

MORAY FIRTH PARTNERSHIP
ENVIRONMENTAL QUALITY TOPIC GROUP

Executive Summary

At the request of the Moray Firth Partnership a group of nine individuals selected for their knowledge of the subject of environmental quality within the Firth formed a Topic Group to prepare a paper on which the Partnership intend to develop an Issues and Opportunities paper for public consultation. This approach forms the initial stage in the development of management guidelines which are intended to form a framework within which future management decisions affecting the Firth can be taken.

The Group identified a total of fourteen issues which had to be addressed and prioritised them as follows:-

Priority	Subject
High	Biotoxins Land Use Wastewater Discharges
Medium	Waste Management Decommissioning Petroleum Hydrocarbons Persistent Substances
Low	Dredging and Dumping Radionuclides Ballast Water and Non Native Species Air Pollution Noise Aquaculture Nutrient Enrichment

These topics ranged from those where little evidence of impact within the Firth could be identified such as radioactive waste contamination, air pollution, ballast water and dredging with its associated dumping to those where an impact could be demonstrated such as waste management, wastewater discharges land use, nutrient enrichment and biotoxins.

Each topic is considered in detail on the basis of the current situation, the key organisations involved, the key sources of data and information and the issues and opportunities arising.

On the basis of their discussions the Group concluded that the environment of the Firth would benefit from the existence of management guidelines which would form a setting within which decisions can be taken on the future management of the Firth.

1 Introduction

1.1 The Moray Firth Partnership intend to formulate management guidelines as a framework for the future management of the Firth as a means of helping them achieve their stated aim of promoting the integrated management of the natural, economic, recreational and cultural resources of the Moray Firth area in order to retain and enhance a high quality of life for all its residents and visitors. A series of 13 Topic Groups have been established comprising specialists in their fields able to provide expert information and advice on a wide range of subjects. Each group has been charged with the submission of a topic paper which will form a contribution to the compilation of an Issues and Opportunities discussion paper for public consultation.

1.2 It was recognised that various overlaps of interest would arise from the selection of Topic Groups. In the case of the Environmental Quality Group clear overlaps were envisaged with the Information, Research and GIS, Landuse, Natural Heritage and Fisheries Groups. These were ignored in the first instance as benefits will be reaped from the documentation of a variety of viewpoints which can be drawn together in the final compiled Issues and Opportunities paper.

1.3 Membership of the Environmental Quality Group is as follows:-

Mr Tom Anderson	Scottish Environment Protection Agency (SEPA)	
Mr Alan Bentley	Highland Council (HC)	
Mr Alan Berry	Independent Consultant	
Mr Tom Inglis	Scottish Environment Protection Agency (SEPA)	Chairman
Mr Ben Leyshon	Scottish Natural Heritage (SNH)	
Mr James McKie	Marine Laboratory, Aberdeen (MLA)	
Dr Clare Scanlan	Scottish Environment Protection Agency (SEPA)	Secretary
Mr Alan Stewart	North of Scotland Water Authority (NoSWA)	
Mr Ben Wilson	University of Aberdeen	

1.4 The contributions of a variety of other colleagues of the members of the Group must also be gratefully acknowledged as without their assistance the paper would not have been so comprehensive.

1.5 At an early stage it was confirmed that the Environmental Health and Planning interests of Highland, Aberdeenshire and Moray Councils were adequately met through Mr Bentley's membership of the Group and the circulation of minutes of the Group meetings. The Group were also aware of the lack of an industry representative but were unable to identify a suitable candidate. Hopefully the interests of industry are well represented within Topic Groups such as Economic Development to ensure that the ultimate guidelines recommended represent the optimum balanced approach.

1.6 It was agreed at the outset that information gathering was not a key part of the remit from the Partnership but rather the need to document key sources of information.

2 Topic Group's Area of Interest

2.1 The group's interest extended geographically throughout the area specified in the Partnership's Constitution. This covers all territorial waters from Duncansby Head in the North of the Firth to Fraserburgh in the East. The landward extent of the area of interest was far less easy to define as interests in water quality for example could include land use extending as far inland as the watersheds of the catchment areas draining into the Firth. The practical approach was adopted whereby all landward activities were considered by the Group where they impacted on the Group's relevant interests. This area is illustrated in Figure 1

2.2 The Group initially identified the following 12 subjects for inclusion in their topic paper and these have been grouped into three levels of priority in terms of the issues which they raise.

Priority	Subject
High	Biotoxins Land Use Wastewater Discharges
Medium	Waste Management Decommissioning Petroleum Hydrocarbons Persistent Substances
Low	Dredging and Dumping Radionuclides Ballast Water and Non Native Species Air Pollution Noise Nutrient Enrichment Aquaculture

3 Vision

3.1 Vision

Waste

To encourage business and local authorities to assess and audit their waste using the waste management hierarchy .

Waste includes solid and liquid discharges, and the hierarchy includes:-

- the prevention or reduction of waste
- Re-use
- recovery, recycling or reclamation, including waste to energy
- landfill disposal

The Partnership should seek to:-

- comment on both local and national waste management strategies
- inform of the success of industries and areas where waste reduction schemes have been successful and reduced costs
- provide examples of where cost reduction more than pays for the consultants advice and the changes in practice;
- encourage local enterprise companies to pump-prime reduction projects within groups of industries or areas;
- work with waste collection/disposal and education authorities to help awareness of waste issues.

Air

To assess the impacts of air-borne pollution in the Moray Firth area.

Air borne contaminants, be they toxic chemicals or nutrients, may affect water quality, either close to their source or remote from it. The Partnership should seek to:

- determine the extent of existing knowledge regarding air-borne pollutants on water quality
- utilise available air monitoring information to best effect;
- encourage industry, through authorisations, to minimise air pollution within the Moray Firth area;
- encourage appropriate research
- promote understanding of the potential local effects of global warming and the constructions made to this locally, eg CO₂ emissions from oil rigs.
- address the Public Health issues relevant to Moray Firth users.

Water

To maintain and improve water quality within the Moray Firth area within affordable and appropriate time scales.

The Partnership should seek to use the powers of its constituent bodies to maintain and enhance water quality within the Moray Firth area. It should aim to:

- encouraging long-term, strategic monitoring and improve access to resulting information
- continue current monitoring and improve it where possible
- identify areas where improvements are required
- encourage relevant research
- seek improvements within appropriate time scales

4 Review of Information

4.1 Air Pollution

4.1.1 Current Situation

Air pollutants, including particulate matter, can affect the environmental quality of the Firth directly or through either wet or dry precipitation. Some of these pollutants also contribute to ozone depletion and climate change which may result in long-term environmental change in the marine ecosystem. An air quality monitoring site has been in operation at Strathvaich due West of Garve for several years as an integral part of a national network of such sites. The data from the site represents an unpolluted baseline situation by comparison with the majority of other results. The monitoring station is operated by SEPA on the basis of a subcontract from the government's appointed contractor. Information is reported annually, copies of which are available in the SEPA library. Previously, and currently, the Local Authority's role in Sulphur Dioxide and Nitrogen Oxides monitoring should be noted.

