Ministry for the
Environment
Manatū Mō Te Taiao

# Environmental Performance Indicators

## *Summary of Proposed Indicators for the Marine Environment*

*Signposts for sustainability*

This is a summary document; a full discussion document and a series of technical reports are available from the Ministry for the Environment. You should forward your comments on this summary by **26 February 1999** to:


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**Environmental Performance Indicators**

**Summary of Proposed Indicators for the Marine Environment**


**ISBN 0-478-09046-3**

**Published by the Ministry for the Environment**
**PO Box 10-362**
**Wellington**
**New Zealand**

**November 1998**

**Printed on elemental chlorine free 50% recycled paper**

# Contents

# 1. Overview of the EPI Programme

Good information is needed to make good decisions about the environment. This is acknowledged in *The State of New Zealand's Environment* (MfE and GP Publications, 1997) released in October 1997. One way of gathering good environmental information is through the use of indicators and state of the environment reporting.

An indicator is something that is measured regularly to show trends or sudden changes in the state of a system, population, or individual. The power of an environmental indicator lies in its ability to tell us how well we are looking after our environment.

Economists have used indicators to monitor the 'health' of the economy for many years. They have watched the fluctuations in economic indicators – such as food prices, and the Gross Domestic Product (GDP) – to show pressures on the economy, the state of the economy, and the effectiveness of any changes in economic policy, or response.

Environmental managers are not so well off. Nationally coordinated monitoring and reporting programmes exist for such things as weather, atmospheric ozone, threatened species and toxic marine algae. But the vast majority of environmental monitoring is not coordinated or standardised across our nation. Knowledge about environmental impacts is generally poor.

Within a few years, New Zealand will have in place a system to monitor changes in our environment. The Environmental Performance Indicators (EPI) Programme is being coordinated by the Ministry for the Environment (MfE). The idea is to build on existing information and monitoring efforts to develop a core set of national environmental performance indicators for use throughout New Zealand.

**The Purpose of the Environmental Performance Indicators Programme**

*The overall purpose of the EPI Programme is to develop and use indicators to measure and report how well we are looking after our environment.*

*The Government's objectives for the EPI Programme are:*

- *to systematically measure the performance of its environmental policies and legislation*
- *to better prioritise policy and improve decision making*
- *to systematically report on the State of New Zealand's environmental assets.*

The indicators proposed in this document comprise one of twelve work 'strands' under the EPI Programme. These strands are loosely based on issues identified in the *Environment 2010 Strategy*, the Government's strategy on the environment. The current priority is to pilot and implement indicators for air, freshwater, land, ozone, and climate change. At the same time, we need to confirm indicators for the marine environment, terrestrial and freshwater biodiversity, and waste, hazardous substances, and toxic contaminants. Indicators for transport, energy, pests, weeds, and diseases are to follow.

Indicators relevant to Maori are being developed as part of each EPI Programme strand. We intend to present these together in a discussion document in April 1999.

The aim is to have a set of core environmental indicators in place by the turn of the century. This will allow environmental considerations to stand alongside economic and social considerations in the development of sound environmental policy and laws in the new millennium.

**How do we choose only the best indicators?**

Development costs mean we need to choose indicators carefully; we can not afford to measure everything. In 1996, MfE developed a framework to help with indicators identification. In this framework, indicators are defined as **Pressure** (on the environment), **State** (describing the condition), or **Response** (describing organised behaviour to reduce, prevent or mitigate undesirable changes). While developing indicators, we have refined this **P-S-R** framework to emphasise environmental policy goals and the key environmental issues facing New Zealand.

We also use criteria for assessing proposed indicators. Indicators should be:

- Measurable with available technology
- Measurable at reasonable cost
- Scientifically defensible
- Easy to interpret and understand
- Policy-relevant.

**Who does what under the EPI Programme?**

Some data on indicators are already held by central government, regional councils, territorial local authorities, crown research institutes, and Iwi. Responsibility for ongoing monitoring will lie with a number of these agencies. However the responsibility to develop, standardise and "nationalise" the Programme rests with MfE.

**Benefits of the EPI Programme**

The EPI Programme will provide us with better information about the environment, help us to integrate environmental monitoring efforts, and support improved policy decisions.

Ultimately, EPIs can help us achieve better environmental outcomes. In this sense, environmental performance indicators are "signposts for sustainability".

***New Zealand's Unique Marine Environment***

*Much of New Zealand's character and life is defined by the sea. The sea shapes everything from New Zealand's coastline and weather to the outlook of its people. New Zealand has the fourth-largest Exclusive Economic Zone (EEZ) in the world, and is therefore an important maritime nation.*

*From sub-tropical Raoul Island to the sub-Antarctic islands, the EEZ is a combination of diverse environments and ecosystems. These range from shallow tidal estuaries, to ocean valleys up to ten kilometres deep in the great Kermadec Trench. Many of New Zealand's biodiversity assets are found in highly variable marine and coastal habitats.*

*Although far fewer marine than terrestrial species have been described, some 8000 species are known in New Zealand waters. The marine environment also provides many critical ecosystem services, such as climate regulation.*

*The marine environment is a valuable source of income for New Zealand. Fisheries exports will probably be worth more than $1.7b per annum by the year 2000. The annual export value of the aquaculture industry is expected to grow to $250m by 2010. Substantial mineral deposits include the Chatham Rise phosphoric deposit (worth about $10.8b) and hydrocarbon resources (worth about $450m per annum).*

*In addition, more than 90 per cent of our exports and imports are carried by sea. Perhaps most importantly of all, the sea represents a source of myth, inspiration and spiritual significance not only for Maori, but for many New Zealanders.*

Source: *State of New Zealand's Environment* MfE and GP Publications, 1997

## 2. Introduction to Marine Environment Indicators

This summary document signals that New Zealand is a step closer to the implementation of the EPI Programme. It draws from a fuller discussion document to present stage 1 and 2 indicators for the marine environment (the full discussion document will be available from MfE in December). Stage 1 indicators are considered to be those ready to implement in the next 2 years. More work is required for the stage 2 indicators, which generally address monitoring gaps in the stage 1 indicator set.

**Selecting the Indicators**

An extensive process of analysis and consultation, beginning with an examination of legislation, science and monitoring practice, was undertaken. This included a series of workshops, focus groups, and hui.

