

## DISTRIBUTION AND STATUS OF HUMP-BACKED DOLPHINS, *SOUSA CHINENSIS*, IN AUSTRALIAN WATERS

Peter J. Corkeron<sup>1</sup>, Nina M. Morissette<sup>1</sup>, Lindsay Porter<sup>2</sup> and Helene Marsh<sup>1</sup>

1. Department of Tropical Environment Studies and Geography, James Cook University of North Queensland, Townsville Queensland 4811, Australia.

2. The Swire Institute of Marine Science, The University of Hong Kong, Cape d'Aguilar, Shek O, Hong Kong.

### Abstract

We review the distribution and status of Indo-Pacific hump-backed dolphins in Australian waters, using records from museums and wildlife services, unpublished sightings from aerial surveys and a photo-identification study. Records of stranded animals indicate that hump-backed dolphins occur along the northern Australian coastline. Aerial surveys of the Great Barrier Reef region demonstrate that hump-backed dolphins occur throughout the region, mostly in waters close to the coast, although they occur also in offshore waters that are relatively sheltered, and close to reefs or islands. Markrecapture analysis of photo-identification data from Moreton Bay in south-east Queensland indicated that hump-backed dolphins occurred at a density of approximately 0.1 dolphin·km<sup>-2</sup>. Relevant data on the status of hump-backed dolphins in Australian waters are scarce, but it is difficult to interpret the available information optimistically. By analogy with sympatric (and better studied) dugongs, we suggest that hump-backed dolphins may be in decline in Australian waters.

### Introduction

Hump-backed dolphins occur around the coasts of continents facing the Indian Ocean and in southeast Asia from southern China to eastern Australia. Although Atlantic hump-backed dolphins are generally considered a separate species from their Indo-Pacific congeners (Ross *et al.* 1994), Ross *et al.* (1995) have suggested that the genus is monotypic. Throughout most of their range, the biology and status of hump-backed dolphins are poorly known, but their numbers appear declining in the two areas where they are being studied in greatest detail. Off South Africa, nets set for bather protection from sharks seem to be taking hump-backed dolphins at an unsustainable rate (Cockcroft and Krohn 1994) and it has been suggested that hump-backed dolphins may be declining in Hong Kong waters (see Jefferson and Leatherwood 1997 for a discussion of ongoing research on hump-backed

dolphins in Hong Kong).

Hump-backed dolphins occur in mangrove areas, off islands (Pilleri and Gühr 1973–74), and offshore from open sandy beaches where they are seen within one kilometre of the shoreline (Saayman *et al.* 1972; Saayman and Tayler 1979). Moreton Bay, Australia (27°15'S, 153°30'E), is the only place to date where hump-backed dolphins have been recorded several kilometres from shore (mean distance 6km, Corkeron 1990).

Off the east coast of southern Africa, hump-backed dolphins appear to feed preferentially on estuarine fish and squid (Barros and Cockcroft 1991), although they have also been observed apparently feeding in the vicinity of rocky inshore reefs (Saayman and Tayler 1979). Hump-backed dolphins' apparently anomalous distribution in Moreton Bay may be anthropogenically driven. Sympatric bottlenose dolphins, *Tursiops truncatus* (Montagu), appear to obtain a significant proportion of their diet from food made available

by shrimp trawlers (Corkeron 1997) and the same may true for hump-backed dolphins in the bay.

No information on the population status of hump-backed dolphins in Australian waters is available. In the Action Plan for Australian Cetaceans hump-backed dolphins are classified as 'Insufficiently Known' (Bannister *et al.* 1996). In this paper, we present information on the distribution and status of hump-backed dolphins in Australian waters, from records of museums and wildlife services, unpublished sightings from aerial surveys and a photo-identification study.

## Methods

### Records

Sighting and stranding records of hump-backed dolphins were obtained from museums and

government departments in Australia and from the published literature.

### Aerial surveys of the Great Barrier Reef region

Aerial surveys were conducted in the Great Barrier Reef Region between Hunter Point (11°30'S, 142°50'E) and the southern boundary of the Great Barrier Reef Marine Park (24°30'S) during 1987 through 1995 (Fig. 1). The surveys were concentrated in the area between the coast and approximately 20km offshore but extended to the outer Barrier Reef between Cape Bedford (15°15'S, 145°21'E) and Hunter Point. All surveys were conducted between September and December, so the data are seasonally biased.

