

NOTE

Mortality of the Pacific Oyster (*Crassostrea gigas*, Thunberg, 1793) in 2006 at the East Frisian coast, Germany, North Sea

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Abstract

Since 1998 the Pacific oyster *Crassostrea gigas* (*C. gigas*) has spread widely across the East Frisian Wadden Sea. Summer mortality of *C. gigas* was observed for the first time in 2005, in this area. In this study mortality data of the oyster, during summer 2006, are presented. The mortality reached all locations where *C. gigas* was present and in most cases these values were higher than 50% (up to 100% in some locations). Many theories have come up to explain the summer mortality of the Pacific oyster in other regions, based on different environmental factors. The causes for the mortalities in the German part of the Wadden Sea 2005 and 2006 are not yet cleared. *C. gigas* represents the majority of biomass in the study area, yet apart from one study (Watermann et al. 2008) no publications have been made to discuss this phenomenon. The impact on the population is discussed. If a pathogen is the causative agent of the observed mortality, transmission to other molluscs and humans has to be considered.

During the summer of 2005 a mass mortality of *C. gigas* at the East Frisian coast, was identified for the first time (Watermann et al., 2008). In the following year, the oyster remained under analysis, in order to record the dimension and geographical distribution of the mortality of *C. gigas* in summer 2006.

Along the East Frisian Coast the mortality rate of *C. gigas* was analysed during July and August 2006, in more than 20 locations (Figure 1). Oysters were recorded as moribund or dead, in cases where the upper shell was opened with the soft body present or already

disappeared by feeding or digestion.

To estimate the death rate of *C. gigas* various methods were used (two counting methods and an estimation method). The grid-counting method (Figure 2), based on counting all living and dead oysters along 1 m², in order to determinate a death rate (%) and the population density. In the other counting method, samples of oysters were taken to determine the mortality. In the other stations the death rate was estimated.

Table 1 presents the results of the oyster

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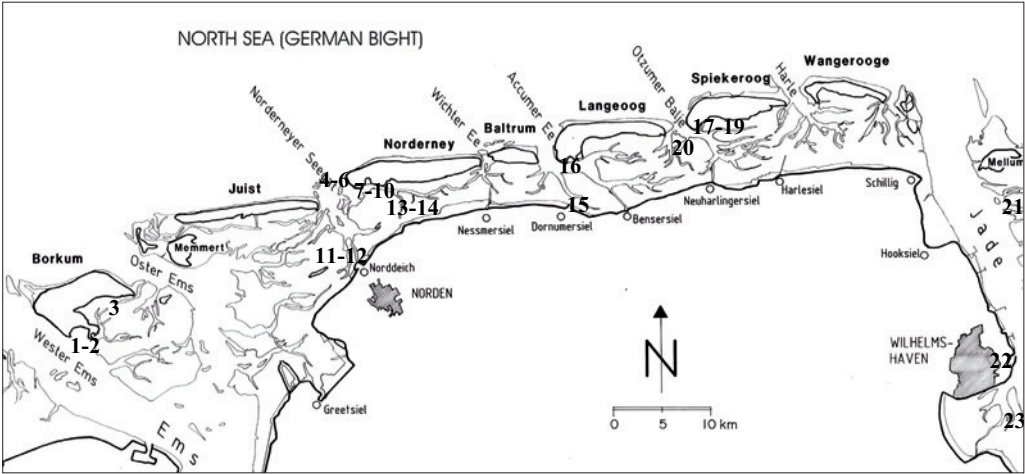


Figure 1. Location of research stations at the East Frisian Coast (German Bight – North Sea).

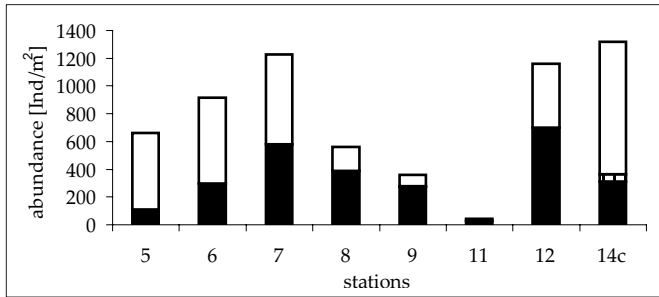


Figure 2. Abundance of *C. gigas* at various stations in Norderney, Norddeich and at the Lütetsburger Plate. Living oysters are represented in black, moribund in black-white, and dead in white columns.

mortality campaign, during summer 2006. The mortality of *C. gigas* doesn't seem to have a clear geographical distribution. Lower values were encountered in the western part of the East Frisian Wadden Sea, around the island Borkum. Also, further West around the Dutch island Texel, on the 30th of July, an estimated death rate of 40% was observed on a quay wall in Oudeschild (Obert pers. comm.).

Another result of this study was, that on the most eastern part of this study area, in the groyne of Eckwarderhörn (Jadebusen) and in

the groynes of Langwarden (Hoherweg) and Cappel (Wurster Küste), no oysters at all were found. Evidently, the spread of the mass development of the oyster from the western to eastern Wadden Sea, had not reached that eastern area in summer 2006.

At the island Norderney, higher mortality of the Pacific oyster occurred in the more confined areas of the inner harbour and lower mortality values in areas outside the harbour, where water currents were more intense and the oxygen content is higher. At the groynes at

Table 1. Mortality rates (%) of *C. gigas* at sampling stations at the East Frisian Coast during summer 2006.

