Emerging Scientific Issues on Victoria's Coast

Science Panel
Victorian Coastal Council

August 2006

Victorian Coastal Council

Victoria
The Place To Be

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Executive Summary

1. Introduction

The Victorian Coastal Council has convened a Science Panel to provide advice to Council on emerging issues and knowledge gaps relevant to Victoria's coast and marine environments. This action recognises the critical role that independent and credible scientific advice has in developing policy, particularly in the mid to long term.

The Science Panel held a workshop meeting on 28 February 2006. Five areas of concern emerged across all workshop groups, along with several other issues that are more discipline-specific. This report identifies these areas of major concern and provides relevant recommendations.

2. Emerging Environmental Concerns

Three major areas of current and emerging environmental concern were identified:

- Understanding the effects of increasing environmental variability associated with climate change;
- Understanding the precise nature of the links between catchments, estuaries and the broader coastline;
- Understanding the ecological consequences of coastal development,

These areas of concern are described in Section 2 and highlight key areas where our understanding is deficient. They have in common the need to focus on processes that occur at long time scales, or potentially over wide areas of the coast. Both of these scenarios will provide challenges to coastal management, as they operate at scales that cross jurisdictions and planning windows.

Recommendations

2.1. Understanding the effects of increased variability associated with climate change

2.1.1. Encourage the development of tools to predict responses of coastal ecosystems to changes in average climatic conditions, and changes to climatic variability (*Comment:* this is a strategic research need requiring multi-disciplinary research teams and multiple sources of funding);

2.1.2. Review monitoring needs for measuring effects of climate change.

2.2. Understanding the links between catchments, estuaries and the broader coastline

2.2.1. Extend the current catchment focus beyond estuarine areas, to determine the importance of these estuaries in a broader coastal and marine context (*Comment:* this is a strategic need);

2.2.2. Understand the physical processes responsible for the exchange of material (including biota) between estuaries and surrounding coasts (*Comment:* this is a scientific research priority and will require increased expertise in physical oceanography in Victoria).

2.2.3. Fill scientific gaps about estuarine chemistry and the degree to which species using estuaries depend on the estuary, rather than using it opportunistically (*Comment:* Filling these gaps may be limited by scientific expertise in the first case, and biological data in the second. Filling these gaps will be necessary for dealing with future environmental issues).

2.3. Understanding the ecological consequences of coastal development

2.3.1. Undertake a formal assessment of the extent of our current ecological understanding of coastal development, to identify knowledge gaps (*Comment:* This review should identify specific scientific needs)

3. Victorian's Technical Capacity to Respond to Emerging Environmental Issues

Two major issues were identified:

- Understanding the state of Victoria's coastal environments;
- Matching Victoria's technical capacity to scientific needs.

These issues are described in Section 3 and concern our technical capacity to deal with emerging environmental concerns, and can be considered part of a Knowledge Strategy. The issues focus on the state of our knowledge about Victoria's coast, the accessibility of that knowledge, and the adequacy of current data to serve as a baseline for identifying future changes.

Failing to develop basic scientific understanding about the Victorian coast limits our ability to respond to new threats, or even assess fully the costs and benefits of particular initiatives.

Scientific understanding depends on the collection of appropriate data and the existence of a scientific skill base to interpret information and provide independent scientific advice. In Victoria, the gathering of information and the provision of advice is not well integrated, with a range of agencies conducting monitoring, and a range of advisory groups, each with narrow ranges of responsibilities (e.g. fisheries, national parks, EPA).

Recommendations

3.1 Understanding the state of Victoria's coastal environments

3.1.1 Undertake a systematic review of existing coastal monitoring, focusing on

- the aims of monitoring programs;
- a technical review of whether those aims are currently being met;
- identifying data collection that will be necessary to meet emerging needs, particularly coastal development and climate change.

3.1.2 Investigate options for centralised data "warehousing", to maximise reach and utilisation of data (*Comment:* Current Federal initiatives, such as the *Australian Ocean Data Centre Joint Facility* (www.aodc.org.au), *BlueNet* (www.bluenet.org.au) and the Victorian Data Warehouse for freshwater monitoring (www.vicwaterdata.net/vicwaterdata) may provide appropriate models and opportunities for integration and expansion).