The primary aim of the surveys was to estimate the distribution and abundance of dugongs (*Dugong dugon*), using standard quantitative techniques (Marsh and Saafeld 1989,

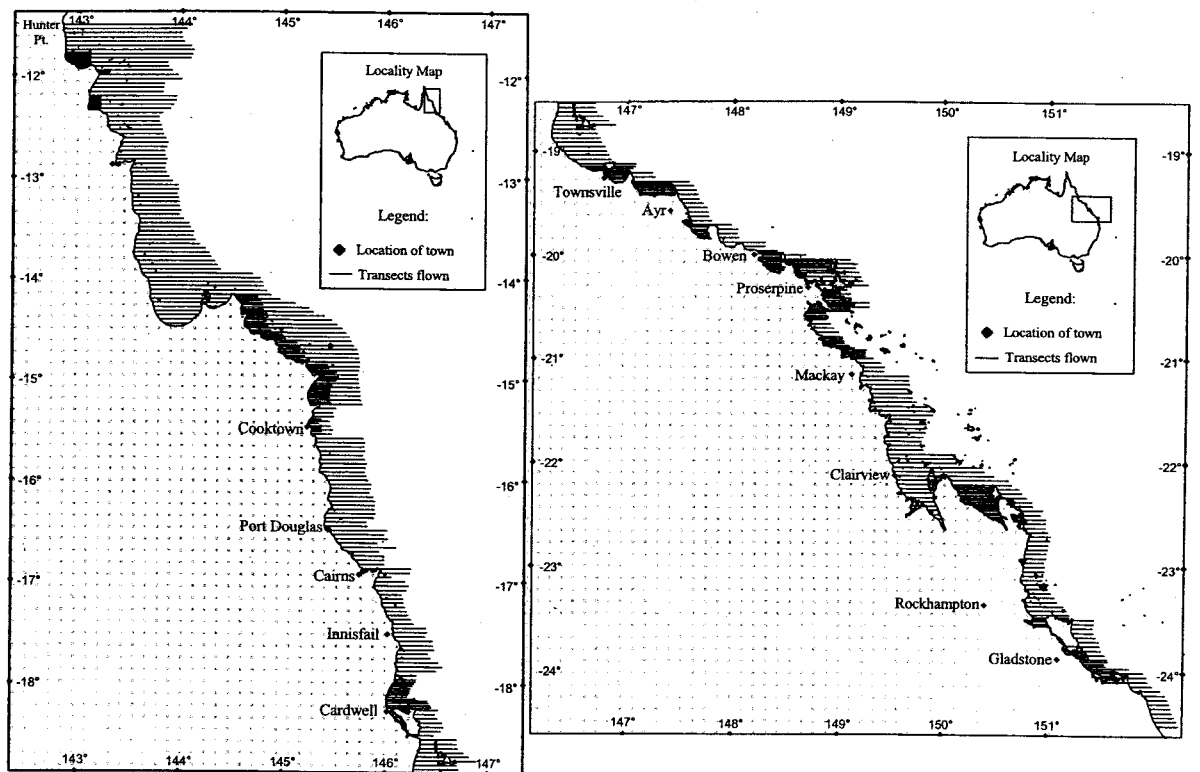


Fig. 1. Transect lines flown on aerial surveys carried out between Hunter Point and the southern boundary of the Great Barrier Reef Marine Park.

1990; Marsh and Sinclair 1989a, b). Surveys were conducted using a Partenavia 68B, flying at  $185\text{km}\cdot\text{h}^{-1}$ , at 137m. Transect lines were aligned east — west (with the exception of one small area), and most lines were spaced at intervals of 5' latitude. Survey intensity was stratified according to dugong abundance and areas of particular interest to the Great Barrier Reef Marine Park Authority (GBRMPA). The aircraft was fitted with a radar altimeter for accurate height control. Surveys were conducted only when the sea state was less than Beaufort 4 and during neap tides, to minimise missing animals due to water turbidity. Surveys were also scheduled to avoid severe glare associated with low or midday sun.

