

# Recent Harvests of Belukha Whales, *Delphinapterus leucas*, in Western and Northern Alaska and Their Potential Impact on Provisional Management Stocks

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## ABSTRACT

The average annual landed harvest and average annual total kill of belukha whales, made by Alaskans in the period 1980–6, is estimated at 241 and 345 respectively. The total kill represents an annual removal by Alaskans of 1.9% to 2.6% of the estimated 13,500 to 18,000 belukhas that occur in, or pass through, waters adjacent to western and northern Alaska. We partitioned the average annual total kill among four provisional management stocks and suggest probable removal rates due to netting and hunting. The postulated rates are 1.8% of the Bristol Bay; 6.7% of the Norton Sound-Yukon Delta, 3.8% of the eastern Chukchi; and 1.0% of the eastern Beaufort stocks. The latter stock is also hunted by Canadians. The combined average annual total kills by Alaskans and Canadians, from the eastern Beaufort stock, is estimated at about 3%. Estimated values for size of the provisional stocks, and for total annual kills, require further verification and refinement. Research is also needed to determine relationships among the provisional stocks.

## INTRODUCTION

This paper concerns the harvest of belukha (or white) whales (*Delphinapterus leucas*) that occur in, or pass through, coastal waters of western and northern Alaska. In Alaska, belukhas are an important subsistence resource for coastal residents. They appear seasonally near several villages where they are hunted with rifles and harpoons, or caught in nets. The small population which resides primarily in Cook Inlet is not considered in this report. Most belukhas in Alaska occur in the Bering, Chukchi and Beaufort Seas, mainly overwintering in the Bering Sea. The belukhas in this region are considered to be separate from those elsewhere in the north and we refer to them as the Bering Sea population. A provisional estimate of the number of belukhas occurring in waters adjacent to western and northern Alaska is 13,500–18,000 (Seaman, Frost and Lowry, 1986). If belukhas that summer in far eastern waters of the USSR are included, the number of belukhas in the Bering Sea population probably exceeds 25,000 (Burns, 1984; Seaman *et al.*, 1986; Burns and Seaman, 1986).

The identity of management units or stocks within the Bering Sea population is poorly known. Based on a compilation of information on distribution, abundance and movements, Seaman *et al.* (1986) tentatively identified four provisional stocks: (1) the eastern Beaufort Sea stock, numbering a minimum of 11,500 (Davis and Evans, 1982); (2) the eastern Chukchi Sea stock, estimated at 2,500–3,000 (Seaman *et al.*, 1986); (3) the Norton Sound/Yukon Delta stock estimated at 1,000–2,000 (Seaman *et al.*, 1986); and (4) the Bristol Bay stock, numbering approximately 1,000–1,500 (Frost, Lowry and Nelson, 1984; Seaman *et al.*, 1986). Stock size estimates for the eastern Beaufort Sea and Bristol Bay are based on aerial surveys, while estimates for Norton Sound/Yukon Delta and the eastern Chukchi Sea are largely based on opportunistic observations, although limited aerial surveys were conducted in the Chukchi Sea in 1978, 1979 and 1981 (Seaman *et al.*, 1986).

There has never been an adequate program to monitor belukha harvests in Alaska, although personnel of the Alaska Department of Fish and Game (ADF&G) have gathered such data whenever possible. The effort devoted to this has varied with availability of funds and staff, and competing priorities and needs.

Information on the magnitude of belukha harvests in Alaska for 1977–9, and review of harvest data in earlier years, was presented by Seaman and Burns (1981). Monitoring of harvests at major hunting sites was continued from 1980–3 with results presented in Burns and Seaman (1986), who also reported a partial compilation of harvest records for 1984. In this paper we present additional data collected from 1984–6, reanalyse the previously reported data for 1980–4, and briefly discuss trends in belukha hunting and harvest levels in western and northern Alaska.

