefish Weight	All Pots: Average Weight	All Pots: Total Weight	Halibut (condition)	Pots without halibut: Average Weight	Pots without halibut: Total Weight
C100E	end pot	25	114.8					
1001	100 fathoms	5	41.9			2 (dead)		
1002	100 fathoms	9	65.7			1 (poor)		
1003	100 fathoms	16	98.5			1 (excellent)		
1004	100 fathoms	35	206.2					
1005	100 fathoms	33	159.1	114.28	571.4		182.65	365.3
10060	transition	25	148.2			1 (excellent)		
601	60 fathoms	62	302.3					
602	60 fathoms	33	180.7					
603	60 fathoms	29	153.4					
604	60 fathoms	35	185.7					
605	60 fathoms	19	108.6	186.14	930.7	1 (excellent)	205.53	822.1
6080	transition	22	135.4					
801	80 fathoms	30	167.9					
802	80 fathoms	35	164.3					
803	80 fathoms	38	191.3			1 (excellent)		
804	80 fathoms	43	204.4					
805	80 fathoms	35	169.2	179.42	897.1	1 (excellent)	178.87	536.6
8040	transition	30	168.4					
401	40 fathoms	38	199.9					
402	40 fathoms	39	196.6					
403	40 fathoms	44	240.5					
404	40 fathoms	13	72.1					
405	40 fathoms	42	211.8	184.18	920.9		184.18	920.9
40120	transition	48	223.1					
1201	120 fathoms	61	322.8					
1202	120 fathoms	43	231.6					
1203	120 fathoms	49	219.5					
1204	120 fathoms	15	93.1			1 (excellent)		
1205	120 fathoms	41	251.5	223.70	1118.5		256.35	1025.4
C120E	end pot	32	181.2					

Table A20. Catch per pot for groundline A (Figure A1), 400 fathoms, Phase III, Sept. 1999.

Potcode (A400)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
A40E	end pot	36	193.0		
401	40 fathoms	39	181.4		
402	40 fathoms	49	245.8		
403	40 fathoms	25	123.3		
404	40 fathoms	44	208.9		
405	40 fathoms	45	218.9	195.66	978.3
40120	transition	23	114.6		
1201	120 fathoms	38	205.3		
1202	120 fathoms	31	145.0		
1203	120 fathoms	49	256.4		
1204	120 fathoms	36	175.8		
1205	120 fathoms	13	85.2	173.54	867.7
120100	transition	33	150.0		
1001	100 fathoms	27	157.0		
1002	100 fathoms	39	208.1		
1003	100 fathoms	33	178.3		
1004	100 fathoms	36	162.9		
1005	100 fathoms	47	228.1	186.88	934.4
10080	transition	18	83.8		
801	80 fathoms	46	223.3		
802	80 fathoms	32	169.2		
803	80 fathoms	36	192.8		
804	80 fathoms	46	198.8		
805	80 fathoms	57	237.3	204.28	1021.4
8060	transition	36	190.1		
601	60 fathoms	47	236.2		
602	60 fathoms	39	184.2		
603	60 fathoms	29	142.0		
604	60 fathoms	41	232.2		
605	60 fathoms	29	164.4	191.80	959
A60E	end pot	73	350.5		

Table A21. Catch per pot for groundline B (Figure A2), 400 fathoms, Phase III, Sept. 1999.

Pot code (B400)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
B80E	end pot	68	278.3		
801	80 fathoms	79	334.7		
802	80 fathoms	64	290.1		
803	80 fathoms	68	287.5		
804	80 fathoms	68	283.0		
805	80 fathoms	89	350.3	309.12	1545.6
80120	transition	71	277.1		
1201	120 fathoms	86	378.8		
1202	120 fathoms	61	261.5		
1203	120 fathoms	67	312.0		
1204	120 fathoms	89	372.1		
1205	120 fathoms	78	318.2	328.52	1642.6
12040	transition	69	304.2		
401	40 fathoms	66	279.7		
402	40 fathoms	66	313.2		
403	40 fathoms	60	277.3		
404	40 fathoms	53	218.8		
405	40 fathoms	53	226.7	263.14	1315.7
40100	transition	59	277.6		
1001	100 fathoms	47	208.9		
1002	100 fathoms	59	268.2		
1003	100 fathoms	60	270.1		
1004	100 fathoms	77	302.6		
1005	100 fathoms	62	274.3	264.82	1324.1
10060	transition	57	261.6		
601	60 fathoms	69	263.7		
602	60 fathoms	37	145.9		
603	60 fathoms	42	183.9		
604	60 fathoms	58	227.4		
605	60 fathoms	57	250.0	214.18	1070.9
B60E	end pot	64	254.3		

Table A22. Catch per pot for groundline C (Figure A3), 400 fathoms, Phase III, Sept. 1999.

