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**HUMPBACK WHALES**

**IN GLACIER BAY**

**NATIONAL MONUMENT, ALASKA**

MARINE MAMMAL COMMISSION  
WASHINGTON, D.C.

FEBRUARY 1980

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Humpback whales in Glacier  
Bay National Monument, Alaska

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Report No. MMC-79/01

# **HUMPBACK WHALES IN GLACIER BAY NATIONAL MONUMENT, ALASKA**

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## **PREFACE**

In 1976, the National Park Service initiated a study to determine whether increased boat traffic or boating activities were having an adverse impact on humpback whales inhabiting Glacier Bay National Monument during the summer months. In 1978, the whales entered the Bay as usual, but left sooner than expected. The scientists conducting the whale studies believed that the early departure of the whales was precipitated by increased boat traffic in the Bay and, in 1979, the Park Service, in consultation with the cruise ship industry, developed and implemented operational guidelines for vessel course and speed in designated areas, where it was felt that vessel interactions with incoming whales could cause the most disturbance.

Researchers spent many hours looking for whales in the Bay during the early part of the 1979 summer season, but few whales were seen. Several interactions between vessels and those whales present in the Bay were observed and, on one occasion, a whale known to have had an interaction with a vessel left the Bay. Monument personnel discussed the problem with the area office of the National Park Service. A number of options, including emergency closure of the Bay were considered. It was decided to provide funds for a more thorough analysis of the available information on whale/vessel interactions, and to consult with the National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act.

The NMFS was advised of the situation and, on 10 August 1979, NPS and NMFS representatives met in Seattle, Washington to review available information concerning the nature and possible causes of the departure of whales from the Bay. Another meeting was held in late August to discuss the problem with members of the cruise ship industry. It was agreed that additional research was needed to better define the nature and possible causes of the problem and that a meeting should be held to discuss possible research approaches with other professionals in the marine mammal field. These decisions led to the meeting described in this report.

Subsequent to the meeting reported here, the National Marine Fisheries Service in a letter dated December 3, 1979, responded to the National Park Service's request for a Section 7 consultation. A copy of the NMFS's response is provided in [Appendix D](#) of this report.

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## INTRODUCTION

Humpback whales (*Megaptera novaeangliae*) inhabit the inland waters of southeast Alaska, including Glacier Bay during the summer months (June-August). In the years from 1967 through 1977, 20 to 25 individually recognizable whales were observed feeding in Glacier Bay. In 1978, the whales entered the bay but left earlier than expected. In 1979, only a few humpbacks entered Glacier Bay. The limited information available suggests that increased human activity in the Bay may have been responsible, at least in part, for the observed shift in distribution. Increased human use of coastal waters is not limited to Glacier Bay and the movement of humpbacks from Glacier Bay to areas outside the Bay may be symptomatic of a larger problem.

The purposes of this meeting were: (1) to review available information concerning the nature and possible causes of the movement of whales from Glacier Bay; (2) to review present and planned research and management actions relating to humpback whales in Glacier Bay and southeast Alaska; and (3) to identify additional research or management actions that may be necessary to conserve and protect the North Pacific population(s) of humpback whales.

The meeting was held on the 12th and 13th of October 1979, at the College of Fisheries, University of Washington, Seattle. The meeting agenda is included as [Appendix A](#). Individuals who made formal presentations at the meeting are identified

on the agenda. A list of the meeting attendees, their organizations, addresses, and telephone numbers are listed in [Appendix B](#).

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## **BACKGROUND**

### **Distribution and Abundance of Humpback Whales in the North Pacific<sup>[1]</sup>**

Humpback whales are seasonal migrants found in all of the world's oceans. In the North Pacific, humpback whales winter in tropical regions over the shallow coastal shelves associated with the Hawaiian Islands, Baja California, central Mexico, the Ryukyu Islands, Bonin Islands, and Mariana Islands. They summer in cold temperate regions, also over shallow coastal shelves, from Point Conception, California, north through Alaska, west through the Aleutians, and south to Honshu Island, Japan. Calving and probably breeding occur on the wintering grounds. Feeding is believed to occur primarily in the summering grounds.

[Pg 3]In Alaska, humpback whales are known to inhabit Prince William Sound, the waters of the Alexander Archipelago, and the waters adjacent to Kodiak Island and the Aleutians. Some whales may also overwinter in the northern summering areas.

The distribution, movements, abundance, and habitat requirements of humpback whales are not well known. Based upon Japanese catch statistics, the pre-exploitation population of humpback whales in the North Pacific is estimated to have been approximately 15,000. Much of the exploitation of humpback whales occurred in the twentieth century, especially during the early 1960's. A small number of whaling stations established in southeast Alaska took humpbacks between 1907 and 1922. In 1966, the International Whaling Commission imposed a worldwide ban on the taking of humpback whales.

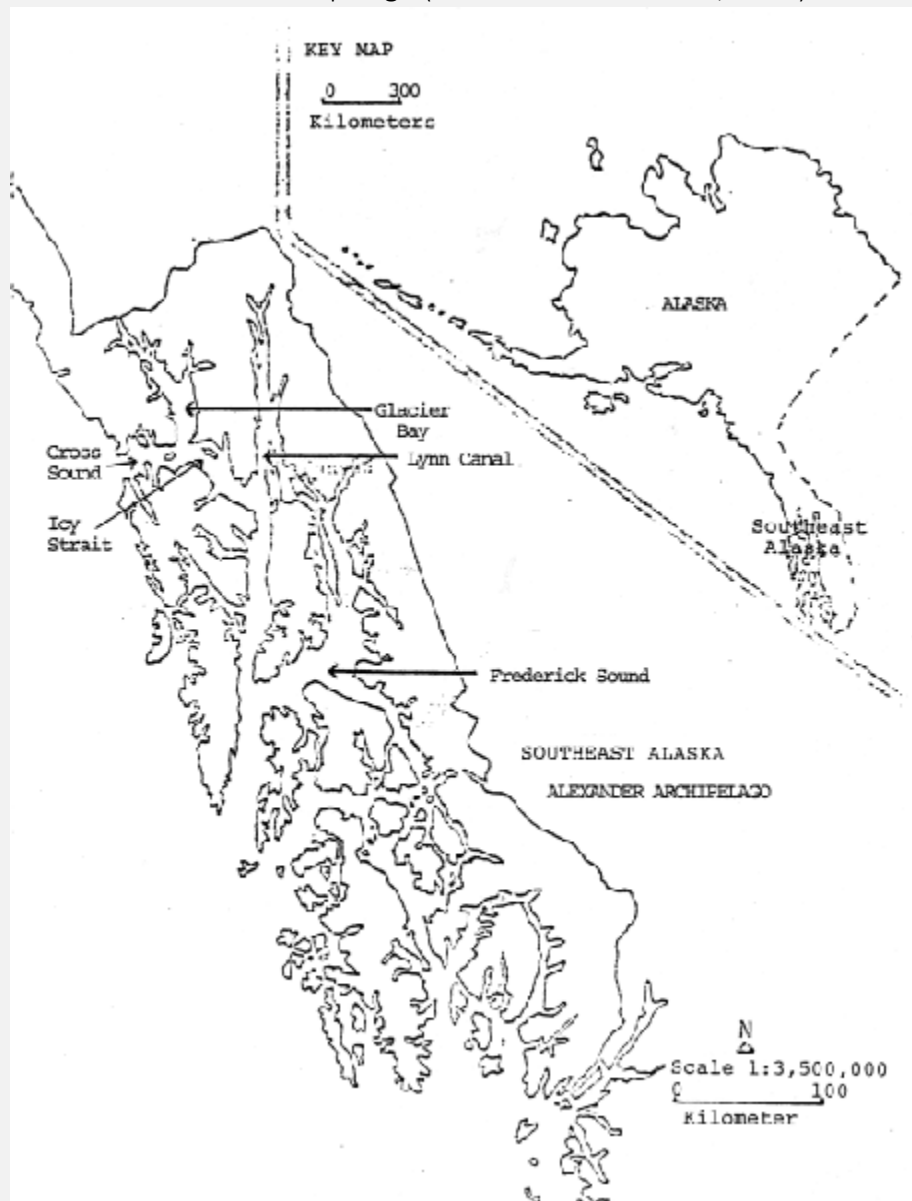
The present population of humpback whales in the North Pacific is estimated to be about 1,000 animals. The number occurring in tropical waters during the winter is thought to be about 600-700 in Hawaii, 200-300 in Mexican waters, and a "few whales" in the western North Pacific. More than 100 individual whales have been identified in the inland waters of southeast Alaska during the summer. Tagging experiments with Discovery Marks indicate movement between the Aleutian Islands and the Western North Pacific; recent photo-identification studies have shown movement from Southeast Alaska to both the Hawaiian Islands and Baja (and southern coastal) Mexico. There is no substantive evidence to indicate whether the number of humpback whales, on either summer or winter grounds, in the North Pacific is increasing or decreasing.



[1] This summary is based on information provided at the meeting by Drs. Michael Tillman and Louis Herman.

