

OBSERVATIONS ON INSHORE AND PELAGIC DOLPHINS ON THE SOUTH-EASTERN CAPE COAST OF SOUTH AFRICA

by

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Abstract – The occurrence, size and seaward distribution of schools of inshore and pelagic dolphins is described for three study areas on the south-eastern Cape coast (Algoa Bay; the Tsitsikama Coastal National Park and Plettenberg Bay). Inshore dolphins (*Tursiops* and *Sousa* sp.) frequented the coast-line in relatively small schools whereas pelagic dolphins (*Delphinus delphis* and *Stenella caeruleoalba*) occurred in very large schools far out to sea. Different ecological zones were used by *Sousa* for feeding and for social behaviour and maintenance activities. The frequency of occurrence of *Sousa* at Plettenberg Bay was not affected by seasonal fluctuations in sea surface temperatures. The role of dolphins as predators and their implication in the regulation of the ecosystem of the Tsitsikama Coastal National Park is discussed.

Introduction

Information on the behaviour of captive specimens of several species of the Delphinidae, the family of smaller toothed whales, has accumulated over recent years (Atlantic bottlenose dolphin *Tursiops truncatus* – McBride and Hebb, 1948; McBride and Kritzler, 1951; Brown and Norris, 1956; Tavalga and Essapian, 1957; Essapian, 1963; Tavalga, 1966; Atlantic pilot whale *Globicephala macrorhyncha* – Kritzler, 1952; Pacific pilot whale *Globicephala scammonii* – Brown, 1960 and 1962; Amazon dolphin *Inia geoffrensis* – Layne and Caldwell, 1964; false killer whale *Pseudorca crassidens* – Brown, Caldwell and Caldwell, 1966). The sophisticated system of echo-location, which dolphins have evolved in response to their aquatic environment, has also received attention (Kellogg, 1961) as has their acoustical mode of information transfer (Lilly and Miller, 1961; Tietz and Tayler, 1964; Caldwell and Caldwell, 1965, 1967 and 1968; Tayler and Saayman, *in press a*). However, very little is known concerning the naturalistic behaviour and social organisation of dolphins in their natural habitat (Evans and Bastian, 1969).

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Several species of Delphinidae occur along the south-eastern Cape coast of South Africa and the Indian Ocean bottlenose dolphin (*Tursiops aduncus*), an inshore species, is currently the subject of systematic study both in captivity in the Port Elizabeth Oceanarium (Tayler and Saayman, *in press b*) and in the wild (Saayman, Tayler and Bower, *in press*). The humpback dolphin (*Sousa* sp.), another inshore variety, is also receiving intensive attention in the wild; no specimens are at present maintained in captivity. Pelagic species such as the common (*Delphinus delphis*) and Euphrosyne (*Stenella caeruleoalba*) dolphins are also observed, but on a more irregular basis, owing to their sporadic appearances within range of coastal observation points.

This report represents comparative data on the occurrence of schools of inshore and pelagic dolphins and outlines some of the factors associated with their behaviour and distribution which may be of relevance to the ecology and management of a coastal National Park.

The Study Areas

Dolphins were observed in three areas along the south-eastern Cape coast: Algoa Bay (34°S 25°E), the Storms River area of the Tsitsikama Coastal National Park (34°S 24°E), and Plettenberg Bay (34°S 23°E). Water temperatures in the study areas averaged 13,9°C in winter and 20,8°C in summer with maxima and minima of 26,7°C and 12,2°C.

Algoa Bay

Dolphins were primarily observed from the grandstand of the Oceanarium which is situated on the beachfront overlooking a rocky coastline with outlying reefs interspersed with small beaches. As the bay sweeps northwards it gives way to long stretches of open beach.

Tsitsikama Coastal National Park

At Storms River the shoreline consists of a rugged coast with rocky outcrops, deep gullies and outlying reefs, which give way to a sandy bottom at the mouth of the Storms River. East of this point the area is comprised mainly of reefs emerging above the surface at "The Knol".

Plettenberg Bay

Two distinct ecological zones were distinguished at Plettenberg Bay:

Zone I

The Robbe Berg peninsula forms a barrier to the prevailing wind and the south-western boundary between the relatively tranquil water of the Bay and the open sea. The sandy bottom directly below the Robbe Berg deepens abruptly from the occasional rocky outcrops and reefs formed largely by crumbling rock. The almost unbroken sandy beach of the bay sweeps round from the Robbe Berg in a gradual curve.

Zone II

The open sea breaks upon the south-western side of the Robbe Berg which extends in submerged reefs in a southerly direction to Whale Rock, also submerged but at times awash, half a kilometre from Robbe Berg Point. The south-western side of the Robbe Berg forms a rocky, undulating coastline, closely resembling the Storms River study area.

The Dolphins

Four delphinids are regularly observed in the study areas: the common dolphin *Delphinus delphis*, the Euphrosyne dolphin *Stenella caeruleoalba*, the humpback dolphin *Sousa* sp. and the bottlenose dolphin *Tursiops aduncus*. Since two Atlantic bottlenose dolphins *Tursiops truncatus* have recently stranded, it is possible that the two *Tursiops* species, sharing the same colour pattern and approximate size, might be confused under field conditions. The humpback dolphin occurs frequently in all three study areas, but very little is recorded concerning its distribution or behaviour. It is described as *Sotalia lentiginosa* by Tietz (1963) and *Sousa plumbea/lentiginosa* by P. J. H. van Bree (*pers. comm.*), but its taxonomic status is by no means settled.

Methods

At Plettenberg Bay a systematic watch was maintained for dolphins throughout the day from coastal vantage points during the following seasonal study periods: mid-October to mid-November, 1970 and the first two weeks respectively of February, May, August and November, 1971. Systematic scoring of the behaviour of dolphins commenced in January 1970 in Algoa Bay and in January 1971 at the Tsitsikama Coastal National Park; sightings of dolphins were recorded on a more irregular basis in these study areas.

A total of 361 sightings of dolphins was obtained in all three study areas between January 1970 and November 1971, incorporating 257,9 hours of direct observation.

Binoculars (8 × 35 and 20 × 60) were used during all observation sessions. Data were recorded on a tape recorder and were later transcribed into field notebooks and were then transferred to scoring sheets and punched cards. Dolphin progressions were plotted with the aid of aerial photographs of the coast. Daily recordings of sea temperatures were made in the surf zone. A comprehensive account of the conditions of observation has been given elsewhere (Saayman, Tayler and Bower, *in press*).

The accurate determination of the number of individuals in groups of dolphins was generally not possible without technical aid (Tayler and Saayman, *in press c*); photographic methods were not employed during this study. Estimations of the size of groups of humpback dolphins were, however, relatively accurate, since these animals tended to remain close

inshore in small groups. Counts of bottlenose dolphins deployed in small groups could reliably be obtained from optimal vantage points but the inherent limitations of land-based observations of marine mammals were compounded in the case of large groups deployed over several square kilometres. Only gross estimates of pelagic dolphins could be obtained from the tightly packed mass of animals, dispersed over a large area, distant from the coast and often many kilometres in extent.

Results

Field Impression

Positive identification of inshore genera (*Tursiops* and *Sousa* sp.) was made without difficulty. Whereas it was generally possible to discriminate between inshore and pelagic dolphins, it was often difficult to differentiate between *Delphinus* and *Stenella*, even on the limited occasions when observations were made at close range from a boat. A general description of body shape, coloration, behaviour and field impression is given for each genus below.

Bottlenose dolphins

Bottlenose dolphins have a well-defined, thick rostrum of moderate length, a streamlined but thickset body and a prominent dorsal fin (Fig. 1). The colour is lead-grey dorsally, lightening along the flanks and culminating in an off-white belly and throat which are usually tinted pink.

