Marine Biodiversity Hub

National Environmental Science Programme

Report from Workshop on characterising underwater shipping noise in Australia

2 November 2017

Project C5 - Quantification of national ship strike risk

Research Plan v3, 2017, Milestone 3.3

CSIRO

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Last updated: 14/11/2017

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Acknowledgement

This work was undertaken for the Marine Biodiversity Hub, a collaborative partnership supported through funding from the Australian Government's National Environmental Science Programme (NESP). NESP Marine Biodiversity Hub partners include the University of Tasmania; CSIRO, Geoscience Australia, Australian Institute of Marine Science, Museum Victoria, Charles Darwin University, the University of Western Australia, Integrated Marine Observing System, NSW Office of Environment and Heritage, NSW Department of Primary Industries.

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WORKSHOP OBJECTIVE

The objective of the meeting was to present and discuss the initial results from the current project related to mapping of shipping noise. The meeting also provided an opportunity to discuss the future proposed project that will be extending this work and coordinate research with stakeholders and their management priorities to ensure the project delivers useful tools for management. Specifically:

1. Provide a brief overview of noise mapping projects overseas and the underlying management imperatives
2. Present preliminary findings of shipping noise maps from current NESP C5 project
3. Identify management priorities related to underwater noise by relevant stakeholders
4. Provide an overview of the future proposed NESP shipping noise project
5. Discuss future direction and development of noise maps for Australia

1. ATTENDEES

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2. SUMMARY OF KEY FEEDBACK AND ACTIONS

Feedback	Action/Comment
The project deliverables need to be tailored for each stakeholder due to their unique requirements (See Section 3.3).	*Follow-up with individual stakeholders/end-users to establish specific needs. This may be an ongoing process as needs may change and new opportunities may arise as the science is developed.*
Important to quantify other ambient noise sources (e.g., wind) in the maps to contextualise the contribution of shipping noise to the soundscape (Section 3.1).	*It was agreed that this is of a high priority and the project team will contact CSIRO/AIMS to establish what data is available.*
Good communication of project outputs to facilitate an appropriate interpretation to inform management decisions was flagged as key. (See Section 4.3)	*It is agreed this is paramount to ensuring the science outputs are used and have impact. We will explore some of the options discussed by the group. In particular supplying guideline information for how the maps can be used and we will look at including some case studies of usage.*
There was a lengthy discussion on quantifying impacts. Some key points that were raised were: - Establishing/quantifying impact is difficult. - Some metric for impact is ultimately required for many management decisions The group did put forward a number of ideas on potential impact measures (Section 4.1).	*The discussion was very helpful and some of the ideas were very interesting and have potential.* *The discussion was a good opportunity to clarify that the proposed project's core aim is to quantify the pressure and complement other projects looking more at quantifying impacts.*
All noise sources are of concern. The group also flagged some potential noise sources the project had not considered (Section 3.2).	*It was useful to help us establish all noise is of concern and we will be conscious of that when looking at the part of the project that investigates the potential to incorporate other sources.*
Have we considered including other existing loggers to validate the model/maps? Is it possible/useful in the first stage of the project to build a map of where all the infrastructure that potentially could be used is deployed? (Section 4.2)	*Some initial work has been done on this. Following up on the information of potential loggers mentioned by attendees.* *Also we will contact APPEA to see if it is possible to gain access to oil company data.*
The project is looking at noise produced by moving vessels. However, vessels at anchor have engines/machinery running and still produce noise. It was asked if the project was going to consider vessels at anchor too?	*This was a very good point. This will be investigated.*

3. RESULTS OF QUESTIONS TO THE ATTENDEES

3.1 Project Priorities

We outlined some potential research goals/ideas both already within the core deliverables of the project, but also extra components not currently included in the project. These are outlined below:

1. Validation
2. Finer-scale modelling in key regions. e.g., GBRMP
3. Build a library of source spectra
4. Measurement of noise around moored vessels
5. Inclusion of wind noise in models
6. Animal perception
7. Animal impact (likelihood, risk, opportunity)
8. Acoustic niches
9. Percentage of time above threshold
10. Include other noise sources, e.g., seismic surveying?
11. Model projected increases in noise
12. Transfer into management

