

## Task Team Proposal

### Overview:

Proposed task	Synthesis and national scale analysis of IMOS acoustic telemetry data
Operating institutions	AIMS, JCU, SIMS
Co-convenors	Michelle Heupel (AIMS), Colin Simpfendorfer (JCU), Rob Harcourt (SIMS)
Other participants	Xavier Hoenner (AODN), Charlie Huveneers (Flinders Uni), Hamish Campbell (CDU), Russ Babcock (CSIRO), Matt Taylor (NSWDPI), Vinay Udyawer (AIMS), Steph Brodie (UNSW), Dan Gledhill (CSIRO)
Timeframe	12 months

## PROJECT DESCRIPTION

### Background

**Include information about national/international progress in this field of research and its relationship to this Proposal**

Telemetry data provide a powerful platform for understanding animal movement patterns over small and large spatial scales. The IMOS Animal Tracking Facility (ATF) is considered a world-leader based on the size and scale of the acoustic telemetry networks maintained in Australian waters. Although other similar networks exist such as the Ocean Tracking Network (OTN) and Florida Acoustic Cooperative Telemetry (FACT), these teams are yet to produce scientific outputs on the scale possible by the Australian network (e.g. Heupel et al. 2015). No national or international scale telemetry studies have been produced by other network facilities, leaving Australia poised to further cement our leadership in this field.

The success of the ATF relies on the cooperation and collaboration of individuals studying fish (and related taxa) around the country. While much of this research is region- or species-specific there are opportunities to conduct synthesis studies of the existing database. The range of species studied, the array of habitats covered and regions (temperate to tropical) provide a unique opportunity to explore broad patterns in fish movement on a scale not possible at an individual scientist level. Synthetic analysis of the database will produce outputs at an unprecedented scale and expand the utility of the collected data beyond its regional or individual species benefits.

### Objectives:

**Outline the objectives for your task team project**

The objectives of this Task Team will be to develop a national approach to synthesis and analysis of IMOS ATF data and use these analyses to inform future aspects of acoustic telemetry networks.

Specific objectives are:

1. Explore the IMOS ATF database to determine species that could be included in a national scale analysis.
2. Develop a set of metrics that can be employed to analyse national scale patterns in fish presence and movement (e.g. dispersal kernels, Brownian bridge home ranges, etc).
3. Produce scientific publications outlining national scale results from telemetry data collected via IMOS ATF.
4. Use fish movement patterns observed in the IMOS ATF database to design an optimised receiver array to improve national scale fish movement monitoring.
5. Set the global standard for large scale telemetry data analysis.

### Rationale:

Define the need for the task team project, how it addresses an important problem and how it relates to relevant IMOS Science and implementation plans and scientific questions.

The IMOS ATF has amassed a large amount of data which have not been explored for broad scale comparative analyses. Although regional analyses (Taylor et al. 2013, Pillans et al. 2014, Smoothey et al. 2016) and some large scale work (Heupel et al. 2015, Espinoza et al. 2016) have been produced, there is much to be gained through dedicated interrogation and analysis of the IMOS ATF database. While telemetry experts around the country are interested in this work taking place, the lack of dedicated time and resources to complete the work mean it is unlikely to be completed without a directed effort. IMOS ATF has an opportunity to take a leap beyond what other telemetry networks are doing by producing collaborative, national scale outputs and this opportunity should be explored.

### Benefits

Describe the outputs that will arise from the project and how they will achieve the objectives of the project. Outputs may be knowledge, skills, processes, practices, models

The benefits of this Task Team will be:

1. Better understanding of the data housed in the ATF database and it's applicability across multiple sites and species
2. Development of a set of analytical tools for comparative analysis of movement data from large scale acoustic telemetry systems
3. Taking a leadership position in the international tracking community by producing national scale analyses of fish movement
4. Demonstrating to State, Territory and Commonwealth agencies the value of broad scale telemetry networks and the potential application of these data to management and policy questions relative to fished species
5. Concept documents for designing an optimised acoustic telemetry network in Australia informed by fish movement parameters
6. Improved communication and collaboration within the Australian fish telemetry community

### Required expertise

Outline the capacity and capability that the task team will need to achieve the objectives of the project.

The ATF community possesses most of the expertise required to complete these tasks. The main impediment has been dedicated time to conduct the required analyses. However, specific skill sets that will be required are database management, statistical analyses, movement modelling, network analysis and ecological knowledge of fish movement. Individuals included in the Task Team have been selected to address these requirements.

### Methods

Outline the methods to be used including protocols or activities; the data to be obtained or knowledge, skills or capacity to be generated. Provide support for any new methods and/or techniques to be employed.

The methods applied by the Task Team will be determined based on the quantity and quality of the data housed in the IMOS ATF database. Although it isn't possible to define the exact methodologies to be employed, it can be anticipated that metrics will include residency indices, activity space or home range analyses (e.g. Brownian Bridge home range), exploration of the potential for application of Individual Based Movement Models, dispersal kernels, integration of environmental conditions or parameters and consideration of the potential for Network Analysis as a scale-independent tool to provide comparative metrics. Task Team members have skills in most of these areas or contacts to complete those that are more specialised (e.g. Network Analysis).

### Task team composition

Please specify the expertise of the different contributors and their responsibilities within the team and the level of involvement of the team members

Michelle Heupel (AIMS). Expertise: animal movement ecology (acoustic telemetry). Heupel will co-lead the Task Team. Michelle will provide expertise on the application of animal movement analyses within an ecological context. She has over 15 years' experience analysing and interpreting acoustic telemetry data of fish movements.

