

From the Editor

The drawing to an end of another year presents a time for reflection and re-focus, highlighting both the tremendous progress that has been made by the international community to date to address aquatic bio-invasions, and the monumental tasks still ahead before this global threat is resolved.

When IMO first formed its Ballast Water Working Group in 1989, only four member States participated. When the GloBallast Programme commenced activities in 2000, participation averaged around 14 countries. At MEPC 48 held in October 2002, there were over 120 participants in the Ballast Water Working Group, most of them engaging actively in the negotiations.

As conclusion of the Convention draws nearer, the ever-intensifying level of engagement and vigour of the debate at IMO must be seen as a positive indication of the interest, concern and commitment of stakeholders in relation to this issue. It also serves to highlight the all-important inclusiveness of the IMO consensus building process. This is reflected in the progress being made with the Convention, as reported on pages 4 and 5.

Under-scoring the global recognition of the need for a unified, international response to the transfer of harmful organisms in ships' ballast, is the continuing progress being made with cooperative, regional action plans under the GloBallast Programme. This is outlined by our Guest Speaker Captain Liu Gongchen, the Executive Director-General of the Maritime Safety Administration of the People's Republic of China, and an article on cooperative arrangements between the mighty maritime nations of East Asia.

Also in this issue we report on two initiatives towards regional cooperation in the Mediterranean Sea, one under the auspices of the UNEP Mediterranean Action Plan, the other a creative brainstorming session by the region's peak scientific commission – CIESM. We also provide some recent results on technical testing of physical separation techniques for ballast water treatment, and present a review of control and eradication measures for established invasive species, courtesy of Dr Bella Galil.

Towards the end of this issue, our last for 2003, we report on the 4th Global Task Force meeting held in Beijing at the end of October, including the outcomes of the independent, external Mid Term Evaluation of the Programme. We conclude with an announcement of the 2nd International Ballast Water Treatment R&D Symposium, which we are most pleased to present under a new alliance with The Institute of Marine Engineering, Science and Technology (IMarEST). As usual, we also highlight a number of publications that have recently been released.

As I wrap up the year to take several weeks R&R, I would like to thank all who helped keep the momentum of GloBallast in 2002, and look forward to keeping this rolling in 2003.



Steve Raaymakers
Contributing Editor

From the Programme

The 48th session of the IMO's Marine Environment Protection Committee was held during the last quarter, and was, as always, a major event with direct implications for the GloBallast Programme. The Committee continued its consideration of the draft International Convention for the Control and Management of Ships' Ballast Water and Sediments.

After extensive deliberations, the Committee decided to further review the draft text during its 49th session in July 2003 and agreed to request the Council of IMO to approve the convening of the Diplomatic Conference on Ballast Water Management in early 2004, instead of the previous plan of October 2003, to allow six months for the circulation of the necessary documents.

The second major event during the reporting period was the 4th Global Project Task Force Meeting, which was held from 28 to 30 October 2002 in Beijing, China and included a briefing on the Mid Term Evaluation of the Programme. A thorough assessment of activities was conducted by an international team of independent evaluators who visited the Pilot Countries and held intensive consultations with organizations and individuals involved in GloBallast.

Although the overall delivery and success rate was considered impressive and Programme staff were given a warm "pat on the back" for their efforts, the evaluation revealed a number of aspects, which need to be reconsidered in light of the further delays with the draft Convention.

The original Project Document was developed under the assumption that the Convention would be adopted before participating countries could commence certain activities. The drafting of the new instrument has proved to be far more complex than anticipated and has required extensive negotiations among the Member States. This, in conjunction with the understandable reluctance of some countries to translate the IMO Guidelines into national legislation prior to finalising the Convention, has significantly delayed the Compliance Monitoring and Enforcement component of the Programme. The independent evaluators recommended reviewing the requirements of this component along with training needs and reformulating activities and outputs.

The evaluators found that GloBallast has raised awareness to an exemplary and outstanding level, project management has been effective and remarkable, the countries have contributed significant and valuable support and the stakeholder participation has been impressive. It is believed that GloBallast has created a solid foundation of support for the new Convention and represents a unique and model example of GEF assistance during the development stages of an international instrument related to GEF's aims and objectives. It is also believed that the experience achieved will significantly reduce the time between adoption of the Convention and its entry-into-force.

GloBallast would like to take this opportunity to wish all our readers Season's Greetings and a Prosperous New Year.



Dandu Pughiuc
Chief Technical Adviser

Ballast Water News is the quarterly newsletter of the Global Ballast Water Management Programme (GloBallast). GloBallast is a cooperative initiative of GEF, UNDP and IMO to assist developing countries to reduce the transfer of harmful organisms in ships' ballast water, through the implementation of IMO ballast water management guidelines.

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Guest Speaker

Captain Liu Gongchen

**Executive Director-General
Maritime Safety Administration
People's Republic of China**



Captain Liu Gongchen graduated from Dalian Maritime University in 1971 to commence a career as a ships officer with the China Ocean Shipping Company (COSCO). He assumed his first full Captaincy in 1980, and in 1987 moved ashore as Director of the COSCO General Office in Qingdao.

In 1988 he became Deputy

Director-General of the Qingdao Maritime Safety Administration, and then Director-General from 1994 until 1998. He then moved to Beijing where he is now Executive Director-General of the Maritime Safety Administration of the People's Republic of China.

The introduction of harmful aquatic organisms and pathogens through ships' ballast water has drawn increasing attention of the world and ballast water control and management has become an increasingly important issue on the agenda of the International Maritime Organization (IMO). We are happy to see that IMO has made substantial progress in assisting member States with the implementation of IMO Resolution A.868(20) and in the development of the new *International Convention for the Control and Management of Ships' Ballast Water and Sediments*. We believe that the transfer and introduction of harmful aquatic organisms by shipping is a global issue of international nature and can only be solved through cooperative international efforts.

