MORPHODYNAMICS OF THE COASTAL LANDSCAPE AND ENVIRONMENTAL ASPECTS OF PALUDE DI TORRE FLAVIA (NORTHERN LATIUM - ITALY)

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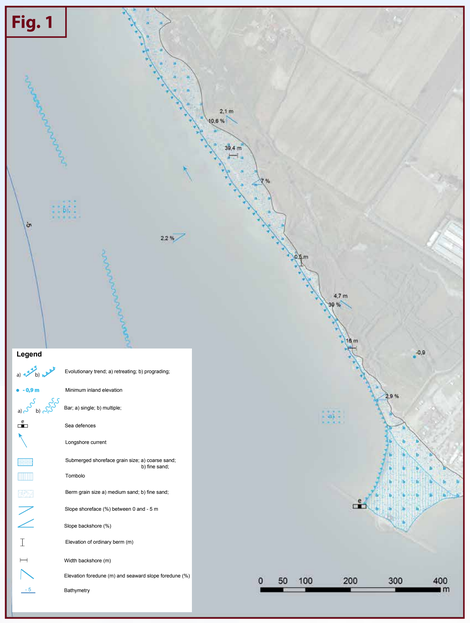
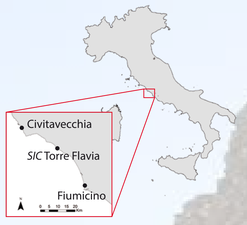
European Geosciences Union General Assembly 2018
Wien | 8–13 April 2018

The "Palude di Torre Flavia" (40 ha) is a marsh situated along the Tyrrhenian coastline, 40 km north of Rome (Fig.1) This biotope is the remnant of a larger heterogeneous littoral wetland area, extended until 1960- 1970 for about 100 ha (Fig 2) . The "Palude di Torre Flavia" Natural Monument is a Special Protection Area sensu Bird Directive 79/409/CEE and 147/2009/UE..

Fig. 1





The main purpose of this study is to reconstruct the morphodynamics of the coastal landscape of "Palude di Torre Flavia" and the paleo-environmental evolution during the late Holocene. The coastal evolution has been investigated by topographic/bathymetric surveys and wind climate. Three cores will provide data for the evolutionary reconstruction of the wetland, while chemical, physical and microfaunal analyses will be used for the environmental characterization of both beach and wetland.

TThe 1961-2010 series of the nearby Automatic Weather Station of the Fiumicino Airport has been analyzed to define the wind climate (Fig. 3). Considering only onshore winds, data shows dominant winds from the third quadrant, with an intensity equal to the VII Beaufort Class, and a percentage of calms ranging between 15% and 22%. Seasonal plots show dominant winds from W and SW, both in winter and summer.

FIUMICINO STATION - 1961 - 2010

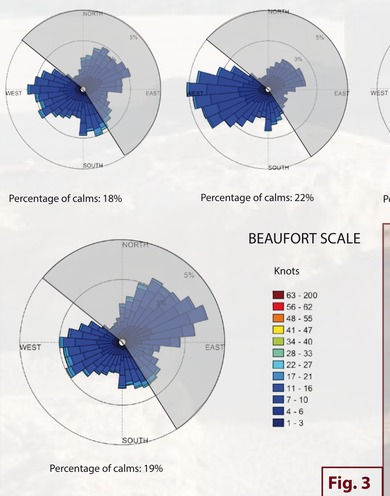


Fig. 3

The study area is one of the last coastal wetlands, largely present in the past in the Agro Romano area. Since the mid-1950's the shoreline dynamics showed an erosive process, at present the coastal erosion is in a very advanced stage so that the bottom of the marsh is outcropping at the ground surface (Fig.4). The "Palude di Torre Flavia" and its typical wetland ecosystem have the strong chance to disappear.

