C.M.1977/N:13
Marine Mammals Committee

Evidence for three substocks of humpback whales (Megaptera novaeangliae) in the Western North Atlantic. [1]

Howard E. Winn and Gerald P. Scott
Graduate School of Oceanography
University of Rhode Island
Kingston, Rhode Island 02881
U. S. A.

1. This work was supported by ONR contract N00014-76-C-0226 in a continued study of the bioacoustics of humpback whales.

Abstract

Evidence is presented that the Western North Atlantic population of humpback whales (Megaptera novaeangliae) may be segregated into three substocks. Information is given on densities, migratory routes, population sizes, fisheries, social organization, chlorinated hydrocarbon levels, and recent sightings, to support this view.

Introduction

The humpback whale population in the Western North Atlantic has generally been regarded as one stock (ANON., 1976). Mitchell (1973a) has mentioned that it is suspected, but not proven, that humpback herds consisting of 20 to 200 animals are small, isolated stock units. These herds may migrate to very specific areas, both in the northern feeding grounds and in the tropics where they mate and calve. This paper presents evidence that the population can be divided into three major substocks.

Evidence and Discussion

It has been shown that there are three areas in the mating-calving grounds of the West Indies with different densities of humpback whales (Winn et al, 1975). It was calculated that the Venezuelan to Martinique area (lower substock) had a density of approximately 1.2 whales per 10^3 km^2; the Dominican to Mona Passage area (middle substock), 5.0 whales per 10^3 km^2; and Navidad-Silver Banks (upper substock), 206 and 231 animals per 10^3 km^2 respectively. This seemed odd since historically more whales were taken from the Dominican to Venezuelan area (43 whales) than from Mona Passage to Navidad-Silver Bank (15 animals) (Townsend, 1935.) Three densities suggest the existence of three substocks.

In another paper (Winn et al, in preparation) we have plotted sightings and strandings between the West Indies and the northern feeding grounds. The results indicate three possible migratory routes: 1) from Silver-Navidad Banks through the Old Bahama Channel and along the coast of the U. S., perhaps also on the ocean side of the Bahamas; 2) from an area between Mona Passage and Martinique to Bermuda and continuing to Greenland; and 3) from an area south of Martinique up mid-ocean to Iceland. These three routes to proposed northern destinations seem to correspond to the three areas of different densities in the tropics. The two areas of low density and the supposed migratory destination correlate with the existence of two subsistence fisheries for humpbacks, one in Greenland (middle substock) and one in Bequia (lower substock).

Estimates of the total number of whales in the three areas were as follows: Silver-Navidad, 631-1003 animals; Mona Passage to Dominica,

about 105 animals; and St. Vincent to Venezuela, about 49 animals. Mitchell (1973b) has divided his estimates of humpback whales into various regions in the north. From Nova Scotia to Labrador he calculates 754 animals, which is comparable to the Silver-Navidad estimates. One could also add to this, his approximation of 352 whales in the Gulf Stream area, although at least some of these are migrants. In West and East Greenland he estimates 153 (87 and 66 respectively) which is comparable to the Mona Passage to Dominica figure. Although he computes 0 for Iceland, there are so few humpbacks from the corresponding area of Martinique to Venezuela that it would have been easy for Mitchell to have seen none on a cruise. There has been a recent increase in sightings around Iceland (ANON., 1976), and whalemen of Bequia believe there was an increase in the 1975-76 winter season (H. Beck, personal communication). One could also interpret that West and East Greenland stocks represent the middle substock and the lower substock, respectively. The estimate of 77 whales is Bermuda (Winn et al, 1975), is comparable to the middle substock estimate of 105 animals.

We have hypothesized that the middle substock stops briefly at Bermuda on its northern migration. There has been a recent increase in catches in Greenland, and Frank Wattlington (personal communication) said that there seemed to be significantly fewer whales on the Bermuda Banks in the last few seasons. We saw many whales on the Bermuda Banks in the 1970 humpback season and very few in 1975.

Four humpbacks were analysed for PCBs (ppm) and DDT (ppm) as follows: Nova Scotia, 5.4 PCB and 23.1 DDT; New Jersey 6.0 and 7.6; Antigua 1.3 and 1.4; and Saint Kitts 1.5 and 2.1, respectively (Taruski et al, 1975).

