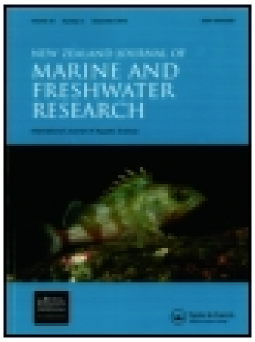

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Seasonal movements of short-beaked common dolphins *(Delphinus delphis)* in the north-western Bay of Plenty, New Zealand: Influence of sea surface temperature and El Niño/La Niña

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Short communication

Seasonal movements of short-beaked common dolphins (*Delphinus delphis*) in the north-western Bay of Plenty, New Zealand: influence of sea surface temperature and El Niño/La Niña

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Abstract Movement patterns of small cetaceans are influenced by a great number of variables including prey availability, sea floor profile, thermocline, oxygen minimum layer, and sea surface temperature (SST). Presented here are data on short-beaked common dolphins (*Delphinus delphis* L.) in New Zealand, showing a seasonal offshore-shift in their distribution, which appears to be correlated with SST. *D. delphis* moved from a mean distance of 9.2 km (SD = 4.42) from shore in spring and summer to a mean distance of 20.2 km (SD = 3.86) from shore in autumn. During warmer La Niña conditions their mean distance from shore was further reduced to only 6.2 km (SD = 2.56), and offshore movement was delayed by a month. Worldwide, *D. delphis* can be found throughout a wide range of sea temperatures, and it is therefore unlikely that SST is the primary factor influencing their distribution. It is hypothesised, that SST influences the distribution of *D. delphis* prey, which in turn affects their seasonal movements.

Keywords common dolphins; *Delphinus delphis*; sea surface temperature; distribution; El Niño; La Niña

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INTRODUCTION

A variety of studies have focused on movement patterns of small cetaceans. Results of these studies show that movements vary both within and between species and are influenced by a great number of variables including: prey availability (Cockcroft & Peddemors 1990), sea floor profile (Hui 1979; Selzer & Payne 1988; Gaskin 1992; Gowans & Whitehead 1995; Davis et al. 1998), thermocline (Reilly 1990), oxygen minimum layer (Polachek 1987), and sea surface temperature (SST) (Gaskin 1968; Dohl et al. 1986). In New Zealand, common dolphins are seen regularly from the Bay of Islands in the north (Constantine & Baker 1997) to Kaikoura in the south (Würsig et al. 1997). Presented here are data on the distribution of short-beaked common dolphins (*Delphinus delphis* L.) in the north-western Bay of Plenty, New Zealand. These were collected during a study on the behavioural ecology of common dolphins and their interactions with tourism. The results indicate a seasonal offshore-shift in the dolphins' distribution, which appears to be correlated with SST.

METHODS

Data (n = 231 sightings) were collected in Mercury Bay (east coast of Coromandel Peninsula, North Island, New Zealand) from a commercial dolphin-watching vessel based in Whitianga, from January 1993 to May 1999, by Rod and Elizabeth Rae, and the author. These trips allow tourists to view and possibly swim with wild dolphins. Typical field effort was 4 h per trip, covering c. 50–60 km of transect, leading out of the mouth of Mercury Bay in either a north-easterly or south-westerly direction. Because the objective of these trips was to allow tourists to view and/or swim with wild dolphins, and not to survey a particular transect, each data point collected represents the first school of dolphins encountered on any given day. This biases the results towards dolphins closest to shore, and therefore

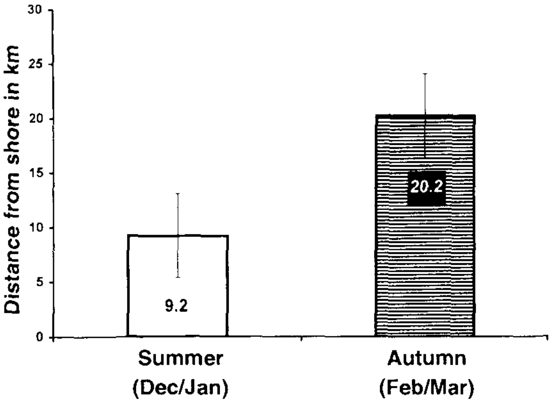

Fig. 1 Mean distance of common dolphins (*Delphinus delphis*) from shore in summer (light bar) and autumn (dark bar) from 1993 to 1999.

