



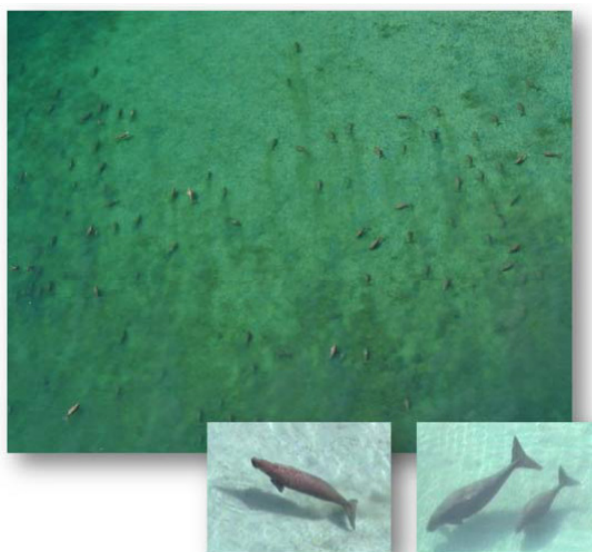
### Project 1.2.5 - Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (*Dugong dugon*) management in the Kimberley

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Aerial view of dugong herds. From front cover of Sobotzick et al. (2013). Dugong aerial survey observer training course: Handbook 2013. James Cook University, Townsville, Australia.



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

## Executive summary

We report the results of the Phase 1 SPP for each milestone and present the SPP for Phase 2, which will remain a draft until WAMSI approval. The original concept plan was to use information from Project 1.5 (Indigenous Knowledge) to inform the designs of the aerial survey and movement studies in Phase 2. To a large extent this objective has been achieved, largely due to the enthusiastic participation of Indigenous ranger groups in the project as it develops and their willingness to share knowledge of cultural dugong sites reported in Healthy Country Plans. Subsequent analysis of the potential overlap and complementarities between Indigenous Knowledge of dugongs and the results of the broad-scale aerial survey and movement studies are also a major concept underpinning the SPP for Phase 2, with the hope that a large degree of integration between the two knowledge systems is possible and would lead to innovative applications for dugong management in co-management settings for existing and proposed marine parks.

The main conclusion from Phase 1 is that resourcing for the aerial survey and movement components of the project in a logistically challenging region such as the North Kimberley is significantly underestimated, particularly for the movement study which requires additionally WAMSI co-investment to deploy all satellite tags purchased by CSIRO (see SSP Phase 2). Additionally, we only have two years remaining to run three major sub-projects in the field, and all three components are required for adequate integration of knowledge for future management purposes. For example, a stratified survey design based on 20m bathymetry and the location of known cultural dugong sites was used to obtain a baseline of dugong distribution and abundance in preference to a systematic coverage out to WA State Waters. Whilst this accommodates the budget it also means that 30% less coverage of existing and proposed marine parks and Native Title areas will be obtained. The Indigenous Knowledge and participation components of the dugong project were heavily dependent on interaction with Project 1.5 (Indigenous Knowledge), which has not yet gained traction. The SPP for Phase 2 accounts for these constraints but cannot reduce the risk associated with time constraints. The expected outcomes in the original project scope may therefore need to be realistically managed given that there is only two years to achieve them. We provide estimates of additional resourcing required to achieve better integration and outcomes, particularly a stronger and more formal link to Project 1.5 (Indigenous Knowledge) using the dugong project as a major case study.

Phase 1 of this project used Landsat 8 and available ground-based data to map areas in the Kimberley that potentially contain benthic vegetation such as seagrass and algae along with other substrate habitats (sand, coral or reef) to help design the aerial survey. A range of surrogate variables for seagrass were examined also as part of this initial assessment, such as bathymetry and light attenuation/turbidity. However, there are insufficient funds in Phase 2 to complete calibration and validation of the preliminary map. Hence, we submit a proposal for additional WAMSI funds to complete the work in collaboration with Project 1.4 (Remote sensing) and other researchers undertaking field work who have the opportunity to collect water quality parameters and undertake rapid assessments of seagrass composition and extent (see Appendix 5).

## Management Implications: Knowledge to action

See Appendix 7.

## Methods

Outlined in the Phase 1 and 2 SPPs.

## Results

### I Annual project planning completed

- Submit a proposal to each of the Aboriginal Corporations or their nominated representative(s) for

Phase I of the project.

