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Effects of disturbance on daily rhythm and haul out behavior in the Harbor seal (*Phoca vitulina*) in the tide estuary of Dollard (The Netherlands)

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ABSTRACT

We studied by direct observation the reactions showed by harbour seals (*Phoca vitulina*) to disturbance in the Dollard tide estuary. The seals hauled out on intertidal sandbanks, which were occupied during low tide, with a highest density of animals in mid August. Haul out rhythms were mainly influenced by tides and boat disturbance. Seals made cyclic routes between different sites following tide floods. Disturbance by fishing boats caused the seals to leave the sandbanks moving to water. Seals were more susceptible during the suckling period than after pup weaning. The first subjects to react to disturbance by entering water were pup and adult females, whilst large males were the last ones. We estimated that pups to react to disturbance used about 12,5% of time otherwise spent for suckling.

Introduction

This research has been done for the Seal Rehabilitation and Research Center of Pieterburen. The seal population of Dollard was chosen because an high percentage of seals under one week of age and even premature ones with very low weight being observed at the Seal Rehabilitation & Research Center Pieterburen came from this population.

Seal pups in difficulties recovered from the Dollard represent the 4,83% of the population, while the ones coming from other localities do not exceed the 1,44%.

The average weight of the pup seals coming from the Dollard was 8,9 Kg while the average of the known weight of all the pups received at the S.R.R.C. was 10,1 Kg.

This suggests that in the population of the Dollard there were more young seals abandoned by their mothers than in other areas and that nutrition for those animals was scarce.

In this study we analyze the responsibility of disturbance caused by coastal navigation on a reproductive colony of common seals (*Phoca vitulina*).

Table 1

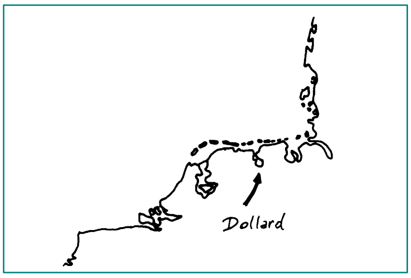
	90	91	92	93	94	95	96	97	98	
Ameland	12.25	8.7	13	11.5	10.65	-	10	9.6	11.5	**10.9**
Schiermon.	7.2	9.8	10.66	10.15	10.35	8.6	11.6	9.9	-	**9.8**
R'plaat	12.25	11.25	11.27	9	10.5	9.3	9	10.4	12.07	**10.6**
Eemshaven	-	8.1	12.82	9.2	9.87	10.05	-	12	9.9	**10.3**
Dollard	8.3	9.3	-	8	-	8.4	10.4	9.4	8.8	**8.9**

Weight in Kg of seals younger than one week recovered at the S.R.R.C. from each locality of the Wadden Sea since 1990 till 1998

Methods and study area

Dollard is the tide estuary of the Ems River on the boundary between Germany and the Netherlands. When this study has been made there were counted by plane around one hundred common seals (*Phoca vitulina*) in the Dollard. The study area is a protected zone where sailing is not allowed from 15th May to 1st September, except for local fishing boats, the Coast guard, the Rijkswaterstaat boats and the Agriculture, Nature Management and Fishery Ministry boats. This study has been made by the direct observation of the seals on the sandbanks, and the seals were not marked for this research. We never disturbed the seals to have information, but we registered every kind of disturbance occurred.
The area was completely submerged during high tide, while the sandbanks emerged for about 8-9 hours per low tide period. Observations took place during low tide periods, from five hours before until three hours after high tide time, only by daylight. Observations took place between 5th August and 21st September 1993. From the observation point three sandbanks were visible, on which we identified seven haul out sites marked with letters of the alphabet (Fig.1).

Fig. 1



On the top: position of the Dollard area on the Wadden Sea coast.
On the right: the study area with haul out sites.

