



International Paint & Printing Ink Council

IPPIC Marine Antifouling Coatings Task Force Position paper on Invasive Species and Biofouling

Colonization of invasive species in marine waters and their detrimental effects to valuable ecosystems and resources has raised concerns about the migration of non-indigenous species between bioregions. Increased world trade and subsequent transport of goods across the oceans and along coastlines has enhanced concerns about harm to valuable resources due to biofouling on ships. This has been highlighted by the inclusion of a new agenda item for the International Maritime Organization Marine Environment Protection Committee, and the recent formation of a correspondence group under the Sub-committee on Bulk Liquid and Gases. This sub-committee and correspondence group is focusing on the development of international measures for minimizing the translocation of invasive aquatic species through biofouling of ships.

Some findings of this sub-committee include:

- 1) Bio-fouling organisms are extremely diverse, and more than 4000 species have been recorded.¹
- 2) Historically vessels were heavily fouled and able to transport species over large distances.² With improved anti-fouling technology the substantial growth that had been observed on vessels after less than 1 year were not being observed after in-service periods of up to 5 years.^{3,4} Consequently bio-fouling as a vector for invasive species transfer was thought to be adequately mitigated. However, this has proved to be a false perception and there is now a sizeable body of knowledge which indicates bio-fouling remains a significant vector for species translocations. This includes both analysis of established non-indigenous species^{5,6,7} and direct experimentation or observation of fouling assemblages.⁸ A recent key finding has been that while the main hull of a vessel may be kept relatively clear of bio-fouling, there are “niche” areas where fouling organisms can accumulate.^{9,10}
- 3) Biofouling has been estimated to be a more significant transport mechanism than ballast water for the introduction of invasive species in many waters including Hawaii, New Zealand, Port Phillip Bay, Australia, North America and the North Sea.¹⁰
- 4) Invasive species from fouling is a significant threat to marine ecosystems and invasions have in some incidences been devastating to an ecosystem; examples include the Japanese kelp in New Zealand and Australia, the red seaweed in Hawaii, mussels including species of *Perna* in the Gulf of Mexico, *Mytilus* in South Africa, *Limnoperna* in Brazil and *Dreissena* in North America and Europe.¹⁰
- 5) Invasive species can be a threat to human health. Although there is little direct evidence of human health impacts from the transport of species in bio-fouling, the complexity and diversity of bio-fouling assemblages suggests the potential for this. For example, crabs can be transferred with bio-fouling and the Chinese mitten crab is a secondary intermediate host for the Asian lung fluke which has caused deaths in Asia.¹⁰
- 6) Invasive species and biofouling can harm resources including aquaculture, fisheries, factories and water supply facilities. Bio-fouling on vessels and other marine structures can interfere with the operation of submerged equipment, impose increased loading and accelerate corrosion on coastal and offshore marine structures, cause navigation buoys to

sink, and adversely affect the performance of ships by increasing hydrodynamic drag, which necessitates the use of more power and fuel to move a ship through the water and consequent increase in greenhouse gas emissions. Many ships and coastal industries, including power and desalination plants, use piped seawater for engine and equipment cooling, fire fighting, and potable water generation. Bio-fouling growth in the seawater intakes, pipe work, heat exchangers and other system components can reduce the efficiency of, or cause failures in these systems. Notable examples are the effects of the zebra mussel on industry in the North American Great Lakes and the Asian green mussel, a problem fouler of power station intakes in India.¹⁰

The fouling of structures and equipment is a constant issue and the introduction of new fouling species, which may be uninhibited by competition, predation and/or disease, can have significant impacts on marine resources. In aquaculture, examples of invasive species which have most likely been introduced as bio-fouling and have significantly impacted operations include; ascidians, serpulid tubeworms, and bivalves *Mytilus galloprovincialis* and *Crassostrea gigas*.¹⁰

Fisheries have also been impacted by the introduction of invasive species for which vessel bio-fouling was the most likely vector. Documented impacts include bryozoans and ascidians.¹⁰

Both aquaculture and fisheries may also be impacted by diseases spread along with hull fouling species but there has been little research to confirm this. The parasitic copepod *Mytilicola intestinalis* is thought likely to have been introduced to northern Europe from the Mediterranean in its host, the mussel *Mytilus galloprovincialis*, on the hulls of ships. An epidemic of *M. intestinalis* damaged mussel fisheries in the Netherlands in the early 1950s, and infections also spread to native bivalve species. The potential spread of disease associated with bio-fouling was summarized¹¹, noting that vertically transmitted diseases such as *Perkinsis* spp. could be spread simply by a spawning of hull fouling species. Other diseases potentially spread by hull fouling are white spot disease via barnacles, amoebic gill disease and bonaiosis.¹⁰

Invasive species are obviously a global problem on many levels and biofouling from vessels has been shown to be an important contributing factor. IPPIC believes that the use of the most effective, safe antifouling systems is essential to minimizing biofouling and the transfer of non-indigenous species, thus providing protection of resources harmed by biofouling. At the same time, other contributing factors like ship design, in-water hull cleaning and treatments for niche areas should be taken into consideration.

