SIGHTINGS OF HUMPBACK WHALES IN GREAT BARRIER REEF WATERS

MARK L. SIMMONS*

AND

HELENE MARSH**

ABSTRACT

Oral history interviews indicate that humpback whales used to winter in Great Barrier Reef waters in such numbers that they were considered a hazard to fishing, and that numbers declined dramatically coincident with whaling on the east coast of Australia in the 1950's and early 1960's. Anecdotal evidence suggests a recent increase in whale sightings in reef waters as well as at the latitudes of the former shore stations. These data suggest that most of the humpbacks which migrate along the east coast of Australia, winter in the Great Barrier Reef lagoon. Recent sightings of humpbacks tend to reflect human usage of the region. In recent years, they have been sighted near many reefs, islands and inshore areas, however, winter concentrations comparable to those seen in some other parts of the world have not been reported. This probably reflects both the vastness of the area and the low whale numbers. Calves have been seen at many places in the Great Barrier Reef lagoon. Some females apparently calve before they reach reef waters. Humpbacks have also been sighted near the northern end of the Great Barrier Reef (10°31′ S) between October and January after the end of the main north-south migration.

INTRODUCTION

The humpback whales (*Megaptera novaeangliae*) which migrate along the eastern coast of Australia en route to their breeding grounds, are part of the Area V stock which spends the summer feeding in Antarctic waters between 130°E and 170°W. The history of the commercial exploitation of this stock has been summarized by Paterson and Paterson (1984), and Bryden (1985). Commercial whaling is estimated to have reduced numbers from 10,000 (Chittleborough, 1965) to less than 500 (Chittleborough, 1965) or 200 (Chapman, 1974). Paterson and Paterson (1984) and Paterson (1985) present evidence, mainly based on

* *Queensland National Parks and Wildlife Service, Maritime Estate Branch, P.O. Box 1362 Rockhampton, 4700, Australia.*

** *Zoology Department, James Cook University, Townsville, 4810, Australia.*

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observations in the vicinity of 27°S, that this humpback population is now recovering. Bryden (1985) on the basis of cliff-top observations at the same latitude tentatively estimated that about 400 humpbacks were migrating up the east coast of Australia in both 1980 and 1981.

Although it is well established that the main northward migratory stream of humpbacks passes through the waters of southern Queensland in June, July, and August (Paterson, 1985; Bryden, 1985), while the southward migrating whales traverse this area in September, October and November (Paterson, 1985), their low latitude destination is unknown. Dawbin and Falla (1949) considered that an area in the Coral Sea north-west of New Caledonia (about 17° to 22°S; 157° to 163°E) was the breeding ground of the humpbacks passing along the eastern coast of Australia. Their opinion was based on examination of the charts of American whalers (Townsend, 1935) who are unlikely to have traversed the dangerous waters of the Great Barrier Reef (Fig. 1) as their preferred target was the sperm whale, which would not be expected to occur in shallow reef waters. Paterson and Paterson (1984) point out that there is no proof of a humpback migratory route between the eastern Australian coast and the Coral Sea, and present evidence that at least some humpbacks calve in the waters of the Great Barrier Reef. However, locations with winter concentrations such as those observed in Hawaii and the West Indies (Winn *et al.*, 1975; Herman and Antinoja, 1977; Tyack and Whitehead, 1982; Whitehead and Moore, 1982) have not been identified.

This paper adds to our knowledge of humpback whale migrations by documenting historical and recent sightings in Great Barrier Reef waters. These observations have resulted from the developing management, surveillance and research activity in the area plus the increased interest of the general public in whales.

METHODS

Oral History

In 1982–83, staff of the History Department of James Cook University conducted a series of taped interviews for the Great Barrier Reef Marine Park Authority. The major objective of this project was to document information on the incidence of the crown-of-thorns starfish, *Acanthaster planci*, on the Great Barrier Reef prior to 1960, however, additional information was recorded which could be of use to marine scientists. Informants were chosen on the basis of their sustained reef experience and included people such as trochus shell divers, fishermen, and charter boat operators.

The interview tapes are indexed by subject. They were made available to us by the Great Barrier Reef Marine Park Authority. Whales were mentioned on 28 of the 69 tapes. Relevant data, such as information indicating specific identification, locations and numbers of whales, presence of calves, and direction of travel were extracted by one of us (M.S.).