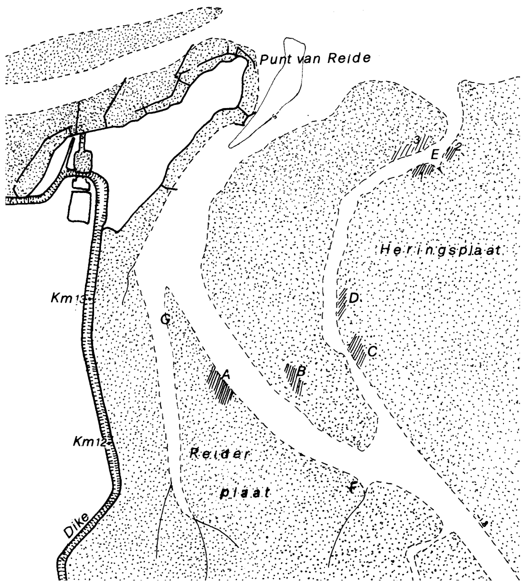
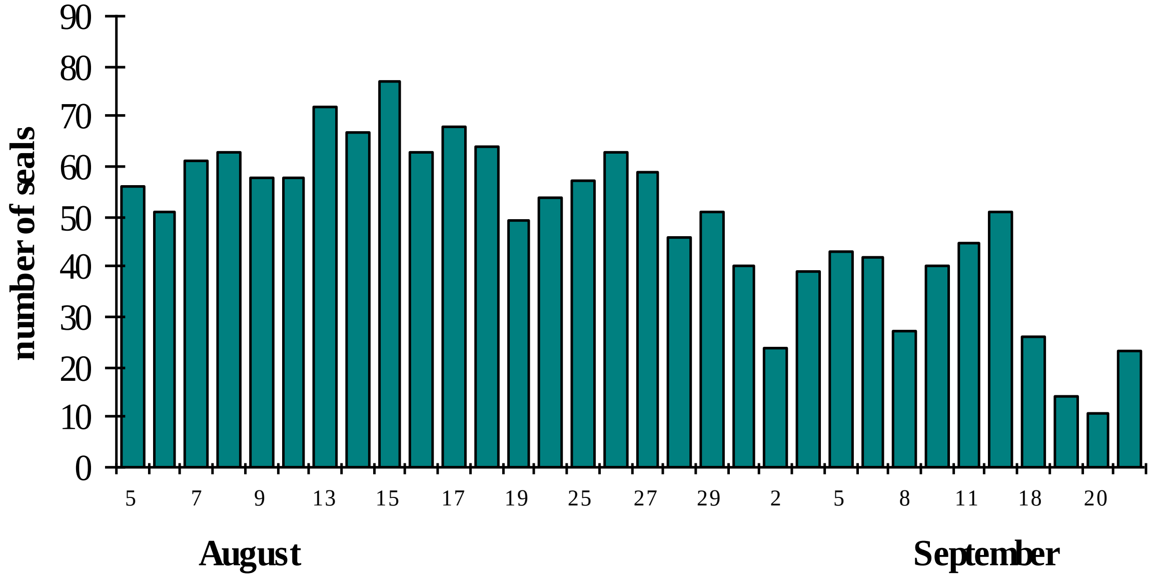


Fig. 2



Results

Seal frequency on the sandbanks. We observed the average of the daily peak of seals was 59 at the end of the nursing period and the beginning of the mating season. Then there has been a slow and gradual decrease of the number of seals on the sandbanks with an average of 32 individuals in September. (Fig. 2).

On site A there were seals every day and pups were born. On this site there was a larger number of seals of all age classes. On C/D there were seals of almost the same size and a pup was seen only once on 23.

When the sandbank was completely under water, the group did not abandon the area immediately but swam around the submerged sandbank.

The average number of seals during low tide periods without disturbance was almost constant (Fig. 3), peaking 2-3 hours after low tide, while when disturbance occurred it decreased soon after low tide (i.e. when the boats entered the area).

The relationship between numbers of seals observed and day light hours is shown in Fig. 4 in which we noted a constant increasing in the numbers of seal hauling out from an average of 40 individuals at 0600 to about 60 at 2030.

Movements. All the seals hauled out in A rested the entire low tide period there. While the seals hauled out in C or D did not spend the entire low tide period in those sites. During the central part of low tide period those seals moved towards the external part of the area (E) and went back before high tide. Seals hauled out in F and G only in case of disturbance.