With the initial investigation and evaluation complete, this summary and the discussion document have been produced. Following consultation, the final indicators will be confirmed. This will be followed by piloting and development of protocols and implementation necessary for state of the environment reporting.

**Submission Process**

This document, and the full discussion document, will be open for comment until **26 February 1999**. Copies of each are available from MfE. We welcome your response to the questions raised in these documents.

You can forward your comments, or requests for further information on the EPI Programme, to the address on page 2 of this document.

## 3. Policy Goals for the Marine Environment

**What is the marine environment?**

We use 'marine environment' to include the area in which the coast is a significant part. This also describes the area from mean high water springs to the full extent of our Exclusive Economic Zone (EEZ – 200 nautical miles offshore). Environments covered in this strand include estuarine, near-shore coastal, continental shelf, seamounts, and sea-trenches. This strand also covers fisheries and aspects of marine biodiversity.

**Overview of Policy and Legislation**

The *Environment 2010 Strategy* provides a starting point for assessing relevant policy goals for marine environment indicators. Its vision is for "a clean, healthy and unique environment, sustaining nature and people's needs and aspirations" (MfE, 1995).

The main policy goals and environmental issues for marine management were identified by reviewing relevant

legislation and government strategies. The legislation examined included:

- Resource Management Act 1991
- Marine Reserves Act 1971
- Marine Mammals Protection Act 1978
- Wildlife Act 1953
- Foreshore and Seabed Endowment Revesting Act 1991
- Maritime Transport Act 1994
- Continental Shelf Act 1964
- Hazardous Substances and New Organisms Act 1996
- Crown Minerals Act 1991

The critical policy documents and strategies included:

- New Zealand Coastal Policy Statement (NZCPS)
- New Zealand Biodiversity Strategy (currently in draft only)
- Changing Course - Towards Sustainable Fisheries 2010
- Ballast Water and Ship's Hull De-fouling (proposed import health standard)
- New Zealand Marine Oil Spills Response Strategy 1996
- National Agenda for Sustainable Water Management (currently in draft only)
- Sustainable Land Management Strategy
- New Zealand Hydrographic and Bathymetric Strategy

**International reporting**

A number of international agreements are relevant to marine environment indicators. These include:

- United Nations Convention on the Law of the Sea (UNCLOS)
- Convention on Biological Diversity (CBD)
- Convention on the Conservation of Antarctic Marine Resources (CCAMLR)
- Convention on the Conservation and Management of Straddling and Highly Migratory Fish Stocks
- Convention for the Conservation of Southern Bluefin Tuna (CCSBT)
- International Convention for the Prevention of Pollution from Ships (MARPOL).

As well as measuring the performance of national policies and legislation, our proposed indicators will help us to fulfil our obligations for international reporting under these agreements. Indicators will also help us to fulfil reporting obligations to international organisations such as the Organisation for Economic Co-operation and Development (OECD) (eg for its reviews of member countries' environmental performance).

Each indicator proposed has, as its basis, a policy goal or issue. These may be summarised as follows:

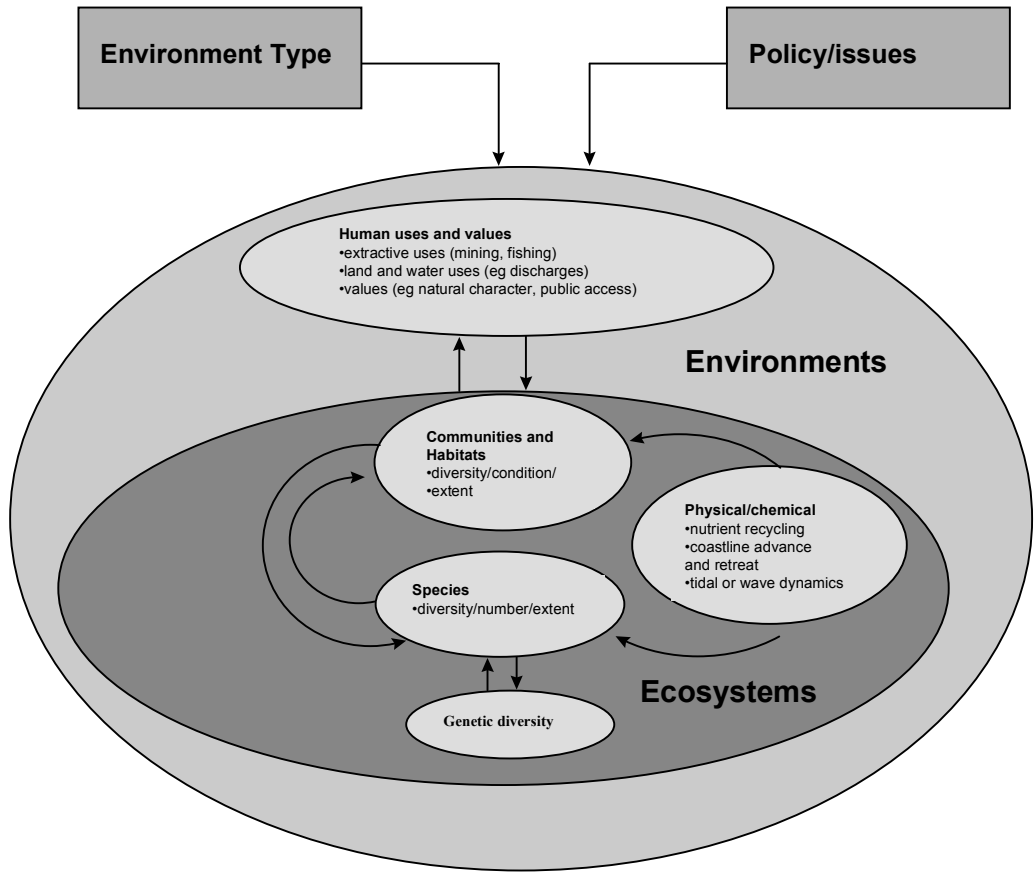
- Protect areas of significant indigenous vegetation and habitats of indigenous fauna
- Preserve and where appropriate restore the natural character of the coastal environment
- Maintain and enhance public access to and along the coastal marine environment
- Avoid natural hazards and mitigate their effects
- Maintain in public ownership all foreshore and seabed
- Protect marine mammals and manage adverse effects of human interactions on them
- Establish, restore and manage a network of marine protected areas representative of the full range of natural features and marine life of New Zealand waters
- Protect indigenous wildlife, gamebirds and their habitats in the coastal marine environment
- Provide for sustainable utilisation of fisheries resources
- Maintain biological diversity of the aquatic environment
- Ensure that decisions are based on the best information
- Avoid, remedy or mitigate any adverse effects of fishing
- Effectively manage or eradicate pests.

