



**Northwest and  
Alaska Fisheries  
Center**

**National Marine  
Fisheries Service**

**U.S. DEPARTMENT OF COMMERCE**

**NWAFRC PROCESSED REPORT 86-04**

**DATA REPORT:  
An Update of Sablefish Tagging  
Studies in Waters  
off the Coasts of Washington,  
Oregon and California,  
through 1984**

**February 1986**

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DATA REPORT: An Update of Sablefish Tagging Studies  
in Waters off the Coasts of Washington, Oregon,  
and California, through 1984

by

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## INTRODUCTION

The sablefish, Anoplopoma fimbria, is an important commercial species inhabiting waters adjacent to the north Pacific rim from Baja California to the Bering Sea and south again to Japan. Eggs and adults are found at depths greater than 150 m. Larvae and young juveniles (less than 1 year) occur near the surface, usually offshore. Juveniles from 2 to 3 years old move to inshore nursery areas, often to bays and inlets, and eventually disperse over the continental shelf and down the continental slope by the time they reach 3 or 4 years of age (Sasaki 1985). The sablefish has been the subject of major foreign and domestic fisheries for many years throughout the U.S. Fishery Conservation Zone and recently has been managed under the auspices of both the Pacific and North Pacific Fishery Management Councils.

Greater fishing effort and higher annual catches have increased the need for information on sablefish production, behavior, and biology. Since 1979 the National Marine Fisheries Service's Northwest and Alaska Fisheries Center (NWAFRC) has conducted annual sablefish abundance index surveys off the coasts of Washington, Oregon, and California. Primary objectives are to monitor changes in relative abundance and biological parameters. Migration, discreteness of stocks, and growth are also studied through a tagging program. Since 1983 emphasis has been placed on the tagging of juvenile sablefish (less than 40 cm) to examine their movements and recruitment patterns.

A number of tagging studies have focused on migrational behavior, some reporting dramatic migrations and tendencies to move in particular patterns (Homberg and Jones 1954; Pruter 1959; Novikov 1968; Phillips 1969; Sasaki 1979; Beamish et al. 1980; Bracken 1982; Dark 1983; Wespestad et al. 1983). This is the second report summarizing the results of the NWAFC sablefish tagging program in the Washington to California region. General background and results of the 1979-83 work were published in "Results of Sablefish Tagging in Waters off the Coast of Washington, Oregon and California, 1979-83" (Shaw 1984). The purpose of this report is to present tag release and recovery information for 1984 and to summarize information on direction of movements using 1979-84 data.

#### METHODS

In 1984 young sablefish were tagged and released during a bottom trawl survey of the upper continental slope groundfish resources. This was conducted between 4 September and 14 October from lat. 43°05' (Coquile Point, Oregon) to long. 46°00' (Tillamook Head, Oregon) between the depths of 110 and 914 m (60 and 500 fathoms). Sablefish were not tagged during the 1984 abundance indexing survey off California and southern Oregon because juveniles are not normally captured by the trap gear utilized.

Sablefish were routinely put into "live" tanks supplied with fresh running sea water immediately after the catch was brought aboard. Anesthetic was not used. Usually within 15 minutes of



the completion of each haul all viable sablefish were measured and those less than 40 cm were tagged in a padded tagging cradle and released. Each fish was marked with a single Floy<sup>1</sup> anchor tag implanted just below the first dorsal fin.

A recovery program was promoted through the use of posters, news releases, and letters explaining the research and enlisting the cooperation of those who may encounter tagged sablefish, particularly fishermen and processors. Individuals finding a tagged fish were requested to return the tag with information about the date, location, method and depth of capture, and fish length. A \$2.00 reward and the release history of the tagged fish was provided to those returning tags. As of 1 January 1986 the reward was raised to \$5.00 for tag returns meeting minimum information requirements.

## RESULTS

### Releases

A total of 18,530 sablefish were released from 1979 to 1984 in areas off the Washington-California coast. Releases are summarized by year and International North Pacific Fishery Commission (INPFC) statistical areas in Table 1. INPFC statistical areas are presented in Figure 1. In 1984, 44 sablefish were released in the Columbia INPFC area between Coquille Point and Tillamook Head, Oregon, at depths ranging from 110 to 914 m (60 to 500 fathoms) (Fig. 1). This low number reflects the relatively low abundance of sablefish less than 40 cm in catches and the difficulty

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<sup>1</sup>Reference to trade name does not imply endorsement by the National Marine Fisheries Service, NOAA.

Table 1.--Number of tagged sablefish released by year and International North Pacific Fisheries Commission (INPFC) Statistical Area.

Year	INPFC Area					Total
	Vancouver	Columbia	Eureka	Monterey	Conception	
1979	802	915	--	--	--	1,717
1980	902	2,203	--	647	6,456	10,208
1981	494	1,842	--	--	800	3,136
1982	--	--	--	763	475	1,238
1983	132	1,260	618	177	--	2,187
1984	--	44	--	--	--	44
Total	2,330	6,264	618	1,587	7,731	18,530

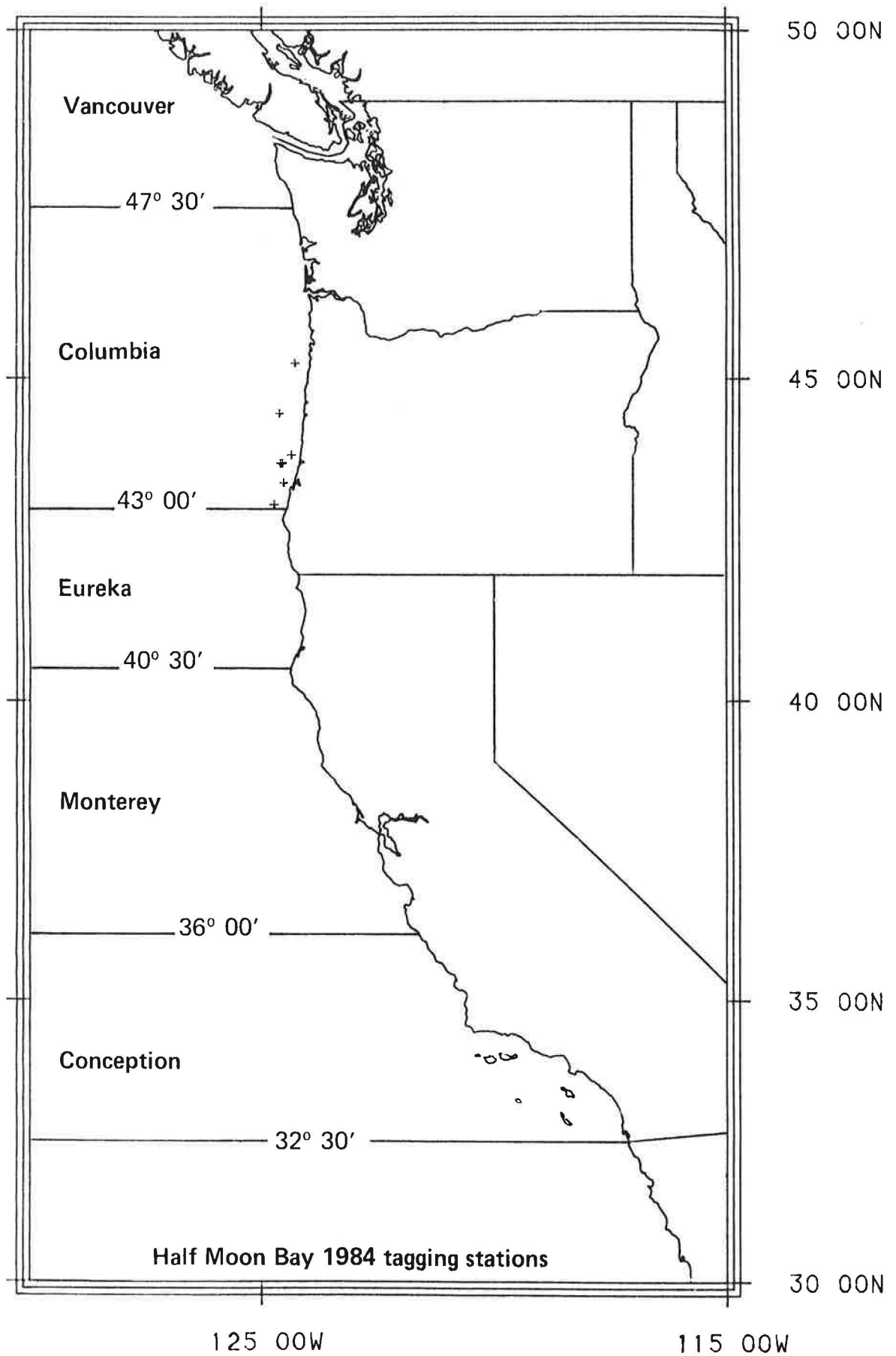


Figure 1.--Locations where tagged sablefish were released during the 1984 west coast upper continental slope groundfish survey.

capturing small fish which are in a physical condition suitable for tagging. A length composition for tagged sablefish released in 1984 is presented in Figure 2. The left and right modes are comprised of 0+ and 1+ year olds, respectively (Boehlert and Yoklavich 1985).

#### Recoveries

As of 31 December 1984, 1,177 sablefish tags were returned from the 18,530 sablefish tagged and released during 1979 to 1984 for an overall recovery rate of 6.4%. Of those, 135 or about 0.7% were recovered in 1984. A summary of 1984 recoveries by release area and year is given in Table 2. Recoveries made in 1984 occurred from the Bering Sea to Southern California (Figs. 3-9). No recoveries were made in Mexican waters south of the Conception area where sablefish fisheries are small and attempts to establish a recovery program have been limited.

#### Movement Distances

Travel distances for all sablefish recovered in 1984 are presented in Table 3. Since the distances between release and recovery points were determined by the great circle method without regard for depths or land masses in between, they should be considered as minimum distances of travel. Forty-five percent of the tagged sablefish recovered in 1984 were recaptured within 50 nautical miles (nmi) of the release site and 16% were recovered at distances greater than 500 nmi. These results indicate more mobility than was reported for 1979-83 when 70% migrated less than 50 nmi and 6.6% over 500 nmi (Shaw 1984).

