

chapter

6

**Overall assessment**

## 6.1 Introduction

The purpose of this final chapter is to focus attention on the impact of human activities upon Region III and to highlight instances where remedial actions at both national and international level are leading to improvement; including those resulting from the OSPAR strategies on hazardous substances, radioactive substances, eutrophication, ecosystems and biological diversity, and offshore activities. Attention is also drawn to other issues, not necessarily within the OSPAR field of influence, where improvements in knowledge or measures to mitigate clearly identified and adverse impacts are necessary. Among the former are improvements in the way data are gathered so as to facilitate their interpretation and assessment for decision-making purposes.

The issues identified have been prioritised subjectively according to their geographic scale, their broad ecological implications and the extent of their impact on economically important resources or amenities. In assigning priorities to particular conditions, account has been taken of the nature of the change or hazard in question, whether it is of natural or anthropogenic origin, the adequacy of existing scientific knowledge and the measures currently in place that should serve to mitigate the condition. In most cases suggestions are made as to what could be done to remedy the situation, based primarily on an assessment of scientific and technical feasibility.

A number of issues are included because they are considered to be of importance either in some parts of Region III or in other areas of the North-east Atlantic. However, because the science indicates that, in Region III at least, the scale and ecological significance of the impacts are currently small, all are ranked lower in terms of priority. This does not mean that no action is required. Rather, it indicates that, provided the measures currently in place to control the sources and activities responsible for the impacts are maintained, it is reasonable to assume the impacts will be reduced in line with both OSPAR and EC objectives.

This report is based on three subregional reports prepared in relation to pre-selected areas of Region III. The lead government departments in Ireland and the UK are making separate arrangements for their publication. The reports reflect the different states of knowledge and past methodologies used to gather data in the subregions. As a consequence, comparisons across the entire region are sometimes difficult. Some possible solutions to such problems are given in Sections 6.2 and 6.3 and a brief summary of the overall status of Region III is provided in Section 6.4.



## 6.2 Assessment of human impacts

### 6.2.1 Issues of high importance

The following issues are considered to be of high importance because of their effects across the whole of Region III and beyond.

#### Fishing

Although certain areas are subject to more intense activity than others, for example certain *Nephrops* grounds are trawled over five times a year, fishing is a long-established practice throughout Region III and almost by definition has one of the biggest impacts on marine life. By its very nature and scale, fishing has an impact on target stocks. However, the precise extent of that impact can be difficult to assess, partly due to incomplete data on discards and recorded fish landings which, in turn, are partly due to the present system of setting landing quotas for each catch region. Together these mean it is often difficult to obtain accurate data with which to estimate fishing mortality and population size and without such data it is not possible to define a level of fishing effort that will ensure the protection of stocks. However, the setting of precautionary thresholds for stock biomass and fishing mortality seeks to allow for such uncertainty. As it is, stocks of several species i.e. cod, hake, saithe, whiting, plaice and sole are considered to be outside safe biological limits in parts of the region while for several other species e.g. skates and rays, the data do not at present allow an appropriate assessment.

Fishing also has an impact on non-target stocks of fish, and on birds and marine mammals, through their incidental catch in fishing gear. Data on which to assess scale and significance are limited but there is concern that mortality rates of porpoises in the Celtic Sea bottom-set gillnet fishery, aimed primarily at hake, are unsustainable. The long-term impact of fishing disturbance on benthic communities and the seabed is dependent on fishing intensity, design of the gear and sediment type. Certain gears, in particular beam trawls and scallop dredges, do have an impact on the seabed due to physical disturbance; this in turn affects the benthic communities and possibly also the transport of seabed material and contaminants. Although some research has been done on this issue (mainly in the Irish Sea), there is currently no conclusive evidence to show that either effect has serious consequences in Region III. Although most of the evidence suggests that the effects of physical disturbance are short-term and reversible, present efforts to clarify the position should be maintained.

#### Endocrine disrupters

Endocrine disruption caused by TBT is a well-established

phenomenon in Region III. However, less obvious interference with the reproductive capability of fish has been detected in freshwater species downstream of particular industrial sites and sewage discharges and similar effects have now been shown to occur in some marine invertebrates and fish. The effect on individuals is, in most cases, fairly obvious but the impact at species and population level needs to be clarified. If shown to be of significance in terms of reproductive potential, efforts to identify and control the causative agents will need to be increased. At present it is suspected that many compounds are involved, of which PCBs, certain industrial detergents and chemicals used as human contraceptive agents are but three of the groups.