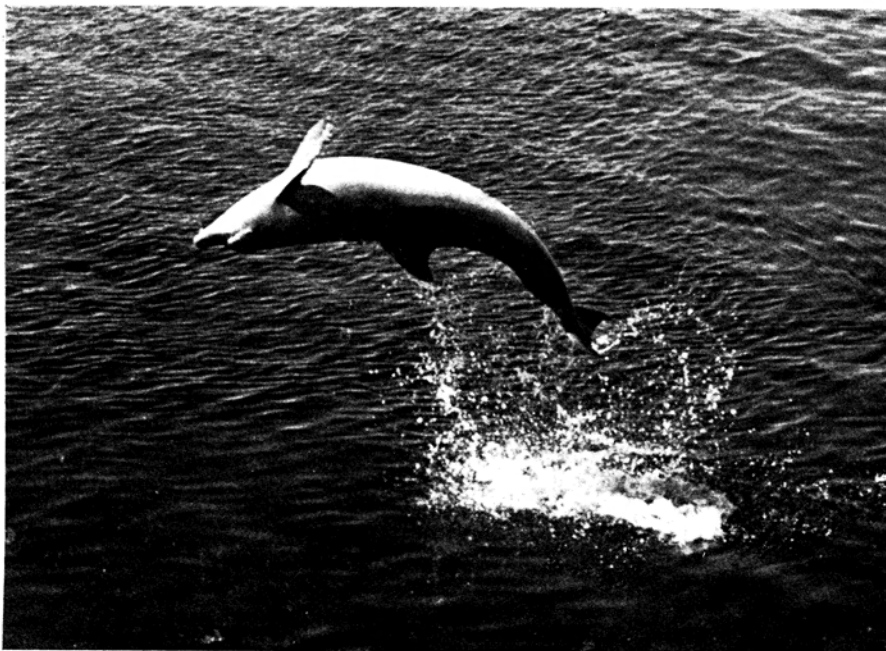


Fig. 1. A two-year old bottlenose dolphin performs an inverted leap.



Fig. 2. Two subgroups of bottlenose dolphins swim at high speed beneath Robbe Berg Point, Plettenberg Bay.



Fig. 3. A tightly knit subgroup of bottlenose dolphins during a slow progression surfacing simultaneously to breathe.

Bottlenose dolphins are generally seen in large groups, frequently numbering several hundred individuals. Subgroups are discernible, swimming in closely co-ordinated formation (Fig. 2). A comprehensive description of group formations and deployment has been given elsewhere (Tayler and Saayman, *in press a*). Progressions are frequently characterised by much surface activity: individuals display-leap, rub violently against each other, swim inverted with belly uppermost and often penetrate the surf-zone to a water depth of 1 metre. When moving slowly the dolphins rise to breathe with a typical motion, arching the back and exposing the melon and mid-dorsal area (Fig. 3); breathing occurs at short and regular intervals, permitting their course to be tracked with ease.

Humpback dolphins

Humpback dolphins are readily distinguishable by a long rostrum which appears first on surfacing for air (contrast Figs. 4 and 5). The dorsal fin is notably small and is situated upon the elevated mid-dorsal section: this "hump" is the most characteristic morphological feature, from which the common name "humpback" is derived. The back is arched strongly as the animal sounds after rising steeply from a depth during feeding; this is not so apparent during group progressions. Colour variations are marked and range from off-white in young calves to grey, through grey-brown to

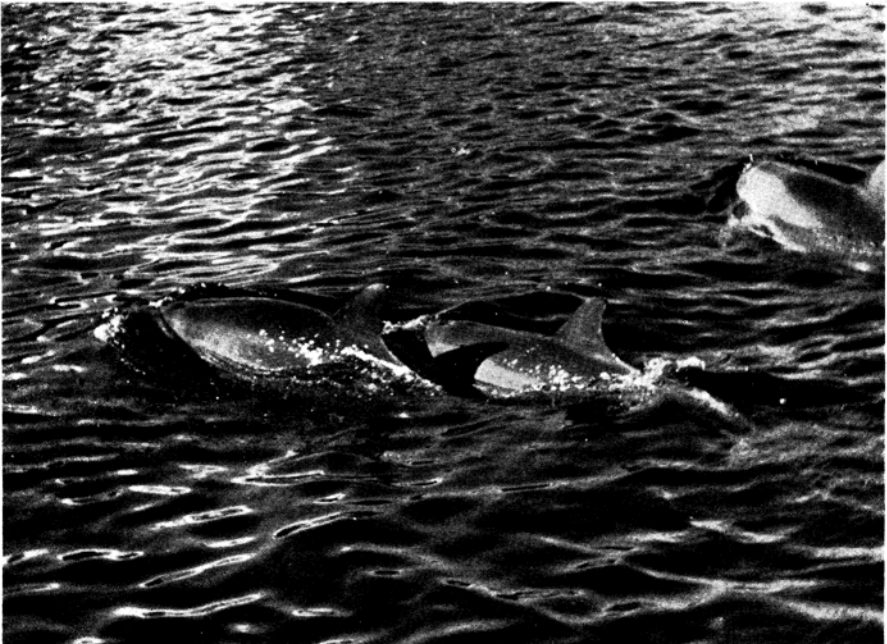


Fig. 4. Bottlenose dolphins during a slow progression. Exhalation occurs as the blowhole is exposed, usually without showing the rostrum. Inhalation occurs with the rostrum and melon already submerged.

bronze, often with a deep purplish tinge on the dorsal surface (Fig. 6). In some large adults, the dorsal fin and adjacent areas are white. The whitening sometimes extends to the tip of the rostrum and flukes and appears to be an index of increasing age. Prominent scars are frequently discernible in the larger animals.

Humpback dolphins give the impression of slow and orderly movement. Travelling and feeding groups engage in little surface activity and remain submerged for relatively long periods; this sometimes makes counting of individuals and tracking of movements difficult. This species normally moves close inshore in small groups.

Pelagic dolphins

Common and Euphrosyne dolphins are notably more slender than the inshore species. Both species have a thin rostrum and a moderately-sized dorsal fin. The varied colour pattern differs in both species but a field impression of both is that of a glossy blue-black dorsal surface, which renders them indistinguishable from a distance. However, at closer range the common dolphin is characterised by a dark-toned V on the flank below the dorsal fin (Fig. 7). The Euphrosyne has prominent dark bands joining the eye to the flipper and the eye to the genital area (Fig. 8).

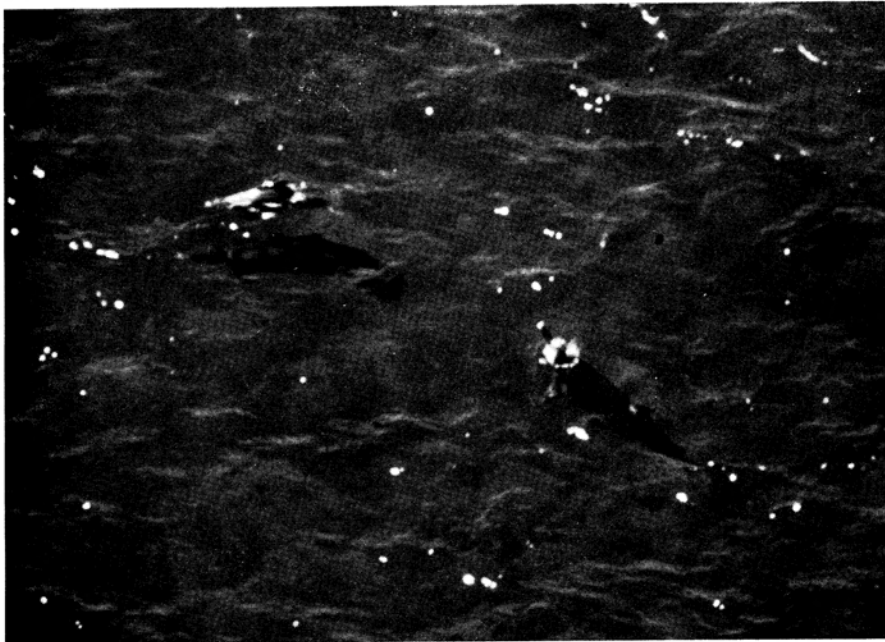


Fig. 5. Three humpback dolphins progress slowly beneath Robbe Berg Point. When surfacing to breathe, the rostrum appears first and is lifted in a characteristic manner; exhalation may commence before the blowhole clears the surface (adult on right). Inhalation follows immediately, the back is arched strongly and the animal submerges (adult and calf on left).