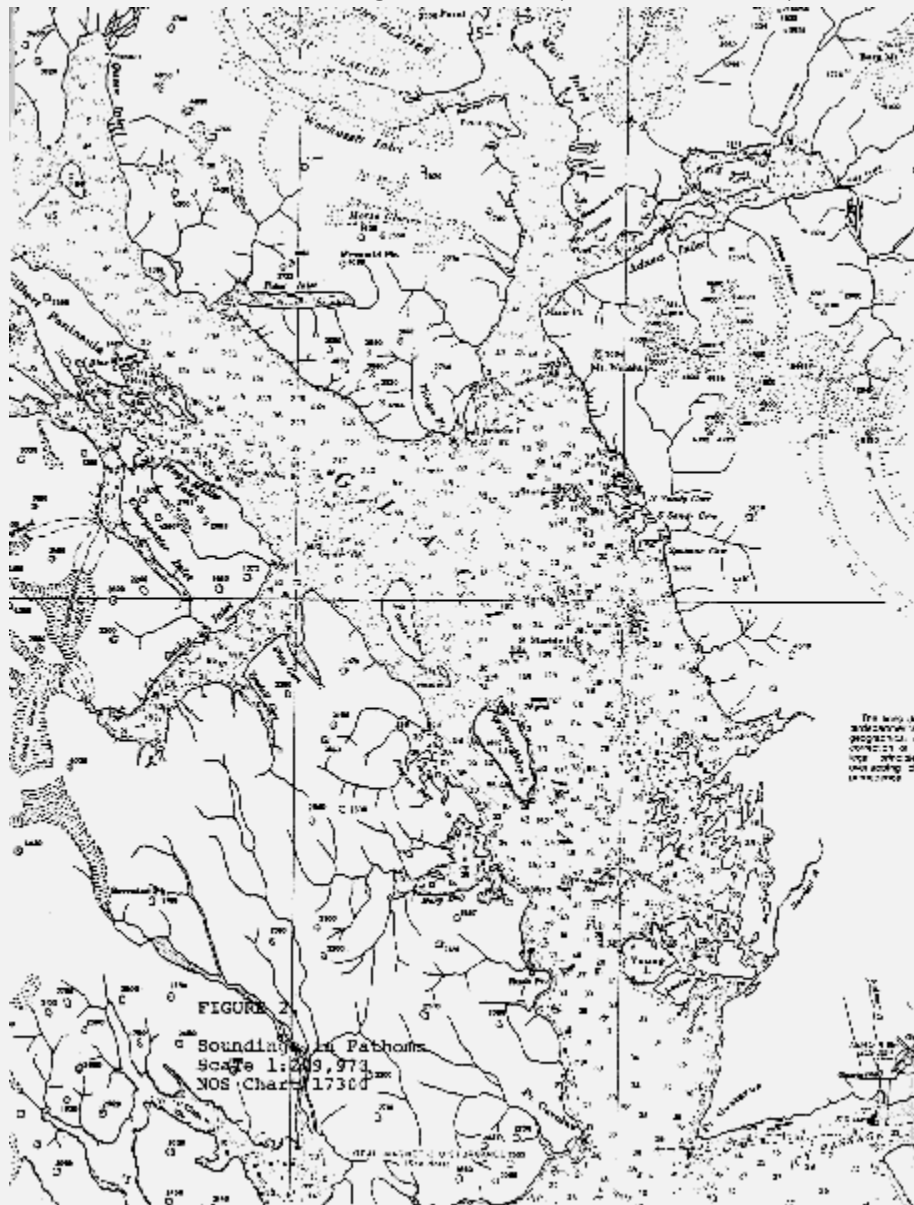
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FIGURE 1. Map showing location of Glacier Bay, Lynn Canal and Fredrick Hole in Southeast Alaska Alexander Archipelago (from Jurasz and Jurasz, 1979)



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FIGURE 2. Soundings in Fathoms (NOS Chart 17300)



[Click on map for larger size.](#)

FIGURE 3. GLACIER BAY, ALASKA SHOWING FORMER POSITIONS OF TERMINI 1760-1966  
(from Hale and Wright, 1979)



Click on map for larger size.

## **Glacier Bay<sup>[2]</sup>**

Glacier Bay is located near the north end of the Alexander Archipelago ([Figures 1 and 2](#)). The Bay opens into Cross Sound and Icy Strait of the Inside Passage of southeast

Alaska. When Vancouver discovered the area in 1780, glacial ice filled the Bay to its mouth ([Figure 3](#)). In 1891, when the Bay was first mapped, Muir Inlet was still filled with ice. Today the ice has retreated up the right (Muir Inlet) arm of the "Y" shaped Bay to tide-water levels. Recently, glacial ice has started to readvance in the upper reaches of the west inlets of the Bay.

[Pg 7]The Bay is defined by shallow sills at its entrance and the entrance to Muir Inlet. Constricted channels in which tidal currents are locally strong occur between sediment covered shores in the lower end of the Bay and the east (Muir) inlet. Deep, unconstricted bedrock channels and basins with weak currents occur in mid-Bay and the west inlet. These features and the configuration of the bay produce a tidal range of 8 meters. There is reduced mixing of waters within the Bay and between the Bay and Cross Sound/Icy Strait. Annual precipitation up to 4 meters, coupled with glacial melt water, create a surface layer and flow of cold fresh water out of the Bay. Strong flood tides push sea water into the Bay over the sills. The dynamics of the flow may effect the behavior and timing of the movement of whales into (on flood tides) and out of (on ebb tides) the Bay (see below).

During the winter, an increase in sea water flow and mixing occur. Increased nutrient levels and sunlight in spring/summer provide sufficient nutrients and energy for phytoplankton "blooms" to occur. In turn, zooplankters appear, especially in the open areas of mid and lower Bay (e.g., euphausiids) and along glacial ice faces (e.g., mysids and amphipods). By autumn, plankton concentrations diminish as light and nutrient levels decrease. Small schooling fish, (e.g., capelin, *Mallotus villosus* and Pacific sand lance, *Ammodytes hexapterus*), feed on the plankton when it becomes available. Both fish and plankton are consumed by humpback whales as well as by other predators. Other marine mammal species reported in the Bay are harbor seals (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), killer whales (*Orcinus orca*), and minke whales (*Balaenoptera acutorostrata*).

[2]This summary is based on information provided at the meeting by Mr. Gregory Streveler.

## **Humpback Whales in Glacier Bay**<sup>[3]</sup>

The distribution in and use of Glacier Bay by humpback whales was not well known until Charles and Virginia Jurasz began observations in 1973. Prior to this, only personal recollections of Park Service employees of the occurrence of humpback whales in the 1950's and the 1960's exist. In 1967, 60 identifiable humpback whales

were observed in three southeast Alaskan areas, i.e., Lynn Canal, Frederick Sound, and Glacier Bay. The number of identifiable whales remained relatively constant until 1974 in Lynn Canal, and 1978 (July 17) in Glacier Bay ([Tables 1-3](#)). In the respective areas, the number of identified whales decreased from 15 and 19 to 1 and 3, respectively. Concurrently, the number of identified whales sighted in Frederick Sound increased.

[Pg 8]

TABLE 1. Relative abundance and distribution of identified humpback whales in southeast Alaskan waters 1967-79<sup>[a]</sup>

Year	67	68	69	70	71	72	73
Glacier Bay	20	20	20	20	20	20	25
Lynn Canal	15	15	15	15	15	15	15
Frederick Sound	25	25	25	25	25	25	25
Total	60	60	60	60	60	60	65

<sup>[a]</sup>Specific dates of censuses, sighting techniques and sighting effort not given. Based on a table presented by the Juraszs at the meeting.

<sup>[b]</sup>First number signifies number originally counted at beginning of season/second number after decrease in number of whales in Glacier Bay and increase in other areas. The identified whales that left Glacier Bay are not necessarily the same individuals that produced the increased numbers in Lynn Canal and Frederick Sound later.

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TABLE 2. Number of humpback whales (individual census) entering Glacier Bay during "influxes".  
(modified from Jurasz and Jurasz, 1979)

Year	1976	1977	1978
First Influx	9	7	7
Second Influx	11	17	16
Seasonal Maximum	20	24	23

TABLE 3. Age composition of humpback whales per year in Glacier Bay (modified from Jurasz and Jurasz, 1979)

YEAR	1976	1977	1978
NO. OF CALVES	1	2	4
NO. OF IDENTIFIED ADULTS	14	14	18
NO. OF JUVENILES		6	1
TOTAL NO. OF ADULTS	19	19	18

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Identifiable humpback whales were sighted in Glacier Bay each year, 1976-1977, for a six to twelve week period. In 1978, all but three whales departed the Bay after 16 days. In the summers of 1976-1978 two influxes of whales occurred ([Table 2](#)). The Juraszs' define an influx of whales as those whales that enter and remain in the Bay for a minimum of three weeks. The second influx arrived 7-14 days after extreme low tides occurred in late June-early July and presumably moved into the Bay on flood tides. In 1979, a single influx comprised of 3 whales entered the Bay. The age composition of

identified whales using Glacier Bay was categorized by the Juraszs' for 1976-1978 ([Table 3](#)).

