

SUMMER DISTRIBUTION AND NUMBERS OF  
FIN, HUMPBACK, AND GRAY WHALES  
IN THE GULF OF ALASKA

*by*

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TABLE OF CONTENTS

	Page
Introduction . . . . .	5
Study Area . . . . .	7
Methods . . . . .	7
Line-transect census . . . . .	7
Photo-identification . . . . .	14
Radio-tracking . . . . .	14
Acoustic recording . . . . .	14
Data management . . . . .	14
Results. . . . .	14
Humpback whale . . . . .	15
Fin whale . . . . .	17
Gray whale . . . . .	17
Other endangered species . . . . .	17
Summary and Conclusions . . . . .	17
Acknowledgements . . . . .	18
Literature Cited . . . . .	18
Appendix. Distribution Charts . . . . .	20

## INTRODUCTION

The Gulf of Alaska is inhabited by 7 of the world's 10 species of baleen whales (Fiscus et al. 1978). Six of these species--the minke Balaenoptera acutorostrata, sei B. borealis, fin B. physalus, blue B. musculus, humpback Megaptera novaeangliae, and--right Balaena glacialis whales--utilize the gulf as one of their major feeding grounds from spring to autumn. Although all six species are virtually cosmopolitan in distribution, all except the small minke whale are classified as endangered species throughout their ranges (U.S. Dept. Comm. 1979). The seventh species--the gray whale Eschrichtius robustus--is endemic to the North Pacific, and virtually the entire world population migrates along the shore of the gulf twice each year, in spring and fall; the gray whale is also classified as an endangered species.

The Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973 stipulate that studies be made to determine whether proposed habitat alterations will have any adverse effects on populations of endangered species of marine mammals, and to determine what measures might be used to alleviate any such effects. In the summer of 1980 we conducted a preliminary survey to determine whether petroleum exploration and development lease sites on the outer continental shelf around Kodiak Island (Sale No. 48) and in the northeastern Gulf of Alaska (Sale No. 55) are important habitats for the endangered whale populations that inhabit the gulf, especially fin, humpback and gray whales.

Most species of baleen whales spend the winter in lower latitudes where they mate and, a year later, bear their calves (Mackintosh 1965). They largely fast during this period. They migrate long distances to their summer feeding grounds in productive high-latitude waters. During the summer they must accumulate sufficient fat reserves to sustain them through their winter fast. Pregnant females must support a rapidly-growing fetus, and lactating females must nurture an even more rapidly-growing calf to independence before the fall migration and winter fast. Being filter feeders, baleen whales require dense concentrations of their prey species to ingest adequate nourishment. For this reason, they tend to be nomadic during the summer, aggregating in local areas with temporarily high food densities. Patterns of distribution and movement may vary considerably from month to month and year to year.

In the Gulf of Alaska, aboriginal whaling was practiced only from Kodiak Island westward (Heizer 1973; Mitchell 1979). It ceased many decades ago. However, the gray whales that migrate through the Gulf and into the Bering Sea (Rugh and Braham 1979) are the object of an important subsistence fishery around the Chukotski Peninsula, USSR, and a few of these whales are sometimes taken by Eskimos in arctic Alaska.

Populations of all species of great whales that inhabit the Gulf of Alaska have been greatly reduced by commercial whaling (Table 1). During the 19th century, right whales were heavily exploited on the "Northwest Coast Grounds" by the American high-seas whale fishery (Townsend 1935). During the same period, gray whales were also heavily

exploited while migrating past California and while in their Mexican calving lagoons (Rice and Wolman 1971). Between 1910 and 1940, **rorquals**--blue, fin, **sei**, and **humpback** whales--were exploited by shore whaling stations in Alaska, British Columbia, Washington and California, and by floating factory ships off Mexico. From 1946 to 1976, large numbers of **rorquals** were killed throughout the North Pacific by Japanese and Soviet pelagic whaling fleets.

Two species of whales that inhabit the Gulf of Alaska--the humpback and the gray whale--now support a lucrative tourist industry on their respective winter grounds in Hawaii and in southern California and Baja **California**, Mexico.

