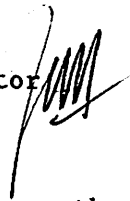


Agenda Item I-3
October 1979

MEMORANDUM

To: Council, SSC, and AP

From: Jim H. Branson, Executive Director 

Date: September 26, 1979

Subject: A proposal for funding -- To Assess the Distribution and Abundance of Certain Marine Mammal Populations (walrus) in Bristol Bay, by Bud Faye (University of Alaska). Cost \$87,200

ACTION REQUIRED:

Approval for funding.

BACKGROUND:

We have received a proposal for funding from Dr. Francis (Bud) Faye, University of Alaska, to assess the distribution and abundance of certain marine mammal populations in Bristol Bay. The proposal is tied to the eastern Bering Sea clam draft fishery management plan as well as marine mammal considerations in the Bering Sea/Aleutian Island groundfish fishery management plan. It is designed to be a one-year study and will cost \$87,220. No determination has been made at this time whether it could be funded by any other agency.

The proposal has been distributed to the Scientific and Statistical Committee and the Advisory Panel for their review and recommendations. After it has been reviewed by the SSC and AP it will be presented to the Finance Committee for their evaluation.

The proposal is attached.

MIH



UNIVERSITY OF ALASKA, FAIRBANKS
Fairbanks, Alaska 99701

FILE	ACT	INFO	ROUTE TO	INITIAL
			Exec. Dir.	
			A. Exec. Dir.	
			Admin. Off.	
			Exec. Sec.	
			Writer/1	
			Writer/2	
			Sec. Recep.	
			Sec. Typist	
			AUG 6 1979	

Institute of Marine Science
2 August 1979

Mr. Jim Branson, Executive Director
North Pacific Fisheries Management Council
P. O. Box 3136DT
Anchorage, Alaska 99510

Dear Jim:

Enclosed are six copies of a research proposal for a project designed to assess the "Seasonal Use and Feeding Habits of Walrus in the Proposed Bristol Bay Clam Fishery Area".

No specific starting date is indicated, since it is a year-round study that could be started at any time.

This study would tie in nicely with an ongoing State-Federal study of the dynamics of the summering herds that utilize the Walrus Islands. That study is being coordinated by Chris Smith of ADF&G King Salmon, who has agreed to contribute about a month of his time to the one proposed here at no additional expense in salary and at a considerable saving in transportation costs. Not mentioned in the proposal is the real possibility that we may be able to monitor the movements of radio-tagged walrus to and from the Walrus Islands, using his radio equipment in the survey aircraft. In this way, we should be able to determine whether the animals reaching the clam fishery area are resident or transient and, if the latter, how frequently they cross the bay for a meal of S. polynyma.

Lloyd and I shall look forward to receiving your comments or suggestions and, of course, the Council's findings on consideration of the proposal.

Sincerely,

Francis H. Fay
Associate Professor

encl. - 6 copies proposal

cc: L. Lowry

RESEARCH PROPOSAL

TO: North Pacific Fisheries Management Council
 P.O. Box 3136DT
 Anchorage, Alaska 99510

FROM: Institute of Marine Science
 University of Alaska
 Fairbanks, Alaska 99701

TITLE: SEASONAL USE AND FEEDING HABITS OF WALRUSES IN THE
 PROPOSED BRISTOL BAY CLAM FISHERY AREA

DURATION: 1 year

COST: \$87,220

CO-PRINCIPAL INVESTIGATORS: Dr. Francis H. Fay and Lloyd F. Lowry
 Institute of Marine Science Alaska Department of Fish
 University of Alaska & Game
 Fairbanks, Alaska 99701 1300 College Road
 Fairbanks, Alaska 99701

Francis H. Fay
 Co-Principal Investigator
 Phone: 479-7026

Lloyd F. Lowry
 Co-Principal Investigator
 Phone: 452-1531

Vera Alexander, Acting Director
 Institute of Marine Science
 Phone: 479-7531

A. B. Frol
 Director Administrative Services
 Phone: 479-7340

Dorothy Brewster, Executive Officer
 Institute of Marine Science
 Phone: 479-7824

Keith B. Mather, Vice Chancellor
 for Research and Advanced Study
 Phone: 479-7282

July 1979

TABLE OF CONTENTS

INTRODUCTION 3

METHODS. 6

WORK SCHEDULE. 9

PERSONNEL. 10

LITERATURE CITED 11

COST ANALYSIS. 12

BUDGET 14

ALASKA DEPARTMENT OF FISH AND GAME SUBCONTRACT BUDGET. 15

 Biographical Sketch - F. H. Fay 16

 Biographical Sketch - L. F. Lowry 21

LIST OF FIGURES

Figure 1. Distributional range of the Pacific walrus population
(after Fay, 1979 and other sources) 4

Figure 2. Survey transects in inner Bristol Bay. Clam fishery
area is shown by cross-hatching 7

INTRODUCTION

A joint industry-government assessment program was conducted in 1976-78 to investigate the potential for development of an hydraulic dredge surf clam (*Spisula polynyma*) fishery in the southeastern Bering Sea. The results of that investigation pointed to the presence of commercially harvestable quantities of surf clams and other bivalves in a 2,700 nm² area in southern Bristol Bay (Hughes *et al.*, 1977; Hughes and Nelson, 1978). The Fishery Management and Conservation Act of 1976 mandates that, before this fishery can be developed, a Fishery Management Plan (FMP) and an Environmental Impact Statement (EIS) must be prepared for it. The FMP for the proposed Bering Sea surf clam fishery has been in preparation since 1977, but its completion has been impaired by three major data gaps: (1) information on the biology of *S. polynyma*, especially its reproduction, growth, and recruitment rate to harvestable size, (2) the effects of hydraulic clam harvesting on the surf clam and its associated benthic community, and (3) the potential for conflict between the proposed fishery and marine mammals, especially walruses (*Odobenus rosmarus*). The goal of the study outlined in this proposal is to provide the information needed to fill the latter gap, i.e. to supply data on the degree of utilization of the proposed clam fishery area by walruses and determine their feeding habits in that area.

