

Appendix 6. Progress report dugong project 1.2.5 Phase 2/1 November 2015

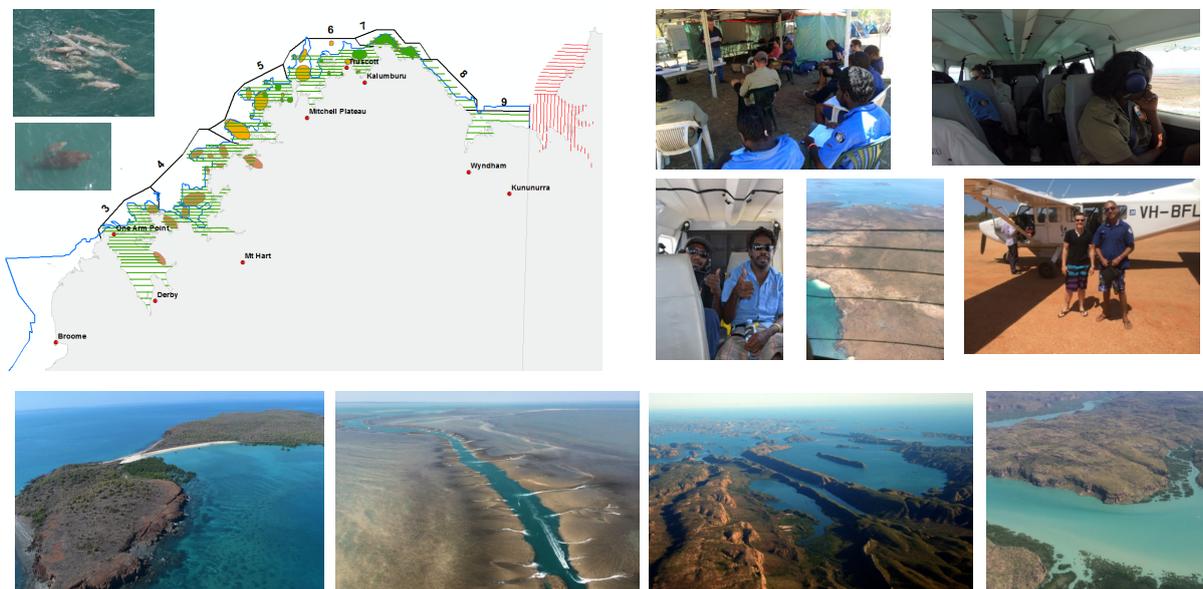


Project 1.2.5 - Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (*Dugong dugon*) management in the Kimberley

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Clockwise from top right: snubfin dolphin pod & dugong/calf; Kimberley aerial survey blocks & transects (Sept-Oct 2015); training camp Truscott (August 2015); survey plane (G8 Airvan) and team; snapshots of Kimberley coastal landscapes.



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Milestone Progress Report for Project 1.2.5 Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (*Dugong dugon*) management in the Kimberley

Phase 2 Milestone Report No: 2/1 Submit a short report on the aerial survey field component.

Milestone Due Date: 30th October 2015

- **Milestones and Activities:** Form a project advisory committee comprising representatives from Kimberley Indigenous ranger groups and the Kimberley Land Council (Table 1), and hold regular fortnightly phone meetings to plan the training course at Truscott and broad-scale survey (8 meetings were held, & numerous one-on-one phone meetings with Healthy Country managers/ranger coordinators). See Bayliss and Wilcox (2015), Science Plan for Phase 2 of the dugong project.
- Develop Project Activity Schedules for the aerial survey component for Balanggarra, Wunambal Gaambera, Dambimangari and Bardi Jawi Indigenous ranger groups, for community approval (completed June 2015) and in support of their Healthy Country Plans (BAC 2011, DAC 2013, KLC/BJ 2012, KLC 2010, WGAC 2010). See Appendix I for an example (Balanggarra). Ensure adequate survey effort/coverage for Camden Sound Marine Park (DEC 2009; DPaW 2013; A. Halford pers. comm.) and proposed marine parks.
- Undertake a procurement process for a suitable survey plane/charter company. Completed in July and included two charter companies recommended by the NTG Marine Ecosystems Unit after completion of a 6 week dugong aerial survey last year.
- Calculate fuel volumes required and purchase and have delivered drummed Avgas to remote localities, with assistance of the ranger groups. Arrange other logistics (accommodation, food, transport, communications, emergency response plans & base contacts etc).
- Discuss learning objectives, content, level and structure of the “Aerial Survey Training Course” to be developed for Indigenous rangers and untrained CSIRO staff (TJ Lawson) prior to the Kimberley broad-scale survey taking place. The Indigenous Advisory Committee to select two rangers from each group based on agreed selection criteria, to undergo training in order to participate as observers in marine surveys over their sea country.