Completed. See Appendix 1 (C Wilcox progress report to 15 December 2014) and Appendix 3 (Application to KLC REAC, which now includes a recent (May 2015) request for an extension to the southern Kimberley region. There is much interest by North Kimberley Indigenous ranger groups for the approach to undertaking the aerial survey because: the project will be undertaken in partnership; cultural maps of dugong occurrence were used to ensure survey effort (transects) were positioned in areas of high cultural importance (in addition to other layers such as bathymetry & the location of Lalang-garram Camden Marine Park & propose marine parks); 1-2 rangers per group will participate in aerial surveys where possible and reporting results; and the project will provide basic training in monitoring wildlife populations and aerial survey prior to the survey.

- Complete a detailed engagement plan for Unguu, Balangarra and Dambimangari rangers and relevant traditional owners.

Completed. See summary of plan below and Appendix 2 (draft Project Activity Schedule for Dambimangari; similar schedules for Balangarra and Wunambal Gaambera have drafted) and the SSP for Phase 2 to increase the Indigenous component and develop stronger links with project 1.5 (integration of Indigenous Knowledge). These drafts will be submitted to relevant Indigenous groups for discussion with the provision that final approvals will be sought subject to WAMSI input and approval of the SPP for Phase 2.

### **Engagement plan for Unguu, Balangarra and Dambimangari rangers and relevant Traditional Owners (prepared by Emma Woodward)**

Representatives of the Unguu (represented by Wunambal Gaambera Aboriginal Corporation), Balangarra and Dambimangari ranger groups have progressively been engaged in the project to date by both Chris Wilcox at the start of the project in February 2014 and recently by Peter Bayliss in February 2015. Each group is a key player in the project and its success is contingent on their continued engagement and involvement. As such, there are a number of activities that the project will engage in to continue to build on our relationship with the three groups.

- i. Continue consultations with Wunambal Gaambera (Unguu rangers), Balangarra and Dambimangari Aboriginal Corporations to sustain the initial support for the research project, and finalise the Research Activity Schedules for each group that area attached to completed (e.g. Dambimangari) WAMSI Research Agreements or developing overarching agreements with WAMSI (Balangarra & Wunambal Gaambera).
- ii. Continually update and advise the Kimberley Land Council Research Ethics and Access Committee (KLC REAC) of any significant variation in the research plan submitted in October 2014 (see Appendix2). Provide copies to the KLC REAC of all annual project progress reports.
- iii. Undertake further research discussion, including consultative meetings, with representatives of each of the three Aboriginal Corporations proposed as partners in the project including Jarrad Holmes for Dambimangari, Tom Vigilante for Wunambal Gaambera, and Thomas Grounds (acting for Cissy Birch- Gore) for Balangarra. Provide information about the proposed project, a copy of the KLC REAC proposal and a proposed consultation and elicitation format. Seek confirmation of a date for consultation with their respective Corporations and Rangers, and information in regards to the Corporation's proposed contracting process.
- iv. Apply for CSIRO Human Ethics clearance for the project (submitted).
- v. Finalise draft Activity Schedules with the Unguu, Balangarra and Dambimangari ranger groups. These Activity Schedules will form the basis for day-to-day project engagement with each of the groups and contain local scale protocols for researcher engagement. They are critical to the research process running smoothly, and will be submitted to each Corporation on WAMSI approval of the SPP for Phase 2.
- vi. The Activity Schedules will remain working documents and will need to adapt to circumstances (including cultural requirements) as the need arises. These will be reviewed periodically with the representatives of each group.
- vii. Adhere to the protocols for research engagement as described in the Activity Schedules as well as the Dambimangari overarching Research Agreement (RA) with WASMI; the yet to be finalised overarching RA between Wunambal Gaambera (WG) and WAMSI, and between Balangarra and

- WAMSI, and as outlined in the CSIRO Human Ethics Application.
- viii. Arrange and deliver ecological monitoring training to representatives of each of the groups at a dugong aerial survey training camp hosted by WG at the Truscott Airfield in September 2015. CSIRO will fund the training, transport, accommodation and food for this intensive training opportunity.
  - ix. Support representatives of each of the three Aboriginal groups through subsequent dugong aerial surveys. Where possible, each aerial survey team will include 1-2 Aboriginal rangers trained in dugong aerial counts.
  - x. Engage with representatives of each Traditional Owner group through the documentation of Indigenous Ecological knowledge related to dugong including seasonal and daily patterns of movement and distribution. Oral histories related to dugong use and management will also be recorded where Traditional Owners are interested in sharing knowledge.
  - xi. Provide six-monthly plain English imaged-based summaries of research activities and findings, and provide informal ongoing feedback of activities and findings as the opportunities arise.
- Develop agreements with Unguu and Balanggarra and Dambimangari traditional owners and indigenous rangers for access and operations (if appropriate).

