MARINE MANAGEMENT SUPPORT:
SHARK BAY

SUMMER DISTRIBUTION AND ABUNDANCE OF SHARK BAY DUGONGS
4 FEBRUARY – 15 FEBRUARY 2002

Field Program Report: MMS/SBY/SBA – 54/2002

A collaborative project between CALM Marine Conservation Branch, CALM Shark Bay District and James Cook University

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Shark Bay World Heritage Area
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ACKNOWLEDGEMENTS

CALM Collaboration

- Gordon Wyre- A/Director of Nature Conservation.
- Dave Rose- District Manager, Shark Bay District.
- Dr Chris Simpson- Manager, Marine Conservation Branch.
- Nick D'Adamo – Section Coordinator Marine Management Support, Marine Conservation Branch.
- Cheryl Cowell- Project Officer World Heritage, Shark Bay District.
- Judy Davidson – Observer, Marine Conservation Branch.
- Richard Campbell- Observer, CALM volunteer
- Gail Neylan – Observer, CALM volunteer

External Collaboration

- Dr Nick Gales – Australian Antarctic Division.
- Craig & Jessie Shankland – James Scheerer Research Charters.
- Dr Ivan Lawler – James Cook University.
- Dr Paul Lavery – Edith Cowan University

Funding and Resources.

- Funding for this project was provided through 2000/2001 Shark Bay World Heritage Property funding.
- Additional funding and resources have been provided by CALM Wildlife Branch and CALM Shark Bay District.

1 INTRODUCTION

1.1 GENERAL

Shark Bay has been identified as a nationally and internationally significant dugong habitat that supports dugongs at higher densities than have been recorded elsewhere (Marsh *et al.* 1994). The management of this dugong population is the responsibility of the Department of Conservation and Land Management under the Wildlife Conservation Act 1950. The Shark Bay Marine Reserves Management Plan (1996 – 2006) is the framework for all management activities. Within this document a number of research priorities have been identified, of high importance is the need for an aerial survey conducted within the summer period to ascertain dugong distribution and population estimates.

This project will be the first comprehensive survey of dugong abundance and distribution in Shark Bay during summer. It will follow established methods for aerial surveys used in the dugong surveys conducted during the respective winters of 1989, 1994, and 1999 (Marsh, 1994, Preen, 1997, Gales, unpublished data). Whilst dugong distribution is known to be affected by water temperature and forage availability, the factors affecting seasonal movements of dugongs within the Shark Bay World Heritage Property are not well understood.

By documenting full summer and winter distribution patterns of dugongs, habitats important to dugongs will be identified and this information will provide a focus for management of the dugongs and their habitat. The project will have important and direct links to the concurrent investigation, Movements and Community based Conservation of Shark Bay Dugongs, under funding from Natural Heritage Trust**,** Coast and Clean Seas, Marine Species Protection Program, Project Number: 28624.

The survey is planned for 4th to 15th February 2002 and will be a collaborative project between the Department of Conservation and Land Management (CALM) and James Cook University (JCU). The project will be coordinated within the research portfolio of the management support section of Marine Conservation Branch (MCB) of CALM. (Section Coordinator Nick D'Adamo). The Field Team Leader for this survey will be Dave Holley, Marine Fauna Zoologist MCB. Leadership of the observation component of this project will be undertaken by Dr Ivan Lawler of JCU. Dr Lawler has substantial experience in the conduct of dugong aerial surveys both in Queensland and Western Australia.

The team will comprise:

- Field Supervisor – Nick D'Adamo, Section Coordinator, Marine Support Section, MCB, CALM.
- Field Team Leader/Observer- Dave Holley, Marine Fauna Zoologist, MCB, CALM.
- Principal Observational Scientist- Dr Ivan Lawler, JCU.
- Chief Pilot – Eddie Malatesta, TropicAir Services.
- Senior Pilot - Lee Mullan, TropicaAir Services.
- Observer 1 – Judy Davidson, MCB, CALM.
- Observer 2 – Richard Campbell, Volunteer, CALM.
- Observer 3 – Gayle Nolan-Neylan, Volunteer, CALM.