**Framework for Marine Indicators**

We needed frameworks to help us develop indicators that would best represent the policy goals and environmental issues we have identified (above). To do this, we reviewed existing ecological models of the marine environment, its functions and attributes. We merged these models with our modified P-S-R framework to identify the indicators that would best represent the pressure, state or response components of a marine environment issue and policy goal.

We also needed to show the relationship between our modified P-S-R framework and the environment. To do this, we developed a conceptual model that relates indicator components within the environment (Figure 1).

**Figure 1: Conceptual model of environments and indicator components**




In this model, the wider environment is described as the interactions between people, their uses and values, and ecosystems. Examples of **human uses and values** in the marine environment include fishing, mining, shipping, public ownership of beaches, swimming without getting sick, natural character of an area, and protection of areas of special significance to New Zealanders.

Ecosystems are shown as a product of **habitats and associated biological communities**, **species** and their **genetic** diversity, and the **physical and chemical** elements and processes in the environment.

Our conceptual model also shows the component parts for biological diversity. Biological diversity or 'biodiversity' for short, describes the variety of all biological life – plants, animals, fungi and micro-organisms – the genes they contain, and the ecosystems, on land or in water, of which they are a part. Biodiversity includes diversity within species, between species and of ecosystems. This means:

- genetic diversity – the variability in the genetic makeup among individuals within a single species

- species diversity – the variety of species, whether wild or domesticated
- ecosystem diversity – the variety of estuaries, forests, grasslands, rivers, lakes, wetlands, etc.

To decide on the best indicators, and what to monitor where, we need to assess:

- the environmental issue or policy goal
- the environment types we are interested in
- the importance of human uses and values
- the ecosystem parts (e.g. species, habitats and communities, or physical/chemical parameters) that contribute to the healthy functioning of those environment types.

For example, some of our estuaries may be at risk of sedimentation, whereas on the continental shelf sedimentation is probably not an issue. To determine which estuaries may be susceptible to sedimentation we need to consider the type of estuary, and the surrounding land uses. To assist managers of the marine environment to decide which estuaries should be monitored (i.e. those at risk) an estuarine classification system needs to be developed.

Our model, and this strand of the EPI Programme, largely focuses on human induced changes to the environment. Indicators for natural hazards, such as tsunamis, may be considered later in the EPI Programme. However, information about aspects of natural processes, such as natural accretion and erosion, will be necessary to provide context for interpreting the proposed indicators.

The proposed indicators are for national state of the environment reporting. They will provide useful information about trends in the extent and condition of *some* aspects of the marine environment – including its biodiversity. They will operate at a scale sufficient to inform resource managers and the public about key issues and risks to the marine environment. In many cases, however, they will signal the need for additional survey, monitoring, or research at finer scales. They will not provide a substitute for more detailed monitoring by management agencies.

Because a particular policy goal or environmental issue will not be relevant everywhere, a risk-based approach is needed to target monitoring on indicators where it is needed most. This approach is discussed further in Chapter 8.

We have structured the discussion of marine environment indicators (including indicators of marine biodiversity) in Chapters 4 and 5 under the following headings:

**Marine ecosystems**

- Physical and chemical
- Habitat and community
- Species and genetic diversity

**Human uses and values**

- Human health and values
- Fishing
    - ◊ Fish stocks
    - ◊ Fishing impacts.

Developing indicators is a moving target. We expect that new indicators will be needed over time, as research and monitoring provide us with a better understanding of environmental issues.

# 4. Proposed Indicators for Marine Ecosystems

Ecosystems include the functions of physical and chemical elements present in the environment. For example, the relationship between climate, erosion, wave action and sedimentation. They also include the interactions between habitats and communities, species (including people), and the genetic diversity of these species. Biodiversity is implicit in these interactions.

## Physical and chemical

Changes in the physical or chemical aspects of the environment can alter an ecosystem at various levels (i.e. species, communities and habitats) by smothering, toxic effects or habitat alteration. Among the issues of concern are nutrient levels, contaminant levels, sediment quality and quantity, and even sea level. Activities at sea, such as spills from ships, can place pressures on the physical/chemical state of the marine environment. Land uses can also place pressure on the physical/chemical state of the marine environment. These can result in sedimentation or eutrophication.

| Physical and Chemical Proposed Indicators | P-S-R | Stage |
|---|---|---|
| % change in land-erosion susceptibility for estuaries susceptible to sedimentation | Pressure | 2 |
| % change in area susceptible to agricultural impacts for estuaries susceptible to eutrophication | Pressure | 2 |
| % change in the tidal prism for estuaries susceptible to sedimentation | State | 2 |
| Toxic and ecotoxic contaminant levels in shellfish and sediments at selected monitoring sites | State | 2 |
| The number of confirmed spills by source and type, and the number of spills over 100L | Pressure | 1 |

**Estuaries susceptible to sedimentation**

Loss of soil from land used inappropriately can result in sedimentation of estuaries (including harbours) – the vulnerable meeting places for land/water and freshwater/saltwater. Estuaries have high natural values and human uses, but few estuaries remain in their natural condition. Types of land uses that can result in soil loss include:

- urban subdivision
- pasture on unstable soil types or slopes
- cropping on unsuitable soil types or slopes
- forestry on unsuitable soil types or slopes.

A risk-based approach is proposed for this indicator (see Chapter 8). Estuaries susceptible to sedimentation will be determined by an estuarine classification system. Changes in land-cover relative to land capability for catchments of these susceptible estuaries will be determined using the land erosion susceptibility indicator from the land strand of the EPI Programme. The percentage change, per region, in land susceptible to erosion will be reported as an indicator of the potential pressure on susceptible estuaries.

This indicator requires an estuarine classification system, and validation of monitoring methods.

**Estuaries susceptible to eutrophication**

Non-point discharges are the main source of surface water pollution in New Zealand. Waste-water discharges, although better managed than non-point discharges, are another pollution source. Shallow, low flush coastal areas, such as enclosed estuaries, can be at risk of eutrophication caused by these discharges.