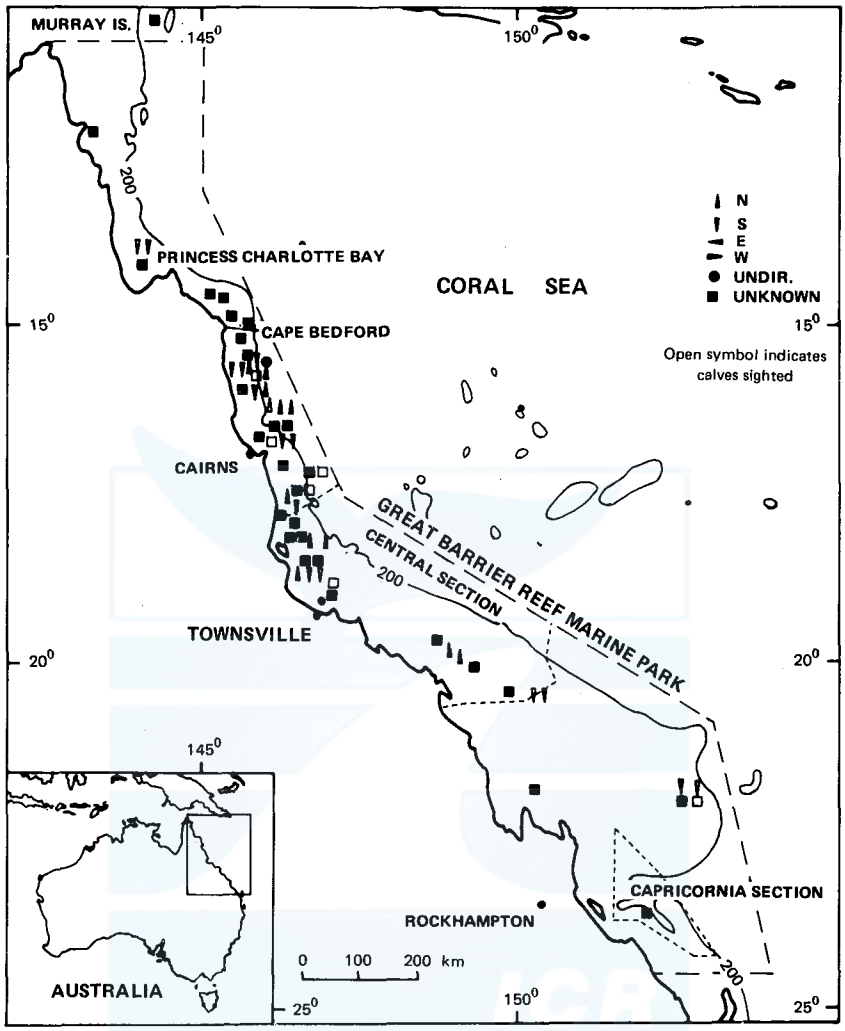

Fig. 1. Map of the Great Barrier Reef area showing the major locations mentioned in the text and the locations where the oral history informants indicated that they had sighted humpbacks. The 200m contourline is shown.

Additional data of this nature were made available by Andrew Smith who has done extensive interviews with residents of the Hope Vale Aboriginal Community near Cooktown (15°30′S; 145°15′E).

Recent sightings

Capricornia Section of the Great Barrier Reef Marine Park

Aerial surveillance: Queensland National Parks and Wildlife Service (Q.NPWS) personnel conducted regular (usually twice weekly) aerial surveillance

