

## Social behaviour of feeding finback whales off Newfoundland: comparisons with the sympatric humpback whale

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Finback whales off Newfoundland and Labrador formed groups of between 1 and 10 animals, with smaller groups being found more frequently. The number of whales in a group was closely related to the horizontal size of the prey schools on which the whales were feeding. Associations between individual finbacks were generally of short duration. In these respects finback social behaviour was similar to that of the humpback whales that frequently fed on the same prey schools as the finbacks. However, finbacks moved faster than the humpbacks, stayed further apart from conspecifics, and, unlike the humpbacks, were never observed to perform energetic above-water displays. Differences in speed and manoeuvrability between the two species may explain why they rarely formed interspecific groupings.

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Au large de Terre-Neuve et du Labrador, les Rorquals communs forment des groupes de 1–10 individus et ce sont les petits groupes qui sont les plus fréquents. Le nombre de rorquals dans un groupe est en corrélation avec la taille à l'horizontale des bandes de proies dont ils se nourrissent. Les associations entre les individus ne durent que peu de temps. Le comportement social des Rorquals communs est donc semblable à celui des Rorquals à bosse qui se nourrissent souvent des mêmes bandes de proies. Cependant, les Rorquals communs se déplacent plus rapidement que les Rorquals à bosse, gardent plus de distance entre eux, et ne sont jamais observés en train de faire des exercices énergiques hors de l'eau. Les rorquals des deux espèces forment rarement des regroupements interspécifiques, probablement parce que la vitesse et la facilité avec lesquelles ils se déplacent ne sont pas les mêmes.

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### Introduction

Despite the end of Canadian commercial whaling in 1972, surveys off Newfoundland and Labrador have suggested that the population of finback whales, *Balaenoptera physalus*, in the area is decreasing (Lynch and Whitehead 1984). Reasons for this apparent decline are unclear, but competition with the sympatric humpback whale, *Megaptera novaeangliae*, is a possibility. Thus, investigation of the ecological niches of these populations is important.

Humpbacks and finbacks seem to form relatively discrete stocks in the Newfoundland–Labrador area (Katona et al. 1980; Mitchell 1974). Examination of stomach contents of animals caught by the whaling industry showed that both species eat a fairly wide and overlapping range of food types, mainly schooling fish and euphausiids, but that for both species the principal food off Newfoundland is the fish capelin, *Mallotus villosus* (Mitchell 1973, 1975). Although humpbacks tend to be found closer to shore (Perkins and Whitehead 1977), the two species can often be seen feeding on the same fish school. Whitehead and Carscadden (1985) found that the distributions of humpbacks and finbacks reacted similarly to declines in the capelin stock; both were found inshore in larger numbers when offshore stocks of 2- to 3-year-old immature capelin declined. Thus, in the Newfoundland–Labrador region, the niches of humpbacks and finbacks are not well separated by prey type or geographical distribution.

In some situations, species that feed in the same area on the same food have their niches differentiated by feeding method. For instance, Davidson (1977) found that sympatric granivorous desert ant species that ate the same-sized food usually differed in feeding type; one species would be a “group” forager, the other an “individual” forager.

In this paper we present information on the behaviour of finback whales off Newfoundland and Labrador, and compare it

with results of similar studies of humpbacks in the same region (largely from Whitehead 1983). We consider whether differences and similarities in feeding behaviour between the species are likely to promote competition or to permit coexistence.

### Methods

The field research was carried out off Newfoundland and Labrador between 1978 and 1983. Much of the data were collected opportunistically during studies of humpback whales that were conducted off the Bay de Verde Peninsula (48°05' N, 52°50' W) during the summers of 1978, 1979, and 1980. Details of the methods used are given by Whitehead et al. (1980, 1982) and Whitehead (1983). Research aimed specifically at finbacks was carried out during the summer of 1983 from a 13-m ketch, during June in St. Mary's Bay, Newfoundland (46°45' N, 53°50' W), and during August on Hamilton Bank, off Labrador (54°50' N, 55°40' W).