On sighting a group of dolphins, data on group size, number of calves, position in the water column (on the surface, underwater) and reliability of species identification (certain, uncertain, guess) were recorded. Cetaceans were identified to species based on shape, size and colouration. On all flights, at least two of the four observers had experience in identifying cetacean species during aerial surveys. Hump-backed dolphins were distinguished from bottlenose dolphins by their relatively thick-set appearance, smaller, longer-based dorsal fin, longer rostrum and characteristic arching surfacing pattern.

Dolphin sightings were plotted in ARC/INFO, a Geographic Information System (GIS). A 1 km by 1 km grid of the 1:250,000 AUSLIG digital map of Queensland was developed. This grid mapped the coastline of both the islands and the mainland. A similar grid was created for coral reefs. Distances to the nearest piece of land or reef were recorded for each cell of these grids using an inbuilt function (EUCDISTANCE; ESRI, 1991) of ARC/INFO. The dolphin sightings were then overlaid on these grids to determine the distance to the nearest object.

#### *Photo-identification in Moreton Bay*

Fieldwork took place within Moreton Bay, a large study area of  $1315\text{ km}^2$  (Corkeron 1990), relatively shallow, embayment in south-east Queensland (Fig. 2), between May 1984 and February 1987. Most research was carried out

from a research trawler during trawling operations; some data were collected from speedboats. Data recorded for each sighting included: species sighted, date and time of sighting, position (recorded either by radar or compass bearings on known landmarks), general behaviour of the group and details of the film used. Further details of field techniques are in Corkeron (1990).

Photographs were taken mostly using a Nikon FM2 with motordrive and a 300 mm Nikkor lens. Slide film (100 and 200 ASA) was used. Individual animals were identified by the distinctive patterns of scars on their dorsal surface, particularly on the caudal edge of their dorsal fin (Würsig and Würsig 1977). All photographs of dolphins were compared with an existing catalogue to determine whether an individual had been identified previously. When a new identification was made, the new animal was given an identification number and representative transparencies were entered into the catalogue.

## **Results**

### *Records*

Data held by museums and wildlife services in Australia include 25 records of dead stranded humpbacked dolphins. The spatial distribution of records is from northern New South Wales ( $31^{\circ}27'S$ ,  $152^{\circ}55'E$ ) on the east coast, to Exmouth Gulf ( $21^{\circ}56'S$   $114^{\circ}07'E$ ) on the west coast (Fig. 2).

### *Aerial surveys of the Great Barrier Reef region*

Between 1987 and 1995, 54 sightings of hump-backed dolphins were classified as certain. Sightings occurred throughout the Great Barrier Reef region (Fig. 3). The mean distance to the nearest point of land (mainland or island) for these sightings was 6.4 km (std. err. = 1.26, range = 0–55.6 km [as sighting distances were rounded to the nearest 100 m, those animals seen within 50 m of land were considered at 0 km]). Mean distance to the nearest shallow area (either point of land or charted reef, less than 2m deep at low tide) was 2.7 km (std. err. = 0.27, range = 0–8.1 km, Fig. 4).

