Cah. Biol. Mar. (2006) 47 : 79-84

From Marennes to Marennes-plage, the management of a mud-flat

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Abstract: Marennes, on the French Atlantic coast, is typified by a socio-economic activity based almost solely on oyster production. At the end of 1990s, the municipality decided to redevelop its sea front by the construction of an artificial area and by beach replenishment of its coastal mud-flat. Rather than just an example of coastal redevelopment, this operation exemplifies the management of the conflicts between users in a strategy of local development.

Résumé : *De Marennes à Marennes-plage, l'aménagement d'une vasière intertidale.* Marennes, en Charente-Maritime, se définit par une mono activité socio-économique ostréicole. A la fin des années 1990, la municipalité décide de réaménager son front de mer par la construction d'un bassin d'eau de mer et par un réensablement de sa vasière littorale. Plus qu'un exemple d'aménagement, cette opération s'inscrit dans une véritable gestion des conflits d'usage qui existent sur le littoral et dans une stratégie de développement local.

Keyword: Beach nourishment; French Atlantic coast; Coastal management; Local and public policy; Planning and local development

Introduction

The Marennes-Oléron bay (Fig. 1), whose vocation is almost solely oyster growing, accounts for 40% of French oyster production. This monoculture makes the 18 oyster-producing communes very dependent and marginalises the region's tourist attraction. In a context of constantly increasing coastal tourism, the commune of Marennes wanted to set the ball rolling. To change direction, the first step was a facelift. The municipality decided to redevelop its seafront, using the beach nourishment method.

Reçu le 24 octobre 2005 ; accepté après révision le 28 mars 2006.
Received 24 October 2005; accepted in revised form 28 March 2006.

The Marennes beach had disappeared long ago

During the 1970s, coastal defences were built along the top of the beach over a length of 800 m with the sole aim of protecting the low-lying agricultural land lying behind the beach. Although it is situated in an area that is relatively protected from waves and currents, the wide sandy and muddy intertidal zone is affected by the rise and fall of the tides that are directed to the north at flood and to the south at ebb. The straight vertical seawall, that does not follow the curved line of the coast, was hit by the waves at each high tide. The undermining and the resulting gradually lowering of the sand level at the foot of the wall, which became weakened, required the installation of a second sea defence. The classical vicious circle of having to build suc-