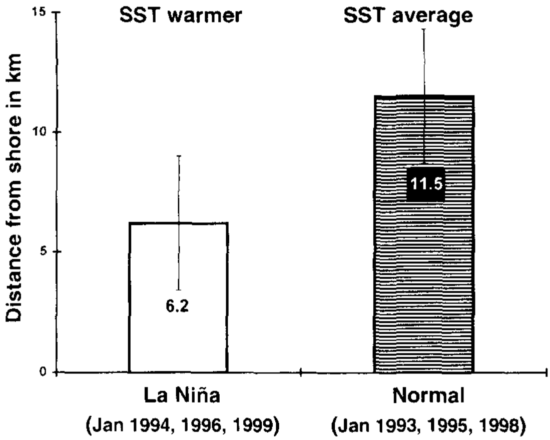

Fig. 3 Mean distance of common dolphins (*Delphinus delphis*) from shore in summer during La Niña conditions (light bar) and average sea surface temperature (SST) conditions (dark bar).

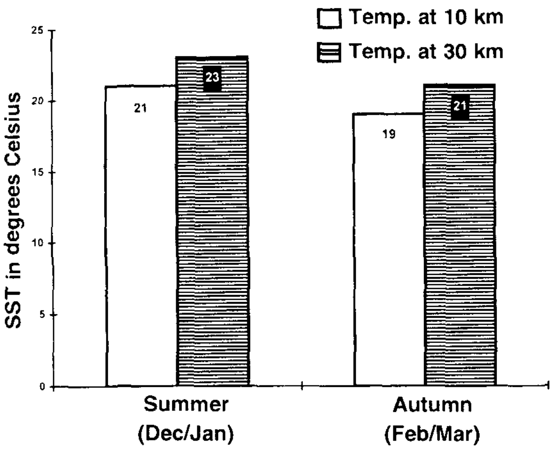

Fig. 2 Differences in average sea surface temperature (SST) 10 km from shore and 30 km from shore in summer and autumn.

should be a relatively accurate representation of the shoreward boundary of the dolphins' home range over the seasons, but not of their range farther out to sea. Surveys conducted during the winter months (June–August), did not yield any sightings of common dolphins. Simple linear regressions were used to test the statistical significance of offshore movements.

RESULTS

Dolphins were found at a mean distance of 9.2 km from shore in spring and summer (SD = 4.42, n = 78), and 20.2 km from shore in autumn (SD = 3.86, n = 65) (Fig. 1). A significant offshore trend progressing from September/October (spring) to March/April (autumn) was observable in 5 of these 6 years (1993/94: $r = 0.295$, d.f. = 62, $P < 0.02$; 1994/95: $r = 0.118$, d.f. = 46, $P > 0.05$; 1995/96: $r = 0.595$, d.f. = 21, $P < 0.02$; 1996/97: $r = 0.402$, d.f. = 27, $P < 0.02$; 1997/98: $r = 0.526$, d.f. = 26, $P < 0.02$; 1998/99: $r = 0.530$, d.f. = 23, $P < 0.02$). This seasonal offshore movement suggests a preference for warmer waters. SST in the study area fluctuates between 16°C in winter and 23°C in summer near shore, with a gradient to 2–3°C warmer waters 50+ km offshore (Fig. 2). Limited survey effort (because of poor weather conditions) during the winter months (June–August) did not yield any sightings of common dolphins, which suggests they spent most of their time >35 km from shore in winter, beyond the range of the survey vessel.

The dolphins' movement appears to be strongly affected by the El Niño and La Niña Southern Ocean oscillation patterns. In January/February 1994, 1996, and 1999 when SST near shore was 2°C warmer than "normal" (La Niña conditions) the dolphins' mean distance from shore was only 6.2 km (SD = 2.56, n = 54), whereas in years with "normal" SST it was

