Expert Witness Statement
Mornington Safe Harbour EES
Marine Ecology Review

M. Edmunds

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Abstract
Expert witness statement for Mornington Environment Association pertaining to the Mornington Safe Harbour EES.

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Port Phillip Bay, Mornington, EES harbour, marina, development.

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1 Background

1.1 Name and Address

Dr Matt Edmunds
Australian Marine Ecology Pty Ltd
82 Parsons St
Kensington
VIC 3031

1.2 Qualifications and Experience

1.2.1 Qualifications

Bachelor of Science (Honours), First Class, (Marine, Freshwater and Antarctic Biology)
Doctor of Philosophy (Zoology)
ADAS Australian Commercial Diver Part 1
ADAS Certificate IV Occupational Diving Dive Supervisor
CMAS International Certificate for Scientific Research Diving
DAN Level II First Aid
DAN Oxygen Provider
Radio Operators Certificate of Proficiency
Coxswains Limited (Tasmania)
Coxswain (Victoria)

1.2.2 Experience

I have been working in various fields of marine ecological research for 23 years. I have substantial experience in marine impact assessments, particularly discharges and physical disturbances to the marine environment. These impact assessments include wastewater, seismic survey, dredging, desalination plants and subsea cable/pipe installations. I have been involved in several major marine impact assessments in southern Australia, including for the PoMC Channel Deepening Project, Gunns Pulp Mill, RPDC Bruny Bioregion Marine Protected Areas Inquiry and Walker Corporation Lauderdale Quay.

I have considerable first-hand experience of the marine habitats and ecosystems of Victoria and Port Phillip Bay. I have been a principal researcher of seagrass, shallow reef, deep reef and sediment bed communities throughout Port Phillip Bay. This work includes research for the Port Phillip Bay Environment Study, long term monitoring of biodiversity within marine protected areas and investigation of dredging and other impacts near shipping channels and other infrastructure.

A *curriculum vitae* is provided in the Appendix.

1.3 Relevant Expertise

My area of expertise is in coastal marine ecology, particularly population and community ecology pertaining to conservation, fisheries and environmental management. I have considerable knowledge of Port Phillip Bay and other ecosystems through long-term monitoring and a variety of other studies in the past 15 years. My ecological expertise and experience also encompasses:

- biodiversity of sediment invertebrate infauna, sediment epibiota, seagrass beds, seaweed beds and other communities within shallow embayments in southern Australia;
- light climate monitoring and modelling;
- photosynthesis, primary production and plant biomass measurement and modelling, including seaweeds, seagrass and sediment microalgae; and
- population and community biology, dynamics and ecological relationships.

My expertise and experience in conservation biology includes assessment of natural values and conservation status, including for threatened species, threatened communities and marine protected areas. I was a member of committees or panels for the Scientific Advisory Committee for the Flora and Fauna Guarantee Act, Fisheries Co-Management Council and the Tasmanian RPDC Bruny Bioregion Inquiry.

I have considerable experience in marine ecological impact assessments, including prediction and monitoring of responses to disturbances, such as from dredging, wastewater outfalls, pollution, aquaculture, introduced marine pests and pathogens. I have been involved in the development of professional standards for ecological impact assessment with the Environment Institute of Australia and New Zealand.

1.4 Contributors to this Statement

There were no other significant contributors to this report.

1.5 Instructions

I was engaged by Mornington Environment Association Inc. to provide a scientific review and expert opinion of marine ecological aspects of the Mornington Safe Harbour Environmental Effects Statement (EES). The review was to include environmental effects on local beaches, water quality, marine life, including *Syngnathidae* and feral Northern Pacific Seastars (common and likely to increase), marine habitats, and larger marine life including dolphins, penguins, whales and seabirds.

1.6 Supporting Tests or Experiments

This report does not rely on any specific tests or experiments.

2 Approach

2.1 Documents Reviewed

The review of the marine ecological impact assessment used the following EES documents:

- Mornington Safe Harbour Environment Effect Statement Volume 1 Main Report.
- Mornington Safe Harbour Environment Effect Statement Volume 2 Technical Reports.
    - Appendix A – Wave Climate
    - Appendix B – Hydrodynamic Assessment
    - Appendix C – Coastal Processes Assessment
    - Appendix D – Water Quality and Sediment Assessment
    - Appendix E – Marine Ecology Assessment
    - Appendix L – Stormwater Assessment

2.2 Review Approach

The review assessed the validity and reliability of information in the EES documents within a framework of criteria for best practice ecological impact assessment.

Well regarded texts establishing best practice for ecological impact assessment (EcIA) are those of Westman (1985) *Ecology, Impact Assessment and Environmental Planning* and Treweek (1999) *Ecological Impact Assessment*. The principles and processes detailed by these authors are also applied by the International Institute for Impact Assessment in conjunction with the Institute of Ecology and Environmental Management UK (IAIA 1998), as well as the Institute of Ecology and Environmental Management UK (IEEM 2006, 2008). The IEEM and IAIA guidelines are accepted as world best practices and are widely referenced. Australia presently does not have a set of accepted practitioner's standards or guidelines, although the Environmental Institute of Australia and New Zealand has prepared a draft set of EcIA guidelines as a precursor to developing best practices for these countries. The guidelines were drafted in concordance with the Treweek (1999), IAIA (1999, 2005) and IEEM (2006, 2008) guidelines.

A key tenet of best practices is adherence to the scientific method and provide an objective and transparent determination (IEEM 2006). This is also reflected in principles detailed by the IAIA (1999), including:

Rigorous The process should apply 'best practicable' science, employing methodologies and techniques appropriate to address the problems being investigated.

Credible The process should be done with professionalism, rigor, fairness, objectivity, impartiality and balance and be subject to independent checks and verification.

Systematic The process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the measures necessary to monitor and investigate residual effects.

The generic structure of best practice ecological impact assessment includes the following:

1. identification of potential sources of ecological stress or disturbance by the proposal;
2. description of ecological receptors in the environment and valued ecosystem components;
3. impact predictions, including nature and magnitude of changes against the baseline;
4. impact mitigation to redress significant adverse effects;
5. impact evaluation to determine the significance and importance of predicted residual ecological impacts;
6. ecological monitoring to strengthen the knowledge base, provide opportunities for corrective management action in the light of unforseen outcomes and ensure compliance.

3 Effects and Stressors

3.1 Effects

The EES provides a description of works, which provides some indication of construction effects, and notes on environmental management, which provides some indications of operation effects. Nevertheless, the EES does not systematically define and predict the nature of all potential effects and ecological stressors.

The Main Report and Technical Appendices lists stressors as:

- noise from pile driving;
- turbidity from pile driving;
- contamination from sediment resuspension by dredging;
- contamination from antifouling;
- contamination from vessel cleaning and maintenance;
- liquid discharges from vessels: oily bilge, sewage and grey water;
- fuel and oil spills;
- solid wastes and litter;
- changed wave climate;
- changed currents and water exchange;
- changed sand movement dynamics – changed beach morphology and smothering by sand;
- optional artificial reef; and
- mechanical relocation of accumulated sand.

There were some important effects that were not considered by the EES, that may have significant effects on local ecosystem. These include:

- shading and reduced light climate – the additional artificial structures and moored vessels would cause increased shading, potentially changing marine communities and reducing levels of primary production;
- similarly, the increased footprint of artificial structures into the bay would cause reduced area of open or unimpeded water and sea surface habitat;
- the substantially changed wave climate in the bay would result in changed sediment dynamics, possibly including increased fine sediments and deposition of organic matter, and cause changed sediment structure and biogeochemistry;
- the movement of vessels greatly increases the risk of marine pest translocation, including pests from the harbour to elsewhere, or from elsewhere to the harbour;
- the increased area of artificial structures, including the marina and optional artificial reef for sand transport management, provides of novel habitats for establishment of marine pests.

- synergistic effects, for example the translocation of Japanese kelp *Undaria pinnatifida* and establishment in the marina is likely to lead to organic overloading of sediments and hypoxia, as occurs at Princes and Station Piers.

3.2 Predicted Effect Levels

Predictions of the magnitude of effects were provided for some stressors but not others. Explicit prediction were provided for:

- copper contamination from antifouling;
- changes in wave climate; and
- changes in currents and flushing.

Although the level of noise from pile driving was explicitly stated, the frequency and duration of noise, sediment suspension by pile driving and sediment disturbance by dredging were not considered. The level of sediment disturbances from pile driving was stated as "*... any increase in turbidity is likely to be extremely localised and transitory in nature and unlikely to affect resident marine communities along the Pier*" (Appendix E, page 22). Even if disturbances are localised and transitory, continual or frequent disturbances over the 18 month construction time may lead to significant impacts. It is later stated that the level of turbidity plumes generated by pile driving is unknown and would be determined once the project commences (Appendix E, page 26).

