DIRK HARTOG ISLAND LOGGERHEAD TURTLE NESTING POPULATION STUDY

A SHARK BAY WORLD HERITAGE AREA MANAGEMENT PROJECT
being part of the Western Australian Marine Turtle Project

REPORT on the 1997/98 SEASONAL WORK PROGRAM

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Introduction

Field work at the Dirk Hartog Island loggerhead turtle nesting beaches along the Turtle Bay - Cape Levillain coast was commenced in January 1994 (Prince 1994). The work was interrupted over season 1994/95, but recommenced in season 1995/96, and was continued in season 1996/97. This report covers work undertaken during the 1997/98 nesting season. It includes results of the seasonal beach work program, information gleaned from reports of captures and/or recoveries of previously tagged turtles from among those handled in seasons 1993/94 and 1995/96 through 1996/97, and additional information on breeding success.

Work Program

The main field sampling and monitoring of the adult female loggerhead turtles nesting at Dirk Hartog Island through summer 1997/98 was conducted over 14 nights between 9 and 23 January 1998. Supplementary visits to check on the early season build up and late season decline of nesting activity were planned and conducted over: 18-20 November (2 nights), and 21-23 December 1997 (1 night on beach only); and 21-23 February (2 nights). The last visit planned for this purpose late March 1998 was abandoned following observations of low turtle numbers and crawls made over 7-9 March 1998. Additional data for 16-17 December 1997 (1 night), 30 January-1 February (2 nights), 7-9 February (2 nights), 28 February-2 March 1998 (2 nights) were collected by a local nature-based tour operator/project volunteer.

Through January 1998, two three member work parties were primarily responsible for the interception, tag and release of new nesting turtles, and the monitoring and appropriate action required to deal with previously tagged turtles when found. These latter included remigrant turtles tagged in seasons 1993/94, 1995/96 and 1996/97, as well as further on beach encounters with 1997/98 tagged turtles.

Some personnel were changed over mid-way through the main sampling period (16 - 17 January 1998). Work parties for other periods were selected as required for the tasks assigned. Some further aspects of breeding success on the Turtle Bay beach were investigated on the 7-9 March 1998 visit.

Results

Very few nesting turtles were beaching overnight during the November 1997 visit - only seven beach crawls were recorded, with one turtle intercepted for tag and release while on the beach. Numbers of turtles beaching overnight had increased by mid-December 1997. Thirty nesting turtles were intercepted on beach overnight 21/22 December 1997. Approximately 35 to 75 new nesting turtles were being intercepted on beach nightly during the January sampling period,

with numbers seen on beach boosted by other already tagged turtles making repeat trips ashore, and remigrants (range total ca. 70 - 110 turtles/night). The number of turtles beaching overnight was little different early February 1998, but apparently declined quickly thereafter, with many less unmarked turtles among those seen on the 21-23 February trip. The two early March 1998 trips revealed overnight beachings of fewer than ten turtles, including false crawls.

In total, 847 new nesting female loggerhead turtles were tagged and released, and another 101 previously tagged remigrant turtles were encountered during season 1997/98 work. Cumulatively, 2 633 adult female loggerhead turtles have now been tagged and released from among those nesting at Dirk Hartog Island, and 201 have been recorded as remigrants.

Among the remigrant turtles recorded over the 1997/98 season, 36 were first records at 4 years from first encounter, 54 were at 2 years, and 4 were at 1 year. One other remigrant turtle, having lost its tags, could not be assigned an interval. No three year interval remigrants were observable, due to interruption of the work over season 1994/95 (noted above). Six other turtles were found for the second time, all having now been recorded twice at 2 years + 2 years after their first seasonal tag and release in 1993/94.

Five of the 1997/98 remigrant turtles had also previously been reported captured and released from a boat working in the Shark Bay prawn trawl fishery. One other turtle previously reported as a capture at sea was also recaptured alive in a trawl and released again late 1997. Thus, we now have obtained records of confirmed survival following a single capture and release at sea of 7 trawled and released turtles from among those tagged from this nesting population. Capture and release at sea reports for 19 Dirk Hartog Island nesting loggerhead turtles total are believed eligible for testing post-trawl capture survival prospects to April 1998.

One clutch count only at laying was done mid-Dec 1997. The count of 135 eggs for this clutch was similar to the averages obtained by excavation after deposition of eggs for larger samples from previous years [135.9 $\pm$ 8.52 (se), n=15, 1996/97; 132.6 $\pm$ 5.20 (se), n=22, 1995/96; range of full size eggs per clutch (combined over both seasons) = 61 - 181 eggs].

Excavation analyses of 13 nest sites having produced hatchlings to the Turtle Bay beach surface were attempted over 7-9 March 1998. Two of these nests were found to include mixed clutches resulting from nest construction by a second female turtle overlapping the eggs deposited previously by another turtle. Excavation of one other nest could not be completed properly due to continual slumping of the steep sandhill above the nest site.

