

Marine Environmental Issues in Maritime Education and Training

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ABSTRACT

In recent times there has been an increasing interest the impact of shipping and ports on the marine environment. Paradoxically, while shipping and Ports are seen as contributing to pollution, the industry is also seen as an environmentally acceptable form of transport, particularly when compared to road and air. Environmental legislation, for ships and ports, at the local, regional, national and international level is set to increase in the next ten years. An awareness of this legislation and the environmental issues should have a higher profile in maritime education and training.

This paper will outline:

- current environmental issues associated with shipping e.g. antifouling
- environmental and socio-economic impacts of the issues, and
- important environmental legislation as it affects shipping

Shipping and Port operations exert pressures on the marine environment.

1. Introduction

Shipping and Port operations exert pressures on the marine environment. Shipping is seen by some as a contributor to marine pollution. In 1990, while being non-specific, marine transport is estimated to contribute some 12% of marine pollutants. Land based inputs were estimated as making the largest contribution. Others see marine transport as being the most environmentally acceptable mode of transport, particularly when compared to road and air (GESAMP, 1990).

Shipping safety and marine pollution are inextricably linked and in addition to legislation regarding ship safety, environmental legislation, for ships and ports, at the local, regional, national and international level is set to increase in the next ten years. An awareness of this legislation and the environmental issues should have a higher profile in maritime education and training.

Shipping and port activities can impact on the marine environment in two main ways:

- Accidental impacts: - e.g. oil spill resulting from collision or grounding/stranding, loss of deck cargo. The incidents tend to be unique and can be only anticipated by scenario setting. Legislation can help to minimise risk and mitigation of the effects of the accident can only be approached from a “toolbox” perspective
- Operational impacts e.g. toxic effect of antifouling paints, discharge of Sox and Nox emissions. The impacts, from ship and port operations, generally tend to be chronic and are often controlled by legislation. Mitigation of effects of operational impacts can be planned and controlled.

2. Environmental issues associated with shipping

2.1 Accidental Risks

Marine accidents, groundings or strandings may result in localised damage and disturbance to the seabed, but may also lead to loss of:

2.1.1 Oil, either as cargo or bunkering fuel, or **Hazardous cargo**, including noxious liquid substances and harmful substances carried by sea in packaged form e.g. pesticides, liquefied gas. The effects will be unique to the situation but the fuel or cargo will have a wide range of toxic or physical effects on marine habitats. The main impacts of both oil and chemical spills are either physical, e.g. smothering by crude oil, or, toxic, e.g. lethal effects of spilt oil or chemicals. It is thought that Birds, molluscs and fish eggs and larvae are particularly at risk from accidental spills.

GESAMP data, collected between 1973 and 1981, suggests that 400-300 thousand tonnes of oil entered the world's oceans by tanker accidents during that period (GESAMP, 1993).

2.1.2 Collision with marine mammals - While not common, collisions do occur and are particularly associated with high-speed craft. Also propeller injuries have been reported on marine mammals.

2.2 Operational Risks

2.2.1 Operational oil spills cargo and bunkering fuel – Operational spills are usually small but repetitive. The effects of these spills are chronic and localised. Impacts on marine habitats, include, physical disturbance, toxic to sensitive species and organic enrichment of the sediments. Annual operational spills of oil (in tonnes) have been estimated as:-

Non-tanker accidents – 750-200

Operational discharge 1080-600

Representing the second largest input of oil into the marine environment (GESAMP, 1993).

2.2.2 Emissions -Sox, Nox, CFC's and VOCs are all regarded as contributing to atmospheric pollution leading to global warming, poor air quality and acid rain. The input of Sulphur and Nitrogen Oxide by shipping is small in global terms. However in regions with a large volume of shipping traffic; there maybe significant regional problems (ImarE, 1996).

2.2.3 Antifouling toxins – The biocides e.g. TBT, Triazines, in some antifouling coatings can leach into the surrounding water and accumulate in benthic organisms and sediments. These biocides, by their nature, are harmful to a range of marine organisms. The nature of the toxicity is chronic and can effect such functions as morphology, growth and reproduction of a range of marine species.

2.2.4 Discharge of ballast water and associated non-native species – The introduction of non-native species via the discharge of ballast water is well documented. These species can be detrimental to local species through competition for space or nutrients or they can be toxic and affect local fisheries.

2.2.5 Noise - Some evidence that vessel noise can disturb marine mammals and fish. There is particular concern over cetaceans that may experience disturbance to feeding and breeding. Cargo handling noise may also disturb mammals e.g. seals and waterfowl.

