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GROUP SIZE AND SEASONAL PATTERN OF OCCURRENCE OF HUMPBACK DOLPHINS SOUSA CHINENSIS IN ALGOA BAY, SOUTH AFRICA

L. KARCZMARSKI, V. G. COCKCROFT† and A. McLACHLAN‡*

The occurrence of humpback dolphins *Sousa chinensis* and their group size in Algoa Bay, South Africa, are described for the period May 1991–May 1994. The mean group size of dolphins was seven (ranging between 3 and 24). Group size was not affected by diurnal, tidal or lunar variability. Solitary, large individuals were commonly observed and they occasionally joined groups of other humpback dolphins. The number of sightings of humpback dolphins per unit effort and their group size varied seasonally, increasing in summer and again in late winter. These observations follow a regular seasonal fluctuation in water temperature, coincide with the dolphins' reproductive seasonal cycle and could be related to seasonal changes in the abundance and distribution of their prey.

Seasonal variability in occurrence and distribution has been reported for several dolphin species and is thought to be a response to seasonal habitat fluctuations and movements of prey (e.g. Condy *et al*. 1978, Selzer and Payne 1988, Reilly 1990). Seasonal movements and distributions of dolphins are, however, often obscured by the fact that some animals remain in the same area year-round. In such cases, although seasonal movements cannot be discerned, there are definite seasonal differences in numbers of animals (Shane *et al*. 1986).

Humpback dolphins *Sousa chinensis* inhabit Indo-Pacific coastal waters and are found along the east and south coasts of South Africa (Ross *et al*. 1994). However, knowledge of the biology and ecology of this species is fragmented (Saayman *et al*. 1972, Saayman and Tayler 1979). This study reports on sightings of humpback dolphins recorded in the Algoa Bay region on the south-eastern coast of South Africa during a three-year period. Their pattern of occurrence is related to seasonal changes in the environment.

MATERIAL AND METHODS

Definitions

The term "group" refers to any aggregation of dolphins (including any age-classes within visual range of the survey team) in apparent association and engaged in similar activities for most of the observation period. Each time a group was observed, it was recorded as a "sighting". The term "sighting", however, includes observation of solitary animals. Consequently, although "group" and "sighting" are defined differently, both refer to sampling units in the field.

The term "population" is used here to describe the dolphins recorded in the Algoa Bay study area. It does not refer to a condition of reproductive isolation. The term "survey day" refers to a day when at least one land- or sea-based survey was conducted.

"Summer" is defined as the period when the mean inshore sea surface temperature (SST) is higher than the annual mean (18°C). The period when the SST drops below this annual mean is referred to as "winter". Consequently, the first days of May mark the beginning of "winter" and late October marks the beginning of "summer". Such oceanographic observations generally correspond with the climatological pattern of the region (Stone 1988, Goschen 1988, 1991).

The study area

Algoa Bay is the easternmost and largest of several bays found on the south-east coast of South Africa (Fig. 1). The Bay is flanked on the western side by Cape Recife and on the eastern side by the less prominent Cape Padrone. Most of Algoa Bay is < 50 m deep (Fig. 1). The mean spring and neap tidal ranges are 1.61 and 0.51 m respectively. Inshore SSTs vary

* Centre for Dolphin Studies, Port Elizabeth Museum, P.O. Box 13147, Humewood 6013, and Department of Zoology, University of Port Elizabeth, P.O. Box 1600, Port Elizabeth 6000, South Africa; now Midway Spinner Dolphin Research Project, Midway Island Station #2, P.O. Box 29460, Honolulu HI 96820 ñ 1860, U.S.A. Email:
† Centre for Dolphin Studies, P.O. Box 1856, Plettenberg Bay 6600, South Africa. Email:
‡ Department of Zoology, University of Port Elizabeth; now College of Science, SQU, P.O. Box 36, SQU 123, Oman.
Email: antonmcl@suq.edu.om

