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STUDIES OF WALRUS AND WHALES

By

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STUDIES OF WALRUS AND WHALES

FINAL RESEARCH REPORT

TO: Committee for Research and Exploration
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INTRODUCTION

The Bering-Chukchi shelf is one of the richest marine areas on earth, in both renewable and non-renewable resources. Marine mammals are renewable resources of great national and international significance and may be "indicators" of the state of the marine ecosystems of these regions. Conflicts in resource exploitation are almost certain to arise in the future. Thus, it is important that the behavior and ecology of marine mammals of the region be known from the point of view of "baseline" information.

The walrus, Odobenus rosmarus, is the easiest of the marine mammals of the region to study. It also may be the most important in terms of the effects which it has on the environment in which it lives, especially in terms of nutrient turnover. For these reasons, we have chosen it as our "target species." The bowhead whale, Balaena glacialis, is a secondary target species biologically because of its ice habitat and politically because native hunting may be reducing its numbers.

Most current work on marine mammals of the Bering and Chukchi Seas is on assessment of numbers, reproductive and recruitment rates, kill by natives, and food preferences. Little work has been done on the behavior and ecology of these animals, subjects which demand long-term observations in their natural habitat. The major reason for this is, of course, the lack of suitable platforms for the work; only icebreakers are capable of invading the ice habitat of the walrus and these ships are available for brief periods of time only.

Previous multi-disciplinary cruises have allowed only 1-3 days of partially continuous observations of single, identifiable groups. Even the enviable record of the present cruise in observing one or two walrus concentrations for 12 days may not be sufficient for quantitative ecological and behavioral analyses. In those 12 days only 17 hours, exclusive of several radio-tagging attempts, were spent on the ice observing walrus. Many more hours, of course, were spent observing animals from the ship. Also we were able to magnify time of observation greatly by a team approach in which 1 hour times 9 observers becomes 9 man-hours. Thus, over 17 hours becomes about 150 man-hours on the ice with walrus.

Our work incorporated the philosophy of integrated research in which each investigation was a part of a greater whole. Investigations ranging from behavior to physiology to biological oceanography were all interrelated through their focus on walrus. A summary of the separate, but interrelated, segments of our work follows. The first seven were general group projects in which all personnel were involved. The remaining ten were complementary "mini-projects" in which the indicated Johns Hopkins University personnel assumed primary responsibility.

Our results will be fully analyzed in the next several months. Therefore, any statements made now must be considered to be preliminary.

OBJECTIVES AND RESULTS

I. (A) Objective: To record the rhythms of hauling out (on ice) of the walrus, related to environmental factors.

(B) Results: On 14 July we spotted a very large herd of walrus. We were able to work in the area of this herd for 12 days, through 25 July. We are not at all certain that we worked with the same herd during this entire period, but it seemed so. In addition, we worked with a different group 29-30 July. Our preliminary results show that the primary hauling-out pattern of the walrus at this time of the year is not a daily cycle. Rather, they appear to be hauled out for 1.5 - 2 days and then to be in the water for an equal amount of time. Thus, in such consistent weather conditions as we experienced, walrus may be hauled out during day or night. The same periodicity was observed in groups separated by at least 15 nmi. Their periodicity is probably related to their need for food. Perhaps, also, the need of calves to haul out to rest is an important factor. The herds we worked with were cow-calf dominated.

Two things of which we can be relatively certain are: (1) walrus generally remain within the same general area of the pack for long periods of time and (2) walrus generally do not haul out on the same ice floes consecutively twice. These tentative conclusions are the result of both direct observations of herds and of their uglek (hauling-out places) (singular = uglit).

II. (A) Objective: To apply radio tags to walrus in order to follow herd and to record diving activity.

(B) Results: Although we have previously attached "limpet" transmitters to walrus and have tracked one animal for about 9 hours, we were not successful in our attempts this year. We are not certain of the reasons for this, but presume that both of the transmitters which were successfully implanted were torn off the animals through contact with the ice. Tests on an isolated piece of walrus skin and blubber showed that a 200 pound pull at an angle of 54 degrees was sufficient to tear the transmitter away from the skin. The fact that only two of ten attempts were successful tells us that we need to reexamine our technique of approach, as well as looking at the durability of attachment.

Radio tracking will remain an essential component of our work. We recognize that it is the only present method whereby we can follow marine mammals at a distance on the open sea. We also recognize its great difficulties and that the experience gained on this cruise has been a valuable component toward eventual success.

III. (A) Objective: To record surface temperatures from walrus as they rest on ice.

(B) Results: Past work has indicated that walrus vasodilate to dissipate heat when hauled out and that they do not haul out during inclement weather when the chill factor falls much below -30 degrees centigrade.

We also have remote sensing (infrared scanning) data (NASA supported) which indicate the integrated heat of walrus herds hauled out on ice. We wished to test both sets of previous data.