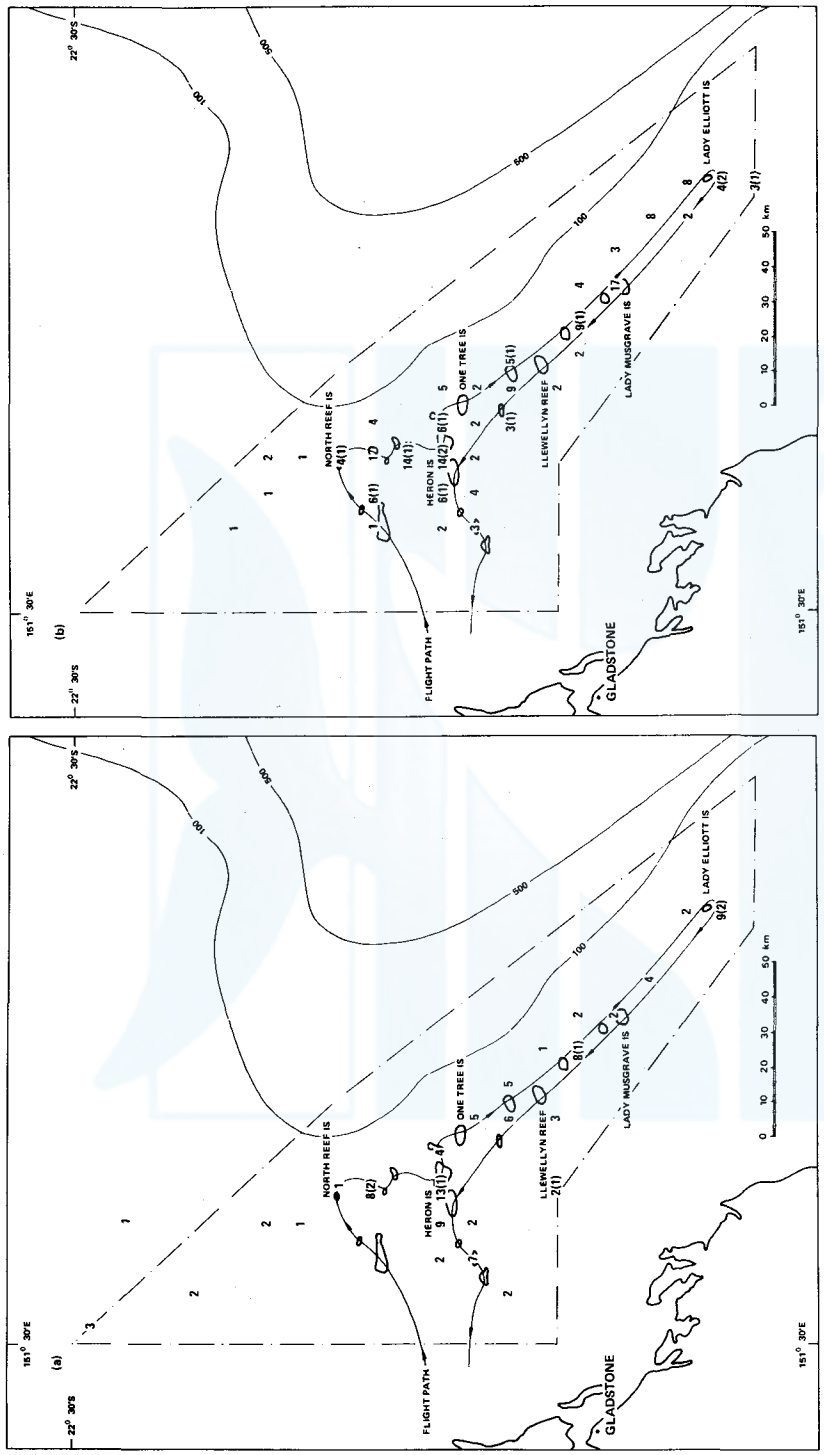

Fig. 2. Locations and numbers of humpback whales sighted in or adjacent to the Capricornia Section of the Great Barrier Reef Marine Park in (a) 1983 and (b) 1984. The numbers do not represent actual group sizes but the total number of humpbacks observed in each 100 km^2 grid square during the year. The corresponding numbers of calves are given in brackets. The routine flight path of the Q.NPWS surveillance flights is indicated.

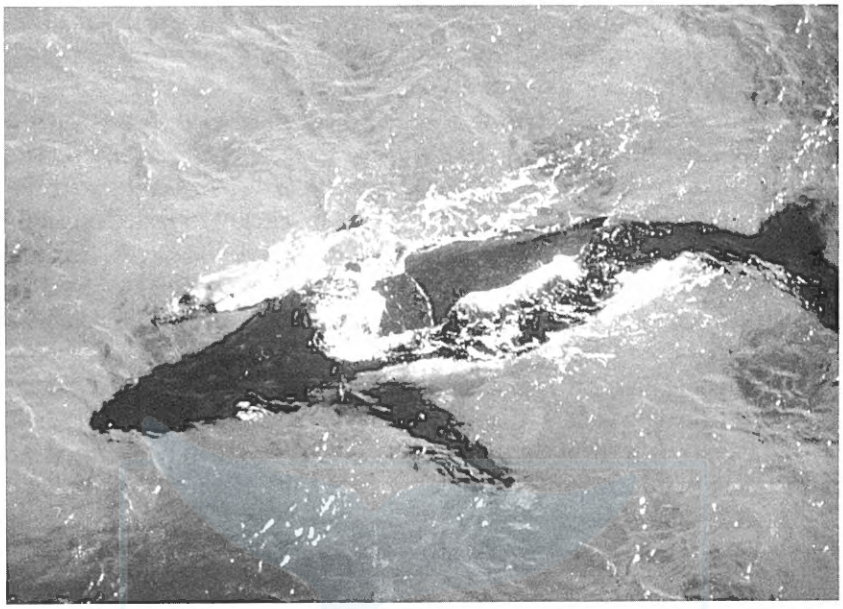

Fig. 3. Aerial photograph of a humpback mother and calf sighted near Wilson Island in the Capricornia Section of the Great Barrier Reef Marine Park during a Q.NPWS surveillance flight on July 20 1985. The light colour and small size of the calf suggest that it was newborn.

of this area in 1983 and 1984. The primary purpose of these flights was to monitor human activities, however they also provided the opportunity to observe natural phenomena, although such observations had a much lower priority. The regular flight plan is illustrated in Fig. 2; once per month the flight was extended slightly southward to cover Lady Elliott Island, the southern extremity of the Great Barrier Reef.

The aircraft used was a high-wing, twin-engine Partenavia. Patrols were flown at a height of 152 m (500'); clearance to descend to 30.5 m (100') was available if required. The number of observers ranged from one (usually) to three; all crew plus pilot communicated via an intercom system. On some flights, the rear door of the aircraft was removed providing an expanded field of view and greater manoeuvrability for taking photographs for one observer. All photographs e.g. Fig. 3, have been taken using a hand-held 35 mm Canon AE-1 camera fitted with a data back and motor-drive or a Pentax super program fitted with a 300 mm lens.

The aircraft orbited each group of whales to allow photography and the recording of data on location, group sizes (a group was defined as a subjectively distinct clump), numbers of calves (other age groups could not be reliably distinguished), direction of swimming, sizes, behaviour, distinguishing marks,

association with other animals, and weather and sea conditions. Thirty-four percent of sightings in 1983 and 38% in 1984 were made on Q.NPWS surveillance flights.

Surface surveillance: Humpback whales were also photographed and observed as detailed above by Q.NPWS field staff during routine boat patrols; sometimes surface and aerial observations were co-ordinated by radio contact between boat and aircraft. Ten percent of observations recorded in 1983 and 7% in 1984 were made during Q.NPWS surface surveillance. A further 10% of observations in 1983 and 7% in 1984 were made incidentally by Q.NPWS staff.

