Preliminary Report on Dolphin Habitat Use in Relation to Oyster Farm Activities in Red Cliff Bay, Shark Bay

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Objective: To examine bottlenose dolphin (Tursiops sp.) habitat use in relation to existing and proposed oyster farm activities (Blue Lagoon Pearls) in Red Cliff Bay. Our main focus is on dolphin mothers and calves who range predominantly within Red Cliff Bay, including the provisioned females and their close associates.

Background: Since 1984, researchers have steadily monitored a population of bottlenose dolphins on the east side of the Peron peninsula (Connor & Smolker 1985). Mann has been studying the mothers and calves (42 pairs, >1400 hours of observation) annually since 1988. In this study we used focal follows to determine dolphin ranging in and around existing oyster farm areas.

METHODS

Focal follows were conducted on a small subset of our population. A "target" focal was chosen each day; we searched for that individual or mother-calf pair and conducted systematic sampling of mother-calf behaviour, group members, location, etc. over long time periods. The provisioned or "beach" dolphins were followed in addition to non-provisioned dolphins. The typical focal follow lasted 3 hours but could range from 1-9 hours. Every half hour, GPS units (Magellan ProMark X and Garmin) were used to determine location during follows in 1996-1998. We restricted our ranging data analysis to three provisioned females (Nicky, Puck and Surprise), their calves, and four non-provisioned females who are close associates of the provisioned dolphins (Joysfriend, Uhf, Square, Joy). Follows were conducted from a single 12-14ft dinghy[1] from 1996-1998. Data were collected year-round in 1996, Mar-May in 1997, and June-Aug in 1998. To map dolphin ranging, we used MapInfo software.

RESULTS

Maps of Red Cliff Bay are enclosed, one for the beach dolphins, and one for their associates. Each red + indicates a GPS reading. The open blue rectangle represents the area with existing pearl lines. The hatched blue section by shore represents additional areas licenced to Blue Lagoon Pearls but without lines. The checkered blue

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[1] This dinghy can maneuver in the pearl farm area. When we use our larger boat, Nortrek (33 ft.) we terminate follows near the pearl farm. No follows using Nortrek are in this database. With the small dinghy, we never terminated follows because of proximity to the pearl farm or if the dolphins went into the pearl farm area.

area represents the area Blue Lagoon Pearls has recently targeted and applied for expansion.

Beach/ Provisioned Females. Of 182 GPS readings (91 hours of focal follows) for the three beach mothers (Nicky, Puck, and Surprise) and their offspring, 9 (4.95%) were in the proposed extension area (checkered blue, see Map 1). One reading was in the buoyed area near existing pearl lines.

Non-Beach, Non-Provisioned Females. For 46 hours, we followed four adult females who commonly associate with the beach dolphins (92 readings, see Map 2). Twenty readings (21.74%) were in the extension area (checkered blue) and none in the buoyed area (open blue rectangle).

In sum, the Red Cliff Bay females (all seven females combined) used the area with existing pearl lines only 0.36% of the time, but used the proposed extension area 10.58% of the time.

DISCUSSION

These data are strongly suggestive that the Red Cliff Bay dolphins avoid or only minimally use the area with existing pearl lines. The area of proposed extension is used much more often by both beach, and especially by non-beach dolphins. Recent data on males indicate that they also use this area extensively (Connor et al. 1999). Placement of oyster lines in the proposed extension area could have a significant impact on dolphin behavior. Since shallow areas appear to be critical to female dolphin reproductive success (Mann et al. In press), limiting access to these shallow habitats could affect their reproduction. As such, and given the high value placed on the Red Cliff Bay dolphins for tourism, especially the beach dolphins, the precautionary principle should apply and the proposed area should not be used for oyster farming. Another area immediately to the south of the current farm seems not to be used by the beach dolphins. However, this area is used by males (Connor et al. 1999) and juveniles (Samuels, personal communication) and is therefore also not good for farming activities. Another option is to investigate the currently licensed area and make full use of it. However, our data only concern bottlenose dolphin ranging. We cannot give information on other species and how they would be affected by extended farming activities, nor how dolphins might be indirectly affected by habitat changes in such areas. Given that Shark Bay is a World Heritage Area, we would recommend a full environmental impact assessment to be carried out before fishing or farming activities are extended.

The data presented in this report are somewhat preliminary. We have a larger database (extending over a 12 year period) on dolphin ranging and are in the process of analyzing it in more detail. This will enable us to give more comprehensive information on ranging and make better suggestions for possible areas that could be used for farming activities. Unless funding can be provided, we anticipate that these

data will not be available until early 2000.

Remaining Questions about Oyster Farming and its relationship to the Dolphins

(1) *Do the mothers and calves avoid the oyster farm?* We cannot say whether dolphins avoid the oyster farm or simply didn't utilize the area prior to placement of the lines. We do not have dolphin ranging data prior to the placement of lines so we cannot determine if this is the case.