No effect predictions, including time of year, duration, frequency or magnitudes, were provided for dredging, including suspended sediments (turbidity) and release of contaminants. It should be noted the effects from dredging are highly related to the technology and work method used, however these were largely undescribed.

Although changed wave climate was explicitly predicted, there was little consideration of the implications for changes to sediment habitats. The decreased wave energy area is likely to lead to larger areas with finer sediments and potentially greater organic loadings and different biogeochemistry – this was not considered in the EES.

The area and level of sand smothering over inshore reefs and changes to beach profiles is vague. This is made more uncertain by the potential option for installing an artificial reef, with little indication of the probability that this would occur. The artificial reef is likely to cause inundation of some of the inshore natural reef but may "minimise the spread of sand across the entire inshore reef".

3.3 Area of Consideration for Impact Assessment

Figure 1-2 of the EES Main Report (page 15) defines the area subject to the EES as essentially the whole bay area southward of the outer pier. This is confirmed by the footprint of the proposed development and modelled changes in waves and currents.

The wave and current modelling also indicated influences to seaward and further along the coast and these wider areas should also be considered in the ecological impact assessment.

It was noted many maps lacked scales, or had scales that were not legible.

3.4 Summary

The EES does not systematically define the potential ecological stressors and provide predictions on the magnitude, duration, frequency and time of year of disturbances – information important for a well considered impact assessment. Some important ecological stressors were not considered by the EES, including: the nature of sediment habitat changes in the reduced wave climate area; the increased area of shading and artificial structures; and the translocation and colonisation of marine pests.

4 Existing Conditions

4.1 Habitats and Species

The EES provides brief descriptions of habitats and species in the bay area, including:

- beaches;
- rocky intertidal;
- soft seabed;
- inshore subtidal reef;
- seagrass; and
- artificial structures.

The distributions of habitats is provided in Appendix E (Figure 5, page 12), however it is noted only "seagrass" habitat is mapped. The two types of seagrass present, *Halophila australis* and *Zostera nigricaulis*, are very different habitat types with different ecological implications. It was noted that the mapped habitats overlay an aerial photographs which has seabed structures not indicated on the habitat map. There appears to be a darker fringe on the seaward side of the inshore sandy banks which could be seagrass or *Pyura* bed habitat. This fringe area would be at risk from sand inundation from the project.

The species and community descriptions for each habitat are very brief, with only one or two common species mentioned without relative abundances. This sparse information makes it difficult to establish similarities and differences of the biota with other places and determine ecological values.

It was noted that many species names in Appendix E were wrong or misspelt:

- seastar *Coscinasterias calamaria* should be *Coscinasterias muricata*;
- mussel *Mytilus planulatus* should have been *Mytilus edulis planulatus* or *Mytilus galloprovincialis planulatus* (see below);
- southern goatfish *Upeineichthys proosus* should be *Upeineichthys vlamingii*;
- kelp *Ecklonia radiate* should be *Ecklonia radiata*;
- *Caulocystis* sp should be *Caulocystis cephalornithos*; and
- *Hippocampus abdominalis* should be *Hippocampus bleekeri* .

Subsequent name changes are *Mytilus edulis* to *Mytilus galloprovincialis* and *Heterozostera nigricaulis* to *Zostera nigricaulis*.

4.2 Ecosystem Processes

The EES makes no attempt to identify any ecosystem processes or functions that may be subject to stressors. Examples of processes that should have been considered include:

- primary production, including by seagrass, drift algae, phytoplankton and sediment microalgae;
- secondary production, including water column mixing zones and biological aggregation areas; and
- sediment ecosystem functions, including organic sinks and denitrification.

4.3 Ecosystem Values

Appendix E contained a section on Environmental Values (Section 5, page 20), however this section only considers listed species. Other ecological and environmental values that should have been considered include:

- presence of unique communities or aspects of biogeographical importance;
- areas of high biodiversity;
- aggregations, high biomass or density;
- areas important as nurseries, feeding areas and home ranges; and
- important ecosystem functions and key functional species and habitats.

Apart from the consideration of listed species, the Main Report (page 27) and Appendix E (page 19) dismiss any values of the species and habitats present and claim they are typical of equivalent environments elsewhere in Port Phillip Bay. The EES does not provide any evidence to validate this claim, such as the location of any equivalent environments or references to other data. There is no explicit analysis to compare species, communities or habitats between Mornington and other locations to establish the uniqueness, importance, representativeness of the Mornington biota.

There are few areas of seagrass on the east coast of Port Phillip Bay so its presence at Mornington may be of significance. Similarly, subtidal reefs to the north, such as at Ricketts Point and Red Bluff, do not have large abalone populations so the abalone on the nearshore reefs at Mornington may also be of significance.

Appendix E notes the presence of *Sargassum* and *Caulocystis cephalornithos* on the nearshore reefs (page 19) – this is potentially suitable habitat for the shortheaded seahorse *Hippocampus breviceps*. The seagrass *Zostera nigricaulis* is potentially habitat for other syngnathids, such as pipefishes. *Hippocampus whitei* was mentioned in the text – this seahorse species is unlikely to be present at Mornington.

The sandy habitats are likely to play an important role in supporting primary production by sediment microalgae and the biogeochemistry of the finer sediments is likely to play a role in water quality.

The open bay waters are likely to be used by a wide variety of transient species, such as sharks, seals, fishes and seabirds. The importance of the open bay area depends on the degree of visitation and usage by each species and cannot be assumed to be insignificant.

The EES claims that the common dolphin *Delphinus delphis* is likely to be only a casual visitor to the area (Appendix E, page 20). In fact, the case is the opposite, with Mornington likely to be a very important area for an unusual group of *D. delphis*. There is a resident breeding population of approximately 30 dolphins. This group has a small home range from approximately Dromana to Olivers Hill, with the highest frequency (70-90 %) of occurrence at Mornington, in or near the bay. The group are likely to have been present from before 2006 (when records began) and the Mornington area is likely to be an important feeding and residence area (Sue Mason and David Donnelly, *pers. comm.*, Dolphin Research Institute).

A colony of the pot-bellied seahorse *Hippocampus bleekeri* is present at the development site and the short-headed seahorse *H. breviceps* may be present on the inshore reefs. These species are listed marine species on the EPBC Act. The resident population of common dolphins *Delphinus delphis* is a listed cetacean. An EPBC Act referral is therefore warranted.

4.4 Summary

The EES provided only basic descriptions of habitats and species. The EES neglected to consider ecosystem processes. The EES concluded that the Mornington habitats and species were typical other areas in Port Phillip Bay without providing adequate evidence or rationale. The EES consideration of values was constrained to listed species. Of these, it failed to note the importance of Mornington and the proposed development area to the common dolphin *Delphinus delphis*.

For a comprehensive impact assessment, further information is required on:

- potentially important ecosystem processes, such as sediment chemistry and sediment microalgal production; and
- systematic assessment of potentially important ecological values, including a biogeographical comparison of species and assemblages with other areas of Port Phillip Bay to establish uniqueness and representativeness.

5 Impact Predictions

It was noted by Treweek (1999) that impact prediction is at the heart of ecological impact assessment but is often the weakest component. There are three complimentary sets of information required for impact prediction:

- the definition or prediction of the stressors, including the magnitude, spatial extent, frequency and duration of exposures;
- the understanding of ecosystem function that accounts for observed baseline states, distributions and variability (existing conditions); and
- identification of ecosystem processes that will drive change in response to levels of the environmental stressors.

From this a model can be used to predict ecological outcomes relative to baseline, taking into account frequency range, magnitude and severity,

As noted in previous sections, the EES provides only cursory descriptions of stressors. There is also little information provided on biological and ecological responses to the stressors. The EES makes little attempt to predict biological or ecological changes resulting from the proposed marina development.

Some of the more concerning, potential adverse ecological impacts may include:

- excessive noise from pile driving over an extended period of up to 18 months causing aversion reactions of the resident dolphins away from feeding areas and subsequent impact on breeding success, leading to population decline;
- persistent turbidity during pile driving and dredging, reducing light levels and biomass of plants and primary productivity, with reductions in secondary productivity;
- loss of seagrass and sediment microalgae habitats through extensive seabed shading by the marina structures and vessels;
- change in sediment biodiversity throughout whole of the bay through changes in sediment structure and chemistry in more sheltered waters;
- changed seabed habitats outside the marina through increased wave exposure through waves reflected off the wave screen;
- translocation and infestation of marine pests (such as the Japanese kelp *Undaria pinnatifida* in the north of Port Phillip Bay) to the harbour, artificial reef or scoured reefs via boat traffic;
- translocation of marine pests from Mornington to other places via boat traffic, causing major ecological changes elsewhere;

- infestation of hulls and marina structures with kelp *Undaria pinnatifida*, which has a seasonal die-off leading to a high organic loading of sediments underneath and causing anoxic sediments and loss of sediment biota (as occurs at Station Pier and Princes Pier);
- pollution of water column and seabed from discharges of solid and liquid wastes, including oils, sewage and litter;
- change in water quality in more sheltered areas through changed ecosystem functioning of sediments, organic loading and pollution;
- sand inundation of inshore reefs and loss of seaweed biodiversity as well as what may be important abalone and short-headed seahorse habitat;
- reduction of open water habitat, excluding critical foraging habitat by resident dolphins and potentially other animals, such as fishes, seabirds, seals and penguins; and
- fouling of the seabed under and around the marina with litter and debris.