During these studies, we tracked groups of humpbacks and finbacks, following them from the boat as discretely as possible. We attempted to keep the boat approximately 70 m from the whales, although ranges varied between 5 and 300 m. We called a continuous tracking of a particular group of whales a “watch.” In general, the nearest group to the boat was selected at the start of a watch. Watches were continued until the whales had not been positively identified for 30 min, the situation became confused by an overabundance of whales, or bad weather halted the watch. Whales were defined as grouped if they were (i) located within 100 m of one another, (ii) heading the same direction (divergences of less than 2 min were permitted), and (iii) coordinating blowings, dives, surfacings, or movements.

This is a utilitarian definition of a group, and describes our subjective impressions of the whales' behaviour. However, we realize that whales may have coordinated over distances greater than 100 m (Whitehead 1983).

The individual members of a group were visually identified as soon as possible from the shapes and markings of their dorsal fins (Katona and Whitehead 1981). The dorsal fins of both humpback and finback whales and the flukes of humpbacks were photographed in order to

TABLE 1. Location and duration of watches of finback groups

Study	No. of watches	Total time, h	Mean time per watch, min
1978			
Bay de Verde, 7 June – 23 July	9	17	114
1980			
Bay de Verde, 4 July	1	1	57
1983			
St Mary's Bay, 8–17 June	5	21	250
Hamilton Bank, 12–17 Aug.	14	34	144

obtain reliable individual identifications. From the photographs taken during the studies, 53 individual finback whales were identified. Two of these were identified on 2 days: No. 056 on 13 and 14 August 1983, and No. 052 on 17 June and 15 August 1983. This latter match shows that at least one animal migrated between our two 1983 study areas, a distance of about 1000 km. The remaining 51 finbacks were each photographed on 1 day.

During each surfacing of the group we recorded the direction of movement, speed of movement (estimated using the knotmeter of the tracking vessel), location, the relative positions of individuals within the group, the distance between adjacent individuals (estimated by eye), and any displays such as "lunging" or "breaching" (defined in Whitehead 1983). Distances between adjacent grouped members and speeds of movement are reported only from the 1980 and 1983 studies, when increasing observer experience made the estimates more reliable. Changes in the composition of the group through splits and joins were also noted. Our estimates of distance were found to be consistent among crew members, and estimates of the length of whales consistent over days (Whitehead et al. 1982).

The number of watches, total time spent studying the whales, and the mean lengths of the watches of finbacks are given for each study in Table 1. Those for humpbacks are given by Whitehead (1983). There are considerably fewer data for finbacks (a total of 73 h of watch) than for humpbacks (407 h). Because of this paucity of finback data, and the presence of confounding factors such as water and prey depth, comparisons of the behaviour of the finbacks at different locations and times have little validity and are not presented here.

During the 1980 study, whenever possible, we categorized the humpbacks being followed as to whether they were feeding or not. In the other studies, and with finbacks, we were insufficiently confident to make this distinction reliably. We estimate that both species were feeding very approximately 70% of the time during all studies.

For analysis, the watches were broken into 15-min intervals, and the occurrences of displays, and mean group size, were recorded for each interval.

During the studies at Bay de Verde, we monitored concentrations of the fish and plankton on which the whales were feeding, using a Simrad EY recording depth sounder (frequency, 75 kHz). The depth sounder traces, together with knowledge of the speed of the boat, allowed us to measure the vertical extent, and estimate the horizontal size, of the whales' prey schools.

Statistical tests employed  $\chi^2$  and Pearson's  $r$ , and only  $P$  values of 0.05 and 0.01 are given.

## Results

### Group size

Finback and humpback whales off Newfoundland and Labrador formed groups containing from one to occasionally seven or more animals. These groups were generally distinct entities, and there was rarely any problem in deciding whether particular whales were grouped.