Apparent clutch sizes indicated for the other ten nests excavated ranged from 82 - 159 eggs (130.9 eggs uncorrected average, n=10). However, difficulty in accurately estimating the number of eggs equivalent to the well shredded remains of egg shells having produced a large group of vigorous hatchlings was suggested by data from two of these nests.

The number of live hatchlings actually recovered from the first of these nests (143) exceeded the initial estimate of split shell numbers (127), and the first estimate also of total clutch (134), which included another seven eggs having not produced a hatchling. In addition to the 143 live hatchlings noted, this nest also contained another 2 dead hatchlings plus 2 live trapped within the nest remains, so the complete clutch size as indicated was 154. Reexamination in light of this result of all shell fragments previously recovered and sorted from the nest did not permit confident re-identification of any more than about six of the obviously misclassified ‘missing’ 20 egg shell remains. The excavation analysis data for this nest seems to have underestimated actual clutch size by 10-13%.

Comparable second nest data were: 103 live hatchlings from nest, plus 21 dead desiccated in sand column above the egg chamber = 124 hatchlings total *cf* 110 split shells (est.); initial estimate of total clutch = 137 (including 27 other eggs = 20 'undeveloped' plus 7 containing dead embryos); indicated actual clutch size = 151; underestimate of numbers (no re-sort of recovered shell fragments attempted) ca. 9.3%.

Reconciliation of excavation data with numbers of hatchlings etc as above for the other nests did not suggest similar underestimates of actual clutch size. Estimates of eggs from shell fragments generally exceeded the numbers of hatchlings assignable to a nest: the two numbers determined were similar for one of the nests (53 'eggs', 51 hatchlings) only. This nest had less than 50% viable eggs, and most of the vigorous hatchlings were seen breaking out of the nest while we were working nearby. Two other nests had hatchling:'eggs' ratios of ca. 0.75 - 0.90, with many hatchlings still within the nest. Meaningful comparisons were not available for the remaining four nests, as most hatchlings had previously broken out of the nest and dispersed, well in advance of the few still remaining within the nest - tracks of those gone were already obliterated, so estimates of numbers were not obtainable.

Noting the preceding discussion, and adjusting numbers for the two nests where clutch egg numbers were underestimated, the corrected clutch average increases to 133.9 eggs, again similar to the nest averages obtained by excavation after deposition in seasons 1995/96 and 1996/97 (above). The majority of eggs laid in each nest also seem likely from examination to have been fertile, but estimated hatchling production from eggs was variable: range ca. 0.42 - 0.95 for different clutches. Hatchling production to emergence on the beach surface appeared generally lower than this: range ca. 0.30 - 0.95, but few good estimates were obtainable at this time.

Reasons for the likely common low emergent hatchling production indicated from the eggs being laid on the Turtle Bay beach proper (restricted area = westernmost section of the Turtle Bay - Cape Levillain loggerhead breeding beach complex of Dirk Hartog Island, Shark Bay) appear attributable primarily to: the physical characteristics (yet to be examined in detail) of the beach sand itself, which comprises a wind-sorted, relatively fine-grained deposit accumulated at the foot of a high cliff (steep dune at rear, with a fringing beach at lower slope in front that is usually reworked each austral winter), and the temperature regimes experienced by nests on parts of this beach, the centre of which faces ca. NNW (see below). This beach, and others located eastward in the complex, can also be subject to substantial storm induced erosion before the end of nesting and conclusion of the expected seasonal hatchling emergence period.

The western end of Turtle Bay beach is shaded from late afternoon, but the lower beach frontage absorbs the full impact of solar radiation to this time. Beach sand temperatures at 5cm below the surface at nest locations in this area were in the range 41-42^{o}C at 1800hrs after ca. 1.5 hours in shade on 8 March 1998. Nest site sand surface temperatures in the range 30-32^{o}C were recorded elsewhere on this beach between 2200 and 0200 hours. Nest chamber bottom temperatures were taken for two nest sites: 26.8 and 29.5^{o}C recorded (not including nest site below).

Twenty-one (21) dead desiccated hatchlings were found in the sand column from below 5-10cm depth in one of the excavated nests, along with a number of still live but severely heat stressed hatchlings (in spasm on excavation, incapable of coordinated movement until cooled by exposure) - temperature at this level was 39^{o}C; temperature at the main mass of nest contents including many retained hatchlings was 35.6^{o}C. This nest was the worst affected by apparent overheating. Several other nests were found with from 1 - 4 dead desiccated hatchlings immediately below the surface - it appeared likely that these stiffened dead siblings could also impede later attempts by other hatchlings still below to break out of the same nest.