Incidental observations: A public education programme about whales in the Marine Park was conducted by Q.NPWS personnel at Heron Island. Standard whale sighting forms including graphic information on how to identify a humpback whale were prominently available at the Heron Island Resort and Research Station and distributed to dive shop owners, charter boat operators and pilots operating in the area including those from the Australian Coastal Surveillance Centre who regularly patrol the Great Barrier Reef. Australian Coastal Surveillance Centre Staff made 20% of observations in 1983; 15.5% in 1984. Other sources of incidental information included the staff of Lloyd's Helicopters (14% of sightings in 1983; 3.5% in 1984) and the general public (16% in 1983; 24% in 1984).

Other regions of the Great Barrier Reef Marine Park

Incidental observations: Since 1980, standard humpback whale sighting forms have been distributed by a group of biologists at James Cook University and by the Great Barrier Reef Marine Park Authority. The forms have been sent to a wide range of reef users including research workers, fishermen, charter-boat operators, dive-shop owners, aircraft pilots, lighthouse keepers, and observers on the Coastwatch Flights (which traverse the Great Barrier Reef lagoon on 28 days each month). Whale field guides including Leatherwood *et al.* (1976) were distributed to regular observers. All observers were encouraged to forward photographs of sightings.

RESULTS

Oral History

Review of the oral history tapes and the information collected by Andrew Smith confirmed that humpback whales were common in the winter in many parts of the Great Barrier Reef Region prior to the 1960's. Indeed, they were considered a hazard of concern to fishermen. Specific locations identified by informants are summarized in Fig. 1.

Interviews were recorded with 36 men as part of the Oral History Project. Twenty-six of the informants mentioned whales and 23 of these gave information indicating that encounters with humpbacks occurred frequently through the winter months from June to October inclusive. Several interviewees spoke of

vast numbers of whales sighted in a single season. For example, Mr Derek Scott spoke of "hundreds and hundreds" of whales, whereas Mr Don Duffy recalled that observing "50 to 60" whales in a single day was not unusual.

Nearly all the informants were emphatic that there was a very significant decline in the number of whales visiting the Great Barrier Reef waters around the 1960's. Some men were remarkably precise in naming the year of the whales' disappearance. For example, Mr Adrian Cummings nominated 1962–63 as the end of the whale era: 1962 was the last year that whales were captured commercially on the east Australian coast (Paterson and Paterson, 1984).

Several informants stressed that although they had not sighted humpbacks in Great Barrier Reef waters for 15 to 20 years, they had seen them again in small numbers in the last five or six years.

Recent Sightings

Capricornia survey: latitude 24° 15′S – 22° 30′S

Locations where humpback whales were sighted within the Capricornia Section of the Great Barrier Marine Park in 1983 and 1984 are summarized in Figs 2a and 2b respectively. Most animals were sighted within 10 km of islands or reefs; it is not known to what extent this pattern is a function of the human usage of the area which in turn also determines the aerial surveillance flight paths (refer Fig. 2).

In 1983, 116 whales were sighted on a total of 50 occasions. Fifty-three individuals (45.7%) were moving north, 44 (37.9%) south. In 1984, there were 58 sightings of a total of 160 individuals. Sixty-three whales (39.4%) were classified as moving north, 49 (30.6%) as moving south. Details are summarized in Table 1. There were no obvious differences between the locations at which northward and southward moving whales were seen. The likelihood that an individual whale was resighted one or more times is unknown.

Table 1 summarizes the monthly sightings for 1983 and 1984. The first sightings for the season were made on June 13 in 1983 and on June 24 in 1984. In 1983, approximately equal numbers of whales were sighted in July, August, September and October, however in 1984 sightings peaked in August. In both years the last sightings were made in the last week of October.

The first group of southerly migrating whales was sighted on August 20 in 1983. In contrast, in 1984 a group of four whales (no calves) was seen travelling in a south-easterly direction on June 30. Although in both years, the majority of animals were travelling north in June/July and south in September/October, two groups of humpbacks were seen travelling north in the second half of October 1984; both groups included one calf.

Calves were first sighted on August 20 in 1983 travelling south, and on August 15 in 1984 travelling north-west. Eight calves were observed in 1983 (6.9% of sightings), 13 (8.1%) in 1984; the difference is not significant (G with William's correction = 0.04; 1 d.f.; $P > 0.5$). More than half the calves (52%) observed in 1983–84 were accompanied by only one other animal, presumably

TABLE 1. SIGHTINGS OF HUMPBACK WHALES IN THE CAPRICORNIA SECTION OF THE GREAT BARRIER REEF MARINE PARK (NEAR LATITUDE 24°15′S – 22°30′S)

Month	Whales sighted			No. of groups travelling in various directions			
	No. groups	No. individuals	No. calves	Northerly	Southerly	Non-directional	Other
1983							
June	4	8	0	3	0	1	0
July	14	32	0	13	0	1	0
August	10	21	1	4	2	3	1
September	15	28	2	4	6	5	0
October	7	27	5	0	7	0	0
TOTAL	50	116	8	24	15	10	1
1984							
June	5	13	0	4	1	0	0
July	15	39	0	9	2	1	3
August	15	54	2	6	5	4	0
September	13	28	8	1	6	1	5
October	10	26	3	2	6	2	0
TOTAL	58	160	13	22	20	8	8

the mother. Single calves were seen with up to six adults. One group of seven animals included two calves.

