

Project Plan SP 2014-021

Habitat use, distribution and abundance of coastal dolphin species in the Pilbara

Marine Science

Project Core Team

| | |
|------------------------------|---------------|
| Supervising Scientist | Holly Raudino |
| Data Custodian | Holly Raudino |
| Site Custodian | Holly Raudino |

Project status as of Dec. 6, 2019, 2:17 p.m.

Approved and active

Document endorsements and approvals as of Dec. 6, 2019, 2:17 p.m.

| | |
|--------------------------------|--------------|
| Project Team | granted |
| Program Leader | granted |
| Directorate | granted |
| Biometrician | granted |
| Herbarium Curator | not required |
| Animal Ethics Committee | not required |

Habitat use, distribution and abundance of coastal dolphin species in the Pilbara

Biodiversity and Conservation Science Program

Marine Science

Departmental Service

Service 6: Conserving Habitats, Species and Communities

Project Staff

| Role | Person | Time allocation (FTE) |
|-----------------------|-----------------|-----------------------|
| Supervising Scientist | Kelly Waples | 0.25 |
| Research Scientist | Holly Raudino | 1.0 |
| Technical Officer | Corrine Douglas | 0.25 |
| Technical Officer | Ryan Douglas | 0.25 |

Related Science Projects

None

Proposed period of the project

July 1, 2014 – June 30, 2018

Relevance and Outcomes

Background

Although little is known about population size, distribution and residency patterns, it is well accepted that Australian snubfin (*Orcaella heinsohni*) and Australian humpback dolphin (*Sousa sahulensis*) inhabit Australia's tropical north-western coastal waters (Allen, *et al.* 2012). Indo-Pacific humpback dolphins occur across Australia's entire northwest coast including resident populations at Ningaloo Marine Park and most likely the Dampier Archipelago as well as further north into the Kimberley. The snubfin dolphin is endemic to northern Australia with identified resident populations in the Kimberley, Northern Territory and Queensland (Brown, *et al.* 2014; Brown, *et al.* 2014). While this species has been sighted occasionally in the Pilbara, their presence and use of this area is yet to be determined, however the Pilbara is likely to represent the southern extreme of their range (Allen, *et al.* 2012).

Limited surveys have been conducted targeting coastal dolphins in the Pilbara; exceptions include a dedicated study of humpback dolphins in Ningaloo Marine Park and Exmouth Gulf (Brown, *et al.* 2012) and opportunistic surveys and anecdotal sightings throughout the region (Allen, *et al.* 2012). Aerial surveys that were targeting humpback whales sighted dolphins but were unable to differentiate between species due to the high altitude flown (1000 ft) (Jenner & Jenner 2004; Jenner & Jenner 2010). Although the presence of several coastal dolphin species is expected in nearshore waters (humpback, snubfin and bottlenose dolphins) (Hanf 2014) the residency, degree of use and habitat characteristics of these species are unknown in the Pilbara.

Human pressures and impacts on these species are increasing, in particular in the Pilbara through activities associated with the rapid expansion of resources sector, including oil and gas exploration and production, coastal infrastructure development and shipping. This is often a key factor that proponents are required to address to secure environmental approvals at the State and Commonwealth levels. However, as noted above, the knowledge base on these species across their range is very poor. In addition, there are no agreed best practice

protocols or standards for survey design and data collection on these species that allow for comparison to be made between studies and study sites. A better understanding of these species and their use of Pilbara coastal waters is needed to provide good temporal and regional context for assessing and managing impacts and to reduce uncertainty in the approvals process. As such, the draft *Strategic Research Priorities for Marine Mammal Conservation and Management in Western Australia 2014* recognised both snubfin and humpback dolphins as high priority species for fundamental research.

Aims

This research is being conducted to develop a baseline understanding of key aspects of the ecology of dolphins in coastal Pilbara waters. The specific aims are to:

- Determine habitat use, distribution, abundance, residency, and movement patterns of dolphins in coastal Pilbara waters;
- Identify the characteristics of habitats used by coastal dolphins, such as water depth, benthic substrate, timing and seasonal variation; and
- Determine the trophic niche of dolphins in the Pilbara by identifying the prey species they consume.