The IMO Anti-Fouling Systems Convention entered into force on September 17, 2008. This treaty addresses the importance of protecting the marine environment and human health from harmful anti-fouling systems. Rigorous legislative systems like the EU Biocidal Products Directive and the US FIFRA, Federal Insecticide Fungicide and Rodenticide Act, legislation are in place, and many countries are regulating the use of chemicals based on chemical inventories similar to US Toxic Substances Control Act and EU REACH. New regulatory schemes will be created that effectively evaluate the risk of anti-fouling systems. The potentially over-restrictive influence of selective legislative regimes, however, could jeopardize innovation and development of new effective antifouling solutions needed to tackle biofouling reduction. We believe that properly reviewed anti-fouling systems should be promoted as one important method to prevent the severe harm from invasive species and biofouling.

Effective anti-fouling systems and the use of fouling release coatings also play an important part in reducing hydrodynamic drag, consequently reducing greenhouse gas emissions and saving fuel resources. A fouled hull leads to increased frictional resistance which results in a loss of speed or increased fuel consumption (in order to maintain speed). Fouling reduces the maneuverability of the vessel and may cause deterioration to, or damage of, the coating system leading to premature corrosion of the hull. This, together with an increased frictional drag has both an economic and environmental impact on shipping operations. According to the IMO the world's trading ships were estimated to burn 369 million tonnes of fuel in 2007 and are estimated to burn 486 million tonnes in 2020.

In order to address bio-fouling responsibly and in a balanced way all stakeholders in shipping need to be involved, focusing on the subject from an integrated perspective. We should not accept one-sided perspectives restricting a multi-faceted issue, an issue posing a threat to ecosystems, human health and the resources we all count on.

The members of the IPPIC Marine Anti-Fouling Coatings Task Force are dedicated to the continued development and support of the most effective, safe coatings systems. It is our position that invasive species and biofouling pose a much more severe threat to ecosystems, human health and the resources we all count on than biocide free and biocidal coating systems that have passed rigorous regulatory review. The IPPIC members will continue to perform studies on existing coatings systems and develop new coatings systems which are safe and effective in preventing bio-fouling and the introduction of invasive species around the world. We are also dedicated to cooperation with other stakeholders, and are willing to contribute in a multifaceted approach to resolve a multifaceted problem.

¹ IMO Sub-Committee on Bulk Liquids and Gases, BLG 12/11, Nov.2, 2007 Document I:\BLG\12\11.doc., “Development of International Measures for Minimizing the Translocation of Invasive Species Through Biofouling of Ships”, Submitted by New Zealand and Australia

^{2,3}SKERMAN, T. M. Ship-fouling in New Zealand Waters: A survey of marine fouling organisms from vessels of the coastal and overseas trades. N. Z. Jl. Sci., v. 3, n. 4, p. 620-648, 1960.

⁴Lewis, J. A (2002) The significance of the prospective ban on tributyl tin in antifouling paints in the introduction and translocation of marine pests in Australia. Report prepared for Agriculture Fisheries and Forestry.

⁵ Cranfield, H.J., Gordon, D.P., Willan, R.C. *et al.* (1998) Adventive marine species in New Zealand. *Technical Report 34*. National Institute of Water and Atmospheric Research, Wellington, New Zealand.

⁶ Callow M.E. Ship-fouling: the problem and method of control. *Biodeterioration Abstr.* 1996;10:411–421.

⁷ Coles, S.L., R.C. DeFelice, & L.G. Eldredge. Nonindigenous marine species introductions in the harbors of the south and west shores of Oahu, Hawaii. Report prepared for the David and Lucile Packard Foundation.

⁸Coutts & Forrest 2006 Development and application of tools for incursion response: Lessons learned from the management of the fouling pest *Didemnum vexillum*

⁹ASA (2006) Commercial Vessels Biofouling Project – Final Report. Australian Shipowners Association, Port Melbourne, Australia

¹⁰ IMO Biofouling Correspondence Group “Summary of Biofouling Research”, September 6, 2008

¹¹Minchin, D. (2007) Aquaculture and transport in a changing environment: Overlap and links in the spread of alien biota. *Marine Pollution Bulletin*, 55, 302-313.