This indicator uses a similar approach to the indicator for estuaries susceptible to sedimentation. That is, a classification system will be used to identify susceptible estuaries. The land indicator which identifies where there

is a risk of nutrient runoff will be matched with these susceptible estuaries. Waste strand indicators may also be included to incorporate the impact of discharges into susceptible estuaries.

An estuarine classification system, and development of the monitoring methods for the land and waste strand indicators, is required before it can be implemented.

**Tidal prism**

This indicator will be measured in estuaries that have been identified as susceptible to sedimentation through monitoring of the 'estuaries susceptible to sedimentation' indicator. It measures the change in tidal prism (the amount of water flowing into an estuary on the incoming tide) and integrates sediment build-up or loss within an estuary over time. Potential methods include continuous flow gauging or bathymetry surveys.

This is a stage two indicator, as it relies on development of other indicators in the marine environment strand. The sensitivity of this indicator to changes attributable to sedimentation also needs to be determined.

**Toxic and ecotoxic contaminants**

Contaminants entering and assimilated into the marine environment can be toxic to marine organisms and ultimately humans. These effects tend to be subtle and long term, but can be critical to protecting ecosystems and human health. The main sources of such contaminants are industrial discharges and urban runoff.

Toxic contaminants are usually not very soluble in water and tend to accumulate in sediments, plants or animals.

***Which of the two methods is most suitable?***

Analysis of the flesh of some types of marine organisms indicates the biological availability of contaminants. Measurement of contamination in marine sediments tracks long-term trends. Feedback is sought on which of these two methods would be most suitable as an indicator.

This is a stage two indicator as it requires agreement on standard methods for sampling, monitoring and analysing marine shellfish and sediments. It also requires a classification system to ensure representativeness of sampling sites.

**Spills**

While rare in New Zealand, oil and hazardous substances spills are potentially damaging for marine environments.

This indicator will help inform us about whether our management systems are reducing the threat of

environmental damage. The number of spills greater than 100 litres from vessels, and the frequency of spills from different sources, will be reported using databases administered by agencies such as the Maritime Safety Authority, the Environmental Risk Management Authority, and councils. For some types of marine spills, such as oil, this indicator is ready to report now. This indicator will form part of the proposed indicator of hazardous waste incidents (see MfE, 1998).

## Habitats and communities

Habitats and communities indicators relate to the extent and condition of various marine ecosystems and habitat types in New Zealand. Since it is not logistically possible to monitor all habitat types, only a few key habitats are proposed for monitoring. These will be monitored at representative sites. These indicators will measure some aspects of ecosystem and species diversity.

| Proposed Habitats and Communities Indicators | P-S-R | Stage |
|---|---|---|
| Change in the extent and condition of selected marine habitats compared to historic and current baselines | State | 2 |
| The % and area of each of New Zealand's different marine environments that are legally protected | Response | 2 |

### Extent and condition of marine habitats

Sea floor habitats and communities are vulnerable to human disturbance. The mechanical disturbance of marine habitats that occurs with some human activities can substantially alter the sea floor. The maintenance of diversity of these habitats and their part in ecosystem function and natural character, are all key policy goals.

Since we cannot realistically monitor the extent and condition of all habitat types, we have identified the following key habitats for which extent and condition should be measured:

- saltmarsh, mangroves, and seagrasses
- biogenic (living) reefs
- horse mussel beds
- kelp beds
- sand and mud flats
- volcanic vent habitats
- sea mount habitats.

Work is required to develop a classification system, select representative sites, and develop methods for monitoring this indicator before it can be implemented.

**Marine environment protection**

This indicator will measure whether our network of protected areas is representative of all types of marine environments (areas of similar environmental conditions) in New Zealand. The proposed environments are:

- estuarine
- near shore coastal
- continental shelf
- sea mount
- sea trench.

This is a response indicator related mainly to biodiversity goals. Currently, some marine environments and their habitat types are under-represented in New Zealand's network of protected marine areas. The goal is to remedy this by ensuring representative samples of all classes of the marine environment are sustained. A marine classification system is required before representativeness of marine protected areas can be determined.

## Species and genetic diversity

The diversity of species is an important factor in maintaining the sustainability of the marine environment. Fishing impacts, pollution and associated loss of habitat can play a significant part in the loss of species. Unfortunately, the importance of genetic diversity to marine ecosystem functioning has not been well defined by science. Indicators proposed here will measure some aspects of biodiversity, in particular the status of threatened species and pressures on species from invasive alien species. No genetic diversity indicators have been proposed at this stage.

| Proposed Species Indicators | P-S-R | Stage |
|---|---|---|
| Change in the number of taxa in different IUCN and NZ threat categories. | State | 1 |
| Change in the number and distribution (range) of selected alien species in the marine environment | Pressure | 1 |

**Taxa in threat categories**

This indicator will help us to understand how well groups of threatened species are faring in the face of continuing human activities – such as the harvesting of plants and animals – and human-induced changes in sediment regimes and characteristics.

The indicator will report changes of threatened species status nationally using IUCN (World Conservation Union) threat criteria and New Zealand's threatened species classification system. A modified New Zealand

classification system will be needed before this indicator can be fully implemented to represent New Zealand's unique situation – ie. that many species have naturally restricted distributions and relatively low numbers of individuals.

**Alien species**

Invasive alien species have the potential to modify the composition, structure and function of some marine communities and habitats, and can threaten ecosystems, habitats and species. Such species, or pests, are relevant to a range of marine environment policy goals. They are also linked to biosecurity issues.

This indicator will identify the number and kind of different alien marine species. The baseline data for this indicator has been published this year (Cranfield et al., 1998), but surveillance monitoring is required to keep the database up to date.

Although proposed here for comment, we will develop this indicator further next year as part of the 'pests, weeds and diseases' strand of the EPI Programme.

# 5. Proposed Indicators for Human Uses and Values

Human uses and values in the marine environment include fishing, mining, shipping, public access to the coast, appreciation of natural character, swimming and eating seafood without getting sick, and protection of areas of special significance.

The proposed indicators are discussed below in two sections:

- Human health and values
- Fishing
  - ◊ Fish stocks
  - ◊ Fishing impacts.

