

# Mont Saint Michel Bay: spatial distribution of major wader species

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The distribution of abundant wader species within Mont Saint Michel Bay is summarised. There are two important areas for feeding and roosting birds: a large area from Chapelle Saint Anne to Cancale in the west and a smaller area on Dragey beach in the east. Saltmarshes and sand banks are important for roosting birds, especially on spring tides. Feeding and roosting areas are threatened, particularly by human activities.

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## INTRODUCTION

Elsewhere (Le Dréan-Québec'hdu *et al.* 1995a), we reported the importance of Mont Saint Michel Bay for wintering waders such as Dunlin *Calidris alpina*, Oystercatcher *Haematopus ostralegus*, Curlew *Numenius arquata*, Grey Plover *Pluvialis squatarola*, Black-tailed Godwit *Limosa limosa*, Bar-tailed Godwit *Limosa lapponica* and Knot *Calidris canutus*. Here we describe the spatial distribution of the main wintering wader species, during different phases of the tidal cycle.

## STUDY SITE

The estuary contains unstable sediments and is relatively poor in benthic macrofauna (Figures 1 and 2). *Macoma balthica* dominates the macrobenthos (Hamon 1984).

There are three communities:

- the basic *Macoma balthica* community: very thin sands with *Macoma balthica* and thin and medium zoogene sand on the lower shore with polychaetes (in particular *Nephtys cirrosa* and *Glycera convoluta*);
- the *Haustoriidea* community in the eastern part of the bay: thin and medium sands with crustaceans; and
- a *Macoma balthica* and *Abra alba* community in medium sands and characteristic of south Granville beach.

The intertidal area can achieve a width of more than 10 km and the tidal range can achieve 15 m during the September spring tide: there are important tidal currents and intense sediment movements because of the small mean depths (Hamon 1984).

## METHODS

On each visit, we recorded, as precisely as possible in relation to fixed marks, the position of flocks of birds, those species present, and their number and activity

(feeding or roosting). We also recorded movements from roosting to feeding areas. Observations were made between December 1992 and March 1993 either from the shore (34 visits), or on four occasions from flying in a glider above areas which are inaccessible on foot.

These observations enabled maps to be drawn of general position of feeding and roosting areas. Unpublished data obtained during winter 1980/1981 and 1981/1982 by PB and RM were also used.

## RESULTS

### *General spatial distribution*

The main high tide roosts are located at the tide edge. The wider the intertidal area (*i.e.* the lower the tidal level) the more roosts there are. For medium tidal levels, the birds remain at the edge of the saltmarsh. The saltmarsh and the sand banks (broken shells) around Le Vivier sur Mer hold the most important concentrations of roosting birds. However, there are roosts on the sand, particularly in the east, where the major roosting areas are on Dragey beach. The importance of this roost seems to have declined since 1982. On spring tides, the available space at high tide is reduced and the roosts are located in the saltmarsh around the Mont Saint Michel and on sand banks around le Vivier sur Mer.

There are two major feeding areas: in the western section from Cancale to the east of the Chapelle Sainte Anne, and in the eastern section on Dragey beach. Wintering waders do not use the east Mont Saint Michel mudflat for feeding. The feeding areas of Dragey have decreased in extent since 1982. At neap and medium tide levels, waders feed within 2 km of the roosting areas. In the west, movements occurs from east to west. The feeding area south of Granville is the most distant from a roost (15 km). The birds come back to the roosting area, usually after having formed a pre-roost between there and feeding areas.