The Peoples' Republic of China is a major maritime nation and its maritime sector is undergoing continued expansion and development, both in terms of its shipping fleet and port infrastructure, in accordance with China's economic and trade development plans. China is both a significant Port State and Flag State, with over 134 international ports, an international shipping fleet totalling more than 16 million gross tonnes and a domestic shipping fleet comprising thousands of vessels.

Having a continental coastline of 18,000 kilometres and more than 650 islands, China is very concerned about the introduction of aquatic invasive species. Shipping, fishing and marine farming play an important role in the economy of the country. Forty percent of the country's population and 50% of the large and medium cities are concentrated along the coastline. While the fast development of the economy has brought prosperity to the country, the coastal areas and waters are suffering from pollution.

Environment protection is one of the two basic National Policies of China, and China is a contracting party to most of the IMO Conventions. Being a Flag State, China has the responsibility to ensure its fleet is in compliance with the requirements of these Conventions.

China has been part of the GloBallast Programme for more than two years, with a Demonstration Site at the port of Dalian in northeast China. Under the National Workplan, activities have been completed according to schedule, including a broad-based awareness raising campaign, a national legislative review, port biological baseline surveys and a ballast water risk assessment for Dalian.

As part of the awareness campaign, seminars have been held at a number of ports along the coast and training provided to hundreds of personnel from relevant organizations. Many Chinese shipping companies are implementing the IMO Guidelines (A.868(20)) - which have been broadly disseminated in Chinese and English - including implementation of onboard Ballast Water Management Plans. My Administration is considering the formulation of ministerial Regulations for ships ballast water management to include the relevant requirements of the IMO Guidelines.

With support from GloBallast, China is also carrying out research and development of alternative ballast water treatment techniques, and is developing a system to alert ships' Captains to outbreaks of harmful red tides in the Bohai Sea, using existing navigation communication means.

With national activities well underway, my Government is now turning its attention to regional cooperation. From 31 October to 2 November this year China was extremely pleased and honoured to host the *1st East Asia Regional Workshop on Ballast Water Control and Management* in Beijing. Representatives from DPR Korea, Japan, the Republic of Korea, the Philippines, Singapore and Vietnam, as well representatives from IMO and the shipping and port industries, attended the workshop. Indonesia and the Russian Federation were also invited but regrettably were unable to attend.

The workshop was considered a major success, laying a strong foundation for regional cooperation to address the ballast water issue in a coordinated, cooperative manner, and a draft Regional Strategic Action Plan was developed.

To date, the GloBallast Programme has achieved more than we expected, including providing China with the opportunity to learn from other countries and to prepare for the new Convention. The Peoples' Republic of China remains committed to implementing the challenging GloBallast workplan, to working towards the earliest adoption and implementation of the new ballast water Convention, and to working closely with our neighbouring countries through a Regional Strategic Action Plan.

Liu Gongchen

Some Regional Marine Programmes in the Seas of East Asia:

GEF/UNDP/IMO

Partnerships for Environmental Management
in the Seas of East Asia (PEMSEA)

www.pemsea.org

UNEP East Asian Seas Coordinating Unit (EAS/RCU)
Coordinating Body for the Seas of East Asia (COBSEA)

www.unep.org/unep/regoffs/roap/easrcu/

IUCN Regional Marine Programme

www.iucn.org/places.asia

www.iucn.org/places/srilanka/coastalprg.htm

East Asia Takes Action



The 1st East Asia Regional Workshop on Ballast Water Control and Management was held in Beijing from 31 October to 2 November 2002. The People's Republic of China, as the GloBallast Pilot Country in the

region, hosted the workshop through its Maritime Safety Administration.

The focus of the GloBallast Programme on regional replication and cooperation activities, as reported in recent issues of Ballast Water News, is continuing according to schedule with the East Asia initiative following on from similar activities for the Black Sea, Eastern Baltic and the ROPME Sea Area.

The GloBallast regional conferences/workshops include a number of objectives common to all regions:

- To raise awareness about invasive marine species, the ballast water problem and IMO ballast water activities amongst key stakeholders in the Region.
- To establish the current status of invasive marine species and ballast water management arrangements in the regional countries.
- To progress a draft Regional Strategic Action Plan (SAP).
- To agree on the machinery for implementation and coordination of regional activities.

The East Asian workshop was opened by Captain Liu Gongchen; Executive Director General of the China Maritime Safety Administration. Captain Liu affirmed China's commitment to implementing IMO ballast water arrangements and the importance of regional cooperation. In addition to China, representatives from DPR Korea, Japan, the Republic of Korea, the Philippines, Singapore and Vietnam, as well representatives from IMO and the shipping and port industries, attended the workshop. Indonesia and the Russian Federation were also invited but unfortunately were unable to attend. Two GloBallast Pilot countries that are currently planning their regional initiatives, India and South Africa, also attended to gain ideas from the East Asia process, and to initiate inter-regional cooperation.

The East Asian Seas region is the most populous region in the world. It is home to almost 1.8 billion people, 60% of whom are concentrated in coastal areas. In the past decade, the region has been the centre of considerable economic growth, bringing about increasing urbanization. Around 300 million people are now living in coastal urban areas (PEMSEA 2002).

The region embraces five large marine ecosystems (LME) or sub regional seas (the Yellow Sea, South China Sea, East China Sea, Sulu Celebes Sea, and the Indonesia Seas). It includes two archipelagic countries (Indonesia and Philippines) and contains the greatest number of islands of all the regions in the world (PEMSEA 2002).

