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Ballast Water: Ecological and Fisheries Implications

A NEW ZEALAND PERSPECTIVE ON BALLAST WATER

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ABSTRACT

The New Zealand economy is dominated by exports of bulky primary products such as meat, dairy and forestry products and, because large oceans separate New Zealand from all its trading partners, we are almost totally dependent on shipping to sustain our economy. We have thousands of kilometres of unpolluted coastline and maintenance of our high water quality and natural biodiversity are major concerns of all New Zealanders especially those involved in environmental organisations and the seafood and tourist industries. Therefore the unintentional introduction of exotic organisms as a result of ballast water discharges is regarded with concern. Voluntary Controls on Ballast Water Discharges have been operating in New Zealand since March 1992. These request vessels entering New Zealand waters to either exchange their ballast water in mid-ocean before discharge, to treat it before discharge or to refrain from discharging if at all possible. Eighty nine percent of vessels larger than 500 tonnes claim to comply with the controls. Although the controls are voluntary, New Zealand authorities have the ability under an Act of Parliament to ban the discharge of ballast water from a vessel if the ballast water is considered a risk to existing flora and fauna.

INTRODUCTION

The unintentional introduction of exotic organisms as a result of ballast water discharges is regarded with concern in New Zealand for several reasons. Large oceans separate New Zealand from all its trading partners and, because our main exports are bulky primary products such as meat, dairy and forestry products, we are almost totally dependent on shipping to sustain our economy. Therefore we cannot afford to ignore the ballast water problem.

Secondly, New Zealand is a relatively small country - similar in area to Great Britain but unlike Great Britain where there are approximately 600 people per square mile, New Zealand is sparsely populated with only 30 people per square mile. The economy is dominated by agriculture, horticulture, forestry, fishing and aquaculture and the threat posed to these industries by exotic aquatic or terrestrial invasions is taken very seriously.

The low population density coupled with the absence of a significant heavy manufacturing sector means that New Zealand has thousands of kilometres of unpolluted coastline. Maintenance of our

high water quality and natural biodiversity are major concerns of all New Zealanders especially those involved in environmental organisations and the seafood and tourist industries. New Zealand's image as a clean and green country is widely used, and fiercely defended, by the seafood and tourism industries. In other words, New Zealand recognises that it has much to lose by ignoring the ballast water issue.

THE NEW ZEALAND BALLAST WATER WORKING GROUP

A Ballast Water Working Group (BWWG) was established in New Zealand in 1988 comprising representatives from research institutes, regional councils, port companies, fishing and shipping industries, and government departments. The Ministry of Agriculture and Fisheries Regulatory Authority (MAF RA) which develops policy and standards related to the importation of plants and animals and their associated pests and diseases was asked to join the BWWG in 1991 with a view to developing guidelines to mitigate the risk of introduction of unwanted organisms in ballast water. MAF RA was seen as the most appropriate agency for the role because of its responsibility for quarantine issues and because it already had inspectors who visited every international vessel at its first, and each subsequent, New Zealand port of call. MAF RA currently chairs the BWWG.

THE NZ VOLUNTARY CONTROLS ON BALLAST WATER DISCHARGES

Voluntary ballast water guidelines for vessels in New Zealand territorial waters were developed and introduced in 1992. These were based on the International Maritime Organisation's (IMO) "Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ship's Ballast Water and Sediment Discharges" and the Australian Quarantine and Inspection Service's guidelines "Controls on the Discharge of Ballast Water and Sediment from Ships Entering Australia from Overseas". Modifications were made to allow for data collection and to give a New Zealand perspective to the problem. The main features of the New Zealand controls are:

1. Ballast water should not be discharged within New Zealand.

2 If ballast water has to be discharged then it should be ballast which has been exchanged or loaded in the open ocean. Details of the exchange must be provided to an inspector. Ballast water, which has been loaded within the territorial waters of another country, cannot be discharged without reporting it to an inspector prior to discharge. The master of the vessel must also provide to an inspector details of the location from where the ballast was taken on. An option is also available where the master can provide a certificate from the relevant overseas authority certifying that the ballast water is clean.

3 Ballast water may be discharged if there is documented evidence to show that the ballast has been disinfected. To date, no vessel has provided such evidence although an occasional vessel has provided evidence that it has taken on town supply water as ballast.

4 If none of the above options can be fulfilled then the master has the option to discharge ballast in an approved area of New Zealand or to an onshore facility, or to treat the ballast, or to have the ballast tested to show it is not a risk. Currently there are no specific areas approved as ballast dumping areas nor any onshore facilities and no vessel has used this option.