## METHODS AND ASSUMPTIONS

Our harvest data come from a variety of sources. In some instances we observed and sampled the entire belukha harvest at a particular village and therefore knew how many whales were retrieved. Usually, such sampling was at the more productive hunting sites. More commonly, our information was derived from interviews with local residents or opportunistic observations of ADF&G staff biologists. In such cases, the numbers were usually estimates rather than exact counts, or may not have represented all hunters or the entire hunting season. Sometimes an informant knew only that a harvest was 'poor' or 'good,' or that 'some' or 'many' belukhas were taken. When harvests were reported in those general terms, we made numerical estimates based on the range of known past harvests at the village in question. In this paper, we continue the procedure used by Burns and Seaman (1986) and provide numbers for the known and/or estimated harvests (each category is identified) for all hunting sites. In cases where values for both known and estimated harvests are given, it is because we had a firm figure for a minimum number taken but knew that additional animals were harvested.

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To determine total kill, the extent of hunting loss must be known. Accurate estimates of hunting loss are difficult to obtain and there are few data available. The loss rate varies greatly with the method of harvest, of which there are several (Seaman and Burns, 1981). Belukhas may be caught in nets set specifically to catch them or may be taken incidentally in the course of fishing for salmon or other fishes. In either case, net-caught belukhas are treated as harvested animals in our data, since those caught incidentally are usually used for human food. We continue to assume a loss rate of 0% for netted whales. Whales are taken, often in large numbers, in organised nearshore hunts during the open-water season by driving them into shallow water where they are killed. We have no additional information that alters the previous conclusions of Seaman and Burns (1981) or Burns and Seaman (1986) that the loss rate during whale drives approximates 20% (i.e. 20% of the total animals shot are lost and 80% are retrieved.)

In the Yukon-Kuskokwim Delta and in Bristol Bay, whales may be pursued individually or in small groups by one or more boats in open water. Water in this area is sometimes deep and often very muddy. Given the factors of water conditions (negative) and the pursuit of individual whales (positive) we estimate the loss rate for such hunting to be 40%. This is intermediate between the deep open water estimate of 60% loss and the 20% loss for whales taken in shallow water during drives.

Belukhas are also hunted in spring as they pass through leads or drifting ice. Loss rates are estimated at 60% for these types of hunting (Seaman and Burns, 1981). In spring 1985 an unusual event occurred near Kivalina when a large harvest was taken from a group of whales entrapped in the ice. Since the whales were in a confined opening, within easy range of harpoons, we have assumed a loss rate of 20% for that event.

Sometimes our information did not indicate the technique used to effect a harvest. This has been a problem with data for Bristol Bay and the Yukon-Kuskokwim Delta and, to a lesser extent, for Norton Sound. For Bristol Bay and the Yukon-Kuskokwim Delta, we have assumed that half the whales are taken in nets (loss 0%) and half in open water (loss 40%) unless we have data indicating otherwise. For Norton Sound villages, whales were assumed to have been taken in drive hunts (loss 20%) unless we were specifically informed that they were caught in nets. Therefore, some netted whales may have been included as animals taken during drives. This may result in a slight overestimate of total kill in this region.

The harvest data reviewed and presented here are partitioned among the four provisional stocks previously indicated. This was done based on a knowledge of the seasonal distribution and movements of belukhas in waters adjacent to Alaska (Seaman *et al.*, 1986). Harvests south of Bering Strait are taken in late spring to early fall and they can be easily ascribed to one of the provisional stocks based on location. However, north of Bering Strait, though belukhas may be present from March to October, they mainly appear along the coast in two peak periods. The first whales pass through coastal leads in spring (March-May) on their way to summering areas in the eastern Beaufort Sea. The second wave of whales appears in coastal waters during and after breakup of the sea ice (June to mid-August) (Seaman *et al.*, 1986). Generally, a village takes belukhas from only one of these groups and the harvests can be ascribed to each based on knowledge of when and where the hunt occurred. Wainwright is the only

village that takes belukhas from both the eastern Chukchi and eastern Beaufort management stocks, as successful hunting occurs in leads during spring and near shore during mid-summer.

We emphasise that estimates of annual total landed harvests, total kills and size of each of the provisional stocks are just that – estimates. Considerable future work is required to make such estimates more accurate. Nonetheless, it is useful to derive preliminary estimates of the significance of average annual hunting mortality on each of the provisional management stocks. We have done this by dividing the mean of the range of the seven-year average estimated total kill by the mean of the range of estimated stock size.