During the period spent in the Bay, humpback whales have been observed to feed on capelin, euphausiids (*Euphausia pacifica*), and pandalid shrimp (*Pandulus borealis*). There appear to be three generalized feeding relationships: 1) early-season feeding on shrimp in the upper Bay; 2) mid-season feeding by concentrations of whales on capelin in the lower Bay; and 3) late-season feeding (around August 5) by concentrations of whales on euphausiids in mid-Bay.

Behaviorally, humpback whales appear to lunge up through concentrated schools of prey during mid-season and use "bubble-netting" as a means of concentrating less dense and/or numerically fewer prey earlier and later in the season. In other areas of southeast Alaska, humpbacks are reported to also feed on herring (*Clupea harengus pallasii*), shrimp, and possibly other small schooling (swarming) prey. The Juraszs' believe that humpbacks establish feeding territories in the Bay, and have described eight "stress behaviors" associated with violations of those territories ([Table 4](#)). The data collected by the Juraszs are extensive (including human use of Glacier Bay) but have not yet been completely analyzed.

[3] This summary is based on information provided at the meeting by Charles and Virginia Jurasz.

## **Human Use of Glacier Bay**<sup>[4]</sup>

John Muir popularized Glacier Bay, leading to tourist activity into the early 1900's, when loose ice resulting from earthquake activity prevented cruise vessels from operating within the Bay. Glacier Bay was designated a National Monument February 26, 1925, the area being added to April 18, 1939.

Vessel and tourist numbers remained low until the late 1960's-early 1970's. Close to 100 percent of the visitors to the Bay use vessels, either entering the Bay aboard them or making use of them to tour the Bay after arriving by aircraft. The Juraszs' developed a classification scheme for vessels and aircraft based upon activities of the craft in the Bay, their size, hull design, and engine characteristics ([Table 5](#)).

TABLE 4. Juraszs' description of "stress behavior" (Progressing from the least "stressful" to the most "stressful") (modified from Jurasz and Jurasz, 1979.)

Mode	Description
Vocalization	Bellowing or trumpeting noise produced by a whale and heard above and below the water. Em
Bubbling	Premature or underwater release of breath in a straight line or as a single "belch" allowing the water's surface.
Finning	Flipper slapping; the striking of the water's surface with the pectoral fins.
Tail Lobbing	Raising the flukes well out of the water and crashing or slapping them back flat against the water
Tail Rake	A subset of the tail lobbing is the rake in which the flukes are raked laterally across the water's s
Half or Full Bodied Breach	A leap from the water in which a portion of the whale's body emerges from the water only to r
Avoidance	The temporary leaving of an area or a change in the direction of travel.
Abandonment	Leaving an area prematurely and not being seen again for at least one season in that area.

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TABLE 5. Juraszs' vessel/aircraft classes (after Jurasz and Jurasz, 1979)

Class 1	Touring Vessel Over 10k Tons
Class 2	Touring Vessel 5k-10k tons
Class 3	Commercial Fishing/Crabbing
Class 4	Charter & Pleasure
Class 5	Cabined High RPM Outdrive Units



Class 6	Sailboat Using Aux. Power
Class 7	Utility Craft, Outboard Engine
Class 8	Kayak, Sailboat (no engines)
Class 9	Aircraft, Fixed
Class 10	Aircraft, Rotor
Class 11	Aircraft, Jet
Class 12	Hydrofoil
Class 13	Another Humpback
Class 14	Killer whales
Class 15	Minke Whales
Class 16	R/V GINJUR (Juraszs' research vessel)
Class 17	Wake Only

[Pg 13]The increase in visitors and vessels to Glacier Bay is presented in [Tables 6-8](#). (Data included in Table 6 cannot be compared to data presented in [Table 7](#) because of difference in methods of data collection, sample area, time, effort, etc.)

Commercial fishing vessel activity in the Bay was probably low until the 1970's. Since 1972 (it is not known whether data are available prior to 1972) commercial fishing vessel visits have fluctuated ([Figure 4](#)), but fishing activity has been greatest during the summer months ([Figure 5](#)). Sport fishing visits have increased during the same time period ([Figure 6](#)).

[4]This summary is based on information presented at the meeting by Mr. John Chapman and Charles and Virginia Jurasz.

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## POSSIBLE CAUSE-EFFECT RELATIONSHIPS BETWEEN HUMAN USE OF GLACIER BAY AND THE

# DISPLACEMENT OF HUMPBACK WHALES FROM THE BAY<sup>[5]</sup>

The meeting participants agreed that the observed decrease in the number of whales in Lynn Canal in 1974 and Glacier Bay in 1978 may be attributable to a number or combination of factors. Available evidence suggests human activity was at least one of the causes, or served to trigger otherwise "natural events". In Lynn Canal, humpback whales were known to feed on herring (*Clupea harengus pallasii*). In 1974, the year a herring fishery began, the number of humpback whales dropped to one ([Table 1](#)). Between 1974 and 1978 fishing continued. There was no fishing in 1979.

Use of the Canal by Class 5 vessels (cabin cruisers with high RPM outdrive units) increased by 15-20 percent each year after 1970 (Jurasz and Jurasz, 1979, p. 85). Three humpback whales were seen in Lynn Canal during the 1975-1977 seasons, the number increasing to five in 1978-1979. The relationship between vessel activity, fishing effort, fish take, fish abundance, and the presence and activity of whales in Lynn Canal does not appear to be documented.

In Glacier Bay, increased vessel traffic may be one of the factors responsible for the movement of humpback whales from the Bay in 1978 and 1979. The Juraszs' data, while not evaluated fully, suggest that there has been a general increase in avoidance by humpback whales of Class 1 through 5 vessels over the three year period, 1976-1978.

[Pg 14]

TABLE 6. Number of visitors and vessels to Glacier Bay National Monument.<sup>[a]</sup>

Year	Visitation	Increase	Private Vessels Juraszs' Classes 1-2
1965	1,800		
1969	16,000	789% over 1965	

1970	29,700	86% over 1969	
1972			3
1978	109,500	269% over 1970 584% over 1969	17
1979			17

[\[a\]](#)Based on a table and information provided at the meeting by Mr. John Chapman, National Park Service. (Modified by adding Juraszs' classes of vessels.)

[Pg 15]

TABLE 7. Number of vessel sightings per month in each class as seen from the Juraszs' R/V GINJUR. (from Jurasz and Jurasz, 1979)

1977				
Vessel Class	June	July	August	TOTAL
1	20	22	11	53
3	67	18	6	91
4	37	42	30	109

5	38	45	17	100
6	3	14	0	17
7	6	4	6	16
8	7	2	7	16
12				

[Pg 16]

TABLE 8. Average vessel sightings per day in each class as seen from the Juraszs' R/V GINJUR. (Modified from Jurasz and Jurasz, 1979)

