

**SURVEY REPORT FOR THE 1997 AERIAL SURVEYS FOR HARBOR
PORPOISE AND OTHER MARINE MAMMALS OF OREGON,
WASHINGTON AND BRITISH COLUMBIA OUTSIDE WATERS**

By

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INTRODUCTION

We report the methods and the preliminary results of August/September 1997 aerial surveys for marine mammals that occupy the outside coastal waters of Oregon, Washington and southern British Columbia. Estimates of abundance of harbor porpoise and other marine mammals will be computed using data from these surveys and summarized in subsequent reports by the National Marine Mammal Laboratory. Encounter rates, frequency distribution of group size, and other important summary information required for abundance estimation are provided for the most commonly seen species: harbor porpoise, Steller sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina richardsi*) and Dall's porpoise (*Phocoenoides dalli*). On-effort and off-effort sighting distributions for the less common species are also illustrated and summarized.

BACKGROUND

The National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) are responsible for reducing human-caused marine mammal mortality below levels deemed to be significant based on population estimates within U.S. waters (MMPA, Barlow *et al.* 1995). As a part of this mission, a number of aerial surveys have been conducted over the past 15 years to collect sighting data of marine mammals occupying Oregon and Washington outside coastal waters (Barlow *et al.* 1988, Calambokidis *et al.* 1990, 1991, 1992). Most of these surveys were flown with the primary objective of estimating abundance of harbor porpoise (*Phocoena phocoena*), a species that is incidentally killed in gillnets set for salmon in several areas of this region (Stacey *et al.* 1990, Gearin *et al.* 1995) and has declined in abundance in several areas of the northeast Pacific (central California: Forney *et al.* 1995; southern Puget Sound: Osmek *et al.* 1995).

Calambokidis *et al.* (1993) reviewed these aerial surveys of Oregon/Washington waters and found the 1990 and 1991 survey data (Calambokidis *et al.* 1991, 1992) were suitable for pooling and calculating improved estimates of harbor porpoise abundance. These estimates were subsequently used to calculate potential biological removal (PBR) levels for two recently designated harbor porpoise stocks: (1) Oregon/Washington Coast and (2) Inland Washington (Osmek *et al.* 1996).

To adequately protect these harbor porpoise and other marine mammal stocks, it is recommended that abundance and PBR estimates be calculated at about five-year intervals (Barlow *et al.* 1995). As a result, aerial surveys for harbor porpoise of the inland Washington stock were conducted during August 1996 (Calambokidis *et al.* 1997, Osmek *et al.* 1997) using the same methods as were used during the 1991 surveys (Calambokidis *et al.* 1992). Surveys for harbor porpoise of the Oregon/Washington stock were delayed until summer 1997 (this study) to coincide with harbor porpoise surveys conducted off California by NMFS, Southwest Fisheries Science Center, La Jolla, CA.

Two methodological changes were made for this 1997 survey: (1) altitude was increased from 183 m (600 ft) to 198 m (650 ft) to make these data comparable with those 1997 data collected off California, and (2) water depths out to 200 m were sampled during 1997, compared to mostly 100 m in 1991, to ensure that the subsequent abundance estimate would include virtually all waters off Oregon/Washington where harbor porpoise occur. The waters of southern British Columbia were also flown during 1997, because no dedicated marine mammals surveys have been conducted in this transboundary region even though marine mammals are incidentally taken in fishing gear there (Stacey *et al.* 1990).

METHODS

Study Area

The study area includes the coastal waters of Oregon, Washington, and southern British Columbia south of 49 degrees N latitude, from shore out to a depth of 200 m (Figure 1). The waters of the west half of the U.S./Canada Strait of Juan de Fuca were also surveyed in 1997 to overlap a portion of the 1996 survey area (Calambokidis *et al.* 1997, Osmek *et al.* 1997) and the harbor porpoise stock boundary located at the Strait's west entrance (see Osmek *et al.* 1996).

Survey Design and Procedures

A total of 107 transect lines (152 unique waypoints, Appendix Table A-1) were planned to provide uniform coverage for areas of similar water depths in Regions 1-6 (Figure 1). Except for the parallel transects of Region 1, the lines followed a saw-tooth pattern (Cooke 1985). Transects were generally stratified to sample water depths out to 100 m and 200 m, with most of the effort being expended in the shallower depths where the highest harbor porpoise densities have been observed (Green *et al.* 1992). Region 4 transect lines all extended out to a depth of 200 m because bathymetry was more variable over Heceta Bank. Each transect was designed to be flown once and when possible from south to north to reduce glare from the sun.

Flights generally originated and ended at Hoquium, WA, although both cities of Coos Bay and Newport, OR were also used as a base of operation when southern and central Oregon were surveyed. Other airports such as Port Angeles, WA and Astoria and Tillamook OR were also used for refueling and waiting for improvements in weather to occur.

Surveys were conducted using a high-wing (*Partenavia* P-68) twin-engine aircraft equipped with left- and right-side bubble windows and a belly window. This arrangement made it possible to observe marine mammals slightly ahead of, to the side, and beneath the aircraft. Three experienced observers, located at left, center and right positions in the aircraft viewed the water for marine mammals while the aircraft flew at an altitude of 198 m (650 ft) and a speed of 167 km/hr (90 kts). Observers rotated to a new position at the

beginning of each flight. Surveys were generally limited to visibility conditions of Beaufort sea state 3 or less and cloud cover 50% or less. When a transect line was aborted prematurely because of poor visibility conditions, these lines were later re-flown when conditions improved.

The data recorder, who also navigated from the copilot's chair, entered survey information using a custom Data Acquisition System (DAS) on a laptop computer that was interfaced with a GPS navigational system. Visibility conditions and altitude were recorded at the beginning of a transect line and when conditions changed. The date, time, and location were updated automatically by the computer each minute and when other data entries were made. When a marine mammal sighting was made, the species, group size, number of calves, and any unusual behavior was called out to the data recorder. In addition, the side observers also called out the clinometer-measured angle of the sighting as the group of animals passed abeam of the aircraft so the perpendicular distance (distance from the survey trackline to the sighting) could be determined. The center observer called out sighting angles from a clinometer-calibrated scale mounted above the belly window.

When a group was sighted from center, the observer would delay for 2-3 seconds waiting for the side observers to register their sighting with the data recorder. This method of recording data was used to avoid confusion at a moment when both the center and a side observer would have traditionally reported the same sighting in unison. The center observer also told the recorder if they saw a sighting made by the side observer to provide information on the number of sightings missed by center within the overlapping search area of 90-65 degrees. This practice of recording "center saw" data was discontinued after 22 August because of its possible effect of decreasing the number of sightings made by center.

Data Editing and Preliminary Analysis

Error checks of the electronic data were conducted prior to analysis, both visually and using computer programs written to test for reasonable speed between one-minute position fixes, altitudes, clinometer angles, and species codes (Appendix Table A-2). On several occasions it was found that the GPS failed to provide reliable positions for portions of a flight (e.g., position format error). In these instances, latitude and longitude were interpolated using the time and position which preceded and followed it. Species codes included a designation for probable, but not certain, species identification as well as codes for unidentified species. Probable sightings were included in the data summaries for that species.

RESULTS

Aerial surveys of Regions 1-6 off south British Columbia, Washington, and Oregon were conducted from 15 August through 9 September 1997. A practice flight was conducted on 15 August off of Hoquium WA (Region 2) to re-familiarize all members of the team with survey operations, viewing marine mammals from the air, and recording data. Over the entire survey period, more than 78 hrs of flight time, during 29 flights, including the ferry of the aircraft back to Oxnard, CA, was required to complete the project (Table 1). Of this total, 31.4 hrs were spent surveying on-effort.

Weather conditions during the 1997 survey period were generally favorable for sighting harbor porpoise, except from 11-14 August and 23-28 August when excessive cloud cover and occasional high winds prevailed (Table 2). Approximately 99% (5,329 km) and 93% (5,038 km) of all survey effort (5,396 km) was flown in the acceptable cloud cover categories of 50% and less and < 25% and less, respectively, while 88 % (4734 km) the effort was flown when conditions were Beaufort 2 and less (Table 3). Good weather effort (both Beaufort 2 and less and 25% CC and less) amounted to 82% (4398 km) of the total. It is important to note that this weather condition summary includes all on-effort data (Figure 2), even those sections of transect lines that were flown again when weather conditions improved (roughly 650 km).

A total of 727 sightings of 1290 animals (including 93 calves/pups) from 15 marine mammal species (plus 7 leatherback sea turtle sightings) were made during on-effort portions of the surveys. An additional 140 sightings of 1191 animals (22 calves/pups) were made while off-effort. Harbor porpoise ($n = 360$), Steller sea lions ($n = 130$), harbor seals ($n = 106$), and Dall's porpoise ($n = 68$) were the most frequently sighted marine mammals and accounted for 91% of the on-effort marine mammal sightings. Other on-effort marine mammal group sightings included California sea lions ($n = 30$), northern elephant seals ($n = 9$), a northern fur seal, humpback whales ($n = 8$), gray whales ($n = 10$), a minke whale, a pod of killer whales, and sea otters ($n = 3$). Figures 3-8 illustrates the distribution of these on- and off-effort sightings of animals that are also quantified in Table 4.

The frequency distributions by group size are summarized for the four primary species (Figure 9). The amount of regional variation in mean group size for these species was especially interesting (Table 5). Group sizes for both porpoise species were substantially higher in Regions 4-6 than Regions 1-3. This variation might be related to changes foraging behavior influenced by factors such as the blue water observed near shore in these southern regions and warmer water temperatures brought about by the 1997 El Niño event. Mean group sizes for harbor seals and Steller sea lions varied much less throughout the study area. One exception was for Regions 3 and 6, where the mean group size of Steller sea lions was relatively high and likely influenced by the hauling areas near the mouth of the Columbia River (Region 3) and Rogue Reef (Region 6).

ACKNOWLEDGMENTS

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LIST OF FIGURES AND TABLES

Figures:

Figure 1. Study area, regions, transect lines and waypoints for aerial surveys flown in 1997.

Figure 2. Survey effort in acceptable weather conditions (Beaufort sea state of 2 or less and cloud cover of 25% or less) is shown as black lines and survey effort in poor conditions as gray lines.

Figure 3-8. Geographic distributions by species for all animals seen by primary observers while on-effort and off-effort.

Figure 9. Histogram of harbor porpoise, Steller sea lion, harbor seal, and Dall's porpoise group sizes while surveying on-effort.

Tables:

Table 1. Flight time summary and regions flown or attempted by day.

Table 2. Summary of waypoints flown and visibility conditions by day.

Table 3. Sighting/effort information summary for each transect line and region. The purpose of this spreadsheet is primarily for use in its electronic form, namely: LINE-SUM.XLS.

Table 4. Number of groups and animals seen by all personnel (including pilot and recorder) during the 1997 aerial surveys.

Table 5. Mean group size by region and species for good weather (25% cloud cover and less and Beaufort 2 and less). Results includes all non-hauled animals sighted by the three primary observers.

Appendix Tables:

Table A-1. Waypoints as illustrated in Figure 1. During the actual surveys, however, the east ends of these transects were either lengthened or shortened to coincide with the shoreline (see Figure 2).

Table A-2. Data codes for the electronic survey data.