The proportion of time groups contained different numbers of individuals are given for the two species in Fig. 1. Whereas

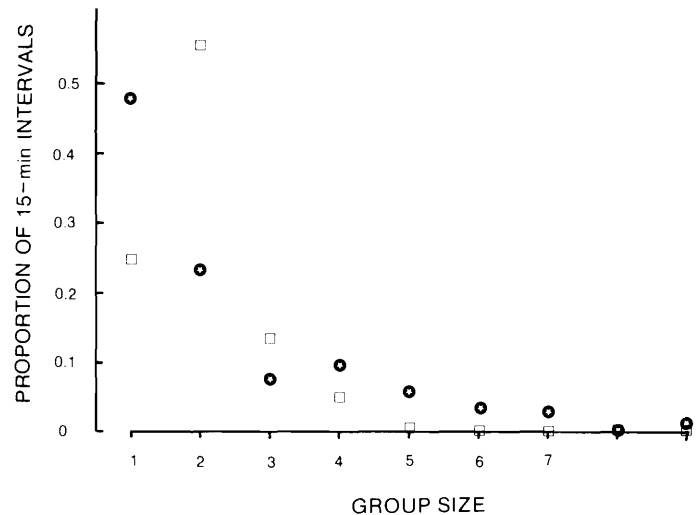


FIG. 1. Observed group sizes of finbacks (circled stars) and humpbacks (squares) (from Whitehead 1983).

humpbacks were most frequently found in pairs, especially when not feeding (Whitehead 1983), finback groups most often contained just one animal, with larger group sizes being progressively less common. Finbacks were more often found in large groups (more than three members) than humpbacks.

Much of the variation in the group sizes can be related to the type of food. For both humpbacks (Whitehead 1983) and finbacks ( $r = 0.44$ ,  $P < 0.01$ ), group size was significantly correlated with the logarithm of the horizontal size of the prey school. There were also positive, but smaller, correlations with the vertical extent of the school and its estimated volume, although both these measures are strongly correlated with the horizontal extent of the school. With larger prey schools the whales formed larger groups, as shown in Fig. 2. The relationship was similar for the two species.

Because the data on the two species were not collected simultaneously, the differences between the observed group sizes (shown in Fig. 1) may not represent differences between the species when they are feeding in similar circumstances. A probable exception is the humpbacks' pronounced preference for pairings, especially when not feeding (Whitehead 1983), which was not found with the finbacks.

### Group structure and speed

The estimated distances between adjacent members of the same group are shown in Fig. 3. Humpbacks were usually between 2 and 16 m from their neighbours, but grouped finbacks were generally separated by between 8 and 80 m. For

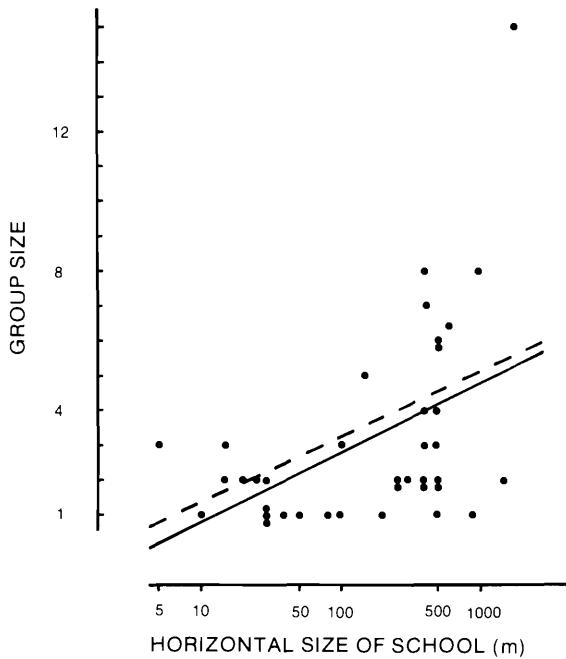


FIG. 2. Maximum group size of finbacks feeding on a prey school plotted against the logarithm of the horizontal size of the school. The least-squares regression line is indicated by the solid line. The regression line for humpbacks (from Whitehead 1983) is also shown (broken line).

both species, grouped whales, especially those in groups of less than five animals, usually swam abreast of one another; departures from this formation rarely lasted longer than 5 min.

Finbacks usually swam at between 3 and 5 kn (5.5–9.3 km/h), considerably faster than the 1–3 kn (1.8–5.5 km/h) of humpbacks (Fig. 4).