Mean length = 33.6 Total number = 44

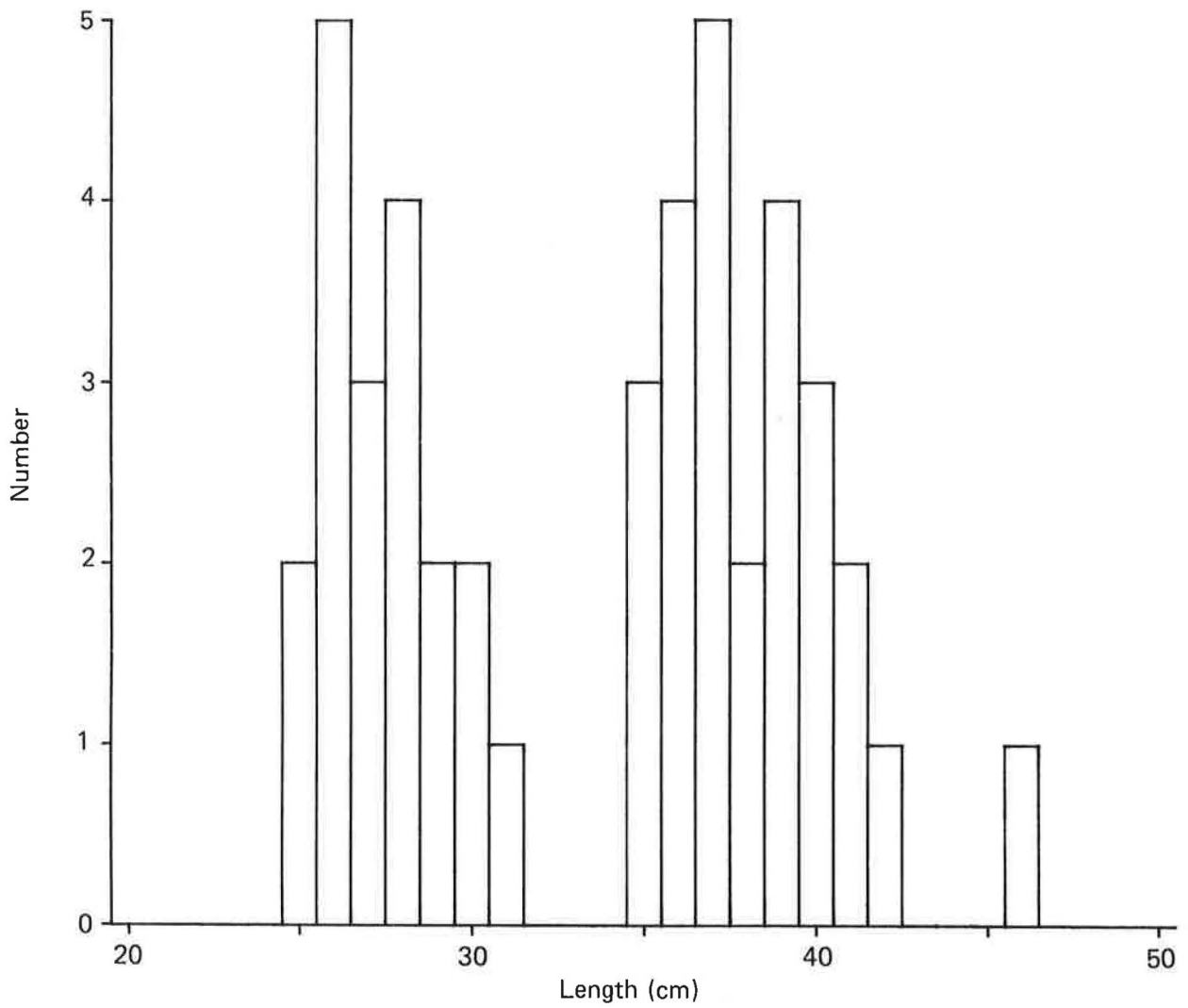


Figure 2.--Length-frequencies of sablefish tagged during the 1984 west coast upper continental slope groundfish survey.

Table 2.--Total releases and 1984 recoveries of tagged sablefish by year and International North Pacific Fisheries Commission statistical area.

Releases		1984 Recoveries						
		North of Vancouver	Vancouver	Columbia	Eureka	Monterey	South of Conception	
Vancouver	- 2,330	--	10	1	1	--	--	--
1979	- 802	--	--	--	1	--	--	--
1980	- 902	--	6	--	--	--	--	--
1981	- 494	--	3	--	--	--	--	--
1983	- 132	--	1	1	--	--	--	--
Columbia	- 6,264	6	1	43	6	1	--	--
1979	- 915	1	--	7	1	--	--	--
1980	- 2,203	2	--	15	1	--	--	--
1981	- 1,842	3	--	8	3	1	--	--
1983	- 1,260	--	1	13	1	--	--	--
1984	- 44	--	--	--	--	--	--	--
Eureka	- 618	1	1	2	11	2	--	--
1983	- 618	1	1	2	11	2	--	--
Monterey	- 1,587	2	1	1	9	10	--	--
1980	- 647	1	--	--	2	3	--	--
1982	- 763	1	1	1	6	6	--	--
1983	- 177	--	--	--	1	1	--	--
Conception	- 7,731	4	2	2	2	15	1	--
1980	- 6,456	4	1	2	1	14	1	--
1981	- 800	--	1	--	1	1	--	--
1982	- 475	--	--	--	--	--	--	--
All Areas	-18,530	13	15	49	29	28	1	--
1979	- 1,717	1	--	7	2	--	--	--
1980	-10,208	7	7	17	4	17	1	--
1981	- 3,136	3	4	8	4	2	--	--
1982	- 1,238	1	1	1	6	6	--	--
1983	- 2,187	1	3	16	13	3	--	--
1984	- 44	--	--	--	--	--	--	--

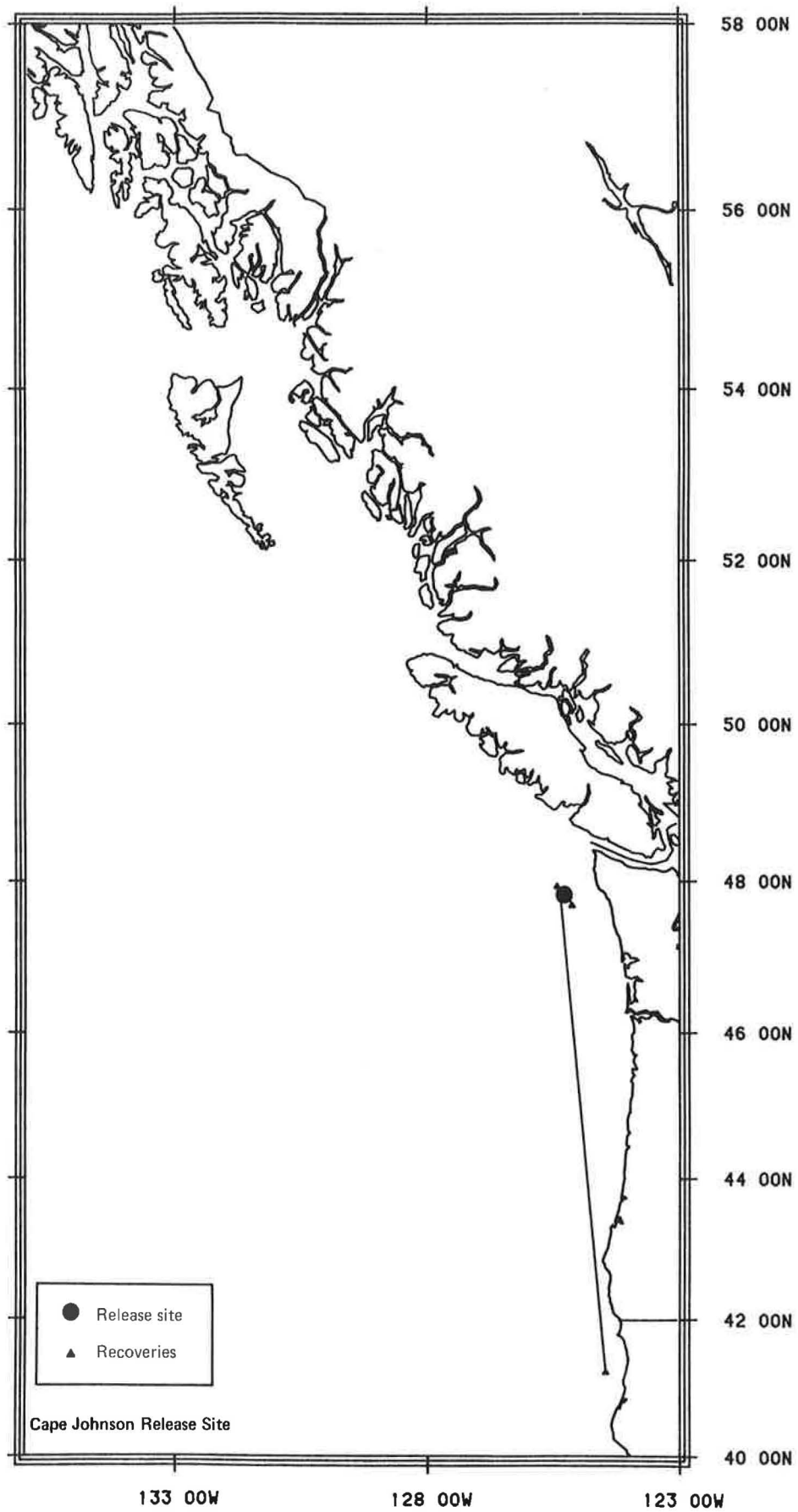


Figure 3.--Distribution of recoveries from sablefish tagged at the Cape Johnson release site and recovered in 1984.

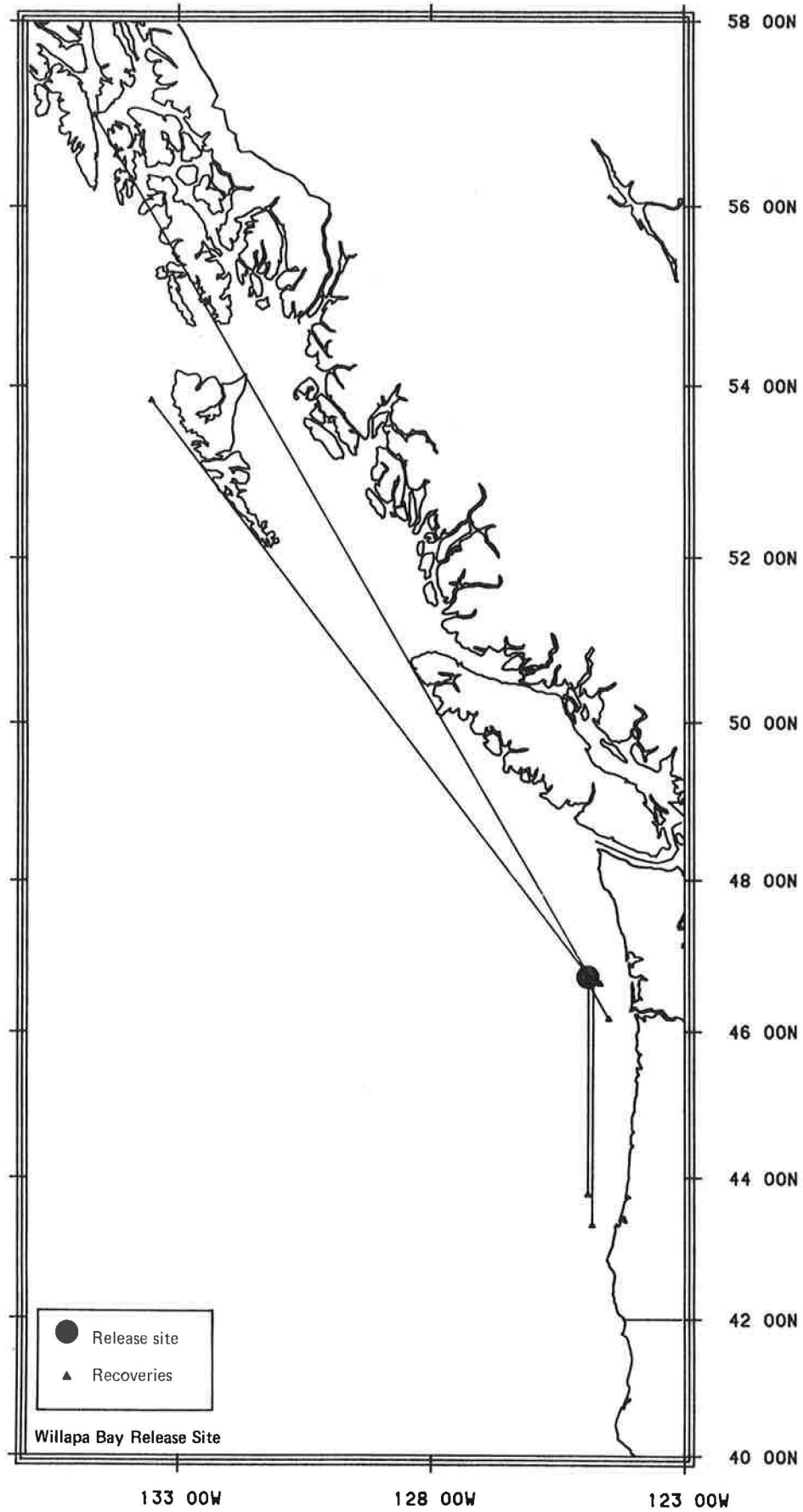


Figure 4.--Distribution of recoveries from sablefish tagged at the Willapa Bay release site and recovered in 1984.