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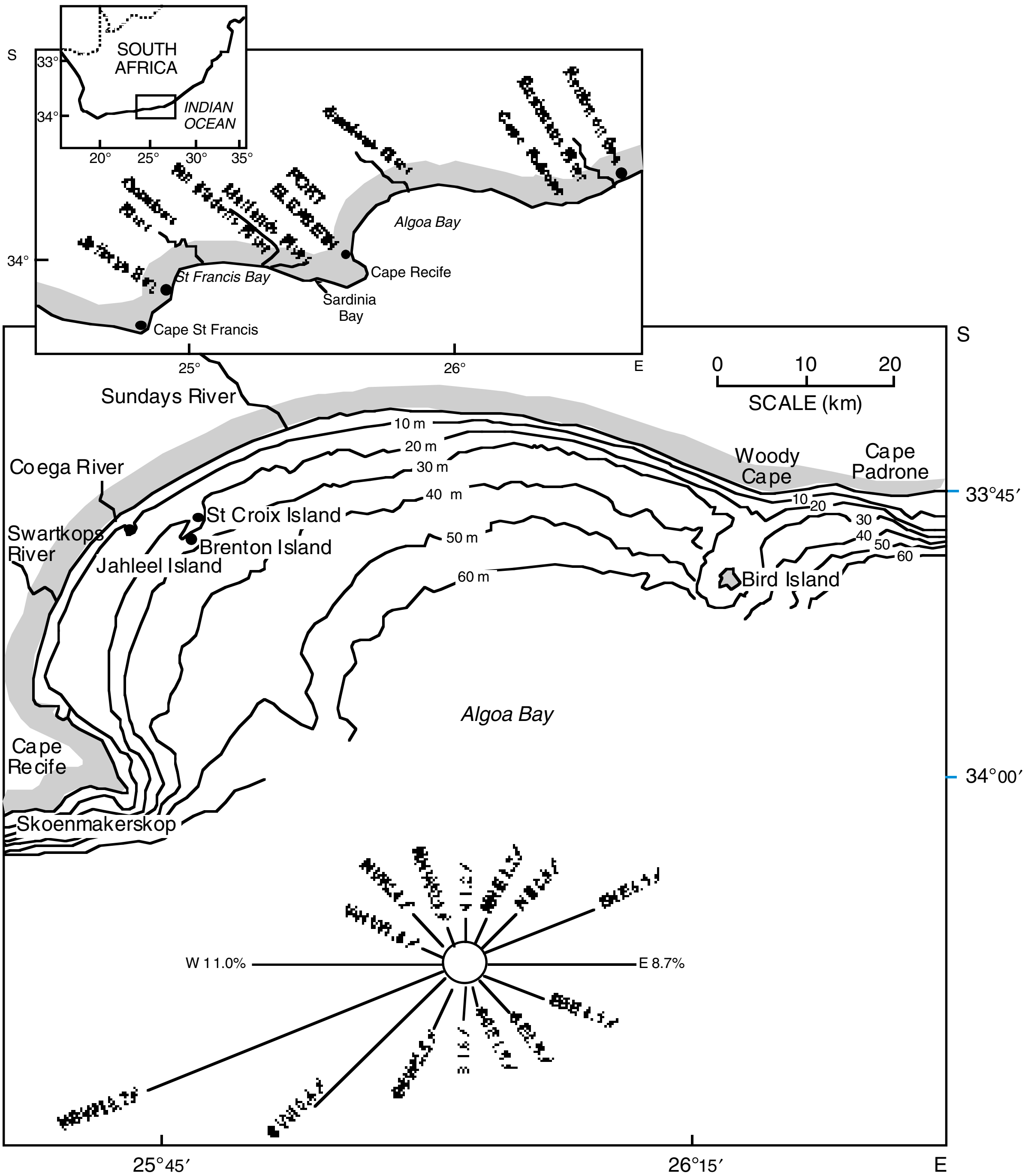

Fig. 1: The Algoa Bay study area on the South-Eastern Cape coast of South Africa. The wind data were provided by the South African Weather Bureau