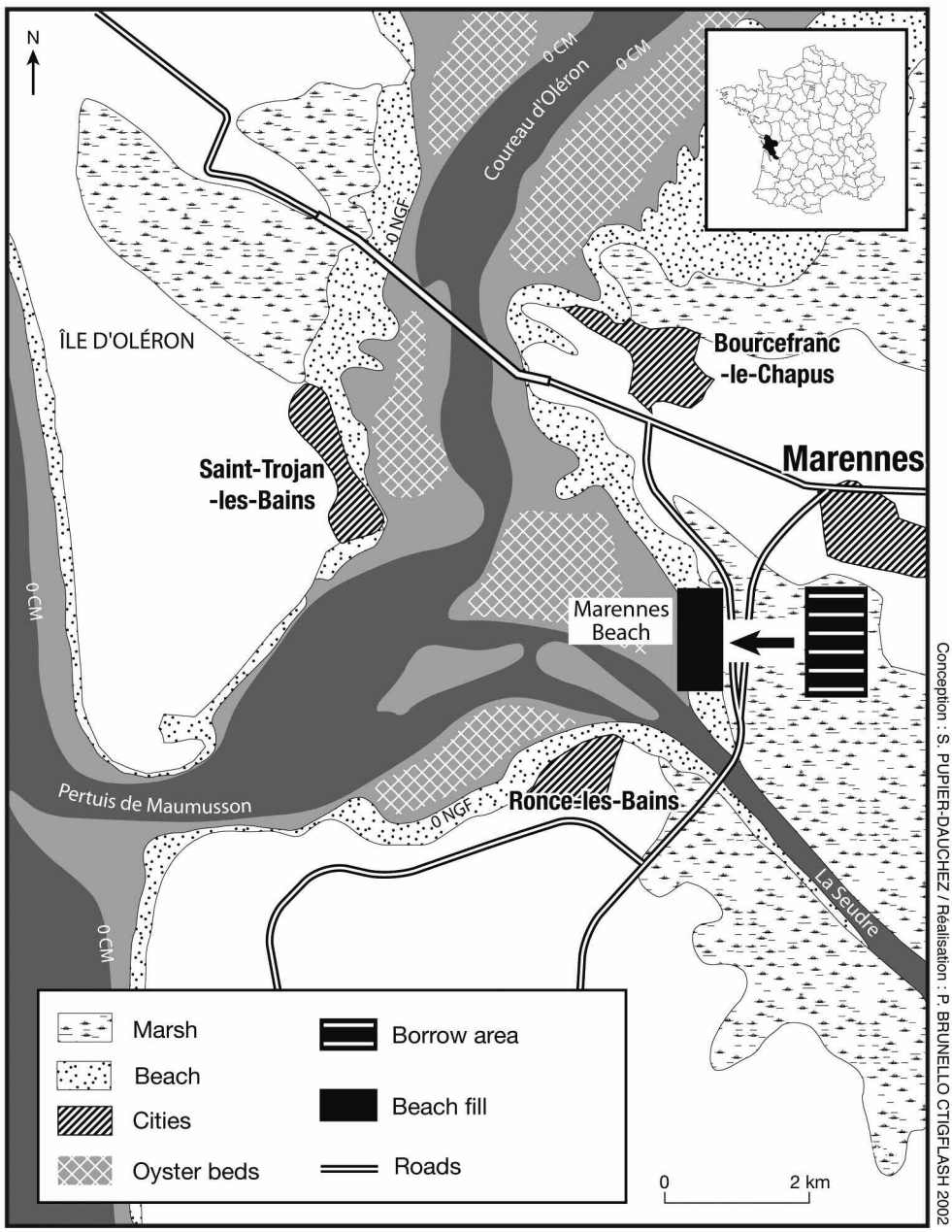

Figure 1. Location of the oyster-farming basin of Marennes-Oléron: a seaside resort development in 1997.
Figure 1. Localisation du bassin ostréicole de Marennes-Oléron: mise en place d'un centre de loisirs littoral en 1997.

cessive ever more imposing defences led in 1995 to the "final situation" — a seawall that reached more than 2 m high, was almost unprotected by the line of rocks at its base and a beach that had completely disappeared.

Before each summer, in order to mask the complete absence of any beach, earthmoving works were conducted consisting of transferring sediments from the lower beach up to the rocks. These operations in no way improved the quality of this vast muddy and sandy intertidal zone, which although suitable for shellfish growing, was not an attractive proposition for bathing, sunbathing or beach games.

The municipality therefore attempted to remedy the situation. In the light of the convincing results of many sand import operations on local beaches (Bourcefranc, Fouras, Châtelaillon, etc.) the council conducted a trial in 1996. Some 3000 m^3 of sand was brought by lorry to Marennes

Beach from the Boyardville channel on the Île d'Oléron. But to distinguish it from the neighbouring resort of Bourcefranc-le-Chapus that had restocked its beach with sand in 1993, the input of sand was accompanied the creation of a small seawater basin in the middle of the beach.

This experimental combination of restocking and a body of water proved to promising for the council. However, the water body was completely destroyed by the sea in the winter. The operation was therefore repeated in 1997, but at a different scale.

Results

The redevelopment of Marennes Beach: an original operation

A first stage of the works started in 1997, consisting of an import of 3600 m^3 of sand from Boyardville, from a sandbar that obstructed the Perrotine channel. The materials were excavated by mechanical excavator and brought to Marennes Beach by truck, where they were spread over the upper beach, thereby covering the rocks at the foot of the seafront. Meanwhile earthmoving works created another small artificial reservoir about a metre deep.

The council had a double aim: first, to show that it was acting to improve bathing facilities and secondly to provide an attractive image when the Tour de France Cyclist race came through the area in mid-July 1997.

The second phase, after the tourist season, consisted of major engineering works with the creation of a permanent body of water.

First, a part of the intertidal zone was excavated out to form a basin. The sandy mud and blue clay that formed the intertidal substratum were piled up and compacted to make a ridge that would constitute the compact core of the prelittoral bar isolating the basin from the sea (Fig. 2). The technique that was used was unusual because of the unstable balance of the machinery that also risked becoming bogged down. The excavation was done by placing the excavators in a straight line and passing the materials excavated by one to the other without moving the machines themselves.

At the same time, the bottom of the basin was excavated out and a pipe was installed through the ridge plus a pump, so that the basin could be filled and emptied at will.

Then 12 000 m^3 of sand was brought in and spread on the upper beach at the foot of the wall. The sediments came from the construction of oyster purification lagoons (claires) not far away, which greatly reduced the transport costs (5740 including VAT in 1997), making the line of rocks completely disappear.