To help us prioritise these goals/ideas and allocate research effort we asked the group if they saw any of the goals/ideas as particularly important to their areas. Some of the goals specifically identified by the group were:

Priority	Feedback
Validation of maps	There was a consensus that validation of the models was paramount for the end use of the maps. AMSA in particular identified this as a strong requirement for their use of any information produced by the project. It was asked whether the validation would look at different time periods to test the methods at different time scales? [The reply was that this was an important point and we will look at different time scales.]
Quantification of natural ambient noise	This was strongly supported and seen as important to properly interpret the shipping noise maps and assess the contribution of shipping in context. It was confirmed CSIRO has wind models we can look at utilising and we should talk to AIMS regarding the GBR as they have fine-scale models. A contact person was suggested at AIMS that has done lots of work on GBR wind models related to cyclones.
Fine-scale mapping	Many of the attendees saw that having fine-scale maps tailored to particular areas of interest was very important.
Prediction of increases in noise	A number of the attendees mentioned this would be important too.

3.2 Noise Sources of Concern

We asked the attendees what sources of ocean noise were of particular concern to them. There was a general feeling that all the 'other' sources that had been mentioned during the day were of concern, e.g.,

- Pile driving
- Dredging
- Seismic surveying
- Small boats

Some other sources the project didn't list in the morning's presentations were also suggested by the group:

- Oil and gas platforms
- FLNG with its subsea infrastructure incl. mooring chains, cooling systems etc.
- Wind farms; both pile driving during installation and residual noise from operation[1]
- Sea floor cable laying

Work being done at CSIRO on extending the GA historical Seismic survey mapping beyond 2012 using AIS data. It was flagged however that it was difficult to produce noise maps from this without further information (incl. metadata on airgun array). It was suggested the maps would still be very useful to at least give a footprint of seismic survey activity. There was some discussion on what data on seismic surveys was readily available.

The existing work quantifying small boat density with NESP projects C1 and C5 and the potential AIMS/CSIRO work in the proposed project on working toward quantifying small boats noise was described.

3.3 Identified End-User/Stakeholder Needs

There were some general comments on end user needs.

- It was unanimously identified that the project deliverables need to be tailored for each stakeholder due to their unique requirements. As stakeholders may need finer scale maps at specific locations important to them and/or for certain key time periods, or may require broad-scale maps summarised over a year. Importantly when it comes to choosing the areas to do fine-scale mapping this is not just a question of science needs/interests but of user need. So those decisions will need input/involvement from the users.
- It was mentioned that part of the onus is on the managers to communicate their requirements and that it was worthwhile acknowledging the workshop is going someway to recognise that different areas of management have different needs e.g., Parks Australia would like to see different types of information to what the Department of Environment needs.
- The important point was raised that this work is highly complex/scientific and that there needs to be considerable thought given to interpretation to link the gap between the science outputs and managers/users. He suggested adding as a component of the project interpretation from science output to managers.
- It was flagged that it was important to note the proposed project is a 2 year project, and that there is another year of NESP funding that has not been allocated. So if

[1] It was flagged there is a proposal for a wind farm off Gippsland, SW of Bass Strait oil and gas platforms.

during this project a key piece of work is identified that should be done a proposal could be put in to do that in the final year. For example, quantify impacts.
- Information on NOPSEMA's series of reference cases was provided. In particular that there is one that involves vessel noise see referencecases.nopsema.gov.au.
- It was summarised that what the project is doing is producing the information on noise that then individual researchers could use for their particular species to determine the impact. It was then asked how is that going to work?
- It was suggested it may be worthwhile producing some case studies for particular species to show how the noise maps can be used for example: Pygmy blue whales, inshore dolphins/dugongs. [Christine mentioned the example of masking of foraging time estimated for killer whales in Canada.]
- The group identified that to properly interpret the maps quantifying ambient noise would be very beneficial.

Further discussion with the stakeholders/end-user will continue to refine and get more detail on requirements but some thoughts were given by individual stakeholders/end-users during the discussion.