There are many data on the past distribution and numbers of **whales** in the Gulf of Alaska. These data derive mainly from commercial whale catches (**Nishiwaki 1966**; Townsend 1935), and from sightings by scouting vessels attached to whaling expeditions (**Berzin and Rovnin 1966**; Wada 1979). Since the cessation of commercial whaling, little information has become available on the distribution and numbers of the surviving populations of these species. The **NMML** has censused humpback populations in southeastern Alaska and Prince William Sound, and annually monitors the gray whale population as it migrates along the California coast. A considerable amount of sighting data has been collected in the last 5 years under **NMFS's** continuing Platforms of Opportunity Program (**Fiscus et al. 1976**). Sightings from NOAA research vessels with trained marine **mammal** personnel aboard have indicated some areas of particular abundance in the **gulf** for humpbacks and fin whales. Sightings by casual observers, although often unreliable for certain species (particularly blue, fin, and sei whales) have also been of some value in determining distribution patterns.

From **17** June to 28 August 1980, we conducted a cruise to investigate the distribution and movements of fin whales, humpback whales, gray whales and other marine mammals in the **Gulf** of Alaska. We surveyed the waters over the continental shelf and slope, and immediate offshore waters, from Cape Fairweather (**138°W**) west to **Chirikof** Island (**156°W**). The primary objectives were:

- (a) To determine the spatial and temporal distribution of humpback and fin whales in the Gulf of Alaska (from Fairweather Grounds to Shumagin Islands), including Prince William Sound and adjacent waters.
- (b) To define patterns of summer (June-August) movements and important areas of habitat use for the gray, fin and humpback whale.
- (c) To improve present abundance estimates for the total number of humpback and fin whales occupying the Gulf of Alaska during summer months.

Secondary objectives were:

- (d) To use radio receivers aboard the survey vessel for detection of gray whales radio-tagged in Mexico as part of the **BLM/NMFS**

radio tagging project.

- (e) To conduct exploratory acoustic monitoring involving deployment of a hydrophore at station intervals along the cruise track to detect the presence of whales which might not be visually sighted.

#### STUDY AREA

Our systematic census area included the waters over the continental shelf, continental slope, and immediate offshore waters of the Gulf of Alaska from 138°W to 156°W.

For statistical purposes, we divided this area into 24 quadrats of 1° latitude (60 nautical miles) by 2° longitude (58-69 miles). The water area defined by these quadrats (Fig. 1) totals 76,117 square miles (221,915 km<sup>2</sup>) (Table 2).

In addition to this primary study area, we also explored (1) the coastal waters from Seattle, Washington to Cape Fairweather, Alaska; (2) Icy Straits and Cross Sound in southeastern Alaska; (3) Yakutat Bay; (4) Icy Bay; (5) Prince William Sound; (6) Shelikof Straits; and (7) the coastal waters from Chirikof Island west to Dutch Harbor in the Aleutian Islands.

#### METHODS

The cruise was conducted with the chartered fishing vessel U.S. Dominator. This vessel, designed for the Bering Sea king crab fishery, is 37.8 m long and its gross tonnage is 199. Its cruising speed is 10 knots (18.5 km/hr). The bridge affords excellent visibility in all directions. The observer's eye level is 7.7 m above the waterline.

Research methods included (1) line-transect censuses of marine mammals; (2) photography of humpback whales for individual identification; (3) radio-monitoring for previously radio-tagged gray whales; and (4) acoustic recording.

##### Line-transect census

A series of north-south transects were established at regular intervals across the study area. During the first half of the cruise (17 June to 20 July), 15 transects were run (Fig. 2 and Table 3); these were spaced at intervals of 1° longitude through the sectors that include lease sites, and at intervals of 2° longitude through the remaining sectors. These transects totaled 1,927 nautical miles.

During the second half of the cruise (24 July to 28 August), 9 transects were run (Fig. 3 and Table 4); all were spaced at intervals of 10 of longitude. These transects totaled 1,179 miles.