#### Tributyltin

The endocrine disruption effect of TBT used in antifouling preparations led in the UK and Ireland to the prohibition in 1987 of TBT in antifouling paints used on small boats (< 25 m) and on equipment used in mariculture. There is clear evidence that these measures have been effective in Region III. In areas close to concentrations of small boats and mariculture operations a reduction in TBT concentrations in the water and a recovery in populations of dogwhelks and other affected species is evident. However, TBT-related responses are still very obvious where illegal use persists (e.g. on fishing vessels) and in areas affected by run-off from boat yards. They are also apparent in the vicinity of ports, harbours and major shipping lanes due to the permitted use of TBT on the hulls of larger vessels. The IMO has recommended measures to prohibit the new treatment of ships with organotin compounds which act as biocides with effect from 1 January 2003, with a total ban coming into force on 1 January 2008. If adopted this would apply to all vessels within the region.

#### Coastal development

Except for the sparsely populated west coasts of Scotland and Ireland there is considerable pressure for more extensive use of coastal land for industry, housing and resort areas such as campsites, but at the same time the number of areas recognised as important from a conservation standpoint is increasing. Many of these are being designated as special areas of conservation, nature reserves and/or sites of special scientific interest etc. with various levels of legal protection accompanying the designations. Careful consideration should be given to resolving the complex social, legal and administrative issues involved as there are likely to be serious conflicts of interest between the needs to protect designated conservation areas and the pressure of human requirements for housing, leisure etc.

### Climate change

There is evidence of an increase in both frequency, and perhaps severity, of storms and also of an increase in temperature. Whilst a definite trend is difficult to assess against known natural variability, the expectation of continued change will have to be allowed for in planning coastal defences and coastal development generally. It will also have to be taken into account when considering what measures can be taken to protect species and habitats. In this context, as climate change is likely to be accompanied by changes within ecosystems, it will also complicate the identification and assessment of other changes attributable to human activities.

#### 6.2.2 Issues of medium importance

The following issues are considered to be of medium importance because although they also have ecological implications and/or impacts on economically important resources, their impact is generally considered to be contained within Region III.

### Sewage

Most of the inhabitants of Ireland and the UK live close to the coast and the sewage from most coastal towns, and indeed many settlements well inland, is discharged to the sea. Until fairly recently, many of the sewage discharges received either no treatment or only primary treatment (i.e. settlement) to remove solids. Consequently a great deal of undegraded organic matter entered the sea and, where screening was inadequate, sewage-derived debris added to the litter problem in beach areas. As a consequence of the EC Directive on Urban Wastewater Treatment (91/271/EEC) many sewage discharges are now receiving, or will soon receive, secondary treatment and this will help to reduce both the litter problem and the potential for organic enrichment and deoxygenation in coastal waters. It will not always adequately reduce either nutrient or microbiological contaminant inputs. Accordingly, where the receiving environment is showing signs of eutrophication, further treatment may be necessary to remove either nitrogen or phosphate or both. If sewage discharges adversely affect bathing waters or shellfish growing waters further treatment in the form of disinfection and/or alterations to the discharge location may be required.

### Litter

Litter clearly has an impact on aesthetic values and the cost of clearance from amenity beaches in particular can be considerable. It also has an impact on certain marine species but the scale to which this occurs within Region III is unclear. Much of the problem can be shown to be of

local or regional origin and controls of local sources would go a long way towards solving the problem. To achieve this will, however, require a major effort to educate the public and those involved in the tourism, fishing and shipping industries.

### Microbiological contamination

As a consequence of the EC Bathing Water Directive (76/160/EEC) a high proportion of bathing beaches in Region III now meet the mandatory standards. There are, however, some notable exceptions, particularly along the north-west coast of England, and further improvements are needed in this area. Many of the necessary improvements are planned. In England, the designation in July 1999 of a further 76 new shellfish waters under EC Directive 79/923/EEC, and the extension of the seventeen existing designations, should lead to further improvements in water quality around coasts and estuaries and should help improve nearby bathing waters.

### Mariculture

Mariculture is now a major industry in Ireland and Scotland. The main species cultivated is Atlantic salmon, but large numbers of mussels and oysters are also reared, especially in Ireland. Inappropriate siting of fish and shellfish farms has, in some cases, given rise to organic enrichment of the sediments beneath the cages or rafts and also, in the case of fish cultivation, to nutrient enrichment through surplus food and excreta. Interactions between intensive finfish farming and the surrounding environments are of concern in a number of areas, especially in western Scotland where the industry has grown rapidly.