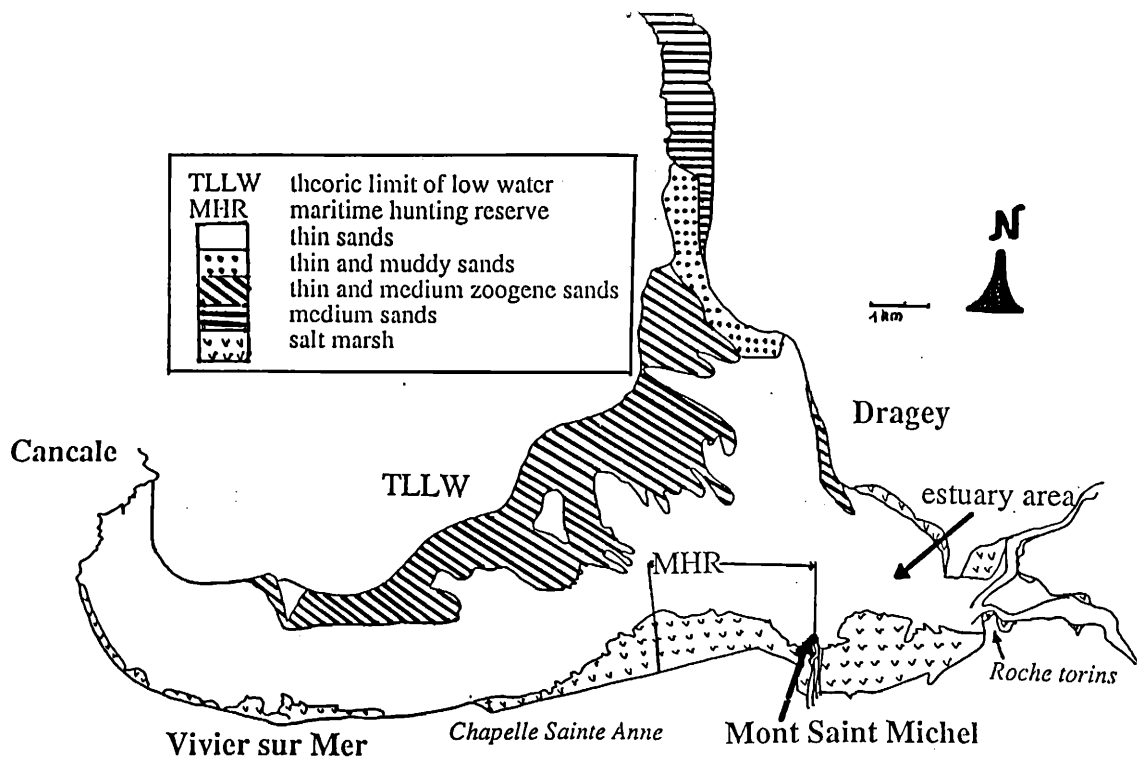


Figure 1. Mont Saint Michel Bay: study site and sediment types (Hamon 1985).

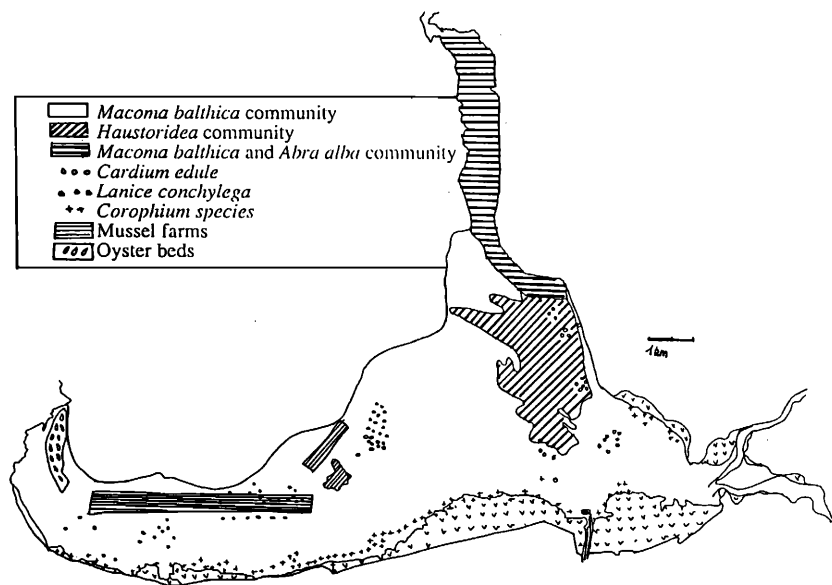


Figure 2. Mont Saint Michel Bay: macrobenthic community.

### Individual species accounts

Dunlin *Calidris alpina* feed essentially on two areas: one in the western part of the bay, between Cancale and Chapelle Sainte Anne and stretching from the edge of the saltmarsh to the mussel banks, and other in the east, on the Dragey beach (Figure 3). These areas are characterised by thin sand, with both *Macoma balthica* and *Haustoridaea* communities. There are two very important roosting areas, holding more than 4,000 birds in the western section and one of medium importance (with more than 1,000 birds) in the eastern section. On spring tides,

there are four roosting areas, one on sandy banks near le Vivier sur Mer, two in the large area of saltmarsh at Chapelle Sainte Anne and one in the saltmarsh east of Mont Saint Michel. The movements from roosting areas to feeding areas occur from east to west in the western section of the bay and without particular direction in the eastern section. This movement occurs progressively, birds moving in flocks of 1,000-2,000 birds, with successive peaks in pre-feeding areas before reaching the main feeding area. Then, the birds disperse in search of food when the tide recedes.