Around 30% of the world's coral reefs, one-third of the world's mangroves as well as many other important critical habitats are found in the region. The region comprises the world's richest marine biodiversity and produces about 41% of the total fish catch of the world (PEMSEA 2002).

The workshop proceeded according to a three-day programme. The GloBallast PCU provided background presentations, China described the significant progress made to date at the Dalian Demonstration Site, and status reports were presented by the other littoral States.

The workshop devoted significant effort to considering the draft Regional SAP and developing recommendations for regional cooperation. During discussions, all countries unanimously agreed that the problem of ballast water and marine bio-invasions must be addressed on a regional basis involving cooperation between all countries in the region.

It was unanimously agreed that regional cooperation on ballast water control and management should be developed and coordinated through existing regional structures and mechanisms, such as the GEF/UNDP/IMO programme 'Partnerships for Environmental Management in the Seas of East Asia (PEMSEA)'.

The Workshop adopted a Resolution with recommendations covering the following major areas:

- Development of the draft Regional SAP.
- The establishment of a Regional Task Force.
- Implementation of IMO Resolution A.868(20) within the Region.
- Support for the rapid adoption and entry into force of the new international ballast water Convention, being developed by IMO.

The workshop agreed to work towards formal adoption of the Regional SAP through a high level meeting to be held in 2003.

Together the countries of the region represent some of the world's major maritime economies, with major ship-building industries, huge international and domestic shipping fleets, some of the largest trading ports in the world and several countries in the region being major suppliers of ships' crews to the world fleet. The development of a cooperative, regional approach to the management of invasive aquatic species and ballast water transfers in this region represents therefore, a major development in the maritime world, and bodes well for similar initiatives in other regions.

The GloBallast Programme is deeply grateful for the assistance of the Government of China, and in particular the China Maritime Safety Administration, for the excellent support provided in convening the Workshop.

SR



Convention Update

From 7 to 11 October 2002 the IMO Marine Environment Protection Committee (MEPC) held its 48th meeting in London, and through its Ballast Water Working Group, continued to make progress on finalising the text of the new International Convention for the Control and Management of Ships' Ballast Water and Sediments.



The week before MEPC, the Working Group held an inter-essional meeting, as agreed at MEPC 47, in order to progress technical details of the draft Convention prior to MEPC itself.

Under the Chairmanship of Mr Mike Hunter of the UK, the Working Group continued to give priority to finalising ballast water treatment standards and addressing all remaining outstanding issues in the text of the draft Convention.

In relation to standards, the Working Group agreed that there should be a standard for ballast water exchange, a short-term standard for ballast water treatment and a long-term standard for ballast water treatment. Draft, provisional text for such standards was proposed as outlined in Table One.

The Working Group was of the view that the final figures in the standards should have a solid scientific basis, which was missing from the concentration element and, therefore, submissions should be invited in this regard to MEPC 49 in July 2003. The Working Group was also of the view that the following elements should be considered for the short-term standard:

- it should offer an alternative to Ballast Water Exchange;
- it should be achievable at the time of entry into force of the Convention;
- there should be some confidence as to the effectiveness of the standard;
- it should lead technology towards the long-term standard.

It was noted the World Health Organization (WHO) was working on water quality standards for pathogens, which would be an important factor in establishing ballast water standards for pathogens.

The Working Group also gave consideration to the need for various guidelines in support of the Convention, and identified the following issues for guidelines in order of priority:

- guidelines for the design, construction and operation of ships that use Ballast Water Exchange. An outline and materials for these guidelines were available and the International Chamber of Shipping undertook to prepare a draft text for future consideration,
- guidelines for the assessment and approval of ballast water treatment systems (type testing),
- guidelines supporting coastal States when considering additional measures, and
- guidelines on ballast water sampling/inspections on board ships by port State Administrations.

The Chairman of the Working Group recommended that, as a next step, the Committee should invite Member Governments to submit supporting information and views on the various options contained in the draft convention, in particular for the standards under Regulation E-2. The Working Group also recommended a thorough legal review of the current text.

In conclusion, MEPC 48 agreed that the revised text of the draft Convention provided a sound framework but time was required to deliberate on its contents. It was agreed that:

- a second Intersessional Meeting of the Ballast Water Working Group would be convened at IMO Headquarters in the spring of 2003 to carry out specific tasks as outlined in a detailed terms of reference and report to MEPC 49 (14 to 18 July 2003);
- the deadline for submissions on ballast water issues to MEPC 49 would be relaxed until an appropriate date in May 2003;
- MEPC 49 would review and approve the draft Convention with the aim of circulating it as the basic document for consideration and adoption at a Diplomatic Conference; and
- the Diplomatic Conference should be held in the beginning of 2004 instead of October 2003 to meet the six-month notice period for the basic conference documents. This re-scheduling is regarded as a technical adjustment to the schedule for preparation of the draft text rather than as a postponement of the Diplomatic Conference.

Of particular interest towards the end of the meeting, was an intervention by the delegation of Japan, which informed the Committee that it had a project underway aimed at developing new ship designs, which need not carry ballast water, when sailing with limited or no cargo. Such designs would solve the problem arising from transfer of non-indigenous species through ballast water. The delegation would prepare a submission giving further information on this project to MEPC 49.

The revised text of the draft *International Convention for the Control and Management of Ships' Ballast Water and Sediments*, as prepared during MEPC 48, is available at <http://globallast.imo.org/convention>

Table One : Extract of text from Draft IMO Ballast Water Convention

(NB : This is not approved text and is subject to change as part of Convention negotiations. Values inserted in options 1 and 2 are place holders only and are subject to technical review and ongoing discussion).