The development of serious infestations of caged salmon by sea lice could lead to the spread of lice to wild stocks of salmonids and some sea trout stocks may be adversely affected by this route. The solution is better farm management and fish husbandry but, where this involves the use of chemicals for parasite and disease control, concerns have been expressed about the impact on other species due to the toxicity and persistence of the chemicals used. However, the evidence offers little support to these concerns, or to worries about the development of antibiotic resistant bacteria. The impact of escaped stock in terms of interbreeding with wild stock is at present unclear but it is feared this could lead to an impaired homing instinct and a general deterioration of genetic diversity. This is mainly an issue for salmon at present but could involve other species in the future as the range of species cultivated is extended.

There are concerns over the introduction of certain cultivated shellfish species because ecological problems could develop if temperature increase allowed them to

breed more readily and thus to become widely distributed. At present under EC rules there is, in principle, free movement of shellfish between all EU countries. There have already been several cases where disease (e.g. *Bonamia*) and parasites (e.g. *Mytilicola*) have been spread as a result of inadequate control of stock movements. Such problems can affect wild as well as cultured stock and better controls appear necessary.

### Biotoxins

All major shellfish growing areas in the region are now subject to regular monitoring both for the presence of toxin-producing algae and toxins in shellfish products. This, coupled with expansion of commercial shellfish production, has greatly increased the probability that biotoxins will be detected. There has indeed been an increase in the number of harmful bloom events but there is no clear indication of the cause. Whilst the involvement of nutrient inputs as a consequence of land run-off and sewage discharges etc. cannot be ruled out in every case there are many instances, for example off the south coast of Ireland and the west coast of Scotland, where it is unlikely to be a contributory factor in large-scale algal blooms. It is also apparent that the presence of toxin-producing species does not always lead to biotoxins in shellfish. Further work is required to understand the causes of toxin production. Meanwhile continued monitoring is necessary to ensure human health protection.

### Metallic contaminants

Metals are naturally present in sea water and run-off from land is part of the natural geological weathering process. Inputs are, however, increased as a consequence of mining and industrial activities and through use of metals and their salts in various applications. In sea water, dissolved metals rarely achieve concentrations that are directly toxic to marine biota but, through bioaccumulation, some metals can occasionally achieve tissue concentrations that are toxic to organisms and their predators, including humans. Within Region III, the concentrations of cadmium, mercury, lead, chromium, nickel, arsenic, silver etc. in sea water are well below the levels likely to give rise to toxicity, as indicated by reference to the ecotoxicological assessment criteria adopted by OSPAR. However, in some heavily contaminated estuaries, such as the Mersey, the northern coast of the Bristol Channel between Swansea and Cardiff and the Avoca river on Ireland's east coast, Environmental Quality Standards set for the protection of marine species are exceeded for copper and zinc and this could account for some of the effects seen in bioassay results. The concentrations of mercury in the flesh of fish from

Liverpool and Morecambe Bays did in the past give rise to concern but, following reductions in inputs from the chlor-alkali industry, there are clear indications of a downward trend and the concentrations are now considered acceptable. However, the concentrations of mercury in the livers of seals, porpoises and dolphins in the northern Irish Sea occasionally exceed 100 mg/kg, a level that may have some toxicological significance. This needs to be clarified and there should be no relaxation over present controls on discharges of mercury.

In the few estuaries contaminated with high levels of copper and zinc, and in the Liverpool/Morecambe Bay areas where the mercury level was high, monitoring ought to continue. Elsewhere, however, given that prevailing concentrations of metals in water, sediments and harvested species do not give rise to concern, and because the changes that can be expected are very small, there seems little benefit in continuing extensive monitoring of metal distributions or trends in most parts of Region III, where selective monitoring on a precautionary basis would be adequate.