The proposed surf clam fishery zone is within the present distributional range of the walrus population that inhabits the Bering and Chukchi seas (Fig. 1). Elsewhere in the Bering Sea, walruses feed mainly on bivalve mollusks, including surf clams (Fay *et al.*, 1977). Hence, it is probable that they feed on *S. polynyma* and other species of

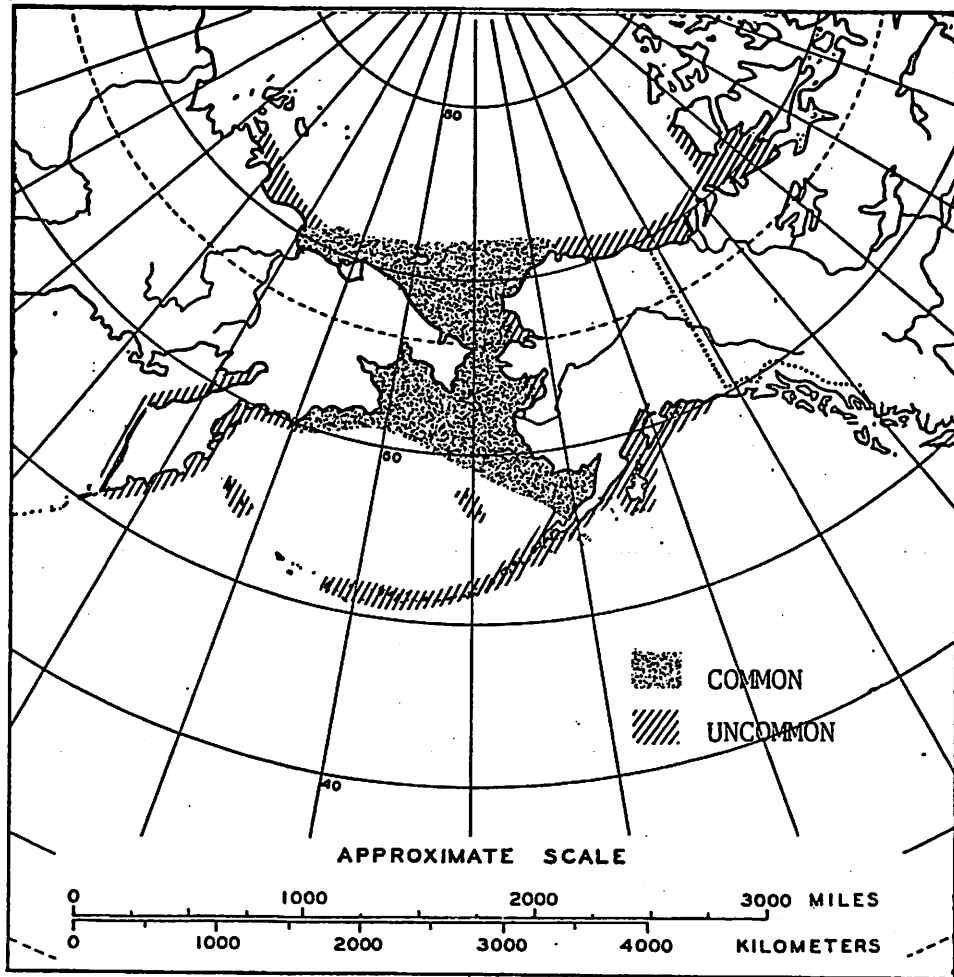


Figure 1. Distributional range of the Pacific walrus population (after Fay, 1979 and other sources).

potential commercial value also in the proposed clam fishery zone, whenever they occur there.

In recent winters, when the seasonal pack ice covered most of Bristol Bay, walruses were abundant well into the bay, at least as far as 159°W longitude (Kenyon, 1972; Burns and Harbo, 1977; Krogman *et al.*, 1979). However, it is not clear whether they utilized the clam fishery zone itself in large numbers. Such extensive distribution of ice and walruses occurred in 7 of the past 10 winters (Burns *et al.*, 1979). Even in 1979, when there was very little ice in Bristol Bay, walruses were present in considerable numbers, and about 2-4,000 were sighted in the clam fishery zone itself (C. Smith, *in litt.* 1979).

