Papers

Formation and species composition of stormcast beach wrack in the Gulf of Riga, Baltic Sea*

doi:10.5697/oc.56-4.673
OCEANOLOGIA, 56 (4), 2014.
pp. 673–695.

KEYWORDS
Beach wrack
Waves
Currents
Storms
Hydrodynamic modelling
Biodiversity
Macrovegetation

Ülo Suursaar*
Kaire Torn
Georg Martin
Kristjan Herkül
Tiit Kullas

Estonian Marine Institute,
University of Tartu,
Mäealuse 14, EE–12618 Tallinn, Estonia;

e-mail: ulo.suursaar@ut.ee

*corresponding author

Received 25 November 2013, revised 10 April 2014, accepted 23 April 2014.

Abstract

The aim of the study was to investigate hydrodynamic effects on the formation of beach wrack at three locations in the northern Baltic Sea and to quantify the differences between the composition of species found in the beach wrack and in the

* The study was supported by the EU Life+ project MARMONI 'Innovative approaches for marine biodiversity monitoring and assessment of conservation status of nature values in the Baltic Sea', ESF grant No. 8980, Estonian target financed project SF0180104s08 and Institutional research funding IUT2-20 of the Estonian Research Council.

neighbouring sea. Hydrodynamic measurements and modelling indicated that the beach wrack was mostly of local origin and that it was formed during high sea level and wave events. Comparison of the methods of beach wrack sampling and seabed sampling (diver, underwater video) demonstrated that beach wrack sampling can be considered an alternative tool for describing the species composition of macrovegetation in near-coastal sea areas. Although the hydrodynamic variability is greater in autumn and more biological material is cast ashore, the similarity between the two sampling methods was higher in spring and summer.

1. Introduction

Wave action, tides and aperiodic water level fluctuations are among the most important factors for the development and distribution of macrovegetation in coastal sea areas (Kautsky & van der Maarel 1990, Kautsky et al. 1999, Boller & Carrington 2006). Besides the direct influence of physical disturbance, the site-dependent hydrodynamic conditions act on benthic communities through turbidity-related light restrictions and by structuring the bottom substrate (Herkül et al. 2011, Kovtun et al. 2011). Most macroalgae and all aquatic vascular plants are attached by holdfasts or roots to the seabed. However, spring tides, strong currents or waves during stormy weather conditions may rip vegetation off its substrate and cast it on to the shore (Lobban & Harrison 1994, Ochieng & Erftemeijer 1999). Detached macrovegetation that is washed ashore and accumulated on a beach is called beach wrack, beach cast, stormcast, wrack band or beach strand. Beach wrack can also be formed from unattached, drifting macroalgae; their mass occurrence is often promoted by elevated nutrient levels (e.g. Kirkman & Kendrick 1997). The wrack line is a strip of debris that usually runs parallel to the edge of the water and marks either the high tide or storm swash line. This wrack line can consist of a mixture of both natural material and man-made litter.

Hydrodynamics plays a major role in the process of detachment, transport and accumulation of macrovegetation. Wrack deposition is highly variable depending on beach type, nearshore hydrodynamics and buoyancy characteristics of the wrack; in a curved or indented coastline, the beach wrack and detritus distribution may be rather patchy (Orr et al. 2005, Oldham et al. 2010). As the wrack particles dry on the shore, the biological material becomes more buoyant and can also be moved back to sea during the next high water event that covers the wrack. The buoyancy of different macrophyte species varies: some species (e.g. *Fucus vesiculosus* L.) can be cast ashore more easily than others. Furthermore, the material may originate in nearby areas but can also be carried as drifting algal mats from distant locations (Biber 2007). Over a period of about one year beach wrack decays and becomes detritus. Regarding persistence,