Although some of the above scenarios are quite speculative, most of these types of impacts have been observed in other marinas and harbours.

There is some concern about impacts of toxicants on marine biota. Two identified sources include release of copper and other toxicants from anti fouling and the resuspension of toxicants from contaminated sediments. In both instances, some mitigation was proposed as dilution (particularly for the antifouling leachate). In this case, the local concentrations may be kept under the ANZECC guidelines but dilution means a wider area is being impacted at a lower contaminant level.

The EES provides modelling of flushing and residence times, however this information is not extended in terms of biological impacts. It appears the EES assumes that a few extra days of residence time is ecologically inconsequential. Further consideration should be given to the consequences of reduced mixing in terms of ecological consequences.

The changed circulation patterns may result in increased seaweed and litter accumulations on the beach or within the bay in general. This may lead to organic loading of sediments and other ecological issues for beach and subtidal issues (as well as social issues, such as the need for beach cleaning).

In summary, the EES provides no predictions of ecological states arising from the proposed marina development. There are, however, a variety of ecological impacts that could occur and require mitigation and evaluation.

6 Impact Mitigation

Appendix E provides indications of potential impact mitigation measures that may be used, however there is no indication of the level of commitment to these suggestions. There is also no indication of the desired or required degree of mitigation. For example, it is suggested that silt curtains are used "if necessary"; however there is no detail of acceptable exposure levels for turbidity to indicate when a silt curtain should be deployed. Similarly, there are no acceptable levels or targets defined for any of the other threatening processes, with the predominant wording being to "minimise" impacts.

The EES does not contain an environmental management plan with explicit management objectives, targets and environmental limits. The Main Report provides an environmental framework with mitigation measures that may be applied (Tables 8.1, 8.2). This information is too vague to enable prediction of residual impacts after the mitigation measures are applied. For management of some stressors, the EES defaults to documents such as the EPA Best Practice Guidelines for Dredging and the SEPP – these have generic properties and do not guarantee protection of local ecological values. For example, the EPA Best Practice Guidelines for Dredging provides a method for protecting the survival of seagrass, but does not provide guidance on maintaining seagrass at biomass levels suitable for conserving habitat and associated biodiversity.

The lack of an EMP greatly hampers the assessment of increased vessels in the harbour affecting water quality. Although the EES indicates the EMP will address water quality issues, the detail of the EMP is quite important. Levels of pollution may or may not be kept low depending on how strict the controls in the EMP, and its enforcement, are. For example, the issue of release of copper and other toxicants from antifouling may be greatly reduced by forcing boats to use much less toxic (but more expensive) silicon based antifouling. Similarly, the detail of the EMP could make a large difference to suspended sediment levels and resuspension of toxicant, depending on the technology and work method proscribed.

The mitigation of the most serious potential impacts can only be done at design phase, such as:

- the area and arrangement of the marina footprint to reduce space constraints on feeding areas, such as by dolphins;
- the design of the wave screen and flushing to minimise formation of anoxic sediments and accumulation of toxicants; and
- design of the artificial reef to limit sediment smothering on inshore reefs.

There was no apparent optimisation of the proposed marina design with respect to mitigating potentially major ecological impacts.

The management of marine pest translocation is a considerable omission, this being a well known problem of marinas and harbours and having major to catastrophic ecological consequences.

In summary, the EES describes general mitigation measures, but does not define clear objectives or limits to ensure significant ecological impacts do not occur. Some ecological impacts can only be mitigated by design while others will need to be addressed in an Environment Management Plan, which was not provided in the EES.

7 Impact Evaluation

As stated above, it is not possible to robustly predict residual ecological impacts from the information provided in the EES. As noted in Section 5 Impact Prediction, there is potential for substantially changed ecosystem throughout bay at Mornington. Impacts that would be considered ecologically significant include:

- disturbance to the population dynamics of the resident dolphin *Delphinus delphis* group;
- loss of inshore reef habitat if it is habitat for important abalone populations, short-headed seahorse *Hippocampus breviceps* or other species restricted in range within Port Phillip Bay;
- changes to the sediment chemistry, nutrient cycling and biodiversity, especially with accumulation of finer sediments with higher organic loading;
- infestation of new marine pests, with Japanese kelp *Undaria pinnatifida* being an immediate threat that would have synergistic effects on sediment and water quality;
- reduced primary and secondary productivity outside the natural level of variation.

Further investigations on effects, existing conditions and impacts are required before it can be determined if or what significant and important ecological impacts would occur. Some of the greatest uncertainties include:

- changes to sediment habitats and consequences for nutrient cycling;
- shading and changes to light climate and plant communities;
- space limitations to more mobile animals through intrusion of marina structures (including for the resident dolphins);
- significance of species on the inshore reefs; and
- translocation and infestation of marine pests.

In summary: the proposed Mornington marina development has the potential to cause impacts of considerable significance and importance, however there is presently a paucity of information to make a proper evaluation.

8 Summary and Conclusions

8.1 Summary

The Mornington Safe Harbour EES marine ecology impact assessment lists some of the ecological stressors that may arise from the construction and operation of the project, however it does not systematically define all stressors and effects. Some effects have considerable attention, such as changes in wave climate, currents and flushing. There were major effects that received no attention at all, including: changed sediment habitat conditions; increased area of shading by artificial structures and vessels; the translocation and infestation of marine pests and the reduction in open water space in the bay.

The description of existing biological and ecological conditions was cursory, essentially being a listing of habitats and the most readily identified species. There was no consideration of ecosystem processes or functions in the study areas. As such, the EES excluded consideration of potentially important processes such as primary production (seagrass, phytoplankton and sediment microalgae), sediment nutrient cycling and aggregations of biota in the water column.

The determination of ecosystem values was largely limited to listed species that may occur in the area. The EES analysis wrongly concluded that the area was not important to the common dolphin *Delphinus delphis*. Monitoring and research by the Dolphin Research Institute since 2006 indicates there is a resident breeding population with a small home range centred on Mornington. They have a high frequency of occurrence in the proposed project area and it is likely to be important habitat for them. The EES did not systematically assess whether there were other important environmental or ecosystem values. Criteria for importance include presence of communities of biogeographical importance, high biodiversity, aggregations or high biomass, nurseries, feeding areas and ecosystem processes important for system functioning and ecosystem services to humans. The EES dismisses any value of the Mornington species and habitats in a single statement which claims they are typical of equivalent environments elsewhere in Port Phillip Bay. There is insufficient data, rationale or other evidence to support this claim and this statement should not be accepted without supporting analysis. For example, the inshore reefs could be important habitat for the short-headed seahorse *Hippocampus breviceps* and the blacklip abalone *Haliotis rubra* on these reefs may be important for meta-population dynamics.

The EES provides no predictions of changes in biota and ecosystem states and functioning resulting from the development – it steps straight from listings of effects

and existing conditions to mitigation measures. There are potentially major ecological impacts that should be identified and considered as part of the decision making process (see Section 5).

The EES describes some mitigation measures, for some stressors. There were no clear commitments to implement these, with no Environmental Management Plan with clear objectives, actions and targets or limits. The mitigation of impacts by project design, particularly shading and footprint area aspects, do not appear to have been considered.

There is essentially no impact evaluation in the EES, although the unsubstantiated statement that the habitats and species are represented elsewhere implies that any impact would be considered of no ecological significance. The EES does not provide sufficient information to establish whether there would be residual impacts of ecological significance. There is, however, potential for significant residual impacts to occur. These include:

- changes in the population dynamics of the resident dolphin *Delphinus delphis* group;
- loss of inshore reef habitat if it is habitat for important abalone populations, short-headed seahorse *Hippocampus breviceps* or other species restricted in range within Port Phillip Bay;
- changes to the sediment chemistry, nutrient cycling and biodiversity, especially with accumulation of finer sediments with higher organic loading;
- infestation of new marine pests, with Japanese kelp *Undaria pinnatifida* being an immediate threat that would have synergistic effects on sediment and water quality;
- reduced primary and secondary productivity outside the natural level of variation.