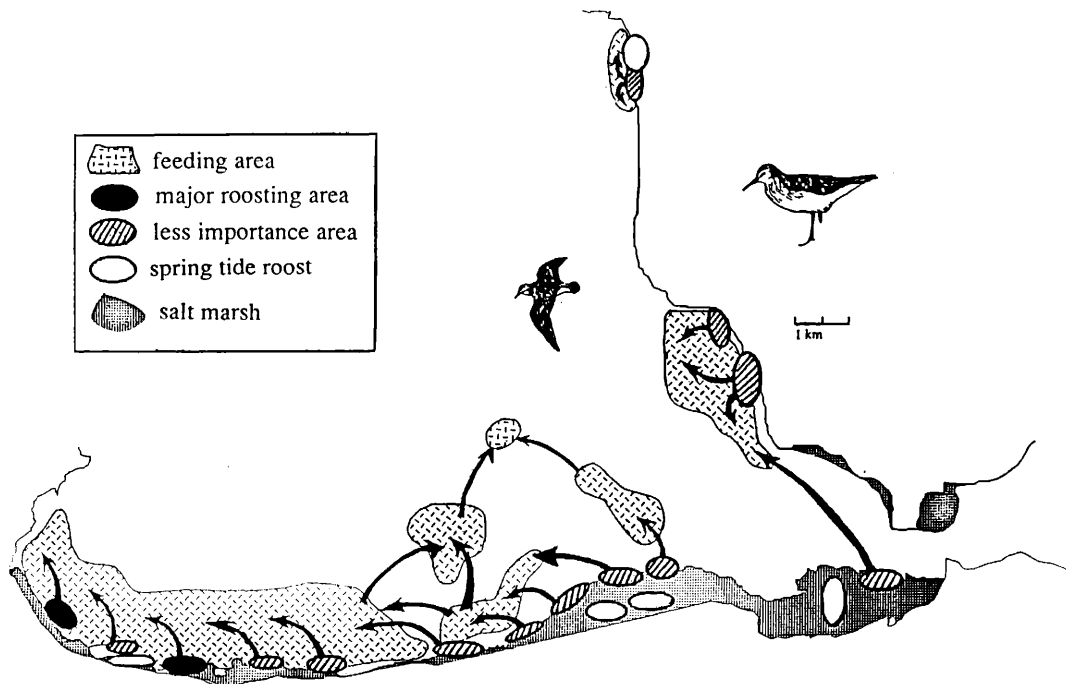


Figure 3. Mont Saint Michel Bay: distribution of wintering Dunlin *Calidris alpina*.

Oystercatcher *Haematopus ostralegus* frequent two main feeding areas: in the western part of the bay, the feeding area corresponds to mussel farm distribution, and in the east they feed on Dragey beach. In these areas, the sediment is characterised by thin sand and the macrofauna by *Macoma balthica*, *Mytilus edulis* and *Cardium edule*. There are six important roosting areas (each holding more than 1,000 birds) in the Chapelle Sainte Anne saltmarsh and on Dragey beach. The roosts further down the beach are post or pre-roosting areas.

Spring tide roosts occur on Chapelle Sainte Anne and Mont Saint Michel saltmarsh, and on the sandy banks around le Vivier sur Mer (Figure 4). In the western section of the bay, movements occurs from east to west. Oystercatchers reach their main feeding areas in stages, like Dunlin, but one of these is a post-roost. Some feeding areas overlap with roosting areas. The return towards the roosting areas occurs in the same way and includes the formation of a pre-roost area. Oystercatchers move in flocks of 500-1,000.

