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Feasibility of using photo-identification techniques to study the Irrawaddy dolphin, *Orcaella brevirostris* (Owen in Gray 1866)

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Abstract

Irrawaddy dolphins, *Orcaella brevirostris*, present a particular challenge to study. They live in shallow, turbid waters, are inconspicuous, have unpredictable surfacing patterns, low surfacing profiles, and are generally elusive animals. Photographs of the dorsal region of Irrawaddy dolphins were taken between December 1998 and November 1999 in Cleveland and Bowling Green Bays, North Queensland, Australia in order to assess the feasibility of using photo-identification techniques in studies of this species. Thirty-five individual Irrawaddy dolphins, all adults, were identified in Cleveland Bay and three in Bowling Green Bay. Distinctive features were notches on the dorsal fin, including deep scars and cuts along the dorsal region, white marks on dorsal fin, and distinct dorsal fin shapes. The use of photo-identification to study Irrawaddy dolphins is feasible. Photo-identification can contribute significantly to the study of Irrawaddy dolphins' ecology and conservation biology.

Key words: photo-identification, Irrawaddy dolphin, *Orcaella brevirostris*, Australia.

Introduction

Over the past 30 years, identification of individual cetaceans using photographs of distinctive marks (photo-identification) has been a standard field technique, providing information on distribution, social structure, movement patterns and population parameters (Hammond *et al.*, 1990). Although photo-identification has proven valuable in studying several species of dolphins and porpoises (Würsig & Jefferson, 1990), the environment (e.g., brackish, shallow, muddy waters) and behavioural characteristics of some species (e.g., constant boat avoidance, unpredictable surfacing patterns, low surfacing profile, brief surfacings) have limited the use of photo-identification.

Irrawaddy dolphins (*Orcaella brevirostris*) are found mainly in shallow, brackish, estuarine, and coastal marine waters and some major river systems of Southeast Asia (Stacey & Arnold, 1999). Their distribution ranges from the east coast of India in the Bay of Bengal, the South China Sea, throughout the Indonesian Archipelago, to Papua New Guinea and northern Australia. The taxonomic status of the species remains unclear (Arnold & Heinsohn, 1996; Le Duc *et al.*, 1999). Irrawaddy dolphins present a particular challenge to study. They live in shallow, turbid water, are inconspicuous, have unpredictable surfacing patterns, low surfacing profile and, in general, are elusive (Dhandapani, 1992; Beasley & Jefferson, 1997; Kreb, 1999). A trial photo-identification study (Stacey, 1996) on the riverine population of the Irrawaddy dolphin in the Mekong River, Lao Peoples' Democratic Republic (Lao P.D.R.), showed that individuals are visually identifiable. However, Stacey (1996) concluded that the collection of suitable photographs was a challenge at that site, largely because of dolphins' elusive behaviour. Fishermen in Myanmar reported they could identify some individuals by distinctive behaviour and body characteristics (Smith *et al.*, 1997). Herein, we evaluate the feasibility of using photo-identification techniques to study marine populations of Irrawaddy dolphins in coastal waters of northern Australia.

Materials and Methods

Boat-based photo-identification surveys in Cleveland and Bowling Green Bays, North Queensland, Australia (Fig. 1) were made using either a 5-m fiberglass boat, with a 90-hp, outboard or a 4.7-m rigid-hulled inflatable boat, powered by a 50-hp outboard engine. Searches for Irrawaddy dolphins took place parallel to the coastline at a distance of 1–6 km from the coast. Surveys were conducted only in calm seas ($\leq$ Beaufort 3). The research team

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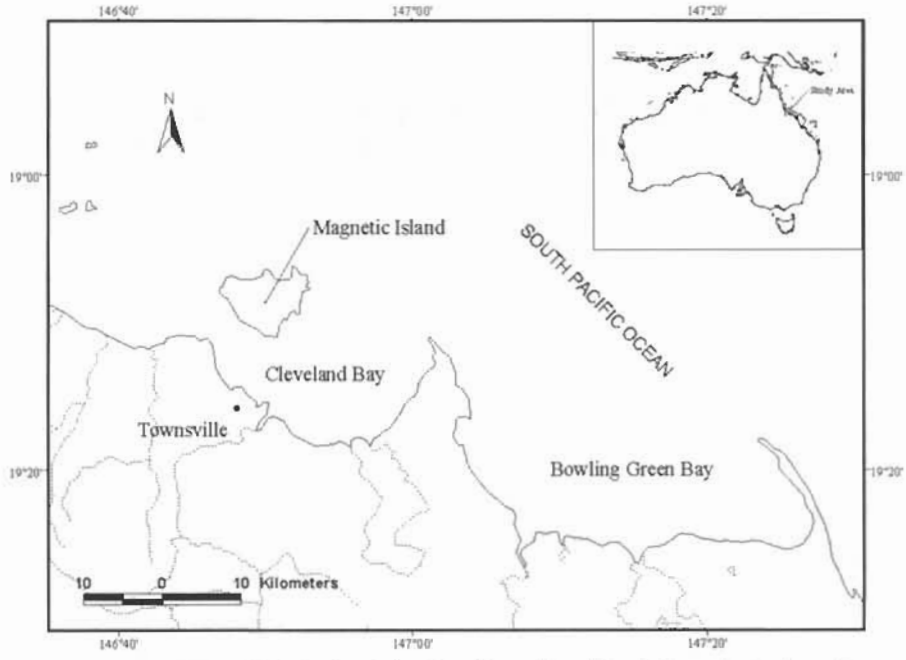