8.2 Conclusions

- The Mornington Safe Harbour EES does not provide a rigorous and systematic marine ecological impact assessment.
- The prediction of project effects is lacking in detail and omits some processes, including sediment habitat changes and translocation of marine pests.
- The description of existing conditions is cursory, ignores potentially important ecosystem functions and excluded the presence of a resident dolphin population;
- The EES statement that the habitats and species are represented elsewhere in Port Phillip Bay was unsubstantiated and should not be accepted until there is scientific evidence and rationale to support this. It may be implied from the EES that the biota at Mornington are inconsequential or 'disposable'. There is no evidence to support such an inference and the EES omits considerations that Mornington may in fact be important ecologically.
- The EES does not describe any ecological impact states or scenarios and the information provided in the EES on effects and mitigation lacks the level of consistency and detail to properly predict residual impacts of construction and operation.
- The Mornington Safe Harbour proposal has the potential to cause substantial and lasting ecosystem impacts throughout the bay area and impact on valued natural assets, including dolphins, primary production, sediment nutrient cycling and water quality. These risks should be further assessed in a systematic, rational manner if they are to be properly incorporated in the decision making process.

9 Declaration

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

19 December 2010

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10 References

IAIA (1999) Principles of Environmental Impact Assessment Best Practice. International Association for Impact Assessment and Institute of Environmental Assessment UK, Fargo, USA.

IAIA (2005) Biodiversity in Impact Assessment. International Association for Impact Assessment Special Publication Series No. 3, Fargo, USA.

IEEM (2006) Guidelines for Ecological Impact Assessment in the United Kingdom. Institute of Ecology and Environmental Management.

IEEM (2008) Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal. Institute of Ecology and Environmental Management, United Kingdom.

Treweek J (1999) Ecological Impact Assessment. Second Edition. Wiley-Blackwell, Oxford.

Westman WE (1985) *Ecology, Impact Assessment and Environmental Planning*. Wiley, Los Angeles.

11 Appendix A – Curriculum Vitae – Matt Edmunds

Dr Matt Edmunds

Principal Marine Ecologist

Education

1987-1990 Bachelor of Science (Honours), First Class
Marine, Freshwater and Antarctic Biology
University of Tasmania, Hobart
Thesis: *The Community Ecology of Fishes on Tasmanian Rocky Reefs.*

1991-1995 Doctor of Philosophy, Zoology
University of Tasmania, Hobart
Thesis: *The Ecology of the Juvenile Southern Rock Lobster*, Jasus edwardsii *(Hutton 1875) (Palinuridae).*

Certificates

Drivers licence
Tasmanian Motor Boat Licence
Coxswains (limited), Tasmanian Navigation and Survey
Coxswains Certificate, Marine Safety Victoria with Port Phillip Heads Endorsement
Radio Operators Certificate of Proficiency
NASDS Master Diver
ADAS Australian Commercial Diver Part 1
ADAS Certificate IV Occupational Diving Dive Supervisor
CMAS International Certificate for Scientific Research Diving
DAN First Aid and Oxygen Provider

Awards

1990 Ralston Trust Honours Prize, University of Tasmania
2000 Royal Humane Society of Australasia Bronze Medal
2007 Australian open 50 m surface fin swimming record

Employment

1999-present	Director, Australian Marine Ecology Pty Ltd
1990-1999	Marine Biologist, Consulting Environmental Engineers Pty Ltd
1990-1995	Teaching, Department of Zoology, University of Tasmania
1990-1991	Technical Officer, Tasmanian Division of Sea Fisheries
1989-1990	Technical Officer, CSIRO Division of Fisheries
1988-1989	Research Assistant, University of Cambridge

Memberships and Committees

- Rock Lobster and Giant Crab Committee, Victorian Fisheries Co-Management Council – member for conservation expertise (2002-2007).
- Ministerial Scientific Advisory Committee for the Victorian Flora and Fauna Guarantee Act – member for marine expertise (2003-2008)
- Panel Member, Inquiry into Establishment of Marine Protected Areas in the Bruny Bioregion, Tasmanian Resource and Planning Development Commission (2006-2008).
- Australian Marine Sciences Association – ordinary member
- Environment Institute of Australia and New Zealand – ordinary member
- Ozfin Inc. – Committee member.

Background

Dr Edmunds is a director of Australian Marine Ecology Pty Ltd. He has specialist expertise in coastal ecological investigations and he has been designing and implementing research and monitoring programs for 22 years. His work encompasses a broad range of ecological aspects, including community-environment relationships, taxonomy, population dynamics and environmental impact assessment.

Dr Edmunds has substantial experience in experimental/sampling design and analysis, in addition to a strong practical background in underwater sampling techniques. His field experience includes thousands of research dives in cold and difficult conditions, predominantly involved with quantitative underwater visual censusing. He has been at the forefront in establishing quantitative deepwater visual censuses using drop-video, towed video and ROV technology.

His work in environmental consulting has focussed on the ecological assessment of wastewater discharges, dredging and other disturbances, as well as the assessment of natural spatial and temporal variations in fished populations and reef communities. These assessments include: multivariate comparisons of subtidal and intertidal reef benthic biota, infauna and intertidal communities near pulp-mill and sewage discharges;

before-after-control-impact type analyses of population abundances and community assemblages; power analysis of monitoring programs; and assessment and implementation of a variety of methods for habitat mapping and environmental monitoring.

Experience and Expertise

Experimental Design and Analysis

Dr Edmunds has substantial experience in the design, implementation and analysis of ecological investigations, particularly for marine populations and communities, and for environmental impact assessments. He is familiar with most biostatistical analyses, including: ANOVA models, multivariate analyses of community structure (including MANOVA, RDA, CVA, CCA, ANOSIM and MDS), diversity indices, dominance curves, univariate and multivariate tests of hypotheses and before-after/control-impact (BACI) analyses. Much of this work goes beyond merely testing for impacts or responses, but describing the nature, magnitude and spatial extents – information critical for environmental management. He is also familiar with regression analyses (linear and non-linear), power and cost-benefits analyses, cluster analysis, analysis of spatial patterns, as well as population and fishery assessment statistics (including CMR models from tagging studies). Dr Edmunds has been involved with teaching statistics to undergraduate students at the University of Tasmania, and is able to communicate the principles and interpretation of biostatistical analyses in a clear and concise manner, in both written and oral form.

Dr Edmunds has experience with a variety of underwater sampling methods for epibenthic biota and infauna. These include diving visual census techniques, ROV census techniques, underwater photography, video, baited video stations, stereo video applications and 3D measurements, sediment sampling and biological collections. His strong practical and analytical skills ensure his work is both efficient and effective.

Fisheries and Population Biology

Dr Edmunds has a strong background in fishery science, particularly coastal fisheries, through research and consulting with Tasmanian Division of Sea Fisheries, CSIRO Division of Fisheries, University of Tasmania, South Australian Research and Development Institute and Australian Marine Ecology. He has ongoing involvement with scientists, management and fishers. Pertinent experience includes the Southern Rock Lobster Research Group, fishery assessment and modelling workshops, Abalone Management Plan Steering Committee and Commercial Rock Lobster Fisheries Committee. Through his population dynamics investigations, he has an understanding of the implementation and implications of fishery management options, for both the fishers and the fishery stocks.

Scientific experience includes:

- Taxonomic revision of the *Squalus* (dog shark) genus in Australasian waters.
- Coastal reef fish stock assessment.
- Spatial and size variations in fecundity and maturity of the southern rock lobster *Jasus edwardsii*.
- The population ecology of juvenile *Jasus edwardsii*.
- Standing stocks of the seaweed *Undaria pinnatifida.*
- Population biology and gonad quality of the sea urchin *Heliocidaris erythrogramma.*
- Density and size structure of abalone, rock lobster, sea urchin, periwinkle and wrasse (Labridae) stocks on Victorian reefs.
- Independent stock assessment of abalone in Victoria.
- Independent stock assessment of rock lobsters in Victoria.

Population and Community Ecology

Dr Edmunds has substantial experience and expertise in ecological investigations in a wide range of coastal marine habitats. Major projects include:

- The behavioural ecology of the seahorses *Hippocampus abdominalis* in Tasmania and *H. breviceps* in Victoria.
- Fish assemblage-habitat relationships on Tasmanian rocky reefs.
- Ecology of the introduced Japanese seaweed *Undaria* in Tasmanian waters.
- Ecology of juvenile southern rock lobster *Jasus edwardsii.*
- Review of the Westernport marine environment, with contributions on seagrass, fish and invertebrate communities.
- Assessment of acoustic methods for mapping the standing stocks of epibenthic flora and fauna.
- Benthic marine habitat and biological assemblage mapping in Tasmania and Victoria.
- Investigation of the composition, standing crop and nutrient content of macrophyte assemblages in Port Phillip Bay.
- Investigation of biological-environmental relationships in Victorian subtidal reef communities.
- Implementation of a long-term monitoring program for Victorian reef flora and fauna.
- Investigations in temporal and spatial variations in Victorian reef communities.
- Project design for monitoring lobster populations within marine reserves in Tasmania.
- Reef assemblage structures and distribution for oil spill atlas.
- Biogeography of Victorian reefs including identification of bioregions and description of reef community types.
- Biological assessment of marine protected area proposals for eastern Victoria.
- Modelling of seagrass, diatom and seaweed production and population dynamics.
- Sponge community structures, community-habitat relationships and temporal variations on Victorian deep reefs.

