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Benthic Prey in a Bowhead Whale from the Northern Bering Sea

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ABSTRACT. Stomach contents were examined from a bowhead whale, *Balaena mysticetus*, killed at Gambell, Alaska, on 1 May 1982. It contained an estimated 20-40 litres of recently ingested prey, principally gammarid amphipods (91.7% of the volume of a 157-ml subsample) and cumaceans (7%). All identified prey were primarily epibenthic forms. The stomach of this whale was significant in several respects: (1) it contained the largest amount of food recorded in any whale taken and examined in spring; (2) it provided the first direct evidence of bowheads feeding in the Bering Sea; and (3) the contents indicated that benthic prey are sometimes intentionally fed upon.

Key words: *Balaena mysticetus*, benthic prey, Bering Sea, bowhead whale, feeding, gammarid amphipods

RÉSUMÉ. Le contenu de l'estomac d'une baleine boréale (*Balaena mysticetus*) tuée le 1er mai 1982 à Gambell, en Alaska, fut examiné. Il contenait quelque 20-40 litres de proie récemment ingérée, constituée principalement d'amphipodes gammaridés (91.7% du volume d'une sous-échantillon de 157 ml) et des cumacés (7%). Les proies identifiées étaient surtout des formes épibenthiques. L'estomac de cette baleine était remarquable pour les raisons suivantes: (1) il contenait la plus grande quantité de nourriture enregistrée dans toute baleine prise et examinée au cours du printemps; (2) il a présenté la première preuve directe d'alimentation de baleines boréales dans la mer de Béring; et (3) le contenu a indiqué que les baleines se nourrissent parfois intentionnellement de proie benthique.

Mots clés: *Balaena mysticetus*, proie benthique, mer de Béring, baleine boréale, alimentation, amphipodes gammaridés

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INTRODUCTION

Although hundreds of bowhead whales (*Balaena mysticetus*) were killed in Alaskan and western Canadian waters by commercial whalers in the late 1800s and early 1900s, whaling records from that era provide no information on stomach contents of this species. From the end of commercial bowhead whaling, around 1910, to 1976, little additional information was gleaned by scientists about the prey of these whales. The only systematically analyzed stomachs were those reported by Johnson *et. al.* (1966) from three whales landed at Point Hope in spring 1960 and 1961. Two were empty and the third was nearly so.

Since 1976 biologists have collected stomach and intestinal contents from 20 bowhead whales taken in Alaskan waters during spring and autumn subsistence whaling. Results of analysis of these stomachs are described and summarized in Lowry *et. al.* (1978), Lowry and Burns (1980), and Lowry and Frost (in press). The stomach contents of one bowhead harvested in the northern Bering Sea in spring 1982 were very different from all others examined and are described in detail in this paper.

METHODS

On 1 May 1982 an 8.8-m female bowhead whale was killed by Eskimo whalers at Gambell on St. Lawrence Island, Alaska (Fig. 1). The senior author measured and collected specimens from this whale (number 82G2). The volume of food contained in the stomach was estimated visually. The contents were stirred, and a single sample of 157 ml was collected and preserved in 10% buffered formalin. The remainder of the stomach contents was scanned for prey items not represented in the sample. The sample appeared to be representative of the entire contents.