Table 1. Dugong project steering committee – Indigenous representatives.

Rangers	Role	Ranger group
Thomas Grounds	IPA ranger coordinator	Balanggarra
Tom Vigilante	Healthy Country manager	Wunambal Gaambera/Uunguu
Jarrad Holmes	Healthy Country manager	Dambimangari
Daniel Oades	Healthy Country manager	Bardi Jawi
Phil McCarthy	Ranger coordinator	Bardi Jawi
Frank Weisenberger	Land & Sea Management	Kimberley Land Council

I Develop and deliver an aerial survey training package to Kimberley Indigenous rangers (July-August 2015)

- Liaise with Tom Vigilante (WGAC), Allister Polkinghorne (for RRR training providers) and Beau Bibby (Kimberley Training Institute) to incorporate the TAFE-level certified courses “Work Safely Around Aircraft (WSAA, PUAFIR209B)” and “Navigate from an Aircraft (PUAFIR315B)” into the aerial survey training package.
- Liaise with Tom Vigilante/WGAC for preparation of course delivery at Gambemirri Ranger Camp (near Truscott Airbase) for up to 15 people.
- Develop aerial survey training package (key learning objectives, course structure, presentation lectures & assessment criteria) with marine survey consultant Glenn Dunshea (EMS Pty Ltd) and CSIRO staff, and obtain feedback from the Indigenous Project Advisory Committee and the two training providers (see Appendix 2). The training package was initially designed around the technical training course developed by James Cook University and customised for the remote Kimberley, and permission was granted to use their training manual as a key reference source (see Sobotzick et al. 2013).
- The training course was delivered between Monday 31st August and Friday 4th September (2 days of Theory & 1-2 days Practical). The feedback obtained by all course participants, trainers and Project Advisory members was very positive.

Table 2. Trainers and participants in the aerial survey training course (Truscott, 31st Aug. - 4th Oct. 2015).

Ranger participants	Ranger group	Trainers	Affiliation
James Birch	Balanggarra	Peter Bayliss (lecturer)	CSIRO
Quentin Gore	Balanggarra	TJ Lawson	CSIRO
Desmond Williams	Wunambal Gaambera/Uunguu	Emma Woodward*	CSIRO
Maggie Captain	WG/Uunguu	Glenn Dunshea	CSIRO consultant
Tom Vigilante	WG/Uunguu	Allister Polkinghorne	RRR RTO provider
Lee Ritchie	WG/Uunguu	Beau Bibby	Kimberley Training Institute
Angie Reed (PhD student)	WG/uunguu		
Erwin Kibily	Dambimangari		
Ethan Jungine	Dambimangari		
Jarrad Holmes	Dambimangari		
Azton Harwood	Bardi Jawi		
Dwayne George	Bardi Jawi		

* Not present but prepared course material and training packages, plus a presentation on the role of Indigenous Knowledge in the dugong project.

The training package was initially developed in collaboration with internationally recognised aerial survey trainers at James Cook University (Susan Sobotzick & Helene Marsh); however due to health reasons Susan could not travel to the Kimberley to deliver the course. Hence, Glenn Dunshea (Ecological Marine Services Pty Ltd) was contracted to help develop and deliver the course, and to participate in part of the actual survey to provide “on the job training” in data base management. The course was developed also in partnership with members of the Indigenous Project Advisory Committee representing Kimberley coastal Native Title groups. The course lectures (Theory) took two days and was structured around the basic principles needed to design and implement wildlife population monitoring surveys for marine and terrestrial environments and from a range of observation platforms (e.g. aerial - fixed-wing & helicopter; boat; vehicle, walk; remote technologies such as drones & satellite images). However, a focus (via case study example) of the course was on aerial survey of dugong and other marine wildlife (coastal dolphins, whales, turtles). Half a day was allocated to teaching rangers how to download and manage aerial survey data recorded continuously onto digital audio recorders. Additional course components included data management and visualisation methods using available software such as Excel and Google Earth. Lectures in basic wildlife population sampling and management methods were given also. Short duration (~1 hr) practice flights over two days comprised the Practical content of the course where participants gained “hands on” experience in obtaining “search images” for different species and familiarity with

survey team operational procedures, OHS procedures around aircraft and use of the recording and communications equipment.