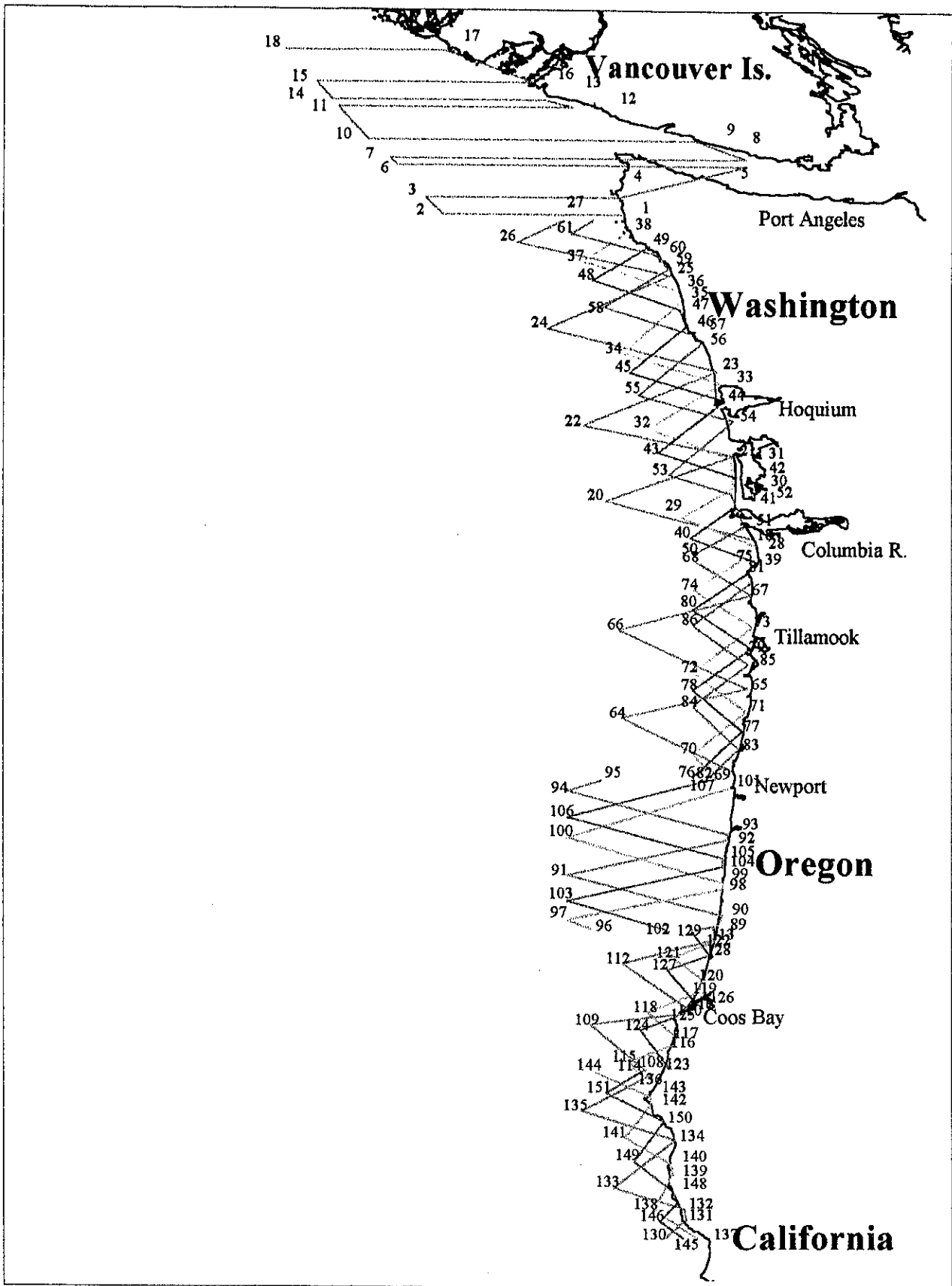


FIGURE 1.

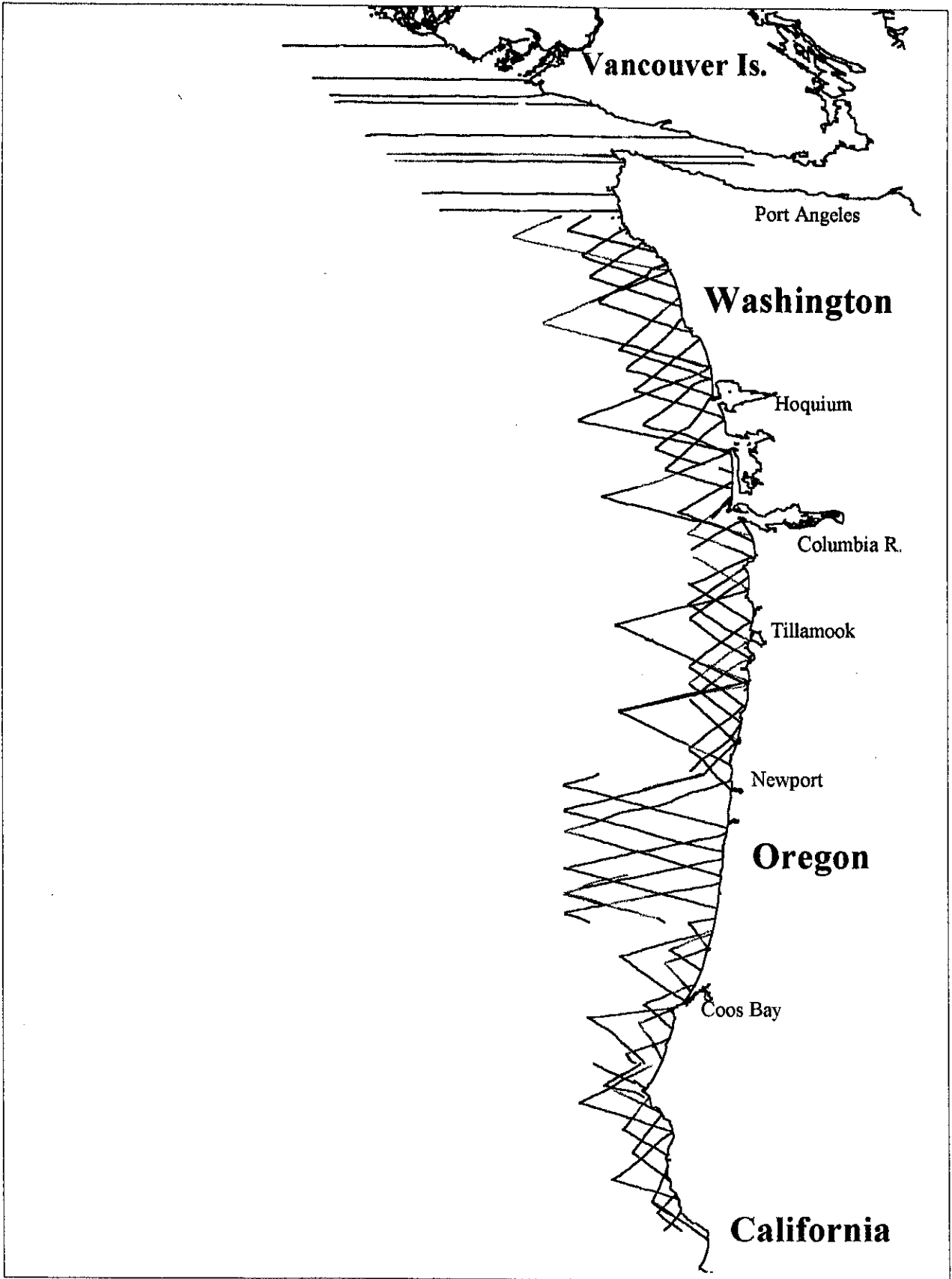


FIGURE 2.

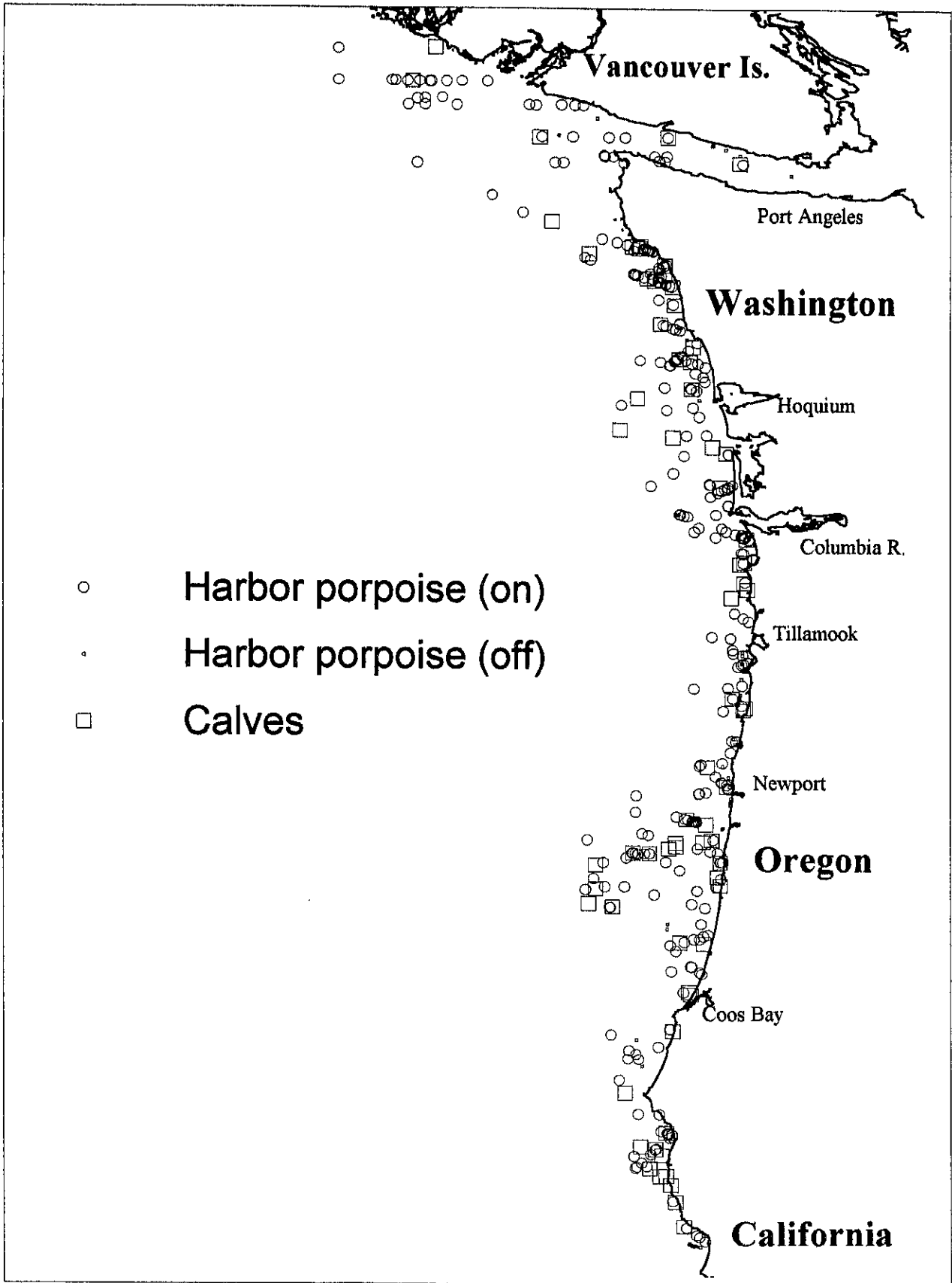


FIGURE 3.