On four occasions, we approached walrus to within 1-15 m on ice and recorded skin temperatures of 4-32 degrees centigrade. During both these periods the black-body temperature was 3.9-16 degrees centigrade. Thus the walruses were vasocilated and dissipating heat. These data contribute to energy budget and climate-space diagram analyses of walrus energetics.

IV. (A) Objective: To record the underwater sounds of walrus.

(B) Results: We have recorded and published sounds of walrus during late winter to mid-spring. Walrus bulls make knocking sounds and bell-tones as a part of courtship behavior during that time. As has been known for some time, only a few bull walrus accompany the females north. However, only a few are in the presence of females during the winter-spring courtship period and no one knows for certain when courtship ceases. Since we recorded no male courtship sounds during this cruise, this is partial proof of the cessation of courtship by early summer.

V. (A) Objective: To record herd structure and inter-observer counting error.

(B) Results: Walrus are exceedingly difficult to count because of their extreme gregariousness and thigmotaxis (lying next to and on top of one another). Counts, nevertheless, are essential for management. A part of counting is determination of herd structure, i.e., the proportions of age classes and sexes in the herds. Individual variation in counts of the same groups ranged as high as 100% but was greatly reduced with both experience and proximity to the herd. For group structure, we emphasized the proportion of calves of the year (born in May) and found that they comprised 6-10% of these primarily female/subadult herds.

VI. (A) Objective: To observe other marine mammals or birds which associate with walrus and to determine the nature of these associations.

(B) Results: Polar bears, seals, and birds were found in the vicinity of walrus. Scientists suspect that seals avoid the immediate vicinity of walrus because of the occasional predation of walrus on them. We did see ringed, spotted, and bearded seals near walrus, that is, closer than a quarter mile. The question of walrus-seal association is still open.

Birds, especially gulls, appear to concentrate about walrus herds. We suspect they depend to a significant extent on the feces of walrus for food (see below).

One of the most exciting, as well as unexpected, findings of this cruise was the concentration of polar bears around walrus herds. We observed chases by polar bears towards walrus and the latter's fright behavior. We were also very fortunate in finding two recently killed walrus calves, one of which was still being consumed by three bears. We conclude that bears are an important predator on walrus, choosing the calves for prey.

VII. (A) Objective: To study the behavior of individual "focal" walrus in order to compare summertime female-dominated herds with the male herds previously studied and to record other behavior.

(B) Results: Walrus use their tusks as a signal of dominance. We found no obvious differences in the use of the tusks between females and males from previous studies.

During the many man hours on the ice with walrus (149 man hours on ice and 66 man hours observations of herds from the bridge; the greatest by far to date for behavioral observations), we also observed nursing behavior, fright behavior, and several other details. Walrus calves may nurse from several females. This has important implications since if this were not so, a calf that loses its mother would die. We believe we observed nursing by two calves on a single female as partial proof of "promiscuous" nursing.

We are also attempting to evolve testable theories for walrus fright behavior. Walrus are obviously very alert animals and appear to use sight, hearing, and smell for clues to possible danger. Their very sudden, group-wide reaction indicates communication of danger on an almost immediate basis. We suspect the polar bear is the principal cause of their alertness, in terms of the behavioral adaptation of walrus to their enemies, which are few.

VIII. "Mini Projects"

The above objectives and results form a matrix of interrelated studies of the walrus per se. However, it is also important to study the walrus indirectly and to utilize the skills and interests of all personnel, to take every opportunity which may arise. Thus, we have asked each of our personnel to formulate a "mini-project," a name chosen not to indicate its lower importance, but to order logistic priorities. Each of the following relates to marine mammals in an ecological sense.

1. George Taylor - Benthos Sampling

(A) Objective: To sample bottom-dwelling food items of walrus from the proximity of walrus herds.

(B) Results: We took a total of 48 Van Veen grab samples from 10 stations, all from the proximity of walrus herds, and in conjunction with STD casts. The purpose is to attempt to correlate bottom-living invertebrates which walrus eat with predation by walrus. This work supplements work by the University of Alaska and is done in cooperation with scientists there. It is essential that the feeding habits of marine mammals of the Bering/Chukchi region be understood both qualitatively (what they eat) and quantitatively (how much) in view of impending fisheries and mineral development.

2. Roland Limpert - Copraphagy in birds

(A) Objective: To detect the possible dependency of birds on walrus feces as food.

(B) Results: Gulls, especially, may depend on walrus feces for a portion of their diet. The concentration of birds about walrus herds is marked as is their eating of both digested and undigested portions of the feces. Twenty walrus, one bearded seal, one polar bear, one Arctic fox, fecal samples and twelve from birds will be analyzed for their caloric value and nutritive content. The implications of this study are to show how walruses effect nutrient transfer from the bottom to the surface and to show how this may be important to some bird populations.