The shoreface morphology between 0 and 3 meters depth is rather uniform with a slope that tends to increase proceeding to the north (Figg. 5,6). The morphology between 3 and 10 meters depth is very articulated and characterized by the presence in the southern part of a promontory with flattened summit that extends towards the west describing an arch. This arch encloses an area cut by gullies exceeding the depth of closure (7.6 m). In the September survey these incisions are even more evident (Fig.6) and accentuated respect to the March survey (Fig.5). These morphologies are due to the structural arrangement of the shoreface, wave action and rip current. The morphodynamic of the shore, characterized by microtidal range, is mainly driven by dominant winds and waves approaching from W and SW, which produce a longshore current that flow from South to North (Fig.1). The height of the foredune is between 2 and 4.7 m. The severe reduction of the beach caused a strong erosion of the dune belt by the waves (Fig. 7). Three cores were drilled into the marsh. Their study is currently in progress (Fig. 5).

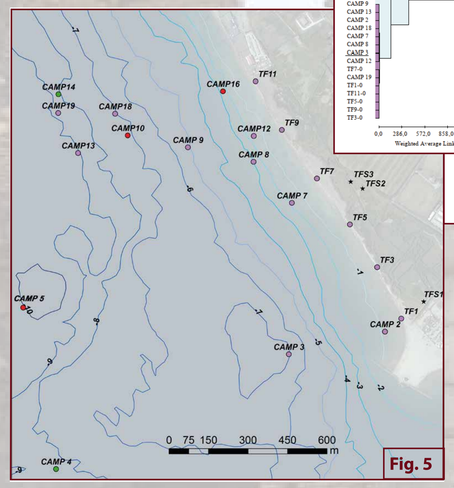
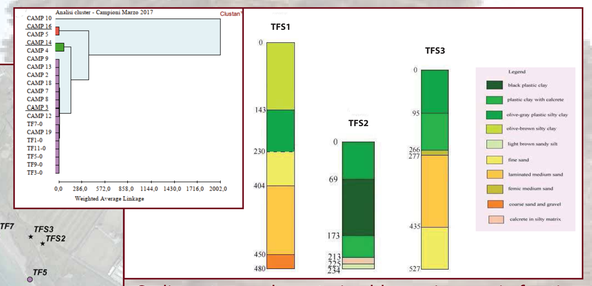


Fig. 5



Sediments are characterized by an inorganic fraction with heavy minerals coming from the adjacent Volcano Sabatino, and bioclastic fraction (mainly bivalves, gastropods and foraminifers). Berm-crest sediment shows commonly medium sand, fine sand is only present on the backshore near the tower. In March 2017 survey, submerged sediment shows a well sorted medium to very fine sand between the shoreline and -5m (Fig. 5). In the northernmost part of the study area very fine, well-sorted sands have also been found beyond the depth of closure. Beyond the depth of closure, sediments commonly consist of sand and silty sands, poorly sorted with a coarse bioclastic fraction even more than 30%.

Fig. 2

Fig. 4

Fig. 7

In the northern area, these features were also recognized at -2m in only one case. The September 2017 survey shows a belt of medium to fine well sorted sand between the shoreline and - 5 m (Fig. 6). Near the depth of closure, there are fine poorly sorted sand and sand with abundant coarse biogenic fraction, remaining the latter in the sediment even beyond the depth of closure. The September survey, carried out after repeated storm events, shows a normal distribution of the sediment, highly influenced by the waves. This feature was not highlighted by the March survey, carried out after several days of calm. Sediment distribution is function of the interaction between wave action and structural arrangement of the shoreface, particularly at depth more than -5m.

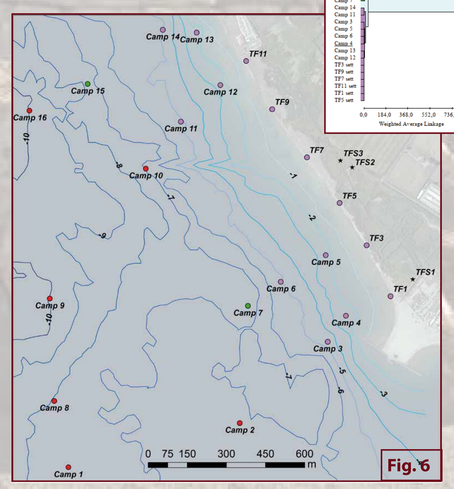
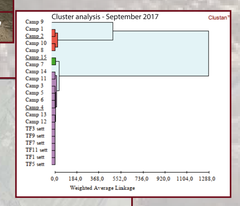
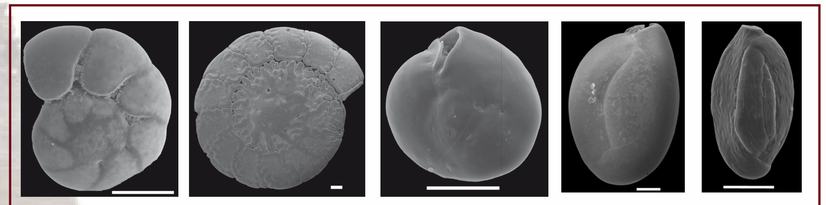