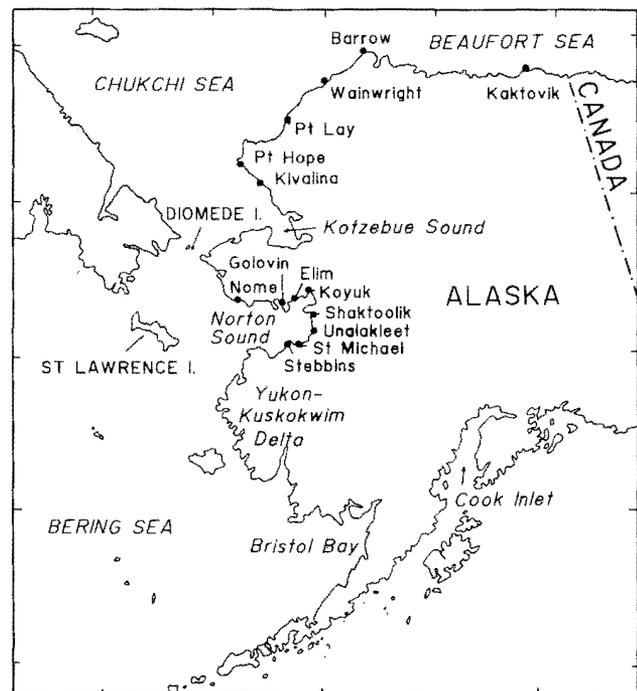


Fig. 1. Map of the Bering, Chukchi and Beaufort seas showing major locations mentioned in the text.

## RESULTS

Estimated total annual landed harvests of belukhas in western and northern Alaska, from each of the provisional management stocks for the years 1980–6, are presented in Tables 1–4. Locations are shown in Fig. 1. Table 5 is an expansion of the landed harvests to estimated total annual kills (landed harvests + hunting losses), based on the loss rates previously discussed. For the four provisional management stocks combined, annual landed harvests during that seven-year period ranged from a low of 174–191 in 1986 to a high of 307–354 in 1982. The mean of the ranges for the seven years was 241, our value of the estimated average size of recent landed harvests in western and northern Alaska. Using similarly derived data about total kills, presented in Table 5, the mean of the ranges of total kills during 1980–6, was 345, or 1.9% to 2.6% of the estimated 13,500 to 18,000 belukhas that are in, or pass through, waters adjacent to Alaska.

Table 1

Known and estimated (in brackets) landings of belukhas from the provisional eastern Beaufort Sea stock of belukhas taken in western and northern Alaska, 1980-6

| Year              | Diomede | Kivalina  | Point Hope | Barrow  | Wainwright | Kaktovik | Total landings    |
|-------------------|---------|-----------|------------|---------|------------|----------|-------------------|
| 1980 <sup>1</sup> | 2       | 3 (3-5)   | 23 (23-25) | 0       | (0)        | 11       | 39 (39-43)        |
| 1981 <sup>1</sup> | (0)     | 3 (10-15) | (4-7)      | 5       | (0)        | 0        | 8 (19-27)         |
| 1982 <sup>1</sup> | 1       | 4 (4-5)   | 17         | 3 (3-5) | (0)        | 0        | 25 (25-28)        |
| 1983 <sup>1</sup> | 0       | 24        | 30 (31)    | 0 (3)   | (0)        | 0        | 54 (58)           |
| 1984 <sup>2</sup> | (2-4)   | 27        | (30)       | 0       | (0)        | 0        | 27 (59-61)        |
| 1985              | (2-4)   | 120-200   | (30)       | 0       | (0)        | 0        | 120-200 (152-234) |
| 1986              | (2-4)   | 7         | (30)       | 0       | 1          | 0        | 8 (40-42)         |

<sup>1</sup> Harvest figures from Burns and Seaman (1986).

<sup>2</sup> Harvest figures, in part, from Burns and Seaman (1986), with additional estimates from this study.