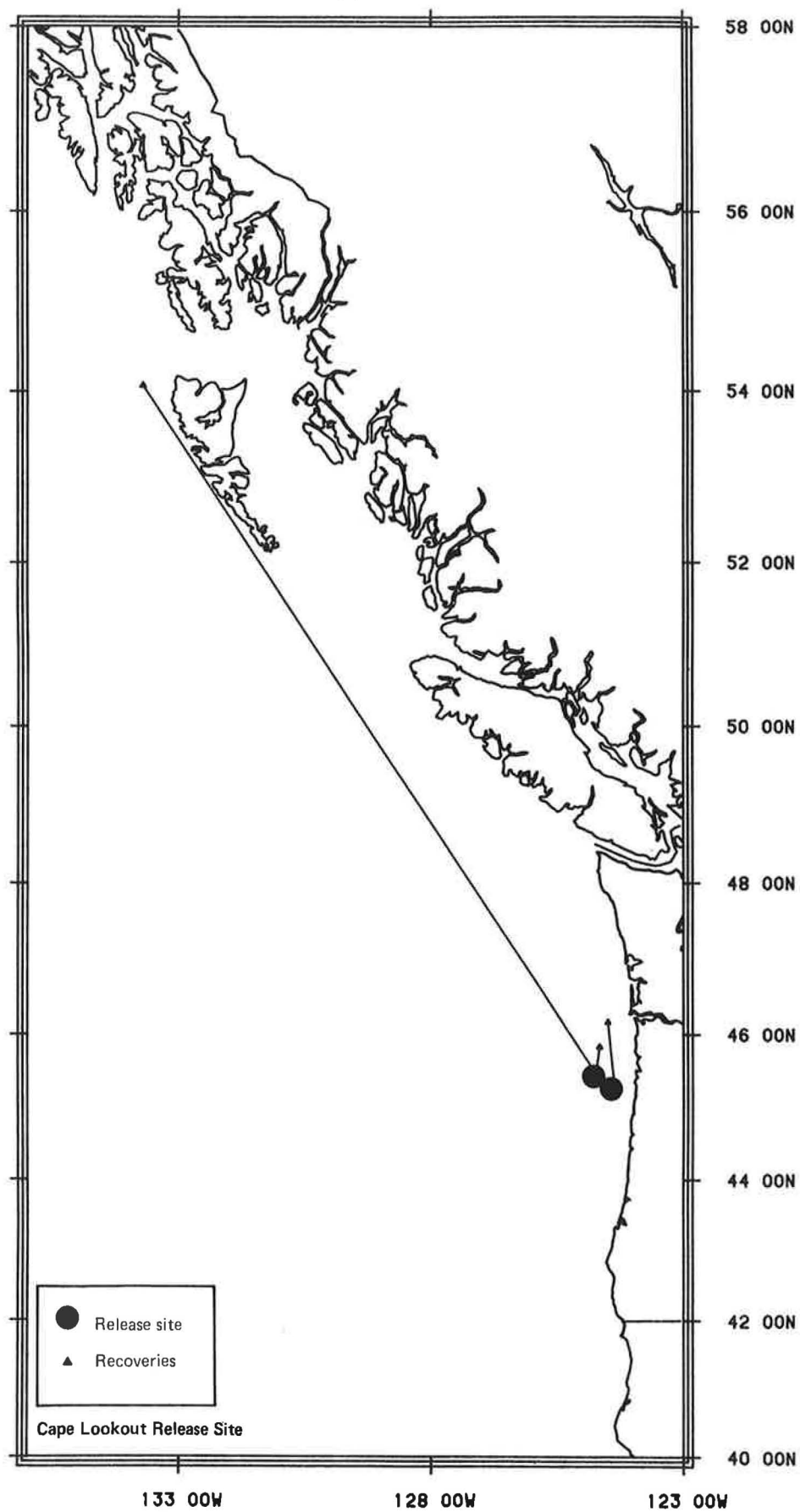


Figure 5.--Distribution of recoveries from sablefish tagged at the Cape Lookout release site and recovered in 1984.

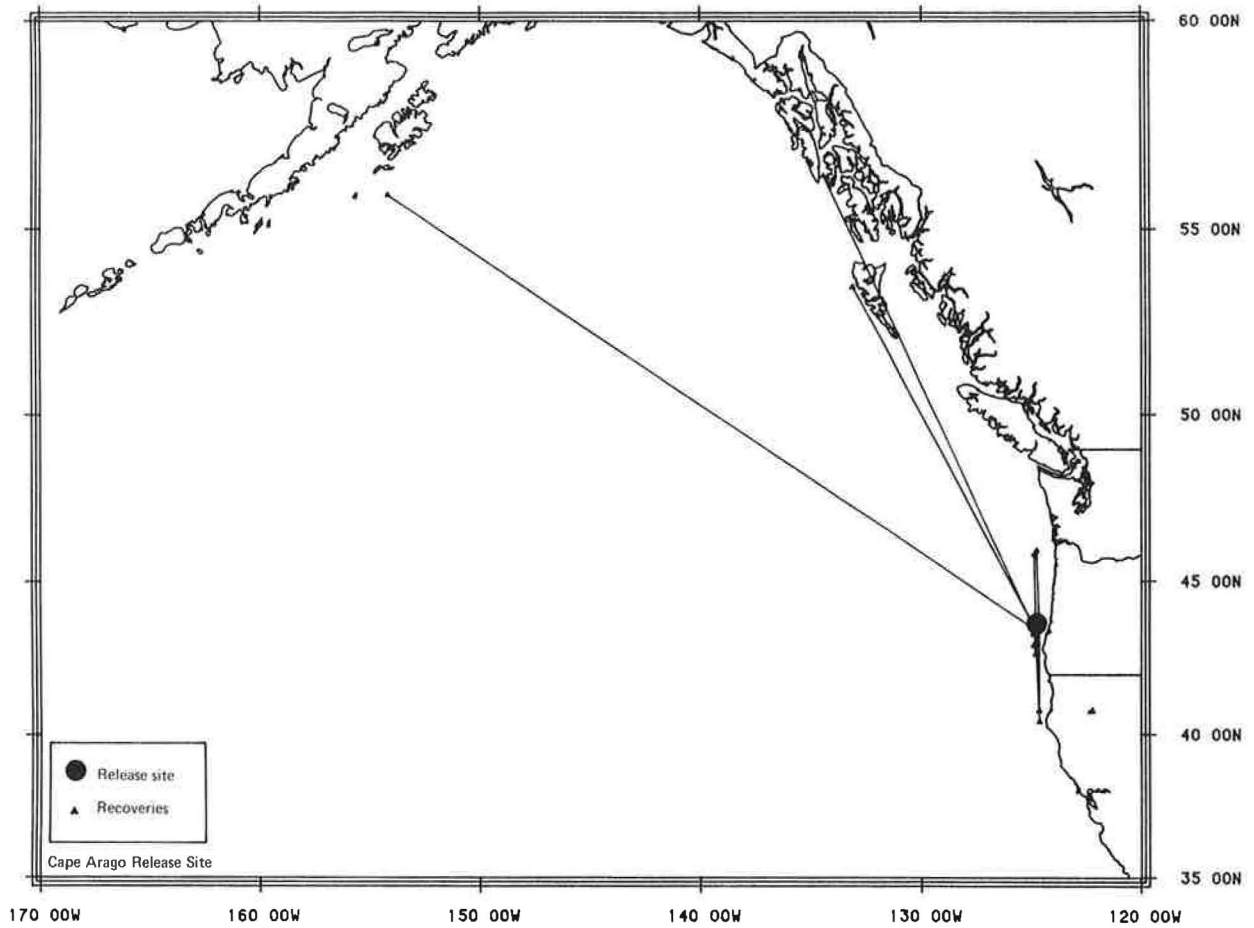


Figure 6.--Distribution of recoveries from sablefish tagged at the Cape Arago release site and recovered in 1984.