Then a second import of 60 000 m^3 of sediment was used to cover the ridge at the bottom of the beach, the bottom of the basin and the beach. This large volume was taken from the Barat sandbar in the Seudre estuary during dredging works for navigation purposes (Fig. 1). This massive import was made using an offshore relay station and a long pipeline crossing the intertidal zone. Once the dredger was full, it moored at a pontoon 1.5 km from the beach, where pumps pumped the sediment slurry through the pipeline as far as the beach.

As a last act of the beach redevelopment, a wooden walkway on piles accompanied by a pontoon was built on the seafront.

The total cost of this operation was about 800 000 . Additional costs were allocated for planting marram grass on the top of the sandbar to reduce wind erosion and in the long term allow natural vegetation to develop (Blanchet, 1996).

Good results despite unfavourable weather conditions

The beach and the seafront were now protected from wave action by the sandbar on the lower intertidal zone. Only wind erosion changed the beach profile by blowing sand onto the walkway on piles. Some mechanical excavation was then needed to distribute the sand uniformly, as on all urban beaches.

On the other hand the sandbar's profile changed on its outside face that was directly exposed to the action of the waves and tides. In the first winter, much to everyone's surprise, there was very little impact, the profile simply becoming steeper than in summer and a with a migration of a part of the sandy sediments onto the intertidal zone. The sea did not break through the sandbar, which remained stable in a defensive position. The particle size of the sediment at the top of the sandbar was changed by the migration of the finer sediments onto the lower beach and the appearance of coarse sand, including a high proportion of shells. Then, the initial conditions were almost re-established in the summer of 1999, with the return of a gentle slope joining further up the natural slope of the intertidal zone, by the migration of sediments.

Furthermore, against all expectations, the storm of 1999 caused but little damage. In the central part there was a lowering of the sandbar summit — a start of a breach — about 70 cm deep occurring as a result of the seawater passing over the top of the sandbar. The sandbar did however hold for several reasons. Firstly, it seems likely the storm surge leading a major rise in water level in the basin stabilised the structure by balancing the forces on either side of the sandbar. The curved shape of the sandbar, its massive base, its structure capable of absorbing wave energy (in contrast to a hard concrete structure) and its position sheltered by a coastline 1 km further out ensured that the