Redeposition of wind blown sand on the Turtle Bay beach is a regular daily event during the nesting season, generally wiping out the on-beach tracks of the previous nights nesting turtles by midday to early afternoon; the movement of large quantities of loose sand during nesting attempts by individual turtles can also bury previous nest sites. Loose surface cover of up to 10-15cm of dry sand was noted overlying the neck of most of the nests excavated. Hatchlings attempting to break out of nests with the deeper cover of this relatively fine grained beach sand also appeared to have been hampered in their efforts. Their original upward group movement paths constrained while within the neck of the nest tended to fan out laterally when they entered this unconsolidated surface layer.

Live hatchling samples (10 hatchlings/clutch) from two nests were weighed: ranges 15-20 grams, and 16-20 grams. Another composite sample of six hatchlings found breaking out from five different nests on our first beach reconnaissance included individuals from 14.5 to 19 grams. These weights may be less than expected for newly hatched loggerheads - many of the hatchlings weighed appeared to have already used part of their original egg yolk reserve, and may have been partially dehydrated (discussion above). Body weight data can be compared with egg weights previously obtained from Dirk Hartog Island nesting loggerheads: Average egg weights from individual clutch samples (1996/97 season - 10 eggs/clutch) ranged from 32.8g to 44.6g, n=13 clutches; and (1995/96) range 30.8g - 42.3g, n=22 clutches.

Discussion

Nesting season observations were generally consistent with similar information obtained by different means in 1993/94, but a late start to the 1997/98 nesting season is also suggested. Turtles observed breaking into previously laid nests through the January sampling period practically destroyed eggs with little or no visible embryo development early on, and with small embryos only later. A few hatchling turtles only were seen late January 1998.

The nesting period for the Dirk Hartog Island breeding loggerhead turtle population can generally be expected to lie within outer bounds from late October-early November through March, with the seasonal peak of activity around late December through January each year. Occasional out of season beaching and egg laying has been recorded. Hatchling emergence lags behind nesting: mid-late January through May is the period generally expected. Aggregation for mating obviously precedes commencement of egg laying - expected timing is ca. 2-4 weeks before the females come ashore. We have no data on mating aggregations and activities for these loggerheads.

Dispersal data obtained from the available capture and release records, and other encounters reported, show that adult loggerhead females nesting at Dirk Hartog Island include some turtles having their home feeding grounds within the Shark Bay WHA. Others have their feeding grounds in Kimberley coastal waters. Some of the adult female loggerhead turtles apparently resident within the Shark Bay WHA are also known to nest at South Muiron Island, off Exmouth Gulf, WA (Prince 1997).

There are, however, insufficient data as yet to adequately define the full range and location of all the feeding grounds occupied by the loggerhead turtles breeding at either Dirk Hartog Island, or in the North West Cape - Muiron Islands area of Western Australia. These turtles comprise a major regional stock, genetically different from the eastern Australian breeding loggerheads (Fitzsimmons *et al* 1996), although there now is known feeding ground overlap within the Gulf of Carpentaria (WAMTP: Prince, unpublished data).

The at-sea interaction data now being obtained for the Shark Bay prawn and scallop trawl fisheries with Shark Bay resident adult loggerhead turtles is providing some new, but still limited, information relevant to further management of the Shark Bay WHA. Survival records for some of the known trawled

and released tagged turtles are very encouraging for fisheries operators. We do not however, know how many adult loggerhead turtles might be resident within the Shark Bay WHA, the proportion of the Shark Bay resident loggerheads that might be sharing the prawn and scallop trawl grounds being fished in Shark Bay, or the proportions of these turtles that are part of the Shark Bay or Exmouth region nesting populations.

More importantly though, we lack data on the location of any of the mating grounds within the Shark Bay WHA where they must aggregate with males at the start of the breeding season, and particularly on the location of the critical internesting habitats of importance to the Dirk Hartog Island breeding loggerhead females when attending that rookery. This necessarily detailed information can only be obtained at sea using tracking technology, and is necessary for review of provisions for conservation of this turtle within the Shark Bay WHA.

The Western Australian breeding loggerhead turtle marked population study in progress has not yet been run for long enough to provide adequate sampling of the nesting female turtles likely to be dependent on breeding sites at Dirk Hartog Island, or in the North West Cape - Muiron Islands area. Data available to date do not provide good indications of individual nesting frequencies in the long term, particularly because of forced interruptions to the field programs in place (WAMTP: Prince, unpublished data). We are also not yet able to assess any current trend in population, or to judge any possible change in status relevant to previous times due to lack of prior baseline data.

The breeding success data suggest that the Turtle Bay beach (*sensu lato*) provides a less than optimal environment for production of hatchling turtles from the eggs laid, but nest temperature data suggest it may be capable of producing young of either sex. Breeding success on the easternmost of the Dirk Hartog Island nesting beach complex around Cape Levillain has not yet been studied. The Cape Levillain beach is comprised of coarser grained sand than found at Turtle Bay beach.

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