Indicators of the state of the coastal environment and management practices

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1 Introduction

The coastal environment, as defined in the draft New Zealand Coastal Policy Statement 1992, is continually changing due to natural processes and human activities. The direction and extent of the change can be determined through the monitoring process. Monitoring the coastal environment needs to be a long term process or it may become impossible, in the short term, to separate true environmental change from the background "noise" or natural oscillations in the environment.

The objectives for undertaking monitoring in the coastal environment are set at different levels. These can be described as reporting levels:

1. *International* - As a member of various international organisations and of the international community at large, the Government has a responsibility to meet various international requests for information. Some international organisations (e.g. OECD) have established monitoring systems and information requirements. Others are more *ad hoc* in nature. Monitoring systems need to be established by the appropriate national government body to enable reporting to the international community.

2. *National* - The Government and various individual Ministers need to maintain an overview of the general state of the coastal environment, or aspects of it. This assists in setting priorities and targeting areas of need, as well as in carrying out essential management roles (e.g. setting the total allowable catch of fisheries). Monitoring systems need to established by the appropriate national government body.

3. *Regional* - Regional bodies (e.g. regional councils) need to maintain an overview of the general state of the coastal environment or aspects of it for reasons similar to those at the national level. To the extent that national bodies have responsibilities at regional levels (e.g. Department of Conservation in relation to regional coastal plans), they may also have regional reporting requirements. Monitoring systems need to be established by the appropriate regional body in conjunction with appropriate national bodies.

4. *District* - As with regional and national levels, the scale is reduced but the objectives are largely the same. Monitoring systems need to be established by the appropriate district body.

5. *Community* - Various communities of interest may have specific objectives requiring targeted local monitoring (e.g. Cheltenham Beach shellfish monitoring). Monitoring systems will need to be developed by the community of interest although implementation or co-ordination may be by a government body (local, regional or national).

6. *Business/consent* - Businesses require certain information to assist them in determining investment and maintenance strategies. Consent authorities require certain information to assist them in monitoring compliance with conditions and rules in plans. Monitoring requirements in this context tend to be activity or consent specific and tightly targeted. Businesses and consent authorities establish monitoring systems as appropriate.

7. *Environment component* - In some situations there may be components (species/habitats) of the coastal environment which should be monitored at a scale which extends beyond that of individual councils or communities. Such components may have special targeted monitoring regimes established for them. Examples of such components of the coastal environment might include the Hauraki gulf and associated catchments, Waitemata or Manakau harbours, Pauatahanui Inlet, or the Pakiri-Mangawhai sediment system. Requirements for these monitoring systems may necessitate inter-agency agreements to establish and implement them.

Effective monitoring to meet the objective set at each of the above levels will assist in prioritising and targeting action and will also improve the transparency and accountability of decision-making at the various levels (both within the level and to each other level). It is probable that much information obtained through monitoring at one level will also be useful at another. Co-ordination of monitoring efforts is therefore likely to achieve greater efficiency. Similarly, it must be recognised that those seeking information from different levels should make clear the objectives that they wish to meet and provide feedback on the extent to which the information has assisted in meeting those objectives.

These general principles aside, the focus of this report is on the needs of the first four levels. This reflects the Government's interest in ensuring that it meets its international and national obligations and that its roles in regional coastal planning in particular are able to be effectively and efficiently met.

This study has developed from work on environmental monitoring and indicators for State of the Environment reporting in New Zealand (McRae *et al.* 1989, Ward 1990, 1991, 1992, Ward and Beanland 1992). In addition, it incorporates the knowledge gained from a review of the literature on monitoring the coastal environment in Canada, Australia and New Zealand.

When monitoring the coast, not all environmental variables can be measured so it is useful to select or develop key indicators. The choice of appropriate indicators must be

related to the problem or the objectives of the monitoring. Ideally, environmental indicators should be capable of identifying changes in environmental conditions; be understandable to the general public, scientists and decision makers; be limited in number if they are to be useful to decision makers; be scientifically based and valid; be sensitive to changes in space and time; be based on relative ease of data collection; and provide early warning of environmental damage (Ward 1990).

The objective of this study is to develop indicators that reflect the state of the coastal environment and also those that reflect management practices. At the same time emphasis will be placed on who should or could carry out the monitoring, both under legislative responsibilities and through public interest, and at what frequency monitoring is required.

The basic philosophy of monitoring the coastal environment that is taken in this report is to keep it simple and involve both the public and private sectors.

2 What should be monitored?

There are a number of reasons and rationales for developing and monitoring indicators of the state of the coastal environment and related management practices. However, this report is deliberately focused on monitoring needs which might assist in meeting Resource Management Act 1991 responsibilities. Other monitoring responsibilities which might exist and which relate to or affect Resource Management Act monitoring are noted, but are not discussed in detail.