Colin Simpfendorfer (JCU). Expertise: animal movement analysis. Simpfendorfer will co-lead the Task Team. Colin will provide analytical expertise on the application of various metrics across species and regions. He has extensive experience analysing fish telemetry data including acoustic and satellite tag data. He has previously been the chair of the IMOS ATF Data Committee and is familiar with the IMOS ATF database.

Rob Harcourt (SIMS). Expertise: animal movement ecology (acoustic and satellite telemetry). Harcourt will co-lead the Task Team. Rob will provide expertise on animal movement as well as intimate knowledge of the IMOS ATF based on his role as Facility Leader and insight from international networks based on his role on the international advisory committee for the Ocean Tracking Network. Rob has extensive experience analysing and interpreting animal movement data.

Xavier Hoenner (eMII). Expertise: databases, statistical analyses. Xavier has been heavily involved in the development and use of the IMOS ATF database, including the development of quality control protocols. His familiarity with the database will enable timely extraction and analysis of data. He also has extensive experience in data analysis that will be very beneficial to the task team.

Other participants in the Task Team have a range of experience with IMOS ATF data. Several (Huveneers, Babcock, Taylor, Campbell) are members of the Data Committee and so are familiar the IMOS ATF database. Some have specialised analytical capabilities specific to acoustic telemetry data (Campbell, Udyawer) or provide national context to the collected data (Gledhill).

Mode of operation for the task team

Specify how the activities of the task team will be undertaken, i.e. are there going to be any face to face meetings, or is it going to be by correspondence or teleconference. How many meetings will the task team envisage within the timeframe? How are the activities going to be coordinated?

Experience suggests that teleconferences may be less effective than dedicated working periods. In the first instance the Team will be sent overview documents related to the species and locations of current data for consideration and exploration. An initial phone meeting will be conducted to consider any obvious gaps or immediate data requirements and potential metrics to apply to the data. At this time capacity within the group to conduct work will be identified and a proposed task list and time frame will be agreed.

Remaining major activities will be conducted as working group meetings in Hobart. Meetings will be 3-4 days each and will be dedicated to data processing, analysis, synthesis, interpretation and writing to produce reports and journal publications. It is anticipated 2-3 working group meetings will be required supplemented by phone conferences as needed.

Milestones

Indicate the timeframe required for this task team project and the milestones with information on the approximate time required to completing each activity

Milestone	Due	Status	Comments
Sharing of summary data from the database and initial phone meeting to establish priority species and metrics	October 2016		

Meeting of full team to begin interrogation and analysis of existing data. Assignment of out of session tasks to continue progress.	TBD Nov 2016-Jan 2017		
Opportunistic meeting of available members in conjunction with IMOS business meeting	February 2017		
Mid-term progress report to IMOS	March 2017		
Phone meeting to assess progress of analyses and publications outputs	April 2017		
Opportunistic meeting of available members in conjunction with ICFT conference	June 2017		
Meeting of full team to continue progress on analyses and publications	July-Aug 2017		
Phone meeting to finalise current analyses and publications	September 2017		
Final report	October 2017		

### Deliverables

Please outline if there are other deliverables for this project beside a final report

The main deliverable of this Task Team will be:

- Scientific journal publications using the telemetry data collected by IMOS. These publications will be designed to have a national perspective and scope, will be collaborative and synthetic in nature.
- A set of analytical tools for examination of broad scale acoustic telemetry arrays.
- Presentation of results and developed tools at international conferences to inform the scientific community of our results and progress.
- An exploration of how to optimise the IMOS ATF network based on animal movement parameters generated by this exercise.

### Communication

Outline how the results from the task team will be communicated

Results from the Task Team will be communicated through:

- scientific journal publications
- articles in the IMOS Marine Matters newsletter
- presentations at conferences and the IMOS Business Meeting as appropriate
- direct communication with Ocean Tracking Network leadership and partners to convey the approach taken and results achieved

#### Resources required

Costs could be minimised by timing meetings to link with other IMOS-related meetings (conferences, QC summits, etc.). However if there are any specific costs anticipated which cannot be covered under other funding sources, please detail here.

Costs for 2 working group meetings to be held in Hobart are requested. Additional or subgroup meetings will also be held where possible (e.g. IMOS Annual Business Meeting, International Conference on Fish Telemetry). Indicative costs of 9\* participants at \$1,000 each \$18,000.

\*Note Xavier Hoenner and Dan Gledhill do not require travel funds for meetings held in Hobart, thus the funding request is for 9 participants.

Espinoza M, Heupel MR, Tobin AJ, Simpfendorfer CA (2016) Evidence of partial migration in a large coastal predator: opportunistic foraging and reproduction as key drivers? PLoS ONE 11:e0147608

Heupel M, Simpfendorfer C, Espinoza M, Smoothey A, Tobin A, Peddemors V (2015) Conservation challenges of sharks with continental scale migrations. Frontiers in Marine Science 2

Pillans RD, Bearham D, Boomer A, Downie R, Patterson TA, Thomson DP, Babcock RC (2014) Multi year observations reveal variability in residence of a tropical demersal fish, *Lethrinus nebulosus*: implications for spatial management. PLoS ONE 9:e105507

Smoothey AF, Gray CA, Kennelly SJ, Masens OJ, Peddemors VM, Robinson WA (2016) Patterns of occurrence of sharks in Sydney Harbour, a large urbanised estuary. PLoS ONE 11:e0146911

Taylor MD, Fairfax AV, Suthers IM (2013) The race for space: using acoustic telemetry to understand density-dependent emigration and habitat selection in a released predatory fish. Rev Fish Sci 21:276-285