Expected outcome

This research will enable a better understanding of coastal dolphin species at a regional and national scale including distribution, abundance, habitat use, movement and connectivity. The main outcomes and benefits will be:

- Distribution and abundance including high density areas and spatial and temporal patterns of coastal dolphins will be identified and mapped across the Pilbara to allow managers to assess conflicts with potential pressures;
- Key habitat will be identified which can be used to assess potential overlap with pressures such as habitat loss from coastal development and displacement from industrial development leading to better informed decision making during Environmental Impact Assessment processes;
- Populations will be defined for coastal dolphin species (humpback, bottlenose and snubfin, where applicable) which will allow managers to assess the relative conservation significance of different populations or species in relation to pressures or factors like restricted distributions;
- Baseline data will inform ongoing regional monitoring and management and for comparison with other regions;
- A state-wide database will be implemented modelled on the Northern Territory database 'DoIFIN' to archive and manage survey and photo-identification data which will improve information management, compatibility and information sharing between jurisdictions
- Data on population abundance and distribution of humpback and snubfin dolphins in the Pilbara will allow a more comprehensive assessment of their conservation status at a State and National level.

Knowledge transfer

At a state level the Department of Parks and Wildlife and the Office of Environmental Protection Authority (OEPA) will be the main user of this knowledge. The Environmental Management Branch within Parks and Wildlife and the OEPA currently have limited information on which to assess Environmental Impact Assessments (EIA) on these dolphin species in the Pilbara. This information will be used in EIA processes to evaluate and mitigate potential impacts on coastal dolphins by informing the appropriateness of proposed developments in relation to critical habitat identified through this project. The presence of coastal dolphin species and the vulnerability of these populations to coastal development will be more apparent from this study. Industry (Port Authorities, Oil and Gas companies) will be interested in methodology, e.g. protocols and standard operating procedures for dolphin surveys and the resulting baseline data to inform future proposals and EIA related documents.

In addition, the findings and information will be used by Parks and Wildlife Marine Science Program to manage marine mammals in the Pilbara and across the state using this baseline information and protocols to establish long term monitoring. Data will be relevant to marine conservation planning through marine protected area planning and through conservation status assessment.

When announcing the 2011 Finalised Priority Assessment List of Threatened Species under the EPBC Act, the Federal Minister for Sustainability, Environment, Water, Population and Communities, Mr Burke said he had received advice that there was currently not enough information to properly assess the snubfin dolphin however he was “hopeful that we will be able to collect enough information to do a proper assessment before long”. This project will gather information on the population status of the snubfin dolphin in the Pilbara region, WA and this information can be used towards the overall assessment of the conservation status of this species.

Tasks and Milestones

| Milestone | Completion Time |
|--|---|
| <i>Project Planning</i> | |
| Submission of Science Concept Plan | Jul 2014 |
| Submission of Science Project Plan | Aug 2014 |
| <i>Field Work</i> | |
| Pilot field trip to test survey and sampling design (Southern Pilbara) | Oct 2014 Mar, Jun/July, Oct 2015 |
| Boat surveys in southern Pilbara sampling dolphins | Mar, Jun/Jul, Oct 2016 |
| Pilot field trip to test survey and sampling design (Northern Pilbara) | Apr and Nov 2015 Apr and Nov 2016 |
| Boat surveys in northern Pilbara sampling dolphins | |
| Aerial surveys in southern and northern Pilbara | |
| <i>Data processing and Statistical Analysis</i> | |
| Pilot run of habitat model | Nov 2014 |
| Photo-identification and distribution analysis | Dec of each year 2014-2016 |
| Occupancy and habitat modeling analysis | |
| <i>Reports (outputs)</i> | |
| Metadata report for each field trip (summary statistics of sample sizes) | Within 3 months of trip completion Annually Sep. Jun 2017 |
| Progress reports | |
| Final reports | |