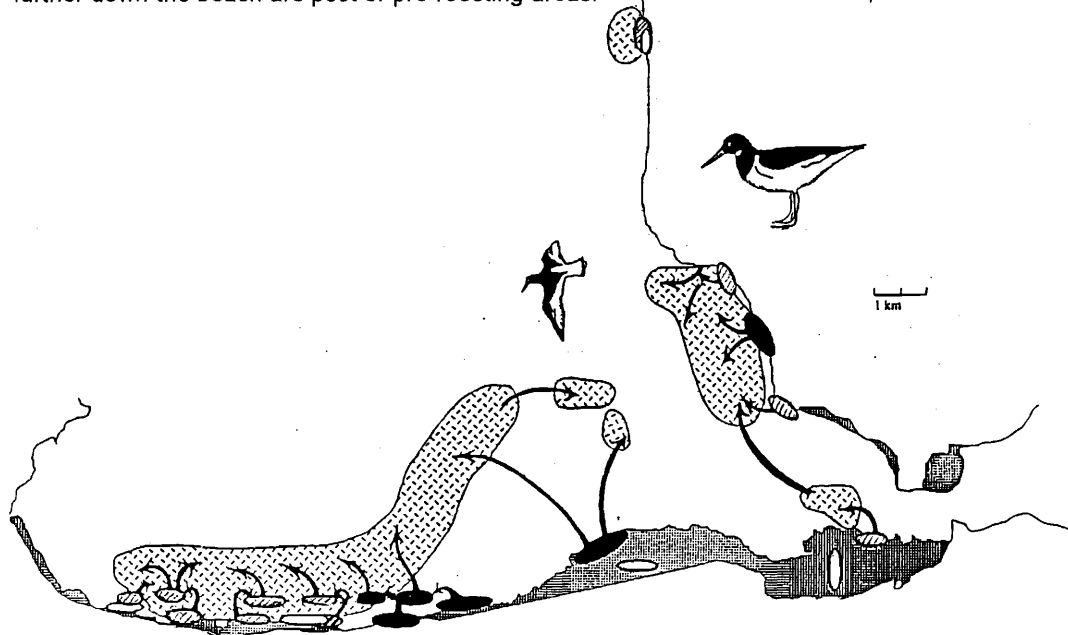


Figure 4. Mont Saint Michel Bay: distribution of wintering Oystercatcher *Haematopus ostralegus*.

Two main areas are used for feeding by Curlew *Numenius arquata*: in the west, from Cancale to Chapelle Sainte Anne (limited towards the sea by mussel and oyster beds) and in the east on Dragey beach, at the top of the beach. These feeding areas are characterised by thin sand, with *Macoma balthica* and *Haustoridaea* communities. Three

major roosting areas exist, each holding more than 500 birds: two in the western section, at the edge of le Vivier sur Mer saltmarsh, and one in the eastern section, to the east of Mont Saint Michel. The latter are used mainly by inland birds. There are three spring tide roosting areas: on sandy banks at le Vivier sur Mer and on the saltmarsh

around Mont Saint Michel. There are numerous smaller feeding and roosting areas (Figure 5). The movements from roosting to feeding areas occur in the western section of the bay with an overall east-west orientation. They also

occur in stages but are less clear-cut than for the species already described. Effectively, some form a post-roost,

others stop on pre-feeding areas. In the east of the Bay, Curlews fly almost directly to their feeding areas from their roost sites. Curlews occupying the roosting area in front of Roche Torin feed inland, flying along the line of rivers, in particular the Sée or the Sélune. These Curlews follow a night and day rhythm.

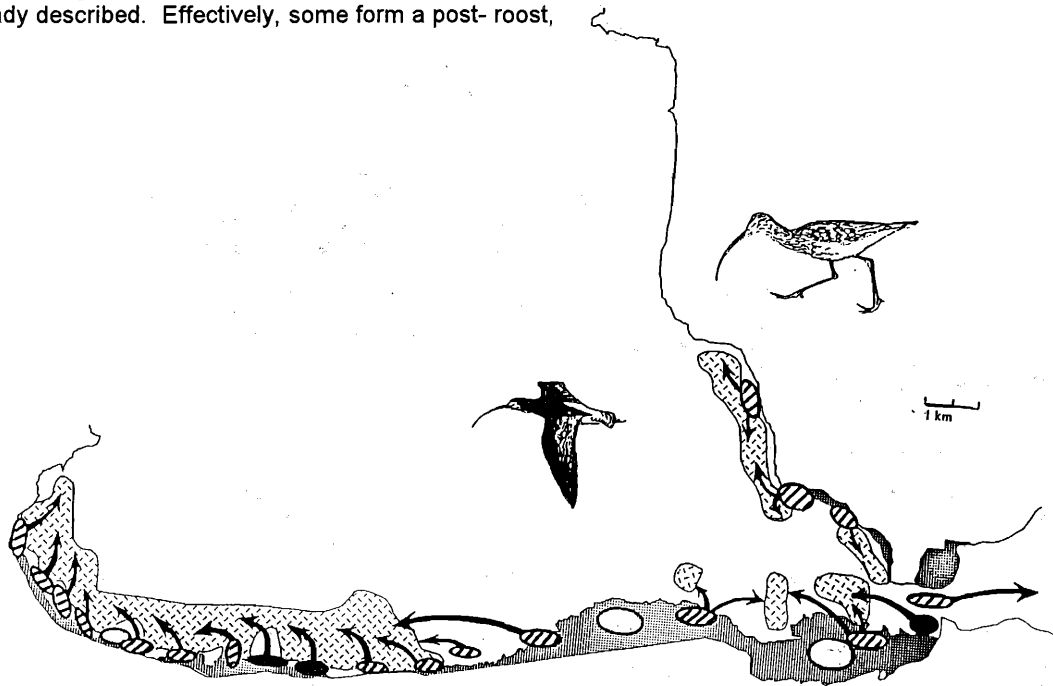
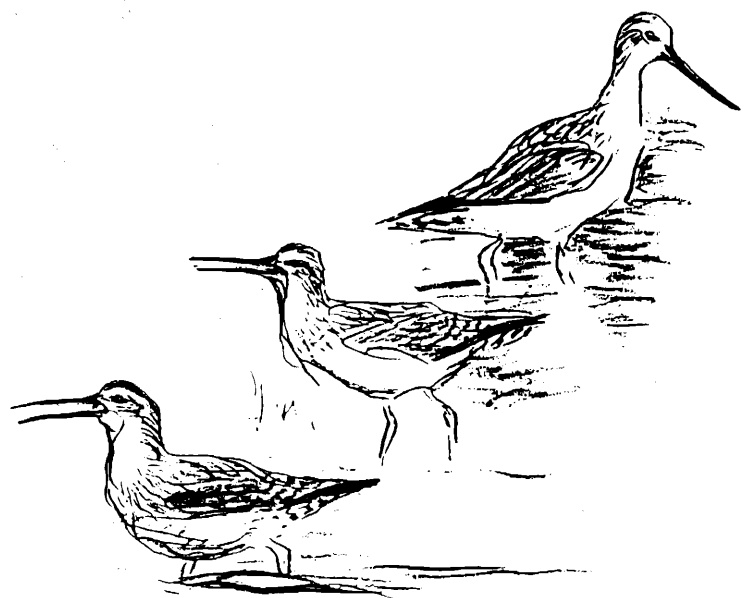