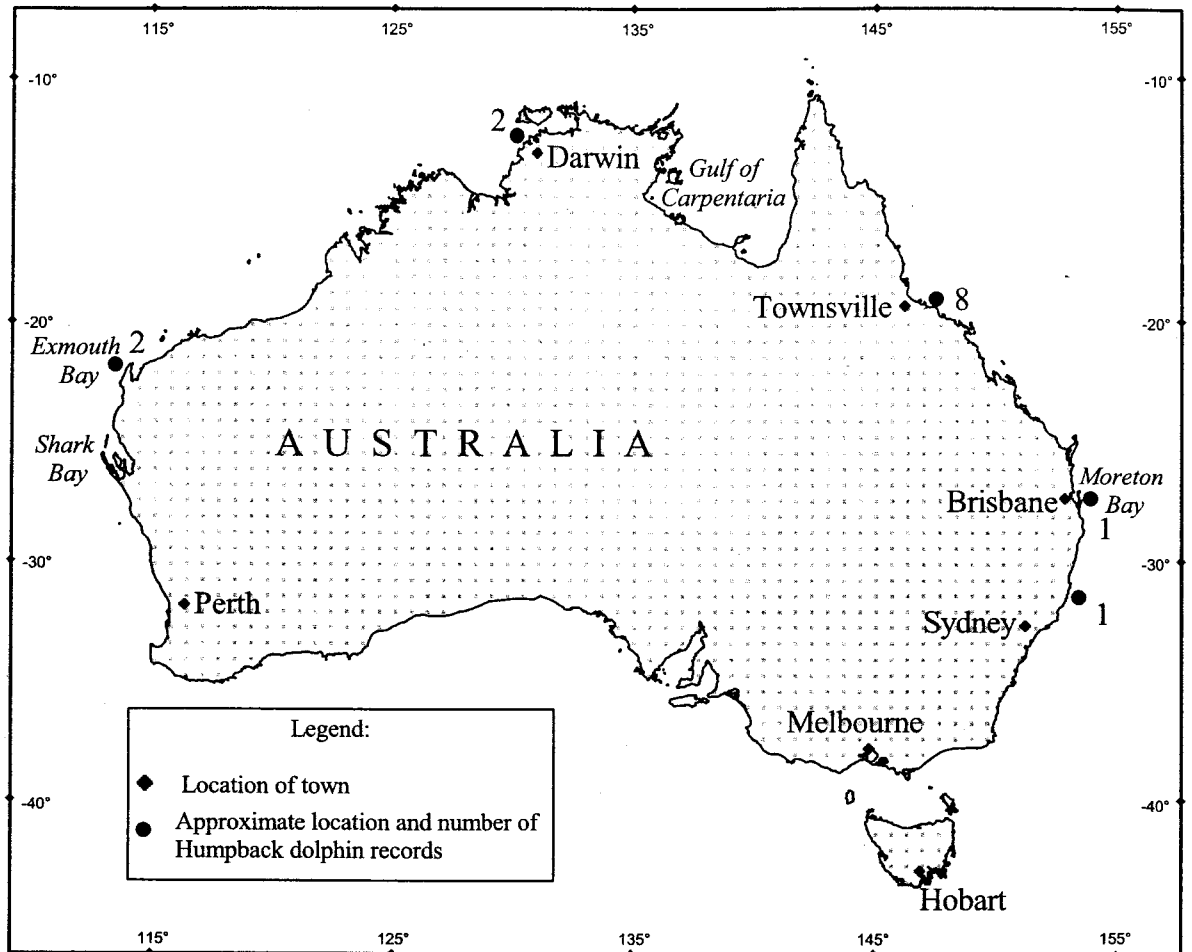


Fig. 2. Recorded positions of dead hump-backed dolphins reported by museums and wildlife services in Australia. Only records with accurate positions are shown.

As there were few sightings in any one year and no estimate of availability bias (the proportion of animals unavailable for sighting due to submergence, and water turbidity [Marsh and Sinclair 1989b]), there were insufficient data to generate a population estimate. However, raw counts of groups sighted on survey were lower in later surveys than they were in earlier surveys (Fig. 5).

#### Moreton Bay

Fifty individual hump-backed dolphins were photo-identified, during 31 days over the study

period. Sightings were divided into three periods of 10, 10 and 11 days on which hump-backed dolphins were photo-identified. Two population estimates, covering the periods 31 May 1984–4 February 1986 and 9 August 1985–20 February 1987 were calculated using the Minta-Mangel estimator (Minta and Mangel 1989) in the MS-DOS programme NOREMARK (White 1996). Estimates were 163 (95% confidence intervals = 108–251) and 119 (95% confidence intervals = 81–166), respectively, giving densities of  $0.124 \pm 0.082$ – $0.191$  dolphins·km<sup>-2</sup> and  $0.091 \pm 0.062$ – $0.126$  dolphins·km<sup>-2</sup>, respectively.