Normally, in at least the past three decades, several thousand walruses also have remained in Bristol Bay during the summer, utilizing the Walrus Islands in the northern part of the bay as a haulout area, where they go ashore to rest and molt. The exact number of this summering group is not known, but it is believed to exceed 20,000 animals, mainly adult males (J. Taggart *fide* C. Smith, pers. comm.). These animals remain ashore for a few days at a time, then go to sea for one to two weeks, presumably to feed. The specific location of their feeding areas is unknown, but it is apparent that they range out over the whole bay. In recent years, groups of walruses have been sighted in summer as far west as Cape Newenham in the north and Amak Island in the south, and as far east as Nushagak and Kvichak bays (R. Baxter, J. Faro, R. Nelson, K. Schneider, pers. comm.). Even at their slow cruising speed of about 5 kt, they could easily reach the clam fishery zone and return to the Walrus Islands within the duration of their feeding forays. A few walruses were

sighted in the clam fishery zone during the 1978 summer resource assessment surveys (C. Hughes, pers. comm.), and some were present near Port Moller throughout the spring and into the summer of 1979 (C. Smith, pers. comm.).

The degree to which walrus utilize the proposed clam fishery area on a year-round basis can only be surmised from the data currently available, and their feeding habits within that area are unknown. The study proposed here would assess their distribution and relative abundance in inner Bristol Bay (east of 161°W long.) on a monthly basis for one year, and would describe their feeding habits in and near the clam fishery zone.

METHODS

Using an amphibious aircraft based in King Salmon, monthly aerial surveys will be conducted along a series of transects of the inner bay, east of 161°W longitude, which is an area of about 8,800 nm². Each survey will cover about 650 nm of north-south transects, 20 nm apart, plus an additional 130 nm of northeast-southwest transect within the clam fishery zone (Fig. 2). The aircraft, carrying two observers and the pilot, will be flown at an altitude of approximately 500 ft and speed of 140 to 150 kt. The area intensively sampled by the observers will be limited to 1/4 mi on each side of the flight track as determined by use of an inclinometer. However, animals sighted outside of that range, as well as along the coastal flight tracks between N-S transects, will be recorded as well. Sightings will be recorded in relation to time and number of animals. Locations and numbers will be plotted at the end of

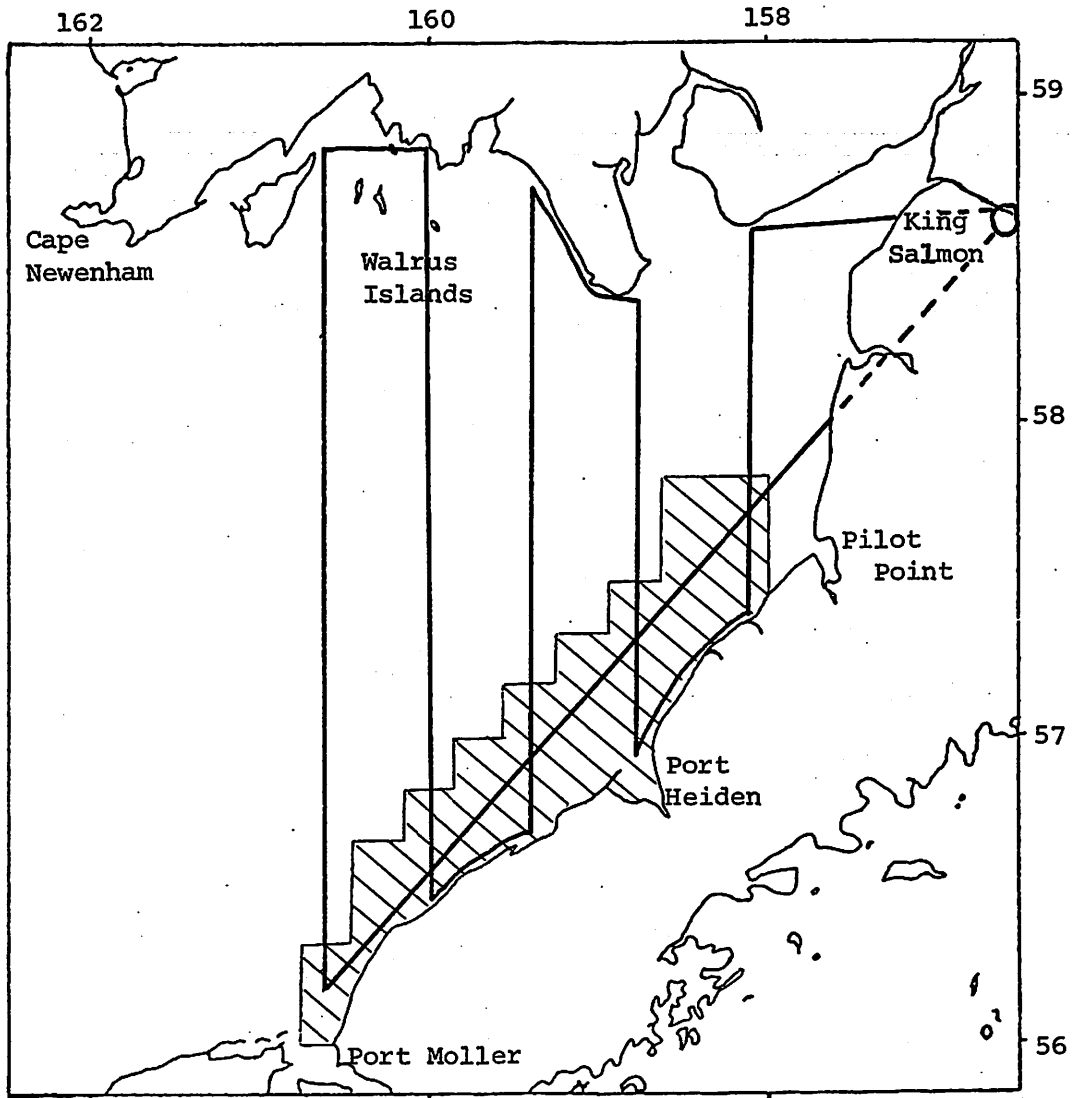


Figure 2. Survey transects in inner Bristol Bay. Clam fishery area is shown by cross-hatching.

each survey on the basis of the time/distance relationship along each transect.

