INFLUENCE OF THE PO FLOODS ON THE WESTERN ADRIATIC COASTAL WATER UP TO ANCONA AND BEYOND

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ABSTRACT - In october 1977, in front of the "Marche" coast between Falconara and Port Recanati, a mass of hypoaline water, probably originating in the Po Valley, was observed. The same phenomenon observed again in November 1979 in occasion of a Po flood, is here presented.

RESUME - En octobre 1977, le long des côtes de la Région Marche entre Falconara et Porto Récanati, on a remarqué la présence d'une masse d'eau hypoaline ayant vraisemblablement sa source dans le Po. En Novembre 1979, à l'occasion d'une crue du Po, on a enregistré le même phénomène qui est ici présenté en détail.

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The continental water which flows into the Adriatic from the large Northern rivers, in particular the Po, has an important role both in dynamics and in biology. It in fact has a great influence on the Adriatic circulation and brings those nutritious salts, tied to plankton presence.
During a hydrologic survey in October 1977, on the coastal area between Falconara and Port Recanati, the presence of a "river" of relatively sweet water was observed.
This strip of water was 5 meters in depth and extended from a minimum of 5 to a maximum of 10 miles from the coast, considering the 34‰ isoaline as separator between the two water masses (Fig.1).
It seemed improbable that this water could be due to the never very abundant Marche rivers flow, while it could have been due to an exceptional Po flood (14.10.77-7950 m^3/s).
To verify this hypothesis, during October-November 1979, in occasion of a Po flood (20.10.79-7260 m^3/s) 3 coastal samplings were executed over the Ancona (B) section up to 10 miles from the coast, in order to control the seasonal normality of the initial hydrological conditions and to catch quite precisely the passing of the flood front through the Ancona section.
On November 8, having règistered on the B section a highly hypoaline situation, observations on three more northern sections, Falconara (A) Senigallia (SG) and Fano (FA), with stations up to 15 miles off-shore were collected also to exclude the influence of the Esino, one of the largest local rivers.