2.2.6 Ship and boat wash – Ship wash may result in erosion of intertidal and shallow water habitats. The resuspension of sediment may also lead to resuspension of toxins in the sediment. Currently there is great concern regarding the impact wash generated by fast-craft.

2.2.7 Waste disposal at sea/ in port – Marine mammals and birds can swallow or become entangled in plastic litter from ships, often leading to fatalities. Distinguishing between ship or land garbage is difficult.

Beachwatch 96 (UK) estimated that shipping generated some 17.4% of the total debris collected on UK beaches.

2.2.8 Dredging and disposal of spoil –Maintenance and capital dredging disturbs the seabed leading to damage of benthic ecosystems (physical and smothering by sediment), increased levels of suspended sediments and attendant pollutants/nutrients in the water column. In addition, the disposal of dredge spoil can also damage other benthic communities by smothering and/or increasing the uptake of contaminants or nutrients by being resuspended into the water column from the dredged sediment (ABP, 1999, ANON, 1998, De Jong, 1997, GESAMP, 1990, ICS, 1993).

3. Environmental and socio-economic impacts of the issues

3.1 Socio-economic impacts

In addition to the direct biological, ecological and environmental impacts of shipping, there are indirect impacts on the economics and sociology of maritime regions. These are generally less obvious than the direct impacts. However there is evidence emerging that the general public are becoming more aware of the issues. A study

carried out by the European Commission in 1999 (ESPO, 2001) based on the views of representative samples of the population in each of the 15 member states threw light on the attitudes of the general public towards the environment. It found that :

- 8 out of 10 Europeans believe they live on ‘a planet in danger’;
- 5 out of 10 believe that it is necessary to ‘fundamentally change our way of life and development if we want to halt the deterioration of the environment’ and that ‘making regulations stricter’ is the best means of delivering this change.

But

- 8 out of 10 believe that an environmental protection policy must take into account ‘social and economic effects’.

It also found that industry spokespersons are the least trusted on matters of the environment (environmental protection organizations are the most trusted).

3.1.1 Sustainability

The International Year of the Oceans in 1998 focussed attention on the need for sustainable management of the ocean resources. Much attention has been placed on the sustainability of marine ecosystems, particularly coastal areas. The increasing exploitation of the coast continues on a global scale and the need for the sustainable development of human activities becomes increasingly important in Europe as well as the rest of the world. Shipping represents one of the human activities that exert a pressure on the coastal marine environment. Paradoxically, while shipping is seen by some as a contributor to marine pollution, in other areas it is seen as being the most environmentally acceptable mode of transport. The many global Short Sea Shipping initiatives recognise this fact.

3.1.2 Socio-economic impact assessment

The assessment of socio-economic impact of shipping is multifaceted and not easy to assess. The interests of maritime regions that could be affected by shipping are:

- Ports, harbours and marinas
- Health of residents and visitors to maritime cities and environs
- Fisheries
- Shellfish beds
- Tourism
- Nature reserves,

All of the above have a high socio-economic value to maritime regions. Ironically, tourism, ports, harbours and marinas are not only impacted by shipping operations, but may themselves contribute to socio-economic impacts (Tait & Dipper, 1998, Viles & Spencer, 1995).

3.2 The main activities associated with shipping that are known to have a socio-economic impact.

3.2.1 Oil Spills - Operational or accidental spills of oil or other hazardous cargo can affect all the named sensitive areas, the previously discussed physical and toxic effects can affect the regions fisheries, by smothering shellfish beds and its toxic nature to fish eggs and fry. In addition, the tainting of fish and shellfish flesh by oil is known to impact on fish sales, following an oil spill. Fishing grounds and shellfish beds may be subject to closure orders. This will have a direct effect on the fisheries economics of the area.

The physical effects of an oil slick will impact directly on the nature reserves and indirectly on tourism, resulting in a loss of tourism income to the region. Examples would be the loss of amenities due to oil cover, with these areas becoming unattractive to visitors. The loss of bird or marine mammals, due to oiling, leading to the nature reserves being less attractive to visit.

Harbours and marinas that are oiled may be themselves closed or seen as a less attractive to visit leading to loss of income in harbour and marina dues and the indirect loss of income generated in associated areas.

3.2.2 Emissions – There is some evidence that the input of Sulphur and Nitrogen Oxide can lead to localised poor air quality, which could have health implications for local residents.

