Variability in stock assessment of cockles *(Cerastoderma edule* L.) in the Oosterschelde (in 1980-1990), in relation to environmental factors

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Abstract

The edible cockle (*Cerastoderma edule L.)* is a dominant suspension feeder in the Oosterschelde, a 351 km^2 tidal bay in the SW Netherlands. To establish its role in the benthic foodweb, and to assess the impact of human activities, data on density, age composition, biomass and growth were collected from several tidal flats in the Oosterschelde between 1980 and 1990.

To estimate the overall biomass development of the cockle, a simple model was used, in which three growing seasons are defined for the cockle population. A standard individual growth curve was constructed. A negative exponential mortality function was assumed to estimate the number of recruits. By combining the estimated number of recruits, the estimated specific mortality rate and the standard individual growth curve, numbers and biomass of each age group in the Oosterschelde population were estimated. Average biomass (including shell organics) per m^2 of tidal flat in August varied from 140 g AFDW in 1980 to 21 g AFDW in 1989, implying a total cockle stock on all tidal flats of 19 170 to 2350 tonnes AFDW (72 x 10^3 to 9 x 10^3 tonnes flesh), respectively.

A comparison of results from field surveys and the reconstructed stock estimations showed large deviations. However, an uncertainty analysis performed on the model showed that most field data fitted within the minimum and maximum biomass calculated.

Total biomass is largely dependent on the strength of certain year classes. In this respect, the year classes 1979, 1982, and 1985 were good. Effects of the construction of the storm-surge harrier and the compartmentalisation dams could not be demonstrated.

The year-to-year variation in cockle stocks, assessed in the way described in this paper should be regarded as relative, because a systematic survey of the intertidal flats was not performed every year, but population dynamics from selected stations were used instead.

Introduction

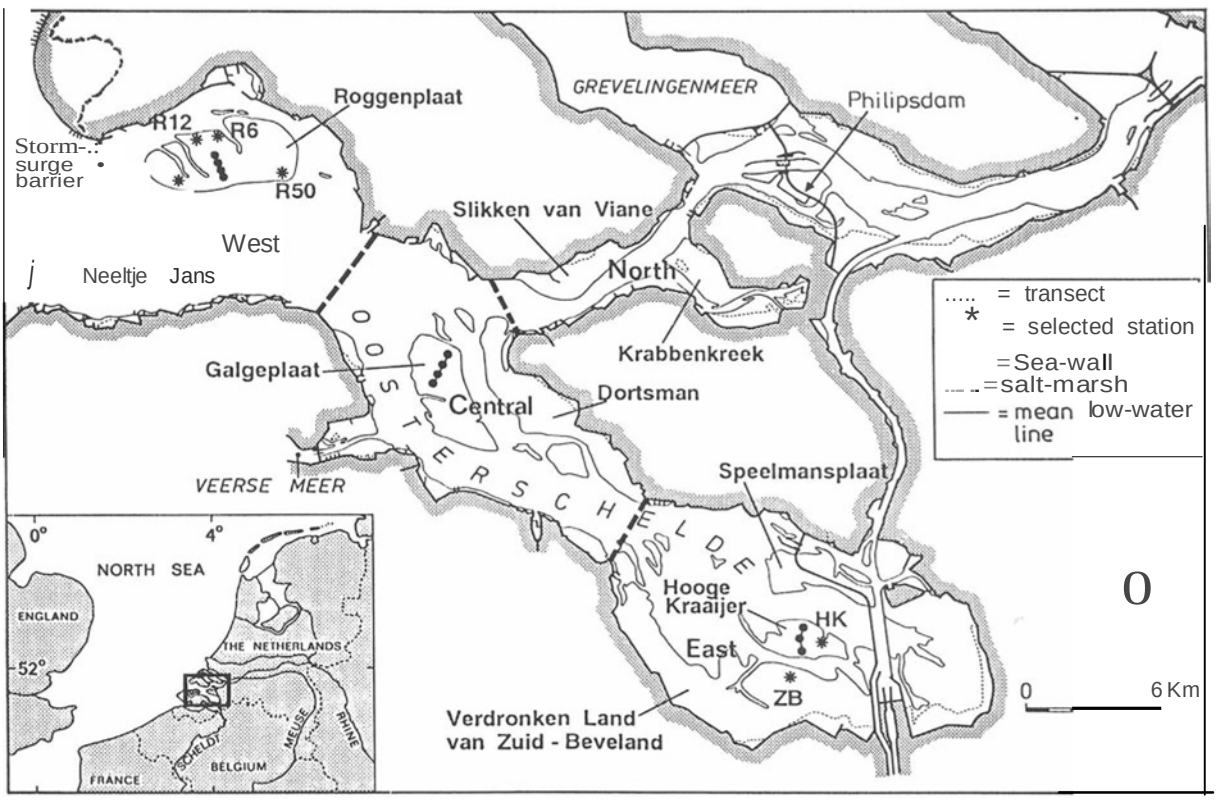
Next to the blue mussel *(Mytilus edulis L.),* the edible cockle (*Cerastoderma edule L.)* is the dominant suspension feeder in the Oosterschelde, a 351 km^2 tidal bay in the SW Netherlands. It is very abundant on most intertidal flats and is also found on subtidal slopes.

Cockles are mostly aggregated in banks, that appear at different places from time to time, depending on local conditions like the presence of low current velocity and silty sediment, which favour the settlement of spat (Wolff, 1973).

Density varies from year to year, depending on success of spatfall, mortality due to low winter temperature, fishing activity and predation by benthic invertebrates, fish and birds. Biomass depends on density and growth, wh1ch in turn is related to food availability. A Simulation Model Oosterschelde EcoSystem (SMOES) has been designed for the Oosterschelde (Klepper, 1989), describing transport processes, nutrient levels and energy fluxes between primary production, filter-feeders, deposit feeders and a number of other variables (Scholten & v.d. Tol, 1994). Since cockles may contribute up to 50% of the biomass of filter feeders and the Jatter is one of the forcing functions in SMOES, it is important to assess the biomass of different age groups per year.

The aim of this paper is to reconstruct the biomass of intertidal cockles from data collected by different workers on spatfall, growth and biomass of individual cockles, at several locations in the Oosterschelde during the years 1980 to 1990. A comparison will be made with extrapolations of field data to establish the sensitivity of the estimate.

In the study period (1980 to 1990) the hydrodynamics and morphology of the Oosterschelde changed due to the construction of the storm surge harrier and two additional dams. Factors such as severe winters and fishery activities could also have influenced the size of the cockle stock in the Oosterschelde. A second aim of this paper is therefore to investigate if variations in the cockle stock can be attributed to specific environmental factors.



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