SECTION E - STANDARDS FOR BALLAST WATER MANAGEMENT

Regulation E-1 *Ballast Water Exchange Standard*

- 1 Ships performing ballast water exchange in accordance with this Regulation shall do so with an efficiency of 95 per cent volumetric exchange of Ballast Water.
- 2 The method used to establish that a ship meets the standard in paragraph shall be one of the accepted methods [contained in this Annex] [in the Code][approved by the Organization].
New ships shall be designed and constructed in accordance with the following requirements (to be listed).

Regulation E-2 *Short-term Ballast Water Management Standard*

Option 1:

- 1 Ships conducting Ballast Water Management in accordance with this Regulation shall achieve at least [95]% removal, rendering harmless, or inactivation of a defined set of taxa.

Option 2:

- 2 Ships conducting Ballast Water Management in accordance with this Regulation shall discharge no detectable quantities of viable organisms above [100] μm in size, and discharge no more than [25 viable individuals of zooplankton per litre, 200 viable cells of phytoplankton per ml] smaller than [100] μm in size.

Regulation E-3 *Long-term Ballast Water Management Standard*

Ships conducting Ballast Water Management in accordance with this Regulation shall Discharge no detectable quantities of viable organisms above [y] μ in size, and discharge no other organisms above a concentration of [z].

Regulation E-4 *Additional criteria for ballast water treatment systems*

Ballast water treatment systems used to comply with this Convention must be:

- .1 safe in terms of the ship and its crew;
- .2 environmentally acceptable, i.e. not causing more or greater environmental impacts than it solves;
- .3 practicable, i.e. compatible with ship design and operations;
- .4 cost effective, i.e. economical; and
- .5 biologically effective in terms of removing, or otherwise rendering inactive harmful aquatic organisms and pathogens in ballast water.

CONFERENCE ANNOUNCEMENTS

International Conference on Ballast Water and Waste Water Treatment

11-13 June 2003
Berlin, Germany

Contact Mrs. Elke Lonicer
Conference Manager
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The 12th International Conference on Aquatic Invasive Species

9-12 June 2003
Windsor, Canada

For further information visit
www.aquatic-invasive-species-conference.org

Mediterranean Moves Forward



The Mediterranean Sea may be considered as one of the world's cradles of civilization and has played a pivotal role in the history of humanity for millennia.

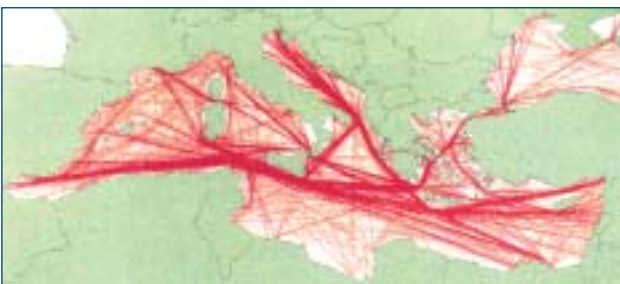


As an enclosed sea surrounded by huge populations it has suffered and is suffering severe environmental impacts, including over-exploitation of resources and marine pollution.

In 1975 the United Nations Environment Programme spearheaded its Regional Seas Programme with the development of the Mediterranean Action Plan (MAP). MAP brings together 20 countries and the European Community, in a cooperative partnership for the sustainable use and protection of the Mediterranean Sea. This partnership includes a number of thematic activity centres throughout the region. One of these is the Regional Activity Centre for Specially Protected Areas and Biodiversity (RAC/SPA), located in Tunis.

The Mediterranean Sea has been subjected to introduction of alien species since the opening of interoceanic maritime routes five centuries ago. The rate of invasions has increased in recent decades, due to the opening of the Suez Canal, intentional and accidental introductions relating to fisheries, aquaculture and aquaria, and increasing ship traffic, causing damage to already imperiled ecosystems, and presenting a major threat to aquatic bio-diversity.

In response to this threat, from 24 to 26 October 2002 RAC/SPA convened a meeting of experts in Barcelona, for the elaboration of an Action Plan concerning species introductions and invasive species in the Mediterranean Sea. The meeting was attended by MAP members States, environmental NGO's and the GloBallast Programme.



Shipping routes in the Mediterranean (Source: REMPEC)

A feature of the draft Action Plan resulting from the meeting is that it takes a holistic, integrated approach to invasive aquatic species, considering all vectors and pathways, and both intentional and un-intentional introductions.

In relation to shipping and ballast water, the draft Action Plan provides for close cooperation with the GloBallast Programme and the implementation of uniform IMO ballast water management arrangements in the region, providing a model for future cooperation between IMO, GloBallast and other regional marine programmes.

www.unepmap.org

SR

Scientists Brainstorm Ship Vectors

From 6 to 9 November 2002 a group of scientists and other experts gathered in Istanbul, Turkey, at the invitation of CIESM – the Commission Internationale pour l'Exploration Scientifique de la mer Méditerranée (International Commission for the Scientific Exploration of the Mediterranean Sea). Their purpose – to brainstorm in a freely structured, creative, think-tank, setting new perspectives and scientific inputs to the problem of ship-transported alien species in the Mediterranean and Black Seas, with a view to provide relevant agencies with science-based analyses and priorities for action.



The CIESM Ship Vectors Workshop in Istanbul

Led by Bella Galil, Chair of the CIESM Sub-Committee on Marine Ecosystems, with the personal involvement of Frédéric Briand, Director General of the Commission, the workshop set a demanding agenda over four full days characterized by lively debate and creative discussions.

A range of scene-setting presentations were given, in a very interactive format, on the current extent of aquatic bio-invasions in the region, the nature of shipping patterns and risks in the region, currently available management options and actions, and the current state of knowledge and gaps in invasion biology and ecology. In addition to Mediterranean experts, there were also participants from northern Europe and North America, bringing a more global perspective to the debate.