Figure 1. Location of Cleveland and Bowling Green Bays, North Queensland, Australia.

consisted of a boat driver, a data recorder and a photographer. The same person (GP) took photographs in all surveys. Once a group was sighted, the dolphins were approached slowly, parallel to their location and within a distance of 5–10 m. A 35-mm camera,with a 70–300-mm lens, shooting Kodak Ektachrome 100 ASA colour slide film (pushed to 200 ASA) at shutter speeds of 1/500–1/1000 of a second was used. Photographs were taken as perpendicular to the dolphin's body axis as possible and concentrated mainly on the dorsal region of the body. The photographer always attempted to photograph all individuals within a group. Photographic effort was terminated once the photographer considered that all dolphins within the group were photographed, or the effort was unsuccessful due to the behaviour of dolphins (e.g., active avoidance of the research vessel). In addition to photo-identification, data on the time and duration of sighting, location (using GPS), group size, group composition (number of adults, juveniles, and calves), behaviour (travelling, feeding, socializing, milling or unknown) and environmental data (sea state, swell height, water temperature, salinity, and clarity) were recorded. Identification, tracing, and classification of photographs followed suggestions made by Würsig & Jefferson (1990) for small cetaceans. The Dorsal Fin Ratio as an identification measure (Defran *et al.*, 1990) was not used because notches on the dorsal fin of Irrawaddy dolphins often lacked clearly distinct top and/or bottom points.

Dolphin groups were defined as aggregations of dolphins with relatively close spatial cohesion (Smolker *et al.*, 1992), with each member within 100 m of any other member. Calves were defined as individuals small in size ($\leq$2/3 the length of an adult), swimming regularly with, and spending most of the time in close attendance to, an adult. Juveniles were defined as individuals approximately 3/4 the length of an adult and swimming independently.

Results

From December 1998 to November 1999, 74 boat surveys were conducted in Cleveland Bay and four in Bowling Green Bay. Irrawaddy dolphins were sighted 45 times in Cleveland Bay and once in Bowling Green Bay. Twenty-nine (63%) of these 46 sightings were successful i.e., we were able to follow the dolphins and take photographs. Mean group size for successful photo-identification encounters was 5.6 ($\pm$ SE 0.4 animals, n=29), and the mean time spent with the dolphins during successful encounters was 0.98 h ($\pm$ SE 0.12 h, n=29).

Of the 1407 photographs taken between December 1998 and November 1999, 819 (58%) were selected for further analysis on the basis of image quality, i.e., focus, glare, angle of the animal in the photograph, distance, and the amount