1.2 BACKGROUND

The world heritage nomination document identifies that Shark Bay is an internationally significant dugong habitat that supports dugongs at higher densities than have been recorded elsewhere. The nationally standardised systematic dugong survey design that provides minimum population estimates and density distribution maps has provided critical base knowledge of winter distribution patterns and trends in abundance for the past decade in the Shark Bay World Heritage Property. An understanding of the summer distribution and abundance of dugongs in Shark Bay is the essential next step in documenting the movements of the animals and determining important habitats. Managers of the Shark Bay World Heritage Property will then be better able to balance the needs of the dugongs against the increasing threatening processes of aquaculture, eco-tourism, hunting, mineral and oil exploration, fishing etc. Aquaculture in particular is a rapidly increasing industry in Shark Bay and lease applications are currently being assessed without an understanding of the relevance of the areas to dugong habitat.

1.3 OBJECTIVES

The objectives as set out in the project application are to:

- To provide a precise minimum estimate of the number of dugongs in the Shark Bay World Heritage Property.
- To obtain a reliable index of the relative density of dugongs, in various parts of Shark Bay to compare with results of previous surveys as a basis for monitoring population changes and movements.
- To assess dugong habitat selection and utilisation.
- To determine dugong group sizes.
- To record sightings and plot the distribution of other large animals (e.g. whales, sharks).
- To examine patterns of dugong distribution and density in relation to tides.

2 METHODOLOGY

2.1 SURVEY METHODS

Dugongs will be surveyed by a strip transect method, based on the protocol of Marsh and Saalfeld (1989) and Marsh and Sinclair (1989a, 1989b). Throughout the survey, the aircraft, a twin engine Partenavia 68B, will fly along predetermined transects at a nominal ground speed of 100 knots

and at a height of 450′ (137m). There will be a total of 81 transects each 2.5 nautical miles apart Appendix 1). Observers will count dugongs, and other opportunistically sighted animals, within a strip of sea defined by rods attached to 'pseudo wing struts'. The strip thus demarcated on either side of the aircraft will be 200m wide (on the water) when the aircraft is flying 450'. The mid seat observers will communicate with the Principal Observational Scientist (POS) via an intercom system linked to a tape recorder. The POS using a microcomputer programmed as a data logger will record information. A taped record will also be kept as a back up.

The observers will report the following information (in order of priority):

1. Number of dugongs, specification of whether each sighted dugong is an adult or a calf, and number of feeding plumes.
2. Information about sea conditions and glare.
3. Sightings of dolphins, including specification of whether each sighted dolphin is an adult or a calf
4. Sightings of turtles, whales, sea snakes, sharks, rays, seagrass beds, plankton blooms.

Herds of ten or more dugongs will be photographed by the POS with a hand held 35mm camera, with a complimentary visual estimate of group size made in case of photographic failure. All such groups will be recorded irrespective of whether they are within the transect strip. In the event of a group of dugongs being sighted the aircraft will be temporarily re-routed at the end of the respective transect back to obtain a photograph of the dugong group. Once that photograph has been taken the transects will recommence as planned.

The four observers will operate in two pairs, as follows. The port observer (mid-seat)(POM) and port observer (rear seat) (POR) form the 'Port Pair'. The starboard observer (mid seat) (SOM) and starboard observer (rear seat) form the 'starboard pair'.

The two mid seat observers will be visually screened from the two rear seat observers, by means of a curtain between the mid and rear sections of the cabin. This is to ensure independence in their respective observations. The port pair will both scan, independently of each other, the port side of the transect. Similarly, the starboard pair will both scan, independent of one another, the starboard transect.

Each middle seat observer will see (mark) a group of dugongs which may or may not be seen (recaptured) by the corresponding rear seat observer on the same side of the aircraft. Hence each rear seat obsever will see groups of dugongs in two categories: those that are "marked" and which she/he "recaptures" and those that are "unmarked". When the data are analysed, it will be possible to categorise each group of dugongs sighted as being recorded by one or both observers. These categories will then be fitted in a mark recapture framework to calculate the probability of a dugong group being seen (captured by a tandem team).