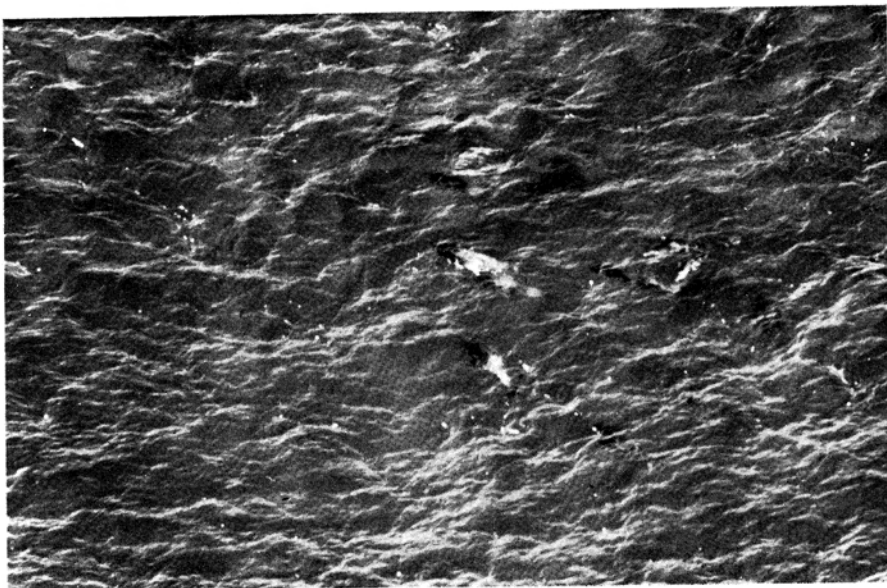


Fig. 6. A group of humpback dolphins resting in sheltered water in Plettenberg Bay. The large adult with the white dorsal fin was identifiable by virtue of a prominent scar. Note the lighter colour of the young calf.

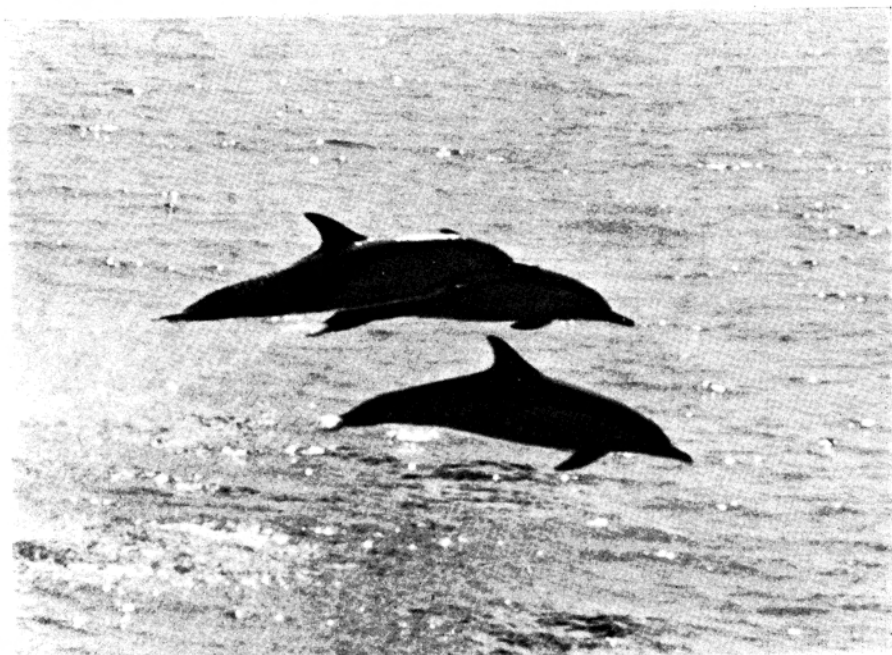


Fig. 7. Three common dolphins during a co-ordinated leap. The saddle, or downward V-shaped extension of the dark dorsal tone is a characteristic feature. (Photograph: David Allen).

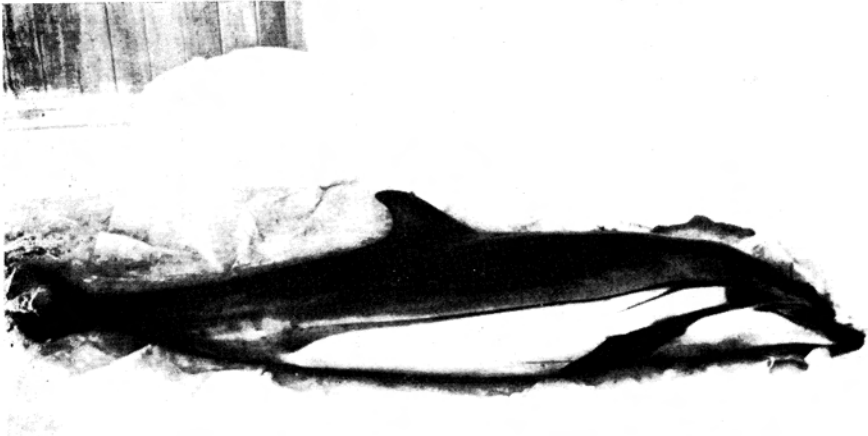


Fig. 8. A stranded Euphrosyne dolphin. Prominent dark bands join the eye to the flipper and to the genital area. Note the absence of the saddle characteristic of the common dolphin. (Photograph: G. J. B. Ross)

Less prominent bands occur in the common dolphin, and the band ending at the flipper originates at a point about midway the length of the mandible.

Both species travel in enormous schools frequently numbering several thousand individuals, sometimes dispersed in one long column over several kilometres. Individual animals, randomly dispersed, appear to form the basis of such schools; seen from a distance the effect is of a large area of water disturbed by a windsquall (Fig. 9). The movement pattern usually noted is sustained, highspeed swimming. This generally gives rise to a long, low trajectory as the dolphin cuts through the surface to breathe; a transverse spray is flung from the melon and dorsal fin and, on re-entry, further splashing is caused by the ventral surface. On a still day the great commotion of a mass movement of pelagic dolphins is audible for several kilometres. The only evidence of subgrouping is in the occasional coordinated leaping seen (Fig. 7).

Occurrence and size of schools

The number of sightings of the respective genera is shown in Fig. 10. Humpback dolphins were sighted more frequently than bottlenose dolphins. Pelagic dolphins were seen on only 10 occasions.