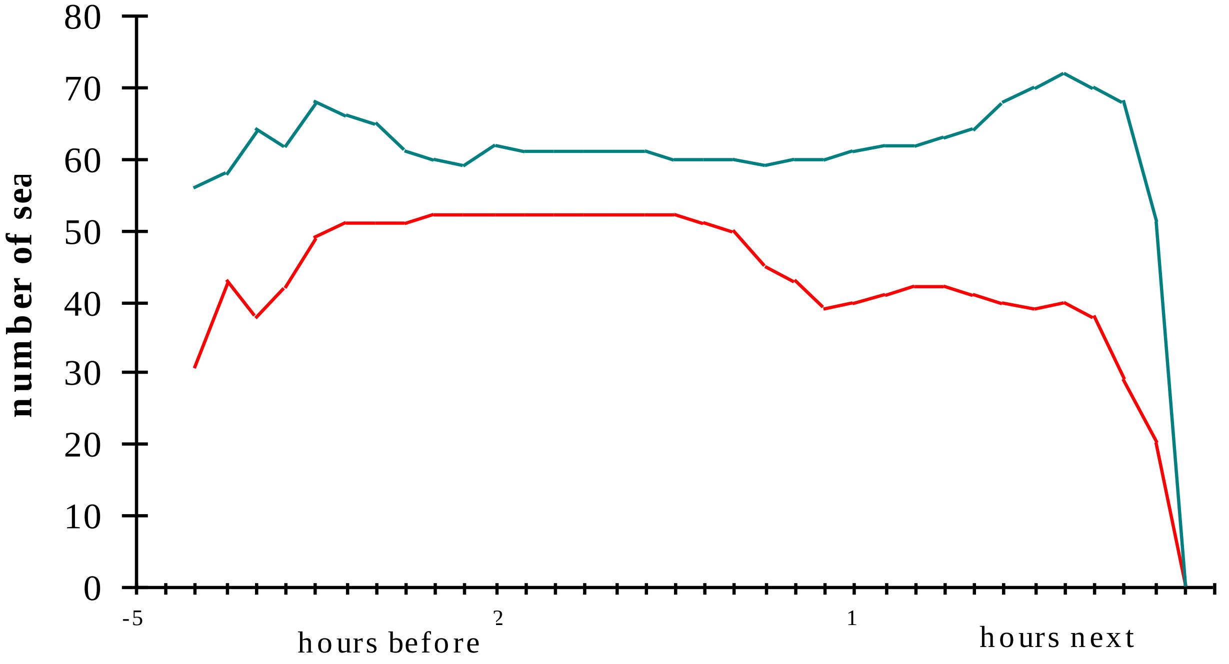
Disturbance. We considered fishing boat disturbance, because other kind of boats were not allowed to enter in the study area. Fishing boat disturbance was quite frequent (one on three low tide periods) and homogeneous (same size of boat and same activities).

The seals could hear the fishing boats already at a distance of almost 1 km, when the boats just entered the protected area. This distance could change depending on the direction of the wind and the biological period of the seals. Soon after the seals noticed the boat, they were more alert without moving until the boat reached of about 20 meters, the seals moved towards the water and went into the water when the boat went nearer to the haul out site.

The percentage of seals leaving the sand bank because of a boat decreased from about 100% in August to 50% in September. In August the 75%, of the seals leaving the sand bank, did not return back on the sandbank at all during the same low tide period, while in September

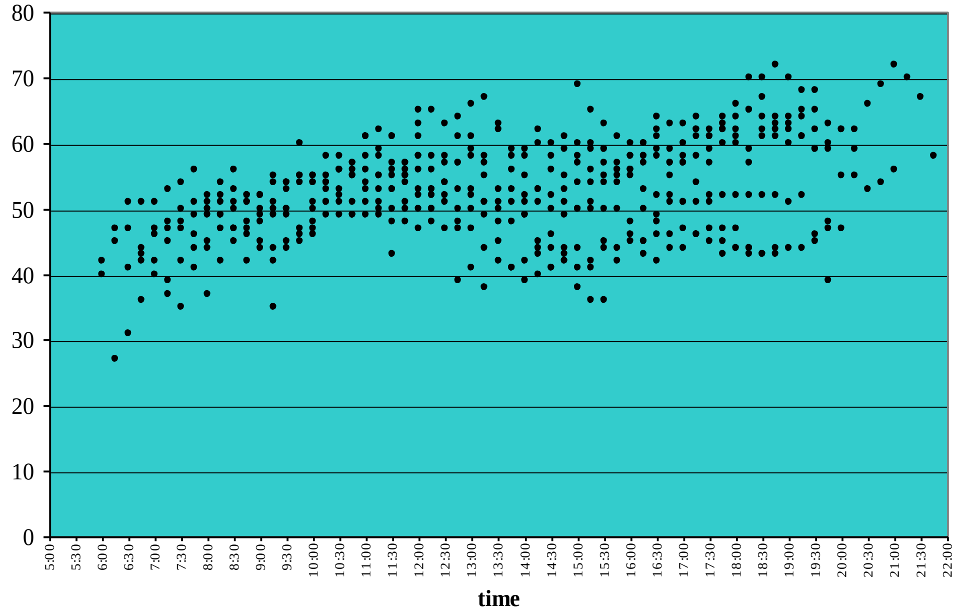
almost all the seals that escaped into the water hauled out soon after the boat had passed (Fig.5).
Female seals showed to be more sensitive than large males and the pups still followed the females into the water also after being weaned.