5 No sediment or mud from the cleaning of the holds or ballast tanks, or anchor or chain

lockers can be landed in New Zealand without the permission of an inspector. This clause of the controls is mandatory because satisfactory alternatives to dumping sediment in the sea exist eg. by disposal in a landfill not immediately adjacent to the sea.

6 Compliance with these controls has to be consistent with the safety of the crew and the vessel. MAF recognises that the safety of the vessel must lie with the Master.

THE BIOSECURITY ACT, 1993

Although legislation and prosecution are only part of the process of minimising the risks associated with ballast water, the Biosecurity Act, 1993 contains all the powers likely to be required in order to enforce any aspect of ballast water policy that the New Zealand government chooses to apply. In the Biosecurity Act, the term "risk good" is defined as any organism, organic material, or other thing that (by reason of its nature or origin) it is reasonable to suspect to constitute, contain, or otherwise pose a risk that its presence in New Zealand will result in:

(a) Exposure of organisms in New Zealand to damage, disease, loss, or harm; or
(b) Interference with the diagnosis, management, or treatment in New Zealand, of pests or unwanted organisms.

This definition allows an inspector to invoke the powers of the Biosecurity Act 1993 if he or she reasonably suspects that ballast water arriving into New Zealand poses a risk to the flora and fauna already in New Zealand. The inspector does not need to suspect there is a particular unwanted organism present. He or she only needs to suspect that the ballast water is a **risk good** according to the above definition.

Sections of The Biosecurity Act permit enforcement of ballast water policy in the following ways:

- The person in charge of a vessel going to New Zealand must give notice of the vessel's impending arrival time and location, and the vessel is compelled to go to that designated arrival place.
- The master must ensure that no **risk goods** leave the vessel without the permission of an inspector and can be required to pay a bond not exceeding $10,000 to ensure compliance.
- The master is legally compelled to obey any reasonable direction relating to the discharge of ballast water and movement of the vessel and must provide written information on the ballast status of the vessel.
- An inspector may board a vessel in New Zealand territory and require that the risk goods be dealt with in a particular manner, may require the vessel to leave New Zealand territory or may seize (in a legal sense) the risk goods.
- The penalties for non-compliance include imprisonment for up to five years and fines up to $200,000.

While there are adequate powers in the Biosecurity Act 1993 to deal with the ballast water issue, there is currently only limited use of it as an enforcement mechanism. That situation is unlikely to change markedly until there are more effective, safe, practicable, economically sound and environmentally acceptable options for dealing with ballast water. At present the Act is used

(i) to ensure that masters of vessels provide correct written information about their ballasting operations,
(ii) to prevent the discharge of sediment and tank cleaning residues in New Zealand waters, and
(iii) to prevent the discharge of Tasmanian ballast water during the months when *Asterias amurensis* larvae may be in the water.

HOW DO THE VOLUNTARY CONTROLS AND THE BIOSECURITY ACT WORK IN PRACTICE?

When a vessel arrives in New Zealand, an inspector from the MAF Quarantine Services boards the vessel to carry out various quarantine functions including a check on the ballast water arrangements for the vessel. The master is required to complete a "Vessel Ballast Report Form" which includes details of compliance with the Voluntary Controls on Ballast Water Discharges. This form is generally completed at the first port of entry into New Zealand but is updated if necessary as the ship moves around the coast. At the final New Zealand port of call the report form is removed from the vessel and put on a database.

Since the introduction of the Voluntary Controls in March 1992, the mean number of vessel visits to New Zealand has been 1,860 per year (Figure 1). This figure may include some vessels which visited New Zealand more then once per year. The average ballast capacity of these vessels was 8.7 million tonnes per year (shaded columns in Figure 1). This figure was estimated by multiplying the total dead weight tonnage (DWT) of each ship type by the average ballast capacity of each type of ship under normal (light) ballast condition (Kerr, 1993). Vessel types included in the calculation were bulk (including woodchip) carriers, tankers (oil and refined products, chemical and liquefied gas), car carriers, container, general cargo and roll-on-roll-off (RoRo) vessels. Vessels such as passenger ships and fishing vessels which carry minimal quantities of ballast water were not included in the calculation.