No.	Location	Station	Substrate	Date	Mortality rate (%)
1	Borkum	ferry terminal ¹	quay wall	16.08	10
2		port Burkana ¹	quay wall	16.08	10
3		tidal flat ²	mussel bed	02.08	20-30
4	Norderney	ferry terminal ¹	quay wall	11.07	50
5		SVN-pier ³	quay wall & embankment	18.07	83,1
6		DGZRS ³	quay wall	20.07	67,3
7		car bridge 2 ³	quay wall	19.07	54,2
8		outer mole ³	quay wall	31.07	30,8
9		launchway ³	quay wall & basalt	01.08	22,8
10		groyne ³	basalt	12.09	no oysters
11	Norddeich	West port ³	quay wall	27.07	56,0
12		East port ³	quay wall	28.07	62,1
13a		southern Lütetsb. plate ⁴	mussel bed	12.07	30
13b		southern Lütetsb. plate ⁵	mussel bed	20.07	80
14a		northern Lütetsb. plate ²	mussel bed	31.07	70-80
14b		northern Lütetsb. plate ³	mussel bed	14.08	66,8
14c		northern Lütetsb. plate ⁶	mussel bed	14.08	72,4
15	Dornumersiel	small harbour basin ¹	quay wall	11.08	90
16	Langeoog	Port ¹	quay wall	16.07	70-80
17	Spiekeroog	Port ¹	quay wall	25.08	54,9
18		old Pier ³	quay wall	25.08	10-20
19		Westbeach ³	groyne	25.08	0
20		Janssand tidal flat ²	old mussel bed	01.08	60-70
21	Mellum	southern tidal flat ²	old mussel bed	08.08	90
22a	Wilhelmshaven	Nassauhafen ⁷	embankment	14.07	25-35
22b		Nassauhafen ²	basalt embankment	17.08	100
23	Jadebusen	Stollh. tidal flat ²	mussel bed	09.08	50-60

Name, type of data acquisition: 1 – Meemken & Daehne (LimnoMar), estimation; 2 – Obert (NLWKN), estimation; 3 – Meemken & Daehne (LimnoMar), grid-counting method; 4- Herlyn (NLWKN), estimation 5 – Stede & Bergmann (Vet.u.a. & Fr.-Löfl.-I.), estimation; 6 – Herlyn (NLWKN), counting; 7 – Heiber (NLWKN), estimation.

the West and Northwest part of the Island no oysters at all were found. The same gradient of the mortality rate, from the inner to the outer harbour, was registered in Spiekeroog island, where the area with more external influence (West beach), showed no oyster death at all.

Abundance at various stations (Figure 2) and of affected size classes (Figure 3) so as the mortality rate of affected sizes (Figure 4) was determined for several stations at the locations Norderney, Norddeich and Lütetsburger Plate. The highest values of populations were observed at the car bridge station in Norderney and at the northern Lütetsburger

Plate station. *C.gigas* is more abundant in smaller size classes (2-7). No relation between affected sizes and mortality rate could be found.

For the Lower Saxony coast, Watermann et al. (2008) reported in September 2005 severe gill necrosis and inflammatory reactions in the cardio-vascular system and the mid gut gland of the Pacific oyster which may be associated with the high mortality rates.

Further studies for this area are necessary, to elucidate possible causative agents of these mortalities. If a pathogen is responsible for

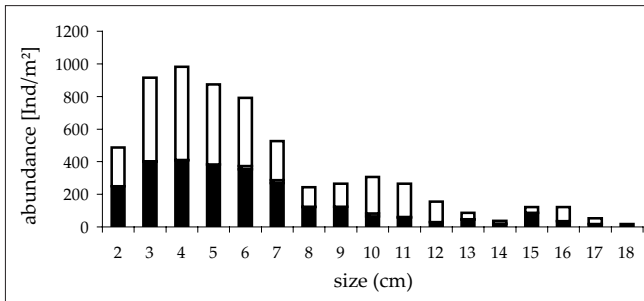


Figure 3. Abundance of *C.gigas* in various size classes (2-18). Living oysters are represented in black, moribund in black-white, and dead in white columns.

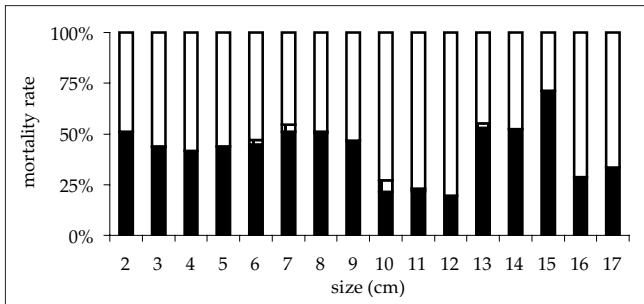


Figure 4. Mortality rate of *C.gigas* in various size classes (2-17). Living oysters are represented in black, moribund in black-white, and dead in white columns.

the mortality, its transmission on other bivalve species should be analysed. Another important aspect is the impact on the oyster population itself. From the data at hand no conclusion can be drawn on the population dynamics. Own observation in the area under study showed that the dead oysters were replaced in the next spring by spat. More sophisticated investigations are necessary to calculate the impact of these recurring mortalities on the population at the Lower Saxony coast.

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References

Watermann BT, Herlyn M, Daehne B, Bergmann S, Meemken M and Kolodzey H (2008) Health condition and mass mortality of Pacific Oysters (*Crassostrea gigas*, Thunberg, 1793) in 2005 at the East Frisian coast, Germany, North Sea. *J Fish Dis* **31**, 621-630.