Within the context of the purpose of the Resource Management Act, this report focuses on environmental quality and efficiency of management processes as a first step toward an effective monitoring system for the coastal environment.

Section 5 of the Resource Management Act promotes sustainable management of natural and physical resources. Section 6 states as matters of national importance: the preservation of the natural character of the coastal environment, and the maintenance and enhancement of public access to and along the coastal marine area. In order to "preserve", "maintain" and "enhance" we need to monitor these aspects of the coastal environment.

The Act provides guidelines as to matters to be taken into account e.g. Second Schedule Part I, Section 2, matters relating to use, development or protection of the coastal marine area or water covering the area which are the responsibility of the regional council in conjunction with the Minister of Conservation. These include (Section 2a) use of the coastal marine area including protection of conservation and amenity values, actual or potential effects of use, development or protection of the land (Section 2b), and discharges of contaminants into land, air or water, and discharge of water into water (Section 2e).

From the Act, values in the coastal environment that need to be conserved include significant conservation values, amenity values and public access. Significant conservation values are listed in Schedule 2 of the draft New Zealand Coastal Policy Statement. Amenity values are "those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes" (RMA Part I, Section 2) including protection of open space. Public access to the coastal environment is important except for the protection of special areas including sites of cultural value, species or ecosystems or water sources of importance, or for safety and health. Provisions for public access could include esplanade reserves, covenants, easements, subdivisional patterns, walkways and accessways.

A monitoring programme needs to have clear objectives because the purpose of the monitoring will influence the parameters measured, the number and location of sampling

sites and the frequency of data collection. For example, monitoring a toxic discharge into an estuary may require taking water samples every hour over two or three days, while monitoring the spread of gorse on sand dunes may require monitoring every 3 to 5 years. The frequency of monitoring compliance with consents will depend upon the number and type of consents granted. Monitoring can also be carried out by auditing data and reviewing compliance with management plans.

If the objectives are not clear and the monitoring programme is not carefully planned from the start, much time and money may be wasted. Long term environmental monitoring requires some assurance that funds and competent personnel will be available to continue the programme in future years.

Planning the choice of indicators to be measured, frequency of monitoring and selection of sites will need particular attention if comparison is desired between sites and regions. This is essential if a national picture of the state of the New Zealand environment is required or may be required in the future. Some form of monitoring template or national guidelines are required to co-ordinate the monitoring programmes in the regions. In addition, the selection of methods for data recording, analysis and electronic compatibility needs to be co-ordinated.

3 Who should monitor?

Study and assessment of change in the coastal environment is carried out by most people who live or work near, or regularly visit, the coast. This assessment of who should monitor is based on institutions involved in coastal monitoring, who derive their interest from a legislative function, and also on interested members of the public who could usefully contribute to the monitoring process.

Resource management administration in the coastal environment is the primary responsibility of regional and district councils. Under the Resource Management Act 1991 Section 35, local authorities have a duty to monitor any part of the coastal environment that is appropriate to enable it to carry out its functions under the Act, the suitability and effectiveness of any policy statement or plan for its region or district, the exercise of any of its functions, powers or duties, and the exercise of resource consents that have effect in its region or district.

The Minister of Conservation has the function of monitoring the effect and implementation of national coastal policy statements and coastal permits under the Resource Management Act Section 28. Functions given in the Conservation Act 1987, and Acts administered under that Act, also empower the Minister of Conservation to monitor a variety of specific aspects of the coastal environment.

Although not required in any legislation, there may be advantages for regional councils to have national co-ordination of monitoring to ensure consistent standard transfer of information and efficient use of monitoring facilities. This would also be of advantage to development interests by providing certainty and consistency within consent conditions.

Some coastal monitoring needs to be co-ordinated nationally, by the Ministry for the Environment (Ward and Beanland 1992), both because comparable national information is required to give an indication of the state of the New Zealand environment as a whole, and because some of this data collection requires considerable expertise and technology that is unlikely to be available at the regional level. National techniques and standards need to be set for monitoring such as the water quality guidelines for control of undesirable biological growths (Ministry for the Environment 1992). Similar guidelines are needed for nutrients, suspended solids, contaminants etc. Experimental design needs to be built into these standards. This type of information must be available to local authorities so that there is comparability throughout the country. Section 43 of the Resource Management Act provides for the Minister for the Environment to disseminate information on national environmental standards.

Monitoring can also be undertaken by the general public and by community and interest groups. Some members of the public already undertake this role by reporting on

unusual events that they observe on their way to and from work. Most bird monitoring is carried by interest groups. The public are increasingly involved in the decision-making process under the Resource Management Act and involvement in monitoring the environment would seem to follow logically from this, given some guidance by local authorities or the Department of Conservation. The Department already has access to community groups who may wish to become involved.