4.1.2 Key Organisations

ORGANISATION	RESPONSIBILITY
SEPA	<ul style="list-style-type: none"> • Regulates emissions to atmosphere from industry
Local Authorities	<ul style="list-style-type: none"> • UK air quality strategy • Pollution control from waste disposal • Dust nuisance control from ships unloading • Smoke control
Industry and shipping	<ul style="list-style-type: none"> • Emissions to atmosphere from industrial activities including oil production

4.1.3 Existing and/or Likely Effects

ACTIVITY	POTENTIAL IMPACT/RISK
Industrial Processes	<ul style="list-style-type: none"> Emissions of volatile organic compounds (VOC's) and other toxins including metals which then deposit in the sea. Carbon Dioxide production including offshore sources (oil installations)
Waste Disposal	<ul style="list-style-type: none"> Methane and CO₂ production contributing to ozone depletion. Atmospheric discharges from incineration.
Vehicles/vessels	<ul style="list-style-type: none"> Emissions of volatile organic compounds and other toxins, including metals, which then deposit in the sea. CO₂ production including offshore sources (oil installations)
Cargo handling and maintenance of oil rigs	<ul style="list-style-type: none"> Dust nuisance and paint and shot blast over spray

4.2 Ballast Water and Non Native Species

4.2.1 Current Situation

- A non-native species is one which has been introduced directly or indirectly by human activity to an area where it has not occurred since major climatic change (5000 years ago) and which is separate from or lies outwith the natural extension that could be expected.
- Ballast water exchanges account for the majority non-native introductions in British waters. Organisms which may be introduced through ballast water include live fish, crustaceans, molluscs, polychaetes, coelenterates, algae (including toxic phytoplankton species), diatoms, bacteria, viruses and protozoa.
- Very few recorded introduced marine species have established in British waters. Two non-native coastal/marine species have been recorded in the Moray Firth. Cord grass (*Spartina anglica*) is present in Dingwall and Udale Bays where it was deliberately introduced for coastal reclamation purposes. The plant has proved to be aggressively invasive with the potential to seriously affect large stretches of intertidal. A second species, the Magellan mussel (*Aulaomya ater*) was trawled up from deep water in the Moray Firth in 1994. This species originates in South America and it is thought to have been introduced into the Firth as a fouling organism attached to South American barges visiting the area. Whether or not this species has managed to establish self-maintaining populations in the Moray Firth has yet to be determined.
- Introduction of non-native species through ballast water becomes significant where vessels from a different bio-geographic zone are involved. Ports at Inverness and in the Cromarty Firth are the main locations where foreign ships dock, although Wick, Burghead, Buckie, MacDuff and Fraserburgh also receive a limited number of vessels from overseas. The Nigg Oil Terminal in the Cromarty Firth is the biggest port in the Moray Firth with respect to ballast discharges.

- There are both legislative and voluntary mechanisms in place to address the introduction of non-native species. International controls include the Convention on Biological Diversity, the Bonn Convention, the Berne Convention, the EC Habitats Directive and the EC Fish Health Directive. The Wildlife and Countryside Act has mechanisms to control introductions within the UK. The International Maritime Organisation and the International Council for the Exploration of the Sea have produced voluntary guidelines on ballast water exchanges.

MLA have been carrying out research into ballast water issues since 1994 and they have initiated a field programme sampling ballast water and ballast tank sediments from ships using a variety of Scottish Ports. The programme is set to finish in 1997.

4.2.3 Key Reference Sources

Fisheries Research Services Report No 3/9

4.2.4 Key Organisations and Individuals Involved

ORGANISATION	RESPONSIBILITY
1. MLA	MLA provides advice on the effects of ballast water discharges on fisheries and the marine environment. It also provides scientific support for the development of policy with respect to coastal planning applications (e.g. super quarries) and supplies information on ballast water issues to MSA and other bodies and is actively involved in collaborative ballast water initiatives in the EU.
2. The Marine Safety Agency	An executive agency of the Department of Environment, Transport and the Regions with responsibility for developing UK legislation on maritime issues. The MSA issues Notices to Merchant Shipping (M Notices) and represents the UK at IMO and MEPC meetings.
3. International Maritime Organisation	A forum in which maritime nations meet to discuss matters of concern. The IMO has adopted a large number of Conventions and resolutions covering maritime safety, efficiency of navigation and prevention and control of marine pollution from ships. The IMO has produced a set of international guidelines for preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediment discharges.
4. International Council for the Exploration of the Seas	A scientific forum for the exchange of information and ideas on the sea and its living resources. The work of the Council is primarily concerned with fisheries, oceanography and marine pollution. ICES has developed a code of practice on the "Introductions and Transfers of Marine Organisms".
5. Joint Nature Conservation Committee	JNCC have reviewed the marine species which have been introduced to and become established in British waters. An assessment of the effects on nature conservation interests has been carried out and a policy on marine translocations for the UK is being developed as part of a statutory nature conservation initiative addressing this issue.
6. SNH	To work closely with JNCC in developing the review of non-native species and to safeguard natural heritage interests under the Natural Heritage (Scotland) Act 1991.

4.2.5 Existing and/or Likely Effects of Ballast Discharges

1. Potential Impact/Risk To Habitats And Native Species	<ul style="list-style-type: none"> • Displacement of native species • Introduction of new pests and parasites • Habitat alteration • Trophic alteration, particularly through dietary competition and predation. • Degradation of the integrity of the gene pool through hybridisation • Fouling of ships, marinas, moorings, nets, shellfish and aquaculture structures • Competition, predation and parasitism of wild and/or farmed commercial species
2. Potential Impact/Risk To Water Quality	<ul style="list-style-type: none"> • Contamination by chemical pollutants, heavy metals and suspended solids • Different nutrient levels (especially nitrates, phosphates, silicates and ammonia) of ballast water and receiving waters • Increases in turbidity in receiving waters • Changes of salinity in receiving waters • Changes in dissolved oxygen levels in receiving waters • Changes in temperature of receiving waters • Potential harm to humans in recreational waters

4.3 Decommissioning

4.3.1 Current Situation

There are over 600 fixed and floating offshore installations in European waters. Most will reach the end of their economic life within the next 30 years. The UK has the highest number of offshore installations (247 in total). Of the 247 structures in the UK approximately 60-70% will be decommissioned onshore. In total, 35 are potential candidates for decommissioning over the next 5 years or so

4.3.2 Key Information Sources

- DTI, October 1996, OSO. Current and future oil and gas projects.
- Marine Forum, 1991. Decommissioning of offshore oil and gas installations
- Cromarty Industries Group conference papers January 1997, "Onshore Decommissioning in the Cromarty Firth".