References

- Allen, S. J., Cagnazzi, D. D., Hodgson, A. J., Loneragan, N. R. & Bejder, L. (2012) Tropical inshore dolphins of north-western Australia: Unknown populations in a rapidly changing region. *Pacific Conservation Biology* 18: 56-63
- Bacher, K., Allen, S., Lindholm, A. K., Bejder, L. & Krutzen, M. (2010) Genes or Culture: Are Mitochondrial Genes Associated with Tool Use in Bottlenose Dolphins (*Tursiops* sp.)? *Behavioural genetics* 40: 706-714
- Bilgmann, K., Griffiths, O. J., Allen, S. J. & Moller, L. M. (2006) A biopsy pole system for bow-riding dolphins: sampling success, behavioral responses, and test for sampling bias. *Marine Mammal Science* 23: 218–225
- Brown, A., Bejder, L., Cagnazzi, D., Parra, G. & Allen, S. (2012) The North West Cape, Western Australia: A Potential Hotspot for Indo-Pacific Humpback Dolphins *Sousa chinensis*? *Pacific Conservation Biology* 18: 240-246
- Brown, A. M., Bejder, L., Pollock, K. H. & Allen, S. J. (2014) Abundance of coastal dolphins in Roebuck Bay, Western Australia *Report to WWF-Australia*, 25
- Brown, A. M., Kopps, A. M., Allen, S. J., Bejder, L., Littleford-Colquhoun, B., Parra, G. J., Cagnazzi, D., Thiele, D., Palmer, C. & Frère, C. H. (2014) Population Differentiation and Hybridisation of Australian Snubfin

(*Orcaella heinsohni*) and Indo-Pacific Humpback (*Sousa chinensis*) Dolphins in North-Western Australia. *PLoS ONE* 9: e101427

Fernandez, R., Garcia-Tiscar, S., Santos, M. B., Lopez, A., Martinez-Cedeira, J. A., Newton, J. & Pierce, G. J. (2011) Stable isotope analysis in two sympatric populations of bottlenose dolphins *Tursiops truncatus*: evidence of resource partitioning? *Marine Biology* 158: 1043–1055

Frère, C. H., Krzyszczyk, E., Patterson, E. M., Hunter, S. & Ginsburg, A. (2010) Thar she blows! A novel method for DNA collection from cetacean blow. *Plosone* 5: e12299

Gibbs, S. E., Harcourt, R. G. & Kemper, C. M. (2011) Niche differentiation of bottlenose dolphin species in South Australia revealed by stable isotopes and stomach contents. *Wildlife Research* 34: 261-270

Groom, C. J. & Coughran, D. K. (2012) Three decades of cetacean strandings in Western Australia: 1981 to 2010. *Journal of the Royal Society of Western Australia* 95: 63-76

Jenner, K. C. & Jenner, M. N. (2010) A Description of Megafauna Distribution and Abundance in the SW Pilbara Using Aerial and Acoustic Surveys – Final Report *Centre for Whale Research* 54

Krützen, M., Barré, L. M., Möller, L. M., Heithaus, M. R., Simms, C. & Sherwin, W. B. (2002) A biopsy system for small cetaceans: darting success and wound healing in *Tursiops* spp. *Marine Mammal Science* 18: 863-878

Nicholson, K., Bejder, L., Allen, S. J., Krutzen, M. & Pollock, K. H. (2012) Abundance, survival and temporary emigration of bottlenose dolphins (*Tursiops* sp.) off Useless Loop in the western gulf of Shark Bay, Western Australia. *Marine and Freshwater Research* 63: 1059-1068

Owen, K., Charlton-Robb, K. & Thompson, R. (2011) Resolving the Trophic Relations of Cryptic Species: An Example Using Stable Isotope Analysis of Dolphin Teeth. *PLoS ONE* 6: 1-10

Smith, H. C., Pollock, K., Waples, K., Bradley, S. & Bejder, L. (2013) Use of the Robust Design to Estimate Seasonal Abundance and Demographic Parameters of a Coastal Bottlenose Dolphin (*Tursiops aduncus*) Population. *PLoS ONE* 8: e76574

Tyne, J. A., Pollock, K. H., Johnston, D. W. & Bejder, L. (2014) Abundance and Survival Rates of the Hawai'i Island Associated Spinner Dolphin (*Stenella longirostris*) Stock. *PLoS ONE* 9: e86132

Study design

Methodology

Field sampling

A combination of distance sampling techniques (through aerial and boat surveys) and mark-recapture (through boat surveys) will be used to investigate dolphin density, distribution and abundance.