*Group stability*

Humpback and finback groups sometimes split into two discrete smaller groups, or joined with other groups. Whitehead (1983) examined the group stability of the humpbacks. In this section, the same is done for finbacks, although as there are fewer data, the analysis is less detailed.

The rates at which finback and humpback groups of different sizes joined and split (joins or splits per minute) are given in Fig. 5. The rates for finbacks were more variable and showed less consistent trends with group size than those of the humpbacks. This is probably principally because of the smaller sample size for the finbacks. The joining rates for the two species were similar, about one join every 3 h. However, the finbacks showed a significantly ( $P < 0.01$ ) lower splitting rate for groups larger than five animals than did the humpbacks. This allowed them to maintain larger group sizes for longer periods (Fig. 1).

In Fig. 6, the probability of two identified finbacks staying grouped is plotted against the time between identifications for all possible pairs of finbacks. Two finbacks were recorded as “grouped” on an occasion if they were both photographed in the same group; they were recorded as “not grouped” if all members of a group were identified but only one of the two finbacks was present. Using these criteria it is harder to determine “not grouped” status than “grouped,” so the proportion of pairs staying grouped after a certain length of time, as given in Fig. 6 will generally be an overestimate. However, these data suggest that particular pairs of finbacks stay grouped for

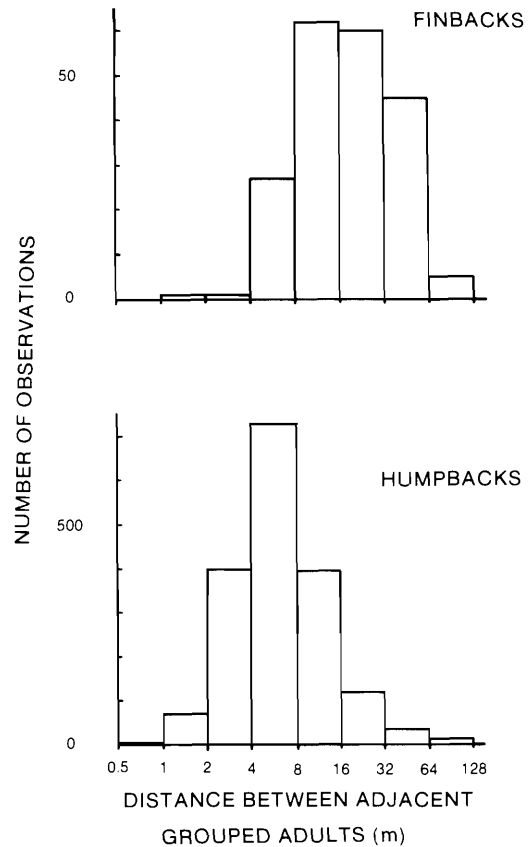


FIG. 3. Distances between adjacent grouped adults, for finbacks and humpbacks (from Whitehead 1983).

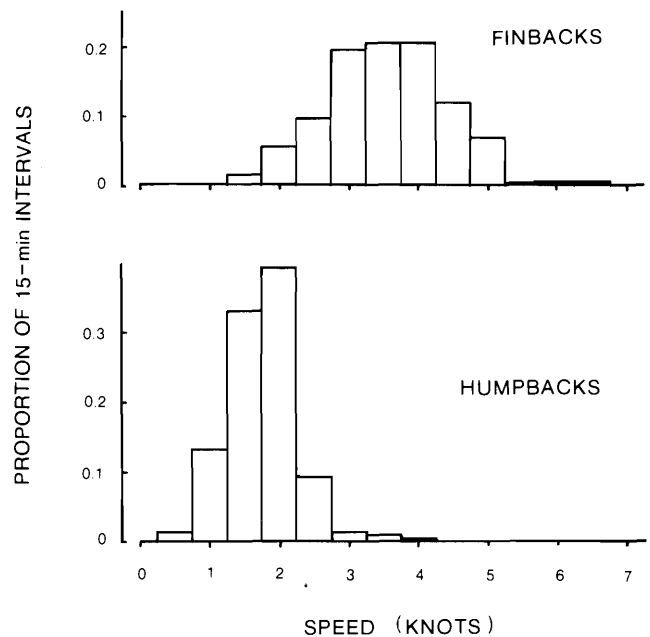


FIG. 4. Speed of finbacks and humpbacks (1 knot = 1.85 km/h).

an average of about 2 h, which is similar to the splitting rate for groups of two given in Fig. 5.