### Polycyclic aromatic hydrocarbons

Polycyclic aromatic hydrocarbons reach the marine environment via sewage discharges, surface run-off, industrial discharges, oil spillages and deposition from the atmosphere, and result largely from incomplete combustion of fossil fuels. Lower molecular weight PAHs can be acutely toxic to aquatic organisms and some form carcinogenically-active metabolites. Residues in sediments have been linked with liver neoplasms and other abnormalities in bottom-dwelling fish. Elevated PAH concentrations may therefore present a risk to aquatic organisms and potentially also to human consumers of fish and shellfish. There are indications that sediments in a number of the region's industrialised coastal inlets contain significantly elevated PAH concentrations and that concentrations in sea water adjacent to Irish Sea coasts, although in the ng/l range, may affect the growth of mussels and possibly other organisms. Further research into the speciation, sources, biological implications, sinks and trends in environmental concentrations of PAHs appears warranted.

### Oil spills

Oil as a pollutant of the marine environment arises from two main sources, accidental spillages and illegal operational discharges from ships. Although the latter are believed to be infrequent, the localised occurrence of oil or tar on beaches is often noted during shoreline surveys. Large-scale oil spills are much more significant and Region III has not escaped their impact. The most recent spill came from the Sea Empress in early 1996. However,

despite the images of destruction and the loss of seabirds in particular, large spills generally have only a transient effect on most impacted species and amenities. The economic impact of an oil spill, in terms of the cost of clean-up to protect tourist and wildlife interests, is often substantial and may be additionally so if fixed fishery resources (e.g. mariculture and shellfisheries) are affected. The solution to chronic oil pollution from illegal discharges is better observation of the rules by ship operators and stricter enforcement by the authorities. Occasional accidental spillages are probably inevitable but the risk of their occurrence can be reduced by measures such as the traffic separation schemes already in operation and by supervising navigation to ensure that ships avoid the more hazardous inshore routes whenever weather permits.

### Ballast waters

The discharge of ballast waters can lead to the introduction of non-indigenous species but the scale of the problem in Region III is unclear. Various means of preventing such introductions have been under review by a joint ICES/IMO working group. Pending the conclusions of that group, there seems little that can be done apart from monitoring areas adjacent to the most likely points of entry and preventing, where possible, the establishment of breeding populations. Once established, removal is almost certainly impractical.

### Ships on passage

Although there are a number of traffic separation schemes in operation in the region which are intended to reduce the chance of ship collisions, the risk of other forms of accidents e.g. loss of cargo or the ship through mechanical failure or storm damage, remains. Thus far within Region III loss of deck cargo and/or chemical spillages have presented few serious problems. Nevertheless, the potential for damage exists if certain hazardous materials are lost close to mariculture sites, spawning grounds or centres of human population. At present it is clear that the number of shipping movements in the region is increasing but data on the type of shipping movement and the cargoes involved are difficult to access. It is therefore impossible to assess the potential for accidents (through collisions, loss of cargo or ship) and thus the potential for damage or the requirements for emergency response. A solution to the problem of data accessibility ought to be found prior to the next quality status report.

### 6.2.3 Other important issues

The issues assigned to this group fall into four categories:

- those affecting very few areas in Region III;
- those perceived to be problems by the public but where the scientific evidence does not support these concerns; and
- those which warrant further scientific research to clarify their potential for environmental degradation.

### Organochlorine pesticides

The use of most organochlorine pesticides has been in decline since the 1960s and none of the substances routinely monitored are now present in concentrations that present a significant risk to either marine species or human health. In the past, DDT residues were suspected of being a partial cause of eggshell thinning in some seabird species but this is no longer the case. Monitoring for organochlorine pesticides in the marine environment, especially for trend determination purposes, is both a complex and expensive undertaking. Considering the present concentrations of the suite of pesticides currently monitored the justification for continuing extensive monitoring of these substances is questionable. However, in view of the recent identification of elevated toxaphene residues in species from the area, clarification of the safe level of toxaphene for human consumers is necessary. Further work to establish more accurately the concentrations of individual chemicals within this group of compounds may also be necessary. Toxaphene is not used in north-west Europe and its presence in marine organisms caught in Region III is almost certainly a result of long-range transport from North and South America.

### Polychlorinated biphenyls

In the past concentrations of PCBs have been implicated in the death of seabirds (coupled with starvation through storms and shortage of food) and possibly eggshell thinning. The available evidence suggests that residues in fish and seabirds are decreasing but the rates of decay and dissipation of PCBs already in the environment is a slow process. Residue levels of PCBs in marine mammals may be high enough to cause harm, especially when the animals suffer a shortage of food or illness and their contaminant body burden is mobilised along with their fat reserves. Similar fears relate to the well-being of young bottle-nose dolphins in Cardigan Bay (through mobilisation of the mother's body burden during lactation) as this population has unusually high PCB concentrations in body fat. As it is impractical to protect marine mammals from natural stress, the need to continue present controls on use and especially disposal of PCBs remains a priority.