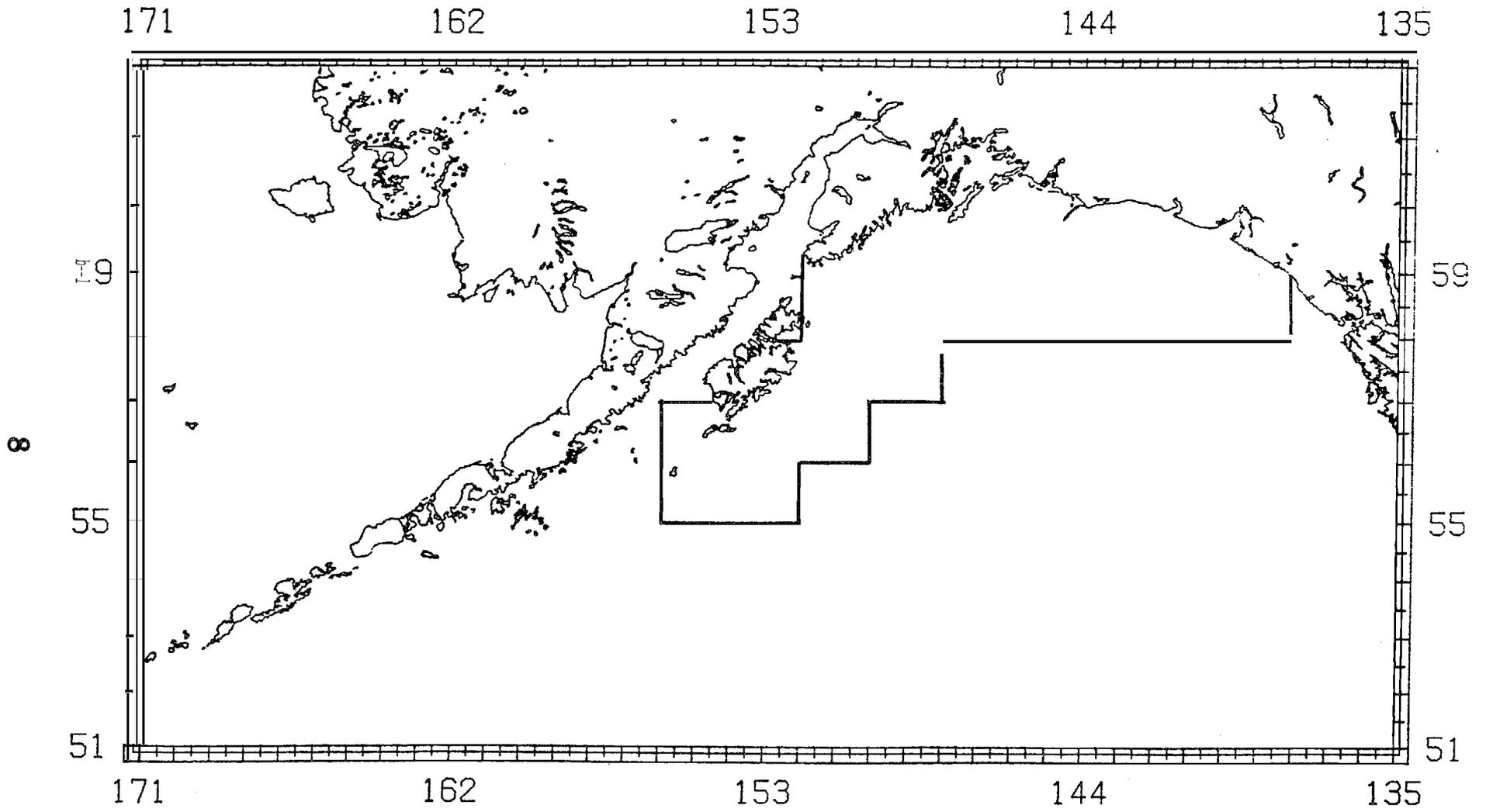


Figure 1.--Chart showing boundaries of census area.