2 Complete marine aerial survey of the Kimberley (20th Sept – 8th Oct)

- Contract a consultant with recent marine aerial survey experience to: provide advice on audio and communications equipment purchase and use; help develop and deliver the aerial survey training package and, for part of the survey, pair off with inexperienced observers to provide calibrated counts; and assist with data management using a customised Access database. Glenn Dunshea (EMS Pty Ltd) was chosen from a range of candidates given his recent (6 weeks in 2014) survey experience in the NT and is a “calibrated” observer. Additionally, he has developed an advanced Access database for marine surveys that use the tandem double count technique, and has provided a revised version of this without licence/restrictions.
- During the training course at Truscott Glenn was made aware by a member of the NTG dugong survey team (who originally recommended use of our aircraft/company) that the aircraft we hired may not have certification for engineering works undertaken decades ago on cracks to the main wing spars (air frame). The information was provided by a 3rd party interested in purchasing the plane and who had undertaken a cursory log book maintenance inspection (& also a company that was selected for our quotation process). This person provided copies of the service schedules in question via email to Truscott Airbase. Given the technicalities were outside my expertise area, the serious safety implications, and the fact that that our charter company provided an Air Operators Certificate and counter documentation, I asked Allister Polkinghorne, the consultant WGAC engaged to deliver the air safety/navigation courses and an ex-CASA inspector, to join in on discussions I had with our charter company and their maintenance providers, and the 3rd party making the claim. Based on these discussions, and with regard to due diligence, duty of care and the safety of our team foremost, I decided to send the aircraft back to base and to commission an independent assessment. Our detailed assessment of historic log book maintenance schedules concluded that there was a missing CASA certification and recommended that this aircraft not be used for survey until CASA made a deliberation. On this basis, and given the timelines for our Kimberley survey, I advised CSIRO to seek termination on the contract so that I could charter another company/aircraft to complete the survey by mid-October.
- Another procurement process was undertaken and a local charter company was contracted to provide experienced pilots and a G8 Airvan (which we trialled during the training course at Truscott). The survey was re-scheduled with input from the Project Committee and the survey team relocated on site on 17th September.
- The survey was completed on 8th October and, apart from a few unusual windy days at the start, went according to plan (Table 3). Indigenous rangers from each of the four Native Title groups that completed the training course participated in the survey. The usual difficulties were encountered when working in remote and isolated communities; however on the whole the survey was successful having completed the full survey design coverage over 18 days (Figure 1). The pilots and observers performed exceptionally well under difficult conditions, with professional support throughout from the local charter company and the indigenous ranger groups.
- The first baseline marine aerial survey of the Kimberley was an excellent learning experience for all concerned and future surveys using a G8 Airvan can now be re-designed to provide greater comfort to observers and how count data are obtained. In my view, for remote and very costly aerial surveys, the current system of data collection is technically way too complicated requiring excessive redundancy/backups on about 50 moving parts making any system failure a great risk to obtaining robust, consistent and cost-effective results (i.e. system depends too much on luck). Additionally, much of the data collected on these surveys using current protocols are redundant to the extent of taking up one passenger seat in the aircraft (i.e. they not required for analysis, never used or duplicated). A new simplified survey system will be designed with input from Indigenous and DPaW rangers in February March next year when processed population-level data and distribution maps will be presented and the next stage of the aerial survey component of the dugong project is commenced - designing future dugong monitoring programs in sea country and co-managed marine parks, potentially using both local site-specific boat survey methods (see Jackson et al. 2013; 2015 for turtles) and broad-scale aerial survey methods (this study).

Table 3. Daily flight schedule of the Kimberley marine aerial survey (17th September to 8th October 2015).