Vessel  
Class

1977

1978

1

3.90

3.20

3

5.74

13.47

4

8.38

16.87

5

6.93

8.19

6

1.11

3.99

7

1.21

1.38

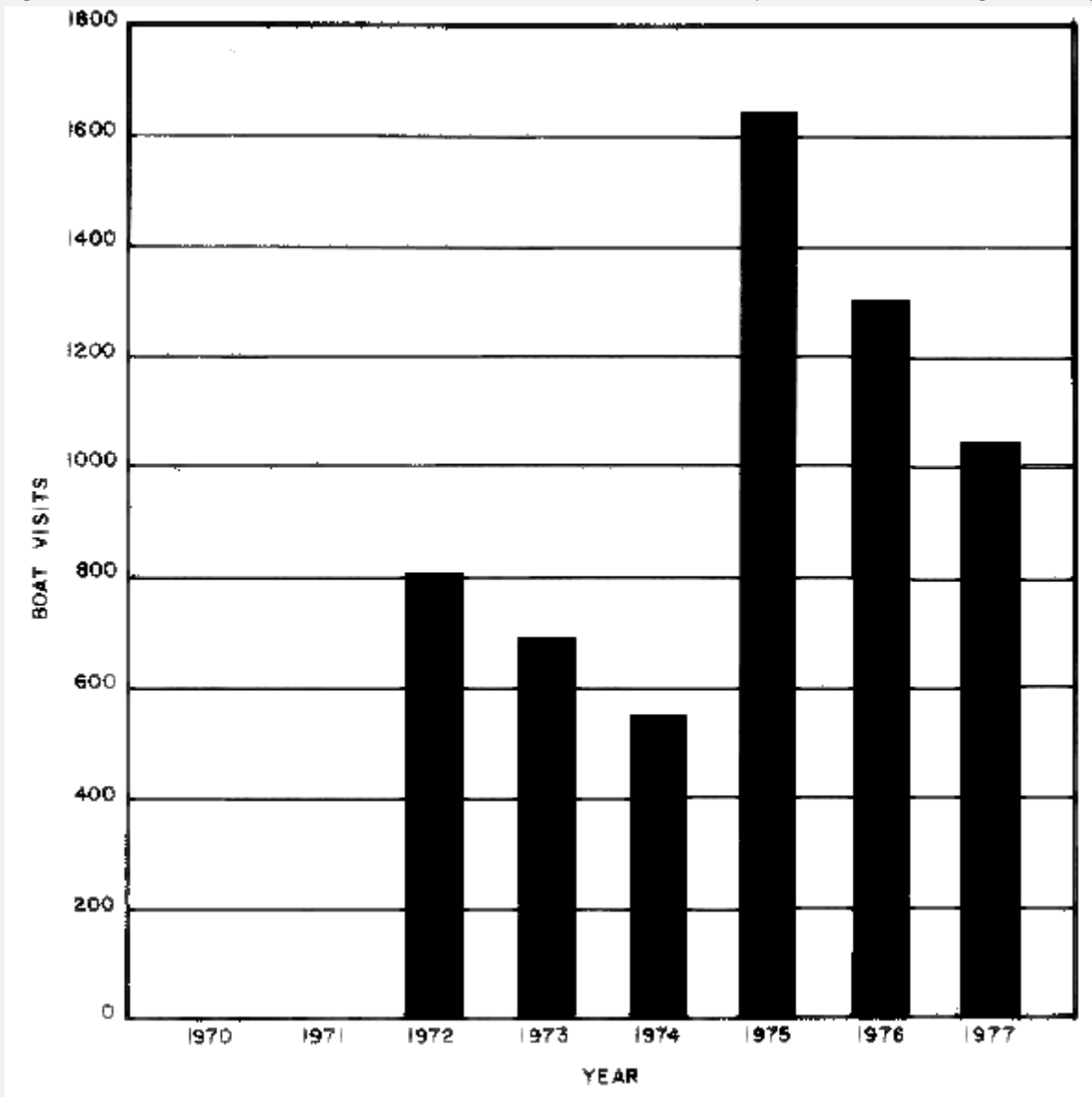
8

1.24

1.18

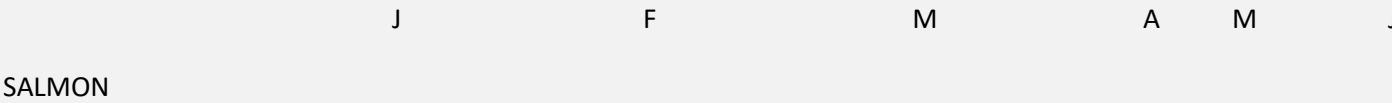
[Pg 17]

Figure 4. COMMERCIAL FISHING VESSEL VISITS TO GLACIER BAY (from Hale and Wright, 1979)



[Pg 18]

Figure 5. COMMERCIAL FISHING ACTIVITY GLACIER BAY (from Hale and Wright, 1979)



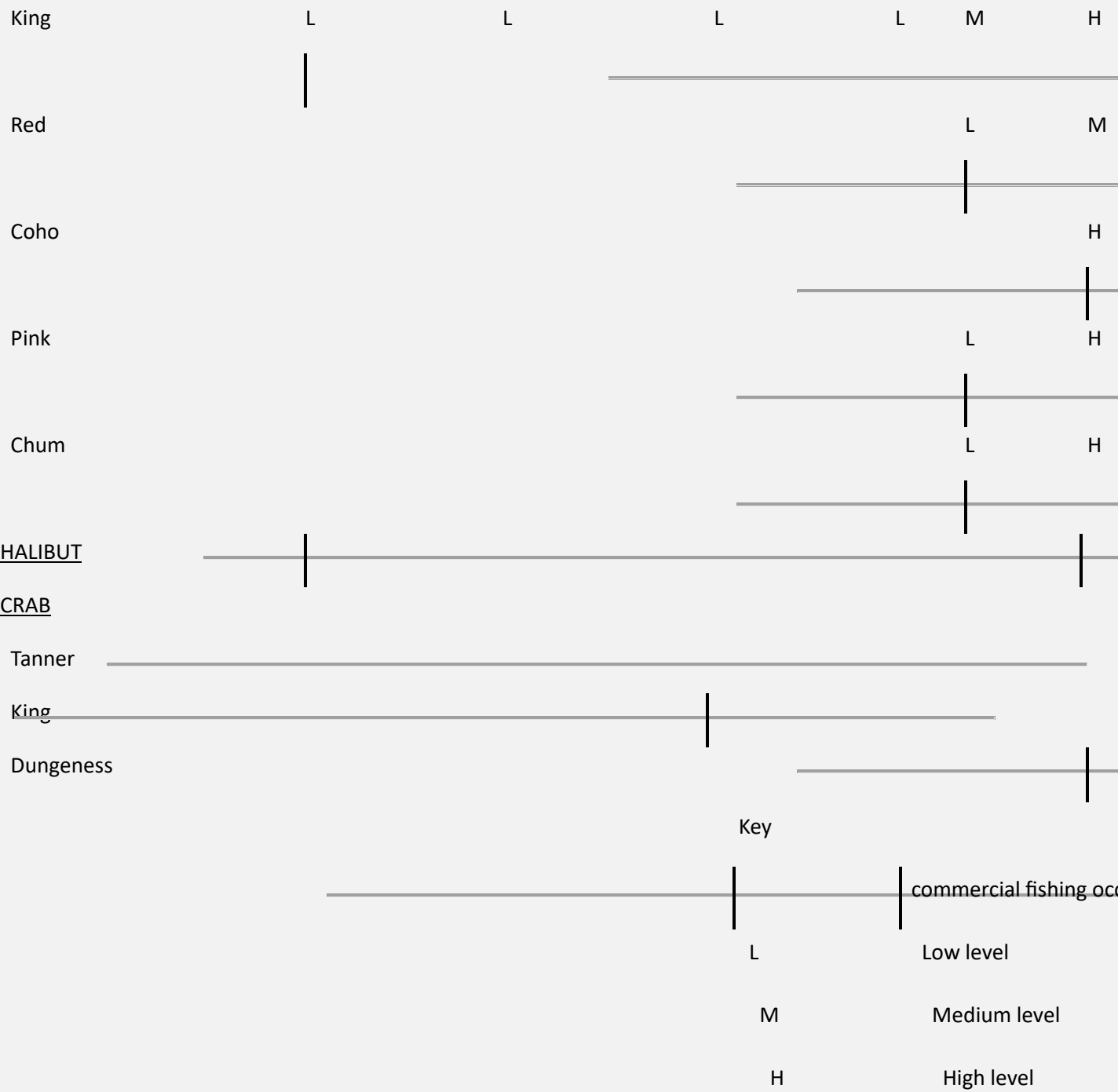
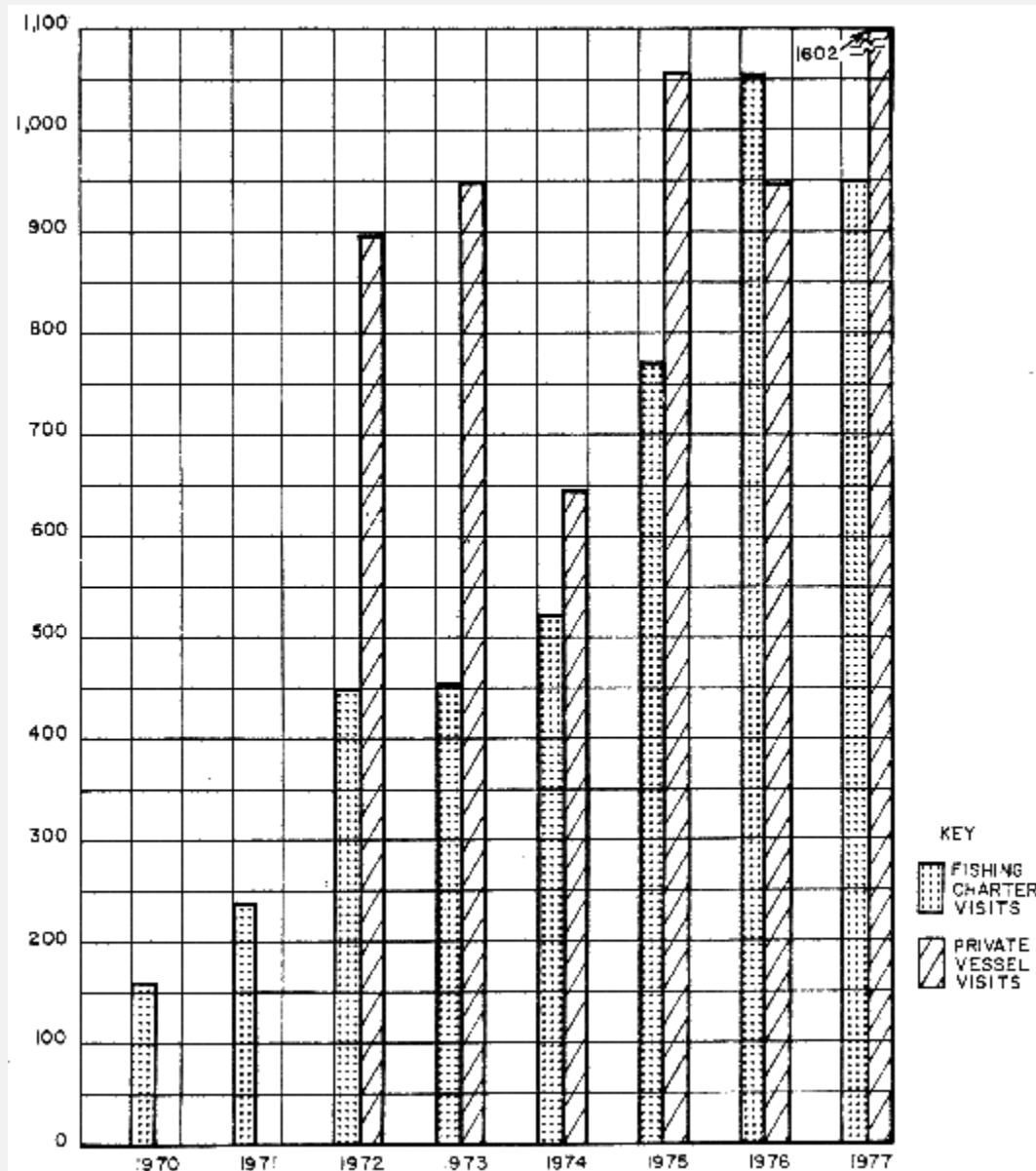