Fig. 3



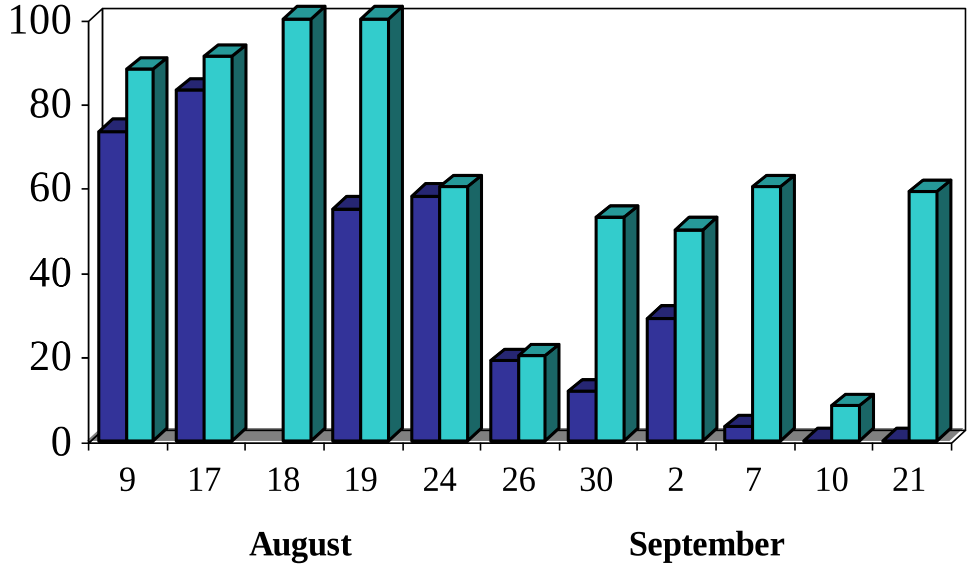
Green: average number of seals in relationship to the hous before and next low tide of periods without disturbance; Red: average number of seals of all periods

Fig. 4



Distribution on daylight hours of the number of hauled out seals

Fig. 5



Light blue: Percent of seals which enter the water in case of disturbance;
Blue: percent of seals which do not return on the sandbank after disturbance

Discussion and conclusions

During the summer common seal (*Phoca vitulina*) haul out in the study area every day during low tide. The majority of seals frequents the site A. Places C and D seemed to be age segregation sites, in accordance with the findings of Kovacs et al. (1990).

The seals which hauled out in A spent all low tide period on the same sandbank, while those which hauled out in C or D made cyclic movements with the tide floods, from the internal site to the outer one and than back. These movements always went with the stream.

A peak in the number of seals in each low tide period was towards its end.

The average number of hauled out seals in the various daylight hours shows a maximum in the evening, as was found by many authors (Allen et al. 1980, Kovacs et al. 1990, Stewart 1984). In particular, Walker and Don Bowen (1993) noticed an increase in the evening of 48% while in this study it was of 33% .

We consider as disturbance when the seals enter into the water. According to Brader (1975) more than one half of the observed cases of disturbance caused by fishing boats were strong ones and Doornbos (1980) considers boats to be the major cause of moderate and strong disturbance, in our study can be moderate or strong according to the period of the year. We confirm that females are easier to be moved by disturbance than large males, as Newby (1973), Van Wieren (1981) and Doornbos (1980).

We agree with Van Wieren (1981) that strong disturbances can have negative effects on weaning of pups: directly, with the possibility for a mother to loose her pup before it is weaned, and indirectly with the interference on lactation and the consequent underfeeding.

The seals remain on the sand bank about 8 hours every low tide period, of which about 5 hours before the tide time and 3 hours after it. The common seal pups are not able to suckle in the water until they are 8-14 days old (Wipper 1975), than as longer they can stay on dry as much they can suckle. Boats enter the area soon after low tide time and the seals escape into the water, the pups loose 3 hours on the bank out of the 8 every time they are disturbed. The disturbance occurred once every 3 low tide periods, that means about one hour every low tide period, about 12.5% of the time necessary for suckling.

We can conclude that disturbance has greater consequences during the suckling period. Underfeeding of young seals seems not to depend on shortage of food in this area, but on shortness of lactation due to boat disturbance.
An underfed pup cannot develop a fat layer and will get into a poorer condition and can be exposed to disease.
Seals need incontrovertible quite places where they can haul out and suckle their pups in order to keep the populations healthy.

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