Date	Day	Base	Component	Notes	Session	Km travel	Flight hours	Sum daily hours	Ranger group	Block/Transect	Pilot
17-Sep	Thursday	Kununurra		CSIRO staff arrive Kununurra late afternoon							
18-Sep	Friday	Kununurra		Day with Shoal Air developing a detailed Emergency Response Plan (ERP) & for pilot briefing							
19-Sep	Saturday	Kununurra		Finalise detailed daily survey plan with Shoal Air							
START SURVEY											
20-Sep	Sunday	Kununurra	Travel	Travel Kalumburu Maggie/Desmond		282	1.4	1.4	Uunguu	As below	Scott
21-Sep	Monday	Kalumburu	Practice flight	Session 4 practice	P1	185	2.0		Uunguu	As below	Scott
			Survey		Session 4	213	1.2	3.2	Uunguu	B6 (T18, T19, T20, T21, T22, T23)	Scott
22-Sep	Tuesday	Kalumburu	Travel	Birdie/ Quentin from Wyndham		422	2.1	2.1	Balanggarra		Scott
23-Sep	Wednesday	Kalumburu	Practice flight	Session 4 practice	P2	213	2.2	3.2	Balanggarra	As above	Scott
24-Sep	Thursday	Kalumburu	Survey	Pilot swap	Session 1	534	2.9		Balanggarra	B7 (T1, T2, T3, T4); B6 (T1); B7 (T5, T6, T7, T8, T9)	Scott
			Survey	Balangg rangers to Wyndham			2.2	5.1			Scott
25-Sep	Friday	Kalumburu	Survey	Maggie	Session 5	680	3.7	3.7	Uunguu	B6 (T2, T3, T4, T5); B6 (T17)	Scott
			Survey	Maggie	Session 6				Uunguu	B6 (T6, T7, T8,	Bantu

										T9, T10, T11)		
26-Sep	Saturday	Mitchell Plateau	Travel	Travel Mitchell P			0.8		Uunguu		Bantu	
			Survey	Pilot swap; Maggie	Session 7				Uunguu	B5 (T1, T2, T3, T4, T5, T6)	Bantu	
			Survey	Maggie	Session 8	693	3.7	4.5	Uunguu	B5 (T1, T2); B6 (T12, T13, T14, T15, T16)	Bantu	
27-Sep	Sunday	Mitchell Plateau	Survey		Sessions 9 & 10	775	4.2		Uunguu	B5 (T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19)	Bantu	
			Survey		Session 8A	270	1.5	5.6	Uunguu	B6A (T1, T2, T3, T4)	Bantu	
28-Sep	Monday Public Holiday	Mitchell Plateau	Survey		Session 11 & 12	751	4.1		Uunguu	B4 (T1, T2, T3, T4, T5, T6); B4 (T34, T35, T36, T37); drop T33	Bantu	
			Travel	Maggie to Kalumburu - 50 hr service		200	1.1	5.1	Uunguu		Bantu	
29-Sep	Tuesday	Derby	Travel	Glenn Broome		688	3.4	3.4	Dambi		Bantu	
30-Sep	Wednesday	Derby		PILOT / OBSERVER DAY OFF						37.4		
1-Oct	Thursday	Derby	Practice flight & Survey	Ethan & Erwin	P3 & Session 13	780	4.2	4.2	Dambi	B4 (T7, T8, T9, T10, T11, T12, T13, T16, T17, T18)	Bantu	

2-Oct	Friday	Derby	Survey	Ethan & Erwin	Session 14	742	4.0	4.0	Dambi	B4 (T14, T15, T17A); B4 (T19, T20, T21, T22)	Bantu	
3-Oct	Saturday	Derby	Survey	Jarrad & Erwin	Session 15	764	4.1	4.1	Dambi	B4 (T23, T24, T25, T26, T27, T28, T29, T30, T31, T32)	Bantu	
4-Oct	Sunday	Derby	Survey	Jarrad	Session 17 & 18C	753	4.1	4.1	Dambi/BJ	B3 (T11, T12, T13, T14, T15, T16, T17, T18)	Bantu	
5-Oct	Monday	Derby	Practice flight	BJ rangers OAP Azton	P4	Before refuel 748km		4.0	Bardi Jawi		Bantu	
			Survey	Refuel OAP	Session 16	869	4.7	4.7	Bardi Jawi	B3 (T1, T2, T3, T4, T5, T6, T7, T8, T9, T10)	Bantu	
6-Oct	Tuesday	Derby	Survey	PB & TJ only	Session 17 & 18D	478	2.6		Dambi	B3 (T19, T20, T21, T22)	Bantu	
			Travel	Fly Kununurra		570	3.1	5.7			skip T23-T24	Bantu
7-Oct	Wednesday	Kununurra	Survey	Block 8 Birdie & Quentin	Session 19A	692	3.5	3.5	Balanggarra	B8 (T1 - T8)	Scott	
8-Oct	Thursday	Kununurra	Survey	Block 9 Birdie	Session 19B	591	3.2	3.2	Balanggarra	B9 (T1-5)	Scott	
9-Oct	Friday		FINISH	TJ & PB return			33.4		37.5			
FINISH SURVEY												
							Mean daily hrs	3.9	Total hours	75		