Pot code (C400)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
C100E	end pot	26	145.9		
1001	100 fathoms	22	140.6		
1002	100 fathoms	24	131.6		
1003	100 fathoms	33	187.3		
1004	100 fathoms	22	119.0		
1005	100 fathoms	8	43.2	124.34	621.7
10060	transition	29	170.0		
601	60 fathoms	28	153.4		
602	60 fathoms	16	111.1		
603	60 fathoms	18	101.9		
604	60 fathoms	15	86.3		
605	60 fathoms	35	174.1	125.36	626.8
6080	transition	26	152.1		
801	80 fathoms	27	125.7		
802	80 fathoms	19	107.3		
803	80 fathoms	47	218.6		
804	80 fathoms	23	139.4		
805	80 fathoms	27	134.8	145.16	725.8
8040	transition	17	93.0		
401	40 fathoms	38	210.4		
402	40 fathoms	37	171.6		
403	40 fathoms	29	157.7		
404	40 fathoms	32	160.9		
405	40 fathoms	19	101.7	160.46	802.3
40120	transition	33	191.5		
1201	120 fathoms	28	143.6		
1202	120 fathoms	34	192.5		
1203	120 fathoms	38	194.7		
1204	120 fathoms	21	103.6		
1205	120 fathoms	13	56.6	138.20	691
C120E	end pot	26	148.4		

Table A23. Catch per pot for groundline A (Figure A1), 600 fathoms, Phase III, Sept. 1999.

Pot code (A600)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
A40E	end pot	21	121.0		
401	40 fathoms	21	125.8		
402	40 fathoms	31	176.1		
403	40 fathoms	24	161.2		
404	40 fathoms	26	142.2		
405	40 fathoms	35	214.8	164.02	820.1
40120	transition	32	197.7		
1201	120 fathoms	49	286.7		
1202	120 fathoms	25	145.6		
1203	120 fathoms	45	255.4		
1204	120 fathoms	27	168.8		
1205	120 fathoms	36	241.8	219.66	1098.3
120100	transition	39	198.5		
1001	100 fathoms	31	171.0		
1002	100 fathoms	44	245.4		
1003	100 fathoms	39	182.4		
1004	100 fathoms	53	236.2		
1005	100 fathoms	56	245.4	216.08	1080.4
10080	transition	33	153.8		
801	80 fathoms	40	165.5		
802	80 fathoms	39	181.2		
803	80 fathoms	38	203.3		
804	80 fathoms	65	330.6		
805	80 fathoms	57	238.5	223.82	1119.1
8060	transition	37	188.6		
601	60 fathoms	39	177.8		
602	60 fathoms	57	240.9		
603	60 fathoms	25	132.3		
604	60 fathoms	57	292.9		
605	60 fathoms	28	142.8	197.34	986.7
A60E	end pot	36	166.0		

Table A24. Catch per pot for groundline B (Figure A2), 600 fathoms, Phase III, Sept. 1999.

Pot code (B600)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
B80E	end pot	38	221.2		
801	80 fathoms	25	131.1		
802	80 fathoms	50	285.2		
803	80 fathoms	32	188.2		
804	80 fathoms	34	203.8		
805	80 fathoms	34	175.2	196.70	983.5
80120	transition	50	285.2		
1201	120 fathoms	38	231.7		
1202	120 fathoms	25	133.2		
1203	120 fathoms	54	306.3		
1204	120 fathoms	43	235.3		
1205	120 fathoms	40	236.4	228.58	1142.9
12040	transition	28	143.5		
401	40 fathoms	46	239.7		
402	40 fathoms	24	122.7		
403	40 fathoms	38	201.9		
404	40 fathoms	22	103.1		
405	40 fathoms	30	149.0	163.28	816.4
40100	transition	28	154.4		
1001	100 fathoms	43	222.0		
1002	100 fathoms	22	115.0		
1003	100 fathoms	43	218.7		
1004	100 fathoms	39	204.5		
1005	100 fathoms	39	203.3	192.70	963.5
10060	transition	18	101.2		
601	60 fathoms	33	191.1		
602	60 fathoms	18	99.9		
603	60 fathoms	34	171.5		
604	60 fathoms	20	103.4		
605	60 fathoms	39	202.3	153.64	768.2
B60E	end pot	39	224.8		

Table A25. Catch per pot for groundline C Figure A3), 600 fathoms, Phase III, Sept. 1999.