Figure 5. Mont Saint Michel Bay: distribution of wintering Curlew *Numenius arquata*.

Grey Plover *Pluvialis squatarola* frequent two feeding areas: in the western section of the bay, a discontinuous area from Cancale to Chapelle Sainte Anne (limited towards the sea by mussel and the oyster beds) and in the eastern part, Dragey beach. These feeding areas are characterised by thin sand, with *Macoma balthica* and *Haustoridea* communities. Four major roosting areas (each holding more than 300 individuals) are situated in the western part and two roosting areas of medium importance (each holding between 100 and 300 individuals) exist in the eastern part. The three spring tide roosting areas are on the sandy banks and in the saltmarsh around Mont Saint Michel (Figure 6). Grey Plovers reach their feeding areas from east to west. These movements, in groups of 200 to 500 birds, occurs sporadically and often simultaneously with Dunlin. Some plovers form post-roosts and others settle on pre-feeding areas. Grey Plovers are widely dispersed over the whole of their feeding area. They never go further down the shore than the first line of the mussel farm.

Black-tailed Godwit *Limosa limosa* feed in a limited area in the western part of the bay, on the mudflat in front of Vivier sur Mer. This area is bounded towards the sea by mussel farms and towards the mainland by the end of the saltmarsh of le Vivier sur Mer. This area is characterised by thin sand and the *Macoma balthica* community with *Lanice conchylega*. Roosts are situated at the edge of the saltmarsh at le Vivier sur mer and Chapelle Sainte Anne. The spring tide roosts are situated in the Chapelle Sainte Anne saltmarsh (Figure 7). They may use other inland

roosting areas and feeding areas not located during this study. These feeding areas, as well as the roosts, have decreased considerably in extent and number since 1982. Movements occur in flocks containing large numbers of birds, or even the whole population. Black-tailed Godwits are very gregarious and feed in a compact flock at the mid-tide level.