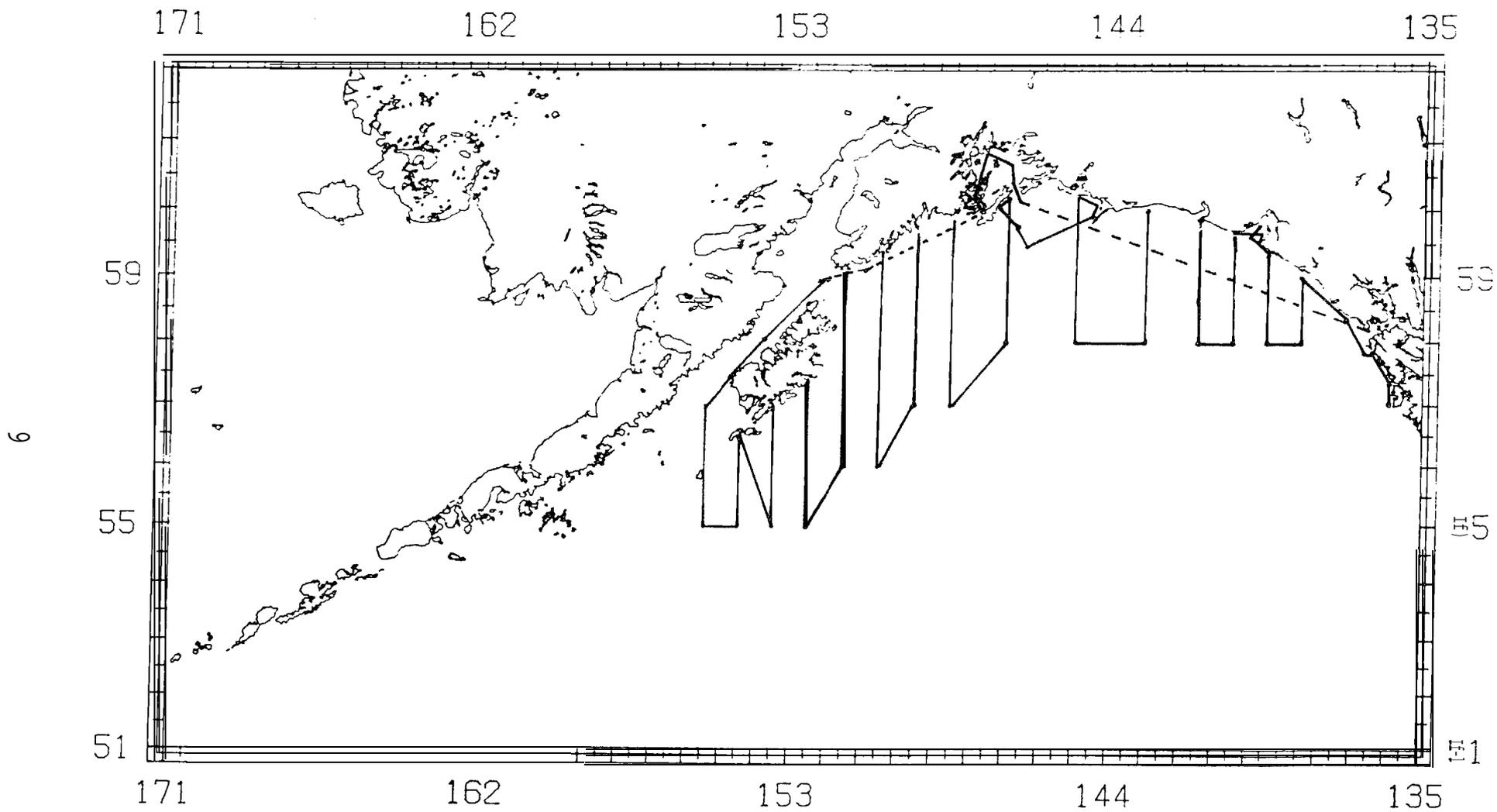


Figure 2.--Chart of cruise track, 17 June to 20 July.