Boat surveys

Sampling will take place three times a year for a two week period, subject to weather (March, June/July, October in 2014-2016). Surveys will be conducted along pre-determined line transects from a small 5m centre console RIB (or equivalent) research vessel driven at a speed of 8 to 12 kn with two observers and one boat driver present during each survey. Line transects will be designed to run perpendicular to the mainland coastline where possible to account for the water depth gradient and distance from coast.

Transect design

The study area will be divided into multiple zones for the purpose of the boat based surveys. The initial four zones have been selected based on known densities of dolphins and/or suspected presence based on habitat. Other potential zones include Exmouth Gulf and Cape Preston.

Zone 1- transects will extend offshore a maximum of 3nm from the mainland coastline and extend alongshore 20 kilometres north and south of Onslow township.

Zone 2- transects will be centred around Thevenard Island and radiate from the island to 2 nautical miles and between Thevenard Island and the mainland (~12km).

Zone 3- transects will centre around Dampier Port and the Dampier archipelago within state waters (3nm)

Zone 4- transects will centre around Balla Balla and extend alongshore extending offshore to state waters (3nm)

A sampling design of transects will be prepared for each zone that will allow for that zone to be surveyed by boat within a single day (weather permitting) to avoid re-sighting dolphins as they move through the study area. The overall survey route will be divided into smaller transects of at least 10 kilometres in length. The 10 kilometre transects will be completed in a random order and repeated at least 6 times over two years.

Sighting data

When a dolphin is sighted the following data will be recorded; species, distance and angle between the vessel and the dolphin, and dolphin group size. The position of the vessel on the transect will also be recorded before the vessel departs the transect line. Once this initial information is recorded, the vessel will approach the dolphin group to within 50 m to capture additional data such as photo-identification of individual dolphins, age and group composition and predominant behaviour (feeding, foraging, travelling, resting or socialising). When foraging or feeding is recorded as the predominant behaviour, the species of prey will be recorded whenever possible.

The duration of sightings of dolphin groups will be short where possible (5 minutes minimum to determine predominant behaviour and photograph all individuals) to maximise the search effort along the transect line and ensure completion of each transect during suitable weather (Beaufort scale <3). At the completion of each sighting the transect line will be re-joined where it was departed (marked by the GPS waypoint).

Aerial surveys

The study area will be divided into two zones for the purpose of aerial surveys

Zone 1 – will be the area surveyed and demarked in the dugong research plan extending south of Onslow and offshore to Barrow Island.

Zone 2- will be the area north of the area already surveyed north of Onslow, Barrow Island and encompassing the Dampier Archipelago.

Aerial surveys will be conducted by a fixed high-wing aircraft flying a pre-determined survey route of line transects. The aircraft will follow transect lines at a low altitude (500 ft) and a speed of 80km/hr. There will be two dedicated observers; one on each side of the aircraft and a survey leader collating the data. The two observers and the survey leader will communicate via aviation headsets and the survey leader will record the data being called by the observers. For each dolphin group sighted the species, number of individuals visible, position in the transect and number of calves will be recorded. For the purpose of species identification and confirming group size, the group will be circled, counted and then the transect line resumed.

Tissue Sample Collection – connectivity and trophic niche assessment

Tissue samples will be collected using remote biopsy techniques; either a modified air rifle with darts (Krützen, *et al.* 2002) or a pole puncture system for bow-riding individuals (Bilgmann, *et al.* 2006). These samples will be collected during vessel based surveys, though these surveys will be conducted separate to the line transect surveys described above. Approximately 20 samples per sample site across the Pilbara region will be the target sample size (maximum total samples approximately 100). Approximately 20 samples already exist from the North West Cape and Dampier Archipelago for humpback dolphins. Tissue samples will be sub-sampled for the purpose of stable isotope and genetic analysis and stored appropriately following Western Australian Museum protocols. External researchers will be engaged to collect samples and the laboratory analysis will be outsourced for this aspect of the project.