Fig. 6



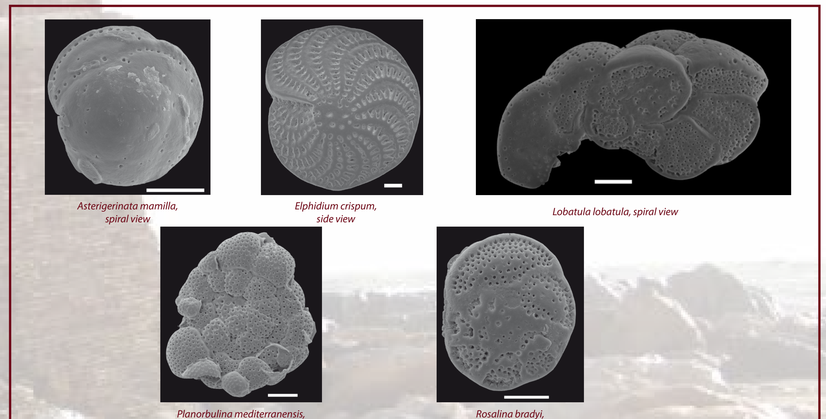
Benthic foraminiferal assemblages (dead and living specimens) of the beach area are characterized by typical infralittoral taxa, as Ammonia *spp*. (e.g., *A. beccarii* and *A. gaimardii*) and miliolids (e.g., *Miliolinella subrotunda*, *Quinqueloculina seminulum* and *Q. stelligera*). Some differences, linked to a different substrate, consist of an increasing of epiphytic taxa like *Asterigerinata mamilla*, Elphidium *spp*., *Lobatula lobatula*, *Miniacina miniacea*, *Planorbulina mediterranensis* and *Rosalina bradyi*. Finer grainsizes are characterized by the smallest number of foraminifera while the coarser sediment sizes contain a more abundant living assemblage and broken tests. The wetland is characterized by the almost complete absence of foraminifera probably due to the lower salinity. Emphasis must be placed on the presence of few rare specimens of *Lagenammina* cf. *L. fusiformis*, *Cribrostomoides jeffreysi* and diatoms in the samples closer to the beach. All the samples are characterized by the presence of ostracods (mainly Candona *spp.*) and rare fragments of gastropods.

Typical infralittoral species



Ammonia beccarii, spiral view | *Ammonia gaimardii, spiral view* | *Miliolinella subrotunda, side view* | *Quinqueloculina seminulum, side view* | *Quinqueloculina stelligera, side view*

Epiphytic species



Asterigerinata mamilla, spiral view | *Elphidium crispum, side view* | *Lobatula lobatula, spiral view* | *Planorbulina mediterranensis, dorsal side* | *Rosalina bradyi, spiral view*

"Scanning electron micrographs of benthic foraminifera from Torre Flavia beach area. Scale bar = 100 μm"

The shoreface and the backshore show a tendency to advance in the southernmost part: here the shoreface morphology played an important role as well as the presence of transversal and longitudinal defences that produced refraction and diffraction processes and the creation of a tombolo. Proceeding to the north the shoreline is retreating and the shoreface is deepening and cutting by the action of rip currents. This scenario exposes the marsh to the risk of disappearance. In the southern part the wetland sediments are characterised by oligotypical microfaunistic assemblages consisting of brackish and freshwater components (rare agglutinated foraminifera, diatoms and freshwater ostracods). This shows how in this area the wetland is still resistant to wave action.

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Aknowledgments

Study carried out in the framework of the Project funded by "Sapienza" University of Rome - year 2016: "Cliff slope failures in the coastal morpho-dynamics: from back- to forward-analysis of processes through monitoring and multi-modelling approaches" (Responsible: Salvatore Martino)