Table 2

Known and estimated (in brackets) landings of belukhas from the provisional eastern Chukchi Sea stock, taken in western and northern Alaska, 1980-6

| Year              | Kotzebue Sound |            | Point Lay  | Wainwright | Total landings |
|-------------------|----------------|------------|------------|------------|----------------|
|                   | Southeast      | Northeast  |            |            |                |
| 1980 <sup>1</sup> | 101            | 13         | 15 (15-18) | 0          | 129 (129-132)  |
| 1981 <sup>1</sup> | 39             | 4          | 29 (29-38) | (0)        | 72 (72-81)     |
| 1982 <sup>1</sup> | 129            | 25         | 28 (28-33) | 0          | 182 (182-187)  |
| 1983 <sup>1</sup> | 48             | 19 (19-24) | 18         | 0          | 85 (85-90)     |
| 1984 <sup>2</sup> | 0              | 31         | 0          | 0          | 31             |
| 1985              | 2              | 13         | 18         | 0          | 33             |
| 1986              | 0              | 3          | 33         | 4          | 40             |

<sup>1</sup> Harvest figures from Burns and Seaman (1986).

<sup>2</sup> Harvest figures, in part, from Burns and Seaman (1986), with additional estimates from this study.

Table 6 includes information about average annual kills during 1980-6, made from each of the four provisional stocks, the estimated size of stocks and the percent annually removed by Alaskans. The annual rate of removal ranges from an estimated 1% for the provisional eastern Beaufort stock to 6.7% for the provisional Norton Sound-Yukon Delta stock.

DISCUSSION

Our data highlight the information needs for the four provisional stocks of belukhas that occur in, or pass through, waters adjacent to western and northern Alaska. A primary need is to understand relationships among the four provisionally recognised management stocks.

Table 3

Known and estimated (in brackets) landings of belukhas from the provisional Norton South-Yukon Delta stock, taken in western and northern Alaska, 1980-6

| Year              | Yukon - Kuskokwim Delta | Saint Michael | Stebbins   | Unalakleet | Shaktoolik | Koyuk      | Elim       | Golovin | Nome | Total landings |
|-------------------|-------------------------|---------------|------------|------------|------------|------------|------------|---------|------|----------------|
| 1980 <sup>1</sup> | 9 (15)                  | (10)          | (10)       | (0)        | (5)        | (15)       | (5)        | (0)     | (0)  | 9 (50)         |
| 1981 <sup>1</sup> | 17 (25-28)              | 11            | 10 (10-20) | (0)        | 7 (7-15)   | 21 (21-25) | 3          | (0)     | 1    | 70 (78-103)    |
| 1982 <sup>1</sup> | 29 (29-47)              | 4 (4-10)      | 6          | (0)        | 16         | 13 (15-20) | 14 (15-20) | (0)     | (0)  | 82 (85-119)    |
| 1983 <sup>1</sup> | 6 (15)                  | 4             | 7          | 2          | 7          | 11         | 10         | 2       | 0    | 49 (58)        |
| 1984 <sup>2</sup> | 5 (20)                  | (5-10)        | (8-10)     | (0)        | (8-10)     | 38         | (10-15)    | 1       | 0    | 44 (90-104)    |
| 1985              | (25)                    | 7             | (8-10)     | (0)        | (8-10)     | 3          | (10-15)    | (0)     | 0    | 10 (61-70)     |
| 1986              | (30-40)                 | 6             | 4          | (0)        | 4          | 10         | 30         | (0)     | 0    | 54 (84-94)     |

<sup>1</sup> Harvest figures from Burns and Seaman (1986).

<sup>2</sup> Harvest figures, in part, from Burns and Seaman (1986), with additional estimates from this study.

Table 4

Known and estimated (in brackets) landings of belukhas from the provisional Bristol Bay stock, taken in western and northern Alaska, 1980-6

| Year              | Landings   | Year              | Landings    |
|-------------------|------------|-------------------|-------------|
| 1980 <sup>1</sup> | 8 (15-20)  | 1984 <sup>1</sup> | 6 (6-15)    |
| 1981 <sup>1</sup> | (10-20)    | 1985              | 6 (10-15)   |
| 1982 <sup>1</sup> | 9 (15-20)  | 1986              | 6 (10-15)   |
| 1983 <sup>1</sup> | 22 (25-30) | Total             | 57 (91-135) |

<sup>1</sup> Harvest figures from Burns and Seaman (1986).