3.2 Matching Victoria's technical capacity to scientific needs.

3.2.2 Develop and maintain a database or scientific network of coastal scientific expertise applicable to Victoria;

3.2.3 Critically analyse future technical needs and the strengths and weaknesses of the current scientific base.

3.3 Operation of the Science Panel

The initial panel meeting also gave some thought to future operations of the Science Panel, and made two general recommendations.

3.3.2 There is a strong need for a group such as the Science Panel to provide independent, strategic, scientific advice for the whole coast;

3.3.3 The Science Panel should also be used to provide high-level technical advice about specific issues, by convening sub-groups with relevant expertise.

1. Introduction

1.1 Background

Victoria's coast is a precious, and in some locations, intensively used environment. Activity and processes on the coast, inland in the catchment and offshore in the ocean, have an influence on the health and sustainability of the coastal environment.

At a national level, the Framework for a National Cooperative Approach to Integrated Coastal Zone Management (NRM Ministerial Council 2006) sets the scene for national cooperation in managing coastal issues and achieving ecological sustainable development outcomes in the coastal zone over the next decade.

As Victoria's peak independent coastal advisory body, the Victorian Coastal Council promotes the importance of the Victorian Coastal Strategy in establishing a framework for long term sustainable management of the Victorian coast. The Council also recognises that trends in population growth and demographic shifts, industry development, protection of the coastal resource base and climate change will be the fundamental drivers that will affect the sustainable use of coastal resources.

The Council has recently partnered the Department of Sustainability and Environment in developing the Coastal Spaces Initiative that has provided a series of recommendations to Government which seek to improve and clarify strategic planning and tools for managing sustainable coastal development in non metropolitan coastal areas.

A related initiative of Council has been to convene a Science Panel. This action recognises the critical role that independent and credible scientific advice has in developing policy, particularly in the mid to long term and responds to the current absence of a scientific advisory body for the coast and marine environments with a "whole of coast" perspective.

1.2 Membership

Membership consists of the Victorian Coastal Council Science sub-committee and external scientists. Individual scientists, rather than organisational representatives make up the panel, and several criteria were used in composing the Panel:

- Individuals' scientific credibility and reputation;
- The need to provide coverage of a broad range of scientific disciplines, particularly geomorphology, physical oceanography, climate (especially climate change), chemistry & water quality, biodiversity and ecology (incorporating terrestrial and marine components);
- Recognition of system-wide linkages and the need to keep broad perspective, including catchment to coast;
- Awareness of long-term and large-scale environmental change.

A practical limitation, given funding, was that scientists be based in Victoria, or with frequent visits. This situation might change in the future, but would require greater resourcing for the Panel.

The result was a group of 24 that included scientists based at academic institutions, within government sectors, and based in the private sector.

1.3 Terms of reference

- To identify **emerging issues** relevant to Victoria's coastal and marine environment;
- To identify **knowledge gaps** relevant to Victoria's coastal and marine environment;
- To provide **recommendations** regarding the above emerging issues and knowledge gaps to the Victorian Coastal Council.

1.4 Meeting of the Science Panel

A workshop meeting of the Science Panel was held on 28 February 2006. Diane James, Chairman of the Council welcomed attendees. Eighteen members of the Science Panel (or their delegate) attended (see Appendix 1), together with members of the Council's Science Sub-committee, Professor Michael Keough and Rob Gell, and Andrew Buckley, Executive Officer of the Council. Duncan Malcolm was an apology.

2. Emerging Environmental Concerns

2.1 Understanding the effects of increased variability associated with climate change

One important effect of climate will be a shift in the factors that cause environmental change – the "drivers". The current drivers of environmental change are immediate human activities, such as coastal development, discharge of waste, fishing, etc. This may continue for the next few years, but within a decade, the physical (climatic) environment will become a major driver. Climate change may also have important synergies with other drivers, such as eutrophication, habitat loss, etc., which have eroded coastal marine ecosystem resilience to climate change.