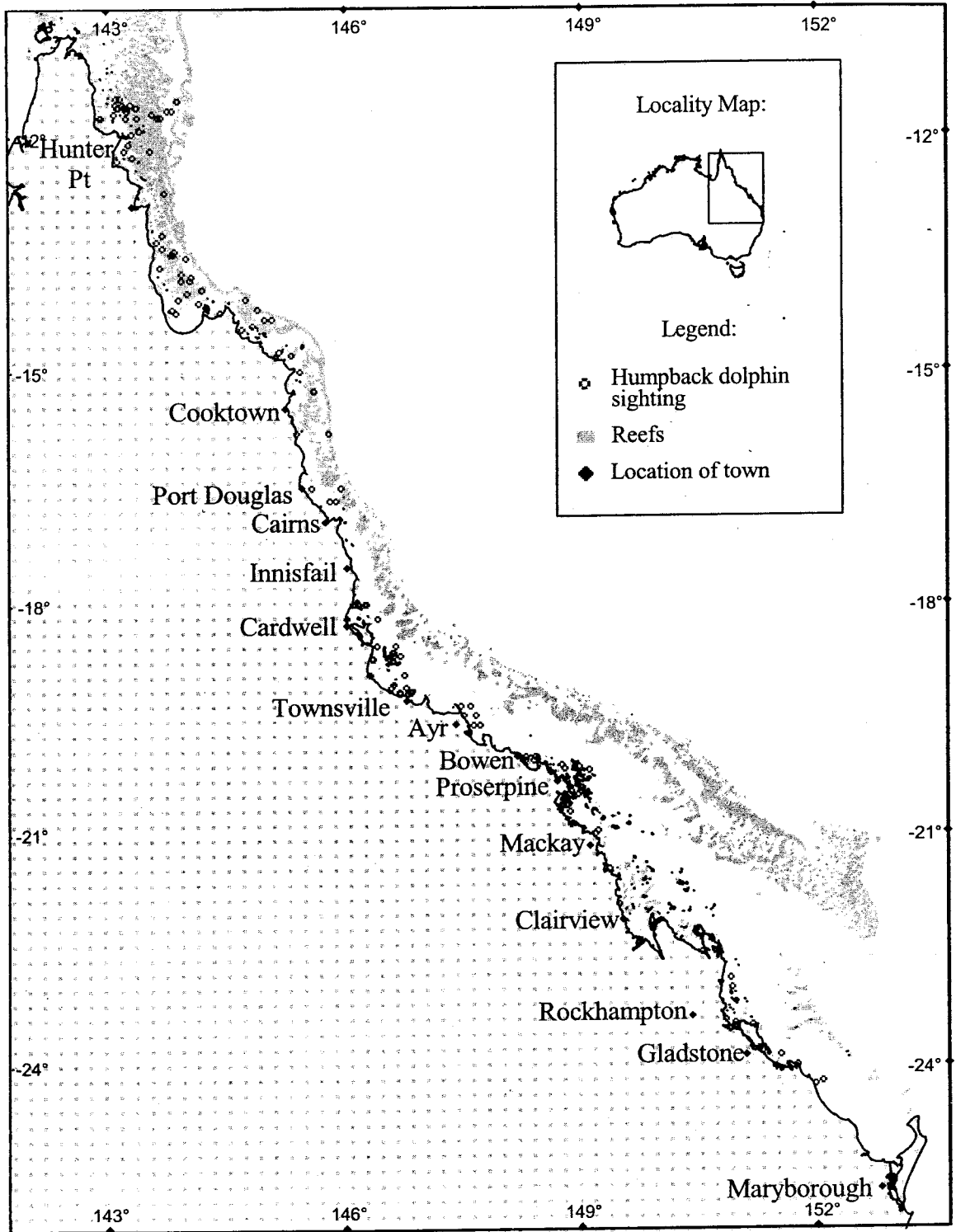


Fig. 3. Hump-backed dolphin sightings made during aerial surveys carried out between Hunter Pont and the southern boundary of the Great Barrier Reef Marine Park.