Pot code (B600)	Spacing Treatment	Sablefish Count	Sablefish Weight	Average Weight	Total Weight
C100E	end pot	29	135.9		
1001	100 fathoms	39	187.3		
1002	100 fathoms	32	165.6		
1003	100 fathoms	23	156.1		
1004	100 fathoms	30	143.5		
1005	100 fathoms	45	209.4	172.38	861.9
10060	transition	50	246.6		
601	60 fathoms	40	208.7		
602	60 fathoms	37	182.7		
603	60 fathoms	31	174.3		
604	60 fathoms	23	124.3		
605	60 fathoms	24	119.0	161.80	809
6080	transition	49	236.3		
801	80 fathoms	55	263.5		
802	80 fathoms	39	206.9		
803	80 fathoms	53	245.9		
804	80 fathoms	31	152.2		
805	80 fathoms	44	203.6	214.42	1072.1
8040	transition	38	175.0		
401	40 fathoms	26	128.8		
402	40 fathoms	35	154.9		
403	40 fathoms	31	141.7		
404	40 fathoms	44	237.1		
405	40 fathoms	32	155.7	163.64	818.2
40120	transition	32	154.6		
1201	120 fathoms	31	147.2		
1202	120 fathoms	49	237.4		
1203	120 fathoms	33	157.8		
1204	120 fathoms	31	168.8		
1205	120 fathoms	36	173.3	176.90	884.5
C120E	end pot	70	343.5		