See above, Project Activity Schedules for Balanggarra, Wunambal Gaambera and Dambimangari have been drafted (Appendix 3). These schedules will be attached to WAMSI research agreements for each group. A research agreement between WAMSI and Dambimangari has been finalised and in development for the other two groups. Project Activity Schedules will be submitted to each of the three Aboriginal corporations after WAMSI approval of the Phase 2 SPP.

## 2 Annual field program completed

- Liaison meeting with Kimberley Land Council

Completed. See “workshop report” dot point below and Appendix 2 (KLC REAC application), which has been amended to include southern Kimberley Traditional Owners (i.e. Bardi Jawi, Mayala, Nyul Nyul, potentially Yawuru) given that the September aerial survey will likely encompass their sea country if all goes according to plan. Additionally, Peter Bayliss has discussed the project on numerous occasions with Frank Weisenberger (KLC Cultural & Environmental Unit Services Manager, Land and Sea Management Unit) since August 2014.

- Conduct participatory workshop at Derby

Completed (see Appendix 1, summarised below).

“A consultation meeting was held with the Dambimangari Corporation and their rangers on 29 August

2014. This consultation lasted approximately 2 hours, and involved a description of the project, the opportunity for questions, comments, and feedback, a vote on approval of the project, and elicitation of spatial information for the project. Community members nominated the portions of the country where they had experience, and observations of dugongs and dugong habitat within those areas. This data was recorded during the elicitation, and incorporated as spatial layers into a Geographic Information System for the project. Similar consultations were planned with the Balanggarra and Wunambal Gaambera Corporations, but due to a mix of workload for the Corporations and contracting complexities between the Corporations and WAMSI, the consultations were pushed back until early 2015”.

- Conduct participatory workshop at Kalumburu (or other)

The planned workshop at Kalumburu was not undertaken with Balanggarra and Wunambal Gaambera Traditional Owners and ranger groups due to heavy field commitments by both groups at the time. However, this milestone was through completed through non-WAMSI workshops and opportunities between February and April 2015 (see below).

- A workshop report that will outline Traditional Knowledge and Aboriginal management aspirations for dugong in the Kimberley.

Only one of three planned “Dugong” workshops with North Kimberley ranger groups was held last

year. Given that the new PI of the project (Bayliss) was already booked out until April with a series of non-WAMSI workshops with the same Kimberley ranger groups (& facilitated by the KLC), it was decided after obtaining permission from the KLC and workshop participants that the best course of action was to capitalise on these workshops for the dugong project rather than attempting to organise separate workshops or meetings (which would be poorly attended given the overlap & other ranger commitments).

From February to April 2015 Bayliss was PI of a joint non-WAMSI CSIRO-KLC project that commenced development of a Regional Assessment Framework incorporating saltwater and freshwater Healthy Country Planning (HCP) targets. The aim of the workshop series was to assist all Kimberley ranger groups review these targets and help design monitoring and evaluation programs. The 3-day saltwater workshop (February 2015), the 2-day freshwater workshop (March 2015), and the 1-day Biodiversity Monitoring workshop (April 2015, as a member of the KLC Research Advisory Group) were used as an opportunity to further engage all Kimberley ranger groups in the dugong project in relation to the focus of Phase I activities outlined above. In particular, Bayliss facilitated the marine target sessions on dugongs, turtles and other marine megafauna (dolphins, whales, saltwater crocodiles), and linked these sessions to the WAMSI dugong project. Permission was obtained by the KLC and ranger groups present to provide both final workshop reports to WAMSI (see Appendix 4). An informal dugong project advisory group was formed during the saltwater workshop to facilitate Indigenous engagement and participation in the project, comprising: Cissy Gore-Birch Gault (Balangarra); Tom Vigilante (Wunambal Gaambera); Jarrad Holmes (Dambimangari); Frank Weisenberger (KLC); and all the CSIRO project team members. Daniel Oades (Bardi Jawi) was also invited to participate in the advisory group given plans to increase the scope of the project to the southern Kimberley if the opportunity arises. The initial project plan was outlined and plans were discussed to provide training for rangers to participate in the Kimberley aerial surveys. The advisory group attempts to meet regularly by teleconference at least once a month and communicates regularly by phone-email otherwise.

In lieu of a workshop report we submit the reports by: Chris Wilcox that summarises the formal Dambimangari consultation in August 2014 (Appendix 1 & above); and the CSIRO-KLC Saltwater Workshop report for February 2015 (Appendix 4).