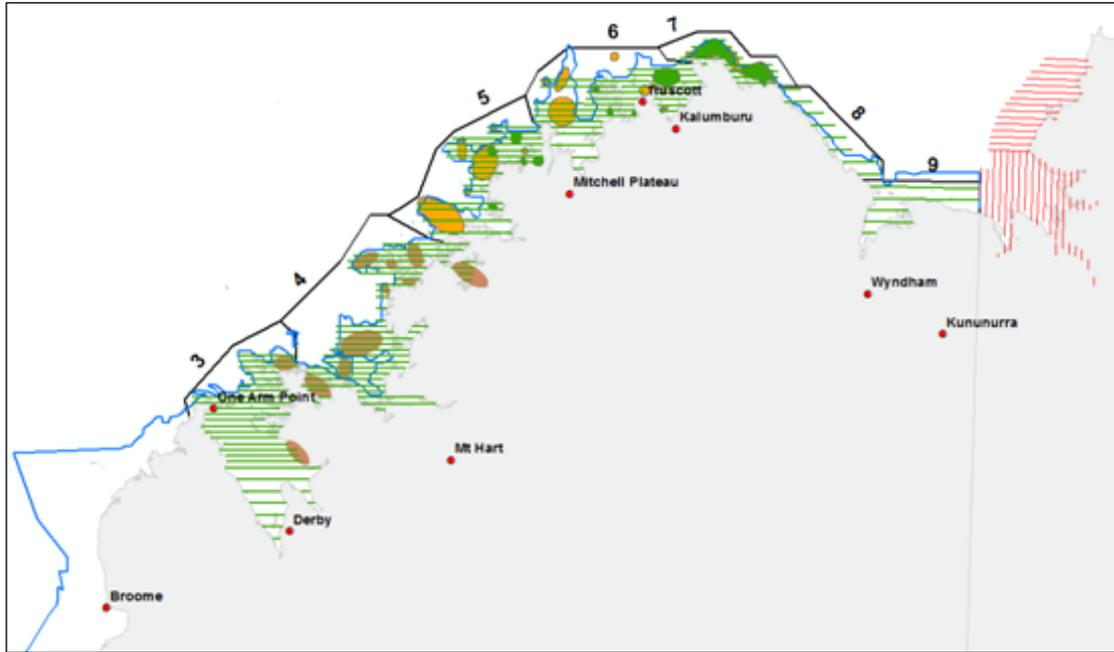


Figure 1. Pre-stratified aerial survey design for Kimberley coastal waters. Map of the dugong aerial survey blocks (black lines 3-9) and transects in the North Kimberley (green lines). Blocks 3-9 were surveyed September to October 2015. Blocks 1 and 2 were surveyed by Woodside in 2009 (RPS 2010, SKM 200). The blue line is the 20m bathymetry and outer boundary. 5-km spaced transects were located in areas where high numbers of dugongs were expected based on Indigenous Knowledge of occurrence, and 10-km spaced transects elsewhere. Green patches in Blocks 5, 6 and 7 are dugong hunting sites and that for turtles, orange patches. Brown patches in Blocks 3 and 4 are dugong and turtle hunting sites combined. Refuelling stops/bases are indicated (red dots). NT survey transects close to the WA border are shown (red lines). All GIS data layers are provided in the attached Google earth file (Appendix 3).