A synthesis of the workshop conclusions, along with a compilation of all individual presentations, is in preparation. It will be published in January in the well-known CIESM Workshop Monographs Series and will be accessible for downloading directly from the CIESM Website at www.ciesm.org

SR

Mechanical Treatment Test Results

The Great Lakes Ballast Technology Demonstration Project has undertaken a multi-year program to demonstrate and evaluate ballast water treatment methodologies that might minimize the transfer of non-indigenous aquatic species.

Full-scale mechanical and biological testing of primary and secondary treatment options has been performed on both operating vessels and a test barge located in Duluth and Two Harbors, Michigan, USA.

Mechanical testing for particle removal efficiency, at a nominal 340 m³/h flow rate; was undertaken for three candidate primary mechanical separation devices over a four-year period. The three treatment methods tested were:

- a 50 micron screen-type surface automatic backwash filter,
- a 100 micron disk-type depth automatic backwash filter, and

- a 100-micron rated cyclonic separator (hydro-cyclone).

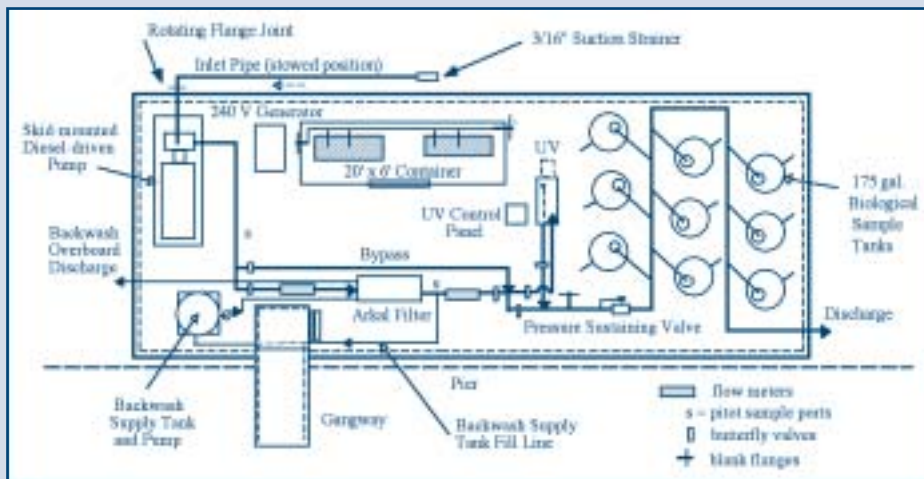
The screen-type and disk-type automatic backwash filters showed particle removal efficiencies at and above their removal rating of over 90 percent. Although more complicated, the disk-type depth filter exhibited a significant advantage through a longer time between backwash cycles and, thus, a greater net filtration throughput.

The hydro-cyclone demonstrated significantly lower effectiveness (about 30 percent) in removing particles that included both neutrally buoyant biota and other materials. While much simpler than filters, the results from this particular work indicate that cyclonic separation devices may not be appropriate for this application, requiring the effective removal of both particulate material and larger biota.

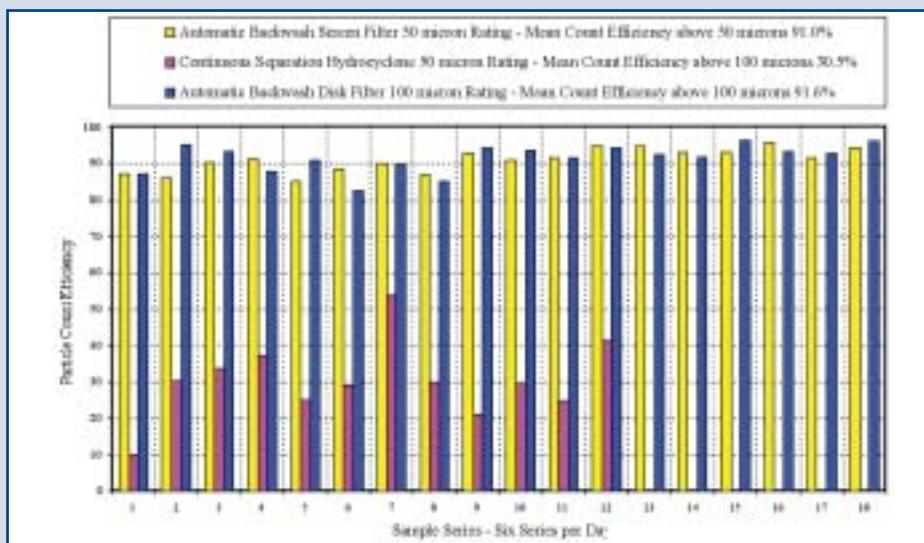
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From: Marine Technology, Vol. 39, No. 4, Oct, 2002, pp. 211-222.



Schematic of Ballast Technology Test Barge



Comparison of overall particle count efficiency of primary separation devices

Between Serendipity and Futility: Control and Eradication of Aquatic Invaders

Significant efforts are underway to develop systems and procedures to prevent the transfer and introduction of invasive aquatic species to new environments. Despite these efforts, aquatic bio-invasions appear to be increasing at an exponential rate, and many of these are exhibiting significant ecological and/or socio-economic impacts.

This begs the question; if not all invasions can be prevented, can populations of invading species be controlled and eradicated once they are established? In this article we examine some examples of aquatic bio-invaders and review attempts made for their control or eradication.

Since the discovery of the **zebra mussel**, *Dreissena polymorpha*, in Lake St. Clair in 1988, the mussel has spread throughout the eastern United States and the Province of Ontario and caused devastating ecological damage and economic loss.