The observed relative frequencies of the different social groupings identified by Darling *et al.* (1983) is summarized according to direction of travel and month in Fig. 4. Although the frequency of social grouping was independent of the direction of travel (G with William's correction = 15.29; 10 d.f.; $P > 0.10$), it was not independent of month (G with William's correction = 34.73; 20 d.f. $P < 0.025$), largely because calves were not seen until the second half of the season. The most common grouping observed for all directions of travel and in all months was two or three adults. Bryden (1985) noted that the most frequently observed group size of the northern migration at 27°S was two whales; the largest group observed at this time was four.

Other parts of the Great Barrier Reef Region

Details of sightings are summarized in Fig. 5 and Table 2. The sightings coincide with areas of human usage. For example, the high frequency of flights between the coasts and reefs in the Whitsunday Island area undoubtedly contributed to the high humpback sighting rate in this area. It is likely that humpbacks use the Great Barrier Reef lagoon more widely and evenly than these data indicate.

Calves have been confirmed as far north as the reefs off Cairns (about 16°30′S see Fig. 1), and at a wide range of locations in the Central Section of the Great Barrier Reef Marine Park (see Figs 1 and 5). The animals off Cairns were observed in August (Table 2). In contrast to the areas south of 21°S

TABLE 2. INCIDENTAL SIGHTINGS OF HUMPBACK WHALES IN GREAT BARRIER REEF WATERS NORTH OF LATITUDE 23°S (BUT EXLUDING THE CAPRICORNIA SECTION OF THE GREAT BARRIER REEF MARINE PARK) BETWEEN 1980 AND 1984 INCLUSIVE

Month	Whales sighted			No. of groups travelling in various directions[2]			
	No. groups	No. individuals[1]	No. calves	Northerly	Southerly	Non-directional	Other
Between 9°S and 11°S (near Don Cay, Murray Island, 10°31'S, 143°45'E)							
November	3[3]	16[4]	0	0	0	3	0
Between 15°S and 17°S (near Michaelmas Cay, Upolo Cay, Green Island)							
August	3	6	2	0	0	0	2
Between 17°S and 19°S (near Dunk Island, Beaver Cay, Rib Reef, Wheeler Reef, Keeper Reef, Davies Reef, Broadhurst Reef).							
July	7	23	6	1	0	5	0
August	7	15	2	0	0	2	1
September	1	2	0	0	0	1	0
TOTAL	15	40	8	1	0	8	1
Berween 19°S and 21°S (near Cape Cleveland, Magnetic Island, "Yongala" wreck, Cape Bowling Green, Holbourne Island, Whitsunday Islands and associated reefs, Smith Group of Islands)							
July	10	27	5[5]	4	2	2	0
August	14	41	3	2	4	5	1
September	17	31	5	1	7	6	2
October	1	2	1	0	1	0	0
TOTAL	42	101	14	7	14	13	3
Between 21°S and 23°S (near Pompey Reefs, Sarina, Percy Isles, Duke Island Group, Cape Townshend, between Swain Reefs and Capricorn Channel.)							
July	2	4	0	1	1	0	0
August	4	7	1	0	1	3	0
September	13	28	8	8	0	3	1
TOTAL	19	39	9	9	2	6	1

1 if some doubt over number the lowest estimate taken. 2 direction of travel not always recorded.
3 very diffuse groupings. 4 all but one seen outside the outer Barrier Reef.
5 includes one cow seen with two calves.

where none of the 75 humpbacks seen in July have been calves and where calves are first seen in August (Table 1), 11 of the 50 humpbacks recorded between 17° and 21°S in July were calves. The difference is significant (G with William's correction = 20.77; 1 d.f.; $P < 0.001$), suggesting that the whales tend to calve north of 21°S.

Although the proportion of calves (17/113 or 15% of sightings) seen north of 21°S in 1983–84 was higher than that seen in reef waters including Capricornia south of this latitude (28/279 or 10%), the difference is not significant (G with William's correction = 2.81; 1 d.f.; $P > 0.05$).

Group sizes are available for 18 calves sighted between 15° and 21°S. Eleven (61%) were accompanied by only one animal, presumably the mother. Single calves were also seen with two, four and six escorts (on one occasion each). Two calves were seen with two adults (once), and three animals (twice). One adult flanked by two calves was followed by a dive boat for about 15 minutes off the 'Yongala' wreck (south of Cape Bowling Green) on the 31 July 1984.