Environmental Impact Assessment and Monitoring

Qualitative and quantitative environmental assessment projects include:

- Impact assessment and monitoring of wastewater discharges on benthic organisms at George Town, Devonport, Wesley Vale, Burnie and Hobart in Tasmania.
- Impact assessment and monitoring of wastewater discharges at Baxters Beach, Phillip Island, Altona, Venus Bay and Boags Rocks in Victoria.
- Impact assesment and monitoring of wastewater discharges at Wollongong and Boambee Head, Corambirra Point and Woolgoolga in New South Wales.
- Pilot studies and biological monitoring designs for Baxters Beach and Boags Rocks outfalls, Victoria, as well as Coffs Harbour EIS, NSW.
- Temporal and spatial comparisons of infaunal community structure and diversity at Wesley Vale.
- Recruitment and community succession on artificial substrata near paper mill effluent outfalls.
- Water quality assessment and monitoring near paper mill outfalls.
- Measurement and modelling of winds, currents and plume dispersal.
- Analysis of metals bioaccumulation in oysters, northern Tasmania.
- Habitat and biological assemblage mapping for dredging and beach restoration at Hampton, Port Phillip Bay.
- Impact assessment and monitoring of dredging at Hampton, Port Phillip Bay.
- Investigation of dredging effects in the Maribyrnong River
- Investigation of impacts of sewage overflows in the Illawarra region.
- Review of marine biological impacts of Sydney ocean outfalls for Cronulla STP EIS.
- Odour modelling for industrial and rural developments.
- Modelling clarifier performance for paper mill wastewater treatment plant.
- Co-development of Ausbeach water quality model for predicting beach exposure to coliform bacteria from outfall discharges.
- Design and implementation of monitoring programs for performance assessment of Victorian marine protected areas.
- Assessment of ecological status of the Victorian marine protected areas.
- Impact assessment of previous and proposed dredging in Port Phillip Bay, including biological modelling and risk assessments.
- Modelling of reductions in primary production by seaweed, kelp and microalgae exposed to suspended sediment plumes caused by dredging.
- Rock fall modelling from dredging and impact assessment on sponge garden communities.
- Impact and recovery monitoring programs investigating rockfall impacts on sponge gardens.
- Measurement and mapping of dredge impacts on water quality.
- Monitoring of light climate and dredge impacts on seagrass beds.

Scientific Review

- Peer reviewer, Bulletin of Marine Science, population dynamics of spiny lobsters.
- Peer reviewer, C. P. Norman, habitat use of early benthic phase lobsters.
- Peer reviewer, Marine Ecology Progress Series, juvenile lobster populations and artificial habitats.
- Review and editing, Andrew N. 1999. Under Southern Seas: The Ecology of Australia's Rocky Reefs. UNSW Press, Sydney.
- Review and editing, Department of Natural Resources and Environment reports.
- Review of mapping projects for CSIRO Environmental Project Office, Melbourne.
- Scientific review of marine ecology components of Gunn's Pulp Mill IIS for Beca AMEC, lead consultant to Tasmanian Resource Planning and Development Commission, Hobart.
- Panel member, inquiry into establishment of marine protected areas in the Bruny Bioregion, Hobart.
- Committee member, Scientific Advisory Committee for implementation of the Flora and Fauna Guarantee Act, Victoria.
- Scientific review of reports associated with channel deepening for the Australian Conservation Foundation, Melbourne.
- Review of marine natural values of the Kimberley region for WWF Australia.
- Scientific review of the marine environmental aspects of the Victorian Desalination Project EES for AquaSure, Melbourne.
- Review of marine nature conservation in Victoria for Victorian National Parks Association, Melbourne.
- Scientific review of the Lauderdale Quay DIIS for Save Ralphs Bay Inc., Hobart.

Conferences, Workshops and Seminars

- Australian Marine Sciences Association Conference, Melbourne, July 1993. Paper: Shelter utilisation and availability for the southern rock lobster, *Jasus edwardsii.*
- CSIRO Seminar Series, Hobart, September 1993. Paper: Lobsters and the Mandelbrot Set: The implications of fractals on the population dynamics of the southern rock lobster, *Jasus edwardsii*.
- Rock Lobster Scientist Meeting, Wellington, April 1994. Discussion leader: Measuring juvenile abundance.
- Southern Rock Lobster Population Modelling Workshop, Adelaide, June 1994.
- Southern Rock Lobster TriState Conference, Victor Harbour, July 1994.
- Australian Society for Fish Biology, Canberra, August 1994. Paper: Ontogenetic shifts in diet of the southern rock lobster.
- University of Tasmania Workshop: Application of Fractals to Ecology, Hobart, February 1995. Co-convenor (with Belinda Robson) and discussion leader.

- Westernport Marine Environment Workshop, Melbourne, February 1995. Discussion leader: Fish and fisheries.
- Southern Rock Lobster Population Modelling Workshop, Adelaide, August 1995. Paper: Microtagging and the population dynamics of the juvenile southern rock lobster.
- Southern Rock Lobster Early Life History Workshop, Hobart, May 1996. Discussion leader: Density dependence in early benthic phase lobsters.
- Southern Rock Lobster Population Modelling Workshop, Adelaide, September 1996.
- Southern Rock Lobster Recruitment Workshop, Hobart-Adelaide, February 1999. Paper: Ecology of juvenile lobsters and recruitment limitations.
- Australian Marine Sciences Association Conference, Melbourne, July 1999. Paper: Impact assessment of reef biota near the Boags Rocks sewage discharge.
- Monitoring Marine Protected Areas, TAFI, Hobart, October 1999. Papers: Monitoring in Victoria and Census of rock lobster populations.
- Monitoring Marine Protected Areas, NRE, Melbourne, September 2001. Papers: Census Methods and Temporal Patterns.
- Primary production modelling for environmental management in Port Phillip Bay, Port of Melbourne Corporation, Melbourne, 2006.
- Deep reef habitat mapping in Port Phillip Bay, Port of Melbourne Corporation, Melbourne, 2006.

Expert Witness Appearances

Channel Deepening Project EES Planning Panel Inquiry, Melbourne 2005

- Dredging impacts on marine ecology and communities.
- Proof of concept primary production modelling.
- Monitoring and modelling system for environmental management of light regime to protect seagrass, kelp and microphytobenthos primary production and adaptive management.

Channel Deepening Project Supplementary EES Panel Hearing, Melbourne 2007

- Deep reef rockfall modelling and sponge garden impacts and recovery.

Lauderdale Quay DIIS Panel Hearing, Hobart 2009

- Marine and estuarine ecology.
- Quantitative modelling of sediment biota and wading bird energetics.

Project Experience

The following is a selection of on-going or completed projects with Australian Marine Ecology.

Reef Monitoring Design and Implementation, 1998-2001
NRE Parks Flora and Fauna

Relational Database Design and Maintenance 1998-2006
NRE Parks Flora and Fauna

Sub-tidal Reef Monitoring Program, 1998-2002
NRE Parks Flora and Fauna

Geospatial Analysis and GIS Support, 1999
Marine and Freshwater Resources Institute

Scientific Peer Reviews of NRE Environmental Inventory Reports, 1999
NRE Parks Flora and Fauna

Environmental Assessment of Proposed Aquaculture Intake Pipe, 1999
Deekna Pty Ltd

Ecological Status of the Bunurong Marine Park, 1999-2000
Marine and Freshwater Resources Institute

Biogeography of Victorian Reef Assemblages, 2000
NRE Parks Flora and Fauna

Kelp Habitat Atlas and Oil Spill Review, 2000
Australian Maritime Safety Authority

Abalone Stock Assessment Surveys 2000-2001
Marine and Freshwater Resources Institute

Bass Strait Hydroacoustic Surveys, 2000
AMOG Consulting

Biological Assessment of Marine Protected Areas in Eastern Victoria, 2001
Abalone Fishermen's Cooperative Ltd

Shallow Reef Monitoring Standard Operations Procedure, 2001
NRE Parks Flora and Fauna

Review of Underwater Visual Census Precision and Biases, 2001
NRE Parks Flora and Fauna

Stock Assessment of Rock Lobster – Discovery Bay, 2002-2004
Marine and Freshwater Resources Institute

Studies on Rock Lobster Climax Populations, 2002
NRE Parks Flora and Fauna

Community-Based Monitoring of Mud Islands Seagrass Beds, 2001-2002
Friends of Mud Island

Juvenile Rock Lobster Recruitment, 2002
Marine and Freshwater Resources Institute

Studies on Introduced Japanese Seaweed, 2001-2004
FPDSavills (VIC) Pty Ltd

Marine Parks and Sanctuaries Management Strategy, 2002
Parks Victoria

Deep Reef Survey, Wilsons Promontory Marine National Park, 2002
Parks Victoria

Port Phillip Bay Channel Deepening Project EES, 2003-2004
Parsons Brinckerhoff and Port of Melbourne Corporation