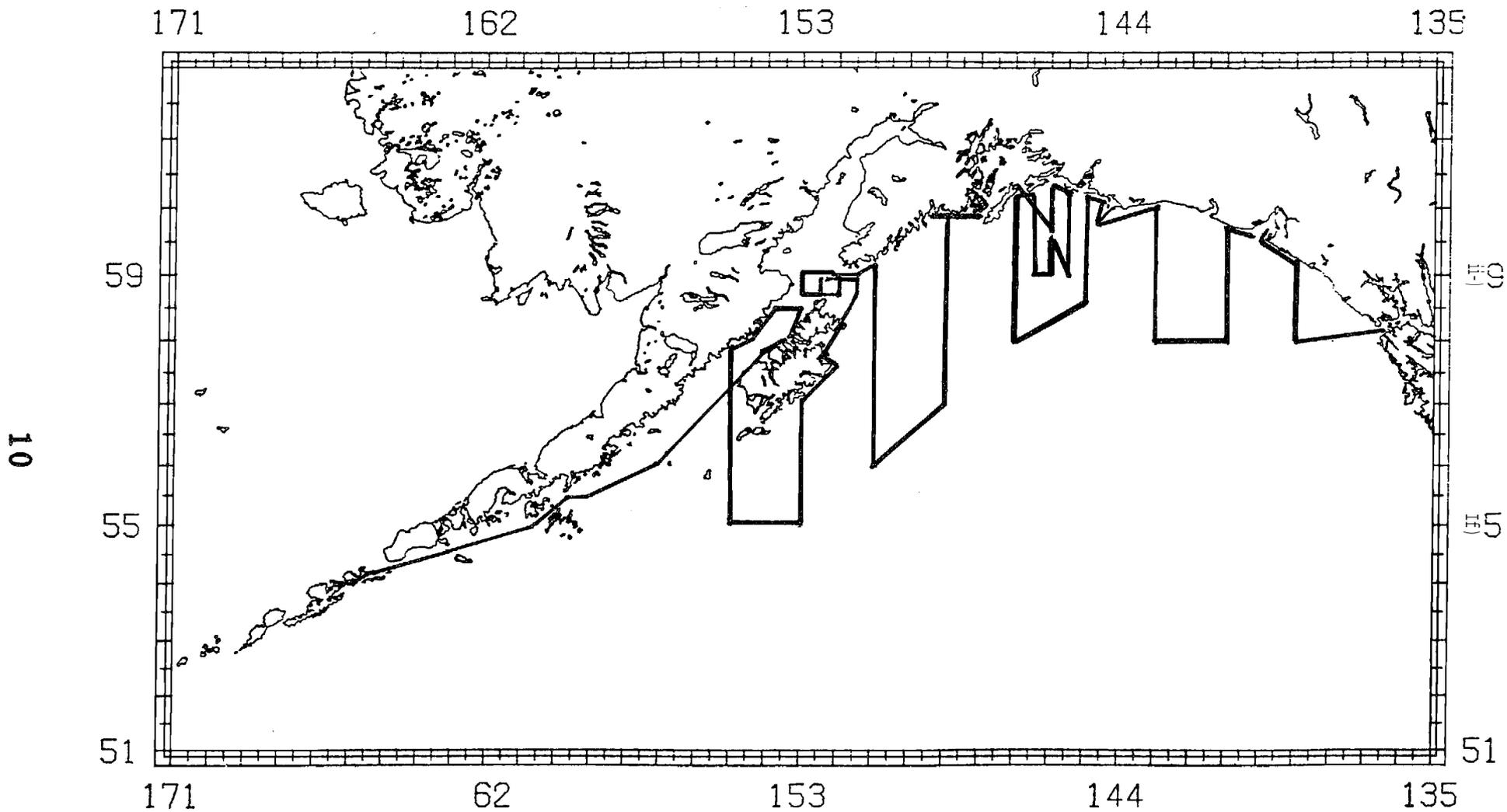


Figure 3.--Chart of cruise track, 24 July to 28 August.

In addition, 3 shorter transects, spaced at intervals of 30 minutes of longitude, were run in the vicinity of Middleton Island (Fig. 3 and Table 5); these totaled 222 miles. Four short transects, spaced at intervals of 30 minutes of longitude, were also run in the vicinity of the Barren Islands (Fig. 3 and Table 5); these totaled 75 miles.

The systematic census tracks for the entire cruise totaled 3,303 nautical miles.

While running the transect lines the vessel maintained a steady speed. When whales were sighted more than 0.5 km from the trackline, the vessel immediately altered course and closed with the animals. After confirmation of the identity and number of the whales and photography (in the case of humpbacks), the vessel headed due east or west until it was back on the trackline, and then continued along the preestablished course.

Three observers (in addition to the helmsman) were continuously on watch on the bridge. We attempted to keep the entire 360° arc under surveillance.

TABLE 1.--Original and current population sizes of large baleen whales in the North Pacific Ocean, and year that each species was afforded complete protection from commercial whaling (Sources: **Gambell 1976**; **Reilly et al. 1980**; **Rice 1978**; **Tillman 1977**; **Wada 1979**).

Species	Year protected	Population	
		Original	Current
<b>Gray whales (<i>Eschrichtiidae</i>):</b>			
Gray whale <u><i>Eschrichtius robustus</i></u>	1947	15,000 <sup>a/</sup>	15,000
<b>Rorquals (<i>Balaenopteridae</i>):</b>			
Sei whale <u><i>Balaenoptera borealis</i></u>	1976	42,000	9,000
Fin whale <u><i>B. physalus</i></u>	1976	44,000	17,000
Blue whale <u><i>B. musculus</i></u>	1967	5,000	1,700
Humpback whale <u><i>Megaptera novaeangliae</i></u>	1967	15,000	1,200
<b>Right whales (<i>Balaenidae</i>):</b>			
Black right whale <u><i>Balaena glacialis</i></u>	1937	n.d.	220

<sup>a/</sup> The gray whale population was reduced to about 4,000 by the Year 1900, and has since recovered.

TABLE 2. --water area (square nautical miles) of quadrats (each 1° lat by 2° long) in study area.

N. latitude	W. longitude									
	156°	154"	152°	150"	148"	146'	144"	142°	140"	138°
61"						638	798			
60°			1020	3125	3398	3654	3654	3290	950	
590			3750	3762	3762	3762	3762	3762	3739	
58°		1740	3869	3869						
57°	3790	3893	3974							
560	4078	4078								
55"										

TABLE 3. --Main census transects and whale sightings during first half of cruise.