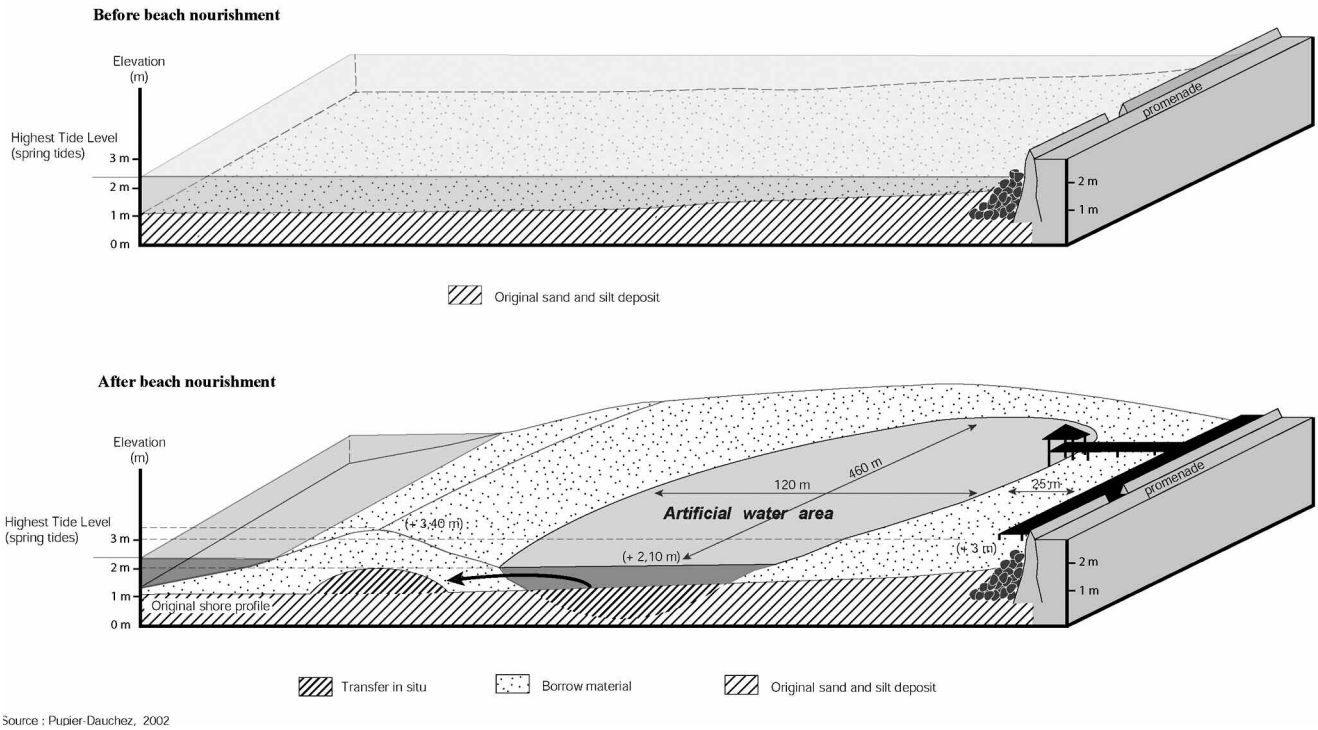

Figure 2. Modification of the shoreline pattern of Marennes in 1997 for recreational activities.
Figure 2. Modification du trait de côte de Marennes en 1997 à usage récréatif.

structure survived. Emergency works consisted of restoring the uniform gentle outline of the outside face of the sand dyke and filling in the start of the breach with existing materials.

Discussion

Finally, the structure perfectly fulfilled its protective role. Its landscape impact, that was criticised mainly by locals opposed to the operation, proved to be less and less of a problem thanks to the natural colonisation of the sandbar by vegetation.

A debatable environmental impact

The water quality in the basin is analyzed at regular intervals because it became warm in summer, with high tourist pressure and the lack of water renewal. Up until now, the bacterial concentration has not prevented bathing. The only problem has been siltation of the bottom of the basin that has required some operations because of the inconvenience and the change in water colour that that this produces. This siltation process that is inherent in the basin's functioning is increased by the nature of the coastal waters that are characterized by a high concentration of fine suspended sediments.

The beds of *Zostera* that extend from the north of beach as far as Bourcefranc, are gradually becoming a victim of significant sand encroachment in the part closest to the sand bar. This phenomenon, which was monitored from 1997 to 2001, does not however seem to be endangering the seagrass beds (Pupier-Dauchez, 2002). From topographic surveys and analyses of photographs, an increase of 25% in the extent of the plant cover has been estimated, despite a maximum increase in the height of the intertidal zone by 40 cm. This increase in height seems to be caused by the process of sediment being trapped at high tides and by inputs from the wind. The most significant phenomena are occurring in a radius of 80 m of the north of the restocked beach. Beyond this sector, the seagrass beds seem to be unaffected directly by the works.

Because of its sheltered position, the operation of building the sandbar and restocking with sand was a success both in landscape terms and in terms of protecting the beach.

A successful tourist project

At present the numbers of tourists visiting Marennes-Plage has shown that the project is an outstanding success, the body of water being used in summer and throughout the

year (e.g. walking on the beach, flying kites and windsurfing).

There have been significant economic benefits from the new seafront with the installation of a hotel and two restaurants. Property prices increased 4-fold between 1999 and 2004, according to the Marennes town hall. The diversification of resources around these new seaside resort activities has therefore given a strong boost to the local economy that previously was based on a sole economic activity.

The redevelopment of Marennes-Plage is therefore not only a successful technical operation, but also the putting into practical form of an interaction between the various local stakeholders.

The management of the coastal mud-flat: an interaction of stakeholders

The installation of oyster growing on the mud-flat dates from so long ago that its has imposed a specialised socio-economic lifestyle that has become the main identifying feature of Marennes-Oléron.

However, at about the end of the 1980s, oyster growing and other activities in the Seudre estuary led to conflicts in land use. Firstly, the environment became increasing less favourable for oyster growing because the siltation and natural sedimentation from the estuary reduced the oxygenation needed for oyster growth. Furthermore, sailing activities were set up on the oyster beds, with increasing numbers of boats requiring improved navigational facilities (dredging, installation of buoys and moorings, etc.). As a result, some oyster-growers had already shifted their beds to more favourable areas, usually further offshore.