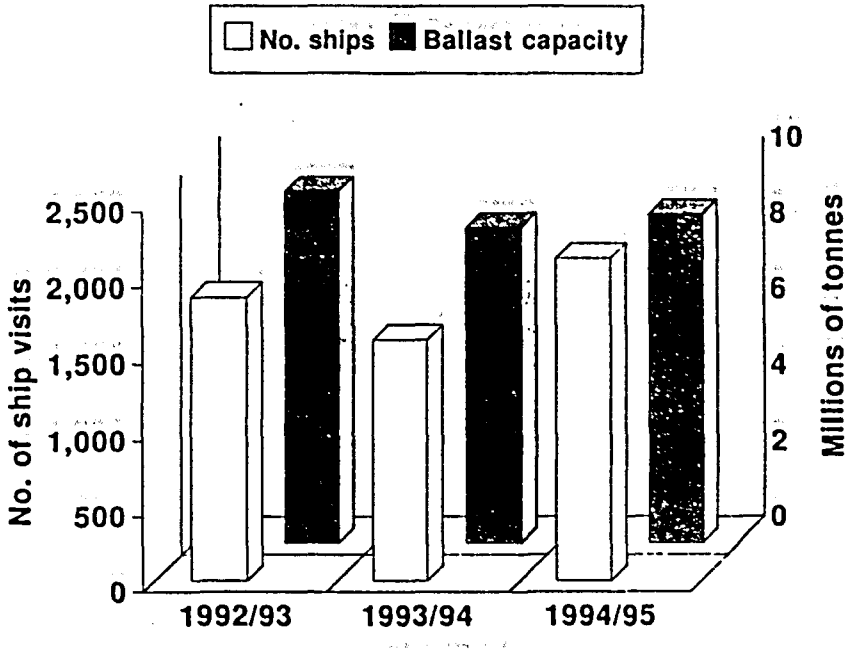

FIGURE 1

Annual number of vessel visits to New Zealand and their estimated ballast capacity

Based on the claims made by ships' masters on the VBR forms, less than half of the estimated volume of ballast water going to New Zealand is actually discharged there. On average, 4.7 million tonnes of ballast water are discharged in New Zealand annually (Figure 2). This figure is derived from the proportion of vessels which have not complied with the New Zealand's voluntary ballast water controls (MAF, 1992) and those that claim to have complied by exchanging their ballast water before discharge. The major portion of ballast water discharged has apparently been exchanged before discharge (striped sections in Figure 2).

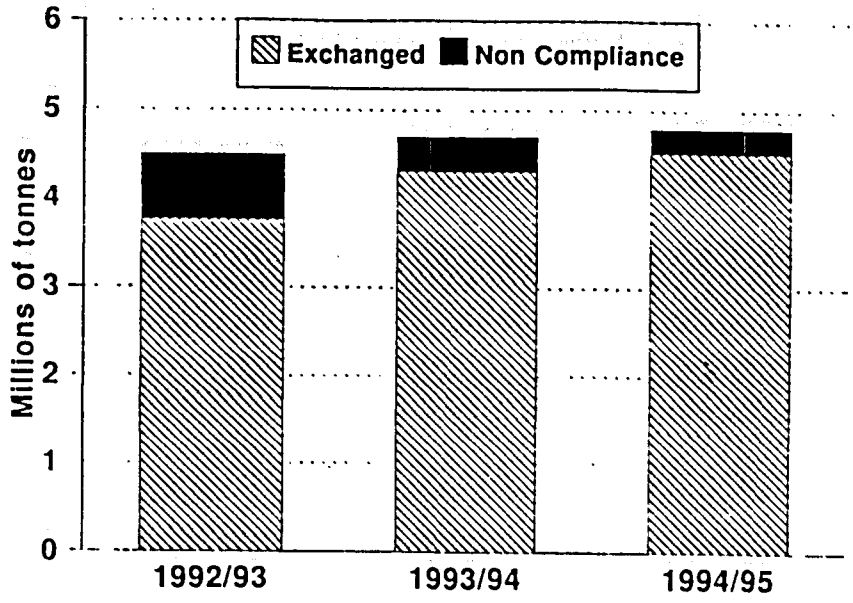

FIGURE 2

Estimated quantity of ballast water discharged in New Zealand

Of the 1,860 vessel visits each year, an average of 89.5% of vessels claim to comply with the voluntary ballast water controls by either exchanging their ballast before discharge or by not discharging it at all (Figure 3). The percentage of vessels which exchanged their ballast prior to discharge has increased during the three years in which the controls have been in place while the percentage able to withhold discharge has decreased. The percentage of vessels which admit to not complying with the controls has also decreased over the three years. These are interesting trends but without more detailed information, one can only guess at the possible causes.