## 5.1 Human health and values

People value the marine environment in many ways, including for its natural character, swimming, and mahinga kai. Different human activities can conflict with these values and create risk to people's health and enjoyment.

| Proposed Human Health and Values Indicators | P-S-R | Stage |
|---|---|---|
| % bathing beaches and shellfish gathering areas complying with microbial guidelines | State | 1 |
| Frequency, location, and species of toxic and algal blooms | State | 1 |
| Quantity (number of items; combined weight) of litter per unit area in the stranding-zone of representative beaches. | State | 1 |
| % of New Zealand coastline in public ownership | State | 2 |
| % of coastal environment in each category of natural character | State | 2 |

**Bathing beaches and shellfish gathering**

Marine and estuarine water is often affected by land uses, urban stormwater, sewage and other discharges. National and regional policy goals aim to make swimming and eating shellfish safe.

Water quality monitoring is already carried out by regional councils and territorial local authorities. MfE and the Ministry of Health will soon publish new microbiological guidelines for bathing and recreational shell fish gathering.

This monitoring of designated beaches and shellfish should provide the foundation for reporting on this indicator. The proposed indicator will report the total number of beaches and shellfish gathering areas monitored in a year, and the number of those that are safe.

**Toxic Algal Blooms**

Certain species of algae produce toxins which can damage marine and estuarine ecosystems, including poisoning shellfish and humans. Policy goals aim to protect human health and the functioning of marine ecosystems.

The cause of marine algal blooms is not always clear. The key trigger in New Zealand appears to be natural changes in sea water temperature. Incidents of algal blooms triggered by pollution have occurred in a small number of countries, but blooms in New Zealand have not been scientifically linked with pollution.

Early warning national monitoring networks are in place. The Ministry of Health holds a database of all bloom information (including information from a commercial shellfish monitoring programme run by the Ministry of Agriculture and Forestry). The existing network needs to be examined for adequate coastline coverage, and options

for presenting the indicator must be considered (e.g. a risk grading system).

**Litter on beaches**

Litter impacts on the natural character as well as the ecosystems of the coastal environment. Marine birds and mammals can become severely injured through entanglement or swallowing debris. Research shows that most of this litter is from urban runoff, although beach users and boat users are still a significant source.

Many coastal litter control programmes exist but they are not currently being reported nationally. Regional, city and district councils, DoC and community initiatives need to be coordinated for indicator data collection. Standard categories and methods for national reporting will also have to be determined. And we need to ensure that the beaches monitored are representative of beach environments nationwide.

**Coastline in Public Ownership**

As a defining feature of the New Zealand way of life, public access to and along the coastal marine area is a clearly identified policy goal. However, this access continues to be restricted as a result of commercial development, private ownership and legal status of lands along the shoreline.

Access to, and along, the coast is not simple to measure because there are many possible barriers to access. We propose public ownership as a crude indicator of access – recognising that it does not address access to the coast via public or private property.

Availability of information will drive the implementation of this indicator. The Department of Conservation's Land Register database and many local councils hold some information on public ownership of the coast. Valuation New Zealand maps have public ownership as a category of public land use. Further development and pilot studies will be required to develop this indicator for reporting.

**Natural Character**

Landscapes, seascapes and landforms make up important elements of the coastal environment's natural character. This policy goal is recognised in the Resource Management Act, New Zealand Coastal Policy Statement, and regional coastal plans, but natural character continues to be degraded through inappropriate development and activities.

Natural character is an elusive concept to define, much less measure. Harder to define elements include ecosystems, natural science values, and the values attached to a place.

Considerable development and trialing will be necessary, but some of the proposed indicators for the marine environment (see above) will provide much of the information needed to develop this indicator. Many of the other indicators proposed for the marine environment reflect aspects of natural character. Indicators relating to marine litter, physical processes, marine and terrestrial species and habitats may be measured to determine the state of natural character. Other components are yet to be defined.

This indicator also needs to link to a coastal classification system to determine how much of each representative coastal type complies with an agreed set of natural character criteria.

## 5.2 Fishing

**Introduction**

The health of populations of fish species living and breeding in the sea forms an important part of the marine environment and the New Zealand economy. Fishing tends to deplete some fish populations, and affect other marine species and habitats associated with those populations that are fished. The Ministry of Fisheries is responsible for ensuring that fisheries are managed in a sustainable way. This includes monitoring and reporting on fish stocks and fishing impacts.

A core set of fishing indicators for fish stocks and fishing impacts is proposed. This set includes pressure, state and response indicators relevant to fisheries policy and environmental issues. While there are a lot of fish stock indicators (and they are quite technical), the reporting format for these indicators will condense and simplify information into a few tables and graphs. These will be easily read and understood. The fishing impacts indicators include policy responsibilities shared by MfE, the Department of Conservation, and regional councils.

### Fish stocks

The Ministry of Fisheries runs a stock assessment programme to ensure that fisheries are harvested sustainably. Each year, information from the previous year's total fish catch is used, along with research and stock assessment models, to assess the sustainability of current catch levels. A system of scientific peer review helps ensure that all information used has been fully discussed and confirmed. A major part of this peer review process is a series of Fishery Assessment Working Groups which bring together scientists and interested persons from sector groups such as the fishing industry, environmental, recreational and Maori groups, to discuss particular stocks. The working

groups meet a number of times to discuss new data and stock assessment models. Although these models can be very sophisticated, they can produce uncertain results because of their basic reliance on uncertain data and assumptions. A plenary report is produced summarising these discussions. This report is put forward for sector groups and fisheries managers to consider before final proposals are made to the Minister of Fisheries for the review of fish catches and management controls. The Minister sets any new catch limits or management controls for fish stocks in the upcoming fishing year.