It is not possible to adequately address the questions highlighted in section 2.5 Methods Phase I of the original SPP with respect to incorporating Indigenous knowledge and aspirations in dugong management planning during short 2-hour workshop sessions. Hence, this component of the study has been re-designed in an attempt to address these issues over the two remaining years of the project.

### **3 Annual data analysis completed program completed**

#### **3.1 Preliminary analysis of participatory workshops, identifying**

Preliminary analysis is completed.

- Areas of relevance for indigenous rangers and traditional owners
- Areas of dugong usage, dependent on reports from rangers and traditional owners along with available data on bathymetry, turbidity, and other environmental variables.
- Appropriate methodology for survey work

The results of the Derby workshop with Dambimangari and the subsequent CSIRO-KLC Saltwater workshop with all Kimberley coastal ranger groups in attendance, were combined with GIS map layers of turtle and dugong hunting areas to help design survey effort through ensuring that transect location captured important cultural dugong sites (see SPP Phase 2; Fig. 1). These GIS cultural layers were provided to the project by each group and permission has been obtained to use and share these layers given that all maps are published in their HCPs and publically accessible. No high resolution bathymetry layers were located for the Kimberley area despite an extensive search. GA has provided multi-beam data for the Kimberley region but the survey transects are far offshore. GA can provide raw multibeam/backscatter/sidescan data files from previous AIMS surveys, but these are unprocessed and for smaller areas in between transit paths. Nevertheless, GIS layers of bathymetry from digitised AHS navigation charts were available and these were used to help define the seaward boundary of the survey area, which followed standard procedure for dugong surveys and used the 20m depth contour (using the medium resolution AHS navigation charts) as illustrated in Figure 2.

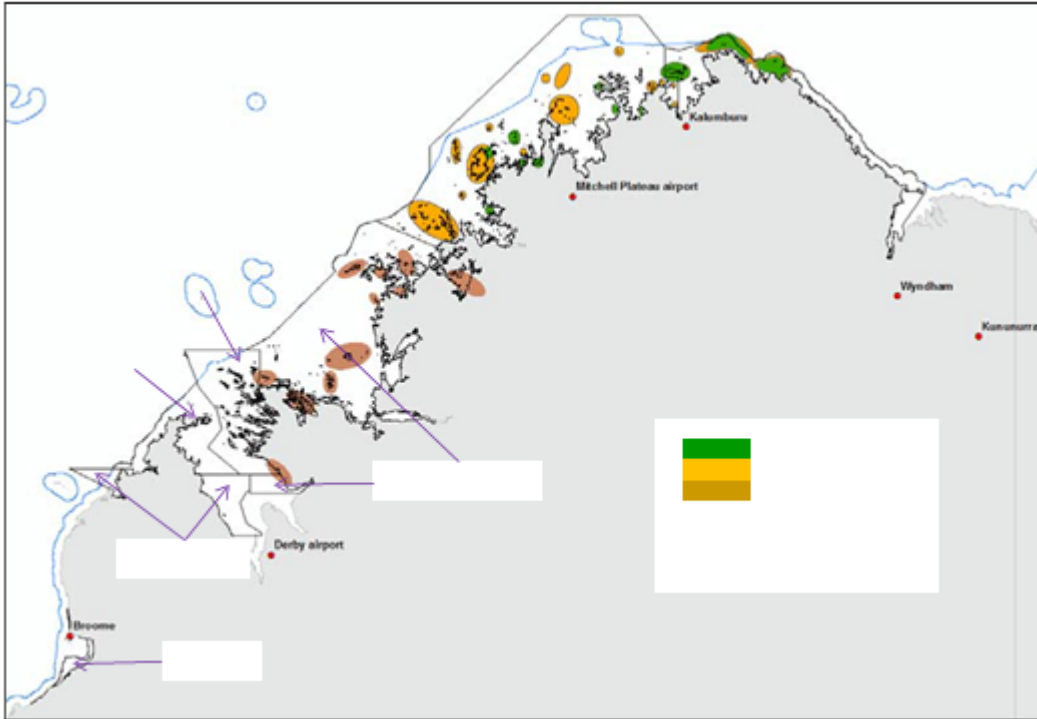


Figure 1. Location of Native Title boundaries in the North Kimberley and cultural maps of dugong and turtle hunting areas in Balanggarra, Wunambal Gaambera and Dambimangari sea country (from their Healthy Country Plans). The locations of southern Kimberley Native Title boundaries are shown also (Mayala, Bardi Jawi & Nyul Nyul).

