

## Native and non-native marine biofouling species present on commercial vessels using Scottish dry docks and harbours

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### Summary

Biofouling samples from the hulls of commercial vessels using Scottish dry docks and harbours were collected to investigate which species are being transported into Scottish waters. During 2009 – 2012 a total of 29 vessels were surveyed in three dry docks and a dive team was used to sample a further six vessels at two busy North Sea harbours. The vessels were representative of those servicing the North Sea oil industry e.g. tugs, supply and safety stand by vessels and provide a good indication of the type of fouling found on vessels that typically trade in Scottish coastal waters. The biofouling consisted of typical North Sea species and four established non-native species, *Jassa marmorata*, *Caprella mutica*, *Austrominius modestus* and *Amphibalanus amphitrite* were recorded. No new non-native species were recorded during this study.

### Introduction

The transport of non-native species via ballast water and biofouling has long been recognised. A number of worldwide studies have investigated which species are transported as biofouling on both commercial and recreational vessels (Coutts and Taylor, 2004; Davidson et al. 2009; ). Currently there is limited knowledge on which species are being transported into UK waters via biofouling and which types of vessel pose a greater risk. A previous study focussing on recreational vessels from Scottish marinas (Ashton et al. 2006a) found that 59 % of surveyed vessels had biofouling, suggesting that this type of vessel posed a high risk of transporting non-native species around UK waters. However no studies examining fouling on commercial vessels have been carried out in the UK. The aim of this study was therefore to assess which species are being transported into Scottish waters via biofouling on these types of vessels by visiting dry docks and harbours.

### Materials and Methods

Three dry docks in Scotland were visited between 2009 and 2012 at Aberdeen and Leith on the east coast, and Greenock on the west coast. Docking schedules were provided by the dry dock companies so sampling trips could be organised. To obtain information on the vessels sampled, a questionnaire was completed during each trip. Each vessel was surveyed for areas of fouling and samples were collected from these targeted areas. Due to differences in vessel design and structure it was not possible to sample from identical areas on each one. In order to sample larger, ocean-going vessels that were unable to utilise these dry docks, a dive team undertook sampling of vessels while berthing in Aberdeen and Peterhead harbours. A similar method of surveying and sampling both sides of each vessel by targeting niche areas was attempted but problems were encountered which limited the success of the dive surveys and examination of the fouling was not always possible. These samples were excluded from further analyses and the study focussed on results from the dry dock surveys. Samples were removed with paint scrapers, stored in small tubs and fixed in 4 % formalin. After fixing, samples were thoroughly rinsed with running tap water in a 100 µm sieve. Following an initial sort to group organisms together subsamples were transferred to glass vials and preserved in 70 % ethanol. Specimens were then identified to species level or lowest taxonomic level possible using a Leica MZ75 stereo microscope. The presence of algae was noted but no further identification was undertaken.

## Results and Discussion

Twenty nine vessels were surveyed during the study. Due to dry dock sizes, these were restricted to local ones servicing the North Sea oil and gas industry including survey, safety standby, tug and search and rescue, and Western Isles passenger ferries. Four non-native species previously recorded in UK waters were recorded on 39 % of vessels; the barnacles *Austrominius modestus* and *Amphibalanus amphitrite*, and the amphipods *Caprella mutica* and *Jassa marmorata*. All of these species have previously been reported as being transported as biofouling on vessels (Eno et al. 1997). No new non-native species were observed. Biofouling communities consisted of species typical of the North Sea. The most commonly occurring organisms were barnacles, algae and mussels. These were followed by amphipods, bryozoans, worms and hydroids. Anemones and isopods occurred less frequently (Figure 1). The most species-rich areas across all vessels were found to be the hull, stern and keel (Figure 2) whilst the most heavily fouled areas were the more protected areas such as the sea chests, bow thrusters and propeller areas (data not shown). This is consistent with previous studies (Cutts and Taylor, 2004; Davidson et al. 2009). To enable more quantitative work to be carried out and to investigate the risks of any new non-native species entering Scottish waters, larger ocean-going vessels on international trade routes would have to be sampled, as in Gollasch (2002).

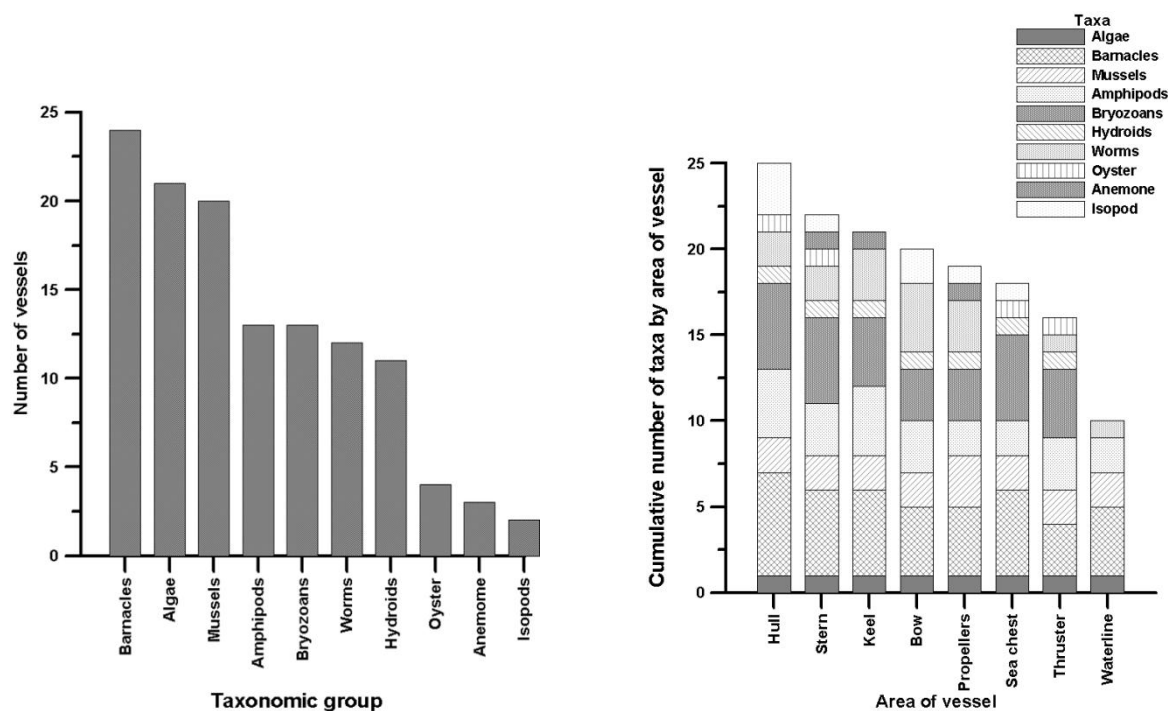


Figure 1. Number of vessels on which each taxon was Recorded.

Figure 2. Number of taxa recorded by area of the vessel

## References

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