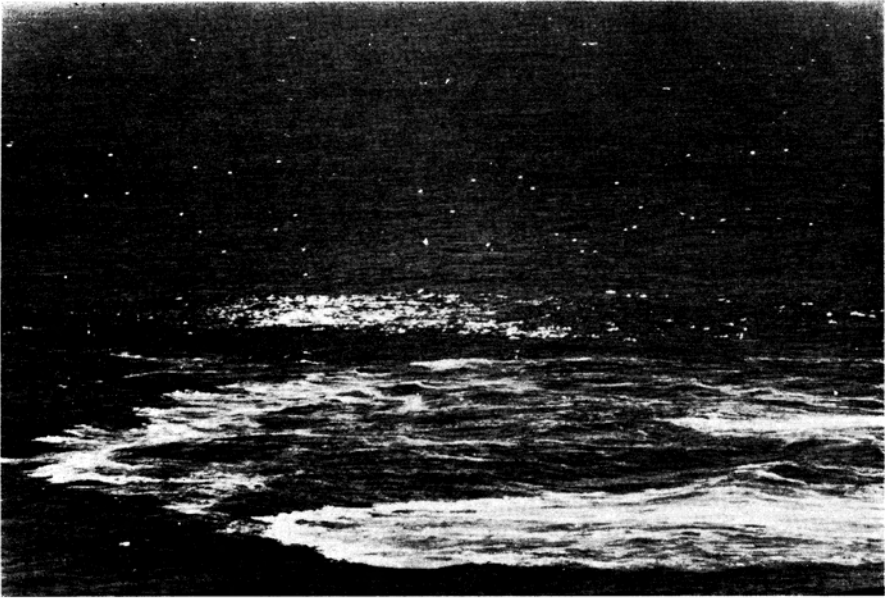


Fig. 9 A large group of pelagic dolphins feeding in association with Cape gannets. The photograph was taken from Robbe Berg Point with Whale Rock awash in the foreground.

The mean size of schools of inshore and pelagic dolphins, shown in Fig. 10, are based upon individual sightings which in many cases incorporated several groups of animals widely dispersed. Humpback dolphins occurred in the smallest schools ($\bar{x} \pm \text{S.E.} = 6,6 \pm 1,4$) whereas the numbers of individuals per sighting increased progressively for bottlenose dolphins ($\bar{x} \pm \text{S.E.} = 140,3 \pm 21,4$ (and pelagic dolphins ($\bar{x} \pm \text{S.E.} = 670,0 \pm 180,00$)).

Distribution

Systematic study was made of the distribution of dolphins in relation to the coastline in Plettenberg Bay and at the Tsitsikama Coastal National Park. Both study areas were divided into grid squares of 0,8 km and dolphin progressions were plotted as the animals entered each individual grid. Only those sightings were used in which progressions could be plotted

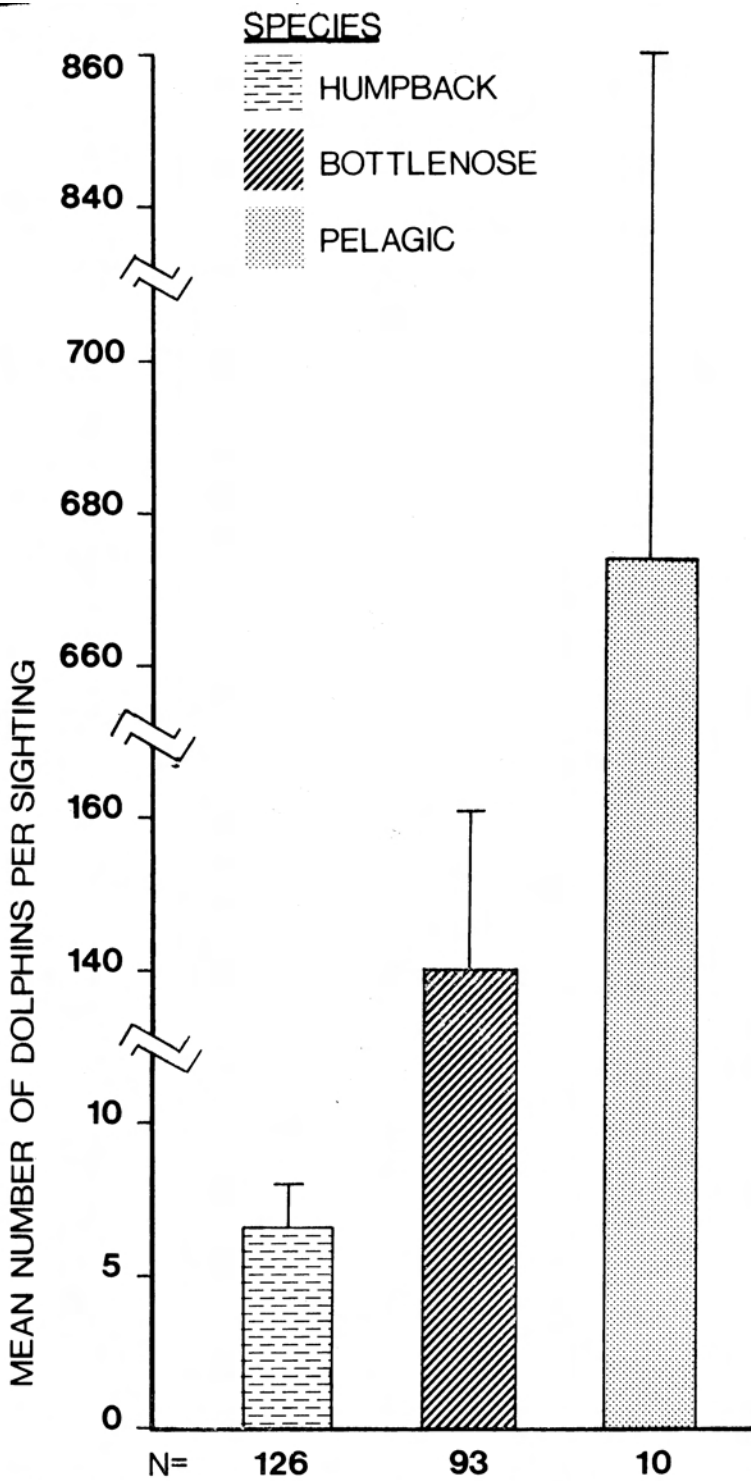


Fig. 10. The average size of schools of dolphins sighted in all three study areas. Humpback dolphins formed the smallest schools whereas pelagic dolphins associated in very large numbers. N = the number of sightings and therefore reflects the frequency of occurrence of the different genera. Vertical bars represent the standard error of the mean. Only those sightings which permitted reasonably accurate estimation of numbers were included.