FIGURE 6. FISHING CHARTER BOATS AND PRIVATE BOAT VISITS TO GLACIER BAY 1970-1977 (from Hale and Wright, 1979)



Natural changes in the environment and/or in the behavior of whales have occurred concurrently with increased human/vessel activity in Glacier Bay. Such natural changes include spatial and temporal trends or cycles in the physical (temperature, tides, currents, turbidity, etc.), chemical [Pg 20](salinity, dissolved gases, inorganic/organic substances—nutrients, etc.) or biological (primary productivity, zooplankton, nekton, benthic species, predators, etc.) properties or characteristics of the waters within and outside the Bay. Temporal and/or spatial differences in relative abundance of three different prey species within and outside the Bay may have occurred and been

responsible, at least in part, for the movement of humpbacks from Glacier Bay. At this time, data are inadequate to relate the movement of humpback whales from Glacier Bay in 1978 and 1979 to physical, chemical, or biological factors. Meeting participants felt that physical and chemical factors were unlikely to have changed sufficiently between 1976 and 1978 to affect humpback whales, while biological factors, perhaps as a result of physio-chemical changes, could have changed sufficiently to have caused or contributed to the movement.

Human activity may have caused changes in the physical, chemical, or biological environment, effecting humpbacks directly or indirectly. Human and vessel activities may have occurred such that the space (vertical and/or horizontal) available to whales for normal activities was less than that necessary (below some threshold level or value). "Too many" vessels may have transited an area and/or approached whales "too closely" for "too long" a period of time, producing visual, acoustic, tactile, chemical, or other as yet unknown stimuli at levels or values (magnitude, intensity, duration, frequency, interval, etc.) greater than the whales would tolerate. The physical-acoustic environment may have changed as a result of sounds produced by vessels. Vessel sounds may be modified, amplified, intensified, etc., as a result of the geological/topographical features of Glacier Bay (and perhaps Lynn Canal as well). Direct interference with the whales' own sounds may have occurred or "environmental" sound levels may have exceeded certain thresholds. Basic data on the acoustic properties and characteristics of Glacier Bay with and in the absence of vessels are lacking.

Changes in water quality may have occurred through pollution. Data are insufficient to document the past or present levels of pollution, but they were thought by meeting participants to be relatively low.

Changes in the biological environment induced by human activity may be contributory to the movement of whales. Movement from Lynn Canal may have resulted from direct competition for the same resource at the same time, by depletion of the resource below levels sufficient to support humpbacks or as a result of noise or the presence of fishing vessels. Fishing activity or overharvesting (depletion of resource) of other species at other trophic levels may indirectly impact humpbacks through the food web/chains. There are insufficient data to prove or disprove such hypotheses at this time.

[Pg 21]In summary, a best interpretation of the available data is that uncontrolled increase of vessel traffic, particularly of erratic charter/pleasure craft, may have adversely altered the behavior of humpback whales in Glacier Bay and thus may be implicated in their departure from the Bay the past two years. The causal mechanism of this adverse reaction to increased vessel traffic remains unknown. The effects of increasing vessel traffic apparently are exacerbated by the narrow physical confines of



Glacier Bay. This analysis is not clear-cut, however, and may be confounded, at least in 1979, by possible shifts in the occurrence and availability of preferred prey species of humpback whales.

[\[5\]](#) This summary is based on information presented at the meeting and resulting discussions.

---

## **ADEQUACY OF EXISTING DATA**

In the Background and Possible Cause and Effect sections it was stated that insufficient data exist to indicate cause and effect relationships. Data are not sufficient in many areas, e.g.:

- 1) environmental baseline data (biological, chemical, and physical) are inadequate;
- 2) data available (i.e., Juraszs') have not been analyzed fully;
- 3) changes in human use of areas are not adequately quantified (e.g., for fishing, cruising, touring, pleasure boating); and
- 4) data on the acoustic characteristics of Glacier Bay or the vessels occurring in the Bay are not available.

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## **MANAGEMENT AND RESEARCH ACTIVITIES TAKEN OR UNDER CONSIDERATION**[\[6\]](#)

The National Park Service (NPS) is responsible for managing and overseeing the use of Glacier Bay National Monument in support of the objectives defined for the Service, when it was established in 1916; an excerpt from the Act creating the Service in 1916 states that the purpose of the Service is:

"To conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The intent in establishing the Monument is defined in the Proclamations of 1925 and 1939, sections of which are excerpted and presented below.

[Pg 22]"Whereas, there are around Glacier Bay ... a number of tide-water glaciers of the first rank in a magnificent setting of lofty peaks, and more accessible to ordinary travel than any similar regions of Alaska,

"And, Whereas, the region is said by the Ecological Society of America to contain a great variety of forest covering consisting of mature areas, bodies of youthful trees which have become established since the retreat of the ice which should be preserved in absolutely natural condition, and great stretches now bare that will become forested in the course of the next century,

"And, Whereas, this area presents a unique opportunity for the scientific study of glacial behavior and of resulting movements and development of flora and fauna and of certain valuable relics of ancient interglacial forests." (Proclamation establishing Glacier Bay National Monument, February 26, 1925.)

"Whereas, it appears that certain public lands, part of which are within the Tongass National Forest ... have situated thereon glaciers and geologic features of scientific interest; and

"Whereas, a portion of the aforesaid public lands ... are necessary for the proper care, management, and protection of the objects of scientific interest situated on the lands...." (Proclamation of April 18, 1939, adding lands to the Monument.)

The management plans developed by the National Park Service for the Glacier Bay National Monument did not anticipate, and apparently have not been adequate to deal with, the increased visitor and vessel traffic and their use of the marine environment in the 1970's. Title 36 of the Code of Federal Regulations, under which the National Park Service operates, contains a section requiring any commercial business conducted or operating within the boundaries of Service area to have a permit issued by the Service. The cruise ship industry companies have not as yet been placed under a permit system. However, it is the intent of the Service to establish a regular system in the future. All other commercial ventures operating on lands and waters of the Monument are under contract or permit. Fishing vessel activity is unregulated although the take of Pacific halibut, (*Hippoglossus stenolepis*) is regulated by the International Pacific Halibut Commission, and the take of salmon and other finfish and shellfish is regulated by the Alaska Department of Fish and Game (ADFG). The need for additional resource/use plans and regulatory programs is recognized by the National Park Service.

[Pg 23]The NPS funded field studies of humpback whales by the Juraszs in 1976-1979, analysis of some of the Juraszs' data, and Hale's and Rice's (of the NPS Alaska area office) report, "The Glacier Bay Marine Ecosystem—A Conceptual, Ecological Model" completed in April 1979.

The movement of humpback whales in 1978 from Glacier Bay to surrounding waters and the suggestion by the Juraszs' field observations, that there may be a cause and effect relationship between vessel activity and the whales' movement, led the NPS to restrict some vessel activities in the 1979 season, and to seek Endangered Species Act Section 7 consultations with the National Marine Fisheries Service in August 1979. The Section 7 consultations were not completed at the beginning of the meeting. Based in part upon NMFS's recommendations, the NPS will consider various future management alternatives. Restrictions imposed in 1979 were temporary (emergency closure authority under Title 36 C.F.R.). Any regulations imposed for 1980 cannot be under emergency closure authority (unless an emergency does arise which was unforeseen in setting up regulatory systems). Regulations which can be foreseen at this time as being necessary would have to proceed through the normal Federal Register publication process. Enforcement of all Federal laws and regulations within Glacier Bay is considered to be the responsibility of the NPS.

The National Marine Fisheries Service (NMFS) has overall responsibility, under the Marine Mammal Protection Act of 1972, for the conservation and protection of all whales including humpback whales. The National Marine Fisheries Service in cooperation with the Juraszs has conducted censuses of humpback whales in southeast Alaskan waters in 1975 and 1976, used radio tags to follow individual whales in Alaskan waters in 1976-78, maintains a catalogue of humpback whale photographs and has developed a computerized retrieval photo-identification system. No research was conducted by NMFS in 1979. NMFS enforcement of laws and regulations is conducted by a few people responsible for large areas in southeast Alaska. A contract with the State of Alaska until August 1, 1979, provided a broader presence of enforcement personnel. That contract was not renewed. The NMFS is now fully responsible for enforcement activities relating to humpback whales except in areas such as Glacier Bay where the responsibility is shared.