The coverage of the 8,800 nm² inner bay by the 1/2 nm-wide intensive survey strips will be about 325 nm² or about 3.7% of the total area. Intensive coverage within the clam fishery zone itself (i.e. N-S + diagonal) will be about 124 nm² or 4.6% of its area. Since this is not a census of actual numbers but a survey of distribution and relative abundance, more intensive (and more expensive) coverage probably is not warranted.

During most of the year, the timing of surveys each month will be determined mainly by weather. However, in the summer months, when personnel of an ongoing Federal-State cooperative study are present on the Walrus Islands, we shall be able to obtain current information on the presence or absence of animals there, on the haulout, through telephone contact with the ADF&G regional office in King Salmon. Weather permitting, the surveys in those months (May-September) will be conducted 2 to 3 days after the animals have left the haulout, in order to assure that maximal numbers will be at sea.

Determination of the feeding habits of walrus in the area will be accomplished by selective collection of feeding animals, at sea. Probably, all of the specimens will be collected in summer, though possibilities for collections at other times will be explored. A minimum of 10 and maximum of 30 animals should be sufficient to characterize the diet of those utilizing the clam fishery area. These will be taken from a chartered vessel, at times when the aerial surveys indicate the presence of animals in the area. These collections will be contingent on issuance

of a collecting permit by the presiding management agency or agencies. A permit application to the U.S. Fish and Wildlife Service is in preparation at this time.

Each specimen will be harpooned before being killed, in order to minimize the possibility of loss through wounding or sinking. The expert assistance of Mr. Ed. Muktoyuk, with a lifetime of experience as a walrus hunter at King Island (northern Bering Sea), will be available for this phase of the work. Sex, age, reproductive status, date, time, and location will be recorded for each specimen. Other vital statistics will be obtained insofar as possible. The stomach will be removed and the contents preserved with 10% buffered formalin for transportation to the Institute of Marine Science's Seward Marine Station, where analysis will take place with assistance from specialists and reference collections of the IMS Marine Sorting Center.

The stomach contents will be analyzed by species, number, weight, and size of food items. The results will be compared with benthic faunal data available from the clam resource assessments and other sources, on the basis of which an effort will be made to evaluate the impact of walrus on the surf clams and other bivalves of potential commercial importance.

WORK SCHEDULE

Aerial surveys will commence as soon as funding has been approved. One 1-day (6-8 hrs) survey will be conducted each month for one year.

Collections also will commence as soon as funding and the collecting permit are received, and provided that some animals are known to be in or

near the fishery zone. Collecting will be continued on an opportunistic basis until at least 10 and not more than 30 animals have been obtained.

PERSONNEL

Each aerial survey will be conducted by one of the Co-PI's with one of the following personnel:

L. M. Shults, Institute of Marine Science, University of Alaska, Fairbanks.

C. Smith, Alaska Department of Fish & Game, King Salmon

Each of these people has had experience with walruses and with aerial survey techniques. The collections of walruses for feeding habits studies also will be conducted by at least one of the Co-PI's and one of the above personnel, plus our expert walrus hunter:

E. Muktoyuk, Alaska Department of Fish & Game, Nome.

Laboratory analysis of the walrus stomach contents will be done by Lowry and Shults at the Seward Marine Station, and data analysis for both the surveys and stomach contents will be done in Fairbanks by our statistician/programmer:

L. Miller, Alaska Department of Fish & Game, Fairbanks.

The final report will be prepared by the Co-PI's, with assistance from Shults and Miller.

LITERATURE CITED

- Burns, J. J. and S. J. Harbo, Jr. 1977. An aerial census of spotted seal, *Phoca vitulina largha*, and walruses, *Odobenus rosmarus*, in the ice front of Bering Sea, Final Report, pp. 58-132. In USDC/NOAA, Environmental Assessment of the Alaskan Continental Shelf, Quarterly Repts. of Principal Investigators, April-June 1977, Vol. 1. NOAA Environmental Research Laboratories, Boulder, Colo.
- Burns, J. J., F. H. Fay and L. H. Shapiro. 1979. The relationships of marine mammal distributions, densities and activities to sea ice conditions, Final Report. (Manuscript in preparation).
- Fay, F. H. 1979. The walrus, *Odobenus rosmarus*, Ch. 1. In R. J. Harrison and S. Ridgway (eds.), *Handbook of Marine Mammals*, Vol. 1, *Pinnipedia*. Academic Press, London (in press).
- Fay, F. H., H. M. Feder and S. W. Stoker. 1977. An estimation of the impact of the Pacific walrus population on its food resources in the Bering Sea. A report to the U.S. Marine Mammal Commission. PB-273-505 Nat. Tech. Info. Serv., Springfield, Va.
- Hughes, S. and R. W. Nelson. 1978. Preliminary results of joint industry-government venture on surf clams in the S. E. Bering Sea - 1978. Ms. Rept., NOAA/NMFS, Northwest and Alaska Fisheries Ctr., Seattle.
- Hughes, S. E., R. W. Nelson and R. Nelson. 1977. Initial assessments of the distribution, abundance, and quality of subtidal clams in the S.E. Bering Sea. Ms. Rept., NOAA/NMFS, Northwest and Alaska Fisheries Ctr., Seattle.
- Kenyon, K. W. 1972. Aerial surveys of marine mammals in the Bering Sea, 6-16 April 1972. Ms. Rept., U.S. Fish. Wildl. Service, Bur. Sport Fish. Wildl., Seattle.
- Krogman, B. D., H. W. Braham, R. N. Sonntag and R. G. Punsly. 1979. Early spring distribution, density, and abundance of the Pacific walrus (*Odobenus rosmarus*) in 1976, Final Report. USDC/NOAA, Environmental Research Laboratories, Boulder, Colo.