Only two finbacks were identified over periods of more than 1 day, and they did not associate with one another; so, from this data set we can draw no conclusions about associations between individuals over more than 24 h.

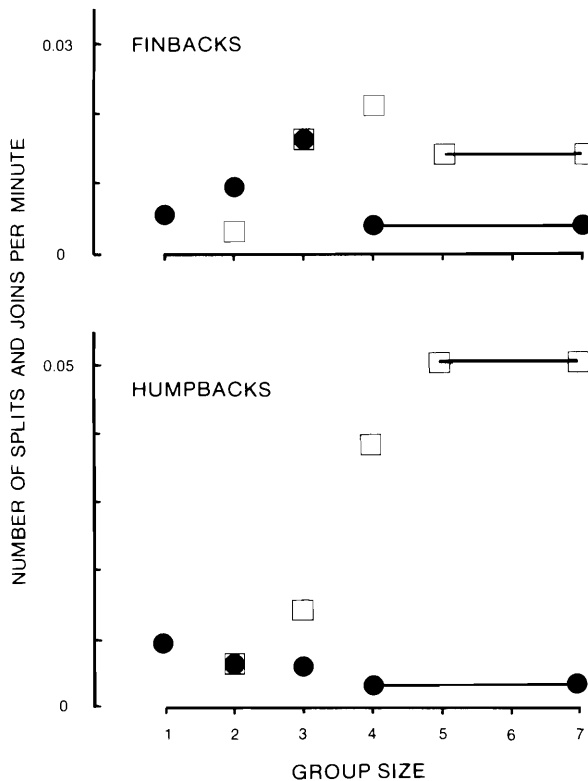


FIG. 5. Number of splits (□) and joins (●) per minute by group size for finbacks and humpbacks (from Whitehead 1983). Group sizes of five to seven are combined for splits, and group sizes of four to seven are combined for joins.

#### Interspecific groupings

At Bay de Verde, humpbacks were observed feeding on 116 occasions. On 29% (34) of these occasions finbacks were observed feeding on the same prey school. The proportion rose to 60% or 12 of 20 occasions, when the prey schools were over 500 m in horizontal size. Despite this frequent co-occurrence, on only one occasion did we see humpbacks and finbacks behaving as a single group according to the criteria given above.

#### Displays

The rates of observing various displays from the two species during the studies off Newfoundland are given in Table 2. Unlike humpbacks, finbacks were never observed to perform the following above-water displays: breaching (leaping from the water), flippering (raising the pectoral flipper above the water surface), or lobtailing (thrashing the flukes onto the water surface). Both species were observed to lunge (thrusting the body through the water surface with less than half of it protruding). Lunging seems to be a form of feeding when the prey are close to the surface (Watkins 1981), and was performed by the finbacks in St Mary's Bay and off Bay de Verde, but not in the deeper waters of Hamilton Bank. Both species were observed to side-fluke (a fluke visible above the water surface, moving laterally but oriented vertically) at similar rates. Side-fluking may result from an animal's turning on its side near the surface.

For finbacks, lunges and side-flukes were observed significantly ( $P < 0.01$ ) more often during 15-min intervals that contained a group split or join. Whitehead (1983, Table 2) found similar relationships for humpbacks.

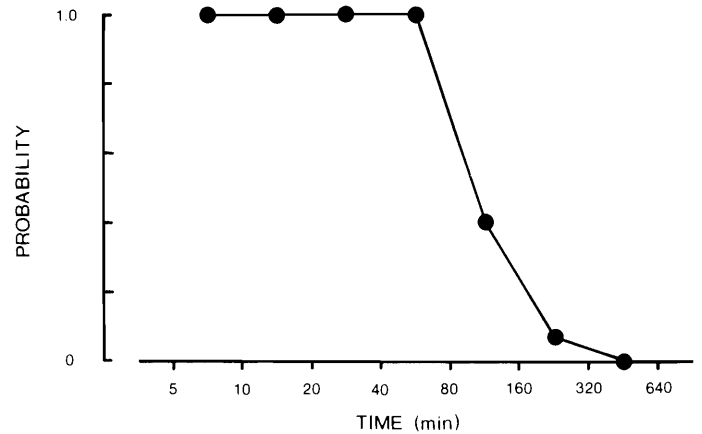


FIG. 6. The probability of two identified finbacks staying grouped, in relation to the time between identification photographs.