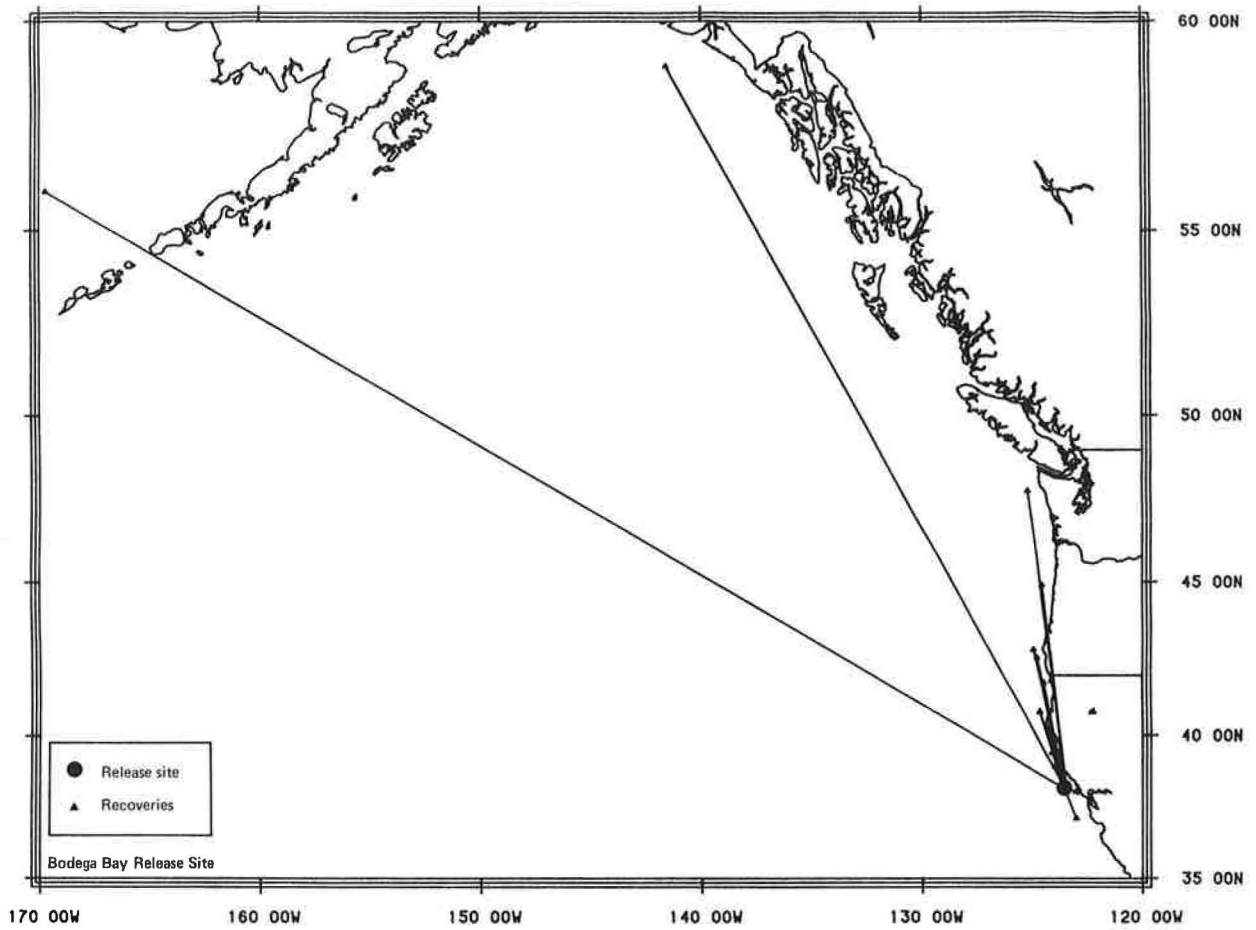


Figure 7.--Distribution of recoveries from sablefish tagged at the Bodega Bay release site and recovered in 1984.

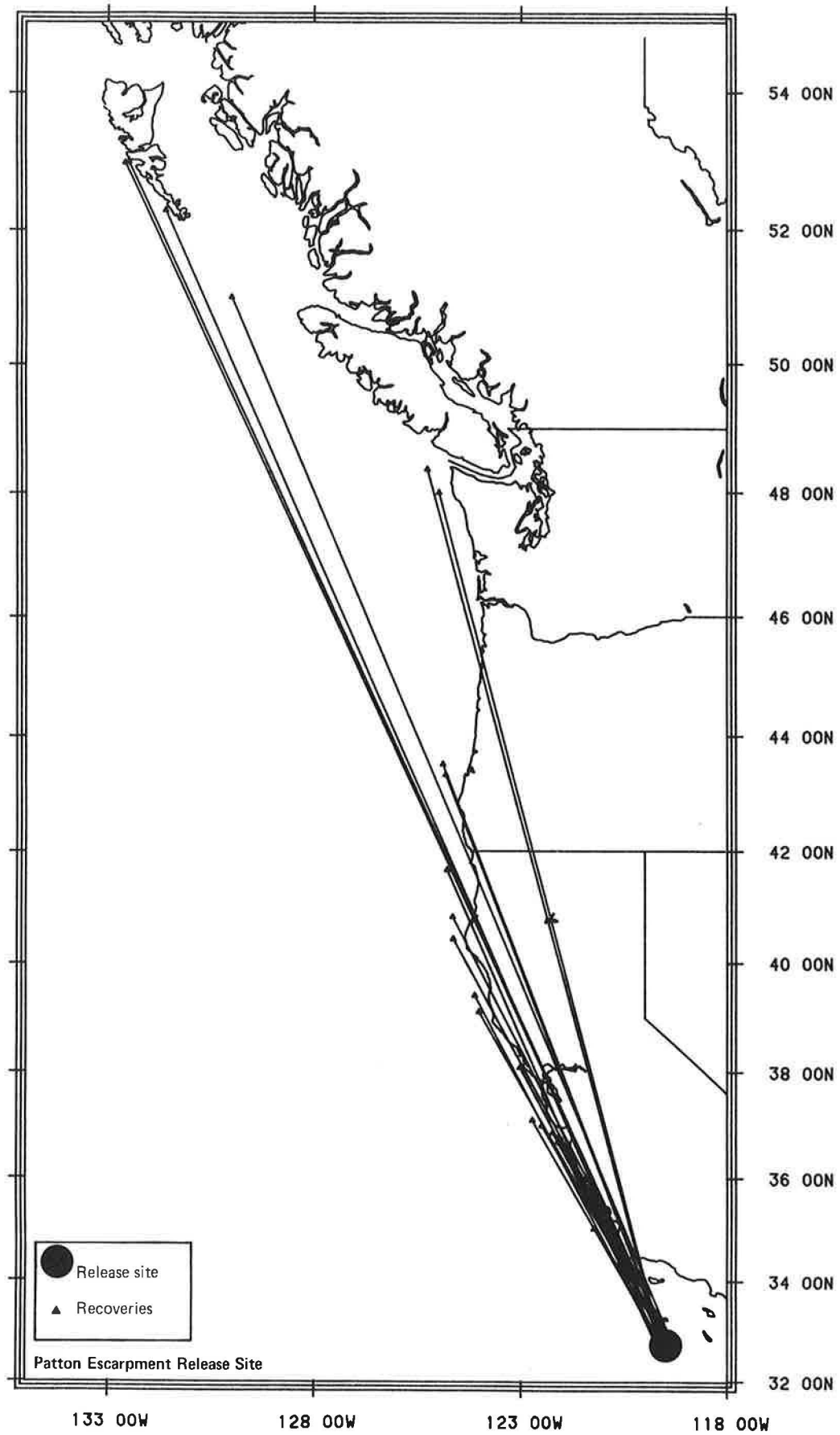


Figure 8.--Distribution of recoveries from sablefish tagged at the Patten Escarpment release site and recovered in 1984.

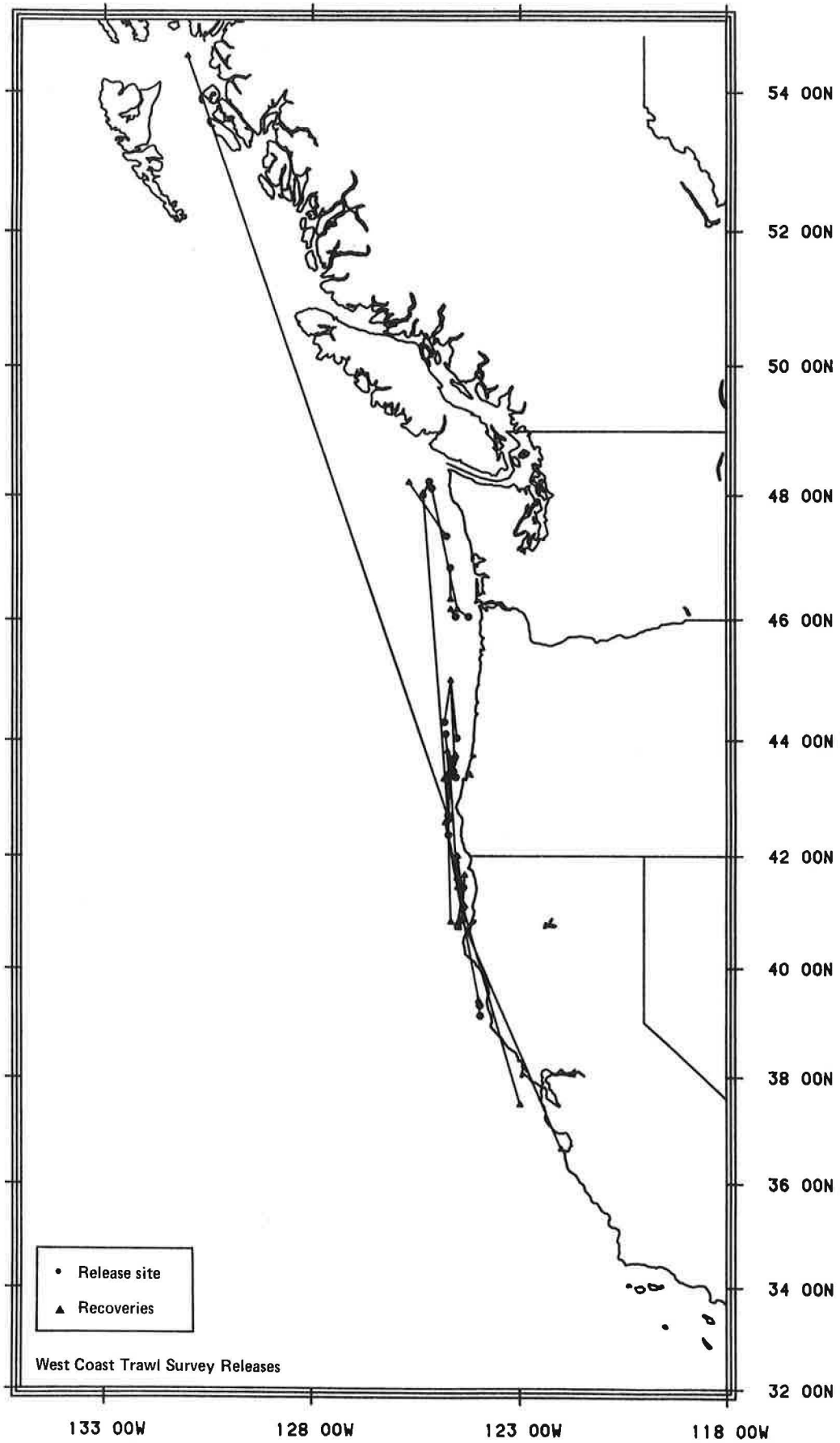


Figure 9.--Distribution of recoveries from sablefish tagged during the 1983 west coast whiting/rockfish trawl survey and recovered in 1984.

Table 3.--Distances (nmi) traveled by sablefish released during 1979-84 and recaptured in 1984.

INPFC area of release	Distance between release and recovery sites (nmi)					
	<25	25-50	51-100	101-500	501-1000	>1000
	-----Percentage of recovered fish-----					
Vancouver	83.3	--	--	16.7	--	--
Columbia	54.4	15.8	7.0	12.3	8.8	1.8
Eureka	17.6	29.4	23.5	23.5	5.9	--
Monterey	13.0	--	26.1	47.8	4.3	8.7
Conception	--	--	--	57.7	26.9	15.4
All Areas	34.8	10.4	10.4	28.9	10.4	5.2

Other authors have also reported a preponderance of short distance movements. Dark (1983) reported that 59% moved less than 50 nmi and Wespestad et al. (1983) reported that 65% moved less than 100 km. A likely cause for the apparent increase in movement is a redistribution of fishing effort away from southern California. This reduction of effort is due to a poor market for small sablefish which make up a very high percentage of the population south of Point Conception. A significant change in fishing effort off southern California would have a profound effect on the study results since three times as many fish were released at the index site in the Conception area as at any other single location.

The Vancouver area had both the highest percentage (83.3) of tagged sablefish exhibiting a sedentary behavior (i.e. movements less than 25 nmi) (Table 2) and the highest percentage (83.3) of fish that were recovered within the INPFC area of release (Tables 4 and 5). The Conception area, despite its large size, had both the lowest percentage (0.0) that migrated less than 25 nmi and the lowest percentage (3.8) that remained within the area. Sablefish released in the Conception area produced the highest percentage (15.4) of long range movements greater than 1000 nmi. There were no reports of such long migrations from the Vancouver and Eureka areas. In the earlier report (Shaw 1984) the Conception area displayed the highest rate (65.1%) of movement less than 25 nmi, and the Vancouver area the highest percentage (4.0) of fish which migrated more than 1000 nmi. The apparent change in behavior suggested by the 1984 data may be an artifact of redistributed fishing effort or changes in reporting rates

Table 4.--International North Pacific Fisheries Commission (INPFC) statistical areas of recovery and release for tagged sablefish recovered in 1984.