PLETTENBERG BAY

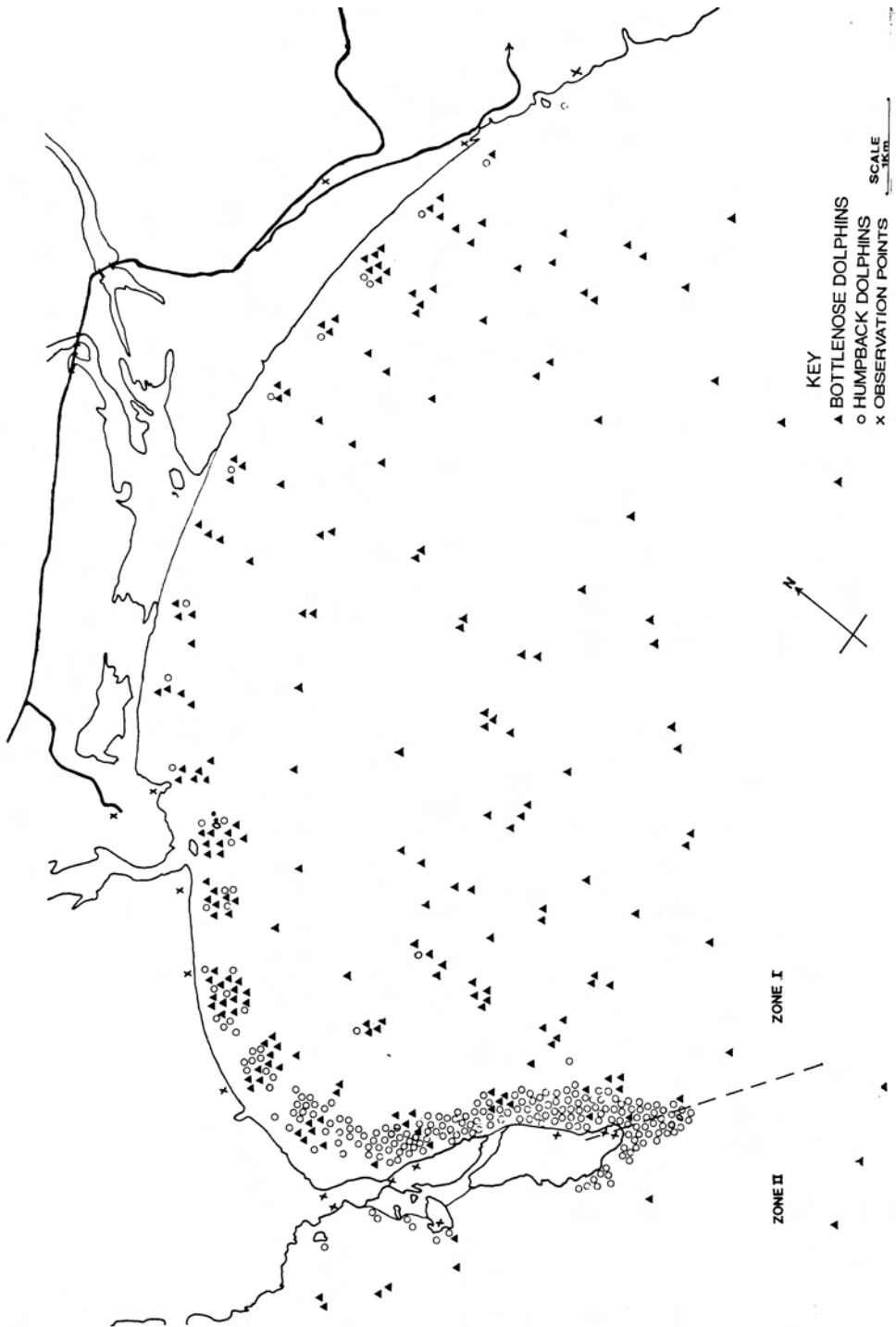


Fig. 11. The distribution of bottlenose and humpback dolphins in Plettenberg Bay. Humpback dolphins in general remained close to the shore whereas bottlenose dolphins entered all sectors. Systematic vigils on the seaward side of the Robbe Berg were less intensive than in Plettenberg Bay.

**TSITSIKAMA COASTAL NATIONAL PARK
STORMS RIVER MOUTH AREA**

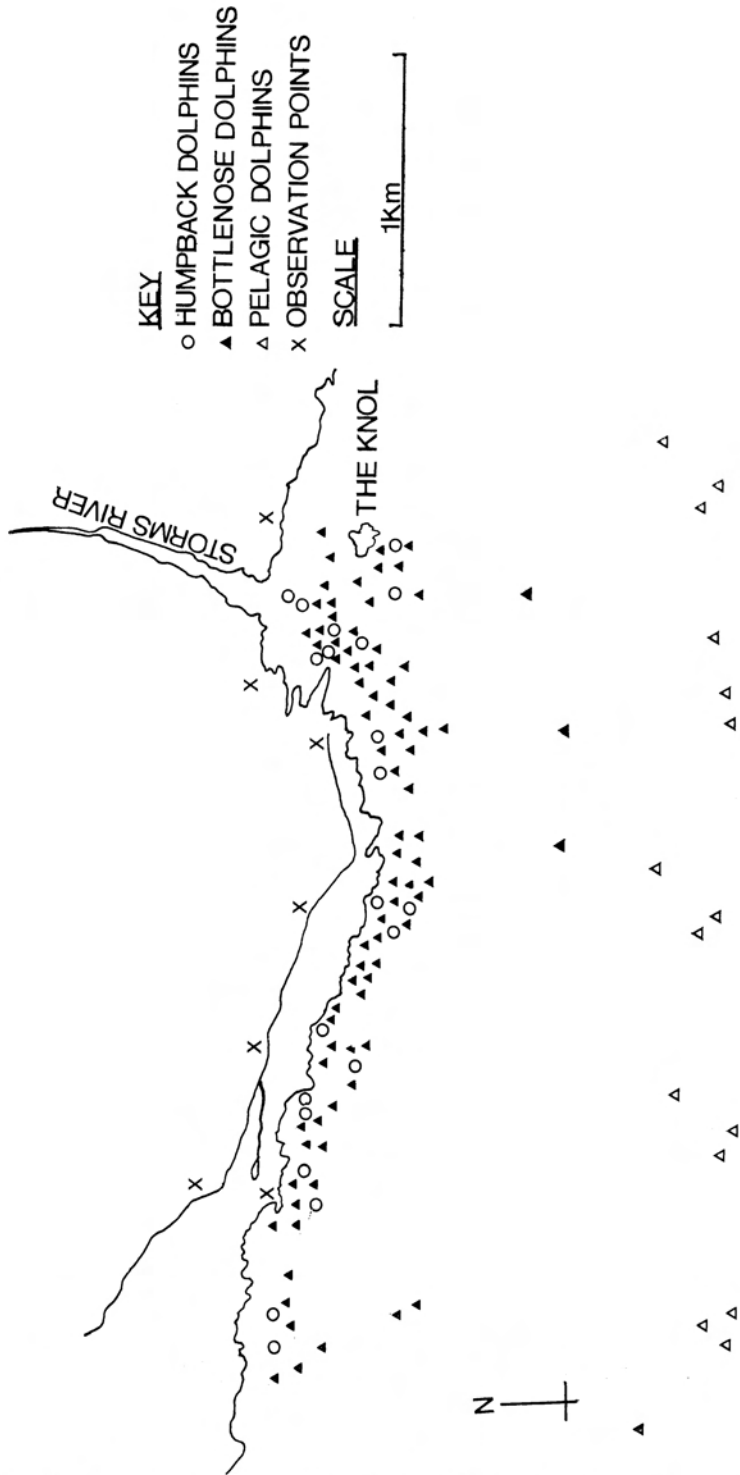


Fig. 12. The distribution of inshore and pelagic dolphins in the Storms River area of the Tsitsikama Coastal National Park.

with accuracy, using aerial photographs as an aid. Individual plots represent the frequency of entries into grid squares but do not reflect the duration present in each.

Plettenberg Bay

Bottlenose dolphins were observed in deep water as well as along the coastline with almost equal frequency (Fig. 11).

Humpback dolphins generally remained close inshore within 250 m of the Robbe Berg and just seawards of the breaking waves along the coastline. Humpback dolphins moved out briefly into the bay only on one occasion, in what appeared to be an exploratory excursion to the vicinity of a fishing vessel which was accompanied by feeding bottlenose dolphins and Cape Fur seals (*Arctocephalus pusillus*).

Pelagic dolphins did not approach closer than one km from the coastline; they were generally seen in the open sea beyond the bay and are not represented in Fig. 11.

Tsitsikama Coastal National Park

Bottlenose and humpback dolphins moved along similar routes close inshore (Fig. 12). On occasion, however, bottlenose dolphins moved out into deeper water. Pelagic dolphins were always observed far out to sea.



Fig. 13. Zone I at Robbe Berg Point. An observer situated on the peninsula had an excellent view of dolphins directly below him in clear and sheltered water.