Manual scraping, abrasive blasting and high-pressure water jets have been successful for the temporary removal of localised mussel populations but are expensive and time consuming. Screens and filters have been used to prevent uptake of mussels through pipes in hydroelectric facilities. Water heated to temperatures greater than the thermal tolerance of the mussel (> 40° C) has been used to destroy newly settled mussels within pipe work. Cathodic protection and UV irradiation have been used to suppress mussel settlement. Numerous organic and inorganic chemicals toxic to the mussels provide versatile, easy to implement and cost-effective ways to deal with established infestations and prevent new ones (Boelman et al 1997) (Specher & Getsinger 2001). However, since chemical biocides must prove harmless to the non-target species, current chemical options are used only in closed systems and internal piping.

Bio-control experiments using a generalist predator, the blue crab *Callinectes sapidus*, indicate that increased populations of the crab may be effective in reducing mussel

abundance (Boles & Lipcius 1997). The successful laboratory and field trials of a selectively toxic microbe, the bacterial strain CL0145A, may hold promise for environmentally safe control of zebra mussels.

The **green crab**, *Carcinus maenas* has invaded both the Atlantic and Pacific coasts of the USA, eastern Canada, southern Australia, South Africa and Japan. A voracious predator, it has damaged fisheries, aquaculture and native fauna, and greatly diminished the numbers of the commercially valuable soft-shell clam *Mya arenaria* in New England and Canada.

Physical removal of *C. maenas* by divers may be useful in small, enclosed areas such as mariculture facilities, but is deemed ineffectual over large areas. Exclusion barriers such as low wire fences used by the New England clam fishery, trapping and poisoning with Lindane or Carbaryl-soaked bait have been unsatisfactory. Possible bio-control agents include viruses, dinoflagellates, ciliates, the egg-predator nemertean *Carcinonemertes carcinophila*, nematodes, tapeworms and an epicaridean isopod (Goggin 1997) (Kuris 1997). A rhizocephalan parasitic castrator, *Sacculina carcini*, that infests *C. maenas* throughout its native range has been found to infect native Australian crabs as well (Thresher 2000).

A shell-boring sabellid polychaete, *Terebrasabella heterouncinata*, was found in California in 1993 in a mariculture facility whence it arrived with South African abalone stock. In 1996 the high prevalence of the sabellid worm on the native black turban snail, *Tegula funebris*, near the outflow of an abalone hatchery in California, signified a spread of epidemic proportions.

Efforts to control the sabellid included coating the abalone shells in waxy substances, immersing the shells in freshwater or in heated seawater close to the upper thermal tolerance limit of the abalone. Microencapsulated and water-soluble toxins were also proposed. The experimental use of ultrasound to destroy the eggs and juveniles was considered inefficient.

An eradication program, based on reducing the density of the sabellid worm populations and the density of the likely native host population, was put into action in late 1996. A screen was installed at the facility discharge, preventing the release of sabellid-bearing abalone shells and shell fragments. All living gastropods, hermit-crab inhabited shells and empty shells were removed from 1500 m² of the intertidal zone near the facility, including 2000 escaped cultured abalone shells and approximately 1.6 million *T. funebris* shells. Surveys of *T. funebris* snails conducted for two years following the program demonstrate the complete eradication of *T. heterouncinata* population (Culver & Kuris 2000).

The **giant fanworm**, *Sabella spallanzanii* has been introduced to Brazil, Java and Australia. The fanworm fouls hard substrates, vessels and man-made structures, forming extensive dense mats of up to 100 specimens/m². Its thick meadows may out-compete native suspension feeders for food, smother native bivalves and impact shellfish aquaculture and fisheries.

The ability of *S. spallanzanii* to regenerate damaged body parts precludes use of dredges for large scale removal, in fact, scallop fishers may have contributed to the rapid spread of the fanworm by discarding fragments overboard. *Sabella spallanzanii* was successfully controlled in Eden Harbour, NSW, where it was manually removed by divers. However, physical removal is feasible only to clear small areas if the fanworm is detected before reproduction occurs.



Workers clearing Zebra Mussels from power station water intakes – Detroit (Source: R Peplowski).

The **Northern Pacific Sea star**, *Asterias amurensis*, may have dispersed to Australia as larvae released with discharged ballast water, in vessel fouling or transferred with mussel lines between mariculture facilities. The Australian population of *A. amurensis* maybe as high as 120 million. *Asterias amurensis* is a shellfish predator and poses a serious threat to mariculture and wild shellfish fisheries.



Physical collection of *A. amurensis* in Tasmania
(Source: CRIMP - CSIRO Australia)

Manual removal by divers is ineffective as a control method for large populations – in the Port of Hobart 6000 specimens were removed from a 300 x 20 m area, yet the next month four times as many seastars were collected. Apart from physical removal, no other attempt has been made to control *A. amurensis* in Australia. Possible biological control agents under study include sporozoans, dendrogastrids, eulimid gastropods and the highly contagious parasitic ciliate *Orchitophyra stellarum* that has caused male infertility in the Japanese populations of *A. amurensis*. However, since the ciliate may parasitize native seastars further research into its host specificity is needed.

The **black-striped mussel**, *Mytilopsis sallei*, has spread to Fiji, India, Japan, Taiwan and Hong Kong. In 1999 large populations of the mussel were discovered in three marinas in Darwin, Australia. *Mytilopsis sallei* may have spread in hull fouling of commercial or recreational vessels. The mussel fouls hard substrates, vessels and structures, causing extensive economic damage and may out compete native marine species, smother native bivalves and impact shellfish aquaculture.