4.3.3 Key Organisations and Individuals Involved

ORGANISATION	RESPONSIBILITY
1. DTI, Oil and Gas Division.	Lead Department in the interdepartmental consideration and approval process of decommissioning programmes under the Petroleum Act 1987.
2. HSE	Approve the decommissioning Safety Case
3. MLA	A member of the interdepartmental process. Considers marine environmental implications of each case and issues marine disposal licenses under the Food and Environment Protection Act 1985

4. SEPA	Administration and enforcement of Radioactive Substances Act 1993 offshore and in connection with radioactive materials and disposal of radioactive waste. Regulate onshore handling and disposal of waste under the Environment Protection Act 1990 (as amended by the Environment Act 1995) and the Control of Pollution Act 1974
5. SNH	Safeguard natural heritage interests under the Natural Heritage (Scotland) Act 1991

4.3.4 EXISTING AND/OR LIKELY EFFECTS

Potential effects will depend on the method of disposal. As far as onshore decommissioning is concerned the following are pertinent to the Moray Firth:

ACTIVITY	POTENTIAL IMPACT/RISK
1. Towing to decommissioning site	<ul style="list-style-type: none"> • Consumption of energy • Pollution arising from risk of grounding, storm loss or loss of control during reduced draught tow. • Disturbance to wildlife • Temporary mooring in shallow water site.
2. Movement into dry dock	<ul style="list-style-type: none"> • Disturbance to wildlife • Pollution hazard • Entrapment of marine mammals in flooded dock and subsequent stranding. • Treatment and disposal of ballast water and ballast materials
3. Onshore decommissioning	<ul style="list-style-type: none"> • Provision of land to hold items • Disposal of sludge (including radioactive contaminated sludges) • Disposal of contaminated pipework and fittings • Disposal and transfer of other radioactive substances • Removal, containment and disposal of marine growths • Removal and disposal of anti-corrosion protective coatings • protection of surface and ground water during dismantling • Containment of hydrocarbons, chemicals, biocides, fuel, PCB's and CFC's and other contaminants • Safe removal and disposal of insulation materials (e.g. asbestos) • Removal and disposal of plastics • Air pollution arising form dust emissions, burning and cutting operations • Noise • Odours
4. Disposal of historic drill cuttings	<ul style="list-style-type: none"> • Assessment of effects on biota if left on site versus effects if moved

4.4 Dredging and Dumping

4.4.1 Current Situation

The bulk of the dredged material deposited in the Moray Firth (the sea disposal operations are licensed by the Marine Laboratory, Aberdeen (MLA) under the Food and Environment Protection Act 1985, Deposits in the Sea) is silt and sand, but coarse sand and shingle can occur in maintenance dredging requirement in the Moray Firth but is considered small in a national context. In 1996 443,584 tonnes of dredged material were deposited in licensed sea disposal sites in the Moray Firth, 2,601,864 tonnes were deposited in Scottish waters. The Marine Laboratory will continue to monitor the quality of dredged spoil being deposited in licensed sea disposal sites in the Moray Firth and ensure that the OSPARCOM guidelines are met.

4.4.2 Key Information Sources

Marine Laboratory, Aberdeen (MLA) records.

4.4.3 Key Organisations Involved

Organisation	Responsibility
1. MLA	Licensing authority under the Food and Environment Protection Act 1985 (FEPA), undertakes a multi-disciplinary assessment of proposals.
2. SNH	Safeguards natural heritage interests under the Natural Heritage (Scotland) Act 1991.
3. SEPA	Considers implications of discharges to controlled waters within 3 mile limit under the Control of Pollution Act 1974 and the Environmental Protection Act 1990 (as amended by the Environment Act 1991).
4. Scottish Fisheries Protection Agency	Considers the implication for commercial fisheries and possible interference with navigation and safety of commercial fishing vessels.
5. Inspector of Salmon and Freshwater Fisheries	Considers possible adverse effects that sea disposal operations are likely to have on freshwater fisheries in the tidal reaches of rivers and coastal waters.
6. DETR	Takes account of the possible interference with and safety of vessels and navigation.

4.4.4 Existing and/or Likely Effects

Potential effects will depend on the method of disposal of dredged material at sea, whatever the method of disposal the following impacts/risks are pertinent.

Activity	Potential Impact/Risk
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Sea Disposal

Elevated suspended solids concentrations
Changes to natural seabed sediment regimes
Destruction of benthic fauna and flora
Damage to fisheries and fish breeding areas
Release of pollutants, including heavy metals, to the marine environment

4.5 Land Use

4.5.1 Current Situation

- A range of land uses occur on the 823 km long stretch of coastline from Duncansby Head to Fraserburgh. These include agriculture, forestry, urban development, industry, ports and harbours, military use, oil related development and coastal defence.
- Agriculture (including crofting) and forestry are the most important land uses in the coastal fringe and this section concentrates on these two forms of land use. The occurrence of agriculture and forestry varies from the northern part of the Moray Firth through to the inner firths and along the southern Grampian coastline. The northern coast is remote with small crofts and extensive livestock farming on what is largely poor agricultural quality land. Much of this area has a semi-natural vegetation of predominantly heath, bog, moor and forest. The East Ross, Inverness-shire and Moray and Aberdeenshire coastline is essentially rural but more intensively settled than the northern coast. The Cromarty, Beaully and Inverness Firths are surrounded by prime agricultural land. The Grampian coast is generally rocky with small farms and crofts and the area also supports rich agricultural landscapes.
- Generally speaking, land uses away from the coast vary from agriculture in the south eastern part of the Moray Firth catchment to forestry and deer forest over most of the rest.
- Forestry occurs throughout the region, particularly around the more sheltered shores of the firths that lead into the Moray Firth (e.g. in the Dornoch Firth catchment) and also in some dune areas (e.g. Culbin sands).

4.5.2 Key Information Sources

- ITE. 1993 Countryside Survey 1990: main report. London, DoE. Countryside Survey 1990,
- SOAEFD
- Local plans
- Forest Authority
- Dargie TCD 1993 Sand dune vegetation survey of Great Britain. Part 2: Scotland. Peterborough, JNCC.

4.5.3 Key Organisations and Individuals Involved

ORGANISATION	RESPONSIBILITY
1. SOAEFD	To develop and promote Scotland's agriculture, fisheries and environment. Holds information on land use and agricultural land grades. Issues guidance on preventing environmental pollution from agricultural activity. Co-ordinates a number of countryside schemes such as the Countryside Premium Scheme, set aside.

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2. Macaulay Land Use research Institute.	Undertakes research to find ways of using and managing land to help to create wealth and maintain the quality of rural life. Holds information on land use.
3. Crofters Commission	Promotes crofting, maintains crofting communities and assists in their development. Provides administration of the laws relating to crofting.
4. Crown Estate Commissioners	Manages all Crown Estate interests including almost 1,000,000 acres of agricultural and forestry estates in Scotland. Information held on Crown agricultural and forestry estates
5. Farming and Wildlife Advisory Group	Promotes the development of an attractive, living countryside by the development, demonstration and implementation of sustainable and economic farming and forestry in conjunction with the conservation and enhancement of wildlife habitats and landscape.
6. Scottish Agricultural College	Provides advice on all aspects of commercial agriculture and horticulture plus a responsibility for farm diversification and rural development. Increasing emphasis given to environmental issues.
7. SNH	Seeks to secure the conservation and enhancement of Scotland's natural heritage, to foster understanding and facilitate enjoyment of it. Designates and cares for sites and areas for protecting habitats and wildlife.
8. SEPA	Regulates and controls pollution to land, air and water.
9. Scottish Landowners Federation	Represents the interests of rural landowners on all aspects of land management including agriculture, forestry, recreation and nature conservation.
10. Forestry Commission	Promotes the interests of forestry, the development of afforestation, the production and supply of timber whilst seeking a reasonable balance between forestry and conservation. Responsible for grant aid schemes for private woodlands and oversees 600,000 hectares of forest. Holds information on the distribution, ownership and management of woodlands. Provides guidelines to assist forest managers to safeguard aquatic ecosystems.
11. Ministry of Defence	The MoD manages land at a number of coastal locations around the Firth including at Tain, Fort George, Kinloss, Lossiemouth, Milltown, Binn Hill and Rosehearty.
12. Non-Government Organisations.	The Royal Society for the Protection of Birds own and manage nature reserves in the Dornoch Firth, the Cromarty Firth and Culbin Sands and the Scottish Wildlife Trust own and manage nature reserves at Loch Fleet and Spey Bay.
13. Local Authorities	<ul style="list-style-type: none"> • Strategic and Local Plans • Waste Disposal Sites • Leisure & Recreation Users • Education etc • Landfill Tax Funded Schemes • Environmental Improvements

4.5.4 Existing and/or Likely Effects

This table lists the potential impacts on water quality from agricultural and forestry practice and urban development. Effects from land claim, oil related developments etc. are covered elsewhere.

