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The Environmental Impact of Naval Practices in Navy Bases.

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1. Introduction

All Shipping and Port operations exert pressures on the marine environment. Paradoxically, while shipping and port activities are seen by some as a contributor to marine pollution, in other areas shipping is seen as being one of the most environmentally acceptable modes of transport. While sharing some of the same impacts as the merchant fleet, the navies of the world and their bases produce some particular environmental pressures. While the international merchant fleet is governed by international/ regional/ national and local conventions and directives concerning the protection of the marine environment, in many cases the worlds' navies are exempt.

Generally all shipping and port activities can impact on the marine environment in two main ways:

a. 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, however and mitigation of the effects of the accident can only be approached from a "toolbox" perspective

b. 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.

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 (GESAMP, 1990).

In addition to the direct environmental impacts of shipping, there are indirect impacts on the sociology and economics of the region. These are generally less obvious than the direct impacts. The assessment of socio-economic impact of shipping is multifaceted and not easy to assess (Tait & Dipper, 1998, Viles & Spencer, 1995).

The interests that could be affected by naval shipping and ports include: Fisheries, Shellfish beds, and the health of the local population.

2. Common Impacts From Combined Shipping And Port Operations

a. Oil

Oil spills can generally be "accidental" spills, usually large, of either cargo or bunker fuel, or, operational oil spills. 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. It is currently impossible to differentiate between military and merchant sources.
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).

Oil spills can seriously affect fisheries and shellfisheries either by a toxic effect or by tainting the marketable fish.

b. Emissions

Sox, Nox, from engine emissions and CFC's e.g. Halons and VOCs are all regarded as contributing to atmospheric pollution leading to global warming, poor air quality and acid rain. Sox inputs are related to fuel quality in terms of the sulphur content of the bunker fuel, while NOX emissions are related to the age, and service condition of the ships engines (ImarE, 1996). CO2 is also starting to be a cause for concern. Increased speeds and high performance engines increase the emission of not only of CO2 but also Sox and Nox. Generally 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 particularly in large port areas.

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

c. Antifouling Toxins

The biocides in antifouling coatings e.g. TBT, copper, Triazines, in some antifouling coatings can leach into the surrounding water and accumulate in bottom living 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 affect such functions as morphology, growth and reproduction of a range of marine species. The IMO ban on TBT based paints effective from January 2003, will affect the world's merchant fleet, and indeed the Royal Australian Navy is already trial ling a non tin antifouling paint on one of her ships in a scheduled phase in of tin free paints (ANON, 2002,a)

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

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

While warships carry relatively low volumes of ballast water, the fleet auxiliary ships can carry large volumes which could have an impact within a port. Historically many of the worlds introduced species can be linked to either ballast or heavy fouling and relatively fast movement of naval shipping in times of conflict.

e. 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. Low Frequency Active (LFA) Sonar is also suspected of contributing in the stranding of whales. LFA is thought to disorientate and stress mammals to such a degree they go into panic speed swimming (Anon, 2000). Cargo handling noise may also disturb animals e.g. seals and waterfowl.

f. 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.

g. Waste Disposal At Sea/ In Port

Marine mammals and birds can swallow or become entangled in plastic litter form ships, often leading to fatalities. Distinguishing between ship or land garbage is difficult. Beach watch 96 (UK) estimated that shipping generated some 17.4% of the total debris collected on UK beaches

h. 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 the dredge spoil can also damage bottom-living communities by smothering and/or the uptake of contaminants, nutrients etc, resuspended into the water column from the dredged sediment (ABP, 1999, ANON, 1998, De Jong, 1997, GESAMP, 1990).

Heavy metal contamination e.g. Copper, lead and zinc is particularly associated with the sediment in military ports

i. Hazardous Cargo

The accidental loss of hazardous cargo, including noxious liquid substances and harmful substances carried by sea in packaged form e.g. pesticides, liquefied gas, by merchant or military is not uncommon.

The effects of such a loss will be unique to the situation but 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.

j. 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.

We have considered the general impacts of shipping and port operations, however there are some very specific situations that are associated with naval practices. These are now briefly described:

k. Naval Bases

Many of the environmental impacts of all military bases stem from the increased number of personnel and equipment. Generally there will be an increase in the need for the disposal of black and grey water and garbage, (ship and base generated), increased consumption of fuels and engine emissions.