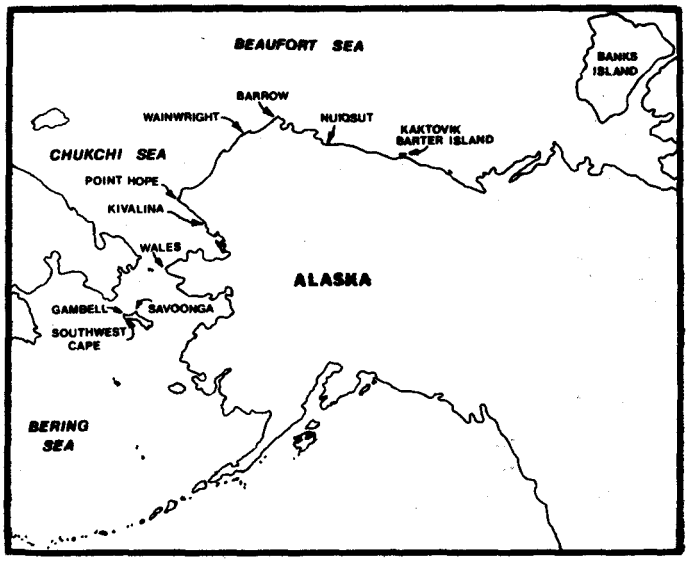

FIG. 1. The nine principal bowhead whaling villages of Alaska. Savoonga whalers of St. Lawrence Island hunt at Southwest Cape.

In the laboratory the sample was drained and gently washed on a 1.00-mm mesh sieve. The stomach contents were sorted macroscopically into major taxonomic groups, and the volume of each group was measured by water displacement. Items were examined microscopically and when possible were identified to species using appropriate taxonomic keys and voucher specimens maintained at the Alaska Department of Fish and Game and at the University of Alaska. The number of each

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species was counted, except in the case of gammarid amphipods, where the number of the various species was estimated from identification of fragments and intact organisms in a 20-ml subsample.

RESULTS

The estimated volume of food in the stomach was 30 ± 10 litres. The contents were very fresh-looking, with many organisms intact and some still pink.

The sample (Table 1) indicates that this whale had fed entirely on benthic organisms, predominantly gammarid amphipods (91.7% of the total sample volume) and cumaceans (7%). No copepods, euphausiids, or other planktonic organisms were found.

TABLE 1. Items identified from the stomach contents of a bowhead whale taken at Gambell, Alaska, 1 May 1982

Item	Number of individuals	Volume (ml)	Comments
Pebbles	4	<0.1	
Clam	1	<0.1	
Cottidae (sculpin)	1	0.1	very small, bones and otoliths only
Chionoecetes opilio (tanner crab)	3	1.5	small, intact
Eualus fabricii (shrimp)	1	0.5	fragment only
Diastylis bidentata (cumacean)	326	11.0	most intact
Gammarid amphipods	—	144.0	mostly broken and partially digested
*Anonyx compactus**	19	—	
Atylus atlassovi	11	—	
Bathymedon sp.	82	—	
Hippomedon denticulatus	3	—	
Hippomedon sp.	12	—	
Monoculoides sp.	10	—	
Orchomene sp.	27	—	
Pontoporeia femorata	8	—	
Synopiidae	8	—	

* Estimates of numbers of each species of gammarid amphipod are based on counts from a 20-ml sample. Much of the gammarid material was partially digested and not identifiable to species.

While stalking this bowhead whale for nearly two hours prior to harpooning it, whaling captain Ralph Apatiki made the following observations. Dive intervals between each series of surfacings lasted 15-20 minutes. Following these long dives, the whale resurfaced near its previous position, not straying more than about 100 m. After each dive the whale surfaced slowly, with water streaming from the sides of her mouth through the baleen plates; she then closed her mouth very slowly. These observations and the fresh condition of the stomach contents indicate that the whale was feeding at the time it was harpooned several kilometres northwest of Gambell.

DISCUSSION

Previous studies of bowhead whales have concluded that, at least in the Alaskan Beaufort Sea, planktonic organisms are the principal prey (Lowry *et. al.*, 1978; Lowry and Burns, 1980). Copepods and/or euphausiids were the dominant prey in 15 samples collected from gastro-intestinal tracts that contained appreciable amounts of food. In four whales killed near Barrow during spring whaling, euphausiids and copepods made up 72.7 to 98.0% of the contents by volume. In samples collected from nine bowheads killed during autumn whaling near Barter Island and two near Barrow, euphausiids and copepods made up 86.7 to 99.7% of the contents by volume (Lowry and Frost, in press). The sample from Gambell represents the first full stomach in which benthic prey have predominated.

