

Beach-cast growth and harvest potential in the Baltic Sea

Socio-economic benefits of sustainable beach-cast production in the Baltic Sea region

Harvesting of naturally occurring marine beach-cast and turning it into a marketable product (food, cosmetics etc.) offers an alternative avenue to macroalgal production while aligning with Blue Growth concepts. Beach-cast does have ecological functions such as providing food and habitat for sandy beach fauna, nutrients for dune vegetation, and protection for coastal dunes. Nevertheless, beach-cast is often considered a nuisance to humans due to the production of unpleasant odours when cast matter decomposes on the shoreline. This decomposition process also coincides with the production of carbon emissions. It has been estimated that the annual CO₂-C flux from seagrass wrack globally is between 1.31 and 19.04 Tg C yr⁻¹, which is equivalent to annual emissions of 0.5–9 million people depending on their geographic region. Thus, harvesting and removal of beach-cast while turning it into a marketable product offers a possibility to contribute reducing carbon emissions. Efficient management of marine resources is of key importance for achieving sustainable environmental status in the European seas and sustainable blue growth of coastal communities.

High production potential and harvest hotspots

Existing environmental data and expert opinions were gathered and harmonized into a GIS database which allowed us to model the expected amounts of beach-cast in the Baltic Sea region. The model carries out spatially explicit analyses on the environmental suitability and production of beach-cast. Higher amount of beach-cast is expected in the late autumn months and the early winter along with the end of production season and the onset of heavier storms. High beach-cast production is predicted at shores that have narrow photic zone (i.e. distance to the 10 m isobath less than 1 km) and are exposed to favourable wave direction. Moreover, higher solar radiance and water salinity is associated with elevated beach-casts (Fig. 1).

Monthly beach-cast production (grams per square metre)

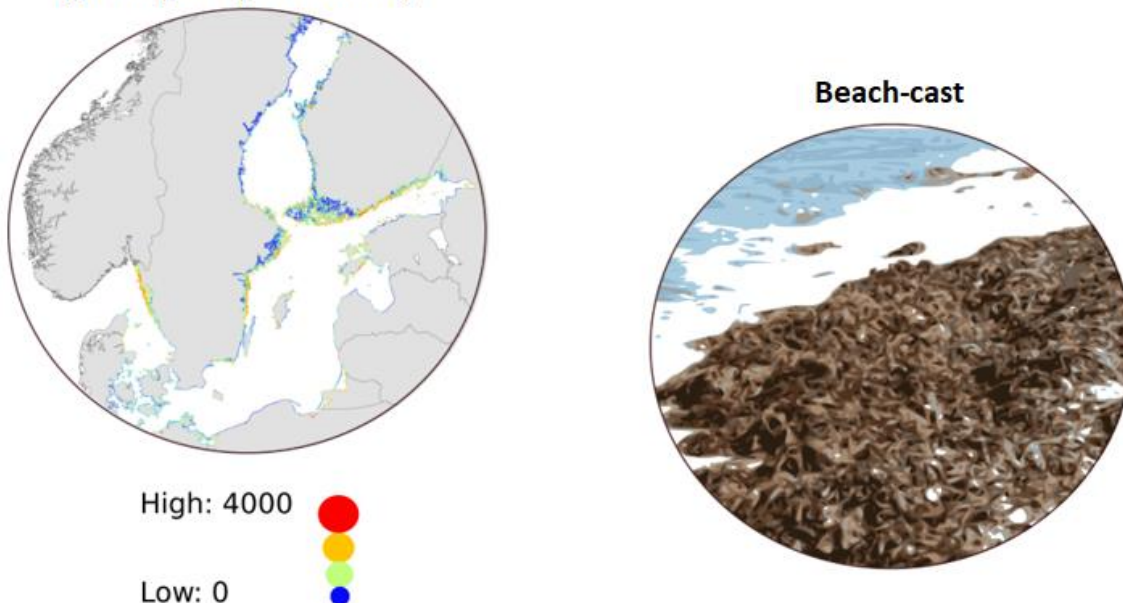


Figure 1. Beach-cast growth production potential in the Baltic Sea. More details see project report: http://www.sea.ee/bbgodss/Materials/GRASS_GoA2.1_final_report_30062020.pdf