Climate change is now a focus of attention for coastal managers, and the first steps focus on changes to average states – changes to average temperatures, mean sea level, wave action, etc. However, a key feature of climate change is not just "average" changes but increases in climatic variability. For coastal environments, this variability may be reflected in changes to rates of opening and closing of estuaries, increased variability in river flows, and changes to frequency of storm waves and other severe weather events.

How are changes in mean and variance of climatic variables likely to affect the distribution of coastal habitats?

Some habitats may shift, with loss of, e.g. dunes in some locations, but increasing deposition in others. The overall effect is unclear – under direct influence of climate change, there may be a net shift from one kind of habitat to another, or no net change, but with the spatial position of particular habitats changing.

Habitat changes will be affected by human responses to climate change – some habitats are seen as more valuable than others, e.g. sandy habitats are more highly valued than swampy habitats, so it is likely that there will be interventions to preserve the amount of particular habitat types. Human intervention to protect coastal developments may result in increases in the amounts of particular habitats. One such change was identified - an increased "hardening" of the coastline, as retaining structures are built to prevent loss of coastal housing. This may be a concern if it increases the potential spread of marine pests, by providing "stepping stones".

What are the effects on biodiversity of changes to habitat distributions?

Responses to habitat changes and shifts in average climatic conditions are the focus of current climate change research and planning. Predicting overall effects on biodiversity is challenging, but it does not require the development of new technological approaches. We currently lack data on the habitat requirements of most species, and their ability to disperse between coastal habitats. This lack of data is a consequence of the limited number of ecologists. Providing the necessary data to predict changes to biodiversity will require increased effort, not technical innovation.

How will biological systems respond to changes in environmental variability?

Effects of variability are much harder to assess, but potentially very important. One aspect of variability is a change in the frequency of extreme weather events. Recent, well-publicised examples of extreme weather, such as the Indian Ocean tsunami, and Hurricane Katrina have emphasised how poorly we are able to understand the ecological effects of such events. These events were once-off perturbations, albeit at a large scale, and dealing with events that recur unpredictably is much more difficult. Although climate changes will happen at a decadal scale, changes to variability have the potential to generate much more rapid biological responses, especially if increased variability is linked to timing of breeding seasons or migration patterns.

Changes in variability will also need to be assessed against the background of anthropogenic (human induced) change. The most obvious example is estuarine flows, where three factors will combine to determine overall variability. Changes to average rainfall and increased variability in this rainfall will be superimposed upon the current pattern, which is strongly influenced by regulation of flows and water extraction in most rivers.

Are our current monitoring programs capable of detecting system responses to variability?

Most current monitoring programs are designed to detect two kinds of environmental change. "Trends" monitoring detects long-term change in environmental variables, and (ideally) uses long time series. "Impact" monitoring is generally aimed at detecting discrete changes associated with particular activities. Neither of these two scenarios is likely to be appropriate for effects of climatic variability, and it may be necessary to modify existing monitoring programs, or to institute new ones to allow us to identify (and mitigate) these effects. A first step will be to examine the capacity of our current monitoring activities to meet this need. This can be accommodated as part of the review recommend in Section 3.

Recommendations

2.1.1 Encourage the development of tools to predict responses of coastal ecosystems to changes in average climatic conditions, and changes to climatic variability (*Comment:* this is a strategic research need requiring multi-disciplinary research teams and multiple sources of funding);

2.1.2 Review monitoring needs for measuring effects of climate change.

2.2 Understanding the links between catchments, estuaries and the broader coastline

In recent years, there has been an increasing focus on integrating catchments and downstream sections of rivers and streams into coastal management. This is reflected, for example, in the responsibilities of Catchment Management Authorities extending their focus into estuaries and out to the limits of State waters. A result of these shifts has been a better understanding of the contributions to estuaries from catchments, and a sharp increase in the perception of estuaries as important parts of coastal management.