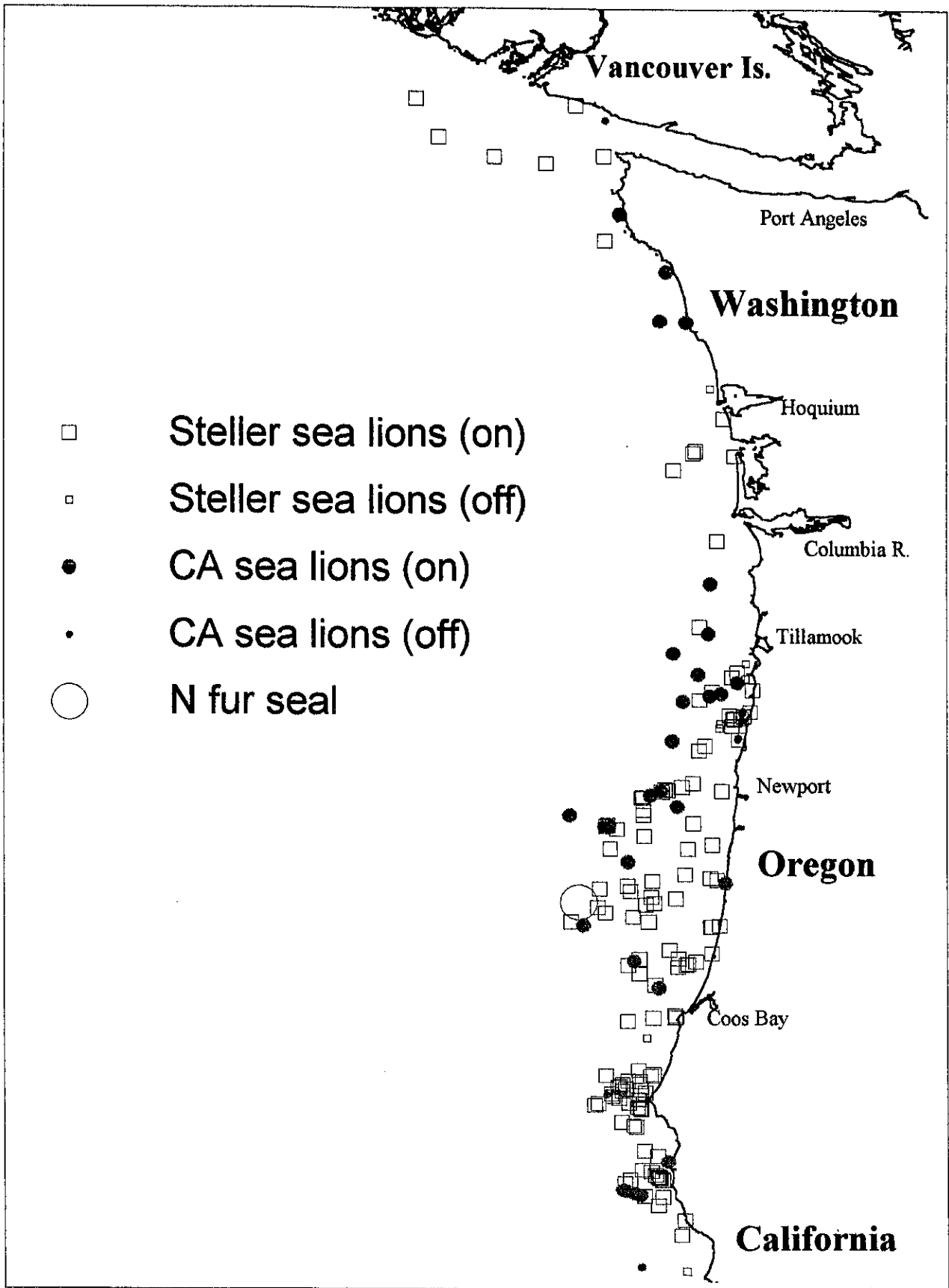


FIGURE 4.

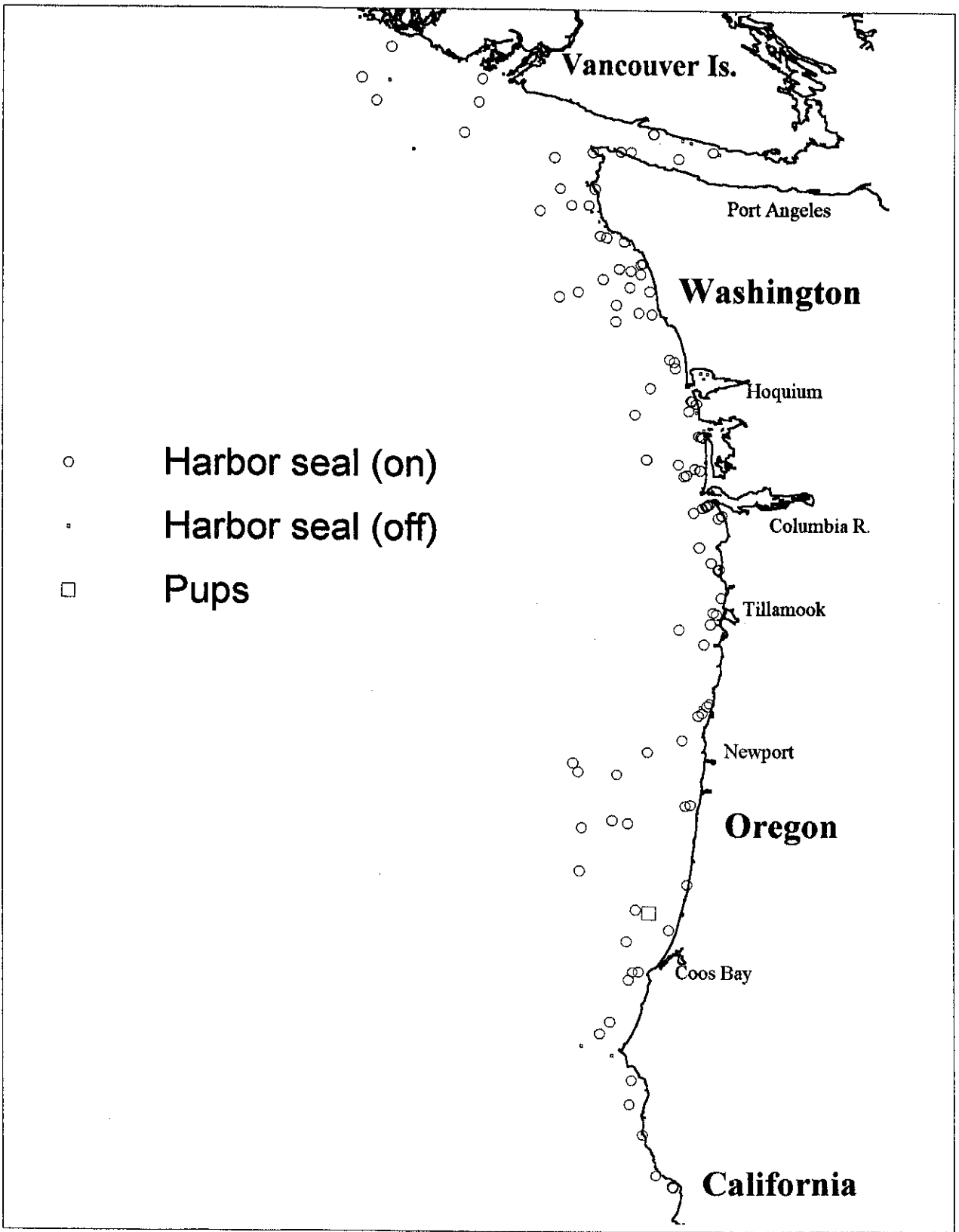


FIGURE 5.

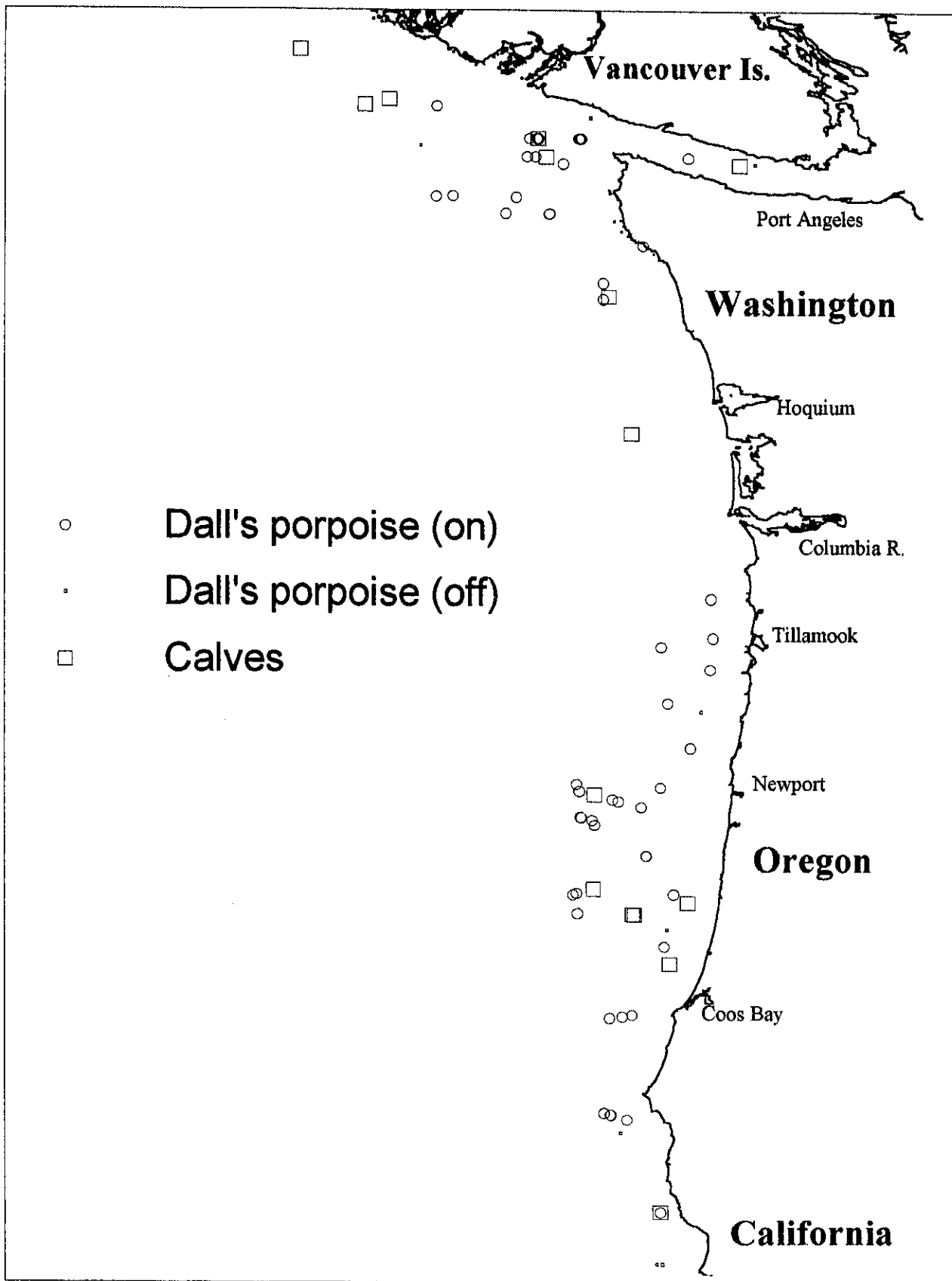


FIGURE 6.