VOC's from cargo, may cause environmental and health damage at a local level.

3.2.3. Ballast Water - Discharge of ballast water may lead to the introduction of non-native species. Historically many of the established introduced species have an impact on shellfish beds. These take the form of competitive or pathogenic species, either of which can have a detrimental effect on the commercial shellfish beds.

Additionally, Some toxic or harmful species are known to be transported in ballast water. Toxins accumulated by shellfish can be harmful to the health of human and marine mammals e.g. PSP.

The vibrio bacterium causing Cholera, *Salmonella* sp. and faecal coliforms are also known to be transported in ballast tanks and represent human health hazards (Rawlings *et al.*, 1999, Knight *et al.*, 1999)

3.2.4 Garbage - Marine debris is generally unsightly and not attractive to visitors, thus impacting on tourism. Medical products associated with debris may pose a health risk. As stated before, it is difficult to distinguish between land and marine debris.

3.2.5 General contamination - As outlined previously, there are many sources of contaminants associated with shipping, e.g. antifouling, dredging activities. Any contaminant that is bio-accumulated in marine organisms, particularly shellfish. may pose economic and health risks (Barrow,1997, De Jong,1997).

4. Environmental Legislation as it Affects Shipping and Ports.

As stated earlier, shipping safety and marine pollution are inextricably linked. Some environmental legislation deals directly with environmental protection eg MARPOL, while other instruments are primarily aimed at at ship and human safety, eg SOLAS, but indirectly have an influence on environmental safety.

4.1 International Legislation

The Marine Environmental Protection Committee (MEPC) of the International maritime Organisation (IMO) are committed to implement regulation in order to mitigate the effects of shipping on the environment. The MARPOL Convention was adopted in 1973 and covers the regulation of pollution of the seas by shipping. Originally intended to cover oil pollution as OILPOL and subsequently MARPOL, it now covers many other contaminants:

Annex I- Oil

Annex II – Noxious Liquid Chemicals

Annex III – Harmful Goods (packaged)

Annex V – Garbage

Annex IV- Sewage

Annex VI – Air Pollution (Nox, Sox, from ship exhausts and emission of ozone depleting substances)

In addition IMO are committed, by means of new Annexes to MARPOL or by new conventions,

- to:Global prohibition of TBT in Antifouling coatings, application ban by 2003, with total ban by 2008, and
- Control and management of Ships' Ballast water to minimise the transfer of Harmful Aquatic Organisms (IMO,2000)

Also of Interest to IMO are, dumping at sea, double hulls, prevention of accidental pollution (SOLAS), compensation for pollution and the designation of “special areas”(IMO, 1998,a, IMO, 1998,b)

4.2 National legislation

Many countries and regions are now adopting their own legislation with regard to the protection of the marine environment. Examples include:

From 1 July 2001, Australia has new mandatory ballast water requirements. Any ship arriving in Australian waters will be required to undergo a ballast water risk assessment and then undertake an approved management option. Interestingly the legislative framework for the new requirements is under the Quarantine Act, 1908 (AFFA, 2001)

The European Union has recently legislated on air emissions and port waste reception. Increasingly the EU is looking at shipping in sustainable terms within the framework of integrated coastal zone management.

Increasingly, regional governments and individual Ports implement legislation or guidelines with respect to marine environmental protection.

5. Education and Training

Within STCW, the protection of the marine environment and the prevention of pollution are recognised as being important within training for navigational watch keeping. In addition, the special requirements for tankers are also recognised.

The ISM Code provides an international standard for the safe management and operation of ships and for pollution prevention.

Education and training to STCW and the ISM code will give a basis of knowledge and understanding of the maritime environmental issues. Many IAMU institutions educate their students to a higher level, some offering postgraduate courses in environmental issues. However, more could be done to educate seafarers to the environmental and socio-economic impacts of shipping and port operations.

6. Conclusions

There are many environmental issues associated with Shipping and Port operations. Some of these issues have socio-economic impacts on the communities in maritime areas. However, shipping is seen as an environmentally acceptable method of transport.

International, national and local legislation and guidelines help control and regulate the impact of shipping and port operations on the marine environment.

Increased training is needed in the environmental and legal issues and is recognised within STCW and the ISM code. Education and training in environmental issues will lead to a better educated workforce with a deeper understanding of the environmental and socio-economic impacts of shipping. This better awareness should help in the further development of legally compliant and ultimately a sustainable industry.

The challenge remains to reduce environmental damage by maritime operations to a level that is acceptable and sustainable.

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