Organisation	Comment
DoE	- Would be useful to have guidance on what can and can't be done with the maps and guidelines on potential uses. - to be able to look at proposed developments and have some idea on what the consequences of the increase in shipping might be - Fine-scale maps around specified areas e.g., Southern right whale breeding areas - Could we come up with guidelines for environmental impact studies? [It was flagged that this could be addressed under the proposed NESP cumulative impact assessment project.]
AMSA	Noted that AMSA will also have different information needs to EPBC Act, e.g., their remit might be where they can put new safety of navigation measures, so they need a compelling need, so a key requirement of that is validation of the maps. Also fine-scale modelling and projected increases in noise.
Parks Australia	Flagged that Parks Australia would be interested in fine-scale sound maps in and around marine reserves.
MSQ	Noted that project is looking at noise produced by moving vessels. However, vessels at anchor have engines/machinery running and produce noise. Is the project going to consider vessels at anchor too?

Organisation	Comment
DSTO	From a Defence perspective with regard to the effect on their sonar operations they certainly would have an interest in better ambient noise modelling (e.g., for hindcasting, nowcasting, or forecasting noise in different locations and times of the year) even without information on what the source is or what biological impacts are. In the longer term that information would be useful though.
IMOS	What they would find useful is recommendations/feedback on if they were to have a network of hydrophones where would they be best placed to be useful for management

4. INTERESTING DISCUSSIONS

4.1 Discussion on Quantifying the Impact of Noise

There was a good discussion on measuring the impact of noise. There was some confusion about the scope of the project and how much it would deal with the impact side of the issue. This was hopefully clarified that the proposed project's core aim is to quantify the pressure end of the issue.

Some points that were raised by attendees were:

- It was suggested some expectation management on what the project can do was required as quantifying impact is very hard.
- The point was made that other species-specific studies are currently underway (e.g., Northwest project) and this work is designed to complement those.
- It was stated that it was worthwhile pointing out that the level of sophistication proposed in this project is significantly more than many of the environmental impact assessments. So even just the sound intensity maps would provide a massive increase in the knowledge-base that could be used in these assessments.
- It was also added that most of the impact studies are qualitative, and this work could also feed into a qualitative framework rather than a full quantitative model of impact.

The group offered some ideas on the issue of deriving impact measures from the noise maps:

- One option suggested could be broad-scale risk assessment e.g., keep noise below a threshold rather than species-specific assessment.
- Another approach suggested was that instead of specific species you could do species groups based on type of risk scenarios e.g., resident species restricted to an area versus a transient species. Karen also suggested focusing on risk rather than impact.

It was asked what has been learnt from the 120dB threshold used overseas, has it been useful and is that applicable in Australia? The response was that to apply here we'd need to consider key species present in Australian waters. As for certain species at certain critical behaviours, there is evidence that this threshold wouldn't be appropriate. So we'd need to look at our critical species. It should be noted it is not a hard level as some individual animals would respond at lower levels, some at higher (dose-response curve analogy). It is rather a population median.

4.2 Discussion on Sound Loggers and Data Collection

Some time was spent discussing the use of sound loggers and equipment for sound spectra library work and validation/ground trothing of maps/models.

Some key points that were raised were:

- It was suggested that Port of Brisbane would provide a good number of vessels of different types.
- It was suggested that deploying a vertical array would be very useful to get whole sound emission beam pattern of vessels, rather than treating the vessels as a single

point of noise. Vertical arrays are required for quality ship noise measurements by international standards.
- It was said that the project has talked about using the IMOS data loggers for validation, were we considering using other data sources?
- There was a question about planned placement of loggers and whether the spatial distribution of vessel types/sizes would be informative. [This was confirmed as the project plan.]
- It was asked if there was information on Propeller type? [It was replied that this level of information was not linked to the AIS.]

Following on from Ana's question there was some discussion in the group of other potential data loggers: It was:

- understood there were potentially loggers in states (e.g., a couple in Tasmania)
- flagged that the Australian Ocean Water Seismographs are available, but wondered if they would be of use to this project given their specifications, in particular very low sampling frequency?
- asked whether AAD had useful data for the noise project? Mike Double (AAD) confirmed they did but it was all from the Southern ocean away from shipping. Ana suggested that maybe a site with low traffic may be useful as a comparison.