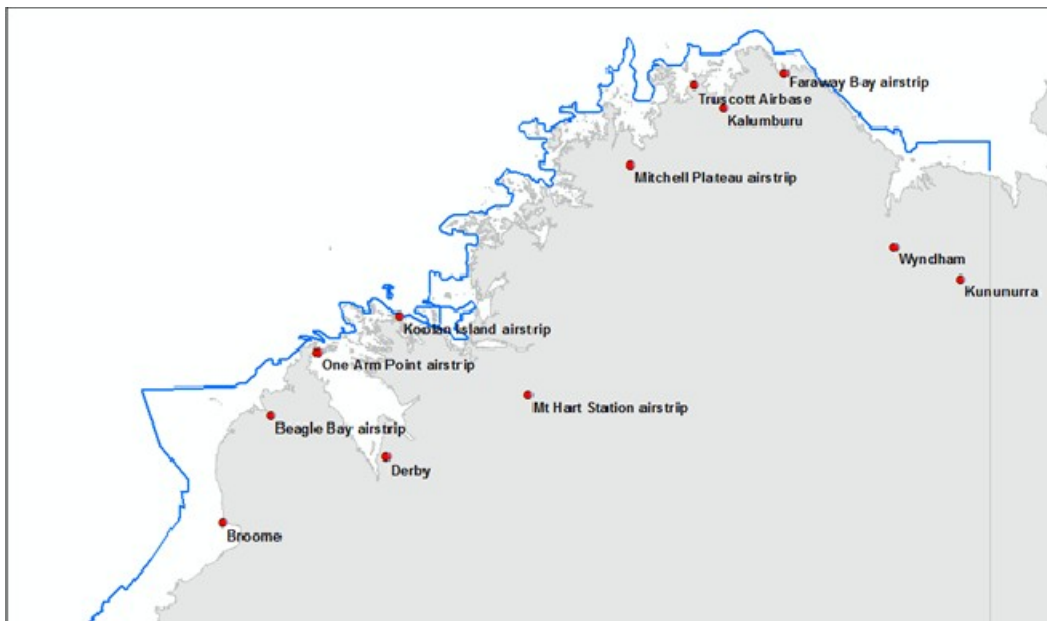


Figure 2. The 20m depth contour used to delineate the seaward boundary of the survey area. Data from digitised medium resolution AHS navigation charts.

A Kd490nm map for October 2009, 2010 and 2011 was created as an indicator of turbidity. The datasets measure the K490 parameter (Down-welling diffuse attenuation coefficient at 490 nm, a turbidity parameter) of Australian oceans. They are derived products from MODIS (aqua) images using NASA's SeaDAS image processing software. The extent of the datasets covers the entire Australian EEZ and surrounding waters (including the southern ocean). The spatial resolution of the datasets is 0.01 dd. The datasets contain 36 monthly k490 layers between 2009 and 2011. The unit of the datasets is 1/m. There is an issue with the map algorithm in that pixels that contain land mass were registered as having "no data", which basically applies to most of the shallow coastal survey area for dugongs. These maps will be re-generated using alternative processing methods, but will not be available for this report.

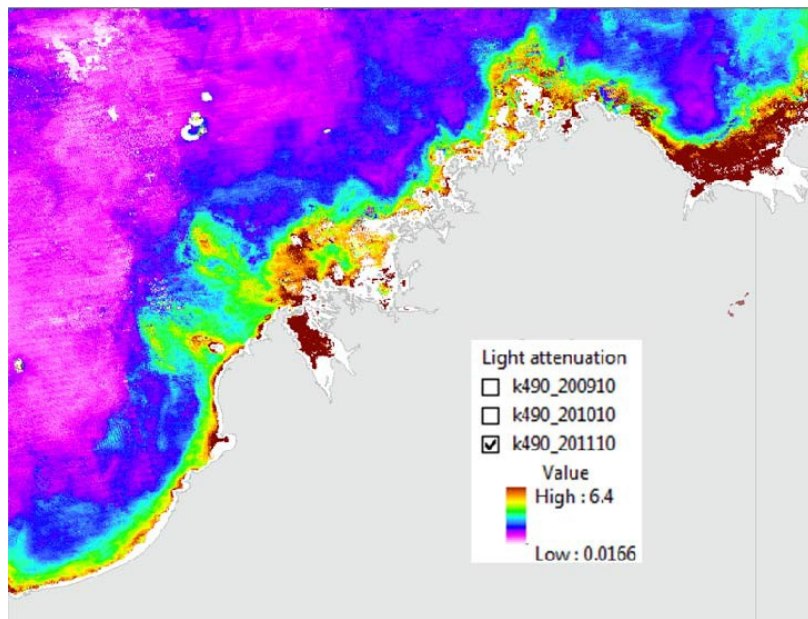


Figure 3. K490 indicator of turbidity map for offshore waters of the Kimberley coastline. The K490 parameter (Down- welling diffuse attenuation coefficient at 490 nm) is a turbidity parameter of Australian oceans.