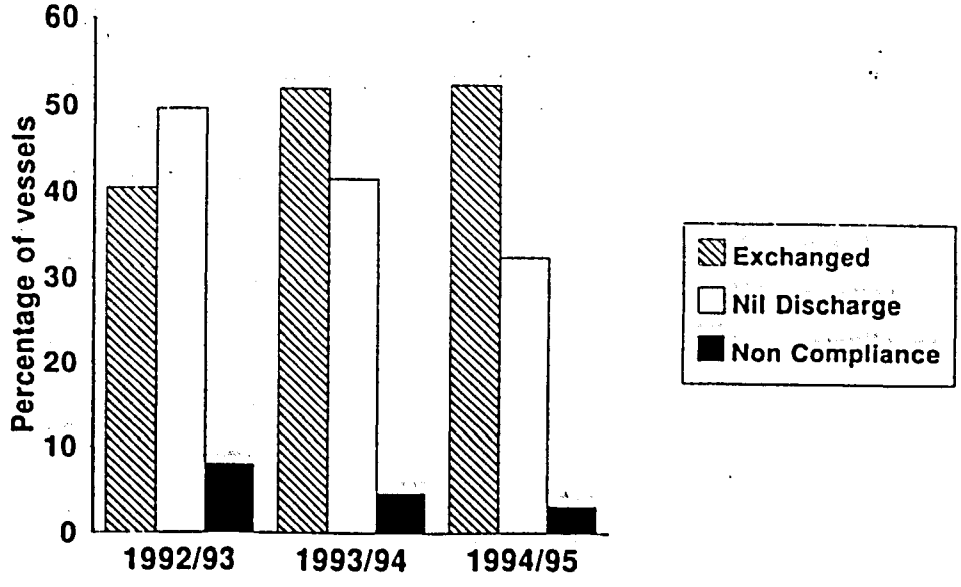

FIGURE 3

Percentage compliance with the Voluntary Controls on the Discharge of Ballast Water in NZ

Although some very large vessels visited New Zealand in the last three years, the majority of vessels (97%) were smaller than 50,000 tonnes. Figure 4 shows the extent of compliance with the voluntary controls by different sizes of vessel. It has been reported in several publications that mid ocean exchange may be unsafe for vessels larger than 40,000 tonnes deadweight. The right hand portion of Figure 4 indicates that even though mid-ocean exchange is not always safe for very large vessels, many are managing to do it.

The solid bars in Figure 4 indicate the proportion of vessels which admit to not complying with the voluntary controls. It is interesting to note that it is not the very large vessels which are failing to comply with the controls. In fact the number not complying increases as vessel size decreases. The reasons for this need investigating. Are the companies which operate larger vessels more committed to developing alternatives to direct discharge? Is there a perception among smaller vessels that because they discharge less ballast they present less of a threat? Or is there a genuine technical reason eg. are the smaller vessels more difficult to modify to allow exchange?