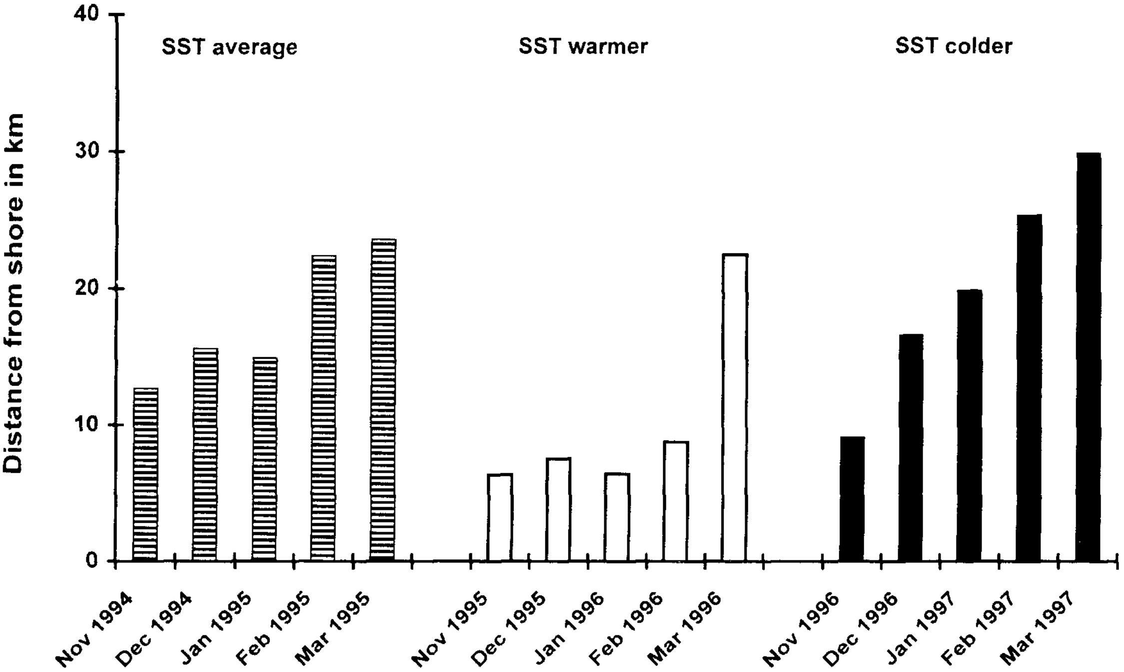

Fig. 4 Mean distances of common dolphins (*Delphinus delphis*) from shore by month from 1994 to 1997. (Note the later start of the offshore movement in March 1996, during La Niña conditions, when sea surface temperature (SST) was 2°C warmer than average.)

11.5 km (SD = 3.84, n = 47) (Fig. 3). Additionally, in years with warmer than average SST, the dolphins' autumn offshore movement appeared to be delayed by about a month (Fig. 4).

DISCUSSION

Findings similar to those of this study have been reported by Goold (1998): in the Irish Sea, common dolphins also moved farther offshore in autumn as SST dropped. Around Kaikoura, South Island, New Zealand, sightings of common dolphins were found to become exceedingly rare in winter, as water temperatures got colder (Würsig et al. 1997). Reilly (1990) did not find any seasonal movements for common dolphins in the eastern tropical Pacific (ETP), arguing that they occupied upwelling-modified habitats year-round. However, Reilly & Fiedler (1994) reported that when upwelling conditions in the ETP changed as a result of El Niño in 1987, the dolphins' distribution shifted accordingly. Tershy et al. (1991) also found a decrease of common dolphin numbers in a nearshore study area as temperatures decreased from an El Niño to a La Niña condition. Note that in the eastern Pacific (American west coast) during an El Niño SST is typically warmer than usual, whereas in the western Pacific (e.g., New Zealand) it is colder. Common dolphins are found throughout a wide range of sea temperatures, from equatorial waters, to high latitudes (Haug et al. 1981). As a result, I consider it unlikely that SST is the primary factor influencing their distribution. A more likely explanation is that SST affects the distribution of common dolphin prey species, in turn causing the dolphins' seasonal movements—a hypothesis that is supported by the findings of recreational and commercial fishermen in our study area. Fishermen also have to move farther offshore in autumn and winter in pursuit of commercial fish species, such as tuna and marlin which are thought to share a number of prey species with common dolphins—in this area mainly kahawai (*Arripis trutta*) and jack mackerel (*Trachurus novaezelandiae*) (A. Hansford, R. Rae pers. comm.). Other fish species that were observed to be taken by common dolphins in the study area were yellow-eyed mullet (*Aldrichetta forsteri*), flying fish (*Cypselurus lineatus*), parore (*Girella tricuspidata*), and garfish (*Hyporamphus ihi*).

The findings of this study present a look at seasonal movements of *D. delphis* in New Zealand, and suggest a similar pattern to those found by other authors for this species in different locations.

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