[6] This summary is based on information presented at the meeting by National Park Service and National Marine Fisheries Service Personnel.

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## **ALTERNATIVE MANAGEMENT ACTIONS**

Based on available information, vessel activity may have been a factor contributing to the movement of whales from Glacier Bay in 1978 and 1979. Alternatives available to manage vessel traffic (assuming increased traffic has had or will have an adverse effect on humpback whales) include:

[Pg 24]1. Total closure of Glacier Bay to all vessels.

2. Closure to all vessels during the whale season.

3. Closure to all vessels during part of the whale season.

4. Total closure to all but certain classes of vessels—e.g.,  
cruise vessels  
charter vessels  
fishing vessels

5. Seasonal closure to all but certain classes of vessels—e.g.,  
cruise vessels  
charter vessels  
fishing vessels

6. Partial season closure to all but certain classes of vessels—e.g.,  
cruise vessels  
charter vessels  
fishing vessels

7. Alternatives 4, 5, or 6 with limitations on total numbers of vessels of various classes given access

8. Alternatives 4, 5, 6 or 7 with restrictions applying only to certain areas of the Bay

9. Establishment of a ceiling for all vessels or certain classes of vessels during all or part of the whale season

10. No restrictions on access but certain activities prohibited or limited to certain areas or vessel classes—e.g.: establish traffic lanes and permit "deliberate" whale-watching only by a few trained and licensed charter-boat operators.

11. No restrictions.

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## **IDENTIFYING AND SELECTING THE MOST APPROPRIATE RESEARCH/MANAGEMENT STRATEGY**

Factors that should be considered in making research/management decisions include (1) that the humpback whale is an endangered species; (2) that there are statutory

requirements to protect the whales and their habitats; (3) that the cause of the present problem is uncertain; (4) that the purpose of the Monument is to provide for educational, recreational, and scientific experiences; and (5) that limiting access or restricting or closing the Monument to some or all vessel activity could affect commercial and private enterprises, including fishing.

[Pg 25]Additionally, there are a number of types and possible consequences of decision errors that should also be considered—e.g.,

1. If Glacier Bay is a critical habitat, and if the [movement](#) of humpbacks is in response to whale watching vessels, pleasure boats, cruise vessels, etc., and if the movement is or will be irreversible; then the humpback whale population will be adversely impacted (e.g., carrying capacity reduced) if no action is taken.
2. If Glacier Bay is not a critical habitat, and if movement is due to whale watching vessels, etc., and it is or will be irreversible; then only the quality of visitor experience/value of monument is decreased if no action is taken. The impact on the population of humpbacks is not critical so long as suitable habitat is available elsewhere. However, the NPS mandate established in the 1916 Act still would not be fulfilled.
3. If all, or a specific type of, vessel traffic is prohibited or regulated, and the movement from the Bay is not caused, directly or indirectly by such traffic; then there will be decreased opportunity for human activity within the Bay, and increased economic impacts on fishermen and commercial operators that may have been unnecessarily restricted.

The optimal short-term research/management strategy would minimize the risks associated with the kinds of errors discussed above, and include actions such as the following:

- 1) by early 1980, compile and complete the analysis and evaluation of all existing and relevant data;
- 2) based upon the evaluation of the best available data, promulgate temporary (one season) whale watching regulations and/or restrict access by all or certain classes of vessels or the number, frequency, or duration of visits of all or certain classes of vessels to certain areas at certain times of the year, as may be appropriate;
- 3) continue and, if appropriate expand, surveys of whale/vessel numbers, distribution, movements, behavior and interactions in and outside Glacier Bay;
- 4) identify and initiate additional research that is needed to identify and mitigate the cause or causes of the observed humpback whale movement from the Bay, e.g.,

- a. characterize the acoustical environment of Glacier Bay and other areas in which humpbacks occur;
- b. characterize the sounds generated by various classes of vessels and aircraft;
- [Pg 26] c. design and conduct sound playback experiments to test hypotheses concerning the possible effects of vessel activities on humpback whale movements and behavior; and
- d. assess and monitor the physical, chemical, and biological characteristics of Glacier Bay, especially the distribution and abundance of prey species upon which humpback whales feed.

The optimal long-range research/management strategy would include:

- 1) the development and implementation of a humpback whale recovery plan to include humpback whales in all of Glacier Bay, all of southeast Alaska and the North Pacific in general, including: the identification, designation and protection of critical humpback whale habitat;
- 2) the development of a universal and/or site-specific definition of "harassment" to apply to humpback whales in Glacier Bay, southeast Alaska and the North Pacific in general;
- 3) the development and implementation of a long-range research/management plan for the Monument including whale and environmental monitoring;
- 4) a determination as to the direct and indirect effects of incidental take, whale watching, fishing activity, etc. on humpback whales in Glacier Bay, Southeast Alaska and the North Pacific in general; and
- 5) a determination as to the long-term cumulative impacts of the degradation and destruction of habitat on the survival of the humpback whale throughout its range in the North Pacific.

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## **AGENCY RESPONSIBILITIES AND NEED FOR COOPERATION AND COORDINATION**

There are many individuals, groups and organizations interested or involved in finding solutions to problems associated with humpback whales and human activities in Glacier Bay. The need for management planning and research [Pg 27]programs has

been identified. The identification of interested and responsible organizations is necessary so that cooperative, coordinated planning and research can occur. Hopefully, by developing such plans or projects, minimum resources will be expended to obtain satisfactory solutions. In addition, by involving all interested and responsible individuals, groups, or organizations at an early stage, cooperative efforts can be maximized and disagreements identified and minimized.

The prime responsibilities of the National Marine Fisheries Service and the National Park Service have been identified. Other Federal agencies that should or might profitably be involved include the Bureau of Land Management, the Office of Coastal Zone Management, Sea Grant, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the U.S. Coast Guard, the Environmental Protection Agency, and the Army Corps of Engineers. State agencies that should or might be profitably involved include the Alaska Department of Fish and Game, the State Coastal Zone Management Commission, and the Alaska Department of Natural Resources. Commercial and recreational companies that organize fishing, tour, and charter activities, private boaters, academic/scientific communities, and environmental organizations are also important. Some of these organizations have on-going, or plan to initiate, research projects, which may provide data and information of importance to the problems discussed in this report.

The Bureau of Land Management, New York Outer Continental Shelf (OCS) Office, is presently initiating noise effects studies on marine mammals. The U.S. Geological Survey at Tacoma, Washington and Menlo Park, California is describing and mapping marine sediment distribution, thickness and characteristics within Glacier Bay. J. P. Mathews, of the Institute of Marine Science, University of Alaska, is summarizing the physical characteristics, especially water mass characteristics and dynamics, of Glacier Bay. If possible, these studies should be coordinated such that a maximum amount of information can be obtained and used in the management and research activities related to Glacier Bay National Monument and the humpback whale.

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## **SUMMARY**

Humpback whales in the North Pacific are migratory, spending the summer months in northern waters including the inland waters of southeast Alaska. Records have been maintained on the number of identifiable humpbacks seen in these waters including Glacier Bay. In 1978, humpbacks departed Glacier Bay after being "in residence" for a

far shorter time period than recorded previously; all but three whales left the Bay within 24 hours of entering in 1979.[Pg 28]

There has been an increase in vessel traffic and activity within Glacier Bay during the 1970's. Such activity may have been a factor in the movement of humpbacks from Glacier Bay. Other factors which may have been at least contributing but for which no known information exists, or is inadequate at best, include: natural environmental changes (chemical, physical, biological) or natural changes in the movement of the whales.

Present management and research plans and activities did not anticipate and, therefore, are inadequate to deal effectively with present day problems associated with a rapidly growing influx of people and vessels/aircraft into any environment with limited space and resources. Some human activities and the activities and behavioral patterns of humpback whales may be mutually exclusive.

The most apparent important short-term research need is to analyze and evaluate all available data, in order to develop short and long term management plans and research programs.

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[Pg 29]

## **REFERENCES**

Hale, L. Z. and R. G. Wright, 1979. The Glacier Bay Marine Ecosystem. A Conceptual Ecological Model. U.S. Department of the Interior, NPS, Anchorage Office. 177 pp.

Jurasz, C.M. and V. Jurasz. 1979. Ecology of Humpback Whales. Draft final report to the National Park Service.