Analysis

Photo identification - processing and archiving

Photo identification images will be collected in the field. A protocol will be followed of collecting at least one image for both sides of the dorsal fin for each individual dolphin regardless of degree of marking or familiarity. The images will then be graded using standard protocols. The images will be graded in relation to: 1) quality (angle, focus and the ratio of fin to frame) and 2) distinctiveness (how marked the individual is from not marked to severely marked). Survey data will be entered and managed in a relational database (DolFIN) with survey images matched to the photo-identification catalogue and linked to the relevant survey information. This database will be used to generate the capture histories and distribution data that will then be analysed statistically using software such as MARK, DISTANCE and Arc GIS.

Distribution and abundance estimation

Mark-recapture methods will be applied to the photo-identification data that will be stored and processed in the DoFIN database. Capture histories will be generated for individual dolphins and abundance will be modeled using either POPAN or the Robust Design in program MARK 23/07/2014 (Nicholson, *et al.* 2012; Smith, *et al.* 2013; Tyne, *et al.* 2014). Parameters such as apparent survival and temporary emigration will be estimated. Abundance and distribution may also be calculated using the program DISTANCE for comparative purposes if time permits.

Habitat modelling

Dolphin sightings from two platforms (aerial and boat) will be analysed in ArcGIS and incorporated into a broadscale habitat model per species with variables such as distance from coast, benthic habitat, SST, water depth, slope and behaviour to investigate which environmental variables best explain dolphin distribution across the Pilbara study area. This analysis will build on preliminary analysis by Hanf 2014 (Murdoch University masters project) that modelled dolphin sighting data collected during 2012 dugong aerial surveys for Chevron using MAXENT modelling (presence-only) software. A pilot project of incorporating Department of Parks and Wildlife benthic habitat data will be incorporated into this model in October 2014 to see if benthic habitat type is an important predictor in dolphin distribution. Boat sighting data will be incorporated into the habitat model to improve the species representation (this may be biased due to dugongs being the focal species of the aerial surveys) and to validate the habitat model. Potentially other habitat models may be used including Generalised Linear Models if the presence-only models in MAXENT are deemed to be of limited value in identifying habitat characteristics important to these dolphin species in this area and if the model has limited overall predictive ability of dolphin distribution across the region.

Connectivity

Genetic analyses will follow methodology by Brown *et al.* 2014 and will likely include mitochondrial DNA (mtDNA) and microsatellite loci with PCR conditions as described in Bacher *et al.* 2010 and Frère *et al.* 2010. Several measures of population differentiation will likely be calculated from several sample sites across the Pilbara region. Statistical software such as STRUCTURE, FLOCK and BOTTLENECK may be used for to examine the differentiation patterns between populations and to test whether there has been a recent bottleneck (Brown, *et al.* 2014). This component of the project will likely be contracted to Murdoch University Cetacean Research Unit.

Trophic Niche/diet

If carcasses are recovered during stranding events, stomach contents will be analysed for hard parts (fish otoliths and cephalopod beaks) and teeth for stable isotope signatures but it is expected that strandings and recovery of carcasses in the Pilbara region will be uncommon (Groom & Coughran 2012). Analysis of the carbon and nitrogen signatures of the tissue samples or teeth compared will indicate whether dolphins are feeding in brackish water, coastally or further offshore (Fernandez, *et al.* 2011; Gibbs, *et al.* 2011; Owen, *et al.* 2011).

Biometrician's Endorsement

granted

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

required

Data management

The survey data, including photo identification images will be stored in DoIFIN database, a purpose built database maintained on a secure server.

Tissue samples will be lodged with the Western Australian Museum

Budget

Consolidated Funds

| Source | Year 1 | Year 2 | Year 3 |
|---------------|--------|--------|--------|
| FTE Scientist | | | |
| FTE Technical | | | |
| Equipment | | | |
| Vehicle | | | |
| Travel | | | |
| Other | | | |
| Total | | | |

External Funds

| Source | Year 1 | Year 2 | Year 3 |
|---------------------------|---------|---------|---------|
| Salaries, Wages, Overtime | 87,940 | 89,535 | 89,535 |
| Overheads | 26,868 | 27,356 | 27,356 |
| Equipment | 13,130 | | |
| Vehicle | 15,000 | 15,000 | 15,000 |
| Travel | 5,500 | 5,500 | 5,500 |
| Other | 105,340 | 105,340 | 105,340 |
| Total | 253,778 | 242,731 | 242,731 |