While estuaries occupy considerable attention, their broader role along Victorian coasts is not yet clear. There are two main impediments to knowing the importance of estuaries – we need a clear picture of the catchment to estuary component, and we need to understand how estuaries are linked to surrounding ocean coasts. In particular, if estuaries play a major role along the broader coastline, there must be export of material, particularly nutrients (nitrogen, phosphorus and carbon) and toxicants to surrounding coasts, or estuaries must provide key habitat for some component of the life cycle of species important to biodiversity.

The view that estuaries are critically important is based on moderate sized estuaries that are open much of the time, as are found commonly down the east coast of Australia. This description does not fit Victoria's coast well. The central coast is dominated by two large, permanently open estuaries (Port Phillip Bay and Western Port), while the west and east coasts are characterised by many small estuaries that may be closed for much of the time.

These differences affect the kind of information that is needed, and the use to which it is put. In the first case, the best studied estuaries, Port Phillip Bay, Western Port, and the Gippsland Lakes, are unique features that require dedicated research programs, and management.

Studies on these estuaries may not tell us much about processes in the dominant estuary type in Victoria – seasonally-closed/open estuaries. These small estuaries are more prone to effects from catchment modification (land-use and flow change). Second, it is not yet clear whether relatively small, seasonally closed estuaries can contribute much to the surrounding coast, and resolving this question will affect the scale on which regional coastlines must be managed.

Characterising estuaries

The focus on estuarine areas is very recent and has yet to deliver much of the expected scientific data. While information about catchment inputs is appearing, there are some important chemical and biological gaps.

Many estuaries are also sites of coastal development, which can result in increased loads of a range of toxicants. Some of these are not well understood at present. For example, there is a need for better identification and quantification of heavy metal (e.g. mercury in the Gippsland Lakes) sources and hydrocarbon behaviour (e.g., in marinas). Other issues are specifically associated with coastal construction, such as the need for better spatial definition of acid sulfate soils.

Human settlements and catchment agricultural and industrial activities also release nutrients into estuaries, and these nutrients require careful management. The removal of those nutrients, either by flushing, or, more usually, through nutrient cycling in sediments, is a central process, the interruption of which can have severe consequences. Another research need is to understand the effects of a range of anthropogenic activities, including marine pests and toxicants, on nutrient cycling.

Estuaries are thought to be biologically important for the species that depend on estuaries for all or part of their life cycles. These species may be commercially or recreationally important, or make an important contribution to biodiversity. Understanding why, even whether, estuaries are important to these species will be necessary as part of understanding effects of climate change. In particular, we need to know if the species using estuaries depend on them. Given the frequent closing of many small estuaries, what happens when the mouth is closed? Do species go through parts of their lifecycle in marine habitats, or does that part of their lifecycle fail in "closed" years? What will happen if the frequency of opening and closing changes in future?

For species that are largely estuarine, do frequent closings mean that small populations are isolated for extended periods? If so, is there "hidden" biodiversity, in the form of species that may be unique to particular estuaries, rather than distributed across a range of estuaries. Will this isolation increase under climate change?

Resolving biological and chemical uncertainties will require additional effort, and may be limited by scientific expertise available in Victoria (see Section 3.2). At present, rather than a detailed recommendation, it is appropriate to emphasise the importance of generating this information.

Linking estuaries to surrounding coastlines

A pre-requisite for estuaries to influence surrounding coasts is a physical transport mechanism capable of moving material to and from the estuary. This is a subset of the broader question of how tight the linkages are between different sections of the coast. The links are provided by three major components:

- Oceanographic processes, which move nutrients, toxicants, sediments, and marine organisms around. These processes are known tolerably well for Port Phillip Bay, but less well for the open coast, and our knowledge is poor for nearshore coastal waters, where the interaction between ocean currents and geomorphology becomes important. There is a serious lack of oceanographic expertise in Victoria, with little postgraduate training within the state, and most expertise residing with private sector consultants.
- Movement of animals along the coast. These are known well for some animals, and poorly for others. For many animals, movement occurs during the larval stage, and is dictated by oceanographic processes, so poor knowledge of physical processes limits our biological understanding.
- Human-aided movements, including shipping.