COST ANALYSIS

There will be twelve aerial surveys, for each of which we shall need round-trip transportation between Fairbanks and King Salmon (\$185) and about 5 days travel expenses (2 travel, 1 survey, 2 weather and other delays) at \$30/day for one of the Co-PI's. The same will be needed for one of the other Fairbanks-based observers (Shults) on 1 or 2 surveys, when our observer based in King Salmon (C. Smith) is not available. In addition, preparation for each survey will require several long-distance phone calls at about \$5 each, plus 7 hrs air charter each (84 hrs total) for the survey aircraft at \$210/hr, plus miscellaneous minor expenses, mainly office supplies and xerox charges.

Each of the two collecting trips will follow immediately after aerial surveys, hence two members of the 3-man collecting team will already be in King Salmon. The third member, Muktoyuk, will need round-trip transportation between Nome and King Salmon (\$310) and expenses for about 3 days of travel at \$50/day. The 3-man team will require transportation (r-t) between King Salmon and the point of boat charter, probably via charter aircraft at about \$500 per collecting trip. Each collecting trip will take about 10 days (1 travel, 5 boat, 4 weather and other delays), for about 30 man days at \$30/day. In addition, there will be some long-distance phone calls, boat charter costs for 5 days per trip at \$500/day, field supplies (e.g. notebooks, labels, formalin, buckets, plastic bags, rifle shells, knives, lines, etc.), and miscellaneous services, such as air freighting of supplies and collected samples, and identification charges for expert assistance at the Marine Sorting Center.

BUDGET

Salaries and Wages

F. H. Fay, P.I. 3.5 mos @\$3831	\$13,409
L. M. Shults, Biological Technician 1 mo @\$1941	1,941
Cost of Living Increment 7.5% of \$15,350	1,151
Annual, Sick, and Holiday Leave 17% of \$16,501	<u>2,805</u>
Total Salaries and Wages	\$19,306
Staff Benefits 21.1% of \$19,306	<u>4,074</u>
Total Salaries, Wages and Benefits	\$23,380

Travel

8 Round-trips Fairbanks - King Salmon w/70 man-day subsistence @\$30/day	2,680
2 Round-trips King Salmon - Port Heiden w/20 man-day subsistence @\$30/day	<u>767</u>
Total Travel	\$ 3,447

Equipment

-0-

Expendable Supplies

500

Services

Aircharter, fixed-wing, multi-engine, 84 hrs @\$210/hr	17,640
Boat charter, accomodates 4, w/small boat, 10 days @\$500/day	5,000
Air Freight 900 lbs @.23/lb	207
L-D Phone, Xerox, Drafting, Photo	500
Marine Sorting Center fees	300
Subcontract (ADF&G), survey and analysis (see attached subcontract budget)	<u>21,149</u>
Total Services	\$44,796

Total Direct Costs

72,123

Indirect Costs 78.2% of \$19,306

15,097

Total Project Costs

\$87,220

Finally, there will be some charges for laboratory and office supplies, xerox fees, and photo and drafting services, as required for analysis of the collected materials and reporting of the data. About 10 man-days will be needed for biological analysis of the stomach contents, 35 man-days for computer programming and statistical analysis of the data from the surveys and the collected specimens, and about 40 man-days for preparation of the final report.

ALASKA DEPARTMENT OF FISH AND GAME SUBCONTRACT BUDGET

Salaries and Wages

L. Lowry, Co-P.I. 2 mos @\$2441	\$ 4,882
L. Miller, Computer Specialist 1.5 mos @\$2,031	3,046
E. Muktoyuk, Game Technician 1 mo @\$2,791	2,791
C. Smith, Game Biologist 1 mo (salary provided by ADF&G)	-0-
Cost of Living Increment 6% of \$10,719	<u>643</u>
Total Salaries and Wages	\$11,362

Staff Benefits 25.5% of \$11,362	<u>2,897</u>
Total Salaries, Wages and Benefits	\$14,259

Travel

6 Round-trips Fairbanks - King Salmon w/30 man-day subsistence @\$30/day	2,130
2 Round-trips Nome - King Salmon w/6 man-day subsistence @\$50/day	920
5 Round-trips King Salmon - Port Heiden w/50 man-day subsistence @\$30/day	<u>1,917</u>
Total Travel	\$ 4,967

Total Direct Costs	19,226
Indirect Costs 10% of \$19,226	<u>1,923</u>
Total Subcontract Costs	\$21,149

Biographical Sketch of

Francis Hollis Fay

SS# 030-20-7749

Born: 18 November 1927; Melrose, Massachusetts, U.S.A.