The data that will be used to prepare and report the proposed indicators is published annually as part of the Ministry of Fisheries' fish stock assessment process. We suggest that only information that has been discussed and reported by a Fisheries Assessment Working Group should be used under the EPI Programme. This will ensure that indicators reflect the best available information. More technical detail on these indicators and the fish stock assessment process can be found in the full discussion document.

| Proposed Fish Stocks Indicators | P-S-R | Stage |
|---|---|---|
| The ratio of current biomass to virgin biomass for modelled stocks | State | 1 |
| The ratio of current biomass to the biomass that would support the MSY for modelled stocks | State | 1 |
| The proportion of stocks modelled that are at or above $B_{MSY}$ (or target) | State | 1 |
| The number of stocks that are modelled that have a) large, b) medium or c) small total catches | State | 1 |
| The number of stocks where status can be deduced that have a) large, b) medium or c) small total catches | State | 1 |
| The number of stocks with unknown status that have a) large, b) medium or c) small total catches | State | 1 |
| The number of associated/ dependent species (stocks): a) that are modelled; b) where status can be deduced; c) where nothing is known | State | 1 |
| Levels of relative biomass for species/groups of species (in an area) which have not been modelled | State | 1 |
| Levels of total catch for stocks | Pressure | 1 |
| The change in total catch for stocks | Pressure | 1 |
| The ratio of total catch to an estimate of sustainable yield | Pressure | 1 |
| The ratio of total catch to the Total Allowable Catch (TAC) or other catch limit | Pressure | 1 |
| Fishery effort as a proxy for levels of by-catch | Pressure | 1 |
| The current TAC for each stock | Response | 1 |
| The change in TAC for each stock | Response | 1 |
| The ratio of TAC to an estimate of sustainable yield for each stock | Response | 1 |

| | | |
|---|---|---|
| The proportion of stocks with current biomass below the target level where stock rebuilding strategies are in place | Response | 1 |

Notes:
'stocks' means Fisheries Management Units
MSY means Maximum Sustainable Yield
TAC means Total Allowable Catch
TACC means Total Allowable Commercial Catch
S/M/L means small, medium and large catches
B means biomass
'current' / 'historic' / 'baseline' refers to a baseline measure (eg. 1998, 1840, 1000AD)

## Fishing impacts

Fishing activities affect almost every marine habitat except the deepest sea floors. Fishing impacts include: direct harvest, by-catch effects, benthic habitat disturbance, food web changes and genetic changes. Dayton et al. (1995) consider that the removal of target and non-target species, and habitat disturbance by commercial fishing, are probably the most important human impacts on the marine environment.

Our proposed fishing impacts indicators are all pressure indicators. They relate to the previously described marine environment state and response indicators. Used alone, or in combination with these other indicators, they will provide coarse scale information about impacts from fishing on the marine environment.

| Proposed Fishing Impacts Indicators | P-S-R | Stage |
|---|---|---|
| The number of marine mammals and seabirds caught by species, by fishery (method), by area, by year | Pressure | 1 |
| The level of fishing effort, by method, by area, by year | Pressure | 1 |
| The area of marine farms by type, location and by habitat | Pressure | 2 |

**Marine mammal and seabird by-catch**

Although marine mammals and seabirds are protected in New Zealand's EEZ, they are incidentally caught during fishing. This indicator will report the information collected as part of the joint Ministry of Fisheries and Department of Conservation Fisheries Observer Programme. Fisheries observers record the number of each marine mammal and seabird species caught, and the total fishing effort for the vessel they observe on. This catch information can be scaled up to estimate the total marine mammal and seabird by-catch for the commercial fishing fleet in each particular fishery. A Fisheries Assessment Working Group reviews and approves this information annually before it is reported through scientific papers. Information from these papers will be used to prepare and report this indicator.

**Level of fishing effort**

On its own, this indicator will track gross changes in fishing effort over time in areas used for statistical purposes. When used in combination with other state indicators, it will

identify potential pressures from fishing impacts on the marine environment. Fishing effort can be reported now based on forms filled in by commercial fishers. Further work on marine environment classification will be required before this indicator can be used with other indicators to report on potential pressures across the EEZ.

**Area of marine farms**

This indicator will report on the extent of different marine habitats directly affected by the physical and biological effects of marine farming. It will provide an indicative measure of the direct pressures of marine farming on selected marine habitats (eg. horse mussel beds, biogenic reefs, sea grass beds, sand and mud flats, kelp beds and rocky reefs). It will not report on effects relating to the movement of plants, animals and farming equipment. This indicator is Stage 2 because it cannot be fully implemented until selected habitats have been identified and mapped. The extent of marine farms by type can be reported now using regional council and Ministry of Fisheries data.

## 6. Maori Indicators for the Marine Environment

Maori have an important relationship with Aotearoa's marine environment. As well as being traditional users of fisheries resources, Maori have interests in the wider marine environment. Maori therefore have an interest in the development of marine environment EPIs.

The Ministry acknowledges this interest, and the value of indigenous knowledge. It is seeking to incorporate Maori concepts into the EPI Programme to ensure indicators are relevant to Maori.

Maori participation in the marine environment strand to date, and the EPI Programme, is outlined below.

**Maori Input into the Marine Environment Strand and EPI Programme**

Under contract work, a series of hui was held around New Zealand to consult with Maori and to seek Maori input into the EPI Programme. The hui were attended by approximately 100 people representing hapu, Iwi and general Maori interests.

These hui were not regarded as consultation in the fullest sense. Rather, they were considered as communication with selected hapu, iwi and Maori to:

- brief them on the EPI Programme
- seek initial Maori views on the marine environment and other EPI Programme strands

- provide input into the selection of Maori specific indicators which could be included in a core set of environmental indicators for further consultation.

The hui confirmed the strong and consistent view held by Maori nationally about the marine environment. As guardians of taonga, Maori claim responsibility to protect and encourage enhancement and restoration of the mauri of taonga.

Four main themes emerged from the hui as having significance to Maori in relation to the marine environment. These are "mauri", "kaitiakitanga", the "holistic view" and "indigenous knowledge".

In addition to the hui, a selected group of Maori attended EPI Programme workshops in February and April 1998. Full details are available in EPI Programme technical papers (Gardiner and Parata, 1998; Technical Paper No. 23).

Three separate marine environment Iwi projects were undertaken to:

- determine the nature of some customary indicators and document Maori environmental monitoring practices
- investigate the potential use of customary indicators for state of the environment reporting
- develop environmental monitoring capacity.

The case studies are an attempt to take a holistic view of the world and assist Maori to build capacity in environmental monitoring.

The Maori Environmental Monitoring Group (MEMG) provided input to the programme at a conceptual level (see EPI Programme Technical Paper No. 26). The MEMG was an independent group of individual Maori with expertise in the area of environmental monitoring. Their report covers issues such as:

- What is an environmental indicator from a Maori perspective?
- What issues must be considered when developing Maori environmental monitoring programmes?
- What generic, nationwide environmental indicators can be identified that are relevant to Maori?
- How can these indicators be implemented in the future?

**Ongoing Maori Input**

Following the completion of the MEMG work, we have

adopted a new process for future Maori input into indicator development.