INPFC area of release	INPFC area of recovery						
	North of Vancouver	Vancouver	Columbia	Eureka	Monterey	Conception	South of Conception
-----Percentage of recovered fish-----							
Vancouver	--	83.3	8.3	8.3	--	--	--
Columbia	10.5	1.8	75.4	10.5	1.8	--	--
Eureka	5.9	5.9	11.8	64.7	11.8	--	--
Monterey	8.7	4.3	4.3	39.1	43.5	--	--
Conception	15.4	7.7	7.7	7.7	57.7	3.8	--

Table 5.--Percentage of tagged sablefish taken within and outside the International North Pacific Fisheries Commission (INPFC) statistical area of release during 1984.

INPFC area of release	North of release area	Area of release	South of release area
-----Percentage-----			
Vancouver	--	83.3	16.7
Columbia	12.3	75.4	12.3
Eureka	23.5	64.7	11.8
Monterey	56.5	43.5	--
Conception	96.2	3.8	--

Table 6.--Domestic landings of sablefish by International North Pacific Fisheries Commission (INPFC) statistical areas (1981-84).

INPFC Areas	Landed Catch (metric tons)			
	1981	1982	1983	1984
Vancouver	1,096	2,420	2,550	3,626
Columbia	3,542	6,308	4,999	4,798
Eureka	2,447	3,789	2,118	2,357
Monterey	3,770	5,083	2,526	2,220
Conception	550	946	1,923	1,070



among INPFC areas. For example, there was a 42% increase in landings in the Vancouver area and a 44% decrease in landings in the Conception area between 1983 and 1984 (Table 6). In 1983 over 200 tags were recovered by one vessel fishing very close to the only release site (Patten Escarpment) in the Conception area. No evidence was found for any change in the reporting rates. In any event, the 1984 data indicate that some fish in the Conception area do move northward for considerable distances.

General lack of movement does not seem to be a function of short periods of liberty (Dark 1983). Sablefish tagged and released from 1983 trawl catches have demonstrated some long distance movements in spite of the fact that they were at liberty only 1-1/2 years or less (Fig. 9).

#### Direction of Movement

Some authors have reported different movement patterns which seem to be associated with fish-length (Bracken 1982; Dark 1983). Therefore, the recovery data from the present study was analyzed by length groups. In order to enhance the sample size for a preliminary assessment of size-related movement, recoveries from 1979 to 1984 and from all INPFC areas were combined. Distance traveled and direction of travel by 2-cm size groups at release are summarized in Figures 10 and 11. It appears that movements may differ according to three size groups approximating juvenile fish (less than 50 cm), fish in transition (50 to 65 cm), and mature fish (greater than 65 cm) (Parks and Shaw 1983). Direction of movement was categorized as "north," "south," and "no movement"

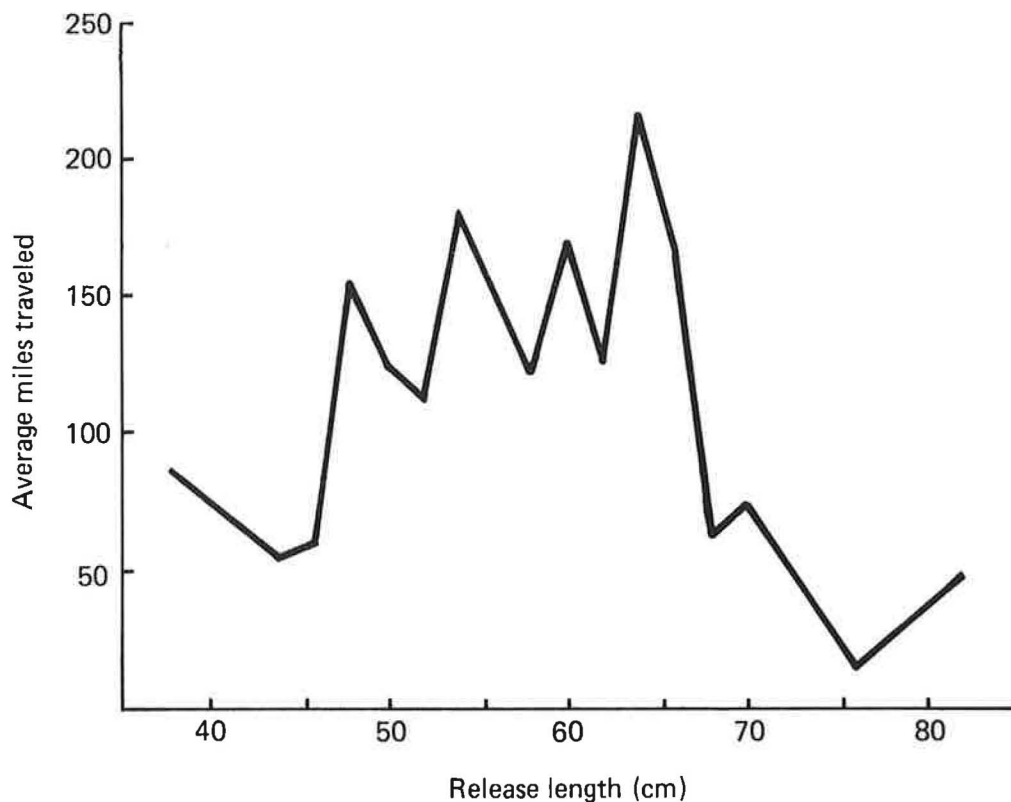


Figure 10.--Average minimal distances traveled by 2-cm size groups for sablefish tagged off Washington, Oregon, and California (1979-84).

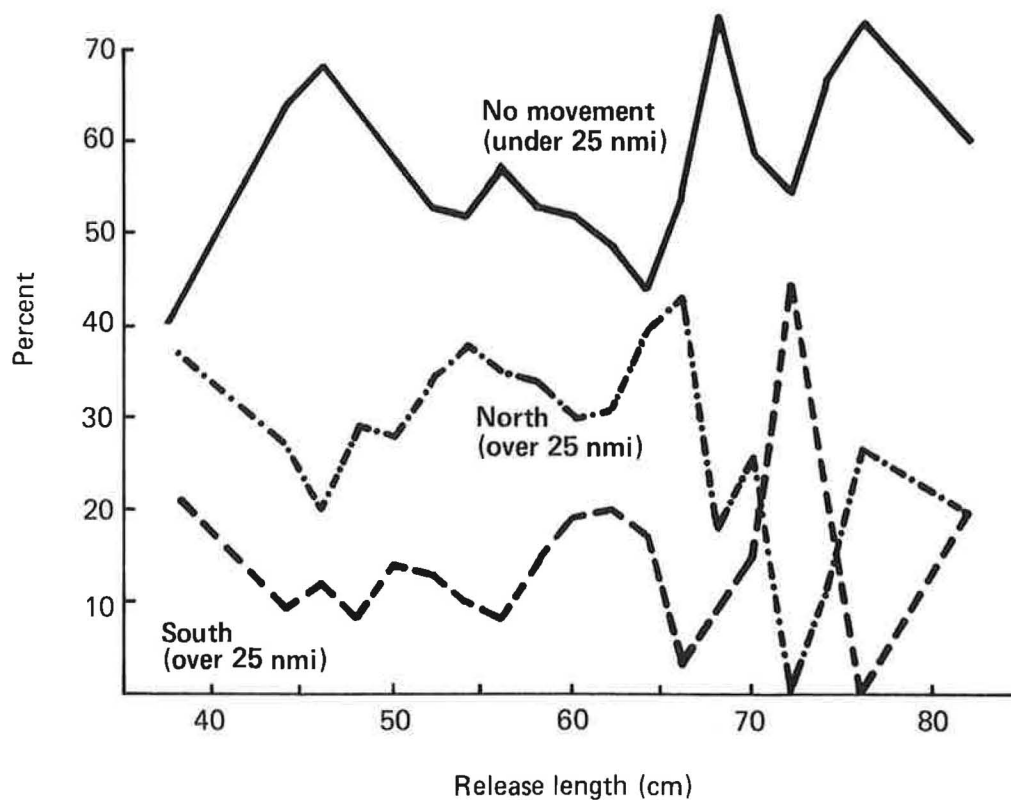


Figure 11.--Direction of travel by 2-cm size groups for sablefish tagged off Washington, Oregon, and California (1979-84).

(less than 25 nmi) and results are presented in Figure 12 by INPFC area. In the Vancouver, Columbia, and Conception areas more than 50% of those tagged failed to move more than 25 nmi. Tagged sablefish released in the Eureka and Monterey areas showed the greatest tendency to move. While interarea differences appear, there is no evidence of migration behavior varying in a consistent fashion among length groups within an area. Among fish which migrated, a larger percentage moved northward than southward in all areas except the Columbia and Eureka areas where movement seemed more random. The greatest tendency for northward movement occurred in fish released in the Monterey and Conception areas but again this could be an artifact produced by the distribution of fishing effort which recently has occurred mainly north of San Francisco. When the data was combined by areas, more than half the tagged sablefish remained within 25 nmi of point of release and of those fish that moved, approximately twice as many went north as went south. The results compare favorably with those of Dark (1983). The notable differences in migrational behavior among size groups released off southeastern Alaska reported by Bracken (1982) and Dark (1983) are not apparent in the Washington-California data.

Factors that should be taken into consideration in the interpretation of this tag data are tag loss, non-reporting, and the distribution of fishing and recovery effort. These factors can greatly influence the distribution of tag recoveries in time and space and may confound attempts to reveal actual migrational behavior. Differences in time at liberty and size composition of release groups (i.e. trawl catches vs. trap catches) also merit further study.