Education: B.S. University of New Hampshire, Durham, 1950 (Agriculture)
M.S. University of Massachusetts, Amherst, 1952 (Wildlife Mgt)
Ph.D. University of British Columbia, Vancouver, Canada, 1955, (Zoology/Wildlife)

Member: American Association for the Advancement of Science (Fellow)
American Polar Society
American Society of Mammalogists
Arctic Institute of North America (Fellow)
Ecological Society of America
The Wildlife Society
Wildlife Disease Association

Special Activities: Member, U.S. Steering-Planning Committee, Marine Mammal Project; US-USSR Environmental Protection Agreement, 1975-present
Member, Committee of Scientific Advisors, Marine Mammal Commission, 1975-1977
Member, U.S. Delegation, Marine Mammal Working Group, US-USSR Environmental Protection Agreement, 1973-74
Delegate, Workshops on U.S. Program for Bering Sea Oceanography: Processes and Resources of the Bering Sea Shelf (PROBES), 1973-74
Member, U.S. Delegation, International Symposium for Bering Sea Study, Hakodate, Japan, 1972
Chairman, Section on Biology, Utilization, and Conservation of Marine Mammals; Alaska Science Conference, 1971
Vice President, Alaska Chapter, The Wildlife Society, 1971
Member, Governor's Ad Hoc Committee on Organic Mercury Poisoning in Alaska, 1970
Member, USIBP Marine Mammal Council, 1967-73
Member, Marine Mammal Committee, American Society of Mammalogists, 1959-67

Experience: Associate Professor of Marine Science and Arctic Biology, University of Alaska, 1975-present
Associate Professor of Marine Science, University of Alaska, 1974-1975
Adjunct Associate Professor of Wildlife and Fisheries, University of Alaska, 1973-1974
Adjunct Associate Professor of Arctic Biology, University of Alaska, 1970-1972

Public Health Service, Arctic Health Research Center,
Research Biologist GS-14, USDHEW, 1967-1974
Medical Biologist GS-11 to 13, USDHEW, 1955-1967
Teaching Fellow, Department of Zoology, University of
British Columbia, 1951-1955
Research Fellow, Massachusetts Cooperative Wildlife
Research Unit, University of Massachusetts, 1949-1951

- Publications: Fay, F. H. 1954. Quantitative experiments on the food consumption of *Parascalops breweri*. J. Mamm. 35:107-109.
- Fay, F. H. and E. H. Chandler. 1955. The geographical and ecological distribution of cottontail rabbits in Massachusetts. J. Mamm. 36:415-424.
- Fay, F. H. 1957. History and present status of the Pacific walrus population. Trans. No. Amer. Wildl. Conf. 22:431-443.
- Fay, F. H. and T. J. Cade. 1959. An ecological analysis of the avifauna of St. Lawrence Island, Alaska. Univ. Calif. Publ. Zool. 63:73-150.
- Fay, F. H. 1960. Technique for trapping small tundra mammals in winter. J. Mamm. 41:141-142.
- Fay, F. H. 1960. Carnivorous walrus and some arctic zoonoses. Arctic 13:111-122.
- Fay, F. H. 1960. Structure and function of the pharyngeal pouches of the walrus (*Odobenus rosmarus* L.). Mammalia 24:361-371.
- Fay, F. H. 1961. The distribution of waterfowl to St. Lawrence Island, Alaska. Ann. Rept. Wildfowl Trust 12:70-80.
- Fay, F. H. and F. S. L. Williamson. 1962. Studies of the helminth fauna of Alaska. XXXIX. *Echinococcus multilocularis* Leuckart, 1863, and other helminths of foxes on the Pribilof Islands. Can. J. Zool. 40:767-772.
- Fay, F. H. 1963. Unusual behavior of gray whales in summer. Psychol. Forsch. 27:175-176.
- Fay, F. H. and R. L. Rausch. 1966. The seasonal cycle of abundance of *Echinococcus multilocularis* in naturally infected arctic foxes. Proc. 1st Internat. Cong. Parasitol. 2:765-766 (Abstract).
- Rausch, R. L. and F. H. Fay. 1966. Studies on the helminth fauna of Alaska. XLIV. Revision of *Ogmogaster* Jagerskiold, 1891, with a description of *O. pentalineatus* sp. n. (Trematoda:Notocotylidae). J. Parasit. 52:26-38.
- Fay, F. H. 1967. The number of ribs and thoracic vertebrae in pinnipeds. J. Mamm. 48:144.
- Feltz, E. T. and F. H. Fay. 1967. Thermal requirements *in vitro* of epidermal cells from seals. Cryobiology 3:261-264 (dated 1966).
- Fay, F. H., V. R. Rausch, and E. T. Feltz. 1967. Cytogenetic comparison of some pinnipeds (Mammalia:Eutheria). Can. J. Zool. 45:773-778.