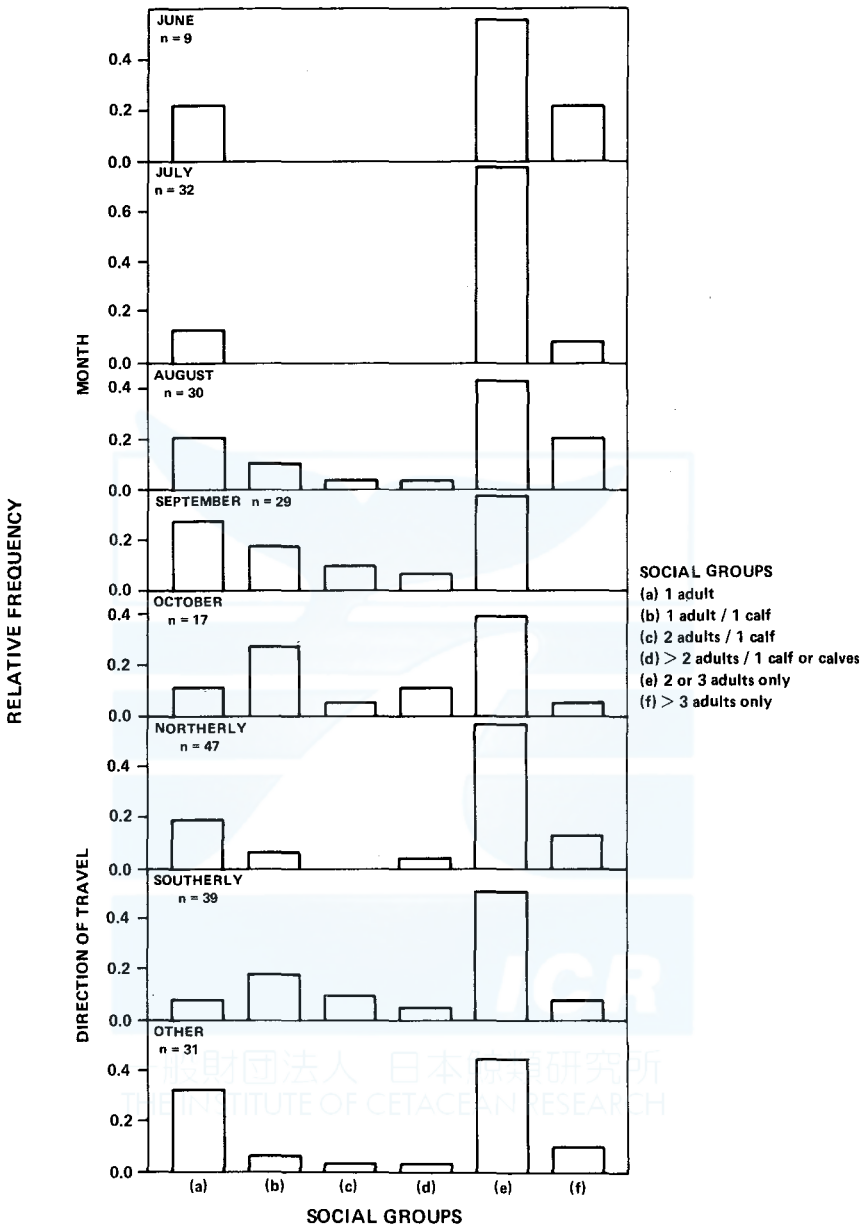

Fig. 4. Relative frequency of the different social groupings identified by Darling *et al.*, (1983) which were recorded in the Capricornia Section of the Great Barrier Reef Marine Park in 1983–84 and summarized according to direction of travel and calender month.