4 Indicators of the state of the coastal environment

Under the Resource Management Act, monitoring the coastal environment needs to focus on environmental effects. These include the effects of activities or developments on coastal water quality, groundwater, aquatic and terrestrial species and ecosystems, and on coastal processes.

In addition, baseline information such as tide gauge records, sea level changes, and movement of coastal sediment must be monitored, although some of this needs to be nationally co-ordinated.

There is a need to distinguish between open coasts and sheltered waters for monitoring because different monitoring is often needed in sheltered estuaries, harbours and lagoons where most impacts occur. Tables 1 and 2 refer to sheltered coastal environments. They are divided at Mean High Water Springs (MHWS) because the area of jurisdiction of district councils is above MHWS.

The following Tables 1 - 3 contain suggestions of indicators of the state of the coastal environment and who could undertake the monitoring, including agencies with coastal monitoring responsibilities. The suggested frequency of monitoring is added in brackets (a.r. = as required, d = daily, w = weekly, m = monthly, y = yearly, 5y = 5 yearly, c = continuous observations). RC = regional council, DC = district council, DOC = Department of Conservation, MfE = Ministry for the Environment, MAF = Ministry of Agriculture and Fisheries, RHA = regional health authority.

Table 1 **Sheltered coastal environment *below* MHWS and 12 nautical miles offshore.**

Indicators	Monitored by: public	Monitored by: government agency
water clarity, turbidity	observation and record (c)	RC, measurement of optical properties (a.r.)
undesirable biological growths: sewage fungus, periphyton, macrophytes, phytoplankton blooms	observation, presence/absence of weed species e.g. *Enteromorpha, Ulva, Euglena, Undaria* (c)	MfE guidelines RC, aerial photos and desk top analysis (5y), RC, analysis of organic matter, N and P (a.r.)
Area of habitat modified or lost particularly for locally rare sp., in areas for internationally migrating species, fish spawning and nursery areas, and in coastal margins	observation and record (a.r.)	RC, measurement (a.r.)
No. species lost, endangered, gained	observation and record (c)	DOC (a.r.)
Area, density, health of key species		RC (y)
Organic matter indicators: coliform counts, dissolved oxygen, BOD		RC, analysis (a.r.)
Shellfish nos.	counts/m^2 (y)	MAF (a.r.)
Fish populations	Nos. fish caught (c)	MAF (a.r.)
Heavy metal levels in bivalve molluscs and sediments		RC, toxicity analysis (consent process, user pays) (m, y)
Contaminated shellfish		RHA, RC, MAF (a.r.)
Toxic algal screening		?? counts (a.r.)
Tide gauge records - height, interval		RC (d)

Table 2 Sheltered coastal environment *above* MHWS.

Indicators	Monitored by: public	Monitored by: government agency
Proportion of estuary, harbour, lagoon with marginal vegetation		RC, DC, aerial photo, desk top study (5y)
Area of habitat modified, lost, gained, particularly for locally rare sp.	observation and record (c)	RC, DC measurement (y)
Species lost, endangered, gained	observation and record (c)	DOC (a.r.)
Spread of weed species	observation and record (y)	RC, DC aerial photos, desk top study (5y)
		DOC (a.r.)
Key bird species: pop. size, age structure, breeding success	observation (m) (also Ornith. Soc. NZ)	DOC (y)
Seal numbers	counts (y)	DOC (y)
Dead bird nos.	counts (c)	DOC (c)
Rubbish levels on beaches	nos. bags collected (a.r.)	

Table 3 Open coastal environment.

Indicators	Monitored by:
Sediment transport within coastal marine area: ▬ transverse beach & near shore profiles -- height, volume, slope ▬ longshore sediment transport (inferred from transverse profiles & sediment composition)	RC (nationally co-ordinated) (y)
Sediment transport between land and sea - river sediment load	NIWAR monitor some rivers under public good science funding
Wave information - height, frequency	Meteorological Service under contract to the Minister of Transport (d)
Sediment size (controls height, slope, volume of beach)	RC (10 y)
Sea level changes	RC (nationally co-ordinated through DOSLI)
Coastal vegetation profiles in relation to beach stability especially as affected by structures	consent holders, RC (a.r.)
No. species lost, endangered, gained	public observation and record (c) DOC (a.r.)
Area, density, health of key species	RC (y)
Organic matter indicators: coliform counts, dissolved oxygen, BOD	RC, analysis (a.r.)
Shellfish nos.	public, counts/m^2 (y), MAF (a.r.)
Fish populations	public, nos. fish caught (c), MAF (a.r.)
Heavy metal levels in bivalve molluscs and sediments	RC, toxicity analysis (consent process, user pays) (m/y)
Contaminated shellfish	RHA, RC, MAF
Toxic algal screening	?? counts (a.r.)
Spread of weed species	public observation and record (y), RC/DC aerial photos, desk top study (5y) DOC (5y)

5 Indicators that reflect management practices in relation to the coast

The ultimate indicators of the effectiveness of management practices are the trends in the state of the environment. However, the effectiveness of management can be monitored using different groups of indicators as suggested in Tables 4-9.