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## **APPENDIX A**

### **AGENDA**

Meeting to Review Information and Actions Concerning Humpback Whales in Glacier Bay National Monument, Alaska



12-13 October 1979  
Room 208, College of Fisheries  
University of Washington, Seattle, Washington

12 October 1979

- 9:00 Discussion of meeting objectives, agenda, and procedures (Dr. Robert Hofman, Marine Mammal Commission)
- 9:15 Overview of available information on the distribution, abundance, and habitat requirements of humpback whales (Fisheries Service)
- 9:30 Physical/chemical characterization and history of Glacier Bay (presentation by Mr. Gregory Streveler, Glacier Bay National Monument)
- a. location, dimensions, geomorphology
  - b. geologic history and structure of the basin
  - c. glaciology
  - d. current patterns
  - e. water characteristics (temperature, salinity, nutrients)
  - f. climate
- 10:00 Review of available information concerning the past and present utilization of Glacier Bay by humpback whales (presentation by Dr. Robert Hofman)
- a. historical distribution, movement, and abundance
  - b. present distribution, movement, abundance, and behavior
- 10:30 Coffee Break
- 10:45 Review of information concerning the past and present human use and its possible effects on Glacier Bay (presentation by Mr. Gregory Streveler)
- 11:15 Possible reasons for observed changes in utilization of Glacier Bay by humpback whales (discussion led by Dr. Robert Hofman)
- 12:15 Lunch

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12 October 1979 (Continued)

- 1:30      Review of on-going and planned research and management activities in Glacier Bay and contiguous waters
- a. 1:30—National Park Service (presentation by Mr. Jim Larson and/or Mr. John Chapman)
  - b. 1:50—National Marine Fisheries Service (presentation by Mr. Milsted Zahn and/or Dr. Michael Tillman)
- 2:15      Identification of additional research/management actions, if any, needed to protect humpback whales in Glacier Bay
- a. Research
    - 1. Physical
      - i. acoustic characteristics of the Bay
      - ii. water currents and tidal factors
    - 2. Biological
      - i. identification of whale food and its distribution and abundance
      - ii. additional whale behavior studies including harassment indicators
    - 3. Human Factors
      - i. acoustic characteristics of vessels
  - b. Management
    - 1. comprehensive monitoring of vessel use patterns throughout the Bay
    - 2. vessel routing, number, and speed controls
    - 3. seasonal and/or area closures
- 4:30      As possible, summarize and rank research and management activities not included in on-going or planned activities
- 5:00      Adjourn

*13 October 1979*

9:00 Continue discussion on ranking research and management activities not included in on-going or planned activities

10:00 Coffee Break

10:15 As possible, identify target initiation dates, target completion dates, optimal methods, time, money, personnel, location, and management projects

11:45 Closing Remarks

12:00 Adjourn

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## **APPENDIX B**

### **LIST OF PARTICIPANTS AT MEETING TO REVIEW INFORMATION AND ACTIONS CONCERNING HUMPBACK WHALES IN GLACIER BAY NATIONAL MONUMENT**

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[Pg 34]

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[Pg 35]

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## APPENDIX C

Needs Relative to Humpback Whales in Glacier Bay and Elsewhere (these lists are examples and not necessarily all inclusive).

of existing data (available data presently are not in a form that is optimally useful)

and abundance in Glacier Bay and surrounding areas—by year, season, time of day, age, sex, weather (tide, rain, etc.), birds, boats (by total effort, prey species, effort,——

at use patterns—home range, temporal/spatial distribution of sightings of individually recognizable animals—are there resident, migratory, or transient patterns—do individuals have seasonal, annual cycles as to when/where they occur

mal"—baseline) whale behavior—by age, sex, group size, group composition, time of day, season, location (descriptive and quantitative)



times/breathing

a. vocalization

g  
eeding

- 1.
- 2.
- 3.
- "

- b. tail lob
- c. raking
- d. finning
- e. breaching
- f. avoidance
- g. other

with other whales/social organization of whales

behavior—stimulus/response— behavior (as above) before, during and after an event—response distance (by age, sex, pre-event activity, location, weather, etc.)—recovery time (by age, sex, etc.).

ic

undance in Glacier Bay and surrounding areas—by type (class), year, season, time of day, weather

patterns—by type, year, etc.

r)—by type, year, etc.

ng  
(commercial)

nical, biological environment—by year, season, etc.)

temperature, sediment load

oxygen content, inorganic nutrient, pollutants

n and abundance of primary and secondary prey species—by year, season, time of day

n, size, and species composition of fish catch, including by-catch—by year and season

n and abundance of predators (killer whales) and competitors other than man—by year, season, time of day, etc.

els—representative areas (in and outside Bay), seasons, time of day, weather and tide conditions, sea state

related noise—representative types, representative areas (in and outside Bay), speed (prop rpm), season, time of day, sea state

e the Bay

at use pattern)[Pg 38]

on

nt/areas of special significance

and outside the Bay

pe, season, time of day

s

nt levels

undance and dynamics of primary and secondary prey species—in and outside the Bay

ize and species composition of fish catch—in and outside the Bay

bundance and movements of competing and predatory species

pothesis concerning possible effects of various stimuli on whales—representative stimuli, representative whales (age, sex), representative  
g, etc.), representative areas, seasons, times of day, weather and environmental conditions.

regular intervals)

chemical)

bundance, movements, activity patterns, vocalization patterns, cow/calf ratios)

ce, type, distribution, movements, activities)

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## APPENDIX D



National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE

Washington, 20235

DEC 3 1979

F6:TRL

Mr. John Chapman  
Superintendent  
Glacier Bay National Monument  
National Park Service  
Box 1089  
Juneau, Alaska 99802

Dear Mr. Chapman:

This letter responds to your August 4, 1979, request for consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, relative to the population of the humpback whale in Glacier Bay, Alaska.

Your problem statement of the same date outlines the basic issue of human activity in Glacier Bay National Monument that might be affecting humpback whales. Section 7 of the Endangered Species Act requires that each federal agency insure that its actions do not jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species. The consultation process requires our comment and opinion on the problem.

Within this context, our response addresses those National Park Service (NPS) actions controlling human activity that may, in turn, affect the humpback whales within Glacier Bay.

### **Biological Background**

In the North Pacific, the summer range of the humpback whale encompasses the area from Bering Strait south to the Subarctic Boundary (ca. 40° N lat) and extends in the east to about Point Conception, California, and the Sanriku Coast of Honshu Island in the west. Humpbacks range into shallow coastal waters more frequently than do most other balaenopterids and regularly occur in sheltered inside waters of Prince William Sound and the Alexander Archipelago of southeastern Alaska.

The wintering grounds of humpbacks in the North Pacific are centered in three areas: (1) the coast and adjacent islands of west-central Mexico; (2) the main Hawaiian Islands; and (3) the Bonin, Ryukyu, and Mariana Islands in the western North Pacific. Some humpbacks that summer in southeastern Alaska are known to migrate to both the Mexican and Hawaiian wintering grounds, although others are found in southeastern Alaska during all months of the year.

Prior to the rise of modern whaling in the late 1800's, the world population of humpback whales exceeded 100,000, mostly in the Southern Hemisphere. The North Pacific population probably numbered roughly 15,000 at the turn of the century.

[Pg 40] Whaling in southeastern Alaska began in 1907 with the establishment of two land stations. The number of humpback whales at the start of this earliest exploitation is unknown. Consistent catch records are available only for 1912-1922, during which time 185 humpbacks were taken, with a peak catch of 39 in 1916.

Since 1922, no whaling has been conducted in the territorial waters of southeastern Alaska. However, the humpback whales of the inside waters were exposed to additional exploitation as they migrated across the high seas or through the coastal territorial waters of British Columbia, Washington, California, and Baja California.

By 1966, when humpbacks were accorded complete legal protection by the International Whaling Commission, the world population of the species had been reduced to about 5,000. The North Pacific population now numbers about 1,000, of which 600 or 700 winter in the Hawaiian Islands, and 200 or 300 winter in Mexico. Only a few humpbacks have been sighted on the western North Pacific wintering grounds in recent years. Since 1966 no trends in abundance have been observed either for the North Pacific population as a whole or on any of its wintering or summering grounds, including southeastern Alaska.

Based upon aerial and vessel surveys, the population that spends the summer in the inside waters of southeastern Alaska numbers at least 70. Photoidentification studies now underway tentatively reveal that the population may exceed 100. Although it ranges throughout the area from Sumner Strait northward, its main concentration areas are Frederick Sound-Stephens Passage, where a minimum of 40 whales occurs, and Glacier Bay, where 20-25 whales occur. Humpback whales congregate in these areas to feed upon the summer blooms of euphausiids, herring, and capelin. Some whales arrive in June and stay on through early September, although as mentioned earlier, other animals appear to remain through the winter months.

When humpback whales historically began occupying Glacier Bay is unknown, but they have occurred there every summer over the past seven years of investigation. Photoidentification techniques indicate that certain individuals repeatedly return to feed there.

The availability of these and other feeding areas in southeastern Alaska has not been constant over the years. Although Glacier Bay has lately been a prominent feeding area, this was not always so since the area was covered by an ice sheet during the 18th century; at that time the humpback population was presumably at its maximum pre-exploitation level. There is some indication that a seasonal feeding area in Lynn Canal was avoided by humpbacks coincident with the onset of a herring fishery in 1972. With the cessation of that fishery, humpbacks reoccupied the area in 1979. The possibility cannot be discarded that these events are related.

### **Present Glacier Bay Situation**

The NPS records indicate that during 1976 and 1977, 20-24 individual humpback whales moved into Glacier Bay during June and remained there into August. In 1978

this pattern of use changed when most of the animals departed [Pg 41]by mid-July. In 1979 this use was modified further with fewer whales entering the Bay and very few of those remaining in the Bay. Observations prior to 1976 are more general in nature, rather than numerical counts of record.