3 Complete data transcription and formatting for detailed analyses (update for Milestone 2 due June 2016).

- Survey data collected on audio discs are currently being transcribed and entered into a custom built Access database. The coding for the database governing selection criteria of observed double counts data is currently being rewritten along the lines of criteria used by the JCU dugong survey team, particularly given the substantial differences in observer experience at times, the sparseness of observations and it's highly clumped nature.
- All survey data and GIS data used to plan the surveys (Appendix 3) and/or used in future analyses of distribution and abundance patterns will be entered into a project Geospatial database, with provision of a database copy to WAMSI, as part of the Milestone due in July 2016.

4 Communication and knowledge transfer (continuous).

4.1 Communication

- A copy of this milestone report and the WAMSI annual science review report for the dugong project (Appendix 4) will be provided to DPaW and the Native Title groups/KLC after review and approval.

4.2 Knowledge transfer

- Raw and processed survey data and all GIS layers will be provide to DPaW and the Native Title/ranger group partners in the project (Balanggarra, Wunambul Gaambera/Uunguu, Dambimangari & Bardi Jawi; KLC).

Personnel and staffing: Peter Bayliss is the Project Leader with support from other CSIRO science leaders and WAMSI Project Leaders. TJ Lawson (Melbourne) is the project's data manager and GIS specialist, and field operations manager. Emma Woodward (Perth) has carriage for Indigenous community participation and engagement, and leads the Indigenous Knowledge component of the project. Richard Pillans (Brisbane) has extensive experience with satellite and acoustic tagging of marine megafauna and will participate in field work for the movement study. The project is continually supported by CSIRO support staff (Greg Lyden & Wendy Steele) with oversight by Andy Steven, Research Director of the Coastal Development and Management Program.

Data/metadata reporting:

Data from completed Phase 1 will be made available to WAMSI via MarLIN using appropriate metadata protocols.

Aerial surveys for marine fauna in the Broome-Dampier Peninsula area of south Kimberley (Cape Bossut to Cape Leveque) were undertaken by Woodside in three consecutive seasons in 2009 (RPS 2010; SKM 2009). WAMSI has arranged access to the full data set to use as baseline for Kimberley dugongs and comprises a very valuable contribution for future regional analysis.

Links to other projects: Relevant KMRP projects include: Remote Sensing (1.4); Indigenous Knowledge project (1.5); and Marine Turtles (1.2.2). A "first-pass" benthic habitat/seagrass map was produced in Phase 1 (Janet Anstee/CSIRO), which now has strong links to other WAMSI seagrass researchers across different projects (e.g. Gary Kendrick, Renae Hovey & Leonardo Ruiz Montoya UWA; Mat Vanderklift & Janet Anstee CSIRO) and DPaW (Andy Halford). An informal working group has been established to share data/ideas in order to further calibrate Janet's seagrass map. A link will be made with Jim Greenwood project 1.4 (potential of benthic irradiance to predict seagrass distribution). The original plan was to use information from project 1.5 to inform the aerial survey and tagging designs in Phase 2, and to examine the concordance between IK and subsequent scientific data on distribution and movement patterns. However, implementation of project 1.5 still remains under development. Hence, this component was partially addressed using cultural maps of hunting areas in Healthy Country Plans (HCPs) and via several HC Planning workshops undertaken jointly by CSIRO and the KLC for other projects. To further reduce the risk of not obtaining sufficient information to undertake the integration of Indigenous Knowledge (IK) with scientific surveys we will significantly increase local engagement/participation concomitant with field work associated with other parts of the project (aerial survey & movements); and plan to adaptively develop strong links to the objectives of 1.5 as it progresses through advocating dugongs as a case study (& see issues/risks section). Continual links are made with the turtle project via Scott Whiting and Tony Tucker (DPaW).

Other issues (including IP) and new or emerging risks:

There is one current risk to the dugong project and, due to new information obtained during the aerial survey, one emerging risk. These are:

1. Delays to the 1.5 Indigenous Knowledge project and hence provision of critical information for the dugong project. Project 1.5 still does not have traction with just over 18 months to go, although lately progress has been made. This is compounded by lack of WAMSI research agreements with 3 of 4 Kimberley Native Title groups. Formal links to the 1.5 IK project need to be made that include regular communications between participants of our two projects. Additionally, the CSIRO staff member (Emma Woodward) who manages the IK component of the dugong project will be taking maternity leave from February to December 2016. Hence, a temporary replacement will need to be found and a plan implemented to build momentum, maintain continuity and develop strong links to the 1.5 IK project as it comes on line.