- Fay, F. H. and C. Ray. 1968. Influence of climate on the distribution of walruses, *Odobenus rosmarus* (Linnaeus). I. Evidence from thermoregulatory behavior. *Zoologica* 53:1-18.
- Ray, C. and F. H. Fay. 1968. Influence of climate on the distribution of walruses *Odobenus rosmarus* (Linnaeus). II. Evidence from physiological characteristics. *Zoologica* 53:19-32.
- Fay, F. H. 1968. Experimental transmission of *Trichinella spiralis* via marine amphipods. *Can. J. Zool.* 46:597-599.
- Fay, F. H. and R. L. Rausch. 1969. Parasitic organisms in the blood of arvicoline rodents in Alaska. *J. Parasit.* 55:1258-1265.
- Burns, J. J. and F. H. Fay. 1970. Comparative morphology of the skull of the ribbon seal, *Histriophoca fasciata* (Zimmermann), with remarks on systematics of Phocidae. *J. Zool. (London)* 161:363-394.
- Fay, F. H. 1970. Development of larval *Echinococcus multilocularis* Leuckart in relation to maturation of the intermediate host. *J. Parasit.* 56(4, sec. II, pt. 1): 97-98 (Abstract).
- Ohbayashi, M. R. L. Rausch and F. H. Fay. 1971. On the ecology and distribution of *Echinococcus* spp. (Cestoda: Taeniidae), and characteristics of their development in the intermediate host. II. Comparative studies on the development of larval *E. multilocularis* Leuckart, 1863, in the intermediate host. *Jap. J. Vet. Res.*, 19(suppl. 3):1-53.
- Fay, F. H. 1971. Dental function in relation to feeding behavior of the Pacific walrus. *Proc. Alaska Sci. Conf.* 22:137 (Abstract).
- Sealy, S. G., F. H. Fay, J. Bedard, and M. D. F. Udvardy. 1971. New records and zoogeographical notes on the birds of St. Lawrence Island, Bering Sea. *Condor* 73: 322-336.
- Burns, J. J., G. C. Ray, F. H. Fay and P. D. Shaughnessy. 1972. Adoption of a strange pup by the ice-inhabiting harbor seal, *Phoca vitulina largha*. *J. Mamm.* 53:594-598.
- Burns, J. J. and F. H. Fay. 1973. Comparative biology of Bering Sea harbor seal populations. *Proc. Alaska Sci. Conf.* 23:48 (Abstract).
- Fay, F. H. 1973. The ecology of *Echinococcus multilocularis* Leuckart, 1863, (Cestoda:Taeniidae) on St. Lawrence Island, Alaska. I. Background and rationale. *Ann. Parasit. Humaine et Compar.* 48:523-542.
- Fay, F. H. 1974. The role of ice in the ecology of marine mammals of the Bering Sea. In D. W. Hood and E. J. Kelley (eds.), *Oceanography of the Bering Sea*. University of Alaska, Institute of Marine Science, Occas. Publ. No. 2, pp. 383-399.
- Burns, J. J. and F. H. Fay. 1974. New data on taxonomic relationships among North Pacific harbor seals, genus *Phoca* (*sensu stricto*). *Trans. 1st Internat. Theriol. Cong., Moscow* 1:99 (Abstract).

- Fay, F. H. 1974. Comparative and functional anatomy of the vascular system in the hind limbs of the Pinnipedia. *Trans. 1st Internat. Theriol. Cong., Moscow* 1:166-167 (Abstract).
- Fay, F. H. 1975. Mammals and birds. In D. W. Hood and Y. Takenouti (eds.), *Bering Sea Oceanography: An Update*. Inst. Mar. Sci. Rept. No. 75-2, University of Alaska, Fairbanks. pp. 133-138.
- Burns, J. J., F. H. Fay, and L. Shapiro. 1976. Marine mammal distribution in relation to ice conditions in the Bering, Chukchi, and Beaufort Seas. *Proc. Alaska Sci. Conf.* 25 (Abstract).
- Shaughnessy, P. D. and F. H. Fay. 1977. A review of the taxonomy and nomenclature of North Pacific Harbour seals. *J. Zool. (London)* 182:385-419.
- Fay, F. H. 1978. Belukha whale. In D. Haley (ed.), *Marine Mammals of Eastern North Pacific and Arctic Waters*. Pacific Search Press, Seattle. pp. 132-137.
- Fay, F. H. 1979. Belukha whale. *J. Amer. Cetacean Soc.* 13:4-6.
- Papers in Press:
- Fay, F. H. The walrus. In R. J. Harrison and S. H. Ridgway (eds.), *Handbook of Marine Mammals*. London: Academic Press.
- Fay, F. H. Industrial utilization of marine mammals. *Trans. 29th Alaskan Sci. Conf., 1978*.
- Fay, F. H. and G. C. Ray. Reproductive behavior of the Pacific walrus in relation to population structure. *Trans. 29th Alaskan Sci. Conf., 1978* (Abstract).
- Fay, F. H., L. M. Shults, and R. A. Dieterich. Natural mortality of marine mammals in Alaskan waters. *Trans. 29th Alaskan Sci. Conf., 1978* (Abstract).
- Reports:
- Matkin, C. O., and F. H. Fay. 1977. The killer whale in Puget Sound. A position paper for the Marine Mammal Commission, Washington. 25 pp.
- Fay, F. H., H. M. Feder, and S. W. Stoker. 1977. An estimation of the impact of the Pacific walrus population on its food resources in the Bering Sea. Marine Mammal Commission, Washington, 38 pp. (NTIS PB-273-505).
- Fay, F. H., R. A. Dieterich, and L. M. Schults. 1977. Proposal for development of a marine mammals stranding alert network in Alaska. Proceedings Marine Mammal Stranding Workshop, Athens, Ga.
- Fay, F. H. 1978. The 1978 Walrus Conference. Marine Mammal Commission, Washington. 26 pp.
- Papers in Preparation:
- Fay, F. H. Distribution and biology of the Pacific walrus. (A monograph, for publication in the North American Fauna series).
- Fay, F. H., IU. A. Bukhtiarov, S. W. Stoker, and L. M. Shults. Food of the Pacific walrus in the winter-spring period in the Bering Sea.