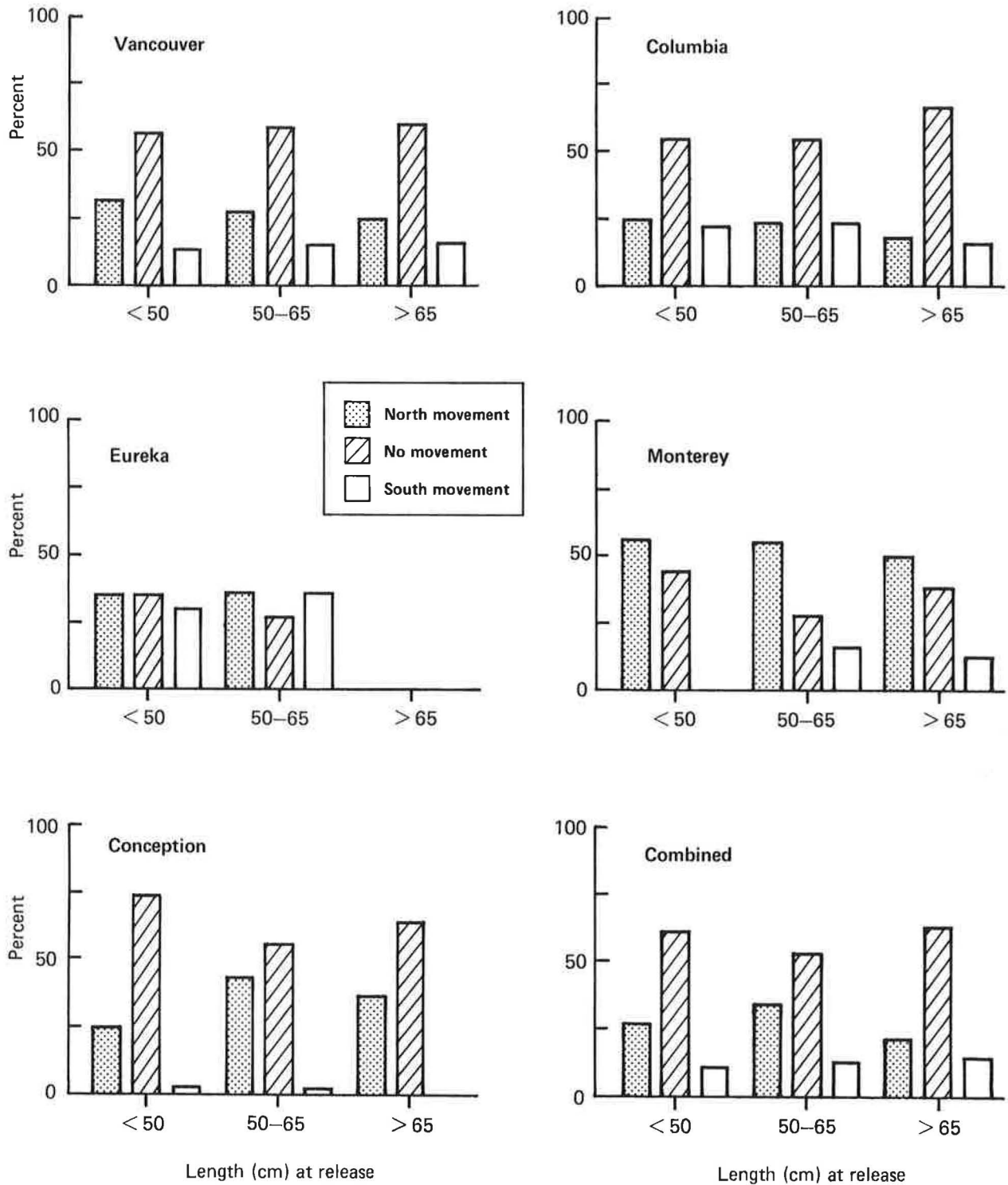


Figure 12.--Direction of travel by size group for tagged sablefish released off the Washington-California coast (1979-84).

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APPENDIX

Information relating to recovery of individual tagged sablefish, 1984.

## Key to Table Column Headings

VES..... Vessel (1 = Chapman, 2 = Cobb, 39 = Warrior II,  
44 = Half Moon Bay, 40 = Nordfjord,  
53 = Collier Brothers)

CRS..... Cruise

Hal..... Haul

Species..... Species code (20510 = sablefish)

Tag No. 1 ..... Tag number

Release..... Release data

Recover..... Recovery data

Date ..... Date

YMMDD..... Year, Month, Day

Latitud..... Latitude

Longitud..... Longitude

DDMM.MM..... Degrees, minutes, fraction of minutes

Nat..... Nation (1 = US, 2 = Japan, 3 = Soviet Union,  
4 = Korea, 5 = Canada)

Gear..... Fishing Gear (160 = Noreastern trawl,  
600 = rectangular sablefish trap,  
623 = research longline, 900 = trawl,  
901 = sablefish trap, 902 = longline)

De-PTH..... Depth (fathoms)

Size..... Fork length (millimeters)

Grow..... Growth (millimeters)

Days..... Days free

Miles..... Miles traveled

Dir..... Direction (360 = north, 90 = east, 180 = south,  
270 = west)

Depth Chng..... Depth change (fathoms, negative = deeper,  
positive = shallower)



## WEST COAST TAGGED SABLEFISH - 1984

RELEASE		DATE		LATITUD		LONGITUD		GE DE-		SIZE	GROW	DAYS	MILES	DIR	DPTH			
VES	CRS	HAL	SPEC.	TAG	NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT							AR	PTH	
2	792	155	20510	SA	2064	RELEASE	79 9 9	4646.00	12454.00	600	300	580						
						RECOVERY	84 8 4	4346.00	12455.00	1	0	440	0	1791	180	180	-140	
2	792	169	20510	SA	2357	RELEASE	79 9 13	4641.00	12449.00	600	225	460						
						RECOVERY	84 6 8	0.00	0.00	0	902	0	520	60	1730			
2	792	194	20510	SA	2979	RELEASE	79 9 21	4749.00	12522.00	600	375	530						
						RECOVERY	84 9 16	4115.00	12429.00	1	900	390	580	50	1822	396	174	-15
2	792	101	20510	SA	3656	RELEASE	79 8 8	4328.00	12441.00	600	217	650						
						RECOVERY	84 9 20	4340.00	12440.00	1	901	0	760	110	1870	12	3	
2	792	101	20510	SA	3665	RELEASE	79 8 8	4328.00	12441.00	600	217	550						
						RECOVERY	84 8 2	4257.00	12455.00	1	901	250	630	80	1821	33	198	-33
2	792	100	20510	SA	3777	RELEASE	79 8 8	4327.00	12450.00	600	303	560						
						RECOVERY	84 3 23	4550.00	12454.00	1	0	0	580	20	1689	143	359	
2	792	99	20510	SA	3817	RELEASE	79 8 8	4328.00	12453.00	600	374	520						
						RECOVERY	84 2 28	5621.00	13426.00	1	902	0	0	1665	856	338		
2	792	99	20510	SA	3839	RELEASE	79 8 8	4328.00	12453.00	600	374	560						
						RECOVERY	84 8 4	4346.00	12455.00	1	0	440	0	1823	18	355	-66	
2	792	120	20510	SA	3930	RELEASE	79 8 13	4327.00	12451.00	600	304	560						
						RECOVERY	84 9 24	4346.00	12441.00	1	901	235	740	180	1869	20	21	69
2	792	122	20510	SA	3979	RELEASE	79 8 13	4328.00	12456.00	600	435	600						
						RECOVERY	84 8 4	4346.00	12455.00	1	0	440	0	1818	18	2	-5	
2	792	122	20510	SA	4039	RELEASE	79 8 13	4328.00	12456.00	600	435	590						
						RECOVERY	84 5 17	4339.00	12501.00	1	901	600	610	20	1739	12	342	-165
2	802	107	20510	SA	4447	RELEASE	80 8 8	4327.10	12449.00	600	298	510						
						RECOVERY	84 5 1	4330.00	12440.00	1	900	0	510	0	1362	7	66	
2	802	115	20510	SA	4591	RELEASE	80 8 10	4327.80	12438.70	600	150	510						
						RECOVERY	84 5 8	4323.00	12451.00	1	900	340	630	120	1367	10	242	-190
2	802	116	20510	SA	4747	RELEASE	80 8 10	4328.40	12440.80	600	225	610						
						RECOVERY	84 8 11	4340.00	12442.00	1	901	0	690	80	1462	12	356	
2	802	116	20510	SA	4774	RELEASE	80 8 10	4328.40	12440.80	600	225	550						
						RECOVERY	84 3 1	4557.00	12447.00	1	901	300	0	1299	149	358	-75	
2	802	116	20510	SA	4800	RELEASE	80 8 10	4328.40	12440.80	600	225	470						
						RECOVERY	84 9 20	4340.00	12441.00	1	901	0	560	90	1502	12	359	
2	802	116	20510	SA	4805	RELEASE	80 8 10	4328.40	12440.80	600	225	620						
						RECOVERY	84 10 22	4342.00	12440.00	1	901	250	710	90	1534	14	2	-25
2	802	117	20510	SA	4812	RELEASE	80 8 10	4328.20	12449.60	600	297	570						
						RECOVERY	84 9 26	4320.00	12450.00	1	0	0	576	6	1508	8	182	

RELEASE					DATE	LATITUD	LONGITUD	GE	DE-							DPTH
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH	SIZE	GROW	DAYS	MILES	DIR	CHNG
2	802	96	20510	SA 8630	RELEASE	80 8 6	4328. 20	12441. 00	600	225	600					
					RECOVERY	84 923	4345. 00	12441. 00	1	901	250	740	140	1509	17	0 -25
2	802	97	20510	SA 8655	RELEASE	80 8 6	4326. 80	12449. 00	600	300	500					
					RECOVERY	84 321	5331. 00	13308. 00	5	901	375	510	10	1323	689	334 -75
2	802	98	20510	SA 8693	RELEASE	80 8 6	4327. 70	12453. 00	600	375	600					
					RECOVERY	84 611	4240. 00	12450. 00	1	901	0	610	10	1405	48	177
2	802	98	20510	SA 8707	RELEASE	80 8 6	4327. 70	12453. 00	600	375	540					
					RECOVERY	84 8 4	4346. 00	12455. 00	1	0	440	0		1459	18	355 -65
2	802	99	20510	SA 8712	RELEASE	80 8 6	4328. 50	12457. 10	600	444	360					
					RECOVERY	84 926	4319. 00	12456. 00	1	900	370	480	-80	1512	10	175 74
2	802	105	20510	SA 8991	RELEASE	80 8 8	4327. 80	12438. 40	600	149	480					
					RECOVERY	84 922	4340. 00	12441. 00	1	901	240	790	310	1506	12	351 -91
53	811	8	20510	SA 9215	RELEASE	81 3 6	4531. 00	12447. 00	901	350	540					
					RECOVERY	84 515	5404. 00	13342. 00	5	901	380	530	-10	1166	619	329 -30
2	802	124	20510	SA 16066	RELEASE	80 812	4519. 40	12422. 40	600	155	650					
					RECOVERY	84 429	4610. 00	12430. 00	1	901	0	0		1356	51	354
2	802	132	20510	SA 16249	RELEASE	80 816	4521. 30	12446. 00	600	300	550					
					RECOVERY	8410 4	4550. 00	12440. 00	1	901	600	570	20	1510	29	8 -300
2	802	164	20510	SA 16901	RELEASE	80 915	4646. 50	12454. 90	600	298	650					
					RECOVERY	84 9 3	5700. 00	13440. 00	1	902	0	0		1449	712	333
2	802	156	20510	SA 16955	RELEASE	80 915	4640. 20	12447. 10	600	154	620					
					RECOVERY	84 7 7	4638. 00	12440. 00	1	902	110	650	30	1391	5	114 44
2	802	168	20510	SA 21025	RELEASE	80 916	4646. 50	12500. 90	600	374	520					
					RECOVERY	84 814	4610. 00	12430. 00	1	901	0	660	140	1428	42	149
2	802	173	20510	SA 21147	RELEASE	80 921	4751. 30	12513. 60	600	223	690					
					RECOVERY	8411 6	4741. 00	12508. 00	1	901	310	840	150	1507	11	160 -87
2	802	173	20510	SA 21207	RELEASE	80 921	4751. 30	12513. 60	600	223	510					
					RECOVERY	841121	4748. 00	12512. 00	1	901	310	580	70	1522	3	162 -87
2	802	176	20510	SA 21342	RELEASE	80 921	4746. 50	12522. 50	600	466	530					
					RECOVERY	841029	4750. 00	12513. 00	1	901	250	560	30	1499	6	55 216
2	802	185	20510	SA 21565	RELEASE	80 923	4748. 40	12521. 20	600	372	550					
					RECOVERY	841026	4756. 00	12526. 00	1	901	380	0		1494	8	337 -8
2	802	185	20510	SA 21575	RELEASE	80 923	4748. 40	12521. 20	600	372	520					
					RECOVERY	841026	4756. 00	12526. 00	1	901	360	0		1494	8	337 12
2	802	194	20510	SA 21818	RELEASE	80 926	4749. 10	12515. 10	600	299	490					
					RECOVERY	841029	4750. 00	12515. 00	1	901	275	470	-20	1494	1	4 24
1	802	13	20510	SA 22444	RELEASE	801024	3243. 00	11938. 50	600	300	560					
					RECOVERY	84 624	3925. 00	12408. 00	1	900	440	600	40	1339	457	333 -140