Gammarid amphipods and other organisms, including hyperiid amphipods, cumaceans, mysids, isopods, shrimp, fish, and occasional pebbles, have frequently occurred in bowhead stomach contents. Gammarid amphipods have been present in 13 of the 20 stomach and intestinal samples collected (Lowry and Frost, in press). The relatively small quantities of these items have suggested, however, that they were taken incidentally while whales pursued other preferred prey just off the sea floor (Lowry and Burns, 1980).

Four previous samples in which euphausiids and copepods did not predominate each contained very little food. One gammarid amphipod and one snail were found in the stomachs of two whales at Point Hope, three clams were found in the colon of a whale at Barrow in 1979, and shrimp fragments occurred in the colon of a whale at Shaktoolik (Frost and Lowry, 1981). All were taken in the spring, and, as was the case with the specimen reported here, all were small animals (8.3-10.1 m long), probably subadults.

Although biologists working in the Canadian Beaufort Sea have postulated that whales observed surfacing with mud streaming from their mouths may have been feeding on epibenthic prey (Wursig *et. al.*, 1982), all samples with appreciable amounts of food collected from whales harvested in the Alaskan Beaufort have contained predominantly planktonic organisms. Results from the stomach analysis reported here provide the first direct evidence that epibenthic organisms are sometimes intentionally fed upon by bowhead whales.

The frequency and importance of benthic feeding by bowheads cannot yet be determined. It is also uncertain whether this behavior is characteristic only of smaller animals. It is possible that benthic foraging could be more practical for the smaller whales because of their short baleen or inexperience in pelagic foraging.

The stomach we examined contained the greatest recorded quantity of food of any bowhead landed in spring. Of 20 other whale stomachs examined from spring catches in the years 1976 to 1982, 12 have been empty, four have been nearly empty, containing only one or several organisms, and four have contained appreciable amounts of food, though never more than two litres (Lowry, unpubl.).

The estimated volume of the stomach contents from this

whale (20-40 l) is comparable to volumes estimated from seven whales taken at Kaktovik in autumn (mean = 23 litres; range 3-44) (Lowry and Frost, in press). Of 12 bowhead gastrointestinal tracts examined in autumn (10 at Kaktovik and two at Barrow), all have contained at least a few litres of food. Considering all the whale stomachs that have recently been examined, the percentage which was empty or nearly empty was significantly greater in spring than in autumn ($X^2 = 17.6$, $p < 0.001$), indicating that less feeding takes place in spring.

This sample shows that at least some feeding takes place during spring in the northern Bering Sea near St. Lawrence Island. Because whales are often flensed in the water at St. Lawrence, the stomachs are generally not accessible. Only five have been examined since 1978; three of those were empty, and the fourth was recorded as containing a few euphausiid-like creatures (Lowry, unpubl.). Although few stomachs have been examined by scientists, Gambell whalers (Conrad Oozeva, Lloyd Oovi, Roger Silook, and Vernon Slwooko, pers. comm.) indicate that observations of apparent feeding behavior and/or the presence of food in stomachs are not unusual occurrences in this region. One whaler said that he has noticed two kinds of feeding behavior: one in which whales make fairly long dives and resurface in nearly the same location, which he interpreted as feeding at or near the bottom, and another in which successive resurfacings occur over a wider area, which he thought represented whales feeding nearer the surface.

Greatest numbers of bowheads are seen at St. Lawrence Island in October and November moving southward and in April and May during their northward migration (Hazard, unpubl.). According to local residents, some whales are seen throughout the winter months depending, at least in part, on the availability of open water. Whalers also state that whales are commonly seen milling, which differs from observations in other villages along the spring migration route, where most whales are steadily moving by. This milling could be associated with feeding, as it is at Kaktovik and Barrow in the autumn, or it may be that the whales are waiting for ice conditions to change or for social aggregations to form. The contents of the stomach described here raise the question of whether whales commonly feed around St. Lawrence Island and, if so, whether they feed in this area during the winter or just at the onset of migration.

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