Fay, F. H., G. C. Ray, A. A. Kibal'chich, and V. N. Gol'tsev. Time and location of mating and associated behavior of the Pacific walrus, *Odobenus rosmarus divergens* Illiger.

Burns, J. J., F. H. Fay, G. A. Fedoseev, and V. N. Gol'tsev. Craniological characteristics of harbor seals of the North Pacific region.

Fay, F. H., R. A. Dieterich, and L. M. Shults. A manual of procedures for postmortem examination of Alaskan marine mammals.

Current
Support:

R.U.#194 Morbidity and Mortality of Marine Mammals OCSEAP (NOAA), FY79, \$80,749, 5 months.

R.U.#248 Relationship of Marine Mammal Distribution to Ice Conditions, OCSEAP (NOAA), FY79, \$48,956, 3 months.

Marine Mammal-Fishery Interactions on the Copper River and in Prince William Sound, Alaska. MMC, 1 April 78 - 31 March 79, \$39,167, 1 month.

Pending
Applications:

Population studies of river otters in Alaska. Alaska Dept. Fish & Game, January 79-June 82. \$69,925 first yr, 1 month.

CURRICULUM VITAE

LLOYD F. LOWRY

Mailing Address:

Alaska Department of Fish and Game
1300 College Road
Fairbanks, AK 99701

Phone: (907)452-1531

Birth Date and Place:

16 January 1950, New Bedford, Massachusetts

Education:

1971 BS - Southeastern Massachusetts University (Biology-Marine option)
1974 MS - University of California, Santa Cruz (Marine Sciences)

Professional Experience:

1972-1974 Sea Grant Trainee, Division of Natural Sciences,
University of California, Santa Cruz
1974-1975 Marine Technician II, Coastal Marine Lab, University
of California, Santa Cruz
1975-present Game Biologist II, Alaska Department of Fish and
Game, Fairbanks, Alaska

Professional Memberships:

American Museum of Natural History
Alaska Conservation Society
American Society of Mammalogists

Publications:

- 1973 Lowry, L. F. and J. S. Pearse. Abalones and sea urchins in
an area inhabited by sea otters. Mar. Biol. 23:213-219.
- 1974 Lowry, L. F., A. J. McElroy and J. S. Pearse. The distribution
of six species of gastropod molluscs in a California kelp
forest. Biol. Bull. 147:386-396.
- 1974 Pearse, J. S. and L. F. Lowry. An annotated species list
of benthic algae and invertebrates in the kelp forest
community at Point Cabrillo, Pacific Grove, California.
Tech. Rept. No. 1, Coastal Marine Lab, Univ. California,
Santa Cruz. 73pp.
- 1977 Lowry, L. F., K. J. Frost and J. J. Burns. Variability in
the diet of ringed seals in the northern Bering and Chukchi
Seas. Proc. Second Conf. Biology Marine Mammals, 12-15
December 1977 (abstract).

- 1977 Frost, K. J., L. F. Lowry and J. J. Burns. Spring foods and feeding of phocid seals in the Bering Sea ice front. Proc. Second Conf. Biology of Marine Mammals, 12-15 December 1977 (abstract).
- 1978 Lowry, L. F., K. J. Frost and J. J. Burns. Foods of ringed seals and bowhead whales near Point Barrow, Alaska. Can. Field-Nat. 92(1):67-70.
- 1978 Eley, T. and L. F. Lowry (eds.). Marine Mammals. Pages 134-151 in Interim Synthesis: Beaufort/Chukchi. NOAA/OCSEAP, Boulder, CO. 362pp.
- 1978 Lowry, L. F. Status of the Pacific walrus. Alaska Dept. Fish and Game, Wildl. Inf. Leaflet No. 4. 4pp.
- In press Lowry, L. F., K. J. Frost and J. J. Burns. Potential resource competition in the southeastern Bering Sea: Fisheries and phocid seals. Proc. 29th Alaska Sci. Conf., Fairbanks, 15-17 August 1978.
- In press Bukhtiyarov, Y. A., K. J. Frost and L. F. Lowry. New information on the foods and feeding habits of the larga seal (Phoca largha) in the Bering Sea in spring.
- In press Lowry, L. F., K. J. Frost and J. J. Burns. Geographical and seasonal variability in the diet of ringed seals (Phoca hispida Schreber) in Alaska. Submitted to the Journal of the Fisheries Research Board of Canada.
- In press Frost, K. J. and L. F. Lowry. Ringed, Baikal and Caspian seals. In R. J. Harrison and S. H. Ridgway, eds. Handbook of Marine Mammals. London: Academic Press.
- In prep. Frost, K. J. and L. F. Lowry. Foods, feeding habits and trophic relationships of ribbon seals (Phoca fasciata) in the Bering Sea.
- In prep. Frost, K. J. and L. F. Lowry. Otolith characteristics and trophic importance of three species of gadid fishes from northern Alaskan waters.
- In prep. Frost, K. J., L. F. Lowry and J. J. Burns. Ringed seals in the Alaskan Beaufort Sea: feeding patterns, trophic relationships and possible effects of offshore petroleum development.
- In prep. Lowry, L. F., K. J. Frost and J. J. Burns. Feeding of bearded seals in the Bering and Chukchi Seas and implications with respect to carrying capacity.