Use of habitat by humpback dolphins

An observer situated at the Point of the Robbe Berg had a panoramic view of Plettenberg Bay and the open sea and could observe dolphins as they passed directly below him from Zone I into Zone II (Figs. 13 and 14). Careful note was made of the time spent by humpback dolphins in Zones I and II and of the duration of their activities in either zone during three study periods (October-November 1970; February and May 1971). A total of 32 sightings, incorporating 35,9 hours of direct observation of dolphins was obtained. 163,4 hours were spent in watching for dolphins at the Point.

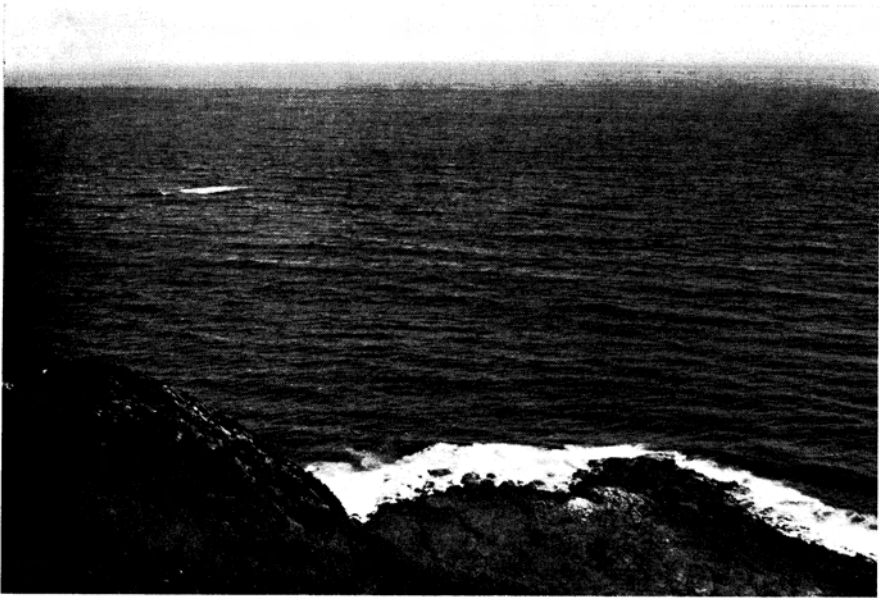


Fig. 14. Zone II at Robbe Berg Point. The open sea breaks upon the rocky coastline. Whale Rock in the lefthand corner is awash at high tide and is barely visible.

Feeding behaviour was scored when the school dispersed widely over an area, remained submerged for periods up to three minutes and when no social behaviour was evident. Juveniles sometimes emerged holding fish in their mouths.

Resting was scored when the dolphins moved slowly but remained in one area without evidence of feeding and social interaction (Fig. 6).

Mating and play activity was scored when there was chasing, leaping, rubbing, biting, fluke-striking, inverted swimming, clasping and the display of erections by bulls.

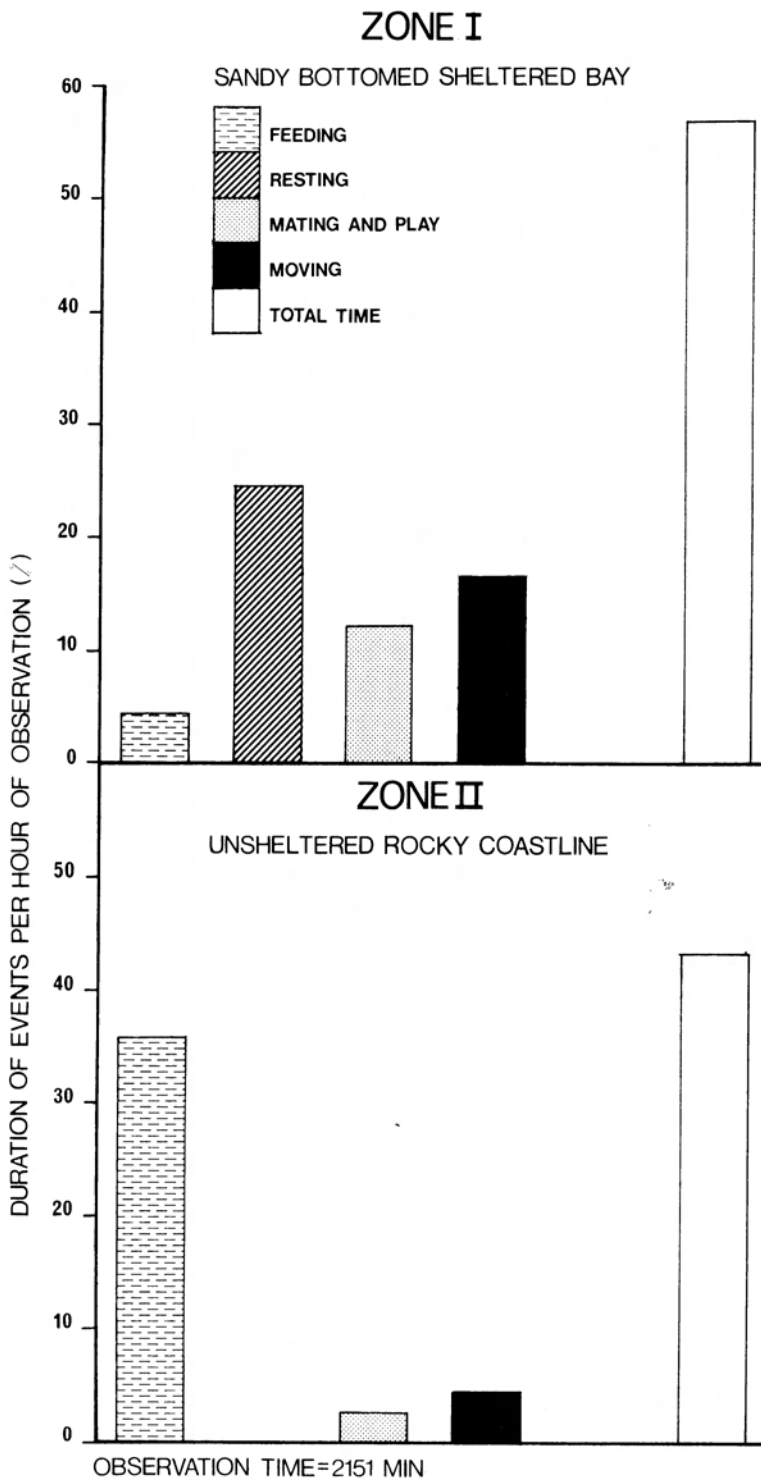


Fig. 15. The duration of social and maintenance activities of humpback dolphins in relation to Zones I and II. The dolphins spent proportionally more time in Zone I, generally occupied in resting, social activities and group progressions. Feeding activity accounted for the majority of the time spent in Zone II.

Moving was scored when the dolphins were clearly in transit and swam rapidly in the same direction from one area to another without evidence of feeding or social activity.

The duration and frequency of feeding, resting, mating, and play activity and group movements are shown in relation to the two different ecological zones in Fig. 15 and Table 1. Groups of dolphins did not always act in unison, and therefore these categories are not necessarily mutually exclusive; however, it was in general possible to categorise the main behavioural activity of the school.

Table 1

The mean duration (\pm S.E.) of episodes of maintenance activities, social behaviour and group progressions of humpback dolphins in relation to two different ecological zones at Robbe Berg Point (32 sightings with a total of 2 151 min of direct observation of dolphins).