### Eutrophication

For the purposes of this report eutrophication has been examined with respect to the existence of persistent (or recurrent) 'undesirable' biological changes associated with increased nutrient concentrations in the environment. It is clear that within the Irish Sea and many estuaries concentrations of both nitrate and phosphate have been anthropogenically enhanced. However, very few areas are considered to be eutrophic within the terms of the definition outlined above. In UK waters only the Mersey Estuary/Liverpool Bay area and Belfast Lough are considered to be showing signs of eutrophication and in Ireland only inner Cork Harbour is considered to be showing signs of eutrophication, with parts of Dublin Bay (and a few estuaries to the north of Dublin Bay) being affected for limited periods. In no case does the degree of eutrophication cause serious biological damage and in all cases it is anticipated that remedial measures in the form of amended agricultural practices and improved sewage treatment will improve the situation.

### Deoxygenation

Sags in oxygen concentration exist in a number of Irish estuaries, in the heavily urbanised Mersey Estuary and in Belfast Lough and occasionally, at times of stratification, in Liverpool Bay. In addition, a limited area of seabed around the Garroch Head sewage sludge disposal ground is affected as a consequence of high concentrations of organic matter arising from the sludge disposal operation. In the two sludge disposal areas, Liverpool Bay and Garroch Head, oxygen depletion is associated with the (former) sludge dumping, rather than decaying algal blooms. In no case is the spatial scale of the impact or its biological effect of ecological concern. Nevertheless, it is anticipated that further treatment of industrial effluent and sewage will lead to improvements in the quality of the affected estuaries and this, coupled with the cessation of sewage sludge disposal, should lead to elimination of oxygen sags in the Liverpool Bay and Garroch Head disposal grounds.

### Radioactivity

The question of radioactive contamination, particularly that arising from the Sellafield nuclear fuel reprocessing plant, is a matter of concern to the public. This concern stems from the higher levels of radioactivity discharged in the past, that sophisticated systems can detect the signal far from the source and recent increases in the discharge of certain radionuclides, particularly technetium-99. However, technetium is of low radiological significance and there have been substantial net reductions in the levels of many other more harmful radionuclides over the last decade. Recent OSPAR commitments indicate this

process (including reductions in technetium) is likely to continue and that radioactivity levels will continue to decline. In terms of exposure to the public, the incremental risks to health due to present discharges from Sellafield are extremely small. For example, in Ireland a heavy consumer of fish and shellfish from the Irish Sea in 1997 would have received an estimated dose of 1.4  $\mu\text{Sv}$  compared to the current dose limit which is set at 1000  $\mu\text{Sv}$ . This would amount to an addition of 0.05% to the average dose of 3000  $\mu\text{Sv}$  received from all other sources of radiation. In the UK the highest reported dose was received by consumers on the Cumbrian coast in 1981, amounting to 3450  $\mu\text{Sv}$  or 69% of the then recommended dose limit of 5000  $\mu\text{Sv}$  (using an enhanced gut transfer factor for plutonium). Exposure levels to marine species are also well below those known to cause adverse effects.

### Munitions

In the past, quantities of surplus and out of date munitions have been disposed of at sea, usually at sites some distance from land. An exception was the use of the deep trough known as Beaufort's Dyke in the North Channel between Northern Ireland and Scotland. From time to time items are washed up on beaches along the east coast of Ireland, the Isle of Man and the west coast of Scotland. The munitions most commonly found are phosphorus incendiary devices; these present a hazard to beach users and are a source of public concern. It is no longer possible to establish exactly what materials and what quantities were deposited in the Beaufort's Dyke or in the general vicinity of the designated disposal area. Detailed surveys of the seabed have clearly established that some material was dumped outside the disposal area as originally marked on the charts; the charts have now been amended. Provided the munitions remain undisturbed on the seabed they do not present a hazard. This applies to both incendiary devices, which only ignite on contact with the air, and those containing phosgene gas, which if it does seep out will be hydrolysed into harmless substances on contact with the water.