Date	Longitude	Latitude		Miles	Whale sightings*		
		N. end	S. end		Humpback	Fin	Sperm
22 June	138°30'W	59°02'N	58°00'N	62			
23 June	139°30'W	59°22'N	58°00'N	82	2(4)		
25 June	140°30'W	59°40'N	58°00'N	100		1(2)	1(2)
26 June	141°30'W	59°51'N	58°00'N	111			
27-28 June	143°00'W	60°03'N	58°00'N	123	2(3)		
29 June	145°00'W	60°07'N	58°00'N	127	1(2)		
1 July	147°00'W	60°12'N	58°00'N	132		5(10)	
2-3 July	148°30'W	59°55'N	57°00'N	175	1(1)		1(2)
4-5 July	149°30'W	59°39'N	57°00'N	159			
6-7 July	150°30'W	59°24'N	56°00'N	204	1(2)		
8-9 July	151°30'W	59°05'N	56°00'N	185			
10 July	152°30'W	57°20'N	55°00'N	140			
13 July	153°30'W	57°00'N	55°00'N	120			
14 July	154°30'W	56°27'N	55°00'N	87	1(2)	1(1)	
15 July	155°30'W	57°00'N	55°00'N	120	1(2)		
<b>Total</b>				1,927	9(16)	7(13)	2(4)

\*Number of sightings, with number of individuals in parentheses.

TABLE 4.--Main census transects and whale sightings during second half of cruise.

Date	Longitude	Latitude		Miles	Whale sightings*		
		N. end	S. end		Humpback	Fin	Sperm
25 July	139°00'W	59°13'N	58°00'N	73			
27 July	141°00'W	59°42'N	58°00'N	102	1(1)		3'(32)
28 July	143°00'W	60°03'N	58°00'N	123	1(3)		
29 July	145°00'W	60°10'N	58°00'N	91	1(1)		
30 July	147°00'W	60°13'N	58°00'N	133	1(2)		
8-9 Aug	149°00'W	59°55'N	57°00'N	175			
10-11 Aug	151°00'W	59°10'N	55°00'N	190			1(1)
19 Aug	153°00'W	57°03'N	55°00'N	123			
20-21 Aug	155°00'W	57°49'N	55°00'N	169	1(2)		
Total				1,179	5(9)		4(33)

\* Number of sightings, with number of individuals in parentheses.

TABLE 5.--Supplementary census transects and whale sightings during second half of cruise.

Date	Longitude	Latitude		Miles	Whale sightings*		
		N. end	S. end		Humpback	Fin	Sperm
<b>Middleton Island:</b>							
1 Aug	145°30'W	60°12'N	59°00'N	72			
31 July-1 Aug	146°00'W	60°16'N	59°00'N	76	2(8)		1(1)
31 July	146°30'W	60°14'N	59°00'N	74			
Total				222	2(8)		1(1)
<b>Barren Islands:</b>							
13 Aug	151°30'W	59°05'N	58°45'N	20	1(2)		
13 Aug	152°00'W	59°05'N	58°45'N	20	2(4)		
12 Aug	152°30'W	59°05'N	58°45'N	20	1(10)		
12 Aug	153°00'W	59°00'N	58°45'N	15			
Total				75	4(16)		

\* Number of sightings, with number of individuals in parentheses.

Each time that marine mammals were sighted, we recorded the sighting angle relative to the vessel's heading, and the distance of the animals from the **vessel** at the time of sighting. Distances were estimated by three methods:

- 1) Visual estimates were made at the time of sighting.
- 2) Dead-reckoning estimates were made by **noting** the time it took at known speed to close with the animals.
- 3) Loran-C positions were recorded at the moment of sighting, and again when we closed with the animals. These positions are accurate to within 0.01 second of latitude and longitude (9 to 18 meters).

#### Photo-identification

Photographs were taken of the flukes of as many humpback whales as possible. The color pattern of the underside of the flukes provides a reliable means of identifying individual animals. The photographs were entered into the National Marine **Mammal** Laboratory's computerized Photographic Identification Storage and Retrieval (PISAR) system for comparison with the extensive file of photographs already in the System.

#### Radio-tracking

During the second half of the cruise (24 July to 28 August) a radio-receiver was mounted on the bridge. It was monitored continuously while the vessel was underway, to detect any radio-tagged gray whales that might be within range. These whales had been tagged the previous winter in Laguna San **Ignacio**, Baja California Sur, **Mexico**, by Bruce R. Mate of Oregon State University.