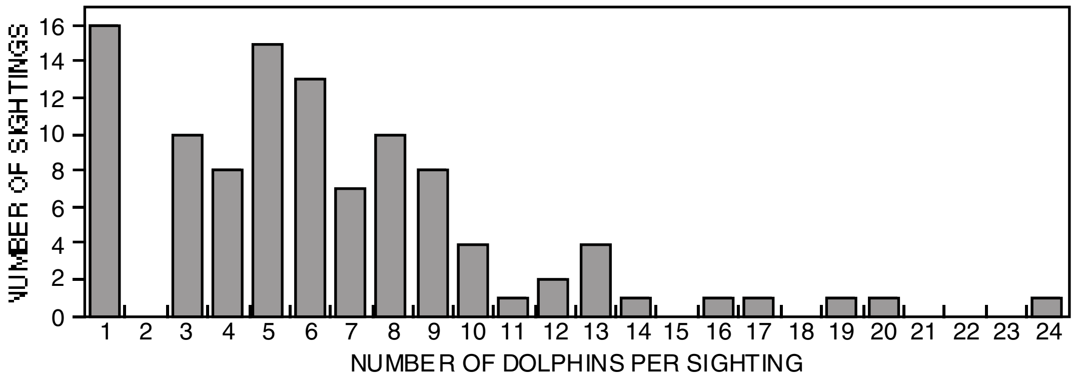

Fig. 2: Frequency distribution of the number of humpback dolphins per sighting recorded in Algoa Bay between May 1991 and May 1994

seasonally within a range of about 8JC. SST variability is greatest in February, March and April, decreases during winter and increases again from October onwards. During summer, surface waters within Algoa Bay are warmer than adjacent waters, whereas in winter the opposite is the case (Beckley 1983, Goschen 1988, 1991). Wind speeds are greatest between September and February and decrease in winter, with minimum wind speeds during May through to July. The onshore, west-south-westerly winds are dominant throughout the year and tend to decrease the height of swells in the inshore zone of the bay. Easterly winds, which are prevalent in summer, bring deep-sea waves into the bay, which heighten the swells (Goschen 1988, 1991).

Survey procedure

Sea- and land-based surveys were undertaken along approximately 55 km of coastline of the south-western region of Algoa Bay (Fig. 1) during a three-year period from May 1991 to May 1994. Land-based surveys were carried out daily (weather permitting) and observations of inshore waters (to approximately 1 km offshore) were carried out from several vantage points. The areas observed from each vantage point generally overlapped.

Land-based surveys usually started 1–2.5 h after sunrise and were conducted by one, and occasionally two, observers. The coastline was scanned with and without binoculars for 10 minutes at each vantage point. Two pairs of binoculars (9 × 35 and 20 × 60) were used. When seen, the size of dolphin group was estimated and its locality and direction of movement were recorded. The most characteristic feature of the humpback dolphin that distinguishes it from other dolphins and ensures positive identification is the wide dorsal hump (or ridge) in the middle of the animal's back, from which the dorsal fin emerges.

The sea state and swell height were also recorded. Weather and sea conditions permitting, surveys were repeated up to 4–5 times per day. Surveys were discontinued if the sea state exceeded Beaufort Scale 3.

Sea-based surveys were opportunistic. If a group of dolphins was sighted from land, a boat survey was conducted to identify it photographically. Initially, the boat progressed approximately 1 km past the dolphin group to ensure that all members of a group were located. Dolphins were photographed using a motorized camera equipped with a variable length (70–210 mm) lens and 100 ASA colour positive film. Individuals were identified following the procedure described by Karczmarski and Cockcroft (1998). Estimates of group size and composition were repeated several times during a survey and subsequently confirmed photographically. From January 1992, water clarity (Secchi Disc depth) and temperature (SST) were also recorded. As the sea conditions in the Bay usually deteriorated during the course of the day, the extent of coastline covered (ranging from 12 to 35 km) and time spent at sea (ranging from 1.5 to 7 h) varied considerably between surveys. Sea-based surveys were never conducted more than once a day.