2.2 ACTIVITIES AND RESPONSIBILITIES OF CREW MEMBERS

2.2.1 PILOT

The major tasks of the pilot are to maintain height (@450′), ground speed (@100 knots), level (horizontal) and transect alignment as instructed by the POS. Specific notes are given here with respect to the pilots role in navigation, height control, speed and transect identification:

1. **Navigation** Flying a transect accurately requires a high degree of control in following lines marked on a map of the census zone. On this survey, a GPS system will be used to locate start and end points of transects and large dugong groups that are observed. The pilot will be asked by the POS to record the GPS fix when large groups of dugongs are seen either within or outside of the transect.
2. **Height control** This is one of he most important aspects of transect piloting. The width of the transect strip, as demarcated by the transect markers, is directly proportional to the aircraft's height above the ground. The higher the aircraft, the wider will be the strip and visa versa. Unacceptable biases can occur in the recordings unless the pilot pays very careful attention to the height control.
3. **Speed** Every effort should be made to maintain a constant ground speed. The airspeed is less important, except of course in respect of aircraft safety.
4. **Transect Identification.** The pilot will blow a whistle to signal the start and end of each transect.

2.2.2 PRINCIPAL OBSERVATIONAL SCIENTIST (POS).

The duties of the POS are:

1. The POS will sit beside the pilot and has final responsibility for managing the survey to get the best possible results.
2. The POS will be responsible for checking and recording speed and altitude during each transect.
3. The POS will record the time at the beginning and end of each transect. During the actual survey period The POS will have voice contact with the mid seat observers only.
4. Each time a mid seat observer reports a sighting or change in survey conditions, the POS will acknowledge the information and then enter the data reported into the palm top computer. Additional information, if missed by the POS data entry, will be recovered when the tape is re-run after the flight.
5. The POS is responsible for entering details of the weather and sighting conditions into the computer.
6. The POS is responsible for setting up the GPS and computer to record the actual flight path followed (as this is bound to vary slightly from the planned transects).

2.2.3 FIELD TEAM LEADER (FTL)

1. The FTL is responsible for the overall organisation of the survey.
2. The FTL will ensure that the pilot and the POS have copies of transect maps for the days flights.
3. The FTL is responsible for transport to and from the airport to accommodation.

2.2.4 OBSERVERS

1. The task of an observer is to observe and deliver information to the POS. This requires maximum concentration at all times during a transect.
2. The major task is to count the dugongs (and other animals) seen in the area defined by the area designated by the rods on his/her side of the aircraft. Searching is best done by looking forward (this may not be possible when flying into the sun and the angle of observation should be adjusted to minimise the effect of glare) and to systematically examine the entire width of the search zone. Observers must make firm identifications if they are to be of value.
3. To facilitate computer entry, all sightings within the transect should be reported verbally over the intercom system in standard format as follows:

Dugong sightings:

- Type of animal, e.g.'dugong'
- Total number in group (including calves), if it's a groups sighted
- Number at surface.
- Position in transect (high- furthest from the plane, low- closest to the plane or mid)
- Number of calves

Note that a group is a distinct clump.

Examples of a call by an observer of a dugong sighting:

"Dugongs, three, none at the surface, high, one calf."
"Dugongs, two, both at surface, low, one calf."
"Dugongs, six, three at the surface, low and mid, no calves".
"Dugong, one, surface, mid".

If time permits, then complimentary sightings of dolphins, whales, turtles and sharks, will be recorded as follows.

- **Dolphins**: Number in group, number at surface, number of calves, position in transect, genus (*Sousa or Tousiops*), reliability of identification (certain, probable, possible, don't know)

  e.g. "Dolphins, six, two at surface, no calves, low, *Sousa*, certain".
  " Dolphins, 25, all at surface,5 calves, mid, *Tursiops*, probable".