This fits the hypothesis that those from Antigua (middle substock) and St. Kitts (lower substock) migrate up the middle of the ocean to higher latitudes and do not encounter high pollutant levels along the Atlantic Coast as does the upper substock.

We also know that animals start leaving the Mona Passage and Virgin Bank area around mid-March (Erdman et al, 1973; Winn et al, in preparation) which corresponds to the arrival at Bermuda. Silver-Navidad animals also leave at this time but there is some evidence that the lower substock leaves a little later (Townsend, 1935).

Groupings of animals appear to differ in the three areas. For instance, there are more trios in the densest population. No information is available for the northern feeding areas, but the social groupings suggest substocks and the differences may well be density dependent.

We have hypothesized that the population of humpback whales in the Western North Atlantic can first be divided into three substocks. There is evidence for three migratory routes between the West Indies and the northern feeding grounds and three different densities in the West Indies (Figure 1). The areas are Navidad-Silver Banks (should also include Monchoir Bank but not discussed here) constituting the upper substock, Mona Passage to Dominica consituting the middle substock and Martinique to Venezuela constituting the lower substock. Exact lines cannot be drawn and Martinique might be better included in the middle substock. This should be irrelevant to the hypothesis. The population estimates of various areas in the north (Mitchell, 1973b) versus the population estimates in the south (Winn et al, 1975) seem to support the hypothesis as do some recent sightings, chlorinated hydrocarbon levels, social organization and time of leaving the West Indies.

It is possible to speculate that the three major substocks may sub-divide into smaller stocks (Mitchell, 1973b) that go to specific areas in the north and West Indies. For instance, animals from Silver Banks could go to Newfoundland and those from Navidad to the Cape Cod-Nova Scotia area. The middle substock could divide into two populations, one going to West Greenland and the other to East Greenland. Much more information is needed before such speculations can be determined.

The degree of genetic isolation is unknown. However, the fact that the lower and middle substocks have remained supressed and the upper substock has increased considerably, suggests a high degree of isolation. It seems possible that there might be some emigration from the densely populated Silver and Navidad Banks to other areas. Whether they would return to their traditional migratory route or join other animals with different routes is unknown.

The proposed stock hypothesis has major implications with regard to estimates of the original or prehunted, virgin population of humpbacks in the Western North Atlantic. Everyone has supposed from Sergeant's (1966) estimate around Newfoundland that the original population was on the order of 2000 animals (Mitchell, 1973; Winn et al, 1975; in ANON., 1976). Since more were caught historically in the lower substock than in either the middle or upper substocks (Townsend, 1935), one might easily suspect that the original population was much higher than has been suggested. We are presently making a new estimate that might well project the original population to have been well over 5000 animals.

Stocks may be identified in various ways such as determining densities, discontinuities in distribution, tagging, population levels, morphological

and biochemical (e.g. pollutant assays) differences, and individual markings (ANON., 1976). Social organization may also be useful. Although dialects have not been proven, song differences might also be a means of stock identification.

Exploitation has continued without an understanding of stocks. This information must be avaliable if exploitation continues as well as understanding what effect man has on whales (pollution, oil drilling, increased boat traffic, etc.). If our analysis of the three stocks is correct, the Greenland and Bequia, West Indies fisheries must be carefully regulated to prevent overexploitation in the middle and lower substocks, and no new exploitation should be allowed, particularly in Iceland.