Table 4 Effectiveness of development control as a process

Indicators	Monitored by
Development proposals	
No. of consents or certificates of compliance granted, refused, cancelled (by type)	RC
Time from consent application to granting	RC
Time from consent application to notification	RC
No. notified to un-notified consents	RC
% submissions to councils resolved by prehearing conferences	RC
% submissions to Planning Tribunal resolved by consent orders	RC
% applications returned for more information	RC
Staff time spent on environmental audit procedures of consent holders	RC
Conditions on consents: standards tending to improve environmental quality	RC, DOC
Effort spent in overseeing development proposals	
% monitoring data required by consents that is received and considered by councils	RC
Staff time spent on environmental audit procedures of consent holders	RC
No. emergency discharges	RC, DC
Assessing compliance	
No. enforcement of consents - notices, warnings, prosecutions	RC
% compliance with consents, no. of return visits to consent holders	RC

Table 5 **Adoption of pollution abatement measures (using best available technology).**

Indicator	Monitored by
Contingency plans for oil spills	RC, DC
Land rehabilitation (rubbish dumps) - $ spent, area, consents cancelled	RC, DC
Population served by primary, secondary, tertiary waste water treatment plants	RC, DC

Table 6 **Cultural sensitivity.**

Indicators	Monitored by
No. violations of tapu	RC, iwi
Areas of cultural significance protected	RC, iwi
Areas jointly managed by iwi and government agencies	RC, iwi
No. consents with cultural concerns	RC, iwi
No. areas restricted for cultural reasons	RC, iwi
No. waahi tapu recognised and protected	RC, iwi

Table 7 Loss of recreational opportunities.

Indicators	Monitored by
Closure of contaminated fisheries for protection of human health	public authorities, local authorities
Warning of contaminated fisheries	public authorities, local authorities
Closure of polluted bathing beaches for protection of human health	public authorities, local authorities
Warning of polluted bathing beaches	public authorities, local authorities
Catch/ unit effort of recreational fisheries	MAF
Restricted access to coast (area, length of coast)	RC, DC
Area CMA where access restricted or prohibited	RC
Area foreshore where access restricted or prohibited	RC

Table 8 Maintenance of biodiversity.

Indicators	Monitored by
Establishment of marine conservation areas (reserves, areas protected or closed under Fisheries Act)	DOC, MAF, RC
Protected area management - $ spent, staff time, staff nos.	DOC, RC, DC
Management of rare, endangered species - $ spent, staff time	DOC
No. violations of designated harvesting quotas	MAF
No. violations of designated fishing practices (net size, type etc.)	MAF, DOC
Impacts of nature tourism - boat & user nos., impact on species (aquatic & terrestrial)	RC, DOC

Table 9 Public perceptions of the coastal environment.

Indicators	Monitored by
Complaints received - no., type	RC, DC, DOC
Restrictions imposed - no., type	RC, DC
Nos. using beach or coast with easy access (car, <0.5 hr walk)	RC, DC
Nos. using beach or coast with facilities (picnic spots, walking tracts, food outlets)	RC, DC
% resource users returning to same site	RC, DC
Nos. using area before and after land rehabilitation, improved water quality	RC, DC

6 Conclusions

Emphasis on the importance of the quality of New Zealand's coastal environment has increased in recent years. Public input into the planning process is being made increasingly possible under the Resource Management Act with the preparation of the New Zealand Coastal Policy Statement, regional coastal policy statements, regional policy statements and district plans. The need for long term monitoring of the coastal environment is now recognised as important but the limitations of resources and lack of information on what to monitor have prevented many monitoring programmes from being initiated. This report suggests simple indicators that can be monitored by the public in addition to those that require the expertise of local authority staff or those from other agencies.

The report provides suggestions for two types of indicators to monitor the coastal environment: indicators of the condition or state of the environment and indicators of the effectiveness of management practices. Some of these indicators are already being monitored by local authorities and national agencies. Others need to be considered for their inclusion in regular monitoring programmes.

Tables 1 to 3 show that public involvement in the state of the environment indicators could provide an inexpensive and useful input to the monitoring process. However to be effective, guidance will be needed as to the best indicators to monitor and the way the information should be collected and transferred to the appropriate agency. For more technical monitoring by local authorities, guidelines are needed and standards must be set to aid those with the responsibility of granting consents so that informed decisions can be made.

Monitoring the effectiveness of management practices inevitably has to be carried out by those with access to the information. However, it is an important aspect of monitoring to determine whether the best decisions were taken and conditions on consents were adequate. Public input to this monitoring process is received through complaints and submissions.

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