Table 5

Summary of estimated total landings and estimated total kill of belukha whales in western and northern Alaska stocks 1980-6. ETL = Estimated total landings; EKL = Estimated total kill

| Year                      | Eastern Beaufort |         | Eastern Chukchi |         | Norton Sound - Yukon Delta |         | Bristol Bay |         |
|---------------------------|------------------|---------|-----------------|---------|----------------------------|---------|-------------|---------|
|                           | ETL              | ETK     | ETL             | ETK     | ETL                        | ETK     | ETL         | ETK     |
| 1980                      | 39-43            | 98-107  | 129-132         | 165-174 | 50                         | 75      | 15-20       | 20-27   |
| 1981                      | 19-27            | 47-68   | 72-81           | 90-102  | 78-103                     | 98-131  | 10-20       | 13-27   |
| 1982                      | 25-28            | 62-68   | 182-187         | 223-239 | 85-119                     | 109-153 | 15-20       | 20-27   |
| 1983                      | 58               | 146     | 85-90           | 103-108 | 58                         | 71      | 25-30       | 34-40   |
| 1984                      | 59-61            | 123-128 | 31              | 36      | 90-104                     | 114-130 | 6-15        | 8-20    |
| 1985                      | 152-234          | 205-310 | 33              | 38      | 61-70                      | 78-89   | 10-15       | 13-20   |
| 1986                      | 40-42            | 75-80   | 40              | 50      | 84-94                      | 101-114 | 10-15       | 13-20   |
| <b>Seven year total</b>   | 392-493          | 756-907 | 572-594         | 705-747 | 506-598                    | 646-763 | 91-135      | 121-181 |
| <b>Seven year average</b> | 56-70            | 108-130 | 82-85           | 101-107 | 72-85                      | 92-109  | 13-19       | 17-26   |

Table 6

Potential magnitude (%) of average annual total kills of belukhas from the four provisional belukha whale stocks, made by Alaskans based on estimated total kills and estimated stock size. Total kills are the means of the ranges for the calendar years 1980-6

| Parameter                    | E. Beaufort |      | E. Chukchi |      | Norton Sound - Yukon Delta |      | Bristol Bay |      |
|------------------------------|-------------|------|------------|------|----------------------------|------|-------------|------|
|                              | Range       | Mean | Range      | Mean | Range                      | Mean | Range       | Mean |
| Total kill                   | 108-130     | 119  | 101-107    | 104  | 91-109                     | 101  | 17-26       | 22   |
| Stock size ('000s)           | -           | 11.5 | 2.5-3.0    | 2.75 | 1.0-2.0                    | 1.5  | 1.0-1.5     | 1.25 |
| Estimated % removed annually |             | 1.0  |            | 3.8  |                            | 6.7  |             | 1.8  |

Whether they are discrete stocks or not is a question central to their management. This is especially true for the Norton Sound-Yukon Delta stock which sustains a postulated kill rate estimated at 6.7%. More accurate estimates of stock size, landed harvests and hunting loss are also needed for this provisional stock.

The Bristol Bay stock is not intensively harvested at this time. A high proportion of the 17 to 26 whales taken annually are caught incidentally in the course of the intensive salmon fishery which is conducted with drift- and set-gillnets. The loss rate of killed whales is low. Surveys and observations in this area suggest that stock size has been stable over the last 30 years (Frost *et al.*, 1984).

Harvest data for both the provisional eastern Chukchi and eastern Beaufort stocks are relatively easy to obtain and are acceptably reliable. However, such records should continue to be compiled. Additional effort should be devoted to obtaining more accurate estimates of losses associated with belukha hunting in relatively deep water, as during the spring hunts in lead systems, and during the shallow-water drive hunts. It is especially important to obtain information about the relationship and extent of discreteness (if any) between the eastern Chukchi and eastern Beaufort management stocks. Better estimates of stock sizes are also needed, especially for belukhas that spend part of the summer in coastal waters of the eastern Chukchi Sea.