There is an urgent research need for physical models that incorporate opening and closing of estuaries, accurate estimates of loads through estuary mouth, the extent of transport along the coast, and the quantity and timing of freshwater flows (as well as nutrients/sediments and toxicants).

Recommendations

2.2.1 Extend the current catchment focus beyond estuarine areas, to determine the importance of these estuaries in a broader coastal and marine context (*Comment:* this is a strategic need);

2.2.2 Understand the physical processes responsible for exchange of material (including biota) between estuaries and surrounding coasts. (*Comment:* this is a scientific research priority and will require increased expertise in physical oceanography in Victoria).

2.2.3 Fill scientific gaps about estuarine chemistry and the degree to which species using estuaries depend on the estuary, rather than using it opportunistically. (*Comment:* Filling these gaps may be limited by scientific expertise in the first case, and biological data in the second. Filling these gaps will be necessary for dealing with future environmental issues).

2.3 Understanding the ecological consequences of coastal development

Changes in coastal development are changing the demographic picture of Victoria, from a few large urban areas with smaller developments in nearby coastal areas, to a substantial number of mid-sized developed areas. The nature of this future development will be addressed as part of strategic directions associated with the Victorian Coastal Strategy and the Coastal Spaces Initiative, but current developments mean more extensive interfaces between human developments and coastal ecosystems.

Coastal development has several important direct effects:

- Roads provide a cascade of changes, affecting runoff, input of toxicants, changing access for wildlife, influencing patterns of recreational use of undeveloped areas, etc.
- Development places new demands on nutrient management, with an increase in the volume of nutrients that must be accommodated.
- Use of undeveloped land (recreation, access by pets, etc.) and potential impacts on biodiversity (species that use particular coastal habitats, such as dune- or beach-nesting birds).
- Biosecurity issues with transport of pest species by recreational activities (boats, trailers, wet gear, etc.)
- Input of toxicants

Some of the local consequences of coastal development are addressed through current regulatory frameworks (EES, EPA licences, planning permits, etc.), but the more strategic question is how strong the links are between coastal developments and surrounding areas. In general, the focus to date has not been on effects on biodiversity, so that, rather than specific issues, we currently have several broad questions about the nature of coastal development and our current knowledge to deal with them:

- Is there a sharp boundary, with effects of developments tapering off quickly beyond their boundaries, or do oceanographic processes and human behaviour extend the effects more widely?
- Do we have sufficient ecological knowledge to underpin assessments?

- Is this knowledge at a sufficient spatial scale?
- Do we have the skills to undertake ecological restoration of coastal areas?

There is increasing demand for restoration skills, as we consider not only the effects of new development but understanding and mitigating effects of past activities whose impacts may have been substantial. Restoration is becoming a part of environmental consents and approvals in other jurisdictions, with permission to develop conditional on the completion of some compensatory action.

This emerging issue of the ecological effects of coastal development will not be independent of climate change. The persistence of the sea change phenomenon will generate pressure to respond to effects of climate change, and human behavioural responses to climate change will influence the ultimate effect of climate change.

Recommendation

2.3.1 Undertake a formal assessment of the extent of our current ecological understanding of coastal development, to identify knowledge gaps (*Comment:* This review should identify specific scientific needs).

3. Victoria's Technical Capacity to Respond to Emerging Environmental Issues

3.1 Understanding the state of Victoria's coastal environments

Effective responses to environmental change are only possible when we have the appropriate data to be able to characterise the magnitude of the change (and hence the degree of concern) and to be able to assess the success of steps taken to minimise or mitigate changes.

The panel expressed concerns that, despite considerable resources being devoted to monitoring, we may not be measuring the right variables to identify future changes, and that a technical review of current monitoring efforts is necessary to provide assurance that current resources are being deployed in a cost-effective manner, and that the data being generated meet current and future needs. A review must include the technical adequacy of current monitoring and consideration of future needs. The outcome of the review would not necessarily be for an increase in monitoring, as there will be gaps and duplications.