The main output of this process will be a discussion document written for Maori. This discussion document will cover the whole EPI Programme, including information and lessons learned from the hui, workshops, and the MEMG. With Iwi consent, the document will also contain information from the ecosystem case studies. The document is due for release in April 1999. Our intention is to follow the discussion document with a series of hui. These hui will be for Maori to consider the issues raised in the discussion document, as well as indicator proposals.

Many suggestions were put forward by the Maori caucus for potential Maori relevant indicators from the February and April workshops. In light of the process outlined above, we consider it more appropriate that these proposals are presented in the Maori discussion document in April 1999. Readers are welcome to request information on these proposals. This information is available in the EPI Programme technical papers noted above.

## 7. Reasons for Rejecting Other Proposed Indicators

The indicators proposed in this document are for national state of the environment reporting. For a range of reasons, many seemingly suitable indicators for the marine environment fell outside the criteria for assessing indicators or the scope of the Programme. In some cases, other proposed indicators are being dealt with in more relevant Programme strands (e.g. pests, weeds and diseases; freshwater biodiversity). In other cases, it was realised that some proposed indicators could not be represented nationally. Sometimes there were difficulties in gathering robust data, or it was decided that more research was necessary before a decision could be made about further development. Indicators are predominantly about extent because representing condition nationally, at this stage, is not do-able. Monitoring and reporting condition will require research.

Examples of other indicators considered and rejected at this stage are:

- the number of marine monitoring programmes
- the number and aerial extent of macro algae blooms
- phylogenetic diversity and distinctiveness remaining in selected taxonomic groups
- the biomass by trophic level inside fished and non-fished areas.

We concluded that reporting the number of marine monitoring programmes does not provide much, if any, information on the state of the marine environment. The programmes may have different objectives, and monitor different parameters.

Although they are sometimes a nuisance, macro-algal blooms were not considered a nationally-important policy issue. They can also be caused by natural or human influences, and consequently it can be difficult to determine the cause. Reporting on their incidence may not tell us whether the state of the environment is good or bad. Macro- algal blooms are also a local scale problem.

At present, a change in marine phylogenetic diversity would largely reflect the amount of taxonomic effort rather than actual change in the status of marine species.

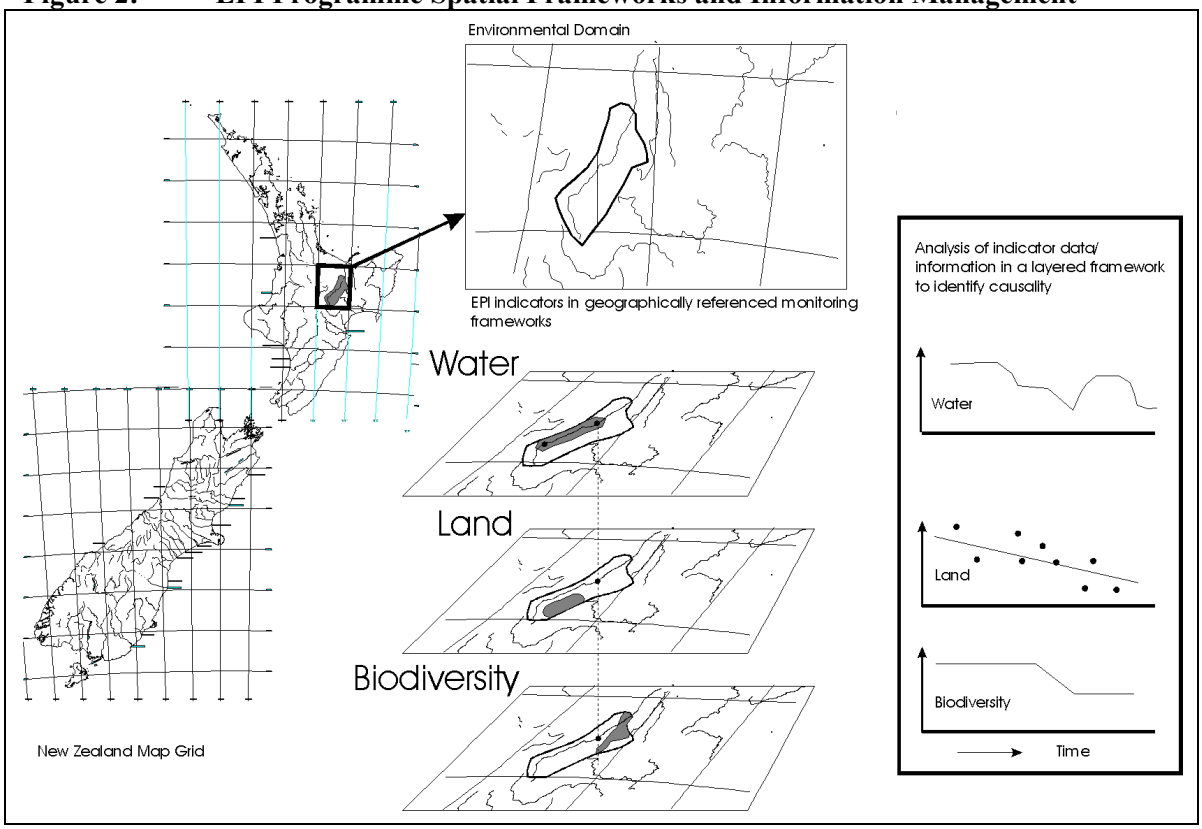
Monitoring biomass by trophic level would require considerable research before it could be developed as an indicator.

The complete list of other indicators considered and rejected can be found in the full discussion document. Submissions are welcome on any of these.

## 8. Implementing Indicators – monitoring and reporting frameworks

To implement indicators we need frameworks (and models) to make connections between indicator data and environmental issues. Figure 2 shows how the EPI Programme proposes to organise spatial information – the approach is equally applicable in the marine environment.

**Figure 2: EPI Programme Spatial Frameworks and Information Management**




## Classification systems

Such frameworks usually incorporate an environmental classification system for identifying the parts of the environment that will be measured (what and where to measure), and maps to show the environment visually over space.

Frameworks and models also provide us with a graphical means for analysing and reporting indicators information – that is, trends and the state of the environment for particular indicators in certain areas over time.

Without a consistent environmental classification system, it is difficult to compare information from similar environments and report this nationally. For example, unless the environments are sufficiently similar in environmental form and function, it would not make sense to compare the extent and condition of different types of estuaries in different parts of the country.