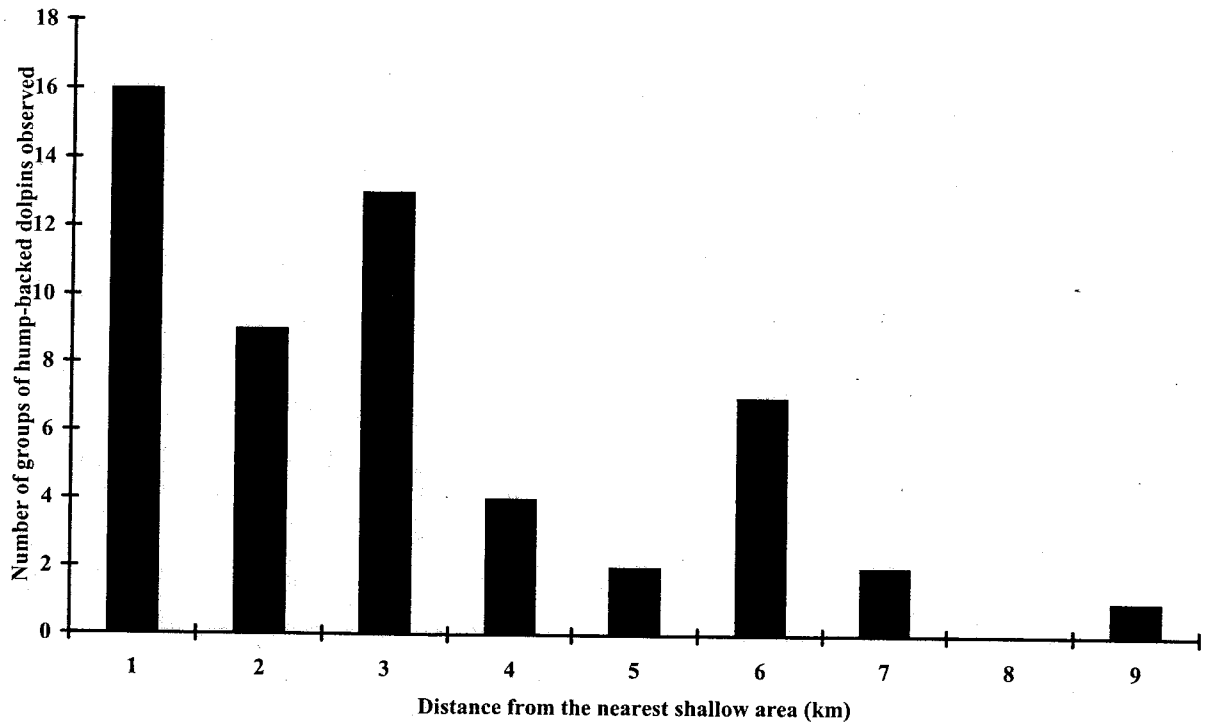


Fig. 4. Distances to the nearest shallow area (either point of land or reef) for groups of hump-backed dolphins observed during aerial surveys of the Great Barrier Reef region.