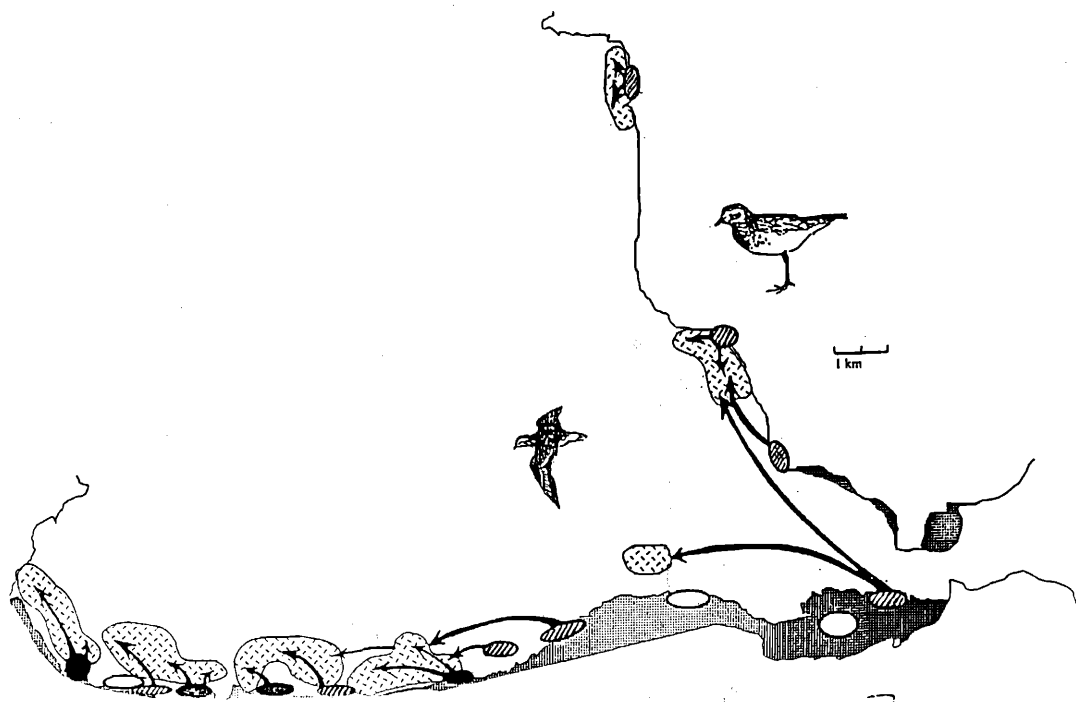


Figure 6. Mont Saint Michel Bay: distribution of wintering Grey Plover *Pluvialis squatarola*.

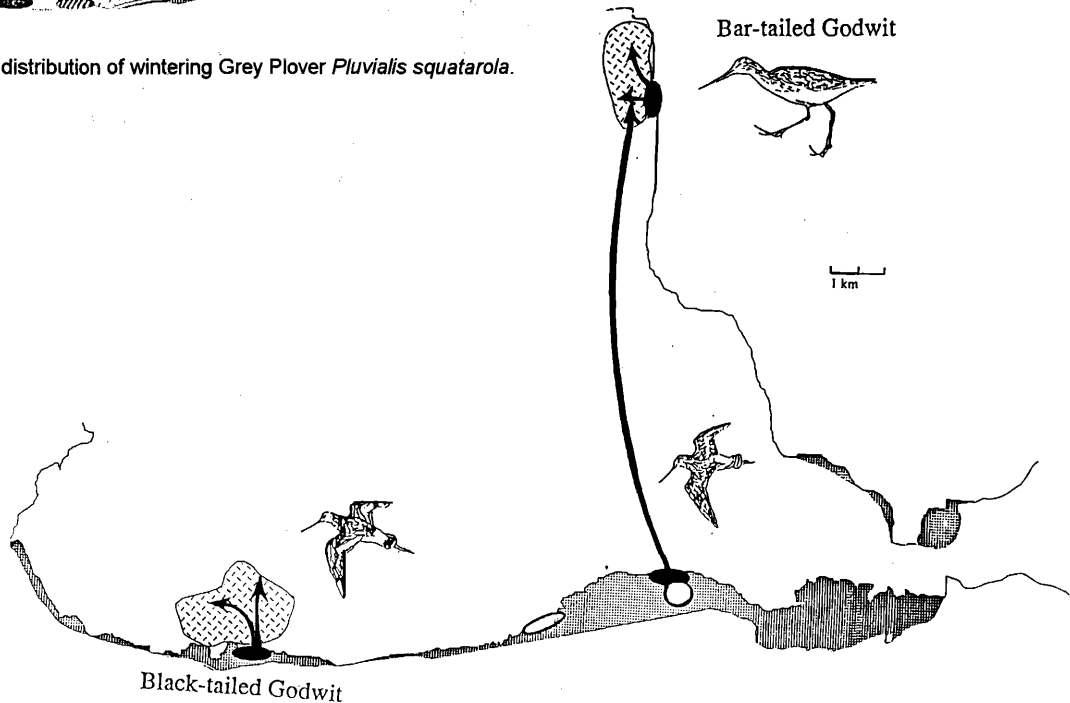


Figure 7. Mont Saint Michel Bay: distribution of wintering Black-tailed Godwit *Limosa limosa* and Bar-tailed Godwit *Limosa lapponica*.