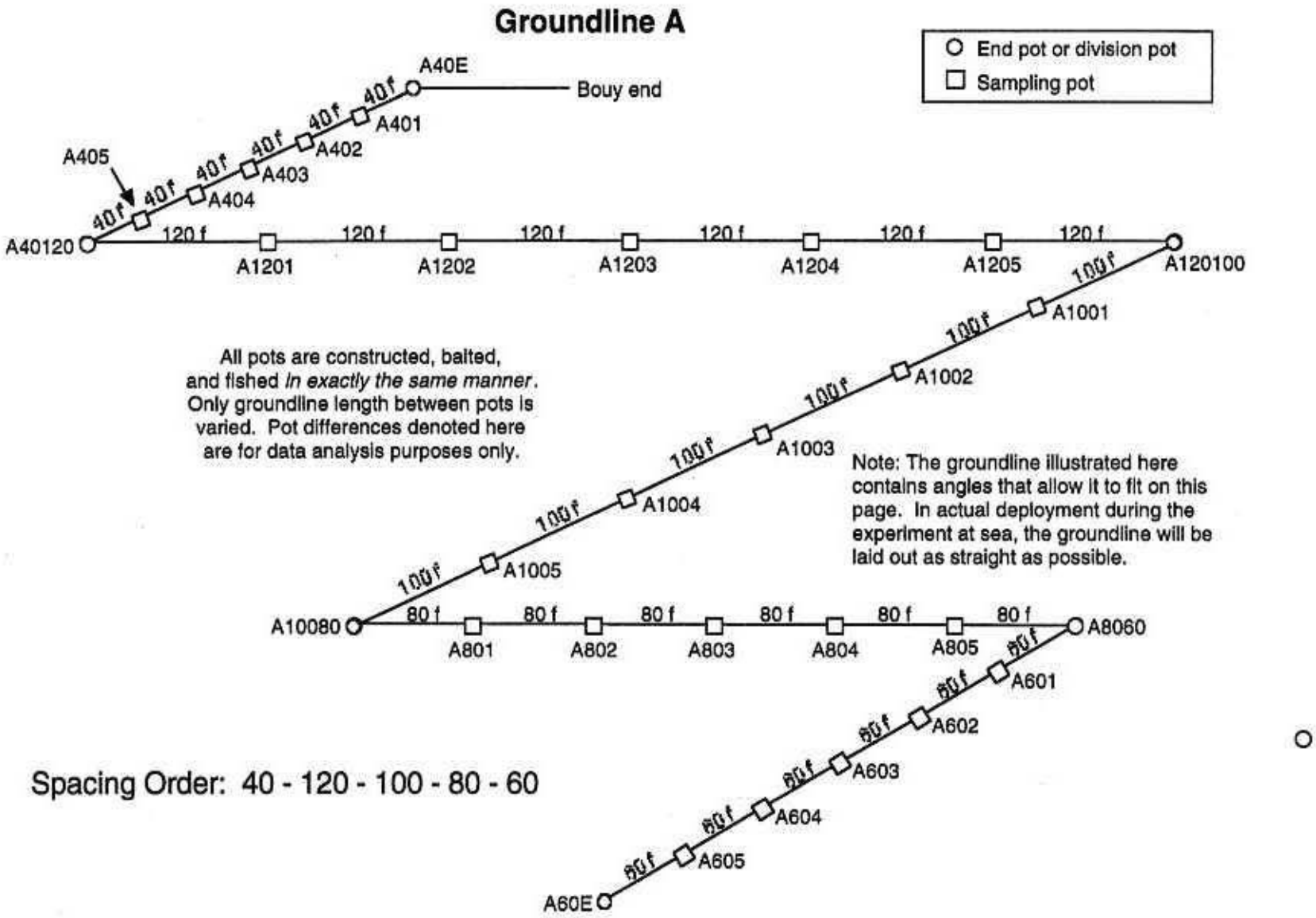

Figure A1. Diagram showing spacing treatment arrangement along Groundline A.

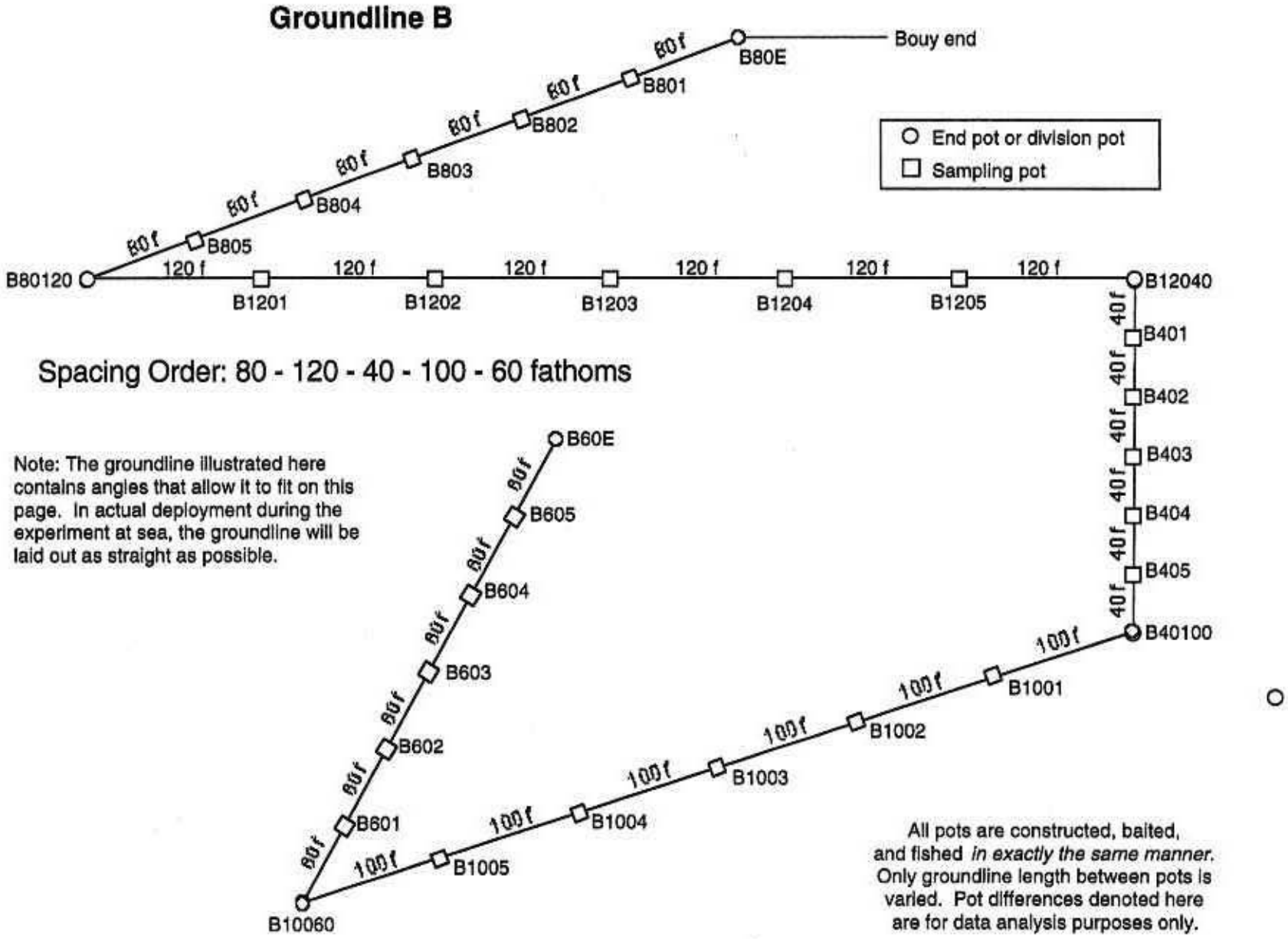

Figure A2. Diagram showing spacing treatment arrangement along Groundline B.