We lack a clear idea of what is being done to characterise the Victorian coastal environment at present, because of:

- Disparate monitoring programs run by wide range of agencies;
- No central data storage;
- No broad coordination of what is to be monitored;
- No systematic assessment of whether, even if the variables are right, we are collecting data sufficient to detect change;
- Emphasis on community monitoring requires critical assessment of what can be expected of community-based efforts, what is not feasible, and what resources, particularly identification guides, are necessary to support such efforts.

A review has two important components: evaluating the technical quality of the current monitoring effort and identifying duplications and gaps, and identifying monitoring needs that will emerge in the future. This step involves thinking about what a statewide monitoring program should look like.

Current monitoring activities

The review must be centred on technical quality, and scientific expertise is required to identify the variables appropriate to particular environmental issues, and to conduct a technical review of the quality of data currently being collected and the data needed in the future.

There are some known weaknesses in current monitoring. One important example is assessing trends in biodiversity. Describing biodiversity is essential to meet broad aims of protecting and conserving biodiversity, such as embodied in the Victorian Coastal Strategy, Marine Protected Area network, etc. This requires training of specialists in particular groups, and marine environments provide a unique challenge, because of the number of unique animal and plant phyla, each requiring their own particular expertise. Some animal and plant groups are not covered at all, and we are not completely confident that their biodiversity is represented by patterns shown in other groups

Attributes of a comprehensive monitoring network

A priority is to develop an understanding of where along the Victorian coast important changes are likely to occur, or where environmental threats are expected. This expectation should guide the monitoring effort.

There are some efforts and opportunities to provide an integrated marine monitoring network. For example, the recently-established network of Marine Protected Areas provides a base for assessing changes to biodiversity with its broad coverage of the Victorian coastline, and attempts to bring a common monitoring framework to all Protected Areas. There are, however, two *caveats:*

- The Marine Protected Area network does not at present capture estuarine areas adequately;
- While the network would be appropriate for biodiversity assessment, monitoring targeted specifically at biodiversity would be required.

Several emerging issues, beyond climate change, must be included into an assessment of a future monitoring network.

Frontier technologies, such as molecular biology, are proving new insights into Victoria's biodiversity. They are showing substantial numbers of cryptic species, where what was thought to be one broadly distributed species is shown to be several narrowly distributed ones. These techniques have the potential to change our picture of biodiversity substantially, with much more local uniqueness to flora and fauna. This result would affect coastal planning and monitoring.

Biosecurity is an important issue, but our focus to date has been primarily around marine pests around Port Phillip Bay. There are some incursions outside of Port Phillip Bay, such as *Asterias amurensis* in Westernport and Anderson's Inlet, and the crab *Carcinus maenas* and the bryozoan *Watersipora subtorquata,* but the serious threats have largely been confined to Port Philip Bay. Because of the volume of shipping traffic, Port Phillip Bay is likely to remain the most likely location for new invasions, but invasions may not be limited to this area.

One pest of major concern, the screw shell *Maoricolpus roseus,* has increased dramatically in shelf waters of eastern Bass Strait. The sea urchin *Centrostephanus rodgersii* is common along the temperate east coast of Australia, but in recent years appears to have spread and increased dramatically in abundance along the east coast of Tasmania.

The review of monitoring should consider whether this focus is appropriate - is the current confinement to Port Phillip Bay linked to some attribute of the Bay that makes spread outside unlikely, or is it a matter of luck? If the latter is the case, invasive species should be addressed for the broader coast, and outside of the commercial shipping ports. It is also important to consider other aspects of biosecurity that may affect coastal management, particularly the introduction of diseases, which may not be centred on Port Phillip Bay.

Recommendations

3.1.1 Undertake a systematic review of existing coastal monitoring, focusing on

- the aims of monitoring programs;
- a technical review of whether those aims are currently being met; and
- identifying data collection that will be necessary to meet emerging needs, particularly coastal development and climate change.

The emphasis on technical parts of the review is critical. A superficial review might consider broad aims of environmental monitoring and record whether resources are being expended in this area. However, an assessment of whether resources are being used cost effectively, and consequently whether monitoring can deliver clear results, requires detailed technical knowledge. This knowledge must be in two areas – the particular scientific discipline relevant to the data being collected, and an understanding of data analysis and interpretation.