The decommissioning old naval bases is also a cause for great concern, e.g. Subic Bay US naval facility. The closure of military bases including naval bases leaves behind toxic contamination e.g. metals, chlorinated solvents and various organic chemicals. When a base is closed and management ceases, very often the contamination seeps into the local environment. Although controversial it has been suggested that one hundred people may have died as a result of illnesses linked to toxic waste from US military bases. Many of these problems are associated with overseas bases. In the US there now exists guidelines with respect to the remediation of contaminated land on decommissioning of a base.

l. Marine Garbage

As with other international conventions, warships and other naval vessels are exempt from the international Convention for the prevention of Pollution from Ships (MARPOL) annex V this convention regulates the discharge of ships garbage. Having said this many navies of states that are signatories to MARPOL, do when practically possible comply with MARPOL conventions. Garbage generated on a naval ship is thought to be 1.36Kg of solid waste a day per person consisting of:

41% food waste
35% paper and cardboard
17% metal and glass
7% plastic

These estimates are less than those from merchant ships.

The non-biodegradable plastics are a real environmental concern and in 1989 the US Navy established a plastics removal in the marine environment program (PRME) to reduce the volume of plastics being taken on board and subsequently having to be disposed of.

m. Ordinance Disposal And Waste

One long-standing issue of concern is the safe disposal of stored ordinance and/or the disposal of explosives and weapons waste. In recent years there has been a concentration on the disposal of nuclear waste from weapon systems. Traditionally weapons have been disposed of in offshore or land weapon dumps. This process is strictly controlled in many countries, however there is a legacy of weapons dumping that has to be addressed in existing and decommissioned bases.

n. Nuclear Issues

The issue of naval nuclear power, weapons and disposal of waste continues to be a major environmental issue. Over the past decade there has been an increasing public concern over nuclear powered ships, resulting in many countries, e.g. New Zealand, in banning nuclear powered or weaponed ships from entering ports. Some naval ports are in heavily populated areas bringing concerns regarding the possibility of nuclear accidents. One source reports 14 documented accidents releasing radiation associated with naval reactors (EHC,2002).

The last five years has seen growing concern over the corroding of the Ex Soviet fleet of nuclear submarines The Northern fleet had 166 submarines, 123 of which were nuclear powered. 90 of these plus some surface ships need to be decommissioned by 2010. Despite western help, including from Norway, the fate and safe disposal of these ships is unclear. Meanwhile the public perception is one of growing concern (Dedial, J. 1999) In addition there is an emerging concern with regard to accelerated corrosion in merchant and naval fleets throughout the world, possibly leading to wider concerns.

The disposal of nuclear waste from ships and naval bases continues to be a universal problem. In some countries e.g. UK, authorization has to be granted by the Environment Agency regarding the disposal of radioactive waste from ships and dockyards. Authorisation is granted only after extensive public consultation and careful consideration with regard to environmental and public safety, and health (Funnel, M., 2002)

3. Positive Signals

While there seems to be a large inventory of environmental problems associated with naval ships and ports, there are also some encouraging signs. There appears to be an increasing awareness of the problems and some political will to improve the situation. The following illustrate some positive signs:

- An increasing awareness of environmental damage caused by naval ships and bases has led to many new initiatives e.g. US Department of the Navy Environment Program, Australian Navy phase in of tin-free antifoulings, British Royal Navy Environmental Management Plan

- As stated before, while naval vessels are not bound by international conventions controlling pollution from ships, many navies will comply when it is practicable. In the US the environmental exemptions for the military are being questioned (Rivera, R. 2002)

- Increasing understanding to clean up existing and closed bases. The US navy has instigated Navy Environmental Leadership Program (NELP) which aims to reduce the environmental footprint of naval facilities. For example, US NS Mayport is investigating the reuse of dredged material, possibly as building material. This minimizes the environmental impact of the disposal of the dredged material (ANON, 2002,b)

- Some naval bases act as wild life havens for birds and marine organisms. Because of security the land and sea surrounding bases remains relatively undisturbed by development.

- Participation by many of the Worlds Navies and/or ministries of Defence in marine environmental research programmes, both at sea and in laboratories.

4. Conclusions

There is no doubt that military activities have an adverse impact on the marine and coastal environment. These impacts can have significant effects on the environment, economics and health of a region.

Increasingly people are becoming more aware of these problems and programmes that mitigate the impact are increasingly common. Many programmes do have an economic benefit, e.g. the reduction in waste and energy and water conservation. There are many areas where there are economic disbenefits, real or perceived, which do not receive such attention e.g. removal of contaminated dredge spoil (DANDP, 2002, Royal Navy, 2002).

The Merchant fleet is controlled by environmental legislation at different levels. This is not always the case with regard to the military fleets, although this practice is now being questioned. As well as environmental legislation concerning merchant ships and commercial ports, there exist many codes of good environmental Practice for the industry, For example, The International Chamber of shipping has a code of practice for shipping (ICS, 1997) and European Sea Ports Organisation (ESPO) also has a code of good environmental practice for commercial ports (ESPO, 2001).

When military ports are housed within commercial areas, e.g. Portsmouth UK, Maura, Brunei, both the military and commercial sectors have to work for the common environmental management of the port. Good Practice guidelines for military ports and their particular environmental issues must surely be a goal worth striving for.

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