ACTIVITY	POTENTIAL IMPACT/RISK
1. Livestock wastes	<ul style="list-style-type: none"> • Direct contamination from surface run-off or from rapid movement through the soil of water contaminated with raw livestock wastes • Long term leaching of nitrates or other chemicals through the soil • High BOD • Bacterial and/or viral contamination
2. Silos and silage effluents	<ul style="list-style-type: none"> • High BOD • Most prevalent cause of water pollution from farms in Scotland
3. Sewage and distillery waste disposal	<ul style="list-style-type: none"> • Build up of potentially toxic elements in the soil • Accumulation of nitrate and phosphate are a potential cause of water pollution • Unpleasant odours • Bacterial and/or viral contamination
4. Agricultural fuel oil and waste oil	<ul style="list-style-type: none"> • Oil is highly polluting substance and spillage can lead to serious implications for aquatic environment
5. Fertiliser application to agricultural and forestry land	<ul style="list-style-type: none"> • Direct contamination of water courses by fertiliser either by leakage from store, field/forest run off or direct application to surface water. • Nutrient enrichment in water courses or the shift in the nutrient status of water bodies. • Can lead to eutrophication and algal blooms in rivers, estuaries and the sea. • Human health implications through high nitrate levels in drinking water.
6. Sheep dip	<ul style="list-style-type: none"> • Highly toxic to fish and aquatic invertebrates • May contaminate drinking water
7. Pesticides (including insecticides, fungicides and herbicides)	<ul style="list-style-type: none"> • Highly toxic to fish and aquatic plants and animals. • May contaminate drinking water
8. Disposal of waste products and litter	<ul style="list-style-type: none"> • Farm and forestry generated litter can cause a pollution and amenity problem if not properly disposed of.
9. Urban run-off (including drainage from roads, industrial and residential areas).	<ul style="list-style-type: none"> • Discharges contain a wide range of contaminants such as oil, organic matter, chemicals and toxic metals.

4.6 Noise

4.6.1 Current Situation

Recent increases in concerns over the effects of human-induced noise on marine mammals have led to the development of substantial research programmes on this issue (Richardson et al. 1995). However, whilst much is now known about levels of noise discharged into the oceans, their impact on marine mammals has proved difficult to quantify. Sound is conducted very efficiently through water and most human activities at sea, or in its proximity, have the potential to produce noise that is propagated within

the marine environment. The propagation properties of sound in water, as compared to those of light, are such that sound detection is a primary sense for marine mammals. Marine mammals use low frequency sounds to navigate over wide areas, whilst higher frequencies are used in finer scale movements, to detect and capture prey and avoid predators. Sounds are also used to communicate information between animals.

Measurable psychological, pathological and social effects on man have been shown to be attributable to noise. They include effects on sleep and mental stress.

Key Sources of sound are:

- Ambient noise - marine mammals have evolved to withstand high levels of noise produced by, for example, wind, waves, rain, tidal movements, friction and other organisms. These levels determine the range over which animals can communicate and the effective area over which man-made noise has an impact.
- Transportation - Aircraft, boats and ships, and road and rail transport all produce sound that enters the marine environment. Additionally, airborne noise is directly relevant to marine mammals that haul-out on land and to man.
- Industry - Sources of sound produced by industrial activity include marine dredging, onshore construction, oil and gas production, marine geophysical surveys, sonars and explosions, e.g. from military testing, and marine construction and demolition.
- Fisheries - Small acoustic devices, such as seal scarers and pingers, are used to keep animals away from fish farms and fishing nets.
- Recreation - Noise producing recreational activities are most likely to involve small power and personal water craft.

4.6.2 Existing and/or Likely Effects

ACTIVITY	POTENTIAL IMPACT / RISK
1. Low flying aircraft	<ul style="list-style-type: none"> • Disturbance at seal breeding sites - increased pup mortality • Startling of cetaceans
2. Boats and ships	<ul style="list-style-type: none"> • Disruption of common seal vocalisations during the breeding season • Disruption of cetacean communication • Cetacean avoidance of areas
3. Road and rail traffic	<ul style="list-style-type: none"> • Traffic bridges may form sound barriers to transiting or disorientated animals •
4. Dredging / oil production	<ul style="list-style-type: none"> • Similar to ships but focused on localised areas for days / years
5. Seismic noise and sonars	<ul style="list-style-type: none"> • Hearing damage
6. Explosions	<ul style="list-style-type: none"> • Death or injury • Hearing damage
7. Seal scarers / pingers	<ul style="list-style-type: none"> • Exclusion of seals and cetaceans from key habitats
8. Recreation	<ul style="list-style-type: none"> • Similar to boat / ship - often directed at marine mammals, especially bottlenose dolphins

Overall, noise has the potential to profoundly impact marine mammals in a variety of ways. Physical injury or deafening can occur in proximity to intense pressure waves (e.g. from explosions, pile driving, seismic blasts etc.). Longer duration disturbance (from ships, boats, planes, pingers etc.) could result in startling responses, abandonment, habitat exclusion, social disruption and physiological stress. Habituation is only likely to occur for animals that use restricted areas where noise levels are continuous or regular.

4.6.3 Key Organisations and Individuals Involved

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ORGANISATION	RESPONSIBILITY
Local Authorities	Responsibility to control impact of noise pollution on man under Planning and Environmental Protection legislation

4.7 Waste Management

4.7.1 Current Situation

It is estimated that over 300,000 tonnes of household industrial and commercial waste arise and are disposed off around the Moray Firth. Less than 5% leaves the area to be recycled and most of the remainder is disposed of by landfill. Some landfills are on the coastline others are a few miles inland.

4.7.2 Key Information Sources

Strategic study of waste disposal in the Highlands 1992.