3. John Beier - Water sampling

(A) Objective: To detect nutrients in water near walrus haul out areas (uglek) on ice.

(B) Results: We have collected 124 water samples from six stations, both from open water and from uglek, for nutrient analysis. Others estimate that walrus of this region eat 3.3 - 4.4 million metric tons of benthic organisms annually. Much of this is returned to the surface as feces, the nutrients from which are returned to local sea water. This could cause major diatom and phytoplankton blooms in the immediately vicinity of uglek. These, in turn, could serve to concentrate zooplankton, fishes, and birds. Thus, the walrus' nutrient transfer could have an as-yet-to-be-determined effect on distributions of marine organisms.

4. Rodney Salm - Species composition of walrus feces

(A) Objective: To detect walrus food species from feces on uglek.

(B) Results: We collected identifiable fragments of walrus food organisms from five uglek. Some were only partially digested and a few small clams passed through the guts of walrus alive. This work is linked to other studies, above, of walrus feces and to the benthic sampling study. It will be largely qualitative, but may give clues to what proportions of walrus food remain undigested, to be eaten by birds, for example. It also may offer a comparison of species present in the grabs to those eaten by walrus in the Chukchi region which we visited on this cruise.

5. Douglas Wartzok - Water column light measurements

(A) Objective: To measure light spectra and intensity with relationship to the vision of marine mammals.

(B) Results: We are conducting experiments on seal vision in Baltimore to determine their sensitivity to different wavelengths of light.

These data must be related to the penetration of different wavelengths of light in the habitat of these animals. To this end, we used a silicon detector with various filters at three stations. The implications of this study are to determine at what depths seals may be able to use vision for various purposes, including food-finding. Presuming that walrus and seals have similar eyes, these studies should cast light on how walrus find their food as well.

6. Lynn Bishop - pathology

(A) Objective: To detect diseases of marine mammals from carcasses found on the ice and from fecal examination.

(B) Results: We examined six walrus fecal samples and the remains of one bearded seal and two calf walruses which were killed by polar bears. The feces yielded evidence of several worm parasites of the gut. Only the seal was in sufficiently uneaten condition for detailed necropsy studies. It showed heavy parasitic infection and evidence of bile duct fibrosis. This study will add to information being accumulated at the University of Alaska on the natural disease and mortality of marine mammals of this region.

7. John Beier - Viral diseases

(A) Objective: To shed light on mechanisms of viral disease transmission among polar marine mammals.

(B) Results: We have collected 86 fecal samples from walrus (47), birds (27), polar bears (5), an Arctic fox (3), and a bearded seal (4) and have stored them for later analysis. Almost nothing is known about this subject and we consider this an important pilot project which could lead to later expanded work on natural disease and mortality in this region.

8. Karen Hulebak - Transmission of trichinosis

(A) Objective: To determine if benthic, carnivorous invertebrates transfer trichinosis among marine mammals.

(B) Results: This experiment repeats work done at the University of Alaska on transmission of trichinosis by amphipod crustaceans. These small animals live on the bottom and presumably eat the remains of polar bears and other marine mammals which die at sea and fall to the bottom. Walrus occasionally contract trichinosis. This disease is dangerous to humans who consume infected meat. We collected several hundred benthic crustacea on seven different days and have exposed the majority of them to infected rat meat. The crustacea will be fed to rats in Baltimore to see if they transfer trichinosis between rats. If they do, it would not be too much to assume that they could transfer the same disease (though a different strain) between polar bears, seals, and walrus, or even to whales.

9. Nancy Murray - Plankton eaten by bowhead whales

(A) Objective: To determine the food species of the bowhead whale by plankton sampling.

(B) Results: As we did not encounter bowheads, there are no results to report. If we had encountered them, we would have endeavored to determine if they were feeding, and would have towed a plankton net through the feeding area. Little is known about the bowhead's feeding habits or behavior and this project will attempt to do so in another year, hopefully.

10. Jean Evans - Biochemical analysis of walrus blubber and liver

(A) Objective: To determine possible adaptations of marine mammals to fasting.

(B) Results: Some marine mammals, including walrus, are reported to fast during migration, courtship, and nursing periods. This would require changes in the biochemical pathways for utilization of stored fats. Consequently, we have collected samples of walrus and seal blubber and seal liver for biochemical analysis in Baltimore.

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A preliminary report is made of the results obtained on a marine mammal expedition aboard the USCGC Icebreaker Glacier in the Chukchi Sea in July 1977. Observations on hauling-out rhythms, radio tagging, underwater vocalizations, on-ice behavior and herd structure of walruses are presented. A variety of student projects, including transmission of trichinosis, benthic and water column sampling, walrus feces composition, and bird copraphagy are summarized.

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