RESULTS

Humpback dolphins were seen in Algoa Bay

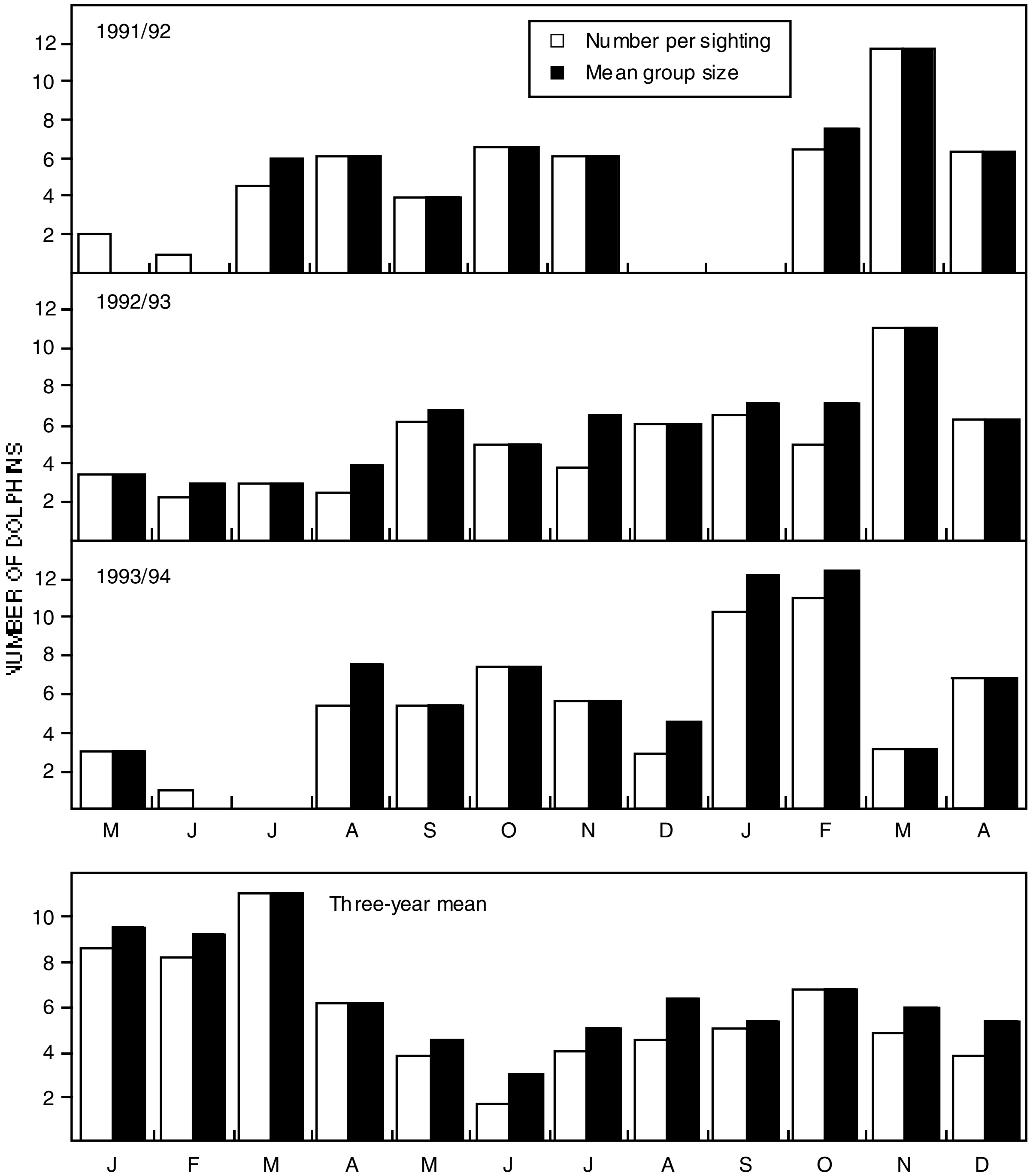

Fig. 3: Mean number of humpback dolphins per sighting and mean group size observed per month in Algoa Bay in three consecutive years between May 1991 and May 1994. The three-year mean is also shown

104 times and directly observed for about 300 h. In all, 68 sea-based surveys were completed (177 h), but photographs recording group size and composition were taken only during 58 boat surveys (157 h). Most sightings (87%) were within 150–400 m of the shore. Only twice were more than one sighting (a group and a solitary individual) recorded on the same day.

Humpback dolphins were recorded with similar frequency throughout the tidal cycle and they often remained in the area for several hours, apparently unaffected by the changing tide. Sightings were made in water of varying clarity. Secchi disc depths ranged from 2.25 to 12.0 m, with a mean of 4.5 m for both winter (n = 16, SD = 1.67) and summer (n = 31, SD = 1.80). Mean SST recorded during the boat surveys was 16.5 ± 1.44°C (n = 17) and 21.3 ± 1.50°C (n = 32) for winter and summer respectively.

Solitary individuals were observed throughout the year. They constituted 15.4% (n = 16) of sightings, which is higher than the sighting frequency for any group size (Fig. 2). Group size varied between 3 and 24 animals (mean = 7 ± 2.52), but seldom exceeded 13 (Fig. 2). Generally, the group size did not change during an observation and it was not affected by the tide cycle (Mann-Whitney U-tests, $p > 0.05$), time of day (Kruskal-Wallis ANOVA, $p > 0.05$) or distance offshore (Kruskal-Wallis ANOVA, $p > 0.05$).