4.7.3 Key Organisations and Individuals Involved

ORGANISATION	RESPONSIBILITY
Highland Council Moray Council Aberdeenshire Council	Collection, transfer and/or disposal of household and requested commercial waste. Local Waste Management plans
Private Sector Waste Collectors and disposers	Industrial and Commercial Waste collection and disposal
SEPA	National waste strategy. Regulation of waste sites
Ship owners and operators of boats	To ensure appropriate disposal of solid and liquid wastes, including waste oil

4.7.4 Existing and/or Likely Effects

Effects depend on the method of waste management adopted

ACTIVITY	POTENTIAL IMPACT/RISK
Waste Reduction	<ul style="list-style-type: none"> No Risk
Waste Reuse	<ul style="list-style-type: none"> No Risk. possible slight increase in effluent for treatment
Waste Recovery Recycling	<ul style="list-style-type: none"> Minimal risk very slight impact caused by process residue disposal and carbon dioxide release from composting schemes Use of non-renewable resources in collection, sorting out and transporting

	recyclables long distances with consequent pollution, noise and road congestion.
Energy from waste	<ul style="list-style-type: none"> • Potential for some air borne pollutants, being discharged to the atmosphere but technologies improving. .
	<ul style="list-style-type: none"> • 'Local' use of combustibles for energy recovery avoiding long transportation implications.
Waste Landfill	<ul style="list-style-type: none"> • Leachate pollution to groundwater, watercourses and the sea • Risk of harm to eco systems • Potential for uncontrolled production of methane - Damaging ozone layer where no controls. • •
Waste disposal at harbour	Minimal risk if storage is secure. Major impact on reducing sea borne litter, if waste facilities readily accessible and used.

4.8 Petroleum Hydrocarbons

4.8.1 Current Situation

Oil is one of the most likely sources of significant pollution of the Moray Firth owing to the risk associated with:-

- (i) shipping activities
- (ii) oil construction/dismantling/exploration operations
- (iii) large scale fuel storage and pipeline operations

Furthermore, the potential for pollution by oil from small scale commercial and domestic storage tanks which have not been properly bunded is also significant.

4.8.2 Key Information Sources

Talisman (Nigg Terminal) - Oil Spill Contingency Plan (includes Beatrice A Pipeline)
 Texaco - Captains Field Oil Spill Contingency Plan
 Highland Council - Oil Spill Contingency Plan
 Unipen - Aviation Fuel Pipeline Emergency Plan
 Texaco - Shoreline Protection Strategy (Wick - Buckie)

4.8.3 Key Organisations and Individuals

Organisation	Responsibility
Texaco	Captains Field production, loading, shuttle tanker movements
Talisman	Nigg Terminal storage, tanker movements, loading/unloading, ship to ship transfers, Beatrice A pipeline, oily water treatment plant
Port Authorities and Harbour Trusts	Shipping movements, unloading, oil spill regulation within port area
Robertson Oils (BP)	Loading, road tanker movements
Highland Fuels (Esso)	Loading, road tanker movements
UNIPEN	Storage, pipeline transfer and volume.
Briggs Marine	Oil spill response, environmental studies capabilities
MPCU	Oil spill response and management.
Health and Safety Executive	Nigg Terminal operation.
SEPA	Monitoring discharges and the aquatic environment, investigating oil spills within controlled waters
SNH	Minimise impact of spills on species and habitats
Local Authorities	Oil spill monitoring reports, cleanup, emergency planning
SOAFD/MLA	Investigate oil spills within marine environment and advise on the implications for fisheries and the marine environment of using dispersants

4.8.4 Key Statistics

Tanker movements
 Types of cargo
 Size of cargo
 Ship to ship transfer - where, frequency, method, volume, type of cargo
 Tanker loading/Unloading - where, method, volume, type of cargo
 Storage (where, how, how much, what type (s))
 Pipelines - volumes, movement
 Road tankers - movements, type, volume, routes
 Oil spills - frequency, location, type, response monitoring - who, where, frequency, method

4.8.5 Existing and/or Likely Effects

ACTIVITY	POTENTIAL IMPACT/RISK
Small scale storage	Failure of systems and bunding results in the contamination of land and/or fresh and marine waters
Large scale storage and transfers	Risk of extensive pollution and damage to wildlife and habitats. Risks of noise and light pollution associated with large oil terminals and harbours
Road Tankering	Accidental contamination of freshwater streams
Oil exploration and production	Risk of extensive pollution and damage to wildlife and habitats

4.9 Radionuclides

4.9.1 Current Situation

Radioactive discharges from major nuclear installations in the Scotland are regulated by SEPA . Although non are located within the area of interest associated with the Partnership Dounreay lies close to its northern extremity. Aqueous discharges for 1996 were within the authorised limits set by the regulator The National Radiological Protection Board based in Glasgow undertakes on the behalf of SEPA a radioactivity monitoring programme throughout Scottish waters to check the safety of these discharges. Discharges from all sites in 1996 were within the limits set by SEPA. Extensive regular monitoring of the marine environment in the Moray Firth is not undertaken and little data exists on concentrations of radioactivity, any monitoring that is routinely carried out in or adjacent to the Moray Firth is limited to the analysis of seaweeds and sea water. Concentrations of caesium-137 measured in seawater collected in northern Scottish Waters in 1994 ranged from 0.01 to 0.03 Bq/l which is approximately one tenth of the concentrations reported in samples collected from the Solway Firth.

4.9.2 Key Information Sources

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- The Department of Transport, Environment and the Regions - Annual Reports on Radioactive Waste Discharges
- SEPA - Radioactivity in Food and the Environment 1996
- Scottish Office - The Scottish Office Statistical Bulletin - Environment Series
- Radioactive Substances Act 1993

4.9.3 Key Organisations and Individuals Involved

Organisation	Responsibility
Scottish Environment Protection Agency	Regulation of all radioactive emissions
Centre of Environment, Fisheries and Aquaculture Science	Monitoring of radioactivity in the marine environment
The Department of Environment , Transport and the Regions	Implements UK Policy on Discharges of Radioactive Waste
Scottish Office	As DETR, and inputs to UK policy and implementation in Scotland; provides a Scottish viewpoint.
National Radiological Protection Board	Advises Government on Appropriate Standards

4.9.4 Existing and/or Likely Effects

Activity	Potential
Liquid Discharges	<ul style="list-style-type: none">• Exposure to contaminated sediments and fine particulate matter• Exposure to consumption of contaminated fish or shellfish

- Exposure to external radiation - active material
- Exposure to airborne radiation - active material

4.10 Wastewater Discharges

4.10.1 Current Situation

Throughout the Moray Firth area there are discharges to the sea of domestic sewage, industrial effluents or these combined. Most discharges containing sewage are owned and operated by the North of Scotland Water Authority (NoSWA), though there are also private sewage and industrial discharges. Where the two are combined within public sewers, NoSWA operates a trade effluent policy, which may require pre-treatment of industrial effluents before they enter the public sewer.

The standard of treatment at various wastewater treatment plants (WWTPs) varies according to:

- the size of population served, or its equivalent in the case of industries;
- the type of receiving water, i.e. estuarial or coastal for the Moray Firth;
- environmental quality standards to be met.

For both private and NoSWA discharges, the standard of treatment and permitted discharge levels are agreed with the Scottish Environment Protection Agency (SEPA), who are the statutory authority charged with controlling water quality. SEPA also monitors works' performance. However, there are many discharges which currently receive no treatment at all other than dispersion. Currently a number of areas are adversely affected by the presence of sewage solids and organic pollution. However, there are new WWTPs planned for Nairn, Inverness, Lossiemouth, Fraserburgh, Banff and Macduff and Buckie, with one currently being built at Brora. These are being done to comply with the EC Urban Waste Water Treatment (Scotland) Regulations 1994, and will result in major improvements in the quality of the current discharges, and prevent the discharge of sewage solids.