## Discussion

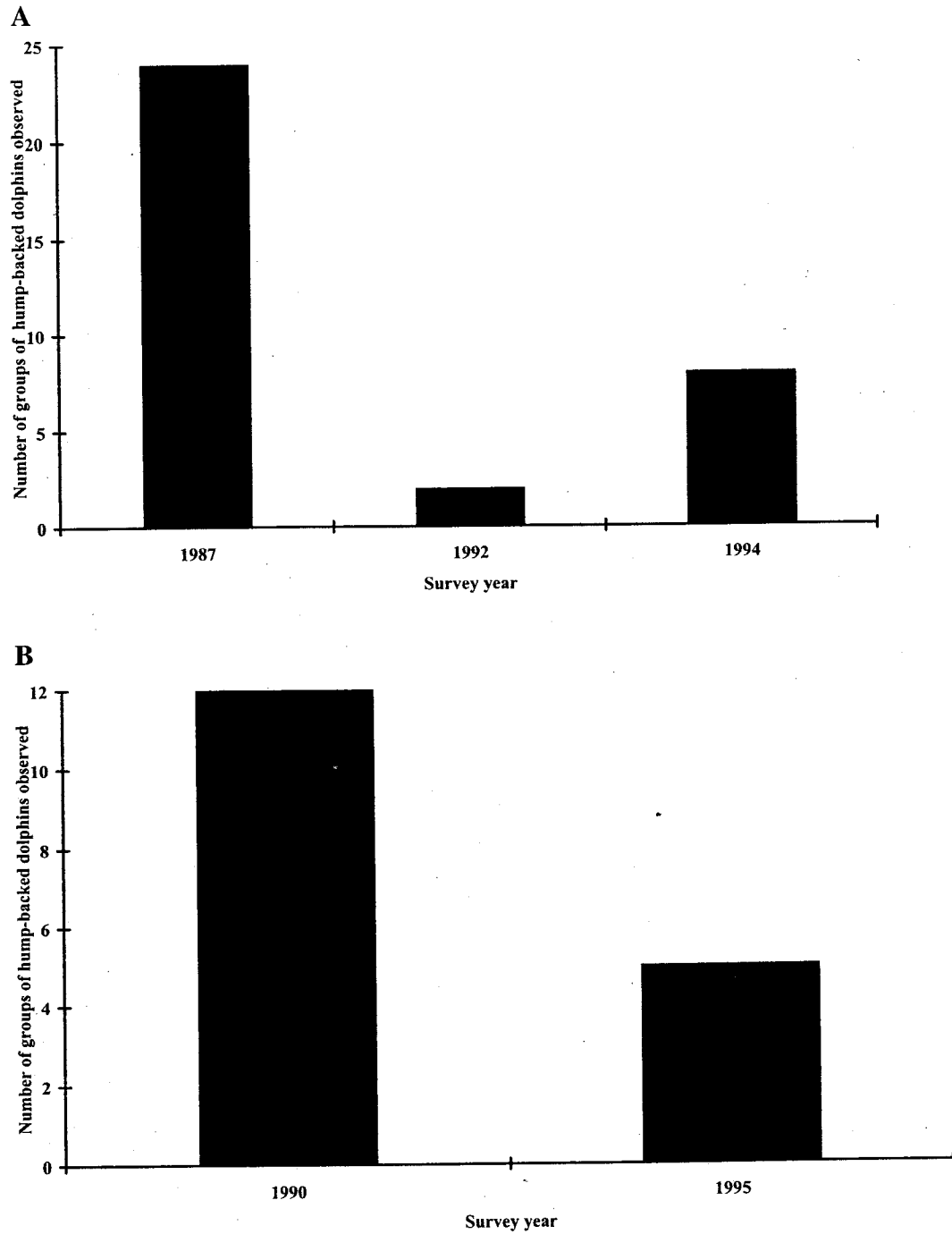
### *Distribution*

In Australia, hump-backed dolphins occur mostly in coastal northern waters, from approximately the Queensland — New South Wales border in the south-east to Exmouth Gulf in the south-west. Within this range, hump-backed dolphins are mostly confined to waters close to the coast or in embayments. An exception is in the waters of the Great Barrier Reef region, which are relatively sheltered, due to the protection from ocean swells afforded by the outer barrier reefs. In the northern waters off Cape York, reef or sand flats occur almost continuously from the mainland to the mid-shelf reefs. In this area, hump-backed dolphins occur offshore, although they remain close to reefs or islands. Dolphins would not have to traverse long distances of relatively deep water to occur in the areas where they have been sighted on aerial surveys. Also, (unlike elsewhere in the Great Barrier Reef region) the fish communities

of the mid-shelf reefs off northern Cape York are similar to those of inshore reefs (Williams 1983). If hump-backed dolphins are specialist feeders on inshore fish species, prey availability would not prevent them from inhabiting these waters. In the waters off Cape York, hump-backed dolphins utilise suitable habitat, even though the habitat extends to several kilometres from the mainland.

### *Abundance*

No estimate of the abundance of hump-backed dolphins in Australian waters can be made from available data. Aerial surveys suffer from a lack of information on availability bias, low numbers of sightings, and difficulties of identifying dolphins to species (Preen *et al.* 1997). Multiplying the density estimates from the Moreton Bay photo-identification study by the area inhabited by humpbacked dolphins in Australia has not been attempted, as the total extent of their habitat, including offshore waters in some regions, is unknown.



**Fig. 5.** Raw counts of hump-backed dolphin groups observed during aerial surveys of the Great Barrier Reef region. Figure 5A shows data for surveys conducted from approximately Dunk Island to the southern end of the the Great Barrier Reef region. As the 1994 survey did not include the area between Cooktown and Dunk Island, any hump-backed dolphin groups sighted north of Dunk Island on previous surveys were not included. Figure 5B shows data for surveys conducted from approximately Cooktown northwards to Hunter Point.