In addition, the collection of indicators data is usually done at a variety of levels (or scales) depending on the specific indicators in question (eg from individual species to habitat and environment levels at a range of scales: 1:10 000, 1:50 000, 1:250 000 etc.). Further work will be required to develop monitoring programmes and standard monitoring

methods for each indicator. Developing a marine environment classification system, and defining scales for monitoring and reporting, will be a focus for this work. (See the full document for further detail).

## Risk Based Approach

A risk-based approach has been used in developing the indicators, and will also be used to implement them.

This approach is implemented through a combination of:

- choosing indicators that monitor pressures, issues and policy goals
- identifying sites based on sensitivity to pressures
- interpreting indicators by assessing data against guidelines, baseline information or benchmark sites.

A risk-based approach will be used with the majority of the Marine Ecosystems indicators, and some of those for Human Uses and Values. For example, % **change in tidal prism**, change in **extent and condition of selected marine habitats** and levels of **fishing effort** by method, by area, by year. This approach involves identifying indicators and monitoring sites based on the susceptibility of the environment to certain pressures.

Some of the more simple indicators can be measured without a classification system or spatial framework. These indicators are usually not site specific, and monitoring will not necessarily be based on risk. Examples of these are the number **of species groups in threat categories**, the number of **spills at sea**, and the % of **coast in public ownership**. Monitoring many of these indicators will identify pressures on the environment and problems requiring better management practices.

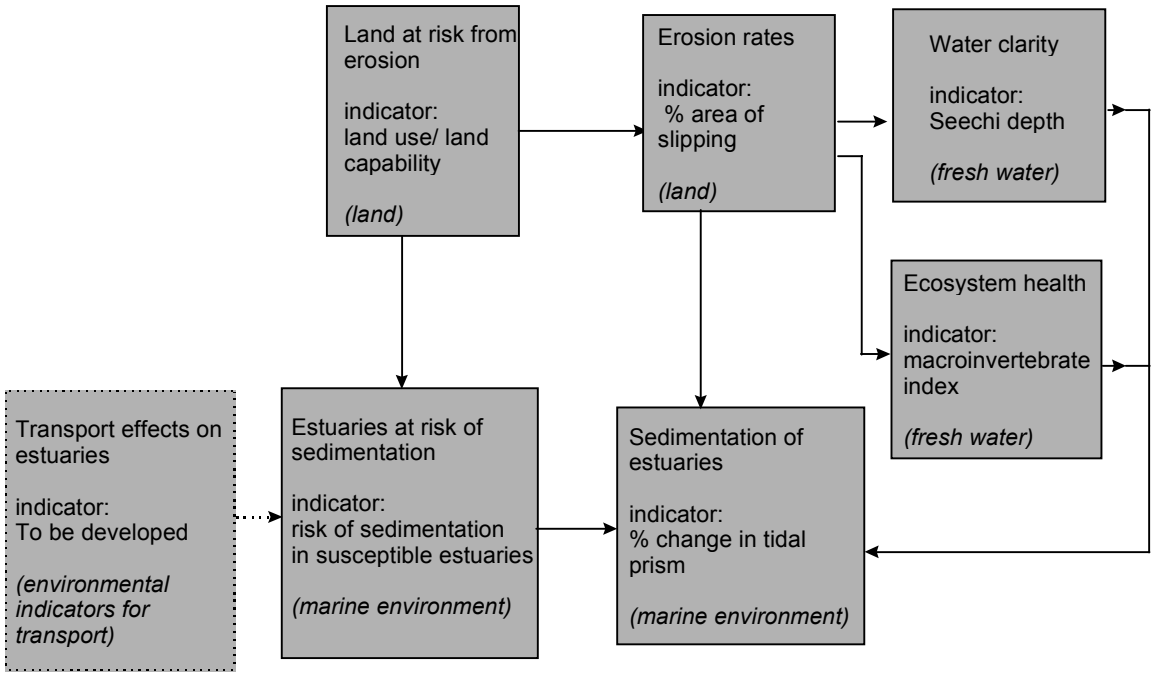
Used in conjunction with classification systems, monitoring of indicators will focus on the parts of the environment at risk of being impacted by human activities. But indicators also need to provide a balanced picture of both "good" and "bad" news. Some less impacted or benchmark monitoring sites will be needed to separate natural changes from those that are human induced.

## Integration

Integrated environmental management requires recognition of linkages between different parts of the environment. Although we are developing indicators through separate EPI Programme strands, we are aiming for an integrated set of indicators. Figure 3 shows one example of how

indicators developed in other strands of the EPI Programme are relevant to the issue of sedimentation in the marine environment.

**Figure 3: Integration diagram for the issue of sedimentation**




## Monitoring

Where possible, the EPI Programme will use existing datasets. Regional councils hold substantial marine environment databases. The Ministry of Fisheries holds extensive information on New Zealand fish stocks. Other agencies, such as the Department of Conservation, the Ministry of Heath, Crown Research Institutes, also hold important databases that will be relevant to the development of indicators.

## Reporting - maps and graphs

A combination of **tables**, **maps** and **graphs** is proposed for reporting the indicators**.** Maps will be used to show information spatially, tables and graphs to show trends over time. This information will be available through links on the Ministry for the Environment Indicator website, at **http://www.mfe.govt.nz**. Where available, we will compare monitoring data against guidelines and standards, such as the Australia and New Zealand Environment and Conservation Council (ANZECC) *Australian Water Quality Guidelines for Fresh and Marine Waters*, and the New Zealand *Guidelines for the Management of Recreational*

*and Marine Shellfish-Gathering Waters* (both in draft form only).

The indicators will provide information from which to assess trends in the state of New Zealand's environment. The first national state of the environment report – *The State of New Zealand's Environment* – was published last year and provides a benchmark for the development of environmental performance indicators. The Ministry will continue to lead and coordinate the development of environmental performance indicators, and future state of the environment reports.

## 9. Confirming Indicators

Consultation and submissions on marine environment indicators will be used to refine and confirm the final set of indicators. Other work will be needed before all confirmed indicators can be used. This work will include development of marine classification systems, scales and spatial frameworks, monitoring and reporting requirements for each indicator, targets for assessing progress, and information management systems.

We need your submission to move this work along. Remember that this is a summary document; a full discussion document and a series of technical reports are available from the Ministry for the Environment.

You should forward your comments on this summary by **26 February 1999** to: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