2. The movement study needs to be re-designed (basically relocated) as too few dugongs were sighted in Dugong and Talbot Bays (the proposed Horizontal Falls Marine Park) during the aerial survey to initiate a long-term movement study there. Anecdotal information suggested that these were likely the highest density areas in the Kimberley, but this proved incorrect (at least for the month of October). The first capture-tagging field trip will therefore need to be delayed from April to June 2016 whilst 3 new study sites with the highest observed densities are investigated for logistical feasibility (i.e. top of King Sound, the large bay just north of Kalumburu/Drysdale River & the shallow shoals opposite Berkeley River towards the NT border). Due to potential safety issues raised with the first aircraft hired and the need to delay the aerial survey to contract a new charter company/plane, additional costs were incurred (\$32K) using up any savings from a carefully planned survey with respect to logistics and running the training camp. This will impact on the movement study, which will need to be re-designed also to fit a reduced budget that was tight anyway.

Communication Activities – Publications, Presentations, Media releases:

Table 4 Summary of Communication Activities – Publications, Presentations and Media releases.

Communication Activity	Total to date
Peer reviewed publication	0
Popular publication (i.e. Landscape, newsletter, etc – see comms section below) WAMSI Bulletin (newsletter) CSIRO Monday Mail (newsletter)	3
Conference Presentation Bayliss P, Wilcox C and Vanderklift M (2015) Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (<i>Dugong dugon</i>) management in the Kimberley. WAMSI Conference 2015, April 2015, State Library of Western Australia, Perth. Presented by M Vanderklift (CSIRO).	1
Presentations/Meetings with DPAW managers	0
Presentations/Meetings with Traditional Owners – encompasses four main coastal-sea country Native Title/ranger groups – Balangarra, Wunambal Gaambera, Dambimangari & Bardi Jawi. Representatives from each group (e.g. ranger coordinators or Healthy Country managers) were part of a project steering committee that held regular meetings/email exchanges. TO groups are research partners in the dugong project.	4 workshops early 2015, 8 phone meetings, 1 3-day training course in aerial survey for 12 Indigenous rangers at Truscott was held in late August 2015.
Presentations/Meetings with other stakeholders (i.e. industry, tourism)	0
Presentations to general public	0
Media releases In train - Kimberley Land Council newsletter/media release; Science Network WA; & interviews/story for ABC will be arranged	1 (via WGAC - ABC), 3 in train
Radio interviews (here ABC radio story)	1
Newspaper articles (Kimberley Echo – see comms section below)	1
Other (internal progress report: Phase 1 milestone report; Phase 2 short report on aerial survey dugongs)	2

The following links demonstrate our project communication activities outlined in Table 4.

- WAMSI Bulletin:
<http://www.wamsi.org.au/news/wamsicsiro-partner-kimberley-aboriginal-groups-manage-dugong>
- CSIRO Newsletter – Monday Mail:
<http://my.csiro.au/News-and-events/News-Listing-Page/2015/November/9/CSIRO-partners-with-Kimberley-Aboriginal-groups-to-manage-dugong.aspx>
- The Kimberley Echo (Kununurra WA local news) ran the following story after interviewing the survey team:
<https://au.news.yahoo.com/thewest/wa/a/29872077/researchers-rangers-count-dugongs-in-aerial-survey/>

WGAC with CSIRO assistance issued a Media Release (2nd October 2015) on the aerial survey training course run at Truscott, which was later picked up by ABC Radio.

1. **Management Questions** What are the distribution and abundance of dugongs in the selected areas of Kimberley coastal waters and, depending on the availability of additional resourcing, what are their movement patterns in a marine park (or proposed marine park) (to be determined with DPAW & Traditional Owners)? (PRI)
 2. What, when and where are their critical habitats in the selected areas of the Kimberley? (PRI)
 3. What are the appropriate spatial management units for this priority species given the data that are available? (SEC)
 4. What environmental factors may influence the above (1) distribution and abundance patterns and population characteristics (e.g. seagrass extent, bathymetry etc)? (SYN)
 5. What are the major pressures on dugongs in this region and how can they be measured using key indicators over the long-term (e.g. marine debris) (SEC)
 6. What cost-effective methods can be developed to enable effective condition and pressure monitoring of dugong? (PRI)
- **Key Stakeholders/End-users** Balanggarra, Wunambal Gaambera, Dambimangari, Bardi Jawi and the Kimberley land Council are the main indigenous stakeholders, but the project will also engage with Myala, Nyul Nyul and Yawuru Traditional Owners.
 - DPaW.