### Military activities

Military activities can lead to disturbance of wildlife and interfere with other uses of the areas involved. In most cases, however, animals appear to get used to noise and many areas used by the military are regarded as wildlife havens and, in some cases, are designated as conservation areas largely because they are not subject to other forms of human interference. There has, in the past, been a number of incidents involving submarines and fishing vessels and more than 50 lives were lost in this way. The frequency of such incidents has been lower in recent years.

### Dredged material

Although some dredged material is contaminated with metals and other substances in most cases its disposal is not a significant source of contaminants. Disposal sites are now carefully selected to ensure that the physical impacts of disposal are of little consequence for surrounding ecosystems. In a few cases contamination levels have been sufficiently high that release has contributed to contaminant residues in sediments and biota outside the disposal area. However, improved control over land-based sources of contaminants is expected to reduce the contaminant burden in dredged material. Furthermore, the regulatory requirements now governing the disposal of any highly contaminated dredged materials preclude their disposal at sea.

### Sand, gravel and maërl extraction

Removal of marine sediments for building or other purposes is currently not a major activity in Region III. In the past, extraction of sand from near shore banks has led to beach erosion but the dangers of this are recognised and extraction is now only permitted after careful assessment of such issues. The process of removal of seabed material inevitably involves some disturbance of the benthos and alteration of the seabed profile. This can lead to major local changes. The planning regimes now being introduced by the Irish and UK authorities should preclude unacceptable changes (e.g. large-scale habitat alteration and interference with fish spawning) should demand for marine aggregates increase.

### Offshore developments

Although the downturn in oil prices has meant the scale of exploration for, and exploitation of, oil and gas deposits is low in Region III at present, there is believed to be considerable scope for expansion in the future. Changes to benthic communities have been identified over relatively large areas surrounding established oil production platforms in other parts of the OSPAR area, e.g. the North Sea where oil-based drilling muds were used and discharged. Whereas such muds have been used in Region III, their discharge to the sea has been prohibited for some time. All operations are now subject to strict national legislation in line with OSPAR requirements and any impact should be minor and localised. There are plans for more land-based wind power generators at a number of coastal sites and for both wind- and wave-power generation systems offshore. Precautions are needed to ensure these do not interfere with other users of the sea, particularly fishing and shipping, and to safeguard habitats.

### 6.3 Adequacy of knowledge and availability of data

The process of producing this report, and particularly the three more extensive subregional reports on which it is based, has revealed a remarkable amount of information, much of which has not previously been compiled or assessed for management purposes. Nevertheless, there are a number of topics about which our understanding is relatively poor. Some of these have been mentioned in the previous section on prioritisation of issues, for example:

- the effects of fishing on benthic species and marine mammals;
- factors causing the development of toxin-producing species of algae and why the presence of such species is not always associated with the formation of toxins, or at least the occurrence of such toxins in shellfish;
- the risks of introducing non-indigenous species via ballast waters;
- data on fishing discards, of both target species and non-target species, and more accurate fish catch statistics;
- the scale and causes of endocrine disruption in marine species; and
- data on the passage of ships carrying cargoes of hazardous materials.

Other needs include better understanding of the implications of, and reasons for, reduced SFG in mussels. There is a lack of consistent, good quality, time series data sets (e.g. on nutrients) and it is difficult to establish trends in contaminant concentrations. There is also a need to compile data on human activities (e.g. tourism and construction) that are specifically relevant to the coastal zone. More fundamental, perhaps, is the lack of understanding concerning the relationships between trends in climate and changes in physical hydrography and how this might influence patterns of water movement and biological production. There is also a lack of understanding of the role of fronts in affecting the abundance and distribution of fish, fish eggs and larvae and as sinks for contaminants attached to suspended particulate material.

### Inputs

The efficacy of input reduction measures can only be assessed with confidence if the data relating to input measurements are reliable. Transport, agricultural, industrial, residential and recreational activities have substantially altered and added to the flux of contaminants reaching the marine environment and in recent years measures have been taken to reduce some of these inputs. Some of the data available for inputs to Region III

are questionable, largely because of the number of inputs for each pathway (rivers and industrial and municipal discharges), seasonal variability and differences in sampling strategies used by different agencies.