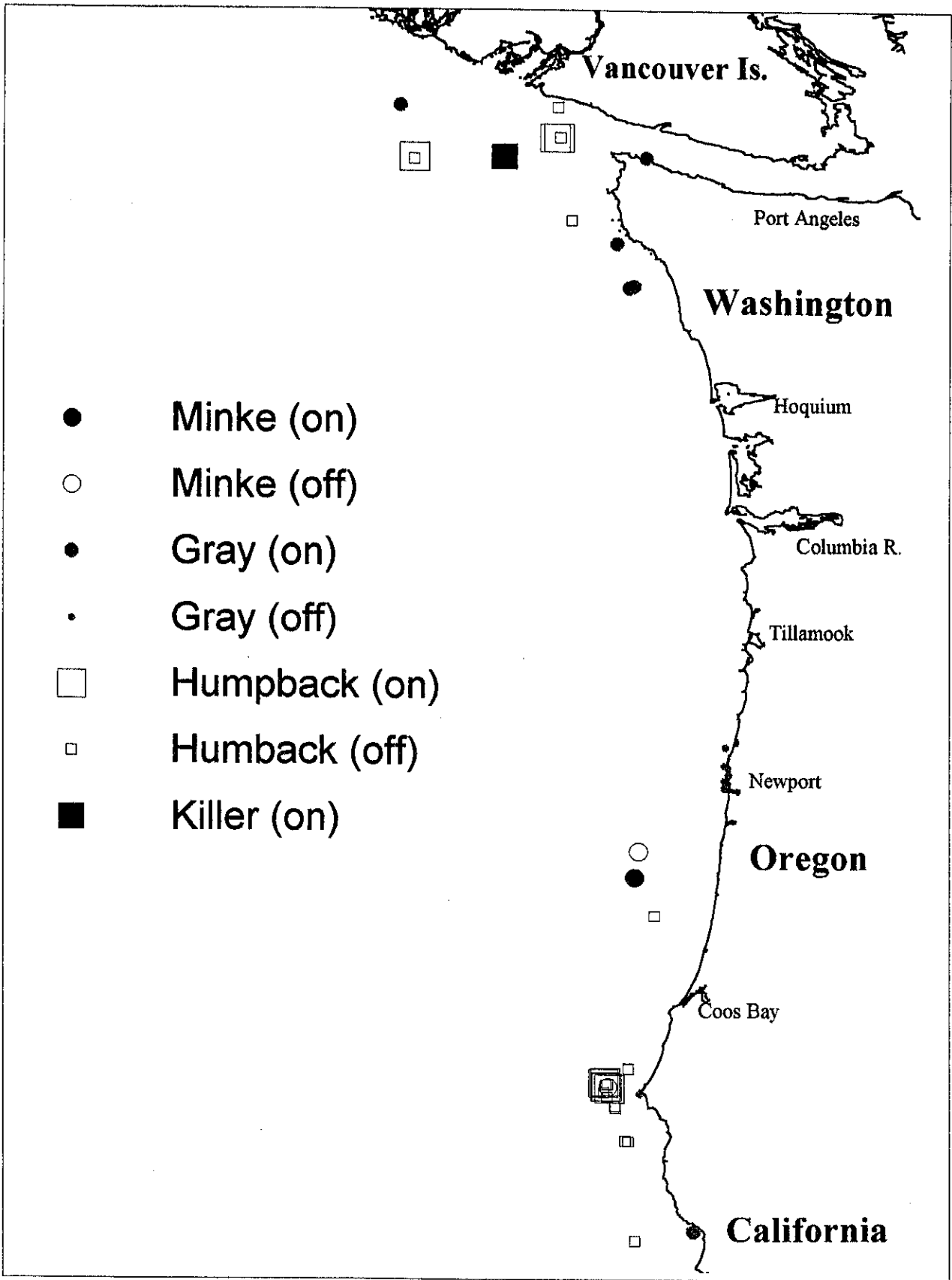


FIGURE 7.

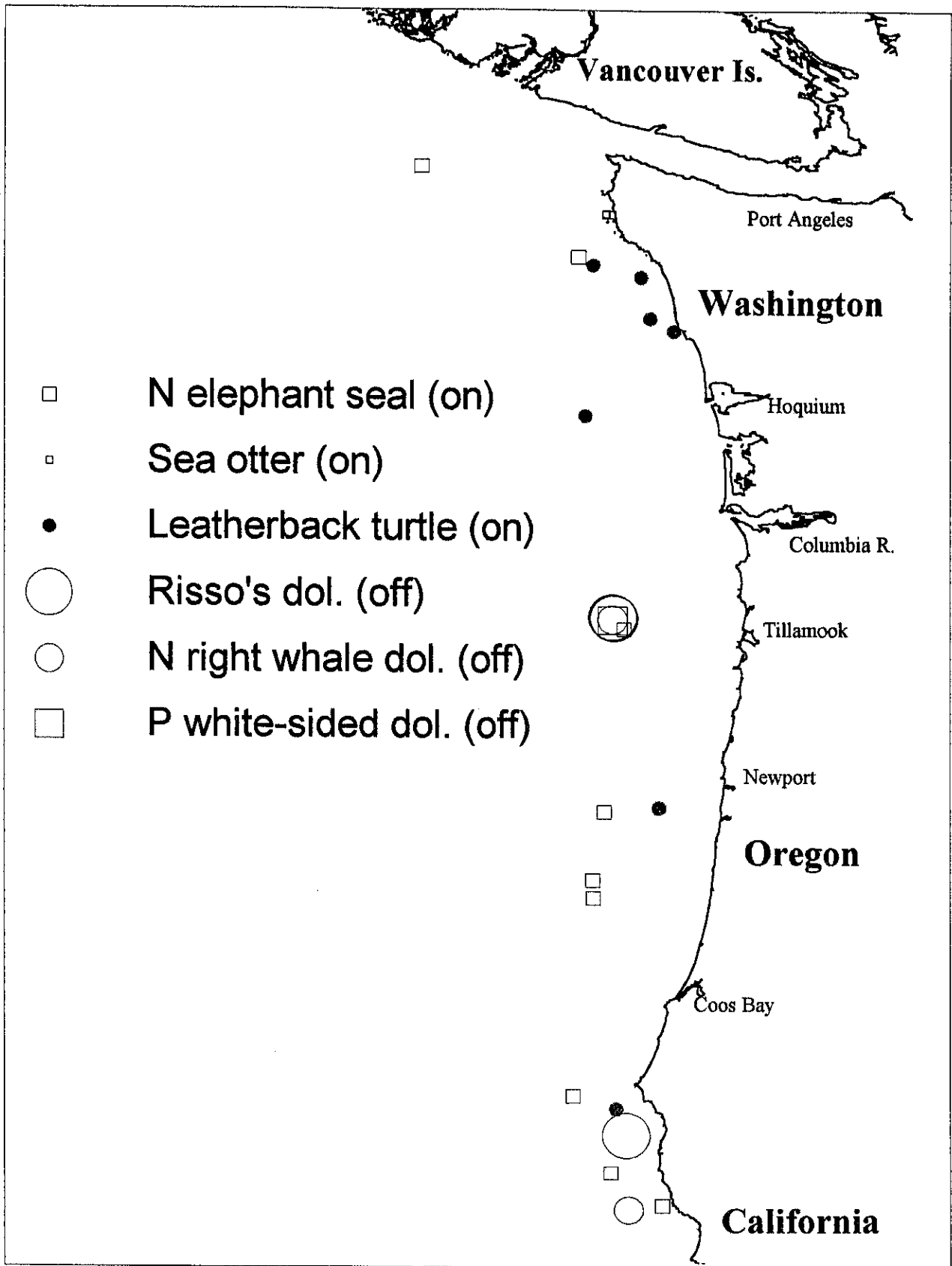


FIGURE 8.

Group Sizes for Species Commonly Observed (n>50)

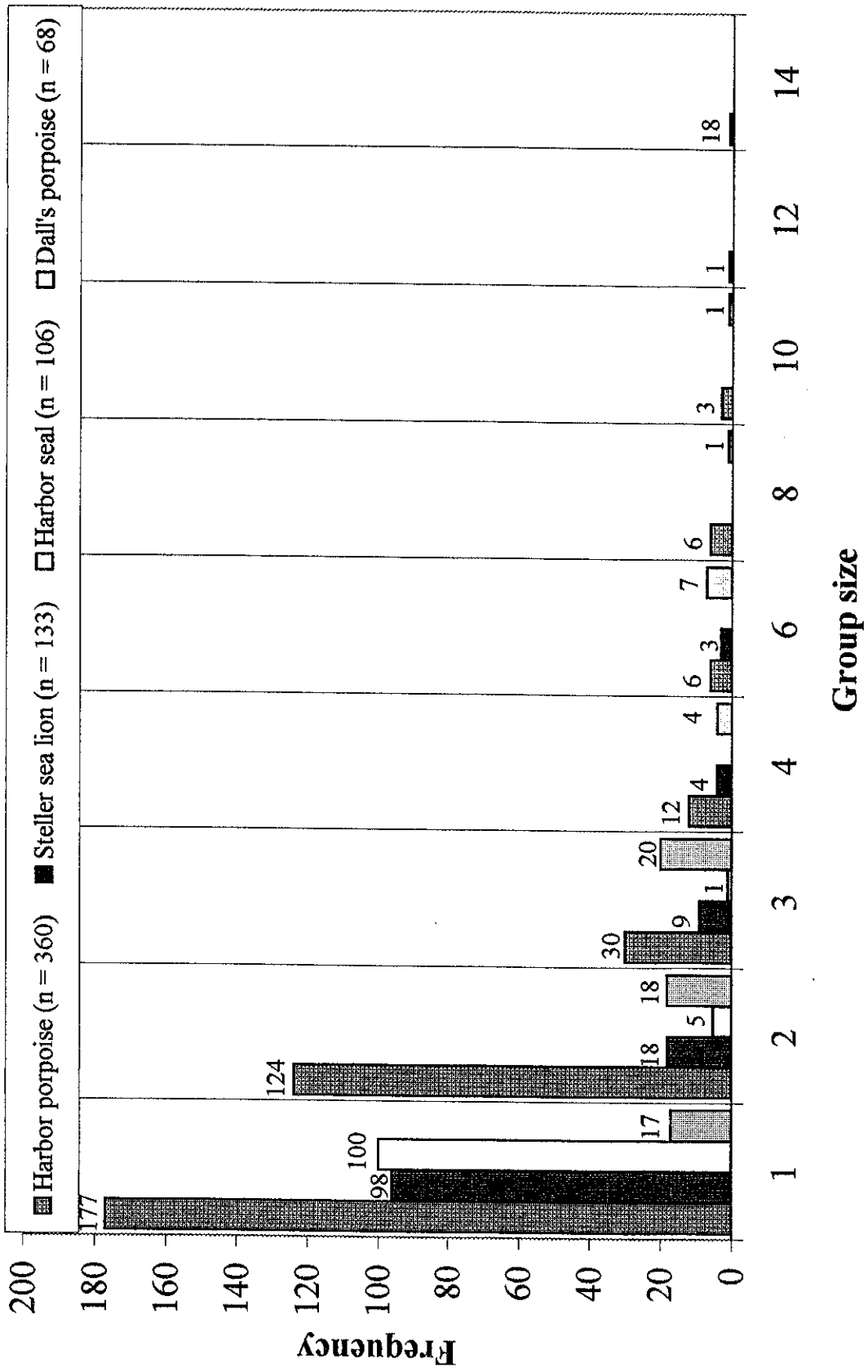


Figure 9.

Table 1. Summary of the 1997 aerial surveys and time expenditures by day.