Human use of the Bay is reflected in NPS records, to wit:

Year	Visitor Days	Large Ships	Private Boats
1965	1,800		
1969	16,000		115
1970	30,000		165
1975	72,000	113	353
1976	85,000	123	318
1977	120,000	142	534
1978	109,000	123	699

Most visitor use is via water access, with cruise ship and recreational craft visitation levels increasing rapidly in recent years.

The recent NPS study indicates that increasing vessel traffic in Glacier Bay may be implicated in the apparent departure of whales from Glacier Bay in 1978 and 1979. Data on the number of observed whale-vessel interactions in Glacier Bay enables calculation of the following "interaction" index (data for 1979 not available):

Year	Whale-vessel Interactions	Hours Observed
1976	98	261.1
1977	201	407.1
1978	268	397.5

Thus the occurrence of whale-vessel interactions increased 29 percent and 76 percent respectively in 1977 and 1978 over the 1976 base level. Despite mitigative

regulations in 1979, observers noted that whale-vessel interactions continued at substantial frequencies.

The NPS data indicate that behavior of the humpback whales in Glacier Bay changed significantly in 1978. Comparison of the frequency distributions of behavioral responses indicates that, whereas distributions were the same in 1976 and 1977, both years were statistically different from 1978. In 1978, more avoidance behavior occurred than in previous years, suggesting that the whales reacted to the increased level of vessel traffic in 1978. However, the causal mechanism for these reactions (whether it be increased noise or visual stimuli) remains unknown.

All classes of vessels were not implicated equally in the increased level of interactions which occurred in 1978. Cruise ship visitations actually decreased 14 percent in 1978 from the 1977 high, while charter/pleasure craft visitations increased 120 percent between 1976 and 1978. Commercial fishing vessel traffic decreased 30 percent between 1976 and 1978. Charter/pleasure craft were often observed to change direction and travel toward whales for a closer look. Cruise ships and commercial fishing vessels, on the other hand, [Pg 42]neither paused for nor actively followed whales. Thus the most likely source for increased interaction would appear to be the increased visitations by charter/pleasure craft in 1978.

This conclusion seems to agree with the perceptions of scientists examining other similar situations. The workshop on problems related to Hawaiian humpback whales, sponsored by the Marine Mammal Commission in 1977, concluded that vessel traffic not oriented toward whales did not ordinarily seem to disturb them. Indeed, it was concluded that whales seem readily to habituate to constant or familiar noises such as those produced by ships of passage. A recent review on the possible effects of noises emanating from offshore oil and gas development concluded that, unlike the abrupt response to sudden disturbances, most whales become habituated to low-level background noises such as would be associated with ship traffic (Geraci, J. R., and D. J. St. Aubin, "Possible Effects of Offshore Oil and Gas Development on Marine Mammals," prepared for the Marine Mammal Commission, August 1979.) Moreover, it was noted that such behavior forms the underlying basis for the success of whale watching cruises. Thus the erratic actions of charter/pleasure craft rather than the more constant action of cruise ships may be the major factor in possible harassment by vessels within Glacier Bay.

Cruise ships also may be implicated as potential sources of disturbance due to the physical setting within Glacier Bay. A direct analogy may be seen in the lagoons of Baja California where gray whales calve. Heavy barge and freighter traffic associated with the salt industry, as well as a dredge operating continuously in the lagoon's mouth, apparently drove gray whales out of Laguna Guerrero Negro between 1957 and 1967. The whales reinvaded in substantial numbers when vessel traffic was eliminated. The

continued high use of Laguna Ojo de Liebre by gray whales suggests that the movement of salt barges, beginning there in 1967, may not have been such a nuisance. However, since Laguna Ojo de Liebre is a much larger area than Laguna Guerrero Negro and has a much wider entrance, the whales there may simply have been able to move and coexist next to the barges. Such luxury of space may not be available to the humpback whales of Glacier Bay and, due to geological configurations of its basin, vessel noise may be accentuated there. These factors may account for the unexpected reaction of humpbacks to cruise ships in Glacier Bay.

The apparent departure of humpback whales from Glacier Bay in 1978 and 1979 may also be due in part to a change in the availability of food. Euphausiids have historically been the primary feed within Glacier Bay in July-August, although little research has been done to compare yearly levels of this feed or to determine what level is necessary to support the whales. The only available information derives from vertical plankton tows by the REGINA MARIS in August 1979, which indicated that fewer euphausiids (5 percent) occurred in Glacier Bay as compared to Frederick Sound-Stephens Passage. The humpbacks may have found the Glacier Bay food levels to be too low, particularly in the face of continued high vessel use, and simply departed to search for better concentrations elsewhere.

A similar abandonment of a prime feeding area, the Grand Banks, was observed for the Northwest Atlantic humpback population and was thought to be associated with the overfishing of capelin stocks there. Consequently, the [Pg 43]occurrence and distribution of humpback whales may be generally dependent upon the occurrence and availability of its desired prey species.

In a worst case analysis, Glacier Bay is a feeding ground, and its long-term abandonment would not be conducive to the conservation of the humpback whale. Up to 20 or 25 individual whales would relocate to other areas, increasing competition for food there. In such case a greater expenditure of energy might be required to obtain the same quantities of food than would be required in Glacier Bay. An increased energy expenditure would tend to decrease the likelihood of humpbacks successfully increasing their numbers, since growth and the onset of sexual maturity would be delayed.

## **Conclusions**

Our present interpretation of the available data is that uncontrolled increase of vessel traffic, particularly of erratically traveling charter/pleasure craft, probably has altered the behavior of humpback whales in Glacier Bay and thus may be implicated in their departure from the Bay the past two years. Our conclusion, then, is that continued increase in the amount of vessel traffic, particularly charter/pleasure craft, in Glacier Bay is likely to jeopardize the continued existence of the humpback whale population



frequenting Southeast Alaska. The alteration in the distribution of the whales in Southeast Alaska can be expected to appreciably reduce the likelihood of the recovery of the North Pacific humpback population, especially when viewed as an incremental aggravation of the problem of humpback/human interaction in general.

## **Recommendations**

Until research reveals the need for more specific action, if any, we offer the following as reasonable and prudent alternatives that the NPS should institute in Glacier Bay to avoid jeopardizing the continued existence of the North Pacific population of humpback whales:

We recommend that total vessel use of the Bay be restricted to 1976 levels, at the very least, since that year preceeded the high point of visitor use in Glacier Bay during 1977. Commercial use of the Bay is predicated on a permit system that should offer good control and accountability of the tour industry. The routing of large vessels is relatively easy to regulate. Recreational craft present the greater challenge to management control. The continuing increase in the amount of recreational traffic in the Bay lends considerable urgency to establishing effective controls.

Collectively, regulations should address vessel routing and vessel maneuvering. The NPS has already regulated these activities to some extent. Specific routes should be published, but the system should be flexible enough to accommodate changes of areas of concentrated feeding activity.

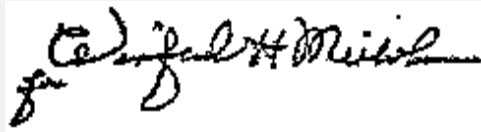
We further recommend curtailment of vessel operator discretion in pursuing, or approaching, whales. General guidelines prohibiting the pursuit or willful or persistent disturbance of whales through vessel maneuvering probably would offer better enforceability and public compliance than would detailed regulations based on specified distances. Vessel operator behavior should receive a thorough public educational effort, possibly through an informative notice to each vessel.

[Pg 44]Finally, we recommend that monitoring of the humpback population and of whale-vessel interactions be continued and that all current data be fully analyzed. New research should also be undertaken (1) to characterize the food and feeding behavior of humpback whales in Glacier Bay and other areas; (2) to ascertain the acoustic characteristics of vessels within the Bay and in other areas with the aim of identifying equipment and/or modes of operation which are inimical to the whales; and (3) to compare behavioral responses of the humpbacks to vessels in Glacier Bay with those observed in other areas of southeastern Alaska.

The conclusions and recommendations stated herein constitute our biological opinion, and we consider consultation on this matter to be at an end. Should significant

new information or factors not considered in this opinion arise, however, either we or NPS are obligated to reinitiate consultation.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Terry L. Leitzell", written on a white rectangular background.

Terry L. Leitzell  
Assistant Administrator  
for Fisheries

## Transcriber's Notes

The text herein presented is essentially that in the original report. To preserve continuity, some text was moved to rejoin text which had been split by Figures or Tables. Footnotes were moved to the end of the section in which they occur. To help distinguish them from text body footnotes, Table footnotes were changed from numbers to lower alpha characters. Three typos were corrected (see below).

The original report appears to have been a typewritten document and species names were underlined instead of italicized as is usually the case. Some other text is centered in all caps, that text has been formatted as headers (e.g., bold and larger sized font).

## Typographical Corrections

Page 11 (TABLE 4.): [visable](#) => [visible](#)

Page 25 (Item 1.): [move-](#) => [movement](#)

Page 33 (3rd Item): [Wildlive](#) => [Wildlife](#)

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MONUMENT, ALASKA \*\*\*

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