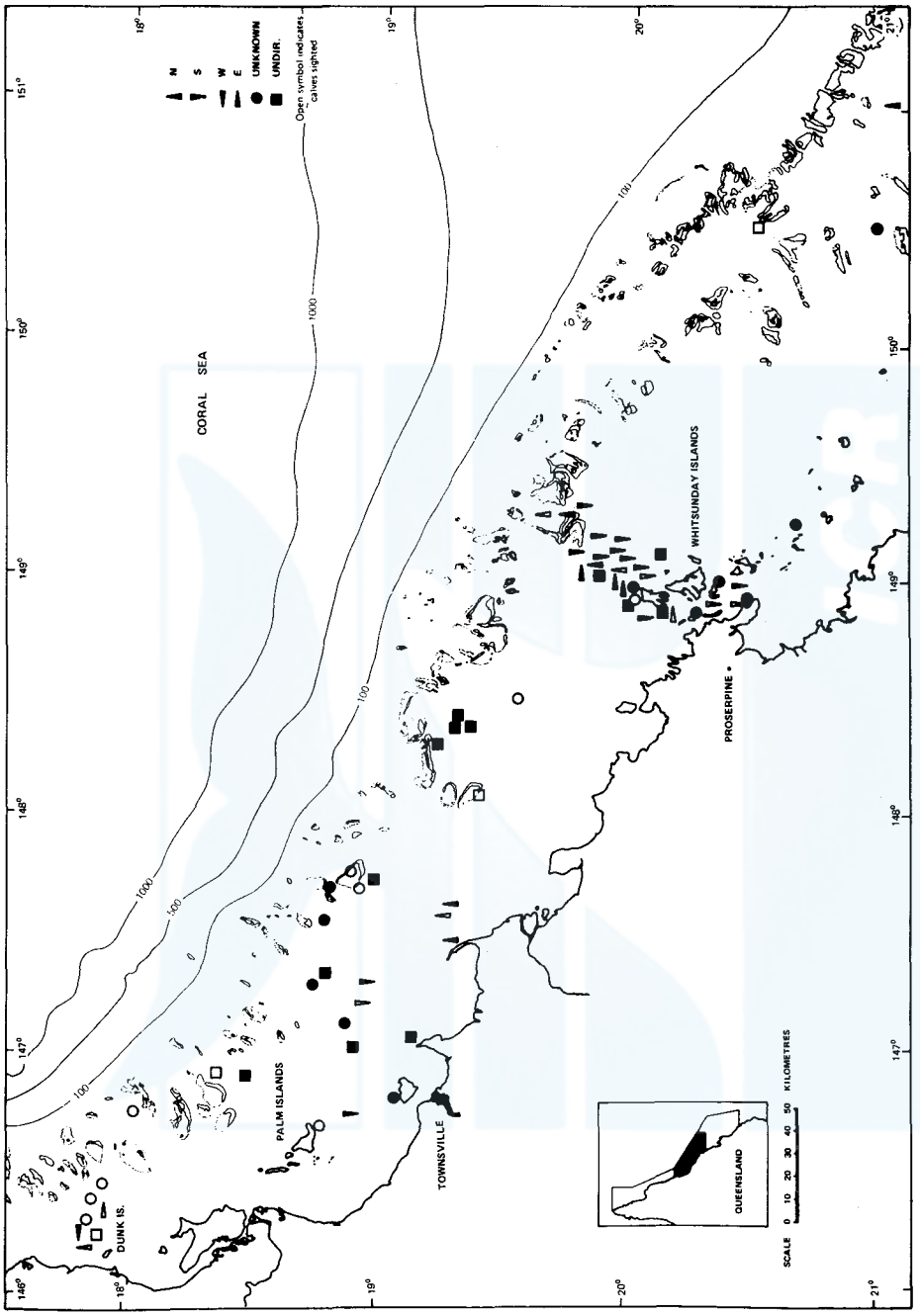

Fig. 5. Location and direction of travel of groups of humpbacks recorded in or adjacent to the Central Section of the Great Barrier Reef Marine Park between 1975 and 1984 inclusive. Groups containing one or more calves have been ringed. The 100m, 500m and 1000m contourlines are shown.

No calves were seen among the humpbacks sighted in the Murray Island area (10°31'S see Fig. 1) in the second half of November in 1981 and 1983 (Table 2). The 1981 sighting made by charter boat operator Mr Perry Harvey was of a very scattered aggregation of 10 to 20 whales. All were outside, but within two miles of, the outer Barrier Reef. Humpbacks were also seen in this area by one of us (HM) during an aerial survey in November 1983. A single animal was observed inside the outer Barrier at approximately 10°31'S; 143°45'E. A diffuse group of five animals was also seen just outside the northern end of the outer Barrier Reef. The simultaneous occurrence of four whale sharks in the same area suggests that it may be rich in plankton in November. A Murray Islander leader, Mr Sam Passi, explained that whales fitting the description of humpbacks are regularly seen between October and January. Most are seen between Murray Island and the outer Barrier Reef. The Murray Islanders have a whale totem indicating that they regard these whales as significant, and suggesting that their occurrence in these waters in the Austral summer is long-standing.

DISCUSSION

"The Great Barrier Reef extends for about 2300 km along the east coast of Queensland (Fig. 1) from about 9° to 25°S with the outer reefs 23 to 260 km from the coast. The Barrier Reef bounds a lagoon, very much broken up by reefs, having a mean depth of 35 m and in which depths of over 60 m are uncommon" (Pickard *et al.*, 1977). The vastness of this region is difficult to comprehend. According to statistics supplied by the Great Barrier Reef Marine Park Authority, the 'Great Barrier Reef Region' has an area of 348,700 km^2 and contains 2,904 gazetted reefs.

Both oral history accounts and recent sightings document the seasonal occurrence of humpbacks over much of this lagoon. Apart from those in the Murray Island area (10°31'S), most recent sightings have been south from about 16°. This may simply be the result of the pattern of human usage of the region. The oral history accounts indicate that humpback sightings used to be commonplace between June and September at least as far north as Princess Charlotte Bay (14°25'S), and that in some areas the whales occurred in such numbers that they were considered a real hazard to shipping. We are unable to determine whether the low number of historical records from the area between Princess Charlotte Bay and Torres Strait is an artefact of the low level of human activity or a reliable indication of whale habitat usage.

Most of the historical accounts agree that humpback sightings in Great Barrier Reef waters dramatically decreased coincident with the period of coastal whaling from east coast shore stations from 1952 to 1962. There is also anecdotal evidence to suggest that numbers are begining to build up again in Great Barrier Reef waters. This apparent recovery is also coincident with the increase in numbers being documented during the east coast migration

further south (see Paterson and Paterson, 1984). All this suggests that the humpbacks migrating along the east coast of Australia mostly winter in the Great Barrier Reef lagoon. The observed contemporary absence of winter concentrations of humpbacks from these waters is probably a consequence of both the vastness of the area and low whale numbers.

Our records show that calves tend to be seen north of 21°S earlier in the year than in the Capricornia Section (Tables 1 and 2), suggesting that whales are migrating though the waters of Capricornia en route to their breeding grounds. However, the observation of a humpback cow with a light-coloured, apparently new-born calf in shallow water near Wilson Island (23°18′S; 151°55′E) on July 20 1985 (Fig. 3) suggests that some humpbacks calve in Capricornia. Paterson and Paterson (1984) and Paterson (1985) present evidence indicating that some humpbacks give birth even before reaching Great Barrier Reef waters. They base their conclusion on an eye-witness report of a humpback giving birth at Rooney Point (24°49′S; 153°07′E), and on two separate sightings of humpbacks each accompanied by a small calf tracking north past Cape Moreton (27°02′S) on August 30 1982 and June 27 1984 respectively. A cow and calf were also seen tracking north in the channel near Heron Island (23°26′S; 151°55′E) on July 23 1985. We have also seen whales with calves tracking northward in the second half of the season at other locations in Great Barrier Reef waters.