Survey date	Regions surveyed or attempted	Departure time			Arrival time			Time (d-hrs)	
		Airport	Eng. on	Take off	Airport	Landing	Eng. off	Taxi	Flight
15-Aug	Practice flight	HQM	14:37	14:47	HQM	15:28	15:38	0.01	1.02
	Region II	HQM	17:01	17:06	HQM	18:14	18:23	0.01	1.37
16-Aug	Regions II and I	HQM	10:21	10:31	AST	13:41	13:46	0.01	3.42
	Region I	AST	15:09	15:17	HQM	15:53	15:55	0.01	0.77
17-Aug	Region I	HQM	8:18	8:30	PA	10:43	10:46	0.01	2.47
	Region I	PA	11:56	12:02	PA	16:13	16:18	0.01	4.37
	Ferry to Hoquiam from PA	PA	17:07	17:12	HQM	17:55	17:58	0.01	0.85
19-Aug	Region II	HQM	11:11	11:19	AST	12:05	12:09	0.01	0.97
	Aborted after attempting Region II	AST	14:21	14:28	HQM	15:04	15:08	0.01	0.78
21-Aug	Regions II and III	HQM	12:50	12:59	HQM	18:39	18:43	0.01	5.88
22-Aug	Regions II and III	HQM	7:35	7:46	TLMK	9:08	9:11	0.01	1.60
	Aborted after attempting Region III and II	TLMK	18:06	18:15	HQM	19:05	19:09	0.01	1.05
29-Aug	Regions II, III, IV, V and VI	HQM	9:51	10:01	COOS	14:34	14:36	0.01	4.75
30-Aug	Regions V and VI	COOS	7:22	7:34	COOS	12:35	12:37	0.01	5.25
1-Sep	Region VI	COOS	9:03	9:12	COOS	12:45	12:49	0.01	3.77
	Region IV	COOS	13:43	13:50	COOS	14:58	15:03	0.01	1.33
2-Sep	Aborted after attempting Region IV	COOS	7:59	8:08	COOS	8:26	8:28	0.01	0.48
	Regions IV and III	COOS	9:46	9:58	NWPT	11:25	11:28	0.01	1.70
3-Sep	Region IV	NWPT	8:08	8:18	NWPT	8:49	8:52	0.01	0.73
4-Sep	Region IV	NWPT	7:57	8:10	NWPT	12:41	12:43	0.01	4.77
	Region II	NWPT	13:27	13:36	NWPT	14:57	14:57	0.01	1.50
5-Sep	Region II	NWPT	9:47	9:56	HQM	11:21	11:25	0.01	1.63
6-Sep	Regions II and III	HQM	8:36	8:46	HQM	12:23	12:25	0.01	3.82
	Region II	HQM	13:16	13:24	HQM	16:46	16:49	0.01	3.55
7-Sep	Region II and I	HQM	10:24	10:36	HQM	13:20	13:23	0.01	2.98
	Region II and III	HQM	14:19	14:27	HQM	16:47	16:52	0.01	2.55
8-Sep	Region I	HQM	8:10	8:19	PA	12:33	12:35	0.01	4.42
9-Sep	Region I	PA	17:56	18:05	HQM	20:23	20:26	0.01	2.50
Total flight time								0.25	70.27
Ferry (back to Oxnard, CA)									8
Total hours									78.51

Table 2. Summary of waypoints flown during August- September 1997 and survey conditions.

Day	Transect line waypoints flown or attempted	Overall conditions*	Comments
15-Aug	Practice flight	fair	PP, PV, ZC, and EJ sighted, GPS failure
	Wpts:33-37	fair-good	broke effort due to Beaufort 3, no cc
16-Aug	Wpts: 36-38, 1-2, 49-40	exc-v. good-good-fair-good	increasing cloud cover
	Wpts: 28-29	poor	broke effort due to Beaufort 3
17-Aug	Wpts: 1-2,6-5	exc-v. good-good-poor	broke effort due to high winds and fog
	Wpts:9-10,11-12,13-14,15-16, 17-18	exc to fair	fog and winds present offshore
	Ferry to Hoquiam from PA	unacceptable	fog and winds present offshore
19-Aug	Wpts:30-29	poor	winds exceeded beaufort 2
	Aborted	unacceptable	high winds
21-Aug	Wpts:33-28,75-69,76-81,50-56	exc-good-fair, v good-good	cloud cover > 25%, refuel
22-Aug	Wpts:41-39, 68-67	v good-good-fair	increasing cloud cover
	Aborted	unacceptable	fog and winds present offshore
29-Aug	Wpts: 85-84, 107-106, 92-88, 113-108, 152-151, 123-125	varied from good-fair	cloud cover > 25%, high winds
30-Aug	Wpts:119-114,126-127,120-122,129-126,142-137,145-152,144-143,135-134	exc to poor	conditions varied greatly, depending on area
1-Sep	Wpts:136-130, 137-138,144-143,150-152,114-115	good-v good, exc-v good	refuel
	Wpts:102-104	v good-good-poor	high winds
2-Sep	Aborted	unacceptable	high winds
	Wpts: 106-107, 82-84	good-fair	local areas of high wind
3-Sep	Wpts: 92-91	good-poor	cloud cover > 25%, high winds
4-Sep	Wpts:101-96,102-107,95-91	good-exc-v good-exc-v good	offshore winds slight problem
	Wpts:63-66	good-v good-fair	increasing winds
5-Sep	Wpts:19-20	fair-poor	increasing winds & high sea state
6-Sep	Wpts:23-19, 67-64,85-87	good-v good	refuel
	Wpts:21-27, 62-58	v good/good/exc/fair	broke due to cloud cover/high winds
7-Sep	Wpts:23-24,57-61,1-4	exc,exc/good	refuel
	Wpts:84-83,64-65	v good	refuel
8-Sep	Wpts:5-6,11-18,10-9,5-8	fair-poor, good-exc-good-poor	variable high winds
9-Sep	Wpts:8-7,6-5	exc-v good-good-fair	high winds, low light level

*=Conditions are listed either chronologically (-) or by frequency of occurrence (/).

Table 3. Summary of effort (km) and sightings by transect line during 1997 surveys. Sightings are for principal species only and reflect only on-effort sightings made by primary observers. Effort and sightings in good weather (GW) are for Beaufort 2 or less and 2.5% cloud cover or less. Data includes refractions of some lines initially flown in poor conditions. Lines that extended to offshore waters are divided with offshore component shown as F.

Reg	Spt	Bpt	Offs	Date	Start time	End time	Hr	TKm	GWkm	B0	B1	B2	B3+	CC<25	CC26-50	CC>50	PPat	PPNo	PPaGW	PPvGW	PVat	PVNo	PVnGW	PVnGW	Elno	ElisGW	ElisGW	PDat	PDno	PDnGW	PDnGW							
1	1	1	2	8/16/97	11:28:39	11:33:48	0:09	16.1	16.1	0.0	4.4	11.7	0.0	16.1	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
1	1	1	2	8/17/97	9:07:04	9:21:08	0:23	41.6	39.4	0.0	26.9	12.5	2.2	41.6	0.0	0.0	1	1	0	0	2	2	2	2	0	0	0	0	0	2	3	2						
1	1	1	2	9/7/97	11:55:07	12:06:54	0:2	33.6	33.6	0.0	0.0	33.6	0.0	33.6	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	3	3						
1	1	3	4	9/7/97	12:12:13	12:40:29	0:47	81.1	81.1	0.0	47.9	33.2	0.0	81.1	0.0	0.0	1	1	1	2	4	2	4	2	4	0	0	3	8	3	8	8						
1	1	5	6	9/8/97	9:05:53	9:10:00	0:07	13.0	0.0	0.0	0.0	13.0	0.0	13.0	0.0	0.0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0						
1	1	5	6	9/8/97	11:15:02	11:24:20	0:15	27.7	0.0	0.0	0.0	27.7	0.0	27.7	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1	1	6	5	8/7/97	9:44:21	10:29:19	0:65	110.0	108.1	4.4	91.9	11.8	1.9	110.0	0.0	0.0	7	12	7	12	2	2	2	2	1	1	1	2	3	2	3	2						
1	1	6	5	9/9/97	19:19:45	19:29:43	0:17	28.1	10.3	0.0	0.0	10.3	17.8	28.1	0.0	0.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1	1	7	8	9/8/97	11:26:35	12:17:01	0:56	91.0	9.4	0.0	0.0	9.4	81.6	91.0	0.0	0.0	1	1	0	2	2	2	0	0	1	1	0	0	0	0	0	0	0					
1	1	8	7	9/9/97	18:16:53	18:31:34	0:24	41.4	41.4	0.0	41.4	0.0	0.0	41.4	0.0	0.0	1	2	1	2	2	2	0	0	1	1	0	0	0	0	0	0	0					
1	1	8	7	9/9/97	18:35:37	19:17:27	0:58	96.0	43.1	0.0	0.0	43.1	52.9	96.0	0.0	0.0	2	3	2	3	1	1	1	1	1	0	0	0	1	1	1	1	1					
1	1	9	10	8/7/97	12:23:22	13:09:04	0:68	114.5	104.6	0.0	37.6	66.9	9.9	114.5	0.0	0.0	7	13	6	11	3	3	3	3	1	1	1	1	9	17	9	17	9					
1	1	10	9	9/8/97	10:56:27	11:04:02	0:13	21.1	21.1	0.0	0.0	21.1	0.0	21.1	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1	1	11	12	8/17/97	13:19:32	13:46:21	0:43	73.7	72.4	0.0	27.1	45.2	1.3	73.7	0.0	0.0	8	11	8	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
1	1	12	11	9/8/97	9:30:48	9:41:34	0:18	32.4	32.4	0.0	0.0	32.4	0.0	32.4	0.0	0.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
1	1	13	14	8/17/97	13:54:08	14:13:55	0:27	46.4	35.8	0.0	4.3	31.5	10.7	46.4	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1	1	14	13	9/8/97	9:43:36	10:02:37	0:32	52.8	52.8	0.0	0.0	52.8	0.0	52.8	0.0	0.0	3	5	3	5	0	0	0	0	1	1	1	1	1	3	1	3	1	3				
1	1	15	16	8/17/97	14:19:50	14:38:47	0:32	55.4	55.4	0.0	9.2	46.2	0.0	55.4	0.0	0.0	6	10	6	10	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0			
1	1	15	16	8/17/97	15:18:18	15:25:31	0:12	22.3	13.1	0.0	0.0	13.1	9.2	22.3	0.0	0.0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
1	1	16	15	9/8/97	10:10:31	10:22:35	0:2	35.2	35.2	0.0	14.9	20.3	0.0	35.2	0.0	0.0	3	5	3	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0			
1	1	17	18	8/17/97	14:51:15	15:07:09	0:26	44.8	43.9	0.0	0.0	43.9	0.9	44.8	0.0	0.0	1	2	1	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0			
1	1	17	18	9/8/97	10:30:04	10:38:08	0:13	22.5	22.5	0.0	22.5	0.0	0.0	22.5	0.0	0.0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	19	20	9/5/97	10:45:51	10:55:11	0:16	26.7	0.0	0.0	27.8	3.9	0.0	26.7	0.0	0.0	47	72	40	64	19	21	17	19	6	6	4	4	25	57	22	47	0	0				
2	1	20	19 F	9/6/97	9:49:52	10:02:24	0:21	35.4	35.4	0.0	9.8	25.6	0.0	35.4	0.0	0.0	2	6	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	20	19	9/6/97	10:02:24	10:05:08	0:05	7.9	7.9	0.0	0.0	7.9	0.0	7.9	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	21	20	9/6/97	9:27:45	9:38:50	0:18	31.9	27.5	0.0	0.0	27.5	4.4	31.9	0.0	0.0	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0		
2	1	21	20 F	9/6/97	9:38:50	9:49:38	0:18	31.0	17.0	0.0	7.5	9.5	14.0	31.0	0.0	0.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	21	22	9/6/97	13:39:52	13:52:07	0:2	35.1	35.1	0.0	15.2	19.9	0.0	35.1	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	22	21 F	9/6/97	13:52:07	14:03:07	0:18	32.2	32.2	0.0	27.8	4.4	0.0	32.2	0.0	0.0	1	2	1	2	0	0	0	0	0	0	0	0	0	0	1	3	1	3	1	3		
2	1	22	23 F	9/6/97	14:03:26	14:13:36	0:17	29.9	29.9	0.0	15.6	14.2	0.0	29.9	0.0	0.0	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	22	23	9/6/97	14:13:36	14:26:00	0:21	35.9	22.8	0.0	9.7	13.1	13.1	35.9	0.0	0.0	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	23	22	9/6/97	8:55:12	9:01:45	0:11	19.4	0.0	0.0	0.0	0.0	19.4	19.4	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	1	23	24	9/6/97	14:26:24	14:42:31	0:27	42.6	25.2	0.0	15.2	10.0	17.4	42.6	0.0	0.0	3	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	23	24 F	9/6/97	14:42:31	14:59:50	0:19	32.5	7.6	0.0	20.2	12.4	0.0	7.6	25.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	24	25	9/6/97	10:46:13	10:52:15	0:1	17.6	17.6	0.0	17.6	0.0	0.0	17.6	0.0	0.0	3	9	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	24	25 F	9/6/97	14:54:21	15:04:15	0:16	28.6	4.4	0.0	0.0	28.6	0.0	4.4	24.2	0.0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	24	25	9/6/97	15:04:15	15:16:45	0:21	35.4	35.4	0.0	0.0	35.4	0.0	35.4	0.0	0.0	4	7	4	7	4	4	4	4	4	0	0	0	0	2	3	2	3	2	3	2	3	
2	1	25	26	9/6/97	15:16:59	15:31:16	0:24	40.7	0.0	0.0	0.0	40.7	0.0	0.0	40.7	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	25	26 F	9/6/97	15:31:16	15:40:42	0:16	27.5	0.0	0.0	0.0	27.5	0.0	0.0	27.5	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	26	27 F	9/6/97	15:41:04	15:49:21	0:14	24.0	2.1	0.0	0.0	24.0	0.0	2.1	21.9	0.0	1	2	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
2	2	29	28	8/21/97	14:00:49	14:13:03	0:2	36.4	36.4	0.0	36.4	0.0	0.0	36.4	0.0	0.0	12	19	12	19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
2	2	30	29	8/19/97	11:59:30	11:41:09	0:03	4.7	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	2	30	29	8/21/97	13:47:41	13:58:55	0:19	30.7	30.7	0.0	21.9	8.7	0.0	30.7	0.0	0.0	9	15	9	15	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	32	31	8/21/97	13:24:52	13:39:22	0:24	41.7	41.7	0.0	33.6	8.1	0.0	41.7	0.0	0.0	5	9	5	9	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	33	34	8/15/97	17:12:39	17:28:09	0:26	43.5	43.5	0.0	0.0	43.5	0.0	43.5	0.0	0.0	5	9	5	9																		