#### Acoustic recording

During the second half of the cruise (24 July to **28** August), underwater **phonations** of cetaceans were recorded on an opportunistic basis.

#### Data Management

Data acquisition and archival, and quality control, followed the procedures outlined by **Mercer, Krogman, and Sonntag** (1978) for the Platforms of Opportunity Project and Outer Continental Shelf Environmental Assessment Program.

### RESULTS

A total of **1,231** sightings, totaling 6,968 individuals, of 13 species of marine mammals **were** recorded during the cruise (Table 6). Distribution of all sightings of each species are plotted on the accompanying charts (Appendix figs. 1-25).

Humpback whale Megaptera novaeangliae

Humpbacks were sighted on 90 occasions, totaling 190 individuals. They were thinly scattered over the entire area, and small aggregations were found during both halves of the cruise in four areas: (1) Yakutat Bay; (2) Cape Saint **Elias** to **Middleton** Island; (3) the Barren Islands, and (4) Prince William Sound.

Only 14 of the sightings totaling 25 individuals, were made during the main systematic census transects (Tables 3-4). A sample size of at least 40 sightings is necessary to enable **valid** statistical inferences to be drawn (**Burnham, Anderson, and Laake 1980**). An approximation of population size may be made, however, by assuming that the "effective transect width" was 1.0 mile (1.85 km) on either side of **the vessel's** track, as we found during four seasons' **censusing** of humpbacks around the Hawaiian Islands. On this basis, the 25 whales sighted along 3,106 miles of main census transect may be extrapolated over the entire 76,117 square mile study area to provide an estimate of 306 humpback whales.

Our maximum counts of humpback whales in each of the four aggregation areas (Table 7), which were not counted **during** the systematic offshore line transects, were as follows: **Yakutat** Bay - 13; Cape Saint **Elias** to **Middleton** Island - 13; Prince William Sound - 12; Barren Islands - 20. These counts are minimum estimates of the number of humpback whales using these areas.

Movements of humpback whales were revealed by photographic documentation of individually recognizable whales. During the cruise we obtained photographs of 36 such whales (19% of the total seen). Repeat observations of four of these animals at intervals of 2 to 27 days were all very close to the positions where they were first found (Table 8); two of them had been observed in the same area in 1977 (and one in 1978) by Hall (1979), Humpback whales that inhabit inshore waters during the

TABLE 6.--Summary of marine mammals sighted during Gulf of Alaska cruise.

Species	First half		Second half		Total	
	No. sightings	No. individuals	No. sightings	No. individuals	No. Sightings	No. Individuals
<u>Eumetopias jubatus</u>	59	303	45	2,558	104	2,861
<u>Callorhinus ursinus</u>	105	144	31	32	136	176
<u>Enhydra lutris</u>	16	41	53	110	69	151
<u>Phoca vitulina</u>	16	167	29	48	45	215
<u>Balaenoptera acutorostrata</u>	21	21	16	16	37	37
<u>B. physalus</u>	13	19	4	14	17	33
<u>Megaptera novaeangliae</u>	43	B2	46	109	89	191
<u>Lagenorhynchus obliquidens</u>	11	874	2	32	13	906
<u>Orcinus orca</u>	6	41	13	92	19	133
<u>Phocoena phocoena</u>	15	25	37	43	52	68
<u>Phocoenoides dalli</u>	372	1,301	269	852	641	2,153
<u>Physeter macrocephalus</u>	3	4	4	33	7	37
<u>Ziphius cavirostris</u>	2	7			2	7
Total	682	3,029	549	3,939	1,231	6,968

TABLE 7---Counts of humpback whales in aggregation areas.

Area	First count		Second count	
	Date	Number	Date	Number
<b>Yakutat Bay</b>	24 June	13	26 <b>July</b>	4
<b>Middleton Island</b>	30 June	13	31 July-1 <b>Aug</b>	8
Prince William Sound	17-18 July	5	2-6 <b>Aug</b>	12
Barren Islands	16 <b>July</b>	15	12-14 <b>Aug</b>	20

TABLE 8.--Repeat sightings of **individually-recognizeable** photo-documented humpback whales.