Sewage treatment results in sludge, which is disposed of by:

- recycling to land as a fertiliser in agriculture and forestry;
- to land fill sites, licensed by SEPA
- disposal to sea - this must be phased out by the end of 1998.

Alternative methods of sludge disposal are being investigated.

4.10.2 Key Information Sources

NoSWA databases and annual reports
SEPA annual reports

4.10.3 Key Organisations Involved

ORGANISATION	RESPONSIBILITY
North of Scotland Water Authority (NoSWA)	Provision of water and sewerage systems
SEPA	Licensing and monitoring of trade and sewage discharges

4.10.4 Existing and/or Likely Effects

ACTIVITY	POTENTIAL IMPACT/RISK
Sludge disposal to land	Excess nutrients, bacteria, viruses or persistent substances (e.g. metals) could find their way into the aquatic system through land run-off.
Aesthetic pollution	Sewage solids (sanitary towels, etc), where not screened out or raw sewage, can cause serious aesthetic pollution of the shoreline.
Faecal contamination	Bacteria and viruses from sewage can infect users of bathing/recreational waters. Marine mammals could also potentially be affected.
Effluent disposal - nutrients	Nutrients in discharge both from sewage and industrial processes (e.g. fish processing) could lead to localised nutrient enrichment of coastal waters.
Effluent disposal - toxic effects	Some effluents may contain toxic compounds, e.g. metals, pesticides.
Discharge of hormone disrupting chemicals	Human hormones are present in untreated sewage in an inactive form, but can become active during the sewage treatment process. They and other natural and unnatural hormone disrupting substances have not been shown to have any significant effects on receiving water fauna, but little research has been done as yet in marine waters.

4.11 Biotoxins

4.11.1 Current Situation

During the last seven years marine biotoxins have become regularly detected in Moray Firth shellfish from early spring to autumn. Paralytic Shellfish Poisoning (PSP) toxins predominate, with Diarrhetic Shellfish (DSP) toxins mainly confined to the Dornoch Firth area. While it is difficult to separate number of occurrences from increased monitoring frequency, it does appear that both the frequency and intensity of toxic algal blooms have increased. PSP and DSP occur throughout Scotland, with affected areas subject to regulation when toxins breach safety levels, and subsequent economic consequences for shellfish growers, gatherers and retailers. It should be noted that toxins occur even when algal numbers are low. There are also potentially public health questions relating to water usage.

While nuisance algal blooms have caused mass mortalities of inshore organisms (e.g. in fish farms) along the Scottish west coast, there are no reports of such occurrences in the Moray Firth.

The mechanisms by which marine biotoxins are produced are as yet poorly understood, but are increasingly being related to shifts in nutrient ratios rather than solely nutrient concentrations *per se*. Some of the toxicity may be of bacterial rather than algal origin, and bacterial contributions to nutrient cycling in the sea are not always considered. Potential sources of nutrient input are i) rivers; ii) effluent discharges; iii) aerial deposition; iv) external aquatic sources.

4.11.2 Relevant Key Statistics

In 1996 30 out of 44 samples tested positive for PSP toxins. Ten of these were above the Food Safety (Live Bivalve Molluscs and other Shellfish) Regulations 1992 action level, one (from the Dornoch Firth) by as much as twelve times. DSP toxins were found in 3 of the 11 Dornoch Firth samples, mussels from where were unsaleable for several weeks in 1996 because of both PSP and DSP toxin contamination.

4.11.3 Key Information Sources

Graneli, E. & Johansson, N. 1997. Toxin production in relation to nutrient conditions for different groups of phytoplankton. Proceedings of the 8th International Conference on Harmful Algae, Vigo, Spain.

Howard, F.G. 1996. Monitoring of algal toxins in Scottish shellfish 1996. Report of the Marine Laboratory Aberdeen.

Wyatt, T. & Saborido-Rey, F. 1993. Biogeography and time-series analysis of British PSP records 1968 to 1990. In: Toxic phytoplankton blooms in the sea. (Eds) T.J.Smayda & Y.Shimizu, Elsevier Science Publishers, pp.73-78.

4.11.4 Legislative Framework

EC Directive Shellfish Growing Waters

EC Directive Shellfish Hygiene

4.11.5 Key Organisations

ORGANISATION	RESPONSIBILITY
Marine Laboratory, Aberdeen (MLA)	Monitoring of shellfish for PSP, etc
Environmental Health Departments	Forwarding of results to producers, retailers, etc
SEPA	General water quality

4.11.6 Existing And/Or Likely Effects

ACTIVITY	POTENTIAL IMPACT/RISK
Nutrients discharge from sewage outfalls, rivers, aquaculture	Change or increase in nutrient balance or status possibly having an effect on plankton communities
Nutrients discharges possibly leading to production of nuisance algae	Possible health effects on those in contact with water

4.12 Aquaculture

4.12.1 Current Situation

Whilst aquaculture is a highly significant activity on the Scottish west coast and in the islands, it is a relatively small scale activity in the Moray Firth area. Currently there are three fin fish farms in the Cromarty and Inverness Firth areas. There is a limited but important interest in mussel and pacific oyster cultivation in this area. There are therefore few, if any, current problems arising from aquaculture, although the shellfishery has suffered from the occurrence of toxic algae. The decline of salmon and trout stocks in west coast rivers has been linked by some to the presence of caged fish farms, though this has not been substantiated. Further development of marine fish farming on the east coast is therefore of some concern for salmonid fishery interests. The government has recently announced its

intention to transfer the Crown Estates' responsibility for planning issues related to marine fish farm developments to local authorities

4.12.2 Key Sources

SEPA Public Register

SEPA Fish Farm Advisory Group 1997. Marine Cage Fish Farming in Scotland, Regulation and Monitoring: A Consultation paper. SEPA, Stirling.

MLA Published reports

SOAEFD Published reports

GESAMP 1996. Monitoring the ecological effects of coastal aquaculture wastes. Report::Stud.GESAMP (57), 38pp.

4.12.3 Key Organisations

ORGANISATION	RESPONSIBILITY
SEPA	Consenting of discharges from fish farms
Crown Estates Commissioners	Licensing of sea bed and planning authority
MLA	Statutory control of fish and shellfish diseases and acts as consultee on planning and discharge applications.

4.12.4 Existing and/or Likely Effects

ACTIVITY	POTENTIAL EFFECT/RISK
Siting of cages	Siting in inappropriate position may lead to adverse effects on local seabed and fauna. Siting in non-Class A areas may have impact on marketability of fish. Passing of sea lice to migrating fish
Discharges from fish cages	Possible adverse effects on seabed if good husbandry is not followed
Escapes from fish cages	Weakening of the gene pool, if inter-breeding with native fish occurs
Nutrient discharges	Potential for localised nutrient enrichment
Monitoring health conditions before marketing fish and shellfish and their products	Possible adverse effect on high status of farmed and wild fish/shellfish stocks
Use of therapeutic chemicals	Discharge of toxic chemicals could damage non-target species

4.13 Nutrient Enrichment

4.13.1 Current Situation

There is currently no evidence of general enrichment of the Moray Firth, although there may be localised areas of enrichment. Nutrient inputs from agriculture and aquaculture have increased generally in recent years, providing direct inputs to the Firth, and potentially indirectly through water flowing into the Firth.

