

## A preliminary carbon budget for a part of the Ems estuary: The Dollard

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**ABSTRACT:** During 1975, measurements were made to quantify all sources of input of organic matter in the Dollard. This made a comparison possible between in situ primary production, import from natural sources and organic waste discharges in terms of organic carbon. In order to make a carbon budget, mineralization and the amount of organic matter buried in the sediment was also measured. Input of organic carbon was mainly based on primary production on the tidal flats (measured in situ as  $O_2$  production,  $9.3 \times 10^6$  kg C · year<sup>-1</sup>), accumulation of suspended matter originating from the North Sea and the River Ems (maximal  $37.1 \times 10^6$  kg C · year<sup>-1</sup>) and discharge of heavily polluted water ( $33.0 \times 10^6$  kg C · year<sup>-1</sup>). Input from primary production in the water phase was negligibly low ( $0.7 \times 10^6$  kg C · year<sup>-1</sup>). Loss of organic carbon was due to mineralization in the sediment (measured in situ as oxygen consumption,  $18.2 \times 10^6$  kg C · year<sup>-1</sup>), mineralization in the water phase (using the BOD technique,  $7.2 \times 10^6$  kg C · year<sup>-1</sup>) and burying of organic matter in the sediment ( $9.9 \times 10^6$  kg C · year<sup>-1</sup>). The loss of dissolved organic matter to the adjacent Waddensea was not measured but must be considerable. Allochthonous detritus was the main source of energy for the food-webs in the Dollard. The role of bacteria as an important source of food for higher organisms in the Dollard is discussed.

### INTRODUCTION

Estuaries are often areas where allochthonous material of natural origin is deposited, due to hydrological factors. This material consists partly of particulate organic detritus, an extra source of energy that makes intensive biological activity in such estuaries possible. This activity requires large amounts of oxygen. Although in shallow estuaries the tidal movement establishes a good oxygen supply by reaeration, undersaturation may occur as a result of the aerobic mineralization (de Groot & Postma, 1968).

The populations of various organisms in estuaries are believed to be adapted to such enriched environments. Caspers (1968) assumed that introduction of organic waste water was essentially only an extension of natural pollution.

The Ems estuary receives organic matter both from natural sources and from waste water discharges. In the "Biologisch Onderzoek Eems-Dollard Estuarium" most of the trophic levels in the estuary are at present studied by a group of biologists. The aim of this investigation is to describe the biological state of the estuary and to