A remote sensing methodology was developed using Landsat 8 satellite imagery and predictive modelling to map substrate habitats in the Torres Strait, and was calibrated and validated with 15 years of boat-based surveys of seagrass in one area (Fig. 4; Anstee et al. unpubl.). The same methodology was applied to Kimberley coastal waters using Landsat 8 images (Fig. 5a) and available, albeit very limited, ground-based observations of seagrass, other information layers (e.g. known dugong & turtle occurrence) and other habitats to calibrate a preliminary "first pass" substrate map (Fig. 5b).



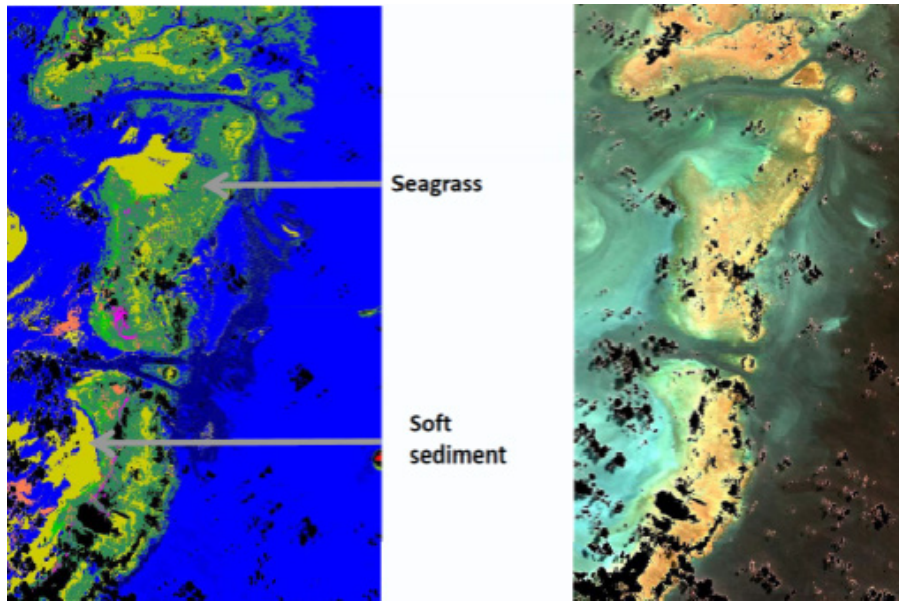
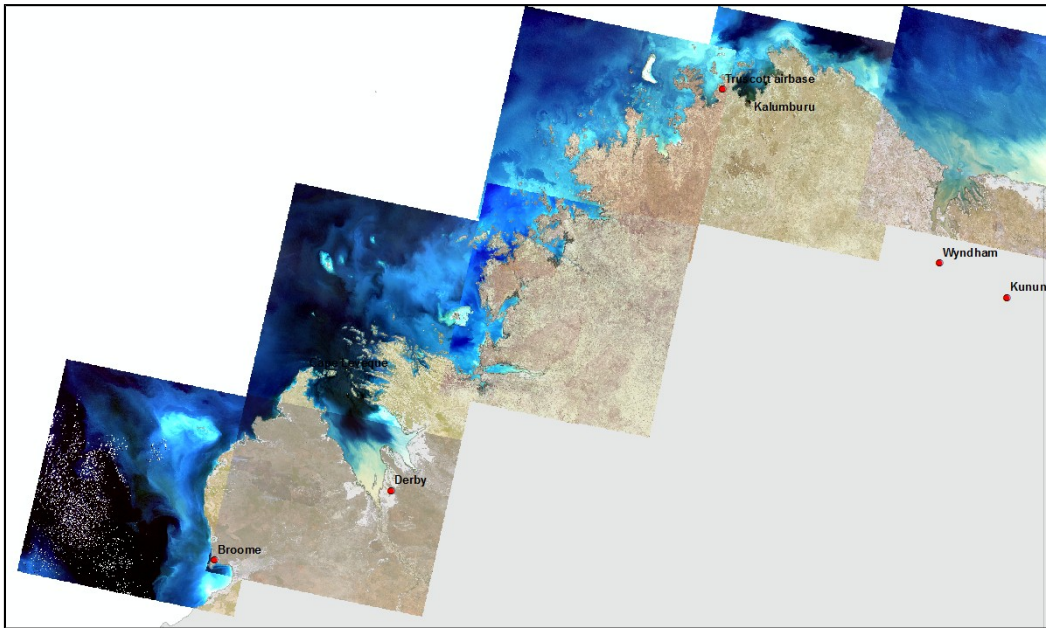