Environmental Assessment of Sub-Sea Optical Fibre Cables, 2002, 2004
Hydro Tasmania

Baseline monitoring for Port of Melbourne Channel Deepening Project, 2004-2006
Port of Melbourne Corporation

Trial Dredging Experiments for Port of Melbourne Channel Deepening Project, 2005-2006
Port of Melbourne Corporation

Deep Reef Survey, Twelve Apostles Marine National Park, 2006
Parks Victoria

Kirk Point Baseline Environmental Survey, 2006
Hollow Core Concrete Pty Ltd

Lorne Pier Marine Survey, February, 2006
Department of Sustainability and Environment

Apollo Bay Harbour Marine Survey, 2006
Department of Sustainability and Environment

Portland Trawler Wharf Marine Survey, 2006
Department of Sustainability and Environment

Port Phillip Bay Channel Deepening Project - Rock Fall Impact Assessment, 2006
Maunsell and Port of Melbourne Corporation

Gunns Pulp Mill Integrated Impact Statement review, 2006
Beca AMEC, on behalf of the Tasmanian RPDC

Port Phillip Bay Channel Deepening Project - Rock Fall Impact Prediction, 2006
Maunsell and Port of Melbourne Corporation

Health Monitoring of Abalone Wild Stock: Port Fairy, 2006-2007
Department of Primary Industries

Princes Pier Marine Environmental Survey, 2007
HLA-Envirosciences Pty Ltd

Lakes Entrance Sand Management Program: Marine Ecology Existing Conditions, 2007-2009
Gippsland Ports

Subtidal and Intertidal Reef Monitoring Program, (1998-2001) 2002-2007, 2009-2011
Parks Victoria

Channel Deepening Project – Deep Reef Impacts Witness Statement, 2007
Maunsell

Flinders Pier and Foreshore Coastal Management Plan: Marine Ecology Baseline Survey, 2007
URS Corporation

Lyalls Inlet Marine Environmental Survey, 2007
Ecology Australia

Tambo Bluff Estate: Marine Ecology Assessment, 2007
East Gippsland Shire Council

Review of Marine and Coastal Natural Values of the Kimberley, 2007
Applied Ecology Solutions on behalf of WWF Australia

Review of Litter Impacts, Sky Lucky Witness Statement, 2008
Victorian Environment Protection Authority

Port Phillip Bay Trial Dredging Program: Deep Reef Monitoring, 2006-2008
Boskalis and Port of Melbourne Corporation

Inquiry into Establishing Marine Protected Areas in the Bruny Bioregion 2006-2008
Resource Planning and Development Commission

Port Phillip Bay Channel Deepening Project: Rock Removal Assessment, 2008
Boskalis and Port of Melbourne Corporation

Quality Management System for Beach Water Quality Monitoring, 2008
Victorian Environment Protection Authority

Action Statements for FFG Act Listed Marine Species, 2008
Victorian Department of Sustainability and Environment

BayMonitor Scientific Monitoring Program, Port Phillip Bay, 2008
Australian Conservation Foundation

Victorian Desalination Plant – Marine Management Plans, 2008-present
AquaSure Consortium

Nature Conservation Review – Marine and Coastal Issues Paper, 2008-present
Victorian National Parks Association

Marine Habitat Mapping of Victorian Marine Protected Areas, 2009
Parks Victoria

Lauderdale Quay DIIS: Marine Ecological Review and Expert Witness, 2009
Save Ralphs Bay Inc., Birds Tasmania and Environmental Defenders Office, Tas

MPA Abalone Virus Impact Monitoring, 2009
Parks Victoria, Marine National Parks Research

Portland Existing Conditions: Benthic Substratum Survey, 2009
Professional Diving Services

Kan Tan IV Drilling Rig Marine Pest Inspection, 2009
Cawthron Institute New Zealand

Victorian Desalination Plant – Marine Monitoring, 2009-2011
Thiess-Degremont Joint Venture

Apollo Bay Introduced Japanese Seaweed Management, 2009-2010
Victorian Department of Sustainability and Environment

Barry Beach Marine Terminal and Channel Dredging, 2010
John Kowarsky and Associates and Esso Australia.

Publications and Reports

References in chronological order

General Selection of Documents in Public Domain

Edmunds M (1990) *Community Ecology of Fishes on Tasmanian Rocky Reefs*. Honours Thesis, University of Tasmania.

Edmunds M (1995) *The Ecology of the Juvenile Southern Rock Lobster,* Jasus edwardsii. *Project Summary and Inventory of Tagged Lobsters, 1991 to 1994*. University of Tasmania report to the Minister of Fisheries, Tasmania.

Edmunds M (1995) *The Ecology of the Juvenile Southern Rock Lobster, (*Jasus edwardsii *Hutton 1875) (Palinuridae).* Ph. D. Thesis. University of Tasmania.

Chidgey S S, Edmunds M and Marshall P A (1995). *Intertidal Biota at Phillip Island Wastewater Outlet – 1991, 1994 and 1995*. Consulting Environmental Engineers report to Westernport Region Water Authority, Cowes.

May D & Stephens A (eds.) (1996) *The Westernport Marine Environment. Based on a Report to the Environment Protection Authority by Consulting Environmental Engineers*. State Government of Victoria Environment Protection Authority, **Publication 493**, Melbourne. [Chapters: Fish and Fisheries, Invertebrates]

Edmunds M and Wallis I G (1996) *Preliminary Underwater Investigations for the Proposed Tranmere Point Outfall*. Consulting Environmental Engineers report to Gutteridge, Haskins & Davey, Hobart.

Edmunds M & Wallis I (1997) *Impact Assessment of Sewage Discharge at Pardoe,* Tasmania. Report to the Devonport City Council.

Chidgey S S and Edmunds M (1997) Standing crop and nutrient content of macrophytes in Port Phillip Bay. *CSIRO Port Phillip Bay Environmental Study Technical Report* **32**.

Chidgey S S and Edmunds M (1998) *Hampton Beach Renourishment Project. Post-Construction Monitoring of* Pyura *Communities, December 1998*. Consulting Environmental Engineers report to Department of Natural Resources and Environment.

Edmunds M (1998) *Relationship between Species Richness and Rock Type for Intertidal Animals in Victoria. Review of Data Provided by the Marine Research Group of Victoria*. Consulting Environmental Engineers report to Victorian Environment Conservation Council, Melbourne.

Chidgey S S, Edmunds M and Willcox S T (1998) *Boags Rocks Environmental Impact Assessment Task 1.1. Biological Assessment of the Offshore Marine Biota*. Consulting Environmental Engineers report to CSIRO Environmental Projects.

Chidgey S S, Edmunds M and Wallis I G (1999) *Pardoe Effluent Outfall Marine Biological Monitoring Program. Ninth Post-Commissioning Survey, November 1998*. Consulting Environmental Engineers Report to Devonport City Council.

Edmunds M and Willcox S T (1999) *Marine Biological Impacts Study. Part I. Existing Discharges*. CEE Northern Australia report to Coffs Harbour City Council. Project Report No. **CHEIS R09**.

Edmunds M, Willcox S T and Reid M T (1999) *Marine Biological Impacts Study. Part II. Deep Sea Release Location*. CEE Northern Australia report to Coffs Harbour City Council. Project Report No. **CHEIS R10**.

Frusher S, Prescott J & Edmunds M (1999) Southern Rock Lobsters. **In:** Andrew N. 1999. *Under Southern Seas: The Ecology of Australia's Rocky Reefs*. UNSW Press, Sydney.

Edmunds M, Chidgey SS and Willcox ST (2000) Association between biological communities and physical variables on Victorian rocky reefs. **In**: LW Ferns and D Hough (eds). *Environmental Inventory of Victoria's Marine Ecosystems Stage 3 (Volume 2)*. Parks, Flora and Fauna Division, Department of Natural Resources and Environment, East Melbourne. Australia.

Edmunds M, Roob R and Ferns L (2000) Marine Biogeography of the Central Victoria and Flinders Bioregions – a Preliminary Analysis of Reef Flora and Fauna. **In**: LW Ferns and D Hough (eds). *Environmental Inventory of Victoria's Marine Ecosystems Stage 3 (Volume 2).* Parks, Flora and Fauna Division, Department of Natural Resources and Environment, East Melbourne. Australia.

Edmunds M (2000) *Ecological Status of the Central Victoria Bioregion, 2000: Macroalgae, Invertebrate and Fish Populations in the Bunurong Marine Protected Area*. Report to Department of Natural Resources and Environment, East Melbourne.

Roob R, Edmunds M and Ball D (2000) *Victorian oil spill response atlas: Biological resources. Macroalgal communities in central Victoria*. Report to Australian Marine Safety Authority, Australian Marine Ecology Report No. 109, Melbourne.