	<i>Zone I</i> <i>Sandy bottomed</i> <i>sheltered Bay</i>	<i>Zone II</i> <i>Unsheltered rocky</i> <i>coastline</i>
		<i>Feeding</i>
Mean \pm S.E. (min)	17,6 \pm 2,6	33,3 \pm 6,0
Range (min)	9—24	5—139
No. of episodes	5	23
		<i>Resting</i>
Mean \pm S.E. (min)	37,3 \pm 7,0	—
Range (min)	5—93	—
No. of episodes	14	Nil
		<i>Mating and Play</i>
Mean \pm S.E. (min)	17,2 \pm 2,4	5,3 \pm 2,7
Range (min)	4—40	7—8
No. of episodes	15	4
		<i>Moving</i>
Mean \pm S.E. (min)	9,3 \pm 1,7	12,7 \pm 2,6
Range (min)	2—40	4—30
No. of episodes	38	10

The dolphins spent proportionately more time in feeding over the reefs of Zone II (Fig. 15). Feeding episodes occurred more frequently in Zone II than in Zone I, with a longer average duration and maximal uninterrupted period of 139 min (Table 1).

All resting occurred in the sheltered Zone I. Resting periods averaged 37,3 \pm 7,0 min ($\bar{X} \pm$ S.E.) with a maximal uninterrupted duration of 93,0 minutes.

The dolphins spent proportionately more time in mating and play activity in the sheltered Zone I (Fig. 15). Episodes of social activity

occurred more frequently in Zone I than in Zone II, with a longer average duration and maximal uninterrupted period of 40 min (Table 1).

Movements of schools occurred more frequently in Zone I and therefore the time spent in transit was proportionately greater in this sector. The average duration of progressions in both zones was approximately the same, and this was a function of the similar visual range of the observer on either side of Robbe Berg Point.

Intergeneric Interactions

Some intergeneric encounters involving bottlenose dolphins have been reported elsewhere (Tayler and Saayman, *in press*, a, b). Associations between humpback and bottlenose dolphins and intergeneric interactions during the feeding activity of pelagic dolphins are described below.

Humpback dolphins were seen either in the company of groups of bottlenose dolphins or in their close proximity on six occasions. In the Storms River study area single adult humpback dolphins on three occasions progressed in the centre of schools of bottlenose dolphins numbering approximately eight, 50 and 300 individuals respectively. The humpback dolphins appeared to be fully integrated members of the bottlenose dolphin schools; in two of these instances groups of humpback dolphins were subsequently seen following the direction of the bottlenose dolphin schools.

However, on two further occasions in the Plettenberg Bay study area, bottlenose dolphins appeared aggressive towards lone humpback dolphins in their vicinity. Several bottlenose dolphins changed direction abruptly, swam at high speed towards the humpback dolphins which turned sharply away and cleared the surface in an effort to avoid bodily contact. A pursuit continued for a short time, whereupon the bottlenose dolphins resumed their former course. The behaviour of the bottlenose dolphins may, however, have represented exploratory excursions rather than aggressive approaches. In all the above encounters, the bottlenose dolphins were following the typical routes of the humpback dolphins close to the shore. The sixth encounter between humpback and bottlenose dolphins in deeper water has been described above (see Distribution, Fig. 11).

Large schools of pelagic dolphins were sometimes seen dispersed over an area of 20 sq. km, on rare occasions approaching within one km of the shore. The association of the dolphins with large numbers of Cape gannets (*Morus capensis*), unidentified cormorant species and occasionally Cape fur seals (*Arctocephalus pusillus*) indicated feeding activity. Several thousand gannets circled in a clockwise spiral and dropped into the water for their prey amongst the dolphins (Fig. 9). The dolphins moved rapidly from one area to another, frequently changing direction and, as they paused to mill and criss-cross over an area, the gannets gathered to drop amongst them. Large pods of gannets, apparently resting after heavy feeding, were widely dispersed on the sea. When seals were present they fed and mingled freely amongst the dolphins. Large shoals of predatory

pelagic fish moved in the same direction as the groups of dolphins. An unidentified species of one of the smaller whales was also seen to follow the direction taken by the dolphins and birds; the number of blows indicated the presence of four or more whales. On one of the instances observed at Plettenberg Bay, the above activity continued for six consecutive days (2-7 May 1971); at dusk large flocks of gannets gathered together on the water in the bay and during the greater part of the day were observed in association with the dolphins as described above. Similar sightings were also recorded off Storms River in the Tsitsikama National Park.

Schools of pelagic dolphins sometimes divided and broke into many unstable groups, which combined with other groups. Direction change of groups appeared to occur when one or two dolphins veered away to be followed by several more, until the movement gained momentum and the whole group had changed direction. Acoustical cues probably influenced school co-ordination. On 5 November 1971 approximately 2 000 pelagic dolphins were actively feeding in Plettenberg Bay. Three km away on the south-western side of the Robbe Berg a small group of dolphins slowly approached, dispersed in a long column. As individuals rounded Robbe Berg Point in varying numbers, their speed of movement accelerated dramatically with the long, low leaps associated with highspeed swimming and they proceeded directly to the feeding school. In this instance the dolphins passed close enough to be identified as *Delphinus delphis*.

Seasonal occurrence of humpback dolphins

Because humpback dolphins occurred in smaller schools than the other species, the numbers of individuals could be relatively accurately counted from the cliffs of the Robbe Berg. It was therefore possible to determine whether humpback dolphins frequented Plettenberg Bay in the same numbers throughout the year despite the marked seasonal temperature fluctuations. Data on the number of humpback dolphins observed per sighting and on the number of sightings of humpback dolphins are shown in Fig. 16 in relation to water temperatures during the five seasonal study periods at Plettenberg Bay between October 1970 and November 1971.

The mean (\pm S.E.) number of dolphins observed per sighting ranged between $4,4 \pm 0,4$ in the summer of February 1971, and $7,3 \pm 0,3$ in the winter of August 1971. An analysis of variance (Winer, 1962) showed no significant differences between the means ($F = 1,42$; df 4, 97; $P < 0,25$).

A sighting rate was calculated by dividing the number of sightings per day by the number of hours of daily vigils for dolphins. Mean sighting rates (\pm S.E.) ranged between $0,10 \pm 0,06$ during the autumn of May 1971 and $0,23 \pm 0,05$ for the spring of November 1971. These differences were not significant ($F = 1,96$; df 4, 65; $P < 0,25$).

Water temperatures (degrees Celsius) were measured daily in the surf zone. The highest mean temperature (\pm S.E.) was recorded during the