Figure 4. Substrate map of the CSIRO long-term (15 years) seagrass monitoring site in the Torres Strait showing distribution of soft sediments and seagrass as mapped by a Landsat 7 time series and Landsat 8 (Anstee et al. unpubl.).



(a) Landsat 8 satellite captures of Kimberley coastal waters.



(b) "First pass" benthic vegetation map.

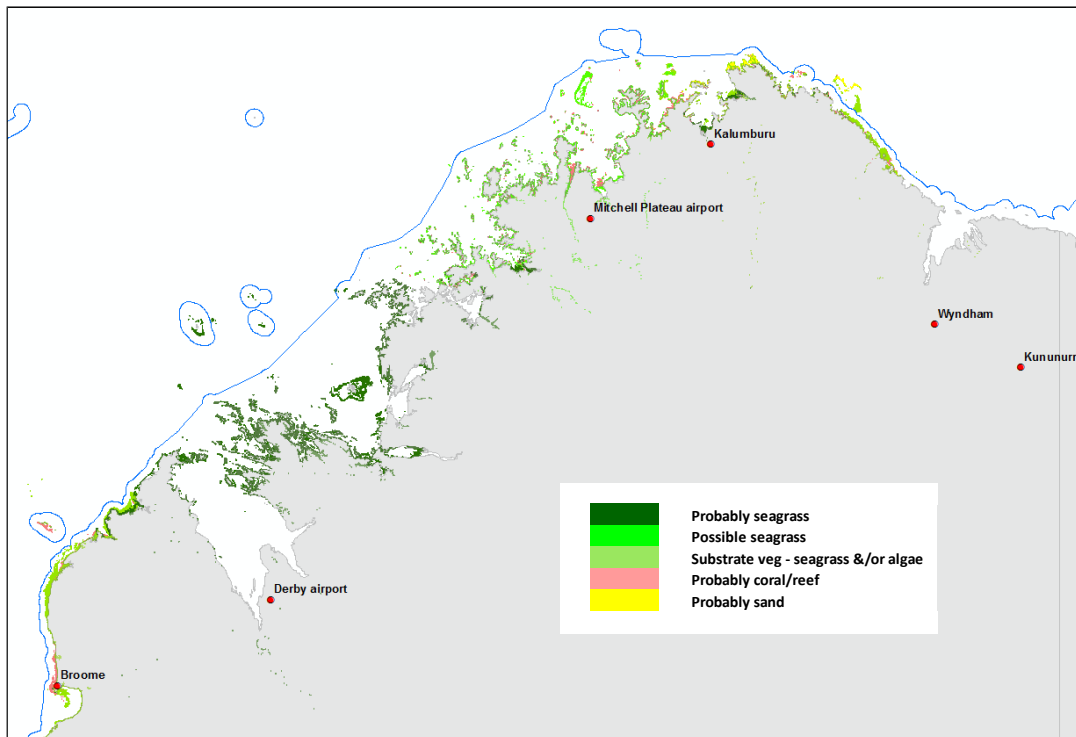


Figure 5. (a) Landsat 8 mosaic imagery of Kimberley coastal waters used to derive (b) an un-validated preliminary benthic vegetation map (see Appendix 5 for methodology & initial classification results; Janet Anstee CSIRO).

Given budgetary constraints the seagrass mapping component of the dugong project was designed in two stages. The first stage (FY 20154-15) is now completed and the objective was to develop a "first pass" benthic vegetation map for the Kimberley using Landsat 8 and very limited ground-based calibration data. The objective of the second stage is to enhance the calibration through opportunistic and targeted collection of ground-based data throughout the Kimberley (water quality, seagrass cover & species

composition, field spectral samples) and to validate the map and provide estimates of certainty. However, there is no budget for this stage so we submit a proposal for additional WAMSI funds to complete it in collaboration with other WAMSI remote sensing projects mapping substrate habitats and water quality, in particular Project 1.4 (see Appendix 5).