PISAR Whale Number	Date	Location
000331	24 June 1900	<b>Yakutat Bay</b>
	26 <b>July</b> 1980	<b>Yakutat Bay</b>
000337	June 1977 <sup>1</sup>	<b>Prince William Sound</b>
	June <b>1978</b> <sup>1</sup>	Prince William Sound
	<b>Aug 1978</b> <sup>1</sup>	Prince William Sound
	4 Aug 1980	Prince William Sound: <b>Icy Bay</b>
	<b>5 Aug 1980</b>	Prince William Sound: <b>Icy Bay</b>
<b>31 Aug 1980</b> <sup>2</sup>	Prince William Sound: Whale Bay	
000342	June 1977 <sup>1</sup>	<b>Prince William Sound</b>
	4 <b>Aug</b> 1980	Prince William Sound: Icy Bay
	<b>5 Aug 1980</b>	<b>Prince William Sound: Whale Bay</b>
	<b>30 Aug 1980</b> <sup>2</sup>	Prince William Sound: <b>Chenega Island</b>
000365	5 Aug 1980	Prince William Sound: Whale Bay
	27 Aug 1980 <sup>2</sup>	<b>Prince William Sound: Bainbridge Passage</b>

<sup>1</sup> Photographed by Hall (1979)

<sup>2</sup> Photographed by Craig **Matkin**

summer thus appear to have strong site-fidelity, with little if any dispersal between aggregation areas.

Fin whale Balaenoptera physalus

**Finbacks** were sighted on only 13 occasions, totaling 19 individuals. The only minor aggregation that we encountered was 10 animals west of **Middleton** Island on 1 July. The remaining sightings were thinly scattered over the entire area.

**Only** 7 of the sightings, totaling 13 individuals, were made during the main systematic census transects (Tables 3-4). A crude approximation of total numbers may be made by assuming an "effective transect width" of 1.0 mile, as for the humpback whale, and extrapolating over the entire 76,117 square mile study area. This gives an estimate of 159 fin whales.

Gray whale Eschrichtius robustus

No gray whales were seen during the cruise, even though most of their preferred close-inshore habitat was searched. No radio signals were received from tagged gray whales.

Other endangered species

Sperm whales Physeter macrocephalus were sighted over deep water beyond the continental shelf on 6 occasions, totaling at least 36 individuals.

No blue whales Balaenoptera musculus, sei whales B. borealis, or right whales Balaena glacialis were sighted. At least until the early 1960's, the immediate offshore waters were a major summer ground for blue whales (**Berzin** and **Rovnin** 1966; **Nemoto** and **Kasuya** 1965). Sei whales tend to range farther offshore (**Nemoto** and **Kasuya** 1965) so our census may have missed most of the Gulf of Alaska population. Right whales are on the verge of extinction in the North Pacific (**Rice** 1974); most of the recent sightings have been made in the area immediately south of Kodiak Island (**Omura** et al. 1969).

SUMMARY AND CONCLUSIONS

Our preliminary survey indicated that the populations of all species of great whales in the Gulf of Alaska have been severely depleted.

Humpback whales were sparsely distributed throughout the area from 138° to 156°W longitude, where the total population is calculated to be 306; we made too few sightings to calculate confidence limits. In addition, minor aggregations of humpbacks were found in Yakutat Bay (≥13), around Middleton Island (≥13), in Prince William Sound (≥12), and around the Barren Islands (≥20). Humpback whales in inshore waters show strong site-fidelity and rarely move between aggregation areas.

Fin whales are sparsely distributed throughout the area, where a rough estimate of the total population is only **159** animals.

No gray whales, blue whales, sei whales or right whales were sighted. **Sperm** whales were seen far offshore on 6 occasions, totaling 36 individuals.

Baleen whales in offshore waters tend to be nomadic during the summer, when they aggregate temporarily in areas of denser food supplies. Therefore one season's observations are inadequate to reveal distribution patterns and numbers in a limited area.

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APPENDIX

Distribution Charts

	Figures
<u>Eumetopias jubatus</u> . . . . .	A1, A2
<u>Callorhinus ursinus</u> . . . . .	A3, A4
<u>Enhydra lutris</u> . . . . .	A5, A6
<u>Phoca vitulina</u> . . . . .	A7, A8
<u>Balaenoptera acutorostrata</u> . . . . .	A9, A10
<u>B. physalus</u> . . . . .	A11, A12
<u>Megaptera novaeangliae</u> . . . . .	A13, A14
<u>Lagenorhynchus obliquidens</u> . . . . .	A15, A16
<u>Orcinus orca</u> . . . . .	A17, A18
<u>Phocoena phocoena</u> . . . . .	A19, A20
<u>Phocoenoides dalli</u> . . . . .	A21, A22
<u>Physeter macrocephalus</u> . . . . .	A23, A24
<u>Ziphius cavirostris</u> . . . . .	A25