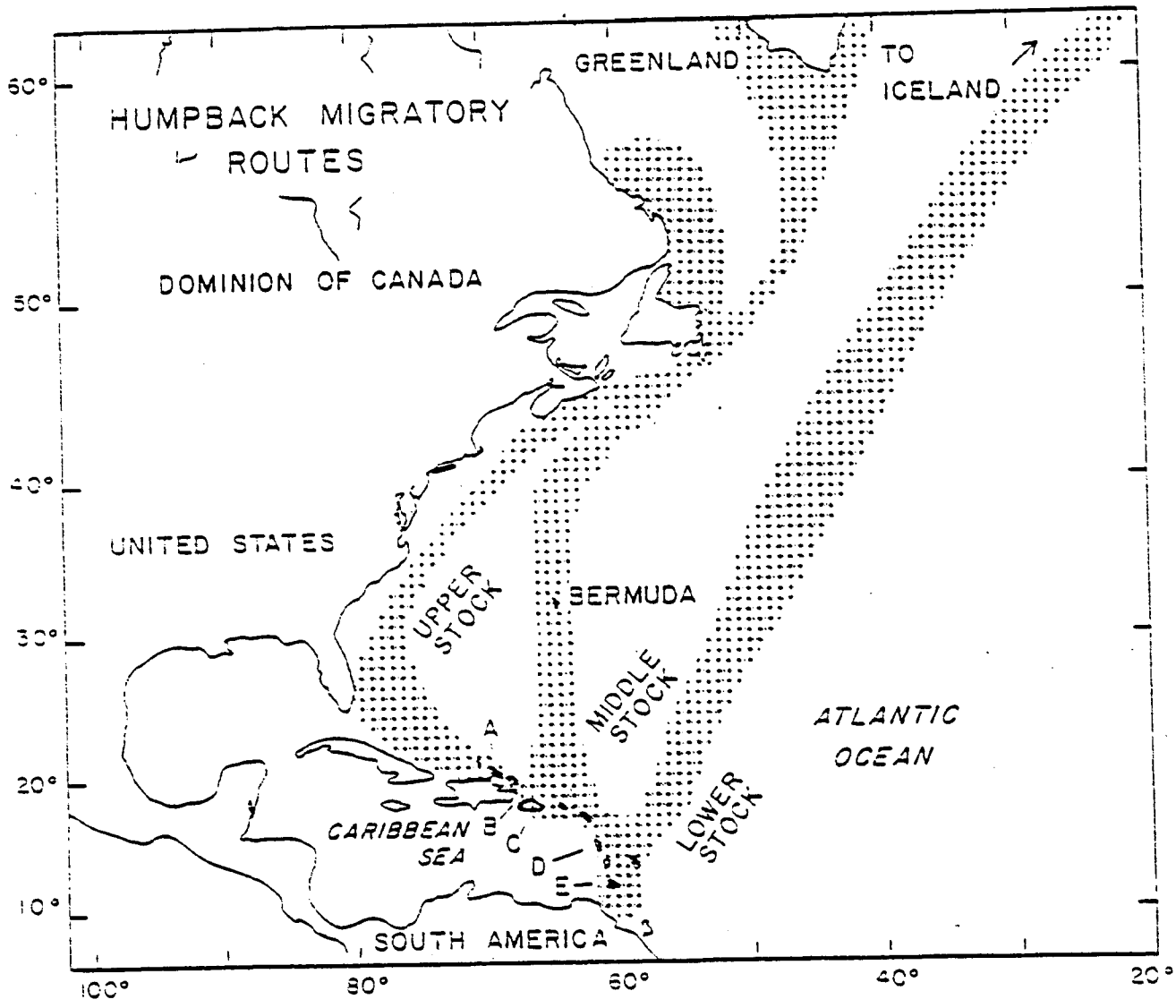

Figure 1. Scheme of the three substock hypothesis for the humpback whale in the Western North Atlantic. A. Silver and Navidad Banks B. Mona Passage C. Puerto Rico D. Martinique E. Bequia.

Literature Cited

ANON., 1976. Report of ad hoc group I on large cetaceans. FAO Sci. Consultation Mar. Mam. Doc. ACMRR/MM/SC/2 Suppl., 1: 5-8.

Erdman, D.S., J. Harms, and M.M. Flores., 1973. Cetacean records from the Northeastern Caribbean region. Cetology, 17: 14p.

Mitchell, E.D., 1973a., The status of the world's whales. Nat. Can., 2: 9-25

Mitchell, E.D., 1973b. Draft report on humpback whales taken under special permit by eastern Canadian land stations, 1969-1971. Int. Comm. Whaling Rep., 23: 138-154

Sergeant, D.E., 1966. Populations of large whale species in the Western North Atlantic with special references to the fin whale. Fish. Res. Bd. Can., Arc. Biol. Stat., Arc. No. 9, 13 pp.

Taruski, A.G., C.E. Olney, and H.E. Winn., 1975. Chlorinated hydrocarbons in cetaceans. J. Fish. Res. Board Can., 32: 2205-2209.

Townsend, C.H., 1935. The distribution of certain whales as shown by log book records of American whaleships. Zoologica, 19: 1-50

Winn, H.E., R.K. Edel, and A.G. Taruski., 1975. Population estimate of the humpback whale (Megaptera novaeangliae) in the West Indies by visual and acoustic techniques. J. Fish. Res. Board Can., 32: 499-506.