- **Whales:** Number in group, number at surface, number of calves, position in transect, type of whale (e.ge Humpback, Minke, Right), reliability of identification (certain, probable, possible, don't know).

  e.g. "whale, one, surface, mid, Humpback, certain".

- **Turtles:** Number seen, number at surface, position in transect (high, mid, low)

  e.g. "turtle, 3, one at surface, high".
  Note: Large turtles only will be visible at this altitude.

- **Rays:** Number seen, number at surface, position in transect (high, mid, low)

  e.g. ray, 2, below surface, one mid, one low.

- **Sharks:** Number seen, number at surface, position in transect (high, mid, low)

  e.g. shark, 1, below surface, mid.

- **Feeding plumes** for which the associated animal is not obvious should be reported if time permits, e.g. plume, number, probable species.

GLARE: Each mid seat observer should report the glare intensity at regular intervals during each transect, using the following ordinal scale:

0 = none
1 = 25% field of view affected by glare
2 = 25-50% field of view affected by glare
3 = >50% field of view affected by glare

By "affected by glare" it is meant that an observer cannot discern with confidence what type of animal , if any, is evident in the field of view.

2.3 CONTINGENCY FOR ADVERSE CONDITIONS

The estimated time that it would take to capture the required data during favourable weather is six days. However to account for the occurrence of unsuitable weather days the time frame for the completion of this survey has been set at 12 days. This should allow sufficient contingency (in time) for adverse conditions. The decision to abort a scheduled flight is the responsibility of the FTL in consultation with the POS.

3 PROJECT MANAGEMENT

3.1 SURVEY TEAM CONTACT DETAILS

Table 1. Contact details for all members of the survey team.

CREW	ORGANISATION	ROLE	CONTACT DETAILS
Dave Holley	MCB, CALM	Field Team Leader/ Observer	Ph (w) (08) 9432 5100 Fax (08) 9430 5408 Ph (mb) 0417 952 118 Ph (h) (08) 9335 6645
Ivan Lawler	JCU	Principal Observational Scientist	Ph (w) (07) 4781 5823 Fax (07) 4781 4020
Eddie Malatesta	TropicAir Services	Chief Pilot	Ph (w) (08) 9941 2002 Ph (mb)0417 178 813
Judy Davidson	MCB, CALM	Observer	Ph(h) (08) 9354 3567
Richard Campbell	CALM, Volunteer	Observer	Ph(h) (08) 9433 5231
Gayle Neylan	CALM, Volunteer	Observer	Ph (h) (08) 9293 1813

3.2 ITINERARY

DATE	DAY	ACTIVITY
02/02/02	Sat	Ivan Lawler (IL) arrives at Perth
03/02/02	Sun	Dave Holley (DH), Richard Campbell (RC) and IL depart for Shark Bay arrive 6pm.
04/02/02	Mon	Meet Pilots, equip plane. Remaining observers arrive @SB, safety briefing.
05/02/02- 14/02/02	Tues - Thu	Aerial survey conducted from Denham. Data to be analysed each evening after flights.
15/02/02	Fri	Clean and sort equipment. All personnel depart SB to Perth.

3.3 SAFETY

3.3.1 General

Field operations shall be carried out in accordance with departmental procedures and protocols. Overall responsibility for field procedures during this field trip and the personal safety of all team members rests with the Field Team Leader- Dave Holley.

3.3.2 Aerial Survey

Safety during flight periods, before and after take off and landing and around aircraft is the responsibility of the designated pilot

3.4 COMMUNICATIONS AND EMERGENCY CONTACTS

The survey team can be contacted through the following numbers

DH mobile phone – 0417 952 118.

Shark Bay District CALM office. 08 9948 1208

TropicAir Services mobile - 0417178813

Silver Chain Bush Nursing Post, Denham- 08 9948 1213

3.5 ACCOMMODATION

During the course of the survey all personnel will be accommodated at the Peron Peninsula Homestead in the Francois Peron National Park. Food will be purchased by DH with all personnel to prepare meals on a rotational basis.