The overall mean number of humpback dolphins per sighting was 6 (± 2.72). Both the mean number of animals per sighting and mean group size varied considerably throughout the year (Fig. 3). The mean sighting size and the group size were significantly higher in summer and late winter (Kruskal-Wallis ANOVA, $p < 0.05$).

Humpback dolphins were observed in Algoa Bay throughout the year, but the number of sightings per unit effort (sightings per hour of searching effort during land-based surveys) varied monthly. This pattern was consistent during each year of study (Fig. 4). The number of sightings per unit effort was significantly higher in summer and late winter (Kruskal-Wallis ANOVA, $p < 0.05$).

The number of animals per sighting, group size or number of sightings per unit effort were significantly correlated (Spearman Rank Correlation, $p > 0.05$) with sea state (measured at 08:00 or at 15:00) or with swell height (Fig. 5). However, they were significantly correlated ($p < 0.05$) with mean monthly SST. Water clarity was significantly correlated with the rate of sightings ($p < 0.05$), but not with the number of animals per sighting or group size.

The lunar phase did not have a significant affect on the sighting rate, number of animals per sighting or group size (Kruskal-Wallis ANOVA, $p > 0.05$).

DISCUSSION

In Algoa Bay, humpback dolphins were observed generally within 150-400 m of the shore. Only two groups were seen venturing about 1–1.5 km offshore and, in both instances, the animals moved back inshore after a short period (Karczmarski *et al.* in press). Humpback dolphins have never been recorded more than 1 km from the shore in that region (VGC, unpublished data). The restricted, inshore occurrence of this species has also been reported for other regions along the South African coast and elsewhere (see review by Ross *et al*. 1994).

The proportion of solitary humpback dolphins in Algoa Bay is similar to the 20% of sightings of that species reported for the KwaZulu-Natal coast, South Africa (Durham 1994). The size range of humpback dolphin groups in the Bay is in accordance with that reported for other humpback dolphin populations (Ross *et al.* 1994), the mean (7 animals) corresponding closely to that of Saayman and Tayler (1979) and Durham (1994).

Reasons for the increase in numbers and group sizes of humpback dolphin in Algoa Bay in summer may include the increase in availability of their prey. Although limited, available data indicate that humpback dolphins in Eastern Cape waters feed predominantly on estuarine and reef-associated fish and cephalopods (Barros and Cockcroft 1991, VGC, unpublished data). The abundance of several reef-associated fish seems to increase during both summer and late winter (Buxton and Smale 1989), and chokka squid *Loligo vulgaris reynaudii* spawn more intensively in summer in inshore waters of the Eastern Cape (Sauer 1993). Also, several other fish species form inshore spawning concentrations during summer and/or winter (Hecht 1976, Lasiak 1981, 1982, 1983a, b). The winter migration of sardine *Sardinops sagax* up the East Coast, the so-called “sardine run”, is associated with the migrations of several fish, birds and dolphins (Cockcroft and Peddemors 1990, Armstrong *et al.* 1991).

The humpback dolphin population in Algoa Bay exhibits considerable seasonal immigration into and emigration out of the bay in summer (Karczmarski in press), as well as possible extensive movement along the coast (Karczmarski 1996). Therefore, the greater number of sightings during summer may be a consequence of a number of individuals or groups temporarily entering the region during that period. The larger size of the groups in summer may reflect temporary associations of the increased number of animals in the area. Alternatively, humpback dolphin groups in the Algoa Bay region may disperse more widely in winter.