SOUSA

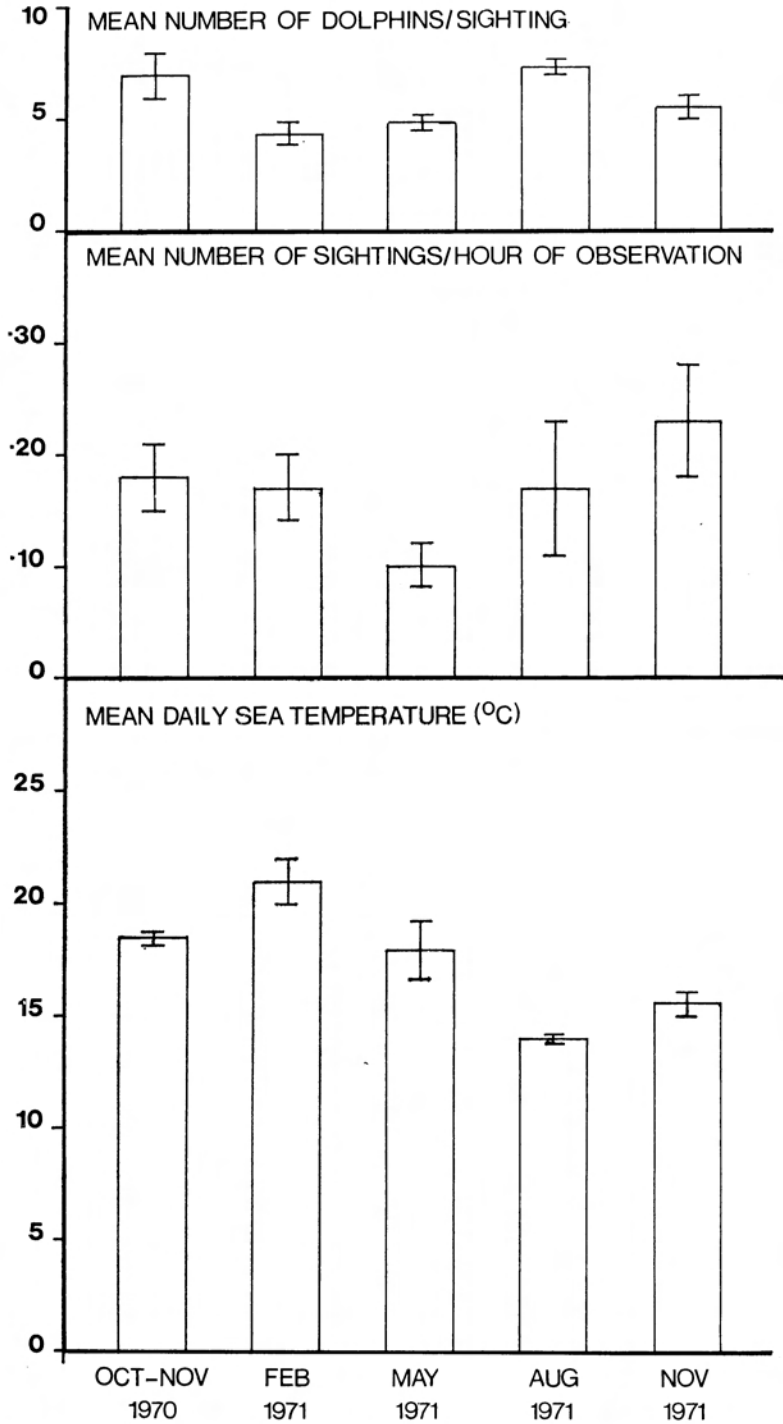


Fig. 16. The occurrence of humpback dolphins in Plettenberg Bay in relation to sea surface temperatures during five seasonal study periods. Significant fluctuations occurred in water temperatures but humpback dolphins were present in the same numbers throughout the year. Vertical bars represent the standard error of the mean.

summer of February 1971 ($20,8 \pm 0,8^{\circ}\text{C}$) and the lowest during the winter month of August 1971 ($13,9 \pm 0,2^{\circ}\text{C}$). The F ratio associated with this distribution was highly significant ($F = 33,16$; $df\ 4, 62$; $P < 0,001$).

A number of individual humpback dolphins were tentatively identified by virtue of prominent scars and colour patterns. At least one of these dolphins was observed during each field trip to Plettenberg Bay, irrespective of season.

Progression rates

Progression rates were determined by plotting the movement of dolphins along the coast with the aid of aerial photographs and recording the time taken for the animals to pass from one prominent geographical feature to another. Progression rates were recorded when the dolphins were clearly in transit from one point to another and no social or feeding activity was apparent.

The average speed of bottlenose dolphins under these conditions was $164,5 \pm 18,6$ m/min ($\bar{X} \pm \text{S.E.}$). These data were obtained from 28 sightings during which the dolphins covered an average distance of $6\ 445,7 \pm 858,6$ m ($\bar{X} \pm \text{S.E.}$).

The average speed of progressions of humpback dolphins was $80,6 \pm 5,5$ m/min ($\bar{X} \pm \text{S.E.}$). These data were obtained from 58 sightings of different groups which on the average covered a distance of $2\ 109,8 \pm 278,2$ m ($\bar{X} \pm \text{S.E.}$).

In the case of pelagic dolphins the lack of suitable landmarks at sea obviated the accurate determination of speed of movement, but the impression was gained that they moved considerably faster than either bottlenose or humpback dolphins.

Discussion

Dolphins represent one of a number of predatory forms, including seals, fish and sharks, which are implicated in the regulation of the stability of the marine ecosystem. At Tsitsikama Coastal National Park, anglers must also play a role in this system. Whereas the daily food requirements of free-ranging dolphins can be estimated from data obtained from captive specimens, it is not known what species form the prey. Daily food consumption in captive adult bottlenose dolphins, weighing from 200-300 kg, is approximately five per cent of body weight; the fish species eaten in captivity have been listed elsewhere (Tayler and Saayman, *in press a*). Knowledge of both the species forming the prey and the quantity taken by dolphins in a coastal national park, where the movements of fauna are unrestricted, is essential for the understanding and management of the ecological balance.

The present systematic studies represent a beginning in the assessment of the occurrence, the numbers and the distribution of delphinids in the study areas. It was clear that humpback dolphins tended to remain close inshore (Figs. 11 and 12) and to disperse and feed individually in small

parties over and in the vicinity of reefs on rocky coastal stretches (Fig. 15). Bottlenose dolphins tended to be less selective in the choice of feeding area, hunting in co-ordinated groups in all coastal sectors including the open sea (Tayler and Saayman, *in press a*; Saayman, Tayler and Bower, *in press*). Pelagic dolphins on all occasions fed in deep water in the open sea and thus it is likely that they have no direct influence upon fish within the prescribed limits of the Tsitsikama Coastal National Park, stretching seawards for approximately 0,8 km, inland for 0,8 km and occupying 75 km of the coastline.

There was a marked tendency for the size of dolphin schools to increase progressively as they occurred further out to sea (Figs. 10, 11 and 12); humpback dolphins, forming the smaller schools, were seldom seen far from shore; bottlenose dolphins, forming schools of intermediate size, were seen both inshore and in deeper water whereas pelagic dolphins, forming the largest schools, were seen only far out at sea. It appears, therefore, that the humpback dolphin is dependent upon reef-dwelling fish and possibly other organisms. Pelagic dolphins, on the other hand, appear to be totally dependent upon the prolific pelagic food source whereas bottlenose dolphins seem to be capable of exploiting these extremes.

The assessment of the numbers of inshore dolphins frequenting an area is a difficult task but can be facilitated by the use of technical aids involving the ciné-filming of schools of dolphins whilst in transit (Tayler and Saayman, *in press c*). The impression has been gained that relatively small groups of bottlenose dolphins move past the Tsitsikama Coastal National Park in transit to and from major feeding grounds such as Plettenberg Bay, where the feeding activity of large groups has been shown to be influenced by a diurnal rhythm with peaks in the early morning and the late afternoon (Saayman, Tayler and Bower, *in press*). Further study is required of the number of dolphin-hours spent feeding within the boundaries of the Park to obtain some indication of the exploitation by dolphins of the area.

The occurrence of humpback dolphins did not appear to be influenced by seasonal fluctuations in sea surface temperatures (Fig. 16) and this species may therefore be resident in the Plettenberg Bay study area and possibly the adjoining Tsitsikama area throughout the year. The collection of similar data for bottlenose dolphins requires more accurate sampling techniques, because of the larger size of groups. However, a field impression has been gained over many years that they may be more abundant in the spring and summer months and this is supported by their reluctance to enter cold-water zones (Tayler and Saayman, *in press a*). Another species (*Tursiops truncatus*) shows a seasonal variation in microhabitat off the coast of Florida (Caldwell, Caldwell and Siebenaler, 1965).

The present investigations indicate the desirability of studying inshore dolphins from elevated coastal vantage points from which naturalistic observations can be obtained of animals undisturbed by boats and with an

optimal field of view. It was clear that humpback dolphins exploited geographical features such as the Robbe Berg and utilised its shelter for resting and social interactions which alternated with episodes of feeding activity over the reefs in its close vicinity. This species, dispersed in small groups close inshore along the coastline, is a particularly suitable subject for studies of social organisation in a delphinid and our observations on its social structure and behaviour will be the subject of a future report.

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