Potential sources of nutrients are: i) sewage and industrial discharges; ii) riverine inputs (including agriculture and livestock); iii) aerial deposition, iv) aquaculture.

It is estimated that 865 tonnes of total nitrogen (N) and 130 tonnes of total phosphorous (P) are discharged into the Moray Firth from these sources (PARCOM). Data indicate that riverine inputs and discharges do not contribute significantly to nutrient concentrations in the greater Moray Firth area, with external water bodies contributing more, although the former might be important locally. PARCOM figures for riverine inputs are 7,811 tonnes N and 303 tonnes P. River "signatures" tend to be lost very quickly. Long term data on nutrient concentrations in the Firth, averaged over thirty years show acceptable nutrient concentrations, but do not show trends over this period. Sampling frequency has decreased in recent years.

There is relatively little information available on atmospheric deposition of nutrients, but many authors believe this to be more important than previously suspected. Data for the Moray Firth do not indicate significant inputs, but this area is not extensively researched.

Aquaculture in the Moray Firth area is currently a relatively small scale, though developing, activity. GESAMP figures estimate that one tonne of fish production produces 80kg of ammonia and 7.5kg of dissolved phosphorous. Moray Firth fish farms are estimated to contribute approximately 148 tonnes of N and 20 tonnes of P.

4.13.2 Key Sources

MLA Published reports
 PARCOM statistics
 SEPA Published reports
 SOAEFD Published reports
 GESAMP 1996. Monitoring the ecological effects of coastal aquaculture wastes. Report::Stud.GESAMP (57), 38pp.

4.13.3 Key Organisations

ORGANISATION	RESPONSIBILITY
MLA	Monitoring of fish stocks; water quality monitoring; provision of expert scientific and technical advice and information on marine and freshwater fisheries, on aquaculture, and on the protection of the aquatic environment and its wildlife.
SOAEFD	PARCOM data compilers; reporting responsibility
SEPA	Discharge licensing and monitoring; monitoring of controlled waters; collection of PARCOM data

4.13.4 Existing and/or Likely Effects

ACTIVITY	POTENTIAL EFFECT/RISK
Discharge of sewage and organic trade wastes	Localised enrichment with potential for increased algal growth
Aquaculture	Localised enrichment effects - currently a small-scale industry within the firth
Agriculture and forestry	Potential for river-borne nutrients to cause local enrichment - currently deemed low risk
Agriculture	Potential for atmospheric deposition through gases
Nutrient discharge	Possible links with occurrence of toxic algae, with

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	consequent risks to human health and to commercial fisheries
Vehicle traffic	Potential for atmospheric deposition of heavy metals and compounds such as sulphur and nitrogen

4.14 Persistent Substances

4.14.1 Current Situation

There are few known problems with persistent polluting substances in the Moray Firth. Possible contaminants of concern are:

- Metals - Monitoring of List II metals in seawater samples collected from the Moray Firth has consistently demonstrated compliance with water quality objectives. MLA monitoring has shown that the concentrations of heavy metals in fish and shellfish tissues are consistent with those reported on samples collected from other Scottish waters. Copper-based anti-foulants are now being used on fish cages. The extent of their use in the Cromarty/Moray Firths is unclear, but no monitoring for copper in seawater has been carried out near fish cages.
- Polychlorinated biphenyls (PCBs) - These are present at elevated concentrations in mussels and sediments from within the Cromarty Firth. Levels have declined as a result of remedial measures taken by the owners of a historically contaminated site, but are still above regional background concentrations. These are less than background concentrations in more industrialised areas.
- Pesticides - e.g. lindane, dieldrin. MLA monitoring has shown that concentrations of various contaminants in fish tissues were low relative to other Scottish waters. SEPA monitoring of waters and shellfish has shown no consistently elevated levels at any site.
- Hydrocarbons from oil-related activities and from shipping (spills) form risks to marine life, both immediate and through chronic pollution. Regular monitoring has detected no significant accumulations of hydrocarbons in shoreline mussels. IPC authorisation for the oil terminal at Nigg will include a requirement to monitor sediments, mussels for hydrocarbon residues and to monitor the benthic fauna at a small number of locations.
- Tributyl Tin (TBT), though banned from use on ships less than 25m in length, is still used on larger ships as an antifoulant. Small affected areas, as detected by imposex in dog whelks, are found around the Firth, particularly near harbours. Severe effects have been found historically within the Cromarty Firth. Despite suitable habitats Findhorn Bay has no dog whelks, and this could be due to TBT pollution from the former use of TBT on small pleasure craft.

Monitoring has shown no significant widespread problems for most of the above contaminants. There are localised areas of concern. Monitoring is often discharge or topic specific, and may not present a complete picture of contaminant burdens and effects.

4.14.2 Key Sources

SEPA Annual reports
PARCOM statistics
MLA published reports

4.14.3 Key Organisations

ORGANISATION	RESPONSIBILITY
SEPA	Discharge control through consenting and monitoring; monitoring of receiving waters
Marine Laboratory, Aberdeen (MLA)	Monitoring of fish stocks; water quality monitoring; provision of expert scientific and technical advice and information on marine and freshwater fisheries, on aquaculture, and on the protection of the aquatic environment and its wildlife.

4.14.4 Existing and/or Likely Effects

ACTIVITY	POTENTIAL IMPACT/RISK
Oil related activities/Shipping	Oil pollution/spills leading to degraded habitats and deaths of marine organisms. Economic effects due to tainting of fish and shellfish stocks.
Use of TBT on shipping; ship painting and cleaning	Hormone disrupting effects on marine invertebrates, potentially affecting community structure
PCBs	Acute and chronic toxic effects on marine organisms; hormone disrupting effects.
Pesticides	Acute and chronic toxic effects on marine organisms; hormone disrupting effects
Metals	Acute and chronic toxic effects on marine organisms.

5.1.1 Air Pollution

5 Review of Issues and Opportunities

- To establish partnerships between Industry, Regulator and Local Authorities to increase monitoring and contribute to effective UK strategy.
- Industry to research ways of reducing CO₂ emission by use of innovative technologies.
- To monitor harbours and to reduce emissions

5.1.2 Ballast Water and Non Natives Species

- To review the findings of MLA's ballast water survey and to seek to continue and extend this work (e.g. through phytoplankton monitoring) if appropriate.
- To assess the potential problem of ballast water discharges in the Moray Firth.
- To determine the sources of ballast water input into the Firth and review any treatment measures currently in place.
- To maintain a record of ballast operations occurring at ports in the Firth.
- To adopt the IMO and ICES guidelines on ballast water management procedures and to consider whether these voluntary guidelines should become legally binding.

- To consider using Harbour bylaws to control ballast discharges if there is a need or if problem areas are identified.
- To be vigilant to the possibility of non-natives establishing in the Firth and to set up a network of organisations and volunteers to monitor the situation. This could extend the current "Magellan Mussel Watch" network which has been set up for this species.
- Through training and education to raise the awareness of a wide audience within the Moray Firth of the issue of ballast water discharges and the problems of non-native marine species.
- To identify what control measures might be appropriate in cases where introduced species become problematic and to maintain links with workers elsewhere (e.g. Australia) where work on biological controls are being explored.
- To review ballast water control methods deployed elsewhere and to consider if some might be appropriate for use in the Moray Firth.
- To review ballast water handling facilities and procedures within the Firth in the light of ongoing research.