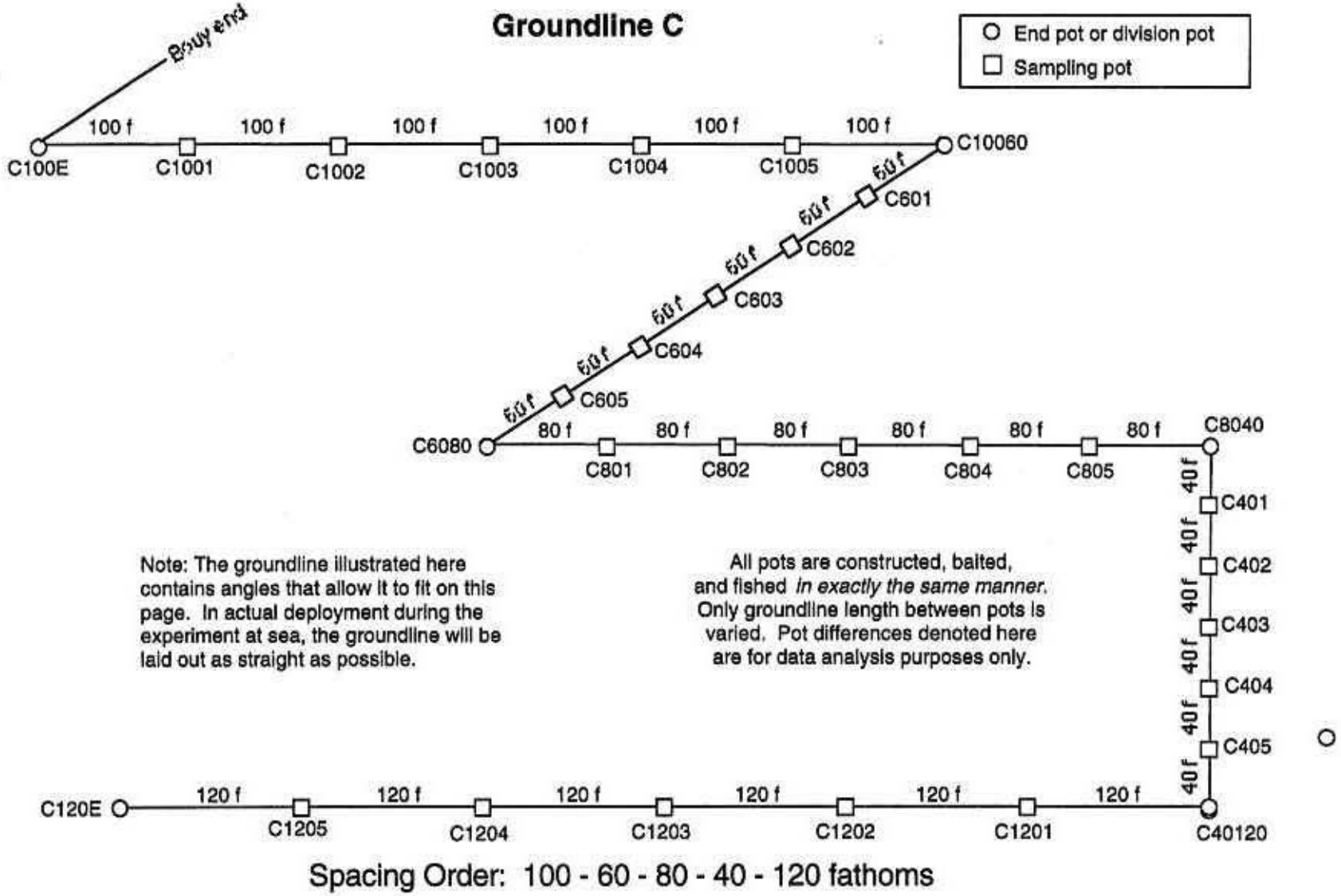

Figure A3. Diagram showing spacing treatment arrangement along Groundline C.