3.1.2 Investigate options of centralised data "warehousing", to maximise reach and utilisation of data. (*Comment:* Current Federal initiatives, such as the *Australian Ocean Data Centre Joint Facility* (www.aodc.org.au), *BlueNet* (www.bluenet.org.au) and the Victorian Data Warehouse for freshwater monitoring (www.vicwaterdata.net/vicwaterdata) may provide appropriate models and opportunities for integration and/or supplementation).

3.2 Matching Victoria's technical capacity to scientific needs

New issues will require scientific and technical expertise that may differ from that currently available in Victoria, and it is essential that we develop and maintain expertise appropriate to our needs. The extent of this expertise must also be known to coastal managers. At present, there has been no systematic examination of our current expertise, nor any need to identify future needs, or the commitment necessary to maintain our current level of expertise.

The panel identified several areas for concern, and suggested some steps to improve some of these concerns. Our current coastal expertise may not be used effectively in coastal management, and overall expertise may be declining in some areas.

One of the major impediments to the effective use of our current expertise is the movement of technical experts in and out of Victoria, between public and private sectors, and between technical and management roles. Many organisations concerned with coastal management also have considerable staff turnover. This weakens corporate memory, particularly in technical areas, with the result that debates are repeated, calls for information recur even after data may have been collected, and in many cases, the appropriate expertise may be available, but the end-user for that expertise may not be aware of it.

In some areas, there is little expertise available in Victoria, or skills exist, but those with skills are in very high demand. Examples here include:

- Little oceanographic expertise is available in Victoria;
- Modelling and GIS skills exist but people are in very high demand.

In other areas, there is concern that the skill base has been weakened or is under considerable threat. Prime examples are:

- Chemical skills are considered to have declined in recent years, particularly in areas of analytical chemistry, interpretation (understanding the fate and behaviour of toxicants), and modelling. The lack of expertise already affects policy and licensing. In the absence of relevant expertise, the alternative approach is use of Best Practice.
- Taxonomists capable of describing (and thereby providing tools for monitoring biodiversity) are in short supply. Specialists are aging, and there are problems replacing them. This is a well-documented national problem, with Victoria reflecting that national issue.

The fourth category is areas in which expertise will be required in the future, but is not currently available. Examples are:

- We need to be able to make realistic predictions about effects of climate change on coastal biodiversity; there is little expertise present now, and expansion of capacity is desirable.
- Ecological restoration. The need for these skills is well recognised for inland habitats, in areas such as revegetation of mining sites, wetland rehabilitation, but expertise in short supply for coastal areas, and almost entirely absent from Victoria for marine areas.

Two steps are necessary to improve this situation. The first is to make the expertise currently available better known to the likely users of this expertise. The second is to assess our current expertise against current and future needs, to identify areas that should be fostered in Victoria.

Recommendations

3.2.1 Develop and maintain a database or scientific network of coastal scientific expertise applicable to Victoria;

3.2.2 Critically analyse future technical needs and the strengths and weaknesses of the current scientific base.

3.3 Operation of the Science Panel

The initial meeting of the VCC Science Panel included discussion of the role of the Panel and more general comments about the provision of scientific advice about coastal issues.

Future Panel meetings will continue to emphasise emerging scientific challenges and our capacity to meet them. Outcomes of these meetings will be provided to the Council, but for maximum benefit to be obtained from the expertise brought to the panel by its members, it is important for the Council to consider how Panel advice can be disseminated. Some material is most appropriately transmitted elsewhere in government, while other recommendations or conclusions may be appropriate for media releases.

The Panel may also become involved in specific issues where technical input is necessary. For specific issues, it will be more appropriate to convene meetings of sub-groups of the Panel, as appropriate.

The broad discussion also highlighted the absence in Victoria of a high level group capable of providing independent advice on coastal science and technology issues. Such a group could provide advice, when requested, to a range of organisations involved in sustainable management of the Victorian coast. The Science Panel could be the basis or a model for such a group, because it brings together a group of scientists chosen to provide broad coverage of scientific disciplines, with individual scientists having strong international scientific credentials.