In this context, the first restocking of the beach with sand in 1996 worried the remaining oyster-growers and quickly led to disputes with the town council, especially as in the next year the redevelopment operations were on a grander scale. These conflicts were soon resolved when the council offered incentives for oyster-growing installations to be set up away from the estuary zones. So oyster growing started to free-up the estuary areas.

In this coastal redevelopment operation the Marennes town council also had to comply with the requirements of government agencies. After several impact studies, the local environment (DDE) and industry and research (DIREN) agencies opposed the implementation of the project. They considered that the massive restocking with sand would have major consequences on the estuary's hydrodynamics and would lead to a loss of equilibrium in the medium term. A compromise was finally found between the two parties: the sandbank on the lower shore (with a blue clay core and muddy sand covering) would hold back the water body and would isolate the intertidal zone from the restocked beach.

The main organization involved in the operation was therefore the municipality of Marennes. The local councillors did everything in their power to see through to completion a project, whose initial aim was to ensure that the many summer tourists who passed through on their way to the beaches of the Île d'Oléron without ever stopping would find the place attractive enough stay.

The council became the promoter and is now the prime contractor. In this latter role it is responsible for maintaining the water body and for moving sand on the sandbar and beach. It also funded most of the operation and subsequent maintenance. The project was an independent initiative outside the scope of the grouping of municipalities to which nevertheless Marennes belongs (the Communauté de Communes de Marennes).

The construction of the water body and its success are mainly the result of the forcefulness of the councillors who wanted the project to come to fruition, in the face of socio-economic, environmental and institutional obstacles.

The political will was motivated by various perceived benefits: these were not only economic, but could also be measured in terms of image and prestige. Marennes has in fact developed a communications strategy that emphasizes its newfound seaside resort facilities — it has for example created a new place name "Marennes-Plage" that now appears on road signs and maps.

A sculpture several metres high of a child in bathing costume towing an inflatable canoe and holding an oyster in the other hand stands proudly on the roundabout on the town's main street. At the entry to the town on the road to Oléron, there is a welcoming sign showing an open oyster with a beach inside; the town's reorientation toward becoming a seaside resort is clear for all to see.

In addition to economic benefits this new image associating oysters and a beach constitutes a cultural resource — Marennes now has more of an image of a seaside resort than an oyster port (Brient, 1999).

The diversification of activities: a new strategy

The same strategy is now found around the whole Marennes-Oléron coastal mud-flat. In the 1990s the municipality of Grand Village on the Île d'Oléron created a small-scale saltern (sea salt works) on its salt-marshes with the aim of diversifying its sole activity as a resort and thereby attracting summer tourists away from the beaches. This works, that produces very little salt, has a nature trail where tourists can learn how salt is made, an ecology museum and a restaurant. Here salt is combined with the town's image of a traditional seaside resort with extensive beaches.

The project of converting the Ors oyster-growing channel (also on Oléron) into a marina port, belongs to the same type of initiative: there will still be oyster growing but some room will be allocated to tourists' boats.

Conclusion

It therefore seem essential that the coastal towns and villages diversify away from the single activity and single image and instead promote a multifaceted "Atlantic" image in which salt, beaches and sailing become the symbols of the Atlantic Ocean. The coastal mud-flats are now being promoted as an "Atlantic resource" where the activities have been diversified to suit a population of tourists who are looking for authenticity, open spaces, freedom and wildlife — the values of the Atlantic Ocean.

The method of sedimentary reloading has turned up as the solution which can solve many problem of erosion and integrate the different objectives of local development policies. In fact, in France and in the others countries where this method is used, this objectives can be the protection of a defence work, the struggle against erosion, the protection of the coastal zone, the modification of the effects of transit, the throwing out of dragging materials at low cost, or the increase of the tourists frequenting beaches. That's why, beach nourishment presents totally different features. Materials being able to be brought on any level of the profiles of coast with materials extracted from the littoral or from the open sea. Besides, in some of these countries, legislators has privileged the resorting to reloading, using it to struggle against and in same time to give a good place to tourism (U.S.A.) (Leonard et al., 1990; Clayton, 1991; Houston, 1996). Other countries go in for it systematically in order to protect the littoral area from waves invasion (Netherlands) (Misdorp & Terwindt, 1997; Moller, 1990), or just for the tourisms activities (Spain). In France, all these objectives can be pursued and combined as Marennes, Chatelaillon-Plage, Fouras, Brest, Frejus, Valras operations on the French Atlantic and Mediterranean coasts (Pupier-Dauchez, 2002).

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