#### **4 Annual data management completed**

- Finalisation of data input into project Geospatial database, with provision of a database copy to WAMSI

Completed. The process to supply WAMSI a copy with metadata is under way, and will be completed after a data repository has been created (Luke Edwards pers. Comm.). This is an ongoing data management activity as the project evolves in stages and will produce model data along with observational data. A preliminary GIS database has been developed using internal CSIRO procedures and storage facilities, and preparation is underway to document metadata in the standardised WAMSI format in order to transfer data and spatial information layers for access by other projects. However, full access to all cultural GIS layers not obtained or developed in any WAMSI related activity will be conditional on participating Indigenous groups agreeing to share cultural data and maps. Data sharing agreements are incorporated into the overarching WAMSI agreements with each participating Aboriginal Corporation for the protection of cultural and other IP and, in lieu of agreements being finalised (all others apart from Dambimangari) this issue will be addressed in the appropriate Schedule of Research Activities. Our GIS technician (TJ Lawson) has contacted Luke Edwards WAMSI data manager to develop a plan for data management related to the dugong project including metadata protocols.

#### **5 Annual reporting/workshop reports completed (outputs)**

##### **5.1 Science**

- Reporting on status of ethics permits and collaborator agreements

Completed. The Human Ethics application has now been submitted to the CSIRO Ethics Committee. Appendix 3 (Project Activity Schedules) outlines the template used to draft collaborative partnership arrangements with the three North Kimberley Aboriginal Corporations (Balangarra, Wunambal Gaambera & Dambimangari) with respect to joint activities on their country. The Schedules have been submitted as drafts pending WAMSI approval of the SPP for Phase 2. Amanda Hodgson (Cetacean Research Unit, Murdoch University) has agreed to be an unpaid co-investigator on the project acting as a key advisor.

- Reporting on proposed operational plan for surveys using WAMSI Science Planning Proforma

See the SPP for Phase 2 operational survey activities.

##### **5.2 Communication**

- Report to DPaW on meetings with KLC, local rangers and traditional owners at Kalumburu and Derby

A copy of the Phase 1 milestone progress report with all Appendices (1-5) will be made available to DPaW via WAMSI on submission of these reports, and will note that the SPP for Phase 2 will be conditional on WAMSI approval and may be modified.

##### **5.3 Knowledge transfer**

- Reporting to Wunambal Gaambera, Balangarra and Dambimangari Aboriginal Corporations or their appointed representatives, rangers and relevant traditional owners on summary of priority areas based on management relevance and likely occupancy by dugongs.

Completed for the aerial survey component of the project but needs further discussion and negotiation for the movement component with respect to choice of a local study site. The latter will be addressed after the SPP for Phase 2 has been approved by WAMSI. A project advisory committee has been established that includes a representative from each North Kimberley ranger group, and includes Bardi Jawi in the south (currently also representing Nyul Nyul & Mayal). Four informal project planning meetings have been held, two during the CSIRO-KLC biodiversity monitoring and evaluation workshops and two by teleconference. The Phase 1 milestone report and a copy of the SPP for Phase 2 will be sent to the Corporations for their input after WAMSI approval.

## **6 Submission of SPP for Phase 2**

Completed.

## **7 References**

- Balanggarra Aboriginal Corporation (BAC) (2011) Balanggarra Healthy Country Plan 2012-2022. Kimberley Land Council. Dambimangari Aboriginal Corporation (DAC) (2012) Dambimangari Healthy Country Plan 2012-2022.
- 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.
- 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.
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- Wunambal Gaambera Aboriginal Corporation (WGAC) (2010) Wunambal Gaambera Healthy Country Plan – Looking after Wunambal Gaambera Country 2010 – 2020.

## **8 Appendices (1-6 are listed but not included in the final report)**

### APPENDIX 1

Project progress report by Chris Wilcox to 15<sup>th</sup> December 2014.

### APPENDIX 2

Submission to the Kimberley Land Council's (KLC) Research Ethics and Access Committee (REAC), including a recent (May 2015) submission to extent the geographic scope to the South Kimberley.

### APPENDIX 3

Draft Research Activity Schedule with Dambimangari Aboriginal Corporation and rangers.

### APPENDIX 4

CSIRO-KLC Saltwater Workshop Report (23<sup>rd</sup>–26<sup>th</sup> February 2015, Derby). Monitoring and Evaluation Workshop: Saltwater Targets.

### APPENDIX 5

Preliminary substrate map for Kimberley coastal waters derived from Landsat 8 imagery. A proposal to complete benthic vegetation and light availability assessments with further calibration and incorporating a validation component.

### APPENDIX 6

The Science Project Plan (SPP) for Phase 2 with the detailed project plan found in Section