Bar-tailed Godwit *Limosa lapponica* feed in only one area, on a sandy beach (medium sands with a *Macoma* and *Abra alba* community and numerous crustaceans), south of Granville. On neap tides, the roosting area is at the top of the beach. On medium and spring tide levels, it is situated on the western Mont Saint Michel saltmarsh, about 15 km from the feeding area (Figure 7). Birds arrive on the beach about two hours after high tide. They flock in a post-roosting area before dispersing gradually into small roosts along the tide edge. In 1982, the feeding area was on Dragey beach. Subsequent observations by the Normandy Ornithological Group seem to show that this change began in 1985.

Knot *Calidris canutus* were recorded in two areas: in the western section, a discontinuous area from Cancale to Chapelle Sainte Anne (limited towards the sea by mussel banks) and in the east on the south Granville beach. The western area is characterised by thin sand with the *Macoma balthica* community, the eastern by medium sand with a *Macoma* and *Abra alba* benthic community. We recorded three roost sites which contained more than 600 individuals: one at Chapelle Sainte Anne, one in the western Mont Saint Michel saltmarsh and one on south Granville beach. These two last roost sites are alternatives, those at south Granville occurring on neap tides and those on the saltmarsh occurring mid-way between neaps and spring and on spring tides. Three

other, less important, roosting areas also exist. The two spring tide roosting areas are situated in the Chapelle Sainte Anne and Mont Saint Michel saltmarsh (Figure 8). The feeding and roosting areas have decreased considerably since 1982. As for Bar-tailed Godwit, there has been a change in the preferred feeding area from Dragey to south Granville. In the western section of the bay, Knot reach the nearest feeding area from their roost site and disperse over the whole area. This progression

occurs by stages on pre-feeding areas, as with Dunlin. In the eastern section of the Bay and on neap tides, Knots gradually approach the tide edge when they reach their feeding area, as does the Bar-tailed Godwit. Then they disperse along the beach. On higher tides, Knots arrive with Bar-tailed Godwit from their roosting area more than 15 km away, about two hours after high tide. As they do, they settle on post-roosting areas before dispersing to feed.

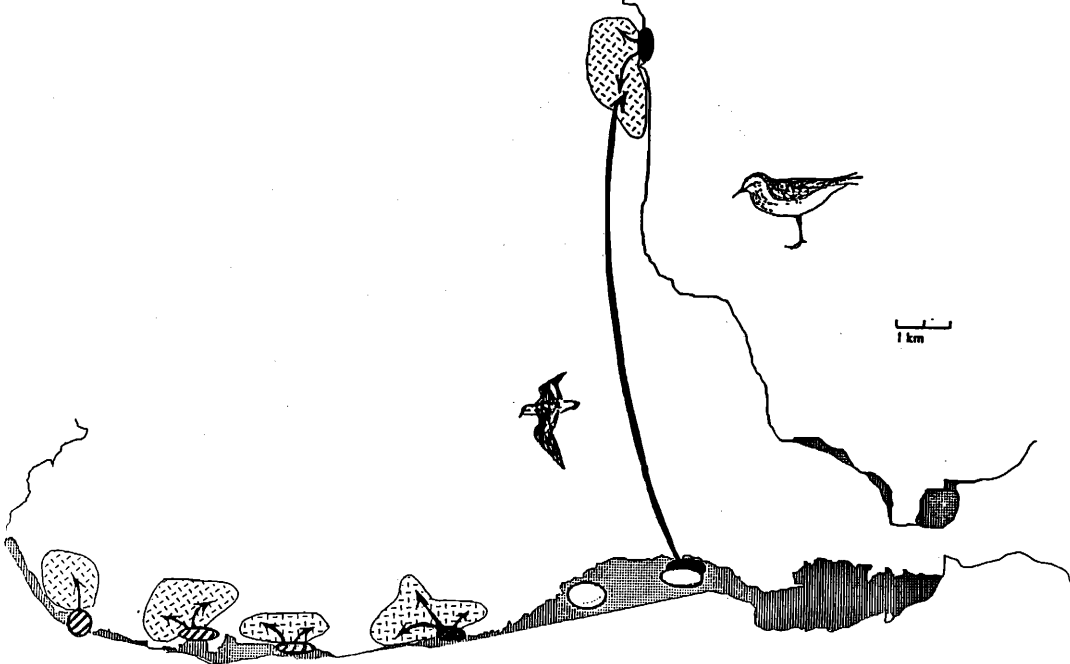


Figure 8. Mont Saint Michel Bay: distribution of wintering Knot *Calidris canutus*.

Table 1 summarises the usage of the different areas of Mont Saint Michel Bay. It shows the importance of the western section for most species. However, it also highlights the importance of the south Granville beach for Bar-tailed Godwit and Knot.