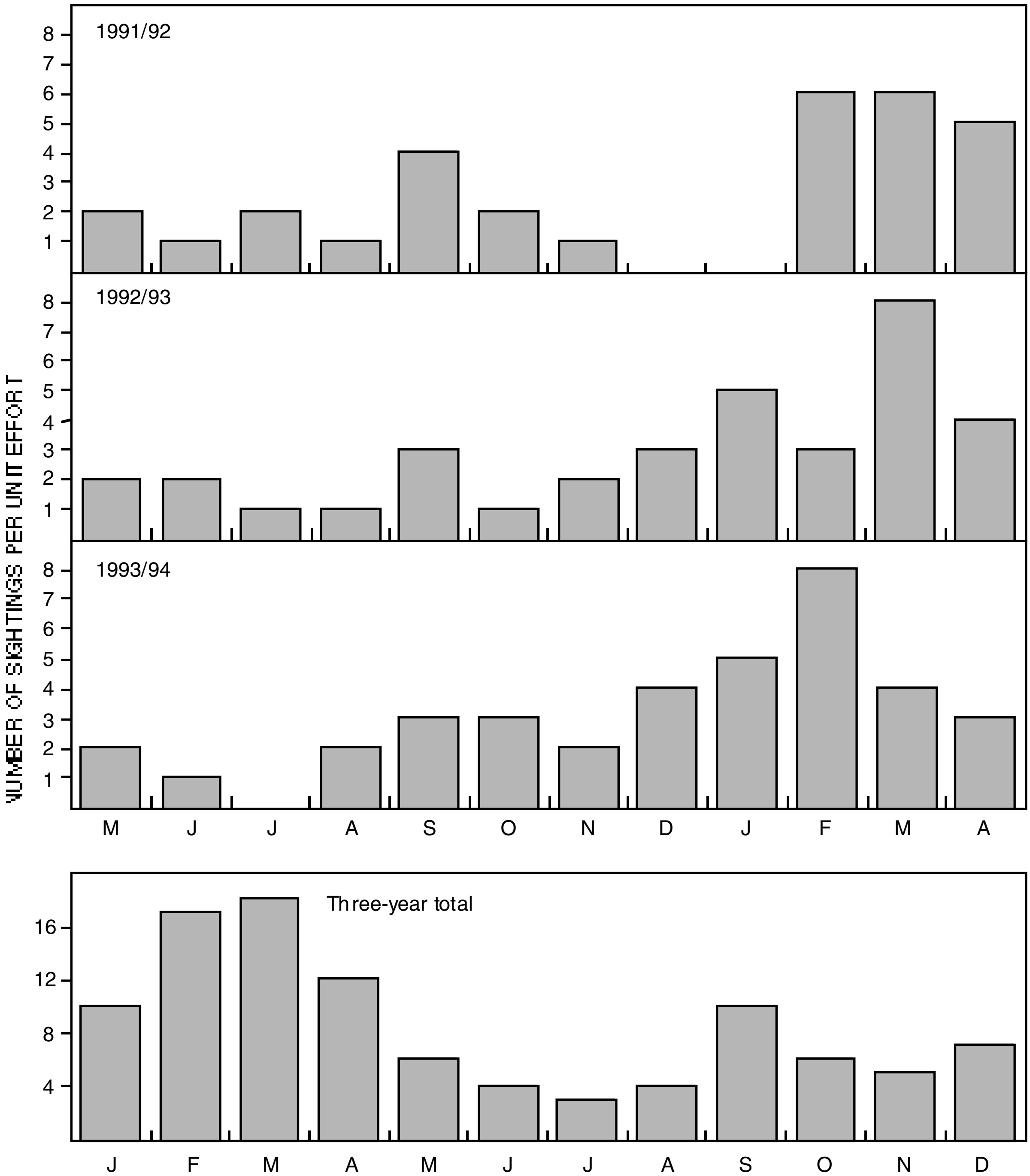

Fig. 4: Number of sightings of humpback dolphins per unit effort (sightings per hour by land-based survey) per month in Algoa Bay in three consecutive years between May 1991 and May 1994. The three-year total number of sightings per unit effort is also shown