### Status

Hump-backed dolphins in Australian waters are subject to anthropogenic mortality from drowning in nets set by commercial fishers (Harwood and Hembree 1987) and nets set to provide bather protection from sharks (Paterson 1990). Commercial fishers do not keep records of cetaceans taken in nets and are not subject to an observer scheme, so takes of cetaceans are unknown (Anon. 1994). Cetaceans caught in anti-shark nets are recorded but not identified to species by netting contractors (Paterson 1990; Anon. 1992). Some carcasses have been retrieved for biological examination (Paterson 1990). Estimates of the take of hump-backed dolphins from the anti-shark nets were made according to the species' proportion of the sampled carcasses multiplied by the total number of cetaceans recorded as caught. Six of 24 (25%) dolphins collected from shark nets in the vicinity of Townsville were humpbacked dolphins (Heinsohn 1979). Catches in the Great Barrier Reef region (where bottlenose, humpbacked and Irrawaddy dolphins, *Orcaella brevirostris* (Owen in Gray 1866), are the species caught) constituted 47.8% of the catch in Queensland. The total catch of cetaceans by shark protection nets between 1967 and 1992 was 544 (Paterson 1990; Anon. 1992) suggesting that the take of humpbacked dolphins in the Great Barrier Reef region over this 25 year period was approximately 65 animals. This underestimates the total number of hump-backed dolphins caught in the anti-shark programme because: data on dolphin catches are unavailable for the first five years of the programme; hump-backed dolphins could be caught in nets set south of the Great Barrier Reef region, but data on catch composition are unavailable; and dolphin takes may be under-reported by netting contractors. Commercial gillnetting activities conducted throughout the Great Barrier Reef region (approximately 7000 km net days·year<sup>-1</sup>) (Marsh and Corkeron 1997; Marsh *et al.* 1996) are an order of magnitude greater than the anti-shark programme activities (approximately 733 km net days·year<sup>-1</sup>) (Marsh *et al.* 1996). Commercial gillnetting differs from the anti-shark programme

(mesh types and sizes, positions where nets are set, lengths of net), so direct extrapolation based on effort is impossible. However, it is likely that commercial netting accounts for considerably more dolphin deaths than does the anti-shark programme.

Hump-backed dolphins, due to their generally coastal habitat, are likely to be particularly susceptible to the intake of organochlorine pollutants (Cockcroft *et al.* 1991). Uptake of pollutants, based on recorded levels in local fish, was identified as a possible problem for hump-backed dolphins in parts of Moreton Bay (Preen *et al.* 1992). A recent review of pollutants in cetaceans in Australian waters (Kemper *et al.* 1994) included no samples from hump-backed dolphins. Pollutant loads in humpbacked dolphins in Australia warrant investigation.

The life history of hump-backed dolphins remains poorly known, but available data (Ross *et al.* 1994) suggest that their life history resembles that of bottlenose dolphins. One well-studied inshore population of bottlenose dolphins has an annual reproductive rate of approximately 5% per annum (crude birth rate =  $0.055 \pm 0.0089$ ; recruitment to age 1 =  $0.048 \pm 0.0085$ ) (Wells and Scott 1990). If the densities of hump-backed dolphins in Moreton Bay (approximately 1 animal·10 km<sup>-2</sup>) are representative for the region, then a population in 1000 km<sup>2</sup> of suitable habitat could produce approximately 5 calves·year<sup>-1</sup>. This suggests that low levels of anthropogenic mortality are likely to have a significant impact on populations of hump-backed dolphins

It is difficult to be certain about the status of hump-backed dolphins in Australian waters, as relevant data are scarce. The only information available on population trends is not encouraging. The small number of dolphin sightings recorded during aerial surveys of the Great Barrier Reef region declined between 1987 and 1995. This corresponds with a significant decline in the population of dugongs in the southern part of this region (Marsh and Corkeron 1996) over the same period. Despite their very different feeding ecology, both species' distribution and habitat in the Great Barrier Reef region are similar, and they share at least one threatening process (drowning

in gillnets). Our interpretation of the data available is that hump-backed dolphins populations are probably declining in Australian waters

Inshore marine mammals may be prone to habitat fragmentation (and perhaps genetic isolation) due to human disturbance. Marine mammals whose habitats include more offshore waters, are probably less affected. Also, animals whose habitat is closer to high densities of people, such as hump-backed dolphins throughout much of their range, are more likely to be immediately affected by human activities. Places such as the Great Barrier Reef Marine Park off Cape York, where hump-backed dolphins occur in more dispersed habitat and where local human population densities are extremely low, will

probably be particularly important for preserving hump-backed dolphins.

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