RELEASE					DATE	LATITUD	LONGITUD	GE DE-			GROW	DAYS	MILES	DIR	DPTH
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH					
1	802	17	20510	SA 22653	RELEASE 801024	3235.90	11931.40	600	360	600					
					RECOVERY 84 5 0	4800.00	12500.00	1	0	0	620	20	1299	956	347
1	802	35	20510	SA 23033	RELEASE 801029	3252.80	11929.70	600	350	560					
					RECOVERY 84 315	5300.00	13230.00	5	901	0	580	20	1233	1331	339
1	802	34	20510	SA 23264	RELEASE 801029	3244.00	11936.30	600	310	490					
					RECOVERY 84 120	3706.00	12244.00	1	900	307	520	30	1178	304	330 3
1	802	34	20510	SA 23334	RELEASE 801029	3244.00	11936.30	600	310	500					
					RECOVERY 84 925	3642.00	12206.00	1	901	540	600	100	1427	268	333 -230
1	802	33	20510	SA 23577	RELEASE 801028	3243.80	11933.90	600	445	490					
					RECOVERY 84 315	5217.00	13136.00	5	901	420	510	20	1234	1285	339 25
1	802	38	20510	SA 23838	RELEASE 8011 1	3254.80	11931.90	600	265	500					
					RECOVERY 84 915	4331.00	12454.00	1	900	400	520	20	1414	684	340 -135
1	802	38	20510	SA 23903	RELEASE 8011 1	3254.80	11931.90	600	265	560					
					RECOVERY 8411 0	3700.00	12230.00	1	901	0	0		1475	285	330
1	802	41	20510	SA 24293	RELEASE 8011 2	3251.80	11930.00	600	355	550					
					RECOVERY 8411 0	3700.00	12230.00	1	901	0	0		1474	289	330
1	802	42	20510	SA 24404	RELEASE 8011 2	3255.50	11932.40	600	260	440					
					RECOVERY 84 627	3907.00	12402.00	1	900	300	460	20	1333	430	331 -40
1	802	44	20510	SA 24859	RELEASE 8011 3	3259.30	11935.40	600	253	560					
					RECOVERY 84 223	3805.00	12302.00	1	0	0	600	20	1207	349	332
1	802	46	20510	SA 25289	RELEASE 8011 3	3255.30	11932.40	600	266	500					
					RECOVERY 841120	3501.00	12114.00	1	900	325	530	30	1478	151	327 -59
1	802	49	20510	SA 25892	RELEASE 8011 4	3256.40	11932.70	600	223	470					
					RECOVERY 84 329	5259.00	13235.00	5	901	475	480	10	1241	1328	339 -252
2	824	26	20510	SA 34950	RELEASE 8211 5	3809.90	12327.76	600	221	660					
					RECOVERY 84 8 5	4454.00	12434.00	1	901	204	610	-50	639	407	353 17
1	802	51	20510	SA 35153	RELEASE 8011 4	3257.50	11927.70	600	263	600					
					RECOVERY 84 814	4050.00	12440.00	1	901	320	670	70	1379	534	334 -57
1	802	54	20510	SA 35699	RELEASE 8011 5	3257.50	11926.30	600	264	0					
					RECOVERY 841210	3640.00	12200.00	1	901	300	0		1496	256	331 -36
1	802	54	20510	SA 35719	RELEASE 8011 5	3257.50	11926.30	600	264	500					
					RECOVERY 84 8 7	3640.00	12203.00	1	901	400	550	50	1371	257	331 -136
1	802	56	20510	SA 36127	RELEASE 8011 6	3259.00	11935.60	600	265	530					
					RECOVERY 84 621	4320.00	12450.00	1	900	0	560	30	1323	668	340
1	802	56	20510	SA 36173	RELEASE 8011 6	3259.00	11935.60	600	265	570					
					RECOVERY 8411 0	3700.00	12230.00	1	901	0	0		1470	280	330
1	802	57	20510	SA 36345	RELEASE 8011 6	3257.00	11933.30	600	227	550					
					RECOVERY 84 925	3647.00	12205.00	1	901	540	590	40	1419	261	332 -313

RELEASE					DATE	LATITUD	LONGITUD	GE DE-			SIZE	GROW	DAYS	MILES	DIR	DPTH
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH						
1	802	58	20510	SA 36510	RELEASE 8011 6	3257.40	11925.20		600	265	490					
					RECOVERY 841015	5100.00	13000.00	5	0	0	499	9	1439	1178	340	
1	802	59	20510	SA 36716	RELEASE 8011 6	3257.80	11926.40		600	291	470					
					RECOVERY 84 3 8	4026.00	12439.00	1	900	340	500	30	1218	513	332	-49
1	802	60	20510	SA 36876	RELEASE 8011 7	3258.90	11935.20		600	252	550					
					RECOVERY 84 926	3652.00	12214.00	1	901	400	620	70	1419	267	331	-148
1	802	62	20510	SA 37306	RELEASE 8011 7	3257.30	11924.20		600	249	560					
					RECOVERY 84 8 7	3640.00	12203.00	1	901	400	640	80	1369	258	330	-151
1	802	65	20510	SA 37656	RELEASE 801114	3811.40	12333.60		600	297	500					
					RECOVERY 84 829	3709.00	12302.00	1	900	380	430	-70	1384	67	158	-83
1	802	65	20510	SA 37709	RELEASE 801114	3811.40	12333.60		600	297	470					
					RECOVERY 84 6 0	4048.00	12440.00	1	901	335	0		1309	165	342	-38
1	802	89	20510	SA 38035	RELEASE 801118	3811.10	12331.40		600	300	480					
					RECOVERY 84 518	3813.00	12333.00	1	900	250	490	10	1277	2	326	50
1	802	89	20510	SA 38036	RELEASE 801118	3811.10	12331.40		600	300	510					
					RECOVERY 84 515	3925.00	12400.00	1	0	0	510	0	1274	77	343	
1	802	89	20510	SA 38047	RELEASE 801118	3811.10	12331.40		600	300	500					
					RECOVERY 84 6 0	4048.00	12440.00	1	901	335	0		1305	166	342	-35
1	802	90	20510	SA 38150	RELEASE 801118	3809.30	12328.00		600	222	500					
					RECOVERY 84 323	5559.00	16942.00	2	902	0	590	90	1221	2123	316	
2	812	111	20510	SA 40541	RELEASE 81 8 5	4329.08	12441.11		600	226	460					
					RECOVERY 84 615	4240.00	12450.00	1	901	0	570	110	1045	49	188	
2	812	112	20510	SA 40565	RELEASE 81 8 5	4327.84	12450.36		600	301	580					
					RECOVERY 84 910	4343.00	12453.00	1	901	0	610	30	1132	15	353	
2	812	112	20510	SA 40573	RELEASE 81 8 5	4327.84	12450.36		600	301	480					
					RECOVERY 84 911	5552.00	15409.00	1	902	370	520	40	1133	1348	314	-69
2	812	112	20510	SA 40577	RELEASE 81 8 5	4327.84	12450.36		600	301	480					
					RECOVERY 84 117	4026.00	12439.00	1	900	370	500	20	895	182	177	-69
2	812	112	20510	SA 40593	RELEASE 81 8 5	4327.84	12450.36		600	301	470					
					RECOVERY 84 926	4319.00	12456.00	1	900	370	540	70	1148	10	205	-69
2	812	131	20510	SA 40771	RELEASE 81 811	4329.26	12440.77		600	221	570					
					RECOVERY 84 911	4342.00	12441.00	1	901	0	610	40	1127	13	359	
2	812	131	20510	SA 40795	RELEASE 81 811	4329.26	12440.77		600	221	510					
					RECOVERY 84 626	4240.00	12450.00	1	901	240	540	30	1050	50	188	-19
2	812	131	20510	SA 40815	RELEASE 81 811	4329.26	12440.77		600	221	520					
					RECOVERY 84 6 0	4048.00	12440.00	1	901	335	0		1039	161	180	-114
2	812	138	20510	SA 40940	RELEASE 81 813	4518.29	12431.96		600	226	620					
					RECOVERY 84 925	4520.00	12428.00	1	900	0	0		1139	3	59	

RELEASE				DATE	LATITUD	LONGITUD	GE DE-								DPTH	
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH	SIZE	GROW	DAYS	MILES	DIR	CHNG
2	812	138	20510	SA 40952	RELEASE 81 813	4518. 29	12431. 96		600	226	600					
					RECOVERY 84 925	4520. 00	12428. 00	1	900	0	0		1139	3	59	
2	812	180	20510	SA 41714	RELEASE 81 914	4750. 36	12512. 63		600	229	490					
					RECOVERY 841026	4756. 00	12526. 00	1	901	210	0		1138	11	302	19
2	812	188	20510	SA 41833	RELEASE 81 916	4749. 13	12522. 02		600	373	490					
					RECOVERY 841026	4756. 00	12526. 00	1	901	386	0		1136	7	339	-13
2	812	191	20510	SA 41878	RELEASE 81 916	4753. 47	12513. 45		600	146	600					
					RECOVERY 841031	4750. 00	12513. 00	1	901	220	760	160	1141	3	175	-74
2	812	202	20510	SA 42103	RELEASE 81 924	4639. 92	12446. 44		600	151	600					
					RECOVERY 84 7 7	4638. 00	12440. 00	1	902	110	640	40	1017	5	113	41
2	812	203	20510	SA 42176	RELEASE 81 924	4639. 74	12448. 38		600	225	550					
					RECOVERY 8410 3	4641. 50	12446. 50	1	900	231	610	60	1105	2	36	-6
2	812	203	20510	SA 42212	RELEASE 81 924	4639. 74	12448. 38		600	225	520					
					RECOVERY 84 510	4320. 00	12450. 00	1	900	0	0		959	200	180	
2	812	203	20510	SA 42223	RELEASE 81 924	4639. 74	12448. 38		600	225	460					
					RECOVERY 84 428	5350. 00	13332. 00	5	901	400	450	-10	947	545	325	-175
2	813	13	20510	SA 43025	RELEASE 811114	3243. 47	11939. 21		600	311	510					
					RECOVERY 84 112	3646. 00	12204. 00	1	900	335	560	50	789	270	334	-24
2	813	22	20510	SA 43200	RELEASE 811121	3242. 20	11935. 40		600	231	540					
					RECOVERY 84 618	4822. 00	12517. 00	1	900	90	430	-110	940	974	346	141
2	813	25	20510	SA 43318	RELEASE 811121	3240. 96	11941. 91		600	342	520					
					RECOVERY 84 726	4140. 00	12448. 00	1	900	470	523	3	978	591	337	72
2	824	27	20510	SA 65100	RELEASE 8211 5	3811. 72	12331. 71		600	300	520					
					RECOVERY 84 7 4	3858. 00	12359. 00	1	900	300	640	120	607	51	335	0
2	824	27	20510	SA 65111	RELEASE 8211 5	3811. 72	12331. 71		600	300	520					
					RECOVERY 84 7 7	4005. 00	12415. 00	1	900	0	540	20	610	118	344	
2	824	27	20510	SA 65165	RELEASE 8211 5	3811. 72	12331. 71		600	300	590					
					RECOVERY 84 721	5859. 00	14135. 00	1	902	360	620	30	624	1430	337	-60
2	824	28	20510	SA 65287	RELEASE 8211 5	3811. 20	12332. 97		600	380	650					
					RECOVERY 84 415	3925. 00	12400. 00	1	0	0	650	0	527	77	344	
2	824	36	20510	SA 65398	RELEASE 821111	3810. 59	12328. 17		600	217	570					
					RECOVERY 841121	4748. 00	12512. 00	1	901	305	620	50	741	582	353	-88
2	824	36	20510	SA 65399	RELEASE 821111	3810. 59	12328. 17		600	217	660					
					RECOVERY 84 6 0	4048. 00	12440. 00	1	901	335	0		582	167	341	-118
2	824	37	20510	SA 65454	RELEASE 821111	3812. 48	12331. 91		600	302	530					
					RECOVERY 84 6 0	4235. 00	12448. 00	1	901	335	0		582	269	348	-33
2	824	37	20510	SA 65473	RELEASE 821111	3812. 48	12331. 91		600	302	530					
					RECOVERY 84 319	4047. 00	12441. 00	1	900	0	550	20	494	163	341	