Clear hotspots of beach-cast production and harvest emerged throughout the whole Baltic Sea area (including Kattegat) (Fig. 1). The highest production values (up to 4000 g per m² per month) were observed on the west and east coast of Sweden, all along the southern coast of Finland, west coast of Estonia and in

Gdansk Bay (Fig. 1). However, some production hotspots were sporadically found even on the east coast of Finland, reaching northernmost parts of the Bothnian Bay as well as on the shores of St. Petersburg (Fig. 1). The remaining parts of the Baltic Sea were characterised by lower beach-cast production potential (approximately 0 - 1,000 g per m² per month).

Technologies and techniques

Collection of beach-cast is commonly done using agricultural machinery and equipment for plowing to create piles and removing piles after completed composting process. The type of machinery vary according to access in the area, and some are modified to better suit the purpose of beach-cast handling, such as minimising the addition of sand and rocks. The procedure is practiced at a systemic scale in Russia, Sweden, and Latvia.

Environmental-ecological benefits/risk

The semi-enclosed Baltic Sea is very sensitive to eutrophication and collection of beach-cast could be an intervention to mitigate these processes. When macroalgae are collected we not only lower nutrients from the sea but we lower the ratio of nitrogen to phosphorus. The latter is important to decrease the eutrophication symptoms in the Baltic Sea region. However, different technologies and techniques used for collection of beach-cast will interact with the environment in different ways. The significance of impacts will depend on machinery and equipment used or amount of beach-cast algae harvested, and the site where the algae is gathered. Caution should be taken when choosing the sites for collection as beach-cast algae provide food and habitat for many invertebrates as well as birds. A removal of algae may disturb these habitats and species.

Decision-support tool for identifying promising areas for beach-cast harvest

The resulting modelling products were made public through an online Operational Decision Support System (ODSS) that provides stakeholders with the basis to identify suitable areas for beach-cast harvest (<http://www.sea.ee/bbg-odss/Map/MapMain>). On the main page of the portal under “switch layers tab” the user can, for example, select the map of monthly beach-cast production and display and compare the results across the Baltic Sea with other data layers.

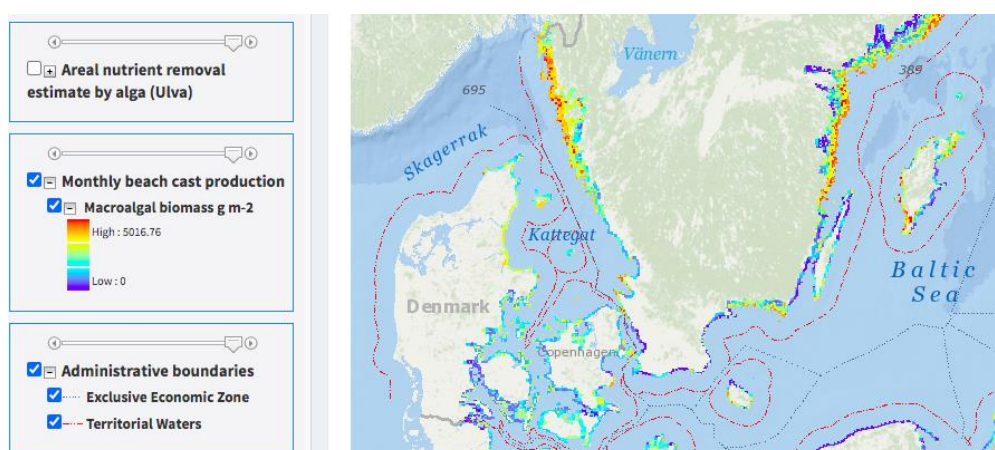


Figure 2. Online ODSS tool displaying beach-cast production in the Baltic Sea

Implications and awareness

The decision-support tool about beach-cast growth production is accessible to everyone - from public authorities interested in harvesting beach-cast in their coastal region to private actors who want to get involved in the algae business. We spatially outline areas with expected high yields of beach-cast accumulation by which we (1) support decision-makers with the best tools for strategy development, resource allocation and spatial planning as well as (2) raise awareness and confidence in public sector towards balanced and environmentally friendly marine beach-cast harvesting in the Baltic Sea.