The breeding areas in Hawaii and the West Indies are characterized by shallow waters (15 m to 60 m deep, see Whitehead and Moore, 1982) with surface water temperatures of 25°C, and 24° to 28°C respectively (Herman and Antinoja, 1977; Whitehead and Moore, 1982). Most of the Great Barrier Reef lagoon is of a suitable depth, but if such temperatures are important, we would expect most humpbacks to calve north of about 14°30′S (see Fig. 6). This seems unlikely in view of the observations discussed above and the lack of recent sightings from the northern area. The distribution of recent sightings of whales with calves north of 21°S (Fig. 5 and Table 2) suggests that calving is occurring over a wide area.

The historical (Fig. 1) and recent sightings (Table 2) of humpbacks in the Murray Island area near the northern tip of the Great Barrier Reef after the end of the main north-south migration along the east coast of Australia is surprising and warrants further investigation, particularly in the light of Paterson's observations of whales tracking north in late September (see Paterson, 1985). The reliability of the observed direction of travel as an indication of the overall direction of migration also needs to be assessed, especially for southward migrating whales whose movement tends to be erratic (Bryden, 1985).

In view of the huge areas involved, and the increasing level of aerial surveillance resulting from the implementation of management plans for the various sections of the Great Barrier Reef Park, we consider that it would be premature to mount dedicated aerial surveys for humpback whales in the

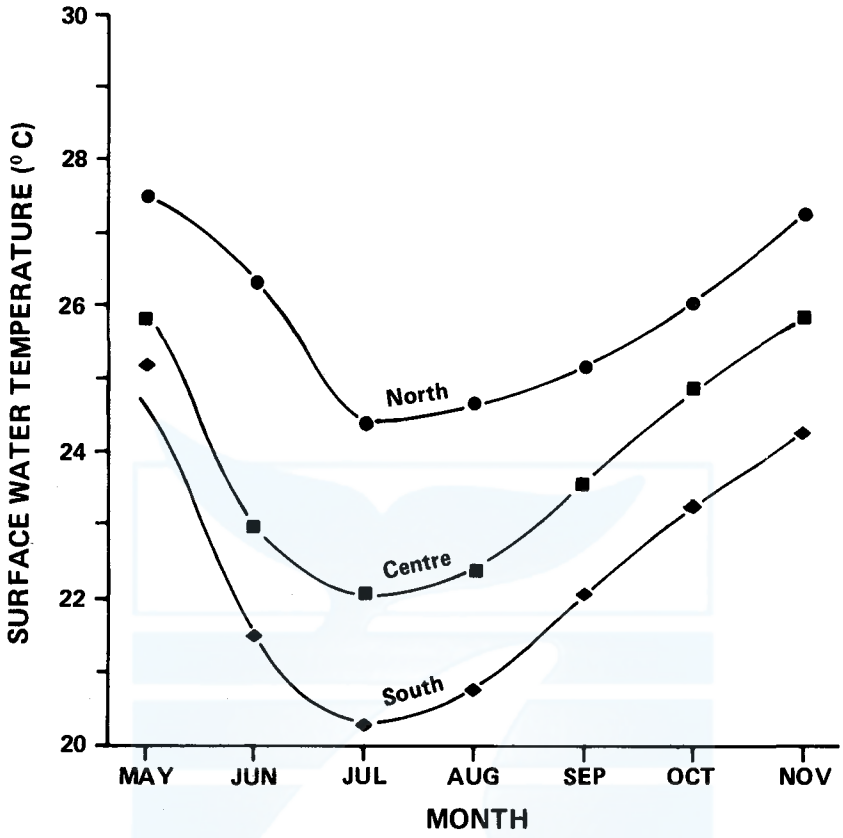

Fig. 6. Surface water temperatures during the Austral winter along the inshore waters of the Great Barrier Reef lagoon (data from Brandon, 1973; figure modified from Pickard *et al.*, 1977). Northern Zone – 10°30′ to 14°30′S; Central Zone – 14°36′ to 19°30′S; Southern Zone – 20°30′ to 24°30′S).

Great Barrier Reef lagoon. The success of such surveys is almost certainly weather-dependent. Bryden (1985) suggests that sighting is much reduced when skies are overcast and winds greater than Beaufort 5. Unfortunately, the occurrence of whales in reef waters coincides with the season of south-east trade winds which means that seas are often rough (Pickard *et al.*, 1977). However, the upgraded incidental sightings programme presently being developed by the management agencies offers an excellent opportunity to systematically acquire more background data and to document the expected recovery of whale stocks.

Improvements planned for this programme include more detailed guidelines for data collection to eliminate some of the problems that emerged during this analysis. We found, for example, that all the data on behaviour, as well as the data on direction of swimming and group size collected outside the Capricornia Section of the Great Barrier Reef Marine Park, were too

inconsistent and subjective to be of use. However, the introduction to Australia of the benign research techniques that have been successfully used to study humpbacks in other areas should quickly improve the quality of the data collected.

If humpbacks recover to their pre-whaling numbers, whale watching promises to become a highlight for winter visitors to the reef, and a potential concern for Great Barrier Reef Marine Park management agencies. It is fortunate that the whales migrating up the east coast of Australia are protected by the Great Barrier Reef Marine Park which includes 99% of the reef region. This is the only whale habitat receiving such protection in the Southern Hemisphere (see Johnson and Wolman, 1984).

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