Recognizing the potential economic and ecological impact of the *M. sallei* infestation, Australia implemented an immediate containment and eradication program. The gated marinas were closed and the enclosed water, vessels and submerged surfaces were treated with 170 t sodium hypochlorite and 3 t copper sulphate, killing the mussels. Vessels that had passed through the infested marinas were inspected and treated and internationally travelled vessels underwent antifouling on entry to Australian waters. Extensive surveys reported no live mussels in the marinas or elsewhere in Australia (Bax 1999).

The Atlantic **comb jelly** *Mnemiopsis leidyi* has drastically affected the ecology and productivity of the Black Sea since its introduction in the early 1980's. In November 1999 *M. leidyi* was also recorded in the Caspian Sea. It was postulated that the population explosion of *M. leidyi* was in response to abundant zooplankton due to over fishing

and eutrophication. The Group of Experts on the Scientific Aspects of Marine Environment Protection (GESAMP 1997) convened to discuss strategies for the control of *M. leidyi* agreed that its eradication is unlikely, since the area affected was too large. Instead, strategies were sought for reducing its abundance. Mechanical removal or destruction was deemed impractical because of its high growth rate. Toxic non-specific chemicals in the concentrations required to exterminate *M. leidyi* would damage the whole food web. It was agreed that biological control using pathogens, parasites, predators or competitors offers the only feasible approach. Species of the ctenophore genus *Beroe* were considered as biocontrol agents as they feed exclusively on other ctenophores such as *M. leidyi* and have reproductive rates high as that of *M. leidyi*.

Providentially, *Beroe ovata* appeared in the Black Sea in 1997 (Zaitzev 1998), and the rapid increase in its abundance was concomitant with significant reduction in *M. leidyi* biomass and increase in zooplankton and fish egg biomass. It has been suggested lately that *B. ovata* be introduced to control *M. leidyi* in the Caspian Sea.

Control of invasive species in aquatic and marine ecosystems is in its infancy, with only a handful of partially successful cases from around the world.

Eradication may be effective when an introduced species is identified at an early stage of colonization and has limited spatial distribution. At such an early stage eradication methods need not be highly specific since their possible damage to non-target species is limited to a small area. Once the introduced species reproduces successfully or is widely dispersed, eradication becomes impossible and long-term control becomes the preferred strategy, to reduce the population to an economically or ecologically acceptable level.

It has been suggested that biological control, involving the introduction of a predator, parasite or pathogen or genetic manipulation, may present an option for aquatic pests management. While bio-control has long been used in terrestrial systems (with mixed results ranging from highly successful to disastrous), recent studies raise concerns over the efficacy, host-specificity and safety of biological control, especially in a contiguous, fluid, 'three-dimensional' aquatic medium. Basic research, rigorous monitoring and development of innovative and highly specific control techniques are urgently needed.

The Australian Centre for Research on Introduced Marine Pests has been somewhat active in this area, and has published an excellent overview, bibliography and toolbox of control options - refer:

<http://crimp.marine.csiro.au/nimpis/controls.htm> and

<http://www.marine.csiro.au/CRIMP/reports/toolbox.pdf>

New Zealand is also developing strategies for the control and eradication of marine pests, for example see:

http://www.cawthron.org.nz/Assets/Undaria_full_report.pdf

While further research on control and eradication techniques is vital, PREVENTION is the key. Sound and prudent management of species transfer vectors will remain the bulwark against aquatic bio-invasions for the foreseeable future.

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References for this article are listed on page 11.

Global Task Force Meets in Beijing

As outlined by Dandu Pughiuc on page 1, the Programme's Global Task Force, which meets annually and acts as an overall steering and advisory committee, held its 4th meeting in Beijing, China, from 28 to 30 October this year, immediately prior to 1st East Asia Regional Workshop reported on page 3 (thereby effecting cost-efficiencies). The meeting was hosted by the Government of China, through the Maritime Safety Administration, the Lead Agency for the GloBallast Programme in China.



The 4th Global Task Force Meeting in Beijing, China

Reports presented by the six Pilot Countries and the PCU showed that significant progress continues to be made in implementing Programme activities. A major outcome of the meeting was presentation of the Mid Term Evaluation results by the GEF-UNDP external evaluators. The findings of the independent review were extremely positive, and are summarised by the evaluators as follows:

- The project has raised awareness to an exemplary and outstanding level at the national, regional and global scale.
- Project execution and management has been effective and remarkable in that so many achievements have been realised under the constraints of time and manpower imposed by the project design.
- The countries themselves have contributed significant and valuable support and have provided very real and serious commitment to this project.
- Stakeholder participation and support has also been impressive, especially for a global project of this nature.
- The project has created a solid foundation of support for the expected Convention on Ballast Water Management, and has initiated many activities, which will stand the participating countries in good stead when the Convention is adopted.
- The project has contributed significantly to our understanding of some of the barriers and constraints which may be experienced at the national level in implementing the requirements of a future Convention, and has provided (and will continue to provide) many lessons and best practices which can be transferred and replicated both nationally and regionally.
- The project represents a unique and model example of GEF assistance being used during the development

stages of an International Convention related to GEF aims and objectives.

- There have been some delays in certain components and outputs (specifically those related to legislation, compliance, monitoring and enforcement), which are not the fault of the project, but are due to external circumstances.
- There have also been delays in the development of mechanisms and processes to transfer/replicate lessons and best practices beyond the demonstration ports. Primarily, the fault for this must lie with the project design rather than implementation.
- The evaluation has also identified some areas of project administration, management and technical output that could be enhanced and improved.

The Programme Coordination Unit and Pilot countries are extremely pleased with the evaluation, are mindful of the areas for improvement that have been identified and the need to continue programme momentum for the remainder of the workplan.