5.1.3 Decommissioning

- High recycling of materials achievable with resultant minor energy benefit
- High level of waste stream control and monitoring achievable
- Employment gains
- Public perception is more sympathetic to onshore decommissioning than to offshore decommissioning. There is an opportunity through education and PR to highlight the issues surrounding decommissioning. Where offshore decommissioning is the best environmental option for a particular installation then misconception by the general public/media should not prevent this course of action being pursued.
- Demonstrate that good practice and the development of high standards and safeguards can result in decommissioning occurring in harmony with environmental interests.
- Carry out a risk assessment. and review decommissioning practices elsewhere to determine the range of potential environmental hazards and how they might be overcome.

5.1.4 Dredging and Dumping

- To encourage that full consideration is given to other relevant interests before dredging and sea disposal activities are undertaken.
- To consider alternative disposal options for the management of dredged material. This should not only include alternative means of disposal but also promote consideration of alternative, constructive and beneficial uses of dredged material.
- To encourage the Marine Laboratory, if necessary, to consider sediment relocation in the water column and as seabed load following dumping between the Sutors at the entrance to the Cromarty Firth.

5.1.5 Land Use

- To continue to apply relevant pollution control guidelines in particular the “Forest and Water Guidelines” and the “Prevention of environmental pollution from agricultural activity” and to update these guidelines as appropriate.
- To continue to monitor and assess the significance of agricultural and forestry sources of pollution on the coastal and marine environment of the Moray Firth.
- To identify any local problem areas and to determine whether changing land use management might help to mitigate the problem.
- To apply Best Management Practices (BMP's) to appropriate developments. BMP's include the deployment of permeable conveyance systems (e.g. French drains and swales) and passive treatment systems (e.g. filter strips and retention ponds).
- To develop, where appropriate, an issue based integrated catchment management approach.

5.1.6 Noise

- Incorporate marine noise into environmental decision making processes, e.g. Currently, divers and boats must be cleared from the vicinity of explosive detonations. As these activities are equally likely to damage marine mammals, they should also be taken into consideration. Similarly, land generated high intensity sound in the vicinity of the marine environment must be considered in relation to its conduction and impacts on the marine environment.
- Given the high densities of marine mammals in the southern and inner Moray Firth and the restricted nature of this area, there is an opportunity for the Partnership to recommend that seismic surveys (using currently available technology) should not take place in these parts of the Firth.
- Reduction in the intensity of long-term or continuous noise. Fitting quieter engines and propeller nozzles to boats can be effective. Facilities to check for faulty and therefore noisy gear boxes and propellers could be easily provided.
- Investigation of the impacts of military activities on marine mammals. The Partnership could invite the MoD to review its case for using live ammunition when bombing marine targets and assess its scope for minimising other sources of noise.
- The use of seal scarers should be regulated especially where fish farms are located at key feeding areas for protected marine mammal species.
- The addition of pingers to fishing equipment in the Moray Firth should be debated before calls to implement them are made.
- Preventative measures such as the Dolphin Space Programme and the Dolphin Awareness Scheme should be given the full backing of the Partnership.
- Encourage local authorities to use their existing planning and environmental protection powers to control environmental noise levels associated with new developments and to address public complaints.
- Encourage all users of the Firth to take appropriate measures to prevent or minimise the noise likely to disturb or annoy others thereby minimising the need to invoke statutory procedures.

5.1.7 Waste Management

- Increase in waste reduction projects would result in a win win situation with less waste and bigger profits.
- Pollution control systems may reduce the likelihood of pollution to negligible levels but they are dependent on management, maintenance, and money.
- Working with Port Authorities to provide facilities for all types of waste storage and enforce regulation and supervision.

5.1.8 Petroleum Hydrocarbons

- To ensure the movement, handling and storage of petroleum hydrocarbons are organised, operated and monitored in such a way as to have the minimum effect on the environment and the population and that in the event of an oil spill there is in place the necessary arrangements to ensure a co-ordinated, effective response
- To work effectively and in co-operation with all interested parties in particular the oil and shipping industries, port authorities, local and central government and regulatory bodies to achieve the above

5.1.9 Radionuclides

- To encourage SEPA in ensuring that discharges are within the limits set in authorisations and kept as low as practicably achievable
- To investigate the relative importance of natural and man-made sources of radioactivity

5.1.10 Wastewater Discharges

- For the sewerage authority (NoSWA) to improve the standard of sewage treatment in the Moray Firth area.
- To educate the public in the disposal of sanitary items, e.g. through NoSWA's "bag-it-and-bin-it" campaign.
- To conduct further studies into alternative methods of sewage sludge disposal.
- To design outfalls to maximise bacterial and viral dispersion and reduce the input of pathogens to the sea.
- To conduct research into effects of oestrogenic compounds on marine fauna.
- To continue to monitor bacteriological quality at a number of sites in the Moray Firth, and possibly increase the number of such sites. To make these results available to the public.
- To monitor discharges and return data to government as required. SEPA/MLA to gather data on nutrient status of Moray Firth.
- SEPA and NoSWA to control toxic discharges to receiving waters/sewers by the most cost-effective means
- To continue collaboration between SEPA and the Environment Agency/MAFF/etc on this.
- To encourage investigation of potential health-related effects of users of beaches which may be affected by discharges.
- To investigate potential links between discharges and algal blooms.

5.1.11 Biotoxins

- For the relevant authorities to investigate possible links between illness in water users, seafood consumers and wildlife and the presence of biotoxins.
- To encourage research into establishing the sustainability of projects involving water use, and the definition of "acceptable impacts".
- To encourage research into the causes of biotoxin production.
- For the appropriate regulatory agencies to continue, and preferably increase, nutrient monitoring in the Moray Firth area.
- To encourage research into the marine science of the Moray Firth, particularly hydrography, microecology and nutrient kinetics.
- For the relevant authorities to give consideration to possible areas of localised enrichment.

5.1.12 Aquaculture

- For the responsible authorities to vet carefully all applications for fish/shellfish farms with due weight being given to the appropriateness of the site.
- To limit localised nutrient enrichment by appropriate siting of cages, controlling stocking densities and encouraging good husbandry.
- To control the use of fish farm chemicals.
- To analyse and strike a balance between the potential benefits and risks of fish farm developments.
- To maintain Great Britain's status as a zone free of List II fish diseases, and of other diseases notifiable under UK legislation, by a programme of inspection and sampling.
- To undertake research that complements MLA's advisory, regulatory and statutory obligations.

5.1.13 Nutrient Enrichment

- To encourage research into aerial deposition of nutrients, on which there is relatively little information available.
- To continue or increase monitoring of nutrients in the Moray Firth.
- To construct a nutrient budget for the Moray Firth.

5.1.14 Persistent Substances

- For the relevant regulatory bodies to co-ordinate appropriate monitoring, e.g. undertaking a gastropod survey in Findhorn Bay.
- For results of monitoring to be made available to the public and published routinely in a readily comprehensible form.