RELEASE				DATE	LATITUD	LONGITUD	GE	DE-									DPTH
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH	SIZE	GROW	DAYS	MILES	DIR	CHNG	
2	824	37	20510	SA 65494	RELEASE	821111	3812.48	12331.91	600	302	510						
					RECOVERY	84 1 4	3805.00	12302.00	1	0	0	530	20	419	25	107	
2	824	37	20510	SA 65519	RELEASE	821111	3812.48	12331.91	600	302	520						
					RECOVERY	84 123	3930.00	12400.00	1	900	310	520	0	438	80	344	-8
2	824	37	20510	SA 65523	RELEASE	821111	3812.48	12331.91	600	302	520						
					RECOVERY	8411 0	4145.00	12430.00	1	0	0	513	-7	735	217	348	
2	824	38	20510	SA 65553	RELEASE	821111	3811.89	12332.74	600	370	520						
					RECOVERY	84 322	4250.00	12457.00	1	900	0	530	10	497	285	347	
2	824	38	20510	SA 65608	RELEASE	821111	3811.89	12332.74	600	370	490						
					RECOVERY	841114	3925.00	12406.00	1	900	450	486	-4	734	78	341	-80
2	824	39	20510	SA 65616	RELEASE	821111	3810.77	12334.17	600	400	530						
					RECOVERY	84 6 0	4235.00	12448.00	1	901	335	0		582	270	348	65
40	831	28	20510	SA 65747	RELEASE	83 720	3908.09	12357.63	160	145	480						
					RECOVERY	84 115	3925.00	12400.00	1	0	0	460	-20	179	17	354	
40	831	46	20510	SA 65780	RELEASE	83 724	4105.17	12422.16	160	130	450						
					RECOVERY	84 5 9	3730.00	12300.00	1	0	0	480	30	290	224	163	
40	831	46	20510	SA 65802	RELEASE	83 724	4105.17	12422.16	160	130	410						
					RECOVERY	84 6 0	4235.00	12448.00	1	901	335	0		327	92	348	-205
40	831	46	20510	SA 65812	RELEASE	83 724	4105.17	12422.16	160	130	430						
					RECOVERY	84 823	4107.00	12422.00	1	0	114	470	40	396	2	4	16
40	831	46	20510	SA 65841	RELEASE	83 724	4105.17	12422.16	160	130	430						
					RECOVERY	8410 8	4200.00	12430.00	1	900	0	460	30	442	55	354	
40	831	48	20510	SA 65873	RELEASE	83 724	4126.84	12421.63	160	55	360						
					RECOVERY	84 8 1	4155.00	12432.00	1	900	163	430	70	374	29	345	-108
40	831	48	20510	SA 65919	RELEASE	83 724	4126.84	12421.63	160	55	350						
					RECOVERY	84 712	4127.00	12430.00	3	900	79	420	70	354	6	272	-24
40	831	48	20510	SA 65985	RELEASE	83 724	4126.84	12421.63	160	55	380						
					RECOVERY	8410 0	4048.00	12430.00	1	0	0	0		449	39	189	
40	831	48	20510	SA 67014	RELEASE	83 724	4126.84	12421.63	160	55	410						
					RECOVERY	8410 6	4045.00	12430.00	1	900	108	471	61	440	42	189	-53
40	831	89	20510	SA 67066	RELEASE	83 8 1	4326.15	12440.57	160	184	500						
					RECOVERY	84 915	4349.00	12445.00	1	901	230	460	-40	411	23	392	-46
40	831	89	20510	SA 67079	RELEASE	83 8 1	4326.15	12440.57	160	184	450						
					RECOVERY	841212	4137.00	12431.00	1	900	226	471	21	499	109	176	-42
40	831	89	20510	SA 67086	RELEASE	83 8 1	4326.15	12440.57	160	184	410						
					RECOVERY	84 4 8	4325.00	12445.00	1	900	0	450	40	251	3	250	
40	831	93	20510	SA 67120	RELEASE	83 8 2	4328.71	12436.40	160	110	470						
					RECOVERY	84 717	4322.00	12442.00	1	900	190	510	40	350	8	211	-80

RELEASE					DATE	LATITUD	LONGITUD	GE	DE-							DPTH
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM. MM	DDDMM. MM	NAT	AR	PTH	SIZE	GROW	DAYS	MILES	DIR	CHNG
40	831	64	20510	SA 67171	RELEASE	83 727	4238.82	12442.74		160 137	420					
					RECOVERY	84 817	5430.00	13100.00	5	900 66	450	30	387	754	343	71
40	831	84	20510	SA 67196	RELEASE	83 731	4322.05	12432.51		160 67	340					
					RECOVERY	84 717	4325.00	12437.00	1	900 102	400	60	352	4	312	-35
40	831	122	20510	SA 67507	RELEASE	83 811	4402.18	12431.16		160 70	360					
					RECOVERY	84 712	4500.00	12440.00	1	900 85	440	80	336	58	354	-15
40	831	119	20510	SA 67525	RELEASE	83 810	4406.39	12447.24		160 58	470					
					RECOVERY	84 1 6	4322.00	12442.00	1	0 0	510	40	149	45	175	
40	831	180	20510	SA 67772	RELEASE	83 823	4602.80	12414.11		160 52	410					
					RECOVERY	84 613	4610.00	12430.00	1	900 0	440	30	295	13	303	
40	831	178	20510	SA 67790	RELEASE	83 823	4602.85	12432.82		160 82	390					
					RECOVERY	84 9 7	4610.00	12440.00	1	900 0	0		381	9	325	
39	831	35	20510	SA 69089	RELEASE	83 721	3919.38	12358.12		160 128	480					
					RECOVERY	84 6 0	4235.00	12448.00	1	901 335	0		330	199	349	-207
39	831	43	20510	SA 69163	RELEASE	83 724	4052.31	12423.42		160 78	490					
					RECOVERY	84 717	4140.00	12420.00	1	900 140	510	20	359	48	3	-62
39	831	43	20510	SA 69170	RELEASE	83 724	4052.31	12423.42		160 78	460					
					RECOVERY	84 613	4044.00	12429.00	1	900 88	455	-5	325	9	207	-10
39	831	43	20510	SA 69179	RELEASE	83 724	4052.31	12423.42		160 78	400					
					RECOVERY	84 221	3640.00	12200.00	1	900 0	0		212	276	155	
39	831	55	20510	SA 69268	RELEASE	83 726	4222.12	12443.43		160 147	530					
					RECOVERY	84 726	4108.00	12421.00	1	900 115	570	40	366	76	167	32
39	831	55	20510	SA 69290	RELEASE	83 726	4222.12	12443.43		160 147	530					
					RECOVERY	84 910	4342.00	12441.00	1	901 0	560	30	412	80	1	
39	831	61	20510	SA 69330	RELEASE	83 727	4242.72	12444.04		160 156	540					
					RECOVERY	84 4 7	4802.00	12520.00	1	900 300	0		255	320	356	-144
39	831	61	20510	SA 69331	RELEASE	83 727	4242.72	12444.04		160 156	380					
					RECOVERY	8410 1	4050.00	12440.00	1	0 0	0		432	113	178	
39	831	61	20510	SA 69343	RELEASE	83 727	4242.72	12444.04		160 156	510					
					RECOVERY	84 4 4	4325.00	12445.00	1	900 0	550	40	252	42	359	
39	831	87	20510	SA 69433	RELEASE	83 8 2	4336.48	12436.94		160 158	440					
					RECOVERY	84 5 1	4345.00	12433.00	1	0 100	460	20	273	9	19	58
39	831	94	20510	SA 69448	RELEASE	83 8 3	4341.67	12434.61		160 123	0					
					RECOVERY	84 912	4320.00	12450.00	1	0 0	453		406	24	207	
39	831	94	20510	SA 69450	RELEASE	83 8 3	4341.67	12434.61		160 123	390					
					RECOVERY	84 526	4500.00	12440.00	1	900 95	410	20	297	78	357	28
39	831	142	20510	SA 69712	RELEASE	83 819	4418.17	12449.22		160 90	330					
					RECOVERY	84 6 1	4500.00	12440.00	1	900 93	410	80	287	42	9	-3

RELEASE				DATE	LATITUD	LONGITUD	GE DE-						DPTH			
VES	CRS	HAL	SPEC.	TAG NO. 1	YYMMDD	DDMM.MM	DDDMM.MM	NAT	AR	PTH	SIZE	GROW	DAYS	MILES	DIR	CHNG
39	831	200	20510	SA 69876	RELEASE	83 831	4650.54	12440.62		160	73	470				
					RECOVERY	84 2 3	4620.00	12440.00	1	900	0	390	-80	156	31	179
39	831	215	20510	SA 69985	RELEASE	83 9 9	4721.03	12446.08		160	108	510				
					RECOVERY	84 3 5	4812.00	12540.00	1	900	192	380	70	178	63	325 -84
39	831	228	20510	SA 80016	RELEASE	83 9 14	4806.60	12507.33		160	124	620				
					RECOVERY	84 9 1	4610.00	12430.00	1	900	0	650	30	353	119	167
39	831	276	20510	SA 80048	RELEASE	83 9 29	4812.80	12510.98		160	101	550				
					RECOVERY	84 3 17	4800.00	12520.00	1	900	200	530	-20	170	14	205 -99

END OF LIST/TAG/REPORT