Table 1. Summary of the usage of different areas of Mont Saint Michel Bay by the main wintering wader species. Values are percentages of average number of each species counted in January.

## DISCUSSION

The choice of the feeding area depends particularly on three factors: the distance between the roosting and the feeding areas; disturbance, especially from humans; and the type of sediment and invertebrate community.

### Distance from roosting area

Feeding areas are located as near as possible to roosting areas. This factor is known to be the most important for the choice of the feeding area (Goss Custard *et al.* 1982). This seems to be important for Dunlin, Oystercatcher, Curlew, Grey Plover, Black-tailed Godwit and Knot in the western section of the Bay. By contrast, for Bar-tailed Godwit and Knot in the eastern section, this does not seem to be a major factor, because these birds feed on an area located at more than 15 km from their roost.

	Western section from Cancale to Mont Saint Michel	Eastern section from Mont Saint Michel to Dragey beach	Eastern section, south Granville beach
Proportion of whole Bay	58%	33%	9%
Dunlin <i>Calidris alpina</i>	90.8%	8.7%	0.5%
Oystercatcher <i>Haematopus ostralegus</i>	83.5%	16.3%	0.2%
Curlew <i>Numenius arquata</i>	76.9%	23.1%	0%
Grey Plover <i>Pluvialis squatarola</i>	71.8%	25%	3.2%
Black-tailed Godwit <i>Limosa limosa</i>	100%	0%	0%
Bar-tailed Godwit <i>Limosa lapponica</i>	0%	0%	100%
Knot <i>Calidris canutus</i>	60.6%	0%	39.4%
No. of major roosting areas	8	2	1
No. of roosting areas on spring tides	3	1	1
Direction of movement from roosting to feeding areas	east-west	without particular direction	south-north on spring tides

## Human disturbance

Disturbance, particularly human disturbance, may lead some sensitive species, such as Curlew, godwits and Knot to desert an area (Cayford 1993). Moreover, species with limited feeding areas, such as Black and Bar-tailed Godwits, will be more severely affected by disturbance or the loss of roost sites, than those which are widespread in the Bay, such as Dunlin or Oystercatcher. So, the increase of human disturbance on Dragey beach (particularly from hunting and horse training) would seem to be the primary cause of the decrease in use of this area by feeding and roosting waders. Bar-tailed Godwit and Knot, species which are very disturbance sensitive, would be obliged to look for an alternative feeding area, in the same direction of dispersal as the one they used formerly. They continue to use the roosting area because there is no place nearer on medium and spring tides. On the other hand, there are some areas which are visited irregularly when disturbance, for example by hunting, become too great.

## Type of sediment and of invertebrate community

Some authors consider prey density to be the main factor influencing bird density, both within and between estuaries (e.g. Goss-Custard *et al.* 1991). It is clear that in Mont Saint Michel Bay waders feed on their "favourite" prey; for example, Oystercatcher feed on the areas with mussels, cockles and *Macoma balthica*. For the other wader species, this relationship is more difficult to show.

The community structure of macrofauna is determined by environmental factors, such as granulometry, organic matter content and dynamic factors (Warwick *et al.* 1991). Moreover, the prey availability and thus their accessibility is influenced by the presence of other birds, mud temperature, wind, rain and substrate dryness (Pienkowski 1983). The granulometry characteristics and the sediment water content seem to be the parameters which influence predominantly the spatial distribution of feeding waders (Moreira, 1993a, 1993b). Thus, some wader species occur preferentially on certain sediment types (Engelmoer 1980). For example, Black-tailed Godwit feed mainly on thin sediments, such as at Le Vivier sur Mer area, whilst Bar-tailed Godwit feed on medium sediments, such as the south Granville beach. Similar selection occurs also on the Swale estuary, UK (Evans 1994).

## CONCLUSION

To conserve the waders' spatial distribution in Mont Saint Michel Bay, it is essential to protect for the major roosting areas, particularly those used on spring tides, when alternative areas are most limited. The sand banks and saltmarsh are important areas for waders, but these are very precarious and threatened, particularly by human activities (for example tourism). There is no protection from hunting on the roosts because the maritime hunting reserve, located on the east of the Mont Saint Michel, holds only a very small number of wintering waders.

As with any protected area, it is essential that all parts used by mobile animals are conserved. In this case, this includes not only the main, regularly used wader roosts and feeding areas, but also alternatives used under certain predictable conditions such as spring tides. The designation of Mont Saint Michel Bay as a Ramsar site (in October 1994) and Special Protection Area (actually limited to the hunting reserve, in the Natura 2000 project for the whole Bay) will aid the conservation of the area and its internationally important populations of waders.

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