Outputs .

Phase 2

- The outputs will attempt to address the management questions listed above and will include spatial information on the distribution and abundance of dugong, scientific publications and standard operating procedures for joint managers with respect to the design of a cost-effective monitoring program for dugongs. The final scope of these outputs will be provided once comprehensive analysis of aerial survey data has been completed for the 2nd Phase 2 milestone report by June 2016.

References

- Balanggarra Aboriginal Corporation (BAC) (2011) Balanggarra Healthy Country Plan 2012-2022. Kimberley Land Council.
- Bayliss, P and Wilcox, C (2015). Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (*Dugong dugon*) management in the Kimberley: Final Report for Phase I of Project 1.2.5 of the Kimberley Marine Research Program Node of the Western Australian Marine Science Institution, WAMSI, Perth, Western Australia, 18pp
- Dambimangari Aboriginal Corporation (DAC) (2012) Dambimangari Healthy Country Plan 2012-2022.
- DEC (2009). Department of Environment and Conservation. Protecting the Kimberley. A synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia. Department of Environment and Conservation. Perth.
- DPaW (2013). Department of Parks and Wildlife. Lalang-Garram / Camden Sound Marine Park management plan 73 2013–2023, Department of Parks and Wildlife, Perth.
- Jackson MV, Kennett R, Bayliss P, Warren R, Waina N, Adams J, Cheinmora L, Vigilante T, Jungine E, Woolagoodja K, Woolagoodja F, Umbagai J, Holmes J and Weisenberger F (2015) Developing collaborative marine turtle monitoring in Indigenous communities in the Kimberley region of northern Australia. *Journal of Ecological Management and Restoration*. Online.
- Jackson M, Bayliss P, Waina N, Adams J, Cheinmora R, Cheinmora L, Warren R, Vigilante T et al. (2013) 'Mangguru (marine turtles) and Balguja (dugong) Monitoring Project: Field Trip Report, Wunambal Gaambera country, WA, 21-28 August 2013'. NAILSMA Knowledge Series 023/2015. North Australian Indigenous Land and Sea Management Alliance Ltd Darwin.
- Kimberley Land Council/Bardi Jawi Niimidiman (KLC/BJ) (2013). Bardi Jawi Indigenous Protected Area Management Plan 2013-1023. Bardi Jawi Niimidiman Aboriginal Corporation RNTBC, 29pp. One Arm Point via Broome, WA 6725.
- Kimberley Land Council (KLC) (2010) North Kimberley Saltwater Country Plan for Balanggarra, Unguu, Dambimangari and Mayala Saltwater Country. North Kimberley Saltwater Country Steering Committee.
- RPS (2010) Browse Liquefied Natural Gas Precinct Strategic Assessment Report (Draft for Public Review) December 2010. Appendix C-9: Nearshore Regional Survey Dugong Report. Subiaco, Western Australia: RPS.
- SKM (2009) Aerial Survey of Inshore Marine Megafauna Along the Dampier Peninsula: Late Wet Season. Sinclair Knight Merz for Woodside Pty Ltd.
- Sobtzick S, Hodgson A and Marsh H (2013). Dugong aerial survey observer training course. Handbook 2013. James Cook University, Townsville, Australia.
- Wunambal Gaambera Aboriginal Corporation (WGAC) (2010) Wunambal Gaambera Healthy Country Plan – Looking after Wunambal Gaambera Country 2010 – 2020.

Appendices (1-4 are listed but not included in the final report)

APPENDIX 1. Project activity schedule for dugong aerial survey component (Balangarra).

APPENDIX 2. Aerial survey training package (zip file).

APPENDIX 3. Kimberley marine survey GIS layers (Google Earth file).

APPENDIX 4. Annual science review dugong project.