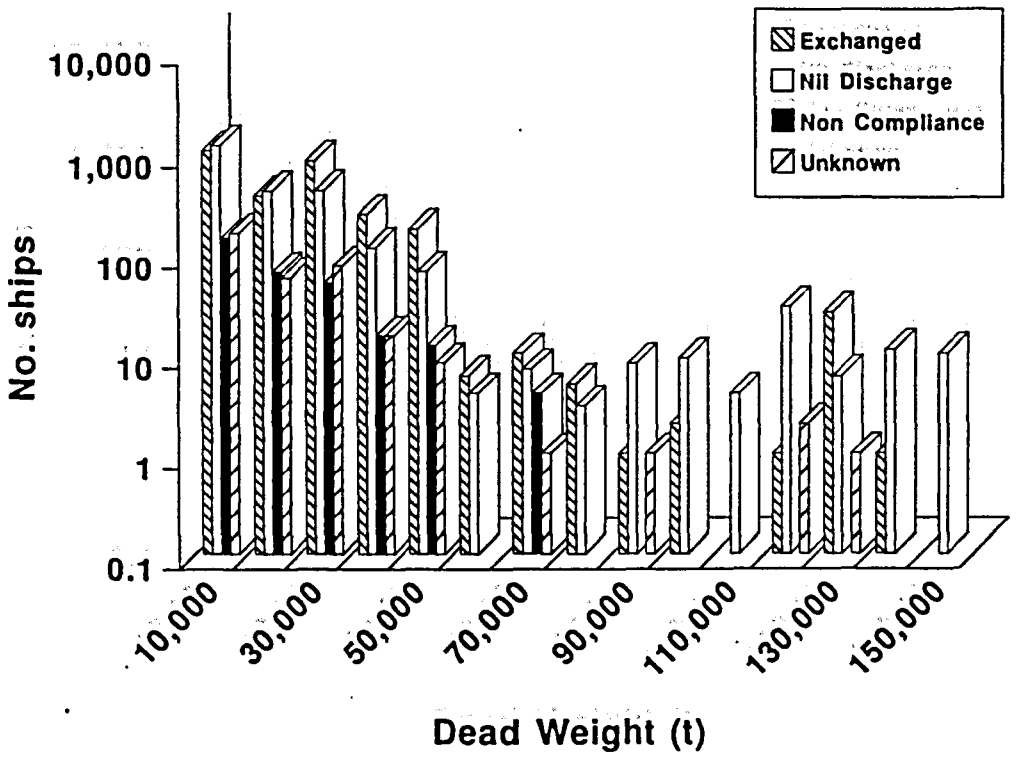

FIGURE 4

Comparison of vessel size and category of compliance with the Voluntary Controls on the Discharge of Ballast Water in New Zealand between March 1992 and February 1995

These data are based on the word of the ships' masters only so we do not know their accuracy. We also do not know how thoroughly the exchange or flushing process has been. We hope that the voluntary controls have significantly reduced the volume of contaminated ballast water being discharged into New Zealand ports but will not know that until a current testing programme and risk analysis has been completed.

RESEARCH NEEDS

New Zealand has recognised the need for a national ballast water research strategy which is linked with, and driven by, policy and management requirements so that the research outcomes will provide the scientific basis for decision making (The Royal Society, 1995). Key priority areas for ballast water research were identified in a 1994 report (Hayden, 1994) which is likely to form the basis of New Zealand's research strategy. The report discusses research options aimed at minimising the risk to New Zealand in the short to medium term as well as research which will contribute to the international research effort to find totally effective long term solutions. The research requirements focus around two main questions:

1. What is the risk to New Zealand associated with ballast water?
2. Having identified the extent of the problem, what can be done about it?

Many countries, including our close neighbour Australia, have done a considerable amount of excellent research which is directly applicable to New Zealand and we have no intention of repeating relevant studies done elsewhere. Because of our proximity and similar latitude to Australia it is tempting to use their ballast water statistics as the basis for solving New Zealand's problem. However analysis of the VBR forms indicates a vastly different picture in New Zealand from that reported in Australia. Based on Kerr's (1993) estimates of the ballast water arriving in Australia in 1991, Australia receives approximately 2.6 times as many ship visits as does New Zealand but 14 times as much ballast water. The reason for the huge discrepancy is that in one year, Australia receives approximately 4000 visits from heavily ballasted bulk carriers. That is more than twice the total number of ship visits of **all** types per year to New Zealand. It is clear that our shipping patterns are very different from those in Australia. It is also clear that the volume of ballast water discharged in New Zealand is far less than in Australia and many other countries. This means that solutions which are inappropriate in Australia because of the large volumes involved may be viable options in some New Zealand ports. Thus we consider research to determine the nature and extent of the problem **in New Zealand** to be an essential first step towards finding solutions. All countries face this challenge if they are to develop solutions which are appropriate to their particular situation. However, the process is hampered by the urgent need for research into appropriate risk analysis techniques.

The second question needs to be addressed in two parts:

(i) What can be done to improve management of the problem now? We consider it a priority to conduct research which evaluates the effectiveness of our current Voluntary Guidelines. They have been in operation in New Zealand for more than three years now but we have no idea how effective they are. Because they are based on the IMO guidelines, such an evaluation will be helpful at the international level as well.

(ii) What can be done to develop more effective solutions for the future? There is ample evidence to show that there is rarely a cure for the effects of unwanted aquatic invaders - prevention is what must be strived for. This will be most effectively achieved by research into alternative ballasting systems for vessels and into technologies for treating the ballast which are safe, effective and economically viable. It is unlikely that a single generic solution will be possible. Rather a "tool box" of solutions is needed to suit the variety of vessel types and port conditions. International collaboration among scientists and shipping companies is essential for this type of research. Studies such as that conducted in Australia on the use of heat for treating ballast water (Bolch & Hallegraeff, 1993; Rigby & Hallegraeff, 1994) have shown that effective treatment options may be just over the horizon. Such research should therefore be given highest priority.

ACKNOWLEDGEMENTS

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