Recent harvests of belukhas in southeastern Kotzebue Sound have been reduced and irregular. Our present hypothesis is that this has resulted from partial displacement (reduced availability to hunters), rather than a decline in numbers of whales or a reduction in hunting effort. A hunting camp in northeastern Kotzebue Sound has been reoccupied in recent years and motor boat traffic between Kotzebue and the camp, through the area once intensively used by belukhas, has increased steadily. Local residents believe the use of new, large outboard motors with underwater exhaust contributes to the problem (P. Schaeffer, Kotzebue, AK, pers. comm.). In southeastern Kotzebue Sound, particularly in the early to mid-1980s, boat traffic associated with the belukha hunt increased greatly as people from other areas where belukhas were less numerous came to hunt. Traditionally, this hunt was highly coordinated and occurred on only a few days each summer, after which the whales were left undisturbed. Beginning in the early 1980s, hunting began to occur in a less coordinated fashion, resulting in much more boat activity in the areas used by belukhas.

Based on an estimate of 2,500 to 3,000 belukhas in the eastern Chukchi Sea provisional stock, the average kill rate of 3.8% is not excessive. Although overhunting cannot be entirely discounted, since stock size estimates are based on aerial photographic counts near Point Lay (the assumption is that Point Lay belukhas are the same as those seen several weeks earlier in Kotzebue Sound), we think it is unlikely. At Point Lay, there has been no recent change in hunting success relative to effort, or in the numbers of belukhas sighted in the area (Frost and Lowry, in review). It is possible that in recent years most belukhas have by-passed Kotzebue Sound and moved directly to the Point Lay area.

The provisional eastern Beaufort Sea stock is the only one hunted in waters of both Alaska and Canada. The current estimate of 11,500 animals (Davis and Evans, 1982) is probably conservative and additional effort will be required to further refine that estimate. The total annual

kills made by Alaskan hunters, estimated to average 119, is 1.0% of the stock. Data on landed harvests and total kills of these belukhas from Canadian waters of the eastern Beaufort Sea and Amundsen Gulf have been obtained by the Canadian Fisheries Joint Management Committee since 1985. In 1985–87, the average annual landed harvest was 137 and the estimated total kill was 175. Data from previous studies indicate a similar average harvest of 135, but a substantially higher average number (225) struck and lost (Sergeant and Brodie, 1975; Hunt, 1976, 1977, 1979; Fraker, Sergeant and Hoek, 1978; Fraker, 1980; Fraker and Fraker, 1982; Finley, Norton and Davis, 1983). Based on the more recent data, the average annual total kills from Alaskan and Canadian waters in combination, estimated at 294 (119 Alaskan + 175 Canadian), is a little less than 3.0% of the current estimated stock size.

At present, little is known about the natural mortality sustained by the four provisional stocks. Recent incidents of entrapment suggest that, on occasion, it may be significant (Burns and Seaman, 1986; Ivashin and Shevlyagin, 1987). In some instances, savssat (whales entrapped in small pockets of open water in the sea ice) are taken by hunters as happened near Kivalina in 1985. The extent to which hunting of entrapped whales is additive to natural mortality is probably quite variable, though presently unknown. The fate of entrapped whales should be studied, though such an undertaking would have to be done on an opportunistic basis.

#### NOTE

On 4 March 1988, the first meeting of the 'Alaska and Inuvialuit Belukha Whale Committee' was held in Fairbanks, Alaska. The meeting was organised and funded by the North Slope Borough Department of Wildlife Management, a local government agency in northern Alaska. Participants included representatives from coastal belukha whale hunting communities, the United States National Marine Fisheries Service, the Alaska Department of Fish and Game, the Inuvialuit Game Council (representing Inuit hunters of the Canadian Beaufort Sea region), and the Canada Department of Fisheries and Oceans.

This Alaska and Inuvialuit Belukha Whale Committee was created with the following goals: (1) to develop an effective belukha whale management plan in consultation with subsistence hunters and the appropriate governmental agencies; (2) to promote hunter education and improved hunting techniques to reduce the number of animals struck and lost; (3) to advocate needed research; (4) to compile statewide harvest statistics; (5) to identify and encourage protection of important belukha whale habitat; and (6) to provide a contact point for the exchange of research and management information on belukha whales.

The committee met again in September 1988 and is currently developing by-laws, seeking funding for operational expenses, and soliciting input from residents of coastal communities and others regarding future actions needed to provide for the conservation of belukha whales in Alaska.

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