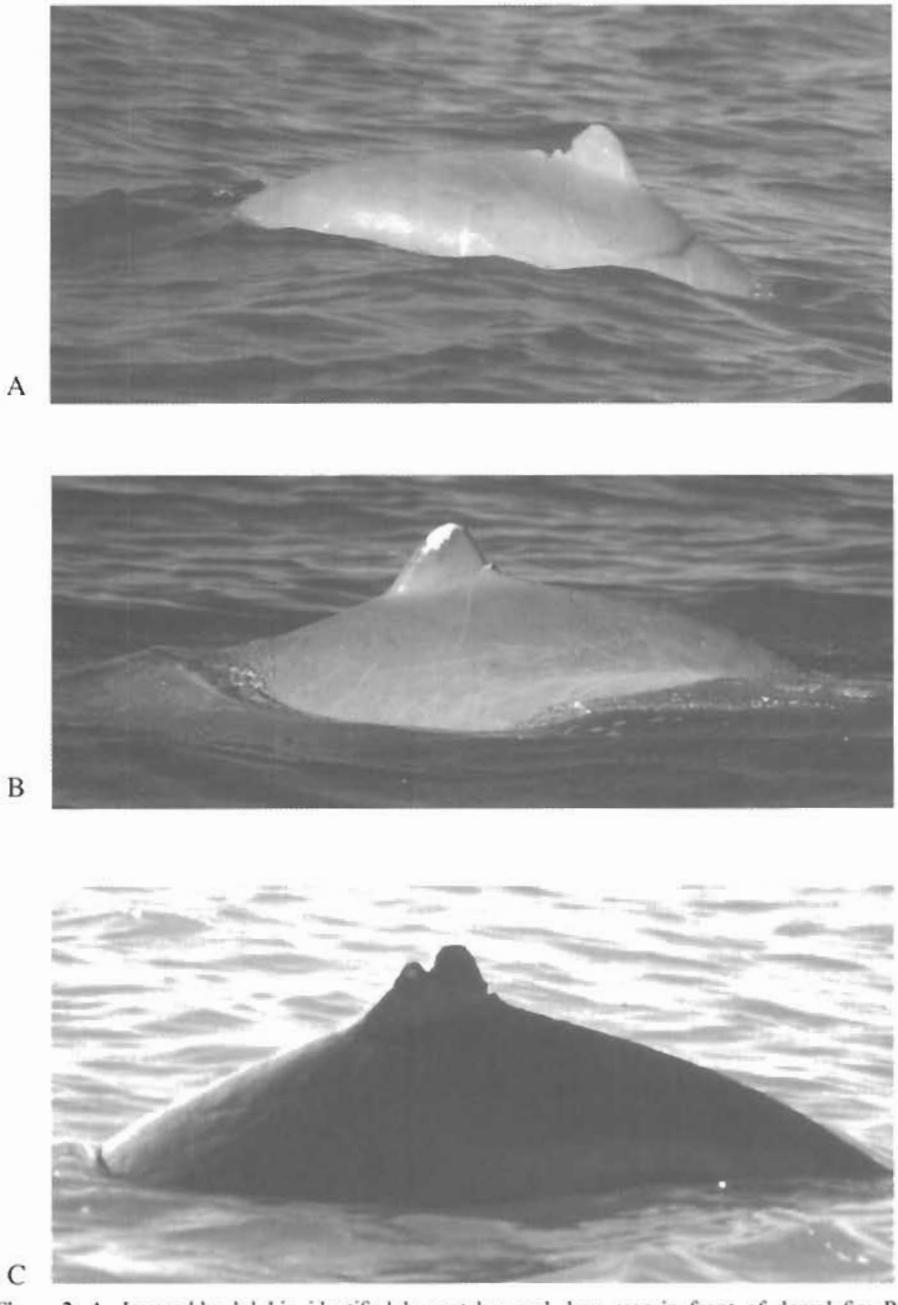

Figure 2. A. Irrawaddy dolphin identified by notches and deep scar in front of dorsal fin; B. Irrawaddy dolphin identified by notch and white mark along dorsal fin; C. Irrawaddy dolphin identified by notches, distinctive fin shape and white mark along dorsal fin.

of the animal shown in the image. A total of 38 individual Irrawaddy dolphins, all adults, were identified. Juveniles and calves were sighted and photographed during surveys, but animals of these age classes did not have any distinctive feature to allow identification. Thirty-three of the 38 identified individuals were seen only in Cleveland Bay, two were seen in both bays, and only three in Bowling

Green Bay. Of the 38 individuals identified, 19 (50%) were photographed on at least two different days and over periods of two to five months. All animals identified in Cleveland Bay during December 1998 were resighted during 1999 field periods.

Distinctive features were notches on the dorsal fin, including deep scars and cuts along the dorsal region (Fig. 2A), white marks along the dorsal fin (Fig. 2B), and distinct dorsal fin shapes (Fig. 2C). Eighteen animals were identified by notches only; 11 by notches and distinctive dorsal fin shapes, three by notches and white marks on dorsal fin, four by notches, distinctive dorsal fin shapes and white pigmentation patterns, and two by distinctive dorsal fin shape only. Animals often were observed involved in close body contact, including biting, during social activities. This could explain the origin of notches on the dorsal fin and dorsal region. Deep scars on the dorsal region and cuts along the back could have been produced either through interactions with sharks (Fig. 2A) and/or anthropogenic factors (e.g. monofilament nets, propeller blades). The occurrence of white marks on the dorsal fin indicated abrasion of the pigmented integument, but the origin of such marks remains uncertain. No evidence of changes in notches or pigmentation was observed through the study period.

Discussion

This research confirms that adult Irrawaddy dolphins can be studied using photo-identification in the Townsville region. Despite their elusive behaviour elsewhere, Irrawaddy dolphins in Cleveland Bay and Bowling Green Bay seem to be habituated to the presence of boats. There were only 10 motorboats in the village adjacent to Stacey's (1996) study area in the Mekong River, Lao P.D.R. By April 1999, there were 7445 registered motor boats up to 10 m in length in the Townsville region (Queensland Transport, personal communication). Motor boating has been a popular pastime in Townsville since at least the 1950s (Taylor, 1980). We used a slow motoring boat, instead of paddling (used by Stacey (1996)) which enabled us to maintain a closer distance to surfacing animals.

Photo-identification can contribute significantly to the study of Irrawaddy dolphins' distribution, social structure, movement patterns, and estimation of population parameters in coastal waters. Despite the broad distribution of Irrawaddy dolphins in northern coastal waters of Australia, no comprehensive studies have been carried-out, and information on their ecology is practically non-existent. The relatively pristine and undeveloped northern coast of Australia could hold the most secure population(s) of Irrawaddy dolphins throughout their range (Perrin *et al.*, 1996). Planning for the conservation and survival of the species is needed. This study represents a first-step into solving one of the basic problems in developing conservation strategies for Irrawaddy dolphins i.e., lack of information.

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