Reg	Rep	Spt	Est	Offs	Date	Start time	End time	Hr	Tkm	GWkm	B0	B1	B2	B3+	CC<25	CC26-50	CC>50	PPat	PPho	PPGw	PPmGw	PVait	PVno	PVgW	PVtGw	Elait	Elfno	ElcGw	ElmGw	ElDno	PDmGw	PDnGw	PDpGw						
2	3	44	42	8/16/97	13:07:24	13:20:18	0.18	29.0	27.7	0.0	0.0	0.0	27.7	1.3	29.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2	3	44	43	8/16/97	12:52:41	13:07:02	0.24	41.9	41.9	0.0	16.0	0.0	25.9	0.0	41.9	0.0	0.0	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0						
2	3	45	44	8/16/97	12:27:03	12:42:02	0.25	39.4	39.4	0.0	39.4	0.0	39.4	0.0	39.4	0.0	0.0	3	4	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0					
2	3	46	45	8/16/97	12:12:08	12:26:36	0.24	41.0	41.0	0.0	10.8	30.2	0.0	41.0	0.0	41.0	0.0	0.0	4	5	4	5	1	2	1	2	0	0	0	0	0	0	0	0					
2	3	48	47	8/16/97	11:54:08	12:09:30	0.26	42.7	42.7	0.0	42.7	0.0	42.7	0.0	42.7	0.0	0.0	3	6	3	6	1	1	2	1	1	0	0	0	0	0	0	0	0					
2	3	49	48	8/16/97	11:42:10	11:53:51	0.2	33.2	33.2	0.0	19.1	14.1	0.0	33.2	0.0	33.2	0.0	0.0	2	5	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0				
2	4	50	51	8/21/97	17:12:21	17:21:02	0.16	28.5	28.5	0.0	0.0	28.5	0.0	28.5	0.0	28.5	0.0	0.0	2	2	2	2	2	6	6	6	1	1	1	1	0	0	0	0	0				
2	4	52	53	8/21/97	17:28:29	17:39:37	0.19	30.9	30.9	16.3	14.6	0.0	30.9	0.0	30.9	0.0	30.9	0.0	0.0	2	2	2	2	4	4	4	4	0	0	0	0	0	0	0	0	0			
2	4	53	54	8/21/97	17:40:00	17:54:07	0.24	41.0	40.1	0.0	27.3	12.8	0.9	41.0	0.0	41.0	0.0	0.0	2	2	2	2	1	1	1	1	3	3	3	3	0	0	0	0	0				
2	4	54	55	8/21/97	17:54:47	18:09:55	0.25	42.7	42.7	16.8	26.0	0.0	42.7	0.0	42.7	0.0	42.7	0.0	0.0	1	1	1	1	4	4	4	4	1	1	1	1	0	0	0	0	0			
2	4	55	56	8/21/97	18:10:15	18:25:17	0.25	43.4	43.4	0.0	27.3	16.1	0.0	43.4	0.0	43.4	0.0	0.0	7	10	7	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	4	57	58	9/7/97	11:13:42	11:30:01	0.23	43.0	43.0	0.0	32.5	10.5	0.0	43.0	0.0	43.0	0.0	0.0	5	7	5	7	2	2	2	2	0	0	0	0	0	0	0	0	0	0			
2	4	58	59	9/7/97	11:13:42	11:30:01	0.23	39.2	39.2	0.0	24.2	15.0	0.0	39.2	0.0	39.2	0.0	0.0	6	9	6	9	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0		
2	4	59	58	9/6/97	16:15:38	16:19:49	0.07	12.0	0.0	0.0	0.0	0.0	0.0	12.0	8.1	3.8	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
2	4	60	61	9/7/97	11:33:30	11:43:51	0.19	31.4	31.4	0.0	31.4	0.0	31.4	0.0	31.4	0.0	31.4	0.0	0.0	12	18	12	18	2	2	2	2	0	0	0	0	0	0	0	0	0	0		
2	4	61	60	9/6/97	15:59:18	16:12:30	0.22	39.2	31.0	0.0	18.7	12.3	8.2	39.2	0.0	39.2	0.0	0.0	6	9	3	4	1	1	1	1	1	1	1	1	1	1	1	0	0	0			
2	4	62	61	9/6/97	15:54:27	15:58:59	0.08	13.1	13.1	0.0	13.1	0.0	13.1	0.0	13.1	0.0	13.1	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Region 2 totals																																							
3	1	63	64	9/4/97	13:43:20	13:51:17	0.13	22.0	11.8	0.0	0.0	11.8	10.2	22.0	0.0	187.3	16.1	139	234	125	206	46	50	41	44	7	7	7	7	7	5	10	5	10	5	10			
3	1	63	64 F	9/4/97	13:51:17	14:04:21	0.22	38.1	36.1	2.9	10.9	22.3	1.9	38.1	0.0	38.1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
3	1	64	65 F	9/4/97	14:04:49	14:16:26	0.19	33.5	33.5	0.0	17.8	15.6	0.0	33.5	0.0	33.5	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	64	65	9/4/97	14:16:26	14:25:51	0.16	26.7	8.6	0.0	0.0	8.6	18.1	26.7	0.0	26.7	0.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	64	65 F	9/7/97	15:46:21	15:51:52	0.09	33.3	33.3	0.0	33.3	0.0	33.3	0.0	33.3	0.0	33.3	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	64	65	9/7/97	15:51:52	15:56:01	0.07	23.0	25.0	0.0	0.0	23.0	0.0	23.0	0.0	23.0	0.0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	65	66	9/4/97	14:26:39	14:34:32	0.13	21.1	3.5	0.0	3.5	17.6	21.1	0.0	17.6	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	65	64	9/6/97	11:27:48	11:34:00	0.1	17.6	2.6	0.0	0.0	2.6	15.0	17.6	0.0	17.6	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	66	65 F	9/6/97	10:40:26	10:41:13	0.01	1.9	1.9	0.0	0.0	1.9	0.0	1.9	0.0	1.9	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	66	65 F	9/6/97	10:51:56	10:58:27	0.11	18.8	18.8	0.0	18.8	0.0	18.8	0.0	18.8	0.0	18.8	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	66	65 F	9/6/97	11:00:47	11:17:11	0.16	25.4	25.4	0.0	25.4	0.0	25.4	0.0	25.4	0.0	25.4	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	66	65 F	9/6/97	11:17:11	11:27:33	0.17	30.7	30.7	0.0	0.0	30.7	0.0	30.7	0.0	30.7	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	67	66	9/6/97	10:18:27	10:28:07	0.16	27.3	27.3	0.0	21.1	6.2	0.0	27.3	0.0	27.3	0.0	0	0	1	2	1	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
3	1	67	66 F	9/6/97	10:28:07	10:40:04	0.2	34.6	34.6	0.0	0.0	34.6	0.0	34.6	0.0	34.6	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	1	68	67	8/22/97	8:40:16	8:51:15	0.18	32.0	0.0	0.0	15.4	11.2	5.5	0.0	18.9	13.1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	2	70	69	8/21/97	15:27:34	15:38:42	0.19	32.2	32.2	0.0	32.2	0.0	32.2	0.0	32.2	0.0	32.2	0.0	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	2	71	70	8/21/97	15:13:43	15:27:11	0.22	38.5	38.5	0.0	38.5	0.0	38.5	0.0	38.5	0.0	38.5	0.0	2	5	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	2	72	71	8/21/97	14:59:46	15:12:26	0.21	36.4	36.4	0.0	12.8	23.6	0.0	36.4	0.0	36.4	0.0	0.0	3	4	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	2	73	72	8/21/97	14:45:05	14:59:20	0.24	40.0	40.0	0.0	4.9	35.1	0.0	40.0	0.0	40.0	0.0	0.0	1	1	1	1	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	74	73	8/21/97	14:30:19	14:43:10	0.21	37.7	37.7	12.0	25.7	0.0	37.7	0.0	37.7	0.0	37.7	0.0	3	3	3	3	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
3	2	75	74	8/21/97	14:16:5																																		