Edmunds M, Roob R and Ferns L (2000) Marine Biogeography of the Central Victoria and Flinders Bioregions – a Preliminary Analysis of Reef Flora and Fauna. **In**: L. W. Ferns and D. Hough (eds). *Environmental Inventory of Victoria's Marine Ecosystems Stage 3 (Volume 2).* Parks, Flora and Fauna Division, Department of Natural Resources and Environment, East Melbourne. Australia.

Edmunds M, Roob R and Ling S (2001) *Biological Assessment of Proposals for Marine Protected Areas in the Twofold Shelf Bioregion*. Report to the Abalone Fishermens Cooperative Ltd. Australian Marine Ecology Report 122, Melbourne.

Edmunds M (2001) *A Review of Biases and Error Pertaining to Underwater Visual Census Methods used in Southern Australia*. Report to Department of Natural Resources and Environment. Australian Marine Ecology Report No. 125, Melbourne.

Edmunds M (2002) Marine Biodiversity of Victoria. **In**: *Management Strategy for Victorian Marine National Parks and Sanctuaries*. Parks Victoria, Melbourne.

Edmunds M (2003) Marine Biodiversity of Victoria. **In**: *Management Strategy for Victorian Marine National Parks and Sanctuaries*. Parks Victoria, Melbourne.

Beca AMEC (2006) *Peer Review of Gunns Limited Bell Bay Pulp Mill Draft Integrated Impact Statement*. Report by Beca AMEC Limited. Resource Planning and Development Commission Tasmania, Hobart.

Last PR, Edmunds M and Yearsley GK (2007) Part 2 – *Squalus crassispinus* sp. nov., a new spurdog of the 'megalops-cubensis group' from the eastern Indian Ocean. **In**: Last PR, White WT and Pogonoski JJ (eds.) *Descriptions of New Dogfishes of the genus* Squalus *(Squaloidea: Squalidae).* CSIRO Marine and Atmospheric Research Paper No. 014, CSIRO, Hobart.

Edmunds M, Stewart K, Judd A, Sheedy E (2007) *Tambo Bluff Marine Ecology Assessment*. Report to East Gippsland Shire Council. Australian Marine Ecology Report No. 392, Melbourne.

Stewart K, Judd A and Edmunds M (2007) *Flinders Pier and Foreshore Coastal Management Plan: Marine Ecology Baseline Survey, July 2007.* Report to URS. Australian Marine Ecology Report 390, Melbourne.

Edmunds M, Judd A, Stewart K, Sheedy E and Ong J (2007) *Lakes Entrance Existing Conditions: Marine Habitats and Communities*. Report to Gippsland Ports. Australian Marine Ecology Report 382, Melbourne.

RPDC (2007) *Inquiry into the Establishment of Marine Protected Areas within the Bruny Bioregion*. *Interim Report*. Tasmanian Resource Planning and Development Commission, Hobart.

Mustoe S and Edmunds M (2008) *Coastal and Marine Natural Values of the Kimberley.* World Wide Fund for Nature, Sydney.

RPDC (2008) *Inquiry into the Establishment of Marine Protected Areas within the Bruny Bioregion*. *Final Report*. Tasmanian Resource Planning and Development Commission, Hobart.

Judd A, Edmunds M, Sheedy E and Ong J (2008) *Lakes Entrance Existing Conditions: Seagrass Monitoring, February 2008*. Report to Gippsland Ports. Australian Marine Ecology Report 395, Melbourne.

Edmunds M, Ong J and Sheedy E (2008) *BayMonitor Program: Field Manual.* Australian Marine Ecology Report 256. Australian Conservation Foundation, Melbourne.

Edmunds M, Ong J and Sheedy E (2008) *BayMonitor Program: Satellite Image Analysis, May 2008*. Australian Marine Ecology Report 399. Australian Conservation Foundation, Melbourne.

Parks Victoria Technical Series

Edmunds M, Hart SP, Elias J and Power B (2003) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Bunurong, April 2003. *Parks Victoria Technical Series* No. **3**. Parks Victoria, Melbourne.

Edmunds M, Hart SP, Elias J and Jenkins S (2003) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Port Phillip Heads, January 2003. *Parks Victoria Technical Series* No. **5**. Parks Victoria, Melbourne.

Edmunds M, Hart SP, Jenkins S and Elias J (2003) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Wilsons Promontory, November 2002. *Parks Victoria Technical Series* No. **6**. Parks Victoria, Melbourne.

Edmunds M, Hart SP, Elias J, Jenkins S and Power B (2003) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Phillip Island, February-March 2003. *Parks Victoria Technical Series* No. **7**. Parks Victoria, Melbourne.

Hart SP, Power B, Edmunds M and Elias J (2003) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Port Phillip Bay Marine Sanctuaries, March 2003. *Parks Victoria Technical Series* No. **8**. Parks Victoria, Melbourne.

Edmunds M and Hart S (2003) Parks Victoria Standard Operating Procedure: Biological Monitoring of Subtidal Reefs. *Parks Victoria Technical Series* No. **9.** Parks Victoria, Melbourne.

Edmunds M, Hart S, Elias J and Power B (2004) Victorian Intertidal Reef Monitoring Program: The Reef Biota in the Central Victoria and Port Phillip Bay Marine Sanctuaries. *Parks Victoria Technical Series No.* **11**. Parks Victoria, Melbourne.

Hart S, Edmunds M, Ingwersen and Elias J (2004) Victorian Subtidal Reef Monitoring Program: The Reef Biota on the Western Victorian Coast. *Parks Victoria Technical Series No.* **14**. Parks Victoria, Melbourne.

Hart S and Edmunds M (2005) Parks Victoria Standard Operating Procedure: Biological Monitoring of Intertidal Reefs. *Parks Victoria Technical Series No.* **21**. Parks Victoria, Melbourne.

Edmunds M, Hart P and Ingwersen C (2006) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Marine Protected Areas in the Twofold Shelf Region.. *Parks Victoria Technical Series No.* **23**. Parks Victoria, Melbourne.

Hart S, Edmunds M, Ingwersen C and Lindsay M (2005) Victorian Intertidal Reef Monitoring Program: The Intertidal Reef Biota of Northern Port Phillip Bay Marine Sanctuaries. *Parks Victoria Technical Series No*. **24**. Parks Victoria, Melbourne.

Hart S, Edmunds M, Elias J and Ingwersen C (2004) Victorian Subtidal Reef Monitoring Program: The Reef Biota on the Western Victorian Coast. *Parks Victoria Technical Series No.* **25**. Parks Victoria, Melbourne.

Lindsay M and Edmunds M (2006) Victorian Subtidal Reef Monitoring Program: The Reef Biota at Wilsons Promontory Marine National Park. *Parks Victoria Technical Series No.* **27**. Parks Victoria, Melbourne.

Lindsay M and Edmunds M (2006) Victorian Subtidal Reef Monitoring Program: The Reef Biota in the Port Phillip Bay Marine Sanctuaries. *Parks Victoria Technical Series No.* **28**. Parks Victoria, Melbourne.

Gilmour P, Edmunds M, Lindsay M and Monk J (2006). Victorian Subtidal Reef Monitoring Program: The Reef Biota in the Port Phillip Bay Marine Sanctuaries. *Parks Victoria Technical Series No.* **30**. Parks Victoria, Melbourne.

Lindsay M, Edmunds M, Gilmour P, Bryant C and Williams J (2006). Victorian Subtidal Reef Monitoring Program: The Reef Biota at Port Phillip Heads Marine National Park. *Parks Victoria Technical Series No.* **32**. Parks Victoria, Melbourne.

Williams J, Gilmour P, Edmunds M (2007). Victorian Subtidal Reef Monitoring Program: The Reef Biota within the Twofold Shelf Bioregion (Volume 2). *Parks Victoria Technical Series No.* **45**. Parks Victoria, Melbourne.

Gilmour P, Edmunds M (2007). Victorian Intertidal Reef Monitoring Program: The Intertidal Reef Biota of Central Victoria's Marine Protected Areas (Volume 2). *Parks Victoria Technical Series No.* **46**. Parks Victoria, Melbourne.

Crozier J, Edmunds M, Stewart K, Gilmour P (2007). Victorian Subtidal Reef Monitoring Program: Western Victorian Coast – Survey 3 (Volume 3). *Parks Victoria Technical Series No*. **47**. Parks Victoria, Melbourne.

Stewart K, Crozier J, Gilmour P, Edmunds M (2007). Victorian Subtidal Reef Monitoring Program: The Reef Biota at Bunurong Marine National Park. *Parks Victoria Technical Series No.* **48**. Parks Victoria, Melbourne.

Gilmour P, Edmunds M, Stewart K, Monk J (2007). Victorian Subtidal Reef Monitoring Program: The Reef Biota at Port Phillip Heads Marine National Park (Volume 3). *Parks Victoria Technical Series No.* **49**. Parks Victoria, Melbourne.