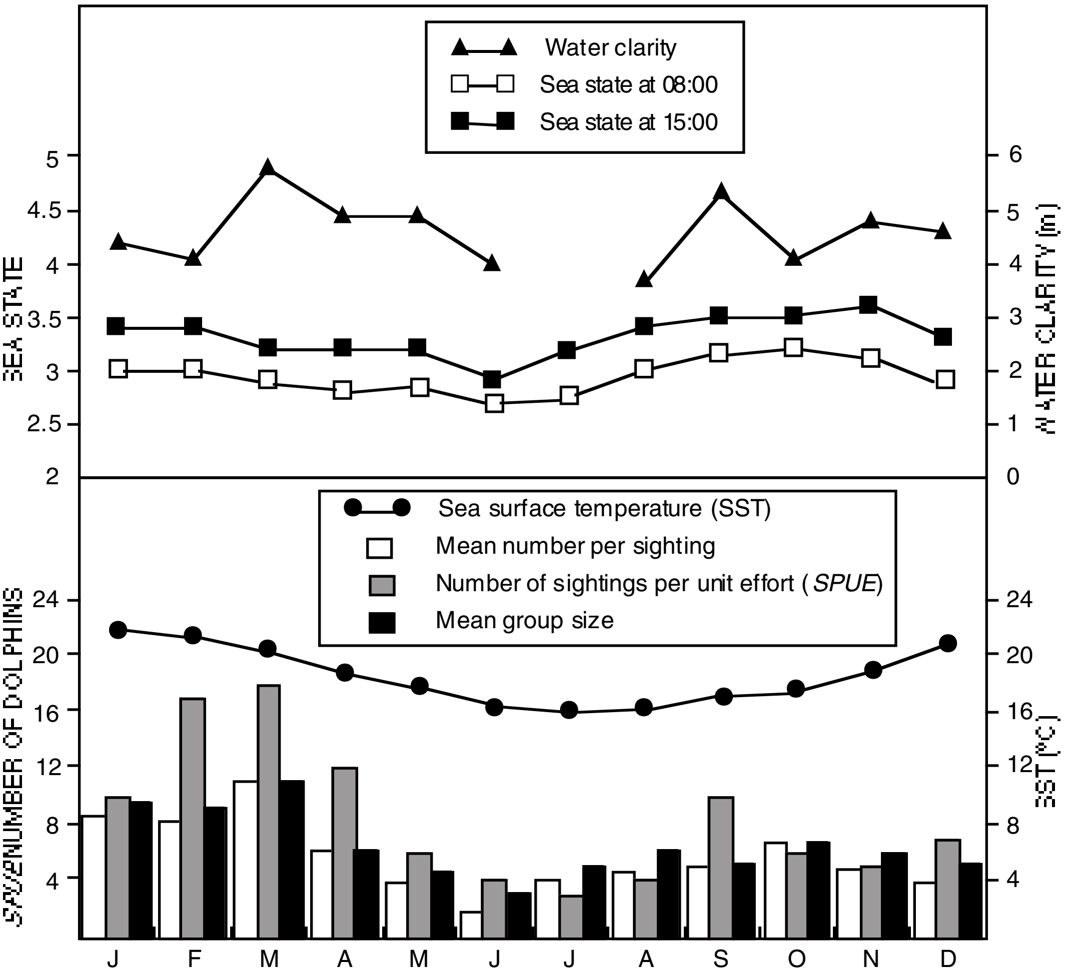

Fig. 5: Number of sightings of humpback dolphins per unit effort, mean number of animals per sighting and mean group size recorded per month in Algoa Bay between May 1991 and May 1994 in relation to mean monthly SST, mean monthly sea state at 08:00 and 15:00, and mean monthly water clarity between January 1992 and May 1994

It is uncertain, however, whether the seasonal variability in occurrence and group size of humpback dolphins in Algoa Bay is a consequence of long-range migration or a seasonal shift in distribution along a relatively limited stretch of the South African coastline.

The seasonal increase in the size of humpback dolphin groups in Algoa Bay may be associated with their reproductive activity. Births of humpback dolphins in that region occur mainly in summer and, to a lesser degree, in winter (Karczmarski in press). It seems likely that larger groups of humpback dolphins in summer and winter offer a protected environment within which early postnatal development and learning may occur (Wells et al. 1987). Larger groups are believed to provide more sensory integration (Norris and Dohl 1980) and increased protection for the individual (Hamilton 1971), and possibly facilitate allopaternal behaviour (Wells *et al*. 1987). Furthermore, larger groups may provide males with easy access to many females, facilitating genetic exchange among populations.

The present study provides indications of links between the seasonal occurrence/abundance of humpback dolphins in Algoa Bay, their group size, reproductive activity, prey availability and water temperature. Bottlenose dolphins *Tursiops truncatus*, also exhibit similar seasonal patterns in Algoa Bay (LK, unpublished data), which further supports the belief that the life history of dolphins in that region could be environmentally driven and related in part to prey availability. Research to provide more information on dolphin diet is required to clarify the extent that the prey availability influences the seasonal movement and density of dolphins on the south-east coast of South Africa.

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