SR

IMAREST



2nd R&D
Symposium

21-23 July 2003,
IMO, London

Call for Abstracts

GloBallast, in conjunction with The Institute of Marine Engineering, Science and Technology (IMarEST), and with support from the UK Maritime and Coastguard Agency and the North Sea Directorate (Netherlands), are pleased to announce the 2nd International Ballast Water Treatment R&D Symposium, to be held at IMO Headquarters, London on 21-23 July 2003.

The 1st Symposium was held at IMO on 26-27 March 2001, and was hailed as a success in bringing stakeholders up-to-date with latest developments in ballast water treatment and management and catalyzing a more coordinated and cooperative global R&D effort. Participants requested that the symposium become a regular event.

Since March 2001 significant progress has been made in the field of ballast water treatment R&D and with the new IMO ballast water Convention. The 2nd Symposium will provide a timely opportunity for another major update and refocus of the global R&D effort.

Individuals and groups involved in relevant R&D are invited to submit abstracts for consideration, in strict accordance with the Template for Abstracts, **by 21 March 2003.**

Abstracts submitted will be reviewed by a technical committee and authors of abstracts selected for presentation will be advised in early April. Registration packages and the symposium programme will also be available in April 2003.

Contact : **Sarah Harden**
Senior Events Organiser, IMarEST
Email : sarah.harden@imarest.org

Publications



CIESM Atlas of Exotics – Vol 2

In Ballast Water News No. 9 we announced the launch of the new *CIESM Atlas of Exotic Species in the Mediterranean* – with release of the first volume on fishes.

Publication of subsequent volumes is proceeding at pace, with Volume 2 – Crustaceans, now available, and Volume 3 – Molluscs, soon to be

released. Copies can be ordered via www.ciesm.org.

More Monographs

In Ballast Water News No. 10 we announced the launch of the new GloBallast Monograph Series.

Additional reports in the series are now available, including the Report of the 1st International Ballast

Water Treatment Standards Workshop and the Report of the 1st Black Sea Conference on Ballast Water Control & Management.

Also available are the Proceedings of all *Global Project Task Force Meetings* held to date, and further reports in the series are under preparation. Hard copies can be ordered free of charge from cgregory@imo.org or downloaded as PDF files from:

<http://globallast.imo.org/publications>

Portuguese Guidelines Online

The IMO ballast water Guidelines A.868(20), translated by GloBallast Pilot Country Brazil, are now also available online in Portuguese at:

<http://globallast.imo.org/guidelines>

Biocides Report Online

In 2001 BMT Fleet Technology Ltd in partnership with ESG International Inc. (both of Canada) undertook research into the use of copper and sodium hypochlorite as ballast water biocides, on contract to the State of Michigan (USA) Department of Environmental Quality (see Ballast Water News No. 9 Page 8). The final report is now available from:

www.fleetech.com/download_ballastreport.htm

Due to its size the web version does not include a number of technical appendixes that contain important information in response to peer review of the original report.

Complete copies with all appendixes can be obtained on CD from dstocks@fleetech.com.

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Progress Report

Activities Undertaken October – December 2002

- ✓ Continued second round of country visits for ballast water risk assessments.
- ✓ Presented at IMO-UNEP Regional Seas Forum, IMO London 2 September.
- ✓ Prepared for and attended Inter-sessional Ballast Water Working Group meeting, IMO London, 30 Sept – 4 October.
- ✓ Prepared for and attended MEPC 48, IMO London, 7-11 October.
- ✓ Attended and presented at MAP/RAC/SPA meeting to elaborate an action plan on introduced and invasive species in the Mediterranean Sea, Barcelona 24-26 October.
- ✓ Reviewed and approved country-specific project proposals in GloBallast Pilot Countries, including ballast water treatment R&D in China, Golden Mussel monitoring and book publication in Brazil and plankton monitoring and pathogen characterization studies in South Africa.
- ✓ Prepared for and held 4th Global Task Force meeting, Beijing, China 28-30 October
- ✓ Prepared for and held 1st East Asian Regional Workshop, Beijing, China 31 October – 2 November.
- ✓ Participated in CIESM shipping vectors workshop, Istanbul, Turkey 6-8 November.
- ✓ Lectured twice at NIOZ marine environment course for seafarers, Texel, Netherlands.
- ✓ Assisted and participated in joint RECSO/GloBallast tanker industry workshop, Dubai 16-18 December.
- ✓ Completed mid term evaluation review.
- ✓ Progressed GloBallast Advanced funding submission to GEF.
- ✓ Published three new volumes in the GloBallast Monograph Series and Proceedings of three Global Task Force meetings.
- ✓ Commenced development of Country Profile database for GloBallast web site.
- ✓ Produced 11th issue of Ballast Water News.



Photo credit: William & Coleman



Activities Planned January – March 2003

- PCU staff annual leave.
- Finalise port biological baseline survey – six Pilot Countries.
- Finalise ballast water risk assessments – six Pilot Countries.
- Implement Country Profiles database, GloBallast web site.
- Prepare for and participate in Inter-sessional Meeting of IMO Ballast Water Working Group 3-7 March.
- Attend/present at 3rd International Marine Bioinvasions Conference, San Diego, USA 16-19 March.
- Co-chair ICES/IOC/IMO Study Group on Ballast and other Ship Vectors, Vancouver 24-25 March.
- Validate ballast water training modules.
- Lecture at NIOZ marine environment course for seafarers, Texel, Netherlands.
- Finalise planning and arrangements for 1st International Workshop on Standards and Guidelines for Ballast Water Sampling, Brazil 7-11 April.
- Finalise planning and arrangements for 1st International Workshop on Standards and Guidelines for Invasive Aquatic Species Surveys and Monitoring, Brazil 13-17 April.
- Continue publishing the GloBallast Monograph Series.
- Produce 12th issue of Ballast Water News.



More Information?

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