3.6 BUDGET

Budget Item	CALM MCB Funds ($) Operational.	EA Funds ($) Operational.
Travel		
CALM MCB vehicle - $0.45/Km for 2,000Km	900	
Airfares		
2 x return Perth – Shark Bay		1000
1 x return Townsville – Perth		1200
Meal Costs		
6 people @ $30/person/day x 13 days		2340
Accommodation		
6people @ $10/person/night x 13 days		780
Aircraft Charter		
30 hours @ $425/hr		12 750
Airport Landing Fees		330
Consultancy Fees		4000
Consumables		1000
Contingency Funds		2340
Staff		
Dave Holley	5365	
TOTALS	**6265**	**25 740**

3.7 EQUIPMENT

PILOT

- High winged, twin engine, 6 seat aircraft (Partnavia)
- Dash mounted GPS
- Hand held GPS
- Fuel for 20hrs flight time.
- Maps with transect
- Polaroid glasses
- whistle

SURVEY LEADER

- Sighting poles (to be fitted by pilot)
- Polaroid sunglasses
- Intercom system/tape recorders
- Tapes
- Maps with transects
- Data sheets
- Pencils
- Palmtop computer
- Spare batteries
- Laptop computer
- Hand held camera
- Headsets

OBSERVERS

- Polaroid sunglasses
- Dark shirt
- Lollies (provided by survey leader)

4 DATA MANAGEMENT

4.1 FIELD PROGRAM REPORT

Hard copies of this report to be held at three locations:

1. Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry st., Fremantle, WA, 6160. Ph (08) 9432 5100 Fax (08) 9430 5408.
2. Woodvale Library, Science and Information Division, Ocean Reef Rd., Department of Conservation and Land Management, Woodvale, WA, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.
3. Archived with CD ROM, Woodvale Library, Science and Information Division, Ocean Reef Rd., Department of Conservation and Land Management, Woodvale, Western Australia, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.

The Marine Conservation Branch will hold digital copies of the Field Program Report:

1. The Marine Conservation Branch Server:
   Shareddata on 'CALM-frem-1' [T:144-Marine Conservation Branch\Shared Data\Current_MCB_reports\MMS\mms_5402]

2. MCB Server full backup DAT tape:
   1' [T:144-Marine Conservation Branch\Shared Data\Current_MCB_reports\MMS\mms_5402]

4.2 DATA

Collected raw data will be:

1. Produced as a Marine Management Support Data Report and copies will be held at the same locations as for the Field Program Report.

2. Metadata to be stored with the Marine Management Support Data Report.

4.3 SLIDE RECORDS

All photographic slides taken by CALM to be stored at the Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia.

5 REFERNCES

Marsh, H., and W.K. Saalfeld. 1989. *The distribution and abundance of dugongs in the northern Great Barrier Reef Marine Park*. Australian Wildlife Research **16**: 429-440.

Marsh, H., and D.F. Sinclair. 1989a. *Correcting for visibility bias in strip transect aerial surveys of aquatic fauna*. Journal of Wildlife Management **53**: 1017- 1024.

Marsh, H., and D. F. Sinclair. 1989b. *An experimental evaluation of dugong and sea turtle aerial survey techniques*. Australian Wildlife Research **16**:639-650.

6 DISTRIBUTION LIST

Department of Conservation and Land management
Dr. Chris Simpson, Manager, Marine Conservation Branch.
Nick D'Adamo, Senior Oceanographer, Marine Conservation Branch.
David Rose, District Manager, Shark Bay District.
Kelly Gillen, Regional Manager, Mid West Region.

James Cook University
Dr. Ivan Lawler

APPENDIX 1: TRANSECT RECORDING SHEETS

Day:		**Take off time:**				**High tide:**	**Location:**
Date:		**Landing time:**					**Time:**
Flight #:		**Transit**		**to transit**			
Transect							
#	**Heading**	**Start time**	**Finish time**	**Duration**	**Turnaround**	**Total flight time**	

APPENDIX 2 2002 Summer Transects

Transects- 2002 Summer Aerial Survey