Reg	Rep	Spt	Ept	Offs	Date	Start time	End time	Hr	Tkm	GW	B0	B1	B2	B3+	CC-25	CC26-50	CC>50	PFbit	PFno	PFnoGW	PFbit	PFno	PVno	PVnoGW	EVbit	EVno	EVnoGW	EHrGW	EHrbit	PDno	PDnoGW	PDnoGW	PDnoGW		
4	1	95	94		9/4/97	11:36:01	11:41:40	0.09	16.6	16.6	12.7	3.9	0.0	0.0	16.6	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
4	2	97	96		9/4/97	9:43:38	9:47:52	0.07	12.2	12.2	0.0	12.2	0.0	0.0	12.2	0.0	0.0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
4	2	98	97		9/4/97	9:18:22	9:43:08	0.41	72.7	59.1	0.0	30.7	28.5	13.6	72.7	0.0	0.0	7	16	4	12	0	0	0	0	4	3	3	2	8	2	8	2	8	
4	2	100	99		9/4/97	8:50:59	9:16:45	0.43	75.0	68.2	0.0	39.0	36.0	0.0	68.2	3.3	3.5	9	15	9	15	1	1	1	3	3	3	3	2	6	2	6	2	6	
4	2	101	100		9/4/97	8:22:50	8:50:41	0.46	80.9	70.1	0.0	54.8	26.1	0.0	70.1	0.0	10.8	5	8	5	8	0	0	0	0	4	4	4	4	1	1	1	1	1	
4	3	102	103		9/1/97	14:03:50	14:21:23	0.29	48.7	26.4	0.0	0.0	29.2	19.5	46.0	2.8	0.0	0	0	0	0	0	0	0	3	7	2	2	2	9	2	9	2	9	
4	3	103	104		9/1/97	14:22:22	14:33:05	0.18	31.6	3.4	0.0	0.0	3.4	28.1	29.7	0.0	10.8	1	2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
4	3	103	104		9/4/97	9:59:35	10:32:30	0.44	75.5	65.9	0.0	13.2	62.3	0.0	65.9	0.0	9.6	8	16	8	16	0	0	0	3	3	3	3	3	2	1	2	1	2	1
4	3	105	106		9/4/97	10:33:26	10:59:12	0.43	75.6	75.6	23.1	25.8	26.7	0.0	75.6	0.0	0.0	6	25	6	25	0	0	0	0	2	3	2	3	3	12	3	12	3	12
4	3	106	107		9/2/97	10:43:09	10:53:00	0.16	28.7	6.5	0.0	0.0	6.5	22.2	28.7	0.0	0.0	0	0	0	0	1	1	1	0	2	2	0	0	0	0	0	0	0	0
4	3	106	107		9/4/97	10:59:49	11:23:00	0.39	65.9	65.9	48.3	17.6	0.0	0.0	65.9	0.0	0.0	1	4	1	4	1	1	1	4	6	4	4	6	1	3	1	3	1	
4	3	107	106		8/29/97	11:28:39	11:34:56	0.11	18.1	9.6	0.0	0.0	9.6	8.5	18.1	0.0	0.0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Region 4 Total									5	876.8	726.0	95.1	329.4	344.2	102.2	824.8	8.0	38.0	67	164	62	156	11	12	10	11	37	46	30	35	21	74	19	65	
5	1	109	108	F	8/29/97	13:29:10	13:37:48	0.14	26.6	26.6	0.0	22.3	4.4	0.0	26.6	0.0	0.0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	109	108		8/29/97	13:37:48	13:42:10	0.07	13.8	13.8	0.0	3.1	10.7	0.0	13.8	0.0	0.0	2	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	110	109	F	8/29/97	13:13:39	13:19:07	0.09	15.6	15.6	0.0	6.2	9.4	0.0	15.6	0.0	0.0	0	0	0	0	2	2	2	2	2	2	2	3	0	0	0	0	0	0
5	1	110	109		8/29/97	13:19:07	13:28:03	0.15	25.7	25.7	0.0	25.7	0.0	0.0	25.7	0.0	0.0	0	0	0	0	0	0	0	0	1	1	1	1	3	7	3	7	3	7
5	1	112	111	F	8/29/97	12:58:05	13:05:58	0.13	23.9	23.9	0.0	23.9	0.0	0.0	23.9	0.0	0.0	0	0	0	0	0	0	0	0	1	1	3	4	0	0	0	0	0	0
5	1	112	111		8/29/97	13:05:58	13:11:34	0.09	17.4	17.4	0.0	8.6	8.8	0.0	17.4	0.0	0.0	4	10	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	113	112	F	8/29/97	12:41:34	12:47:00	0.09	15.7	8.3	0.0	0.0	8.3	7.4	15.7	0.0	0.0	4	10	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	113	112		8/29/97	12:47:00	12:57:11	0.17	29.5	29.5	0.0	24.1	5.4	0.0	29.5	0.0	0.0	2	3	2	3	1	1	1	1	2	2	2	2	1	2	1	2	1	2
5	2	114	115	F	9/1/97	12:24:32	12:27:19	0.05	7.4	7.4	0.0	0.0	7.4	0.0	7.4	0.0	0.0	1	1	1	1	1	1	1	1	1	1	2	0	0	0	0	0	0	0
5	2	114	115		8/30/97	8:07:20	8:09:57	0.04	7.4	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	116	115	F	8/30/97	7:58:05	8:06:08	0.13	22.4	20.6	0.0	7.7	12.9	1.8	22.4	0.0	0.0	2	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	118	117	F	8/30/97	7:48:38	7:55:56	0.12	19.9	19.9	0.0	0.0	19.9	0.0	19.9	0.0	0.0	2	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	119	118	F	8/30/97	7:38:29	7:47:45	0.15	26.4	20.4	0.0	3.7	16.2	6.4	26.4	0.0	0.0	4	11	4	11	1	1	1	1	1	1	1	1	0	0	0	0	0	0
5	2	120	121	F	8/30/97	8:39:58	8:46:31	0.11	19.4	19.4	0.0	11.4	8.0	0.0	19.4	0.0	0.0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
5	2	121	122	F	8/30/97	8:47:35	8:55:04	0.12	21.4	5.4	0.0	0.0	5.4	16.0	21.4	0.0	0.0	1	1	1	1	1	1	2	1	2	0	0	0	0	0	0	0	0	0
5	3	123	124	F	8/29/97	14:02:23	14:06:15	0.06	10.1	10.1	0.0	0.0	10.1	0.0	10.1	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3	123	124		8/29/97	14:02:23	14:20:35	0.22	26.3	16.3	0.0	0.0	16.3	10.0	26.3	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3	124	125	F	8/29/97	14:21:22	14:27:24	0.11	18.2	15.0	0.0	0.0	15.0	3.2	18.2	0.0	0.0	0	0	0	0	0	0	1	1	1	2	1	2	1	0	0	0	0	0
5	3	126	127	F	8/30/97	8:33:36	8:36:15	0.04	8.0	5.9	0.0	4.7	1.1	2.1	8.0	0.0	0.0	1	7	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3	127	126	F	8/30/97	9:29:40	9:37:35	0.13	22.4	8.2	0.0	0.0	8.2	14.2	22.4	0.0	0.0	2	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3	128	127	F	8/30/97	9:20:22	9:28:09	0.13	22.0	20.5	0.0	16.5	4.0	1.5	22.0	0.0	0.0	0	0	0	0	0	0	0	0	4	4	4	4	1	3	1	3	1	
5	3	129	128	F	8/30/97	9:13:16	9:19:40	0.11	17.6	10.7	0.0	0.0	10.7	6.9	17.6	0.0	0.0	2	14	0	0	0	0	0	0	1	2	1	2	1	0	0	0	0	
Region 5 Total									2.44	417.2	340.3	0.0	157.9	182.4	76.9	417.2	0.0	0.0	25	61	20	42	8	9	8	9	17	20	17	20	5	12	5	12	
6	1	131	130	F	9/1/97	10:29:56	10:35:19	0.09	15.1	15.1	0.0	0.0	15.1	0.0	15.1	0.0	0.0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	
6	1	133	132	F	9/1/97	10:15:56	10:22:12	0.1	18.0	18.0	0.0	0.0	18.0	0.0	18.0	0.0	0.0	0	0	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	
6	1	133	132		9/1/97	10:22:12	10:27:26	0.09	15.5	15.5	0.0	8.9	6.7	0.0	15.5	0.0	0.0	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	134	133	F	9/1/97	10:00:43	10:09:35	0.15	26.5	26.5	0.0	0.0	26.5	0.0	26.5	0.0	0.0	9																	

Reg	Rep	Spt	Ept	Offs	Date	Start time	End time	Hr	TKm	GWkm	B0	B1	B2	B3+	CC<25	CC26-50	CC>50	PPhit	PPno	PPxGW	PPnGW	PVhit	PVno	PVsGW	PVnGW	ELhit	ELno	ELxGW	ELnGW	PDhit	PDno	PDxGW	PDnGW							
6	3	148	149		8/30/97	11:05:20	11:14:20	0.15	25.9	25.9	0.0	5.8	20.2	0.0	25.9	0.0	0.0	4	11	4	11	1	1	1	1	1	11	31	11	31	0	0	0	0						
6	3	149	150		8/30/97	11:15:12	11:25:18	0.17	29.6	29.6	0.0	0.9	28.7	0.0	29.6	0.0	0.0	2	4	2	4	1	1	1	1	1	2	3	2	3	0	0	0	0						
6	3	150	151		9/1/97	12:09:06	12:16:20	0.12	20.0	20.0	0.0	20.0	0.0	0.0	20.0	0.0	0.0	1	3	1	3	0	0	0	0	3	3	3	3	0	0	0	0	0						
6	3	151	152		8/30/97	11:45:25	11:50:26	0.26	45.6	19.2	0.0	11.7	7.5	26.4	45.6	0.0	0.0	1	1	1	1	1	0	0	0	6	130	3	127	0	0	0	0	0						
6	3	151	152		9/1/97	12:17:17	12:22:59	0.1	17.3	17.3	0.0	16.7	0.6	0.0	17.3	0.0	0.0	1	4	1	4	1	1	1	1	3	3	3	3	0	0	0	0	0	0					
6	3	152	151		8/29/97	13:45:03	13:51:40	0.11	18.9	8.2	0.0	0.0	8.2	10.8	18.9	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Region 6 total									3.06	527.1	463.4	0.0	152.9	324.0	50.2	513.6	13.4	0.0	38	89	37	88	7	7	7	49	208	44	201	5	19	5	19	5	19					
Grand Total (Regions 1-6)									31.4	5396.3	4398.1	182.9	1942.9	2607.8	662.8	5038.1	291.0	67.2	359	690	319	616	107	116	96	104	133	315	117	293	67	184	61	163	61	163	61	163	61	163

Abbreviations

- Reg Region
- Rep Replicate
- Spt Start Wpt
- Ept End Wpt
- Offs Offshore indicator (f = > 100 m water depth)
- TKm Total number of kilometers flown
- GWkm Kilometers flown in good weather
- B Beaufort
- CC Percent cloud cover
- PPhit Harbor porpoise sightings
- PPno No. of animals
- PPxGW Harbor porpoise sightings in good weather
- PPnGW No. of animals in good weather
- PV Harbor seal
- PVno Steller sea lion
- EJ Dall's porpoise
- PD

Table 5. Mean group size by region and species (for GW, on-effort, and primary observers).

Area	PP	n	PD	n	EJ	n	PV	n
Region 1	1.60	40	2.14	22	1.00	4	1.07	15
Region 2	1.65	125	2.00	5	1.00	7	1.07	41
Region 3	1.71	35	2.00	5	1.73	15	1.08	13
Region 4	2.52	62	3.42	19	1.17	30	1.10	10
Region 5	2.10	20	2.40	5	1.18	17	1.13	8
Region 6	2.38	37	3.80	5	1.73	42	1.00	7
TOTAL	1.93	319	2.67	61	1.44	115	1.07	94

Appendix Table A-1 Waypoints used for the 1997 aerial surveys of coastal Oregon, Washington and British Columbia, Canada.

Waypoint	Latitude (N)		Longitude (W)	
	Deg.	Min.	Deg.	Min.
Region I, Replicate 1				
1	48	01.800	124	42.000
2	48	01.800	125	42.000
3	48	07.800	125	48.000
4	48	07.800	124	43.200
5	48	19.200	124	00.000
6	48	19.200	125	57.600
7	48	21.600	126	00.000
8	48	21.600	124	00.000
9	48	28.200	124	16.800
10	48	28.200	126	07.200
11	48	39.600	126	17.400
12	48	39.600	124	58.200
13	48	42.000	125	07.200
14	48	42.000	126	19.200
15	48	48.000	126	24.600
16	48	48.000	125	11.400
17	48	59.400	125	41.400
18	48	59.400	126	34.800
Region II, Replicate 1				
19	46	07.740	123	57.180
20	46	21.240	124	47.040
21	46	37.440	124	04.200
22	46	47.880	124	54.840
23	47	07.320	124	09.660
24	47	21.900	125	06.780
25	47	40.860	124	25.380
26	47	52.200	125	16.680
27	48	00.000	125	01.200
Region II, Replicate 2				
28	46	05.400	123	56.040
29	46	15.600	124	21.600
30	46	26.400	124	04.200
31	46	36.600	124	04.800
32	46	46.800	124	32.400
33	47	03.000	124	08.400
34	47	13.200	124	41.400
35	47	31.200	124	22.200
36	47	35.400	124	22.800
37	47	45.600	124	55.200
38	47	55.800	124	40.200

Appendix Table A-1 Continued.

