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## **Hull fouling as a source of marine invasion in the Antarctic**



## Hull fouling as a source of marine invasion in the Antarctic

### Introduction

1. Annex II to the Protocol on Environmental Protection, on the Conservation of Antarctic Fauna and Flora requires that precautions be taken to prevent the introduction of non-native species to the Antarctic Treaty Area.
2. At CEP IX, New Zealand introduced WP13 and IP46 on *Non-Native Species in the Antarctic*. The CEP agreed with the six recommendations arising from the workshop reported in WP13, including that ‘the issue of non-native species should be given the highest priority...’ and that ‘...particular research attention needs to be given to microbial communities and marine ecosystems’.
3. The introduction of non-native marine species can take place either via dispersal as fouling organisms on kelp rafts (and possibly other organisms), plastic debris or small water craft, or via transport on or in ships entering the Antarctic Treaty area. In the case of ships, introductions may take place via ballast water exchange or by fouling of the hull and sea chests (recessed intake areas for seawater used in the ship’s operation).
4. At CEP IX the United Kingdom presented WP 5 (rev. 1) Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area, with the aim to support early implementation of these guidelines developed by the IMO Ballast Water Convention. This led to Resolution 3 (2006) which recommended that the Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area be used by all ships in the Antarctic Treaty area except those referred to in Article 3, paragraph 2 of the IMO Ballast Water Management Convention.
5. Although the risks from introductions via ballast water could be significant, adoption of Resolution 3 (2006) by the ATCM has substantially reduced that risk.
6. This information paper focuses on risks associated with fouling communities that have been reported from vessels operating in the Antarctic Treaty Area. It provides a brief summary of the available information, provides access to this information through an appropriate bibliography, and makes several recommendations for additional research.

### Hull fouling on vessels operating in Antarctic Treaty area

7. As a source of introductions, biofouling has been neglected relative to ballast water. However, recent studies have shown that it is an important vector. To date, five vessels that regularly travel to the Antarctic Treaty area have been surveyed for hull fouling. In all five cases, fouling was found to be substantial whilst the ships were in port.
8. Fouling is, unsurprisingly, much reduced by anti-fouling treatments, but those areas of the hull resting on supports in dry dock, that typically go untreated, have much denser fouling assemblages than treated areas.
9. The recorded fouling assemblages can be large and diverse, including as many as 18 species, at least some of which are known invasive species elsewhere in the world.
10. Although hull fouling assemblages are reduced during transit at sea, the speed of many vessels entering the Antarctic is thought to be too slow to remove much of the assemblage.
11. Ice-scouring is known to remove hull fouling assemblages and anti-fouling treatments (*c.* 50% after a 60 day voyage in one case). However, the relationship between ice thickness, extent, encounter rate, and the extent of removal of fouling is unknown.
12. Ice-scour is unable to remove fouling from sea chests. Sea chests are recessed areas from which sea water is drawn into the ship for operational purposes. They are typically guarded by grates and include several baffles.

13. To date, only a single study has investigated fouling assemblages in the sea chests of a vessel regularly travelling to the Antarctic. This study demonstrated that, after three years, an extensive fouling assemblage of the invasive Mediterranean mussel, *Mytilus galloprovincialis*, had developed. This assemblage included individuals that had travelled to the Antarctic (c. 69°S) and survived exposure to conditions typical of the Antarctic marine environment.
14. Smaller vessels and craft, typically transported on board larger research vessels and deployed for use on arrival at a given destination, may also harbour considerable fouling assemblages. The only study undertaken to date found a diverse (c. 20 species) and substantial fouling assemblage on a barge that was planned to be used in local operations.

### **Research requirements**

15. The extent to which hull fouling assemblages are found on all vessels entering the Antarctic Treaty area is poorly known, as is the relationship between port layover time, ship size and the extent of fouling.
16. The relationships between ice characteristics and cover, and removal of hull fouling assemblages and anti-fouling treatments remains unknown. Low pack ice cover is likely to have a minimal effect on fouling communities, which is of particular importance in those cases where many vessels are entering an area that is typically mostly free of pack ice in the summer.
17. Hull fouling assemblages in sea chests remain little known, yet potentially of considerable significance.
18. The extent of fouling and organisms found on smaller vessels and craft used for operations remains poorly explored.
19. The physiology of typical fouling organisms from various parts of the world is a neglected research area. It is to be expected that establishment of non-native marine species will only be possible in those species that can tolerate the conditions of the Antarctic marine environment.
20. Because Antarctic marine diversity remains relatively poorly known (given the size of the Antarctic region), detection of novel organisms is likely to be problematic without better characterization of this diversity. The Census of Antarctic Marine Life is a welcome step in this direction. Nonetheless, research to find ways of appropriately reducing the risks posed by hull fouling is urgently required.

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