TABLE 2. Proportion of 15-min intervals containing different displays for humpbacks and finbacks watched off Newfoundland and Labrador

	Humpbacks	Finbacks
Breach	0.012	0
Flippering	0.049	0
Lobtail	0.046	0
Lunge	0.079	0.049
Side-fluke	0.056	0.087
No. of 15-min intervals	1245	265

#### Discussion

Our results on the behaviour of finbacks generally agree with those of other reports. A radio-tracked finback off Iceland swam at between 2.2 and 6.8 kn (4.1–12.6 km/h) over 6-h periods (Watkins et al. 1984), which is in close agreement with the results presented in Fig. 4. Observed finback group sizes are variable, with groups of six to seven being most common in the eastern North Pacific (Leatherwood et al. 1982), but single animals are most frequent off Cape Cod (C. Carlson, personal observation). The results presented in this paper suggest that these differences may result from the presence of different prey types in the different areas, although geographical segregation by sex or age-class might also be a factor. Although we have no data on associations between pairs of finbacks over more than 1 day off Newfoundland and Labrador, the groups were labile over periods of hours. This suggests that the long-term pair bonds between finbacks presumed by earlier scientists, such as Mackintosh (1965), may not be common.

Of the results presented in this paper, in only three cases are there pronounced differences between the behaviour of finback and humpback whales; finbacks generally moved faster, stayed further apart from conspecifics, and almost never performed breaches, flipperings, or lobtails. The first two of these differences can be directly related to the comparative morphology of the two species; finbacks are slimmer, larger, and have smaller flippers. They would thus be expected to travel faster and, being less manoeuvrable (the radius of the turning circle of a whale is closely related to the relative size of its flippers), to stay further apart. These differences in speed and manoeuvrability might explain why humpbacks and finbacks almost

never formed interspecific groupings when feeding on the same prey school; the humpbacks would be turning more sharply and the finbacks travelling faster.

The structure and stability of the groups of the two species were similar, and the group sizes of both species were similarly related to the size of their prey schools. Finbacks did not show the humpbacks' preference for pairings, and this, together with the lack of above-water behaviour, which Whitehead (1985) found to be generally related to social tension in humpbacks, might suggest that pairwise associations were of more significance to humpbacks. Large groups of finbacks were rather more stable than those of humpbacks. But, in general, the two species seemed to relate similarly to conspecifics, forming temporary intraspecific groupings when feeding together. In contrast, the third major mysticete of the region, the minke whale (*Balaenoptera acutorostrata*), also principally a capelin feeder, generally feeds alone (Perkins and Whitehead 1977).

Whitehead (1983) suggests that for humpback whales, a principal function of grouping may be to reduce interference when animals are feeding together on the same prey school. Individual prey may scatter when a whale enters the school, thus lowering the density of the school and its profitability to another feeding whale entering it a little later. Whales that coordinate their movements, and thus their "attacks" on prey schools, might be expected to encounter denser concentrations of prey than uncoordinated whales. Thus, coordination with other whales might reduce interference and increase the feeding success of an individual. If this is the case, the lack of interspecific groupings will mean that each whale is more severely affected by members of the other species feeding on the same school than by members of its own. Interference competition will be stronger interspecifically than intraspecifically.

Although Winters (1975) has shown that neither humpbacks nor finbacks takes a significant proportion of the total capelin resource, if only a small part of that resource is available to the whales (because of age, depth, distribution, schooling behaviour, etc.), the two species may also experience interspecific and intraspecific exploitation competition. Thus, there is potential for both interference and exploitation competition for food between humpback and finback whales off Newfoundland and Labrador.

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