Paul Hedge (NESP) asked if it was possible in the first stage of the project to build a map of where all the infrastructure that potentially could be used is deployed.

4.3 The Bridge between Science and Management

The issue was raised during discussions of the gap between science outcomes and managers. It was flagged that interpretation of project outputs was key to ensuring uptake by managers. Paraphrasing the discussion it seemed two distinct aspects were flagged:

1) The language/communication of results needs to be clear to managers who are not experts in the science
2) It is important for managers to know what can and cannot be done with the results and the caveats and the unknowns of the work.

It was suggested:

- A component be added to the project to deal with interpretation from science output to managers, for example provide guidelines on how to use the outputs when providing any deliverables.

- The step from noise level maps to actual impacts is important. It would be useful to have some simple case studies to demonstrate the potential uses of noise maps.

It was mentioned as an example for other work GA had produced a video to communicate/translate the science to management and will send a link around to the group.

It was noted that the NESP project plan template includes an impact table that aims to get researchers to think exactly about this issue. What are they going to produce, what

consultation mechanisms are needed, and how will it help end-users. One aim of this section is to get researchers to recognise and consider exactly these kind of issues. Paul flagged that the stakeholders currently have the opportunity to give input for that table.

4.4 Discussion about the Humpback Component of the Project

The proposal has a component looking at deploying equipment targeted at establishing the impacts for GBR humpbacks. There were some questions about why humpbacks were chosen and whether there were species (e.g., pygmy blue whales, Southern right whales or resident inshore species) that are more of a priority.

After some discussion it was realised that it was not clear by the attendees what this component of work entailed in terms of resources, its aim/purpose and why humpback whales had been selected as a case study. Specifically, extra detail was given and it was established that:

- This component will not have a large additional cost as it was levering on the planned fieldwork to build ship noise spectra and using extra existing equipment.

- The main motivation was to develop methods and proof of concept on a species with good data/knowledge available regarding distribution/abundance located within a World Heritage Area with shipping lanes running through a critical (breeding) area, rather than because humpbacks had been identified as the species of most of concern.

It was suggested we could use the results from this well-informed/understood species and via artificially subsampling/reducing information, establish how well methods will work on other less understood/data poor species that are of concern.

4.5 Fine-scale Noise Mapping

There was a discussion about the process of fine-scale mapping of noise. Some points raised were:

- It was flagged the need to establish how far we can go with the data/models we have. Specifically we don't want to go to such a fine scale that the maps give a false sense of confidence about uncertainty.
- The point was made that when it came to identifying areas of concern to do fine-scale mapping, we may want to go the other way and look at areas of less concern, for example an area like the Bight where there is a lot of shipping but there is also a lot of natural contribution to noise.
- It was noted that it seemed that when it comes to choosing the areas to do fine-scale mapping that is not just a question of science needs/interests but of user need. So those decisions will need input/involvement from the users.

There were a number of questions asked about fine-scale mapping:

- It was asked what do we require to be able to do the fine-scale modelling and what timeframe? The answer was that we would need bathymetry, sound-speed profile

based on temperature and salinity, and information on the upper seafloor. Furthermore, if a vertical logger was deployed outside a major port we'd get variability estimates for the same vessel (i.e., loaded/unloaded) with the noise emission beam directivity.

There was a question about whether the greater fidelity from the vertical array would require greater fidelity in the other model data? It was confirmed this was true but we would only exploit the vertical array fidelity in smaller areas and wouldn't run the big complicated models for the whole of Australia as that would be unfeasible and the result not anymore useful at that scale. But for example, say we wanted to model in the GBR a small area of interest and use a high resolution we would have to use the more complex model and the data from a vertical array.

5. CONCLUSION

This was a very rewarding workshop outlining the research proposed for developing guidelines around underwater noise from shipping in Australia and has opened the dialogue between science and management on this topic. An important outcome of the workshop was to align the work on shipping noise in Australia with each stakeholders needs so that from the very beginning research output is aligned with management needs and the uptake of the research can be maximised.

We wish to thank all the attendees for their time and participation and Geoscience Australia for providing the venue to hold the workshop.

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