Recommendations

3.3.1 There is a strong need for a group such as the Science Panel that provides independent, strategic, scientific advice for the whole coast;

3.3.2 The Science Panel should also be used to provide high-level technical advice about specific issues, by convening sub-groups with relevant expertise.

Appendix 1

Membership of Science Panel and attendance at initial meeting, together with broad area of expertise.

Title	Name	Surname	Position	Department	Organisation	Meeting 2/06	Disciplinary group for meeting/expertise
Prof.	Sam	Adeloju	Head of School	School of Applied Sciences and Engineering	Monash University	Yes	Chemistry/water quality
Prof.	John	Beardall	Deputy Head of School	School of Biological Sciences	Faculty of Science	Yes	Climate
Prof.	Ian	Bishop	Director	Centre for Geographic Information Systems and Modelling	University of Melbourne	No	Oceanography/Geomorphology
Mr	Austin	Brown	Statewide Leader - Pedology and Soil Physics	Primary Industries Research Victoria	Dept of Primary Industries	Yes	Chemistry/Acid Sulfate Soils
Mr	Gerry	Byrne			Vantree P/L	No	Coastal engineering
Dr	Michael	Coughlan	Superintendent	National Climate Centre	Bureau of Meteorology	Yes	Climate
Prof.	Chad	Hewitt	Foundation Chair	National Centre for Marine & Coastal Conservation	Australian Maritime College	Yes	Ecology/Biodiversity
Dr	Greg	Jenkins	Statewide Leader - Marine and Estuarine	Dept. of Primary Industries	Queenscliff Centre	Yes	Ecology/Biodiversity
Prof.	John	Langford	Director		Melbourne Water Resource Centre	Yes	Chemistry/water quality

Title	Name	Surname	Position	Department	Organisation	Meeting 2/06	Disciplinary group for meeting/expertise
Dr	Brett	Light	Environmental Chemist	Marine Science	Environment Protection Authority	Yes	Chemistry/water quality
Mr	Andrew	Longmore	Senior Science Officer	Dept of Primary Industries	Queenscliff Centre	Yes	Chemistry/water quality
Assoc. Prof	Mark	McDonnell	Director		Australian Research Centre for Urban Ecology	Yes	Ecology/Biodiversity (Terrestrial/urban)
Dr	Andrew	McCowan	Director		Water Technology Pty Ltd	Yes	Oceanography/Geomorphology
Dr	Gary	Poore	Senior Curator	Crustacea	Museum Victoria	Yes	Ecology/Biodiversity
Prof.	Gerry	Quinn	Chair	Marine Biology	Deakin University	Yes	Ecology/Biodiversity (Catchment/estuary)
Prof.	Ian	Rae		History and Philosophy of Science	University of Melbourne	No	Environmental chemistry
Mr	Neville	Rosengren		Physical Engineering and Physical Sciences	Latrobe University, Bendigo	No	Geomorphology
Assoc. Prof.	John	Sherwood		School of Ecology and Environment	Deakin University	No	Chemistry.
Dr	David	Smith	Research Theme Leader		CSIRO	No	Fisheries
Dr	J. David	Smith				Yes	Chemistry/water quality

Title	Name	Surname	Position	Department	Organisation	Meeting 2/06	Disciplinary group for meeting/expertise
Dr	Stephen	Swearer	Lecturer	Dept of Zoology	University of Melbourne	Yes	Ecology/Biodiversity
Mr	Dale	Tonkinson		School of Land and Reource Management	University of Melbourne	Yes	Ecology/Biodiversity (Terrestrial)
Dr	Kathleen	McInnes (for Penny Whetton)		Atmospheric Research	CSIRO	Yes	Climate
Dr	Grainne	Maguire (for Mike Weston)			Birds Australia	Yes	Ecology/Biodiversity (Terrestrial)
Dr	Mike	Weston	Research and Conservation Manager		Birds Australia	No	Ornithology
Dr	Penny	Whetton		Atmospheric Research	CSIRO	No	Climate