Edmunds M, Crozier J, Judd A, Gilmour P (2007). Victorian Subtidal Reef Monitoring Program: The Reef Biota at Wilsons Promontory Marine National Park (Volume 3). *Parks Victoria Technical Series No.* **50**. Parks Victoria, Melbourne.

Stewart K, Judd A and Edmunds M (2007) Victorian intertidal reef monitoring program: the intertidal reef biota of central Victoria's marine protected areas. *Parks Victoria Technical Series No.* **52**. Parks Victoria, Melbourne.

Port Phillip Bay Channel Deepening Project – EES Studies

Edmunds M, Hart S, Elias J and Power B (2004e) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 2: Legislative*

and Policy Requirements. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation Melbourne, 42 pp.

Edmunds M, Avery L, Hart S, Elias J, Matthews T (2004a) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 3: Infauna*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 65 pp.

Edmunds M, Beardall J, Hart S, Elias J, Stojkovic-Tadic S (2004b) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 4: Microphytobenthos*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 45 pp.

Hart S, Edmunds M, Elias J and Power B (2004a) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 5: Seagrass and Sediment Biota*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 119 pp.

Edmunds M, Hart S, Elias J and Power B (2004f) *Port Phillip Bay Channel Deepening Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 6: Shallow Reef Biota*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 139 pp.

Elias J, Edmunds M and Hart S (2004a) *Port Phillip Bay Channel Deepening Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 7: Deep Reef Habitat Study.* Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 48 pp.

Elias J, Edmunds M, Power B, and Hart S (2004b) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 8: Plankton and Nekton.* Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 29 pp.

Edmunds M, Elias J, Hart S, Power B (2004c) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 9: Ecological Processes*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 43 pp.

Elias J, Hart S and Edmunds M (2004c) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 10: Multimedia Maps.* Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 9 pp.

Edmunds M (2004) *Port Phillip Bay Channel Deepening Study Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 11: Impact Analysis Methods.* Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 65 pp.

Edmunds M, Hart S and Elias J (2004d) *Port Phillip Bay Channel Deepening Study Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 12: Ecological Communities and Management Units*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 23 pp.

Edmunds M and Hart S (2004) *Port Phillip Bay Channel Deepening Study Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 13: Description of Impact Processes*. Channel Deepening EES Volume 3 A1. Port of Melbourne Corporation. Melbourne, 24 pp.

Edmunds M, Mustoe S, Ngo AT, Ingwersen C, Hart S and Elias J (2004n) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement –Ecology Specialist Studies. Volume 14: Physical Pressures and Effects.* Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 143 pp.

Hart S and Edmunds M (2004a) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 15: Introduced Species - Impact and Risk Assessment*. Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 43 pp.

Edmunds M, Hart S, Ingwersen C Robinson J and Ngo AT (2004g) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies*. *Volume 16: Seagrass Impact and Risk Assessment*. Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 80 pp.

Hart S and Edmunds M (2004b) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 17: Oil Spill Impact and Risk Assessment.* Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 27 pp.

Edmunds M, Hart S, Ingwersen C, Robinson J, Ngo AT (2004k) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies*. *Volume 18: Pyura Impact and Risk* Assessment. Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 75 pp.

Edmunds M, Hart S, Ingwersen C and Robinson J (2004h) *Port Phillip Bay Channel Deepening Study Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 19: Sediment Biota Impact and Risk Assessment*. Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 120 pp.

Edmunds M, Hart S, Ingwersen C and Robinson J (2004i) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 20: Shallow Reef Impact and Risk Assessment.* Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 87 pp.

Edmunds M, Hart S, Ingwersen C and Robinson J (2004j) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 21: Deep Reef Impact and Risk Assessment.* Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 93 pp.

Edmunds M, Hart S, Ingwersen C, Robinson J and Ngo AT (2004l) *Port Phillip Bay Channel Deepening Project Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 22: Environmental Management*. Channel Deepening EES Volume 3 A2. Port of Melbourne Corporation. Melbourne, 84 pp.

Port Phillip Bay Channel Deepening Project – Trial Dredge Studies

Edmunds M, Bryant C, Pickett P and Crozier J (2006). *Port Phillip Bay Channel Deepening Project. Trial Dredging Experiment: Microphytobenthos*. Australian Marine Ecology Report 332, Melbourne.

Edmunds M, Gilmour P, Pickett P, Bryant C, Crozier J and Stewart K (2006). *Port Phillip Bay Channel Deepening Project. Trial Dredging Experiment: Kelp and Seagrass*. Australian Marine Ecology Report 333, Melbourne.

Edmunds M, Bryant C, Crozier J, Gilmour P, Pickett P, Stewart K and Williams J (2006) *Port Phillip Bay Channel Deepening Project. Trial Dredging Experiment: Deep Reef Impact Assessment*. Australian Marine Ecology Report 334, Melbourne.

Stewart K, Pickett P, Crozier J and Williams J (2006) *Port Phillip Bay Channel Deepening Project. Trial Dredge Program Experiment X2: Underwater Visibility.* Australian Marine Ecology Report 342. Port of Melbourne Corporation, Melbourne.

Port Phillip Bay Channel Deepening Project – Supplementary EES Studies

Edmunds M, Williams J, Stewart K, Crozier J and Monk J and Pickett P (2007) *Port Phillip Bay Channel Deepening Project. Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 1:Marine Ecology Existing Conditions Summary Report*. Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M., Williams J, Stewart K, Judd A and Pickett P (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 2: Infauna.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Crozier J, Monk J and Pickett P (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 3: Microphytobenthos.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Monk J and Stewart K (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 4: Epibenthic Plants and Animals.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Stewart K, Williams J and Judd A (2007) *Port Phillip Bay Channel Deepening Project. Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 5: Pyura Seasquirt Beds.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Pickett P and Stewart K (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 6: Seagrass Beds*. Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M and Pickett P (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 7: Water*

Column. Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Judd A, Gilmour P, Stewart K, Pickett P, Monk J and Crozier J (2007) *Port Phillip Bay Channel Deepening Project. Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 8: Shallow Reefs.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 6, Technical Appendix 47, Melbourne.

Edmunds M, Gilmour P, Power B, Shimeta J, Pickett P, Judd A, Baker K, Sams M, Wassnig M, Williams J, Crozier J, Stewart K and Monk J (2007) *Port Phillip Bay Channel Deepening Project. Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 9: Deep Reef Biota.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 7, Technical Appendix 47, Melbourne.

Edmunds M, Pickett P and Judd A (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Marine Ecology Specialist Studies. Volume 10: Ecological Processes and Inventory*. Channel Deepening Project Supplementary Environmental Effects Statement Volume 7, Technical Appendix 47, Melbourne.

Edmunds M, Shimeta J, Judd A and Baker K (2007) *Port Phillip Bay Channel Deepening Project Supplementary Environmental Effects Statement – Rock Fall Impact Assessment.* Channel Deepening Project Supplementary Environmental Effects Statement Volume 8, Technical Appendix 54, Melbourne.

Port Phillip Bay Channel Deepening Project – Impact Assessment

Edmunds M, Judd A, Sheedy E and Ong J (2008) *Port Phillip Bay Channel Deepening Project. Trial Dredging Program: Deep Reef Monitoring, January 2008*. Report to Boskalis Australia and Port of Melbourne Corporation. Australian Marine Ecology Report 396, Melbourne.

Edmunds M (2008) *Port Phillip Bay Channel Deepening Project. Trial Dredging Program: Rip Bank Monitoring, January 2008.* Report to Boskalis Australia and Port of Melbourne Corporation. Australian Marine Ecology Report 397, Melbourne.

Threatened Species Action Statements

Action statements were prepared for DSE for 11 species listed as threatened under the Victorian Flora and Fauna Guarantee Act.

Witness Statements

Edmunds M (2005) *Port Phillip Bay Channel Deepening Project. Environmental Effects Statement Panel Panel Inquiry. Expert Witness Statement of Dr Matthew John Edmunds.* Prepared for Port of Melbourne Corporation . Australian Marine Ecology Report 191, Melbourne.

Edmunds M (2007) *Port Phillip Bay Channel Deepening Project. Supplementary Environmental Effects Statement Panel Hearing. Expert Witness Statement of Matt Edmunds.* Prepared for Port of Melbourne Corporation . Australian Marine Ecology Report 385, Melbourne.

Chidgey SS, Edmunds M and Lincoln-Smith M (2007) *Joint Experts' Statement on Canyon Communities.* Channel Deepening Project SEES Panel Hearing, Melbourne.

Edmunds M (2007) *Tambo Bluff Estate Marine Ecology Assessment*. Prepared for East Gippsland Shire Council. Australian Marine Ecology Report 392, Melbourne.

Edmunds M (2008) *Expert Witness Statement – Sky Lucky Incident.* Prepared for EPA Victoria. Australian Marine Ecology Report 394, Melbourne.

Edmunds M (2009) *Lauderdale Quay DIIS. Marine and Estuarine Ecology Review. Proof of Evidence*. Prepared for EDO Tasmania. Australian Marine Ecology Report 412, Melbourne.