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Species richness and invasion vectors: sampling techniques and biases

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Abstract

During a European Union Concerted Action study on species introductions, an intercalibration workshop on ship ballast water sampling techniques considered various phytoplankton and zooplankton sampling methods. For the first time, all the techniques presently in use worldwide were compared using a plankton tower as a model ballast tank spiked with the brine shrimp and oyster larvae while phytoplankton samples were taken simultaneously in the field (Helgoland Harbour, Germany). Three cone-shaped and 11 non-cone shaped plankton nets of different sizes and designs were employed. Net lengths varied from 50 to 300 cm, diameters 9.7–50 cm, and mesh sizes 10–100 μm. Three pumps, a Ruttner sampler, and a bucket previously used in ballast water sampling studies were also compared. This first assessment indicates that for sampling ballast water a wide range of techniques may be needed. Each method showed different results in efficiency and it is unlikely that any of the methods will sample all taxa. Although several methods proved to be valid elements of a hypothetical 'tool box' of effective ship sampling techniques. The Ruttner water sampler and the pump P30 provide suitable means for the quantitative phytoplankton sampling, whereas other pumps prevailed during the qualitative trial. Pump P15 and cone-shaped nets were the best methods used for quantitative zooplankton sampling. It is recommended that a further exercise involving a wider range of taxa be examined in a larger series of mesocosms in conjunction with promising treatment measures for managing ballast water.