(2) *Do other age and sex classes of dolphins use the oyster farm area?* This is possible but we don't have an immediate answer. Since mothers and calves are the subjects of our particular study, we cannot address this question. Dr. Amy Samuels and Dr. Richard Connor have ranging data for juveniles and adult males and might be able to look at this in the future.

(3) *Is there any evidence to suggest that it is the lines that the dolphins avoid, the type of habitat, or human activity in the area?* Again, our data cannot address this directly. An experiment (e.g., placing an oyster-farm type line where the dolphins normally pass through to see if they avoid it) or comparison of habitats (fish distribution, benthic habitat, human activity) and dolphin use may help answer this question. If the dolphins used the farm area at night, for example, this would suggest that they are not avoiding the lines, but would not help distinguish between human activity and fish activity in the area since both would change during the evening.

(4) *Is there any reason that dolphins would be unwilling to swim over lines in the water?* Dolphins in captivity and in the field behave in a variety of ways around nets and lines. Perhaps of greatest relevance are reports by marine mammal trainers that they must often work extensively with dolphins before they can get them to pass over a rope (Pryor 1975). In Sarasota, Florida, dolphins who are captured typically do not jump over nets (Randall Wells, personal communication). This is also the case for spotted dolphins encircled with tuna nets who require extensive experience before they can be led out of nets (Pryor and Shallenberger 1991). In several parts of the world, dolphins are known to steal bait from crab traps — indicating that they do not avoid objects in the water per se (e.g., Noke 1999). They are also known to rub on anchor lines and we routinely observe the Monkey Mia dolphins swim over and rub on mooring lines at the beach. However in 1994, Puck became entangled in a fishing net and nearly drowned (Janet Mann, personal observation) indicating that even the females who routinely beg from fishermen are not invulnerable.

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THE INFLUENCE OF WATER DEPTH ON BOTTLENOSE DOLPHIN DISTRIBUTION IN SHARK BAY

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To determine the relative importance of shallow water areas to the bottlenose dolphins in Shark Bay, I analysed water depth data from dolphin surveys conducted from 1988-1998. The main reason for presenting these data is to show how important shallow and moderate depths are for the beach females and their associates. This must be considered with respect to oyster farming activities.

Surveys have been conducted regularly by all researchers in Shark Bay. When a dolphin is sighted, we recorded identity of animals in the group using a ten-meter chain rule (Smolker et al., 1992). Non-group members are also indicated (those outside the 10-meter chain). Location, water depth and other information are systematically recorded. Survey data for depth were included in this report, but I did not use survey data for ranging because of potential biases. For example, dolphins may be more difficult to sight within the Pearl Farm because of buoy markers or other activities. Similarly, we are likely to survey the beach dolphins near the provisioning area because we typically begin our offshore research in the mornings, when the beach dolphins are still near the provisioning area. No surveys are conducted within a 200m radius of the provisioning area. Surveys of seven Red Cliff Bay reproductive age females (5 beach and 2 non-beach) sighted between 1988-1998 are used in this analysis.

RESULTS

For this comparison, I included 5 beach/provisioned females (Holeyfin, Nicky, Crookedfin, Puck, Surprise). Holeyfin and Crookedfin died before 1996 when I began using GPS units so they are not included in the previous ranging analysis. Two of the beach females' close associates, Joysfriend and Square are added because of their exclusive use of Red Cliff Bay and because they were of reproductive age throughout the 10 year survey period. The number of surveys per female is indicated in the second column. The proportion of time spent in shallow (<4m), moderate (4-7m) and deep (>7m) water is indicated for each female. They spend little time in deep water. Of 38 females I have studied (Mann et al. In press), the beach females are the only ones whose median depth is less than 5m.

ID	#surveys	% Shallow (<4m)	% Moderate (4-7m)	% Deep (>7m)
Holeyfin	114	26	60	14
Nicky	166	36	54	10
Crookedfin	93	29	68	3
Puck	224	30	60	10
Surprise	159	47	43	10
Joysfriend	254	36	53	11
Square	210	31	48	21

DISCUSSION

I must emphasize that even though shallow water appears to significantly enhance female reproductive success, the calves born to the beach dolphins have suffered significantly higher mortality compared to non-beach dolphins (Mann et al. In press). All five beach females had the shallowest median depths compared to 33 non-beach females in our study population. Thus, given our results, the beach females should have greater, not lower calving success than other females in the population. The fragility of Monkey Mia is evident when one considers that only one daughter born to a provisioned female has survived past the age of five (Piccolo) over the last 20 years (Holly died at age 5). Since the continuity of the provisioning depends on the survival of female calves born to Nicky, Puck and Surprise, extreme caution is warranted in changing their habitat or adding human pressures.

MAP 1

1996-1998 Ranging Data for Beach Dolphins: Nicky, Puck and Surprise. GPS readings every 30 minutes (N=182 GPS readings) marked by +. Open rectangle is area with existing pearl lines; checkered area north of that is the proposed extension area. Hatched lines by the shore of Cape Rose indicate area within the current lease, but without lines.