Waypoint	Latitude (N)		Longitude (W)	
	Deg.	Min.	Deg.	Min.
Region II, Replicate 3				
39	46	00.000	123	56.400
40	46	08.400	124	18.600
41	46	19.800	124	03.600
42	46	30.000	124	03.600
43	46	38.400	124	29.400
44	46	57.000	124	07.200
45	47	06.600	124	39.000
46	47	22.800	124	19.800
47	47	28.800	124	22.200
48	47	39.000	124	51.600
49	47	51.000	124	32.400
Region II, Replicate 4				
50	46	03.000	124	16.800
51	46	12.600	124	00.600
52	46	24.000	124	04.800
53	46	30.600	124	25.800
54	46	49.800	124	04.200
55	46	58.800	124	36.000
56	47	16.800	124	15.000
57	47	19.800	124	16.800
58	47	29.400	124	48.000
59	47	43.200	124	25.800
60	47	48.000	124	30.000
61	47	55.200	124	58.800
62	48	00.000	124	51.600
Region III, Replicate 1				
63	44	46.800	124	06.000
64	45	04.800	124	41.580
65	45	15.420	123	59.520
66	45	36.000	124	42.600
67	45	48.420	123	58.140
68	46	00.000	124	16.680
Region III, Replicate 2				
69	44	43.380	124	10.320
70	44	52.200	124	17.880
71	45	07.200	124	00.000
72	45	21.480	124	17.880
73	45	37.200	123	57.600
74	45	50.400	124	17.880
75	46	00.000	124	02.400

Appendix Table A-1 Continued.

Waypoint	Latitude (N)		Longitude (W)	
	Deg.	Min.	Deg.	Min.
Region III, Replicate 3				
76	44	43.800	124	17.880
77	45	00.360	124	01.200
78	45	14.880	124	17.880
79	45	29.700	123	58.380
80	45	43.200	124	17.880
81	45	56.640	123	58.740
Region III, Replicate 4				
82	44	43.320	124	13.200
83	44	54.000	124	02.400
84	45	09.420	124	17.880
85	45	24.000	123	59.400
86	45	37.800	124	17.880
87	45	52.800	123	58.200
Region IV, Replicate 1				
88	43	50.040	124	18.420
89	43	51.420	124	09.420
90	43	55.080	124	07.980
91	44	09.240	125	00.000
92	44	21.900	124	06.000
93	44	24.000	124	06.000
94	44	39.000	125	00.000
95	44	42.600	124	48.600
Region IV, Replicate 2				
96	43	50.040	124	51.720
97	43	53.400	125	00.000
98	44	04.560	124	07.560
99	44	06.660	124	07.440
100	44	22.620	125	00.000
101	44	40.080	124	05.400
Region IV, Replicate 3				
102	43	50.040	124	26.520
103	44	00.000	125	00.000
104	44	12.540	124	07.800
105	44	15.540	124	07.800
106	44	29.640	125	00.000
107	44	42.840	124	13.200

Appendix Table A-1 Continued.

Waypoint	Latitude (N)		Longitude (W)	
	Deg.	Min.	Deg.	Min.
Region V, Replicate 1				
108	43	00.000	124	33.480
109	43	16.200	124	52.320
110	43	20.040	124	22.200
111	43	22.440	124	19.860
112	43	37.980	124	41.280
113	43	46.740	124	10.320
Region V, Replicate 2				
114	43	00.000	124	36.660
115	43	03.300	124	39.240
116	43	09.000	124	24.180
117	43	11.640	124	23.040
118	43	20.640	124	32.880
119	43	27.780	124	16.080
120	43	32.220	124	14.340
121	43	40.200	124	24.480
122	43	45.900	124	10.800
Region V, Replicate 3				
123	43	01.020	124	25.680
124	43	14.340	124	35.220
125	43	19.020	124	23.640
126	43	24.900	124	17.280
127	43	35.760	124	26.220
128	43	41.040	124	12.000
129	43	49.380	124	18.120
Region VI, Replicate 1				
130	42	00.000	124	27.120
131	42	07.140	124	20.160
132	42	10.800	124	20.760
133	42	18.360	124	44.340
134	42	35.520	124	23.640
135	42	45.780	124	55.200
136	42	59.220	124	30.840
Region VI, Replicate 2				
137	42	00.000	124	16.680
138	42	10.620	124	30.840
139	42	23.700	124	24.480
140	42	27.180	124	25.500
141	42	36.360	124	40.740
142	42	47.760	124	32.040
143	42	51.000	124	32.040
144	42	59.400	124	50.340

Appendix Table A-1 Continued.

Waypoint	Latitude (N)		Longitude (W)	
	Deg.	Min.	Deg.	Min.
Region VI, Replicate 3				
145	42	00.000	124	21.000
146	42	06.360	124	29.160
147	42	13.260	124	22.740
148	42	17.580	124	24.780
149	42	27.780	124	37.500
150	42	42.240	124	27.420
151	42	52.080	124	47.100
152	43	00.000	124	34.620

Appendix Table A-2. Data Acquisition System (DAS) program codes for 1997 harbor porpoise aerial survey data (file name: HP97-ALL.DAS). Line transects where flown over Oregon, Washington, and British Columbia waters from 15 August through 9 September 1997.

Column	Description of data entry
1	Event code
3-6	Begin waypoint number
7	Off shore designator
8-11	End waypoint number
13-14	Month
16-17	Day
19-20	Year
22-23	Time (Hours)
25-26	Time (Minutes)
28-29	Time (Seconds)
31-33	Position (Latitude degrees)
35-39	Position (Latitude minutes)
41-44	Position (Longitude degrees)
46-50	Position (Longitude minutes)
52-55	Altitude
57-59	Sighting number
57+	Comment only (if no sighting data on line)
61-63	Species code
65-67	Angle to sighting
67	Side of center observer's sighting (L or R)
69-72	Group size
75-77	Minimum group size
80-82	Maximum group size
84-85	Number of calves or pups

Appendix Table A-2, continued. Data codes for the DAS program

93-94	Behavior code
103-105	Observer initials
107-109	Cloud cover
112	Beaufort scale
114	Glare left observer
116	Glare center observer
118	Glare right observer
120	Visual quality left observer
122	Visual quality center observer
124	Visual quality right observer
126+	Comment for the sighting on this line
161	Indicates whether center saw last side observation

Appendix Table A-2, continued. Data codes for the DAS program

Event code (column 1): 1 digit code representing the reason for data entry. The different codes are as follows:

- 1 = left observer sighting
- 2 = center observer sighting
- 3 = right observer sighting
- 4 = sighting from data recorder or pilot
- 8 = altitude update
- W = Weather
- B = Begin line
- E = End line
- X = short break of a given trackline, usually due a land crossing
- R = Resume on-effort (back over water)
- C = Comment
- O = Observer update for left, center, right, data recorder, pilot positions
- * = aircraft position captured by the DAS program (positions are sampled each minute even when observers were off-effort).

Begin waypoint (columns 3-6): Alpha-numeric code representing the region (letters) and waypoint number at the beginning of the transect line (see attached waypoint table for details).

Offshore (column 7): Indicates if effort is offshore (F) in water depths greater than 100 m.

End waypoint (columns 8-11): Alpha-numeric code representing the region (letters) and waypoint number at the end of the transect line (see attached waypoint table for details).

Month (columns 13-14): Numeric value representing month (e.g. 12 for December).

Day (columns 16-17): Numeric value representing the day of the month.

Year (columns 19-20): Numeric value representing the year (e.g. 96 for 1996).

Time (Hours) (columns 22-23): Numeric value representing the hour (e.g. 13 for the thirteenth hour of the day - Pacific Daylight Savings Time).

Time (Minutes) (columns 25-26): Numeric value representing minutes (e.g. 10 for the tenth minute of the hour).

Time (Seconds) (columns 28-29): Numeric value representing seconds (e.g. 10 for the tenth second of the minute.)

Appendix Table A-2, continued. Data codes for the DAS program

Position (Latitude degrees) (columns 31-33): Numeric value representing the latitude (e.g. N48 for 48 degrees north; 'T' indicates that the position was interpolated based on the time and latitude of the position that proceeded and followed it).

Position (Latitude minutes) (columns 35-39): Numeric value representing the minutes latitude (60 minutes equals one degree).

Position (Longitude degrees) (columns 41-44): Numeric value representing the degrees longitude (e.g. W123 for 123 degrees west; 'T' indicates that the position was interpolated based on the time and longitude of the position that proceeded and followed it).

Position (Longitude minutes) (columns 46-50): Numeric value representing the minutes longitude (60 minutes equals one degree).

Altitude (columns 52-55): Numeric value representing the altitude of the survey aircraft at time of event.

Sighting number (columns 57-59): Numeric code given for the sighting number. DAS numbered the sightings sequentially beginning each time the DAS program was loaded. Skips in the sighting numbers represent that a sighting was removed from the data file.

Species code (columns 61-62): Code representing the species sighted:

- 1 = Harbor Porpoise
- 2 = Harbor Seal
- BA = Minke Whale
- EJ = Northern Sea Lion
- EL = Sea Otter
- ER = Gray Whale
- GG = Risso's Dolphin
- LB = Northern Right Whale Dolphin
- LBT = Leatherback Turtle
- LO = Pacific White-Sided Dolphin
- MA = Elephant Seal
- OO = Killer Whale
- PD = Dall's Porpoise
- TS = Shark (Most Likely Thresher Or Blue)
- UP = Unidentified Pinniped
- UO = Unidentified Otariid
- UW = Unidentified Whale
- ZC = California Sea Lion

Angle to sighting (columns 65 - 67): Numeric value representing the clinometer reading in degrees to animal as it passes abeam of the aircraft (90 degrees = trackline). Angles for the belly observer was estimated from a premarked grid positioned above the viewing port.

Appendix Table A-2, continued. Data codes for the DAS program

Side of aircraft (column 67): Left (L) or right (R) side of the aircraft (for center observer sightings)

Group size (columns 69-72): Numeric value representing the number of animals seen for the specific sighting (number includes all calves or pups in group).

Calves/Pups (column 84-85): Number of calves or pups if seen

Behavior code (column 94): Number: 3 = stationary, 6 = hauled pinniped, 15 = cetacean pectoral fin slap, 32 = alteration of normal activities, 33 = quick dive

Observer initials (columns 103-105): 2 digit code for the using the first letters from the observers first and last name.

Cloud cover (columns 107-109): Numeric code representing percent of cloud cover (e.g. 25 for 25% cloud cover).

Beaufort wind scale (column 111-112): Representing the Beaufort wind scale (1 = Beaufort 1).

Glare: Numeric code representing surface glare conditions.

1 = no glare problems

2 = glare problems - affects search

3 = severe glare - scorched eyeballs

Left observer (column 114)

Center observer (column 116)

Right observer (column 118)

Visual quality: Numeric code of overall impression of ability to see animals

1 = Excellent

2 = Good

3 = Fair

4 = Poor

5 = Unacceptable

Left observer (column 120)

Center observer (column 122)

Right observer (column 124)

Comment for sighting: (columns 126+): Comment about sighting or flight.

Center saw: Numerical code indicating whether the center observer saw the side observer's last sighting. No code indicates the center did not see the sighting. These data were not collected after 22 August 1997.