Furthermore, estimates of atmospheric inputs to the region (which for some contaminants constitute a high proportion of the total input) are very tentative due to the scarcity of stations for sampling atmospheric deposition. As a result, it is not possible to determine what proportion of the actual input the current data represent or that the load estimates for different parts of Region III are comparable. A particular difficulty centres on those data reported on the basis of concentrations below a specified detection level. This applies particularly to riverine inputs where the volumes are large and detection levels used by different agencies differ widely. For some catchments the problem is exacerbated because measurements are too infrequent to account for the high seasonal variability of river discharges. Clearly, improvements are necessary if the effectiveness of the various input reduction measures is to be assessed. Harmonisation of sampling methodologies and the use of more realistic detection limits will be required. For the purpose of assessing trends in the inputs of many substances it might be more cost-effective to refocus sampling as close as possible to the main known sources.

#### Intra-regional comparability of data

Apart from the instances identified, the data assessed in this report were generally considered reliable and, as far as could be ascertained, comparable. One of the reasons for this has been the introduction of schemes for data quality assurance at national and international level. At national level, the UK's quality assurance schemes for chemical and benthic monitoring, and also for some bioassay techniques, have been particularly successful. The Quality Assurance of Information for Marine Environmental Monitoring in Europe (QUASIMEME) system of chemical analytical quality control has also improved the situation. Nevertheless, there are some notable disparities between the concentrations of PAHs reported by laboratories in Ireland and the UK and this raises questions as to whether the methods used by the two parties are actually measuring the same substances or categories thereof.

More serious differences arise in the comparability of data on metals in sediments where several laboratories supplying data did so using normalisation procedures that were not in line with ICES/OSPAR recommendations. In another case an important data set on metals in sediments was reported as 'wet weight' rather than the standard 'dry weight'. The other major problem arose over disparate and often inadequate procedures for measuring input loads. The adoption of detection limits suited to

input measurement rather than compliance with quality standards, and closer harmonisation of sampling frequencies, would help to improve this situation.

## 6.4 Overall assessment and conclusions

The coasts and seas of Region III exhibit marked differences in both natural characteristics and human pressures as well as the degree to which human activities are changing the environment. Generally the waters off the west coasts of Ireland and Scotland are relatively unimpacted by contamination arising from within the region. The main needs in these areas are to ensure that exploitation of their mariculture potential does not result in serious contamination and disruption of natural ecosystems and that recreational activities, and associated developments, do not cause long-term damage to valuable habitats and landscapes.

Ecosystem effects due to pollution are, for the most part, confined to urbanised estuaries such as inner Cork Harbour, the Liffey Estuary and inner Dublin Bay, Belfast Lough, the upper reaches of the Bristol Channel, the Mersey Estuary and Liverpool Bay, and the upper Clyde Estuary. Less obviously, much of the Irish Sea is subject to elevated levels of contaminants ranging from nutrients to metals, organochlorine pesticides, PCBs and radionuclides. Environmental levels of most contaminants routinely monitored appear to be either stable or decreasing. Apart from TBT, there is little scientific evidence to indicate that present concentrations of these contaminants, either alone or in combination, have been harmful to populations or communities of marine biota. Nevertheless, in the absence of more extensive biological effects monitoring, the possibility of some localised effects (e.g. reduced Scope for Growth, endocrine disruption, changes in community structure, loss of biodiversity) on marine biota due to chronic exposure to contaminants cannot be ruled out. Monitoring of commercial species from the Irish Sea and elsewhere in Region III has shown that seafood from the area is of good quality and safe to eat.

Certain other human activities are having an appreciable impact on the marine and coastal environment. Most notably fishing, where recent exploitation rates of some species in some areas have resulted in stock sizes that are considered to be below safe biological limits and where the impact on non-target species is often either unclear or clearly detrimental. The ecological significance of the constant removal by fishing of large amounts of biomass from the middle ranks of the food web, although largely unknown, could be considerable and warrants greater research.

Many environmental impacts, both at sea and on shore, are associated with the operation of commercial ships including ferries, cargo and fishing vessels. These

include the dredging of ports and harbours, operational and accidental discharges of oil, vessel-derived litter and netting, the importation of non-indigenous species in ballast water and the effects of antifoulant paints. Although such effects are generally localised, and in some cases intermittent, any trend towards increase in traffic, vessel size or port expansion ought to be associated with attention to environment protection measures.

In a number of areas the loss or modification of

coastal habitats due to construction for housing, infrastructure and recreational developments is at odds with the move towards better conservation of wildlife, scenic landscapes and sites of ecological or archaeological importance. This provides a strong argument for a more integrated approach to coastal zone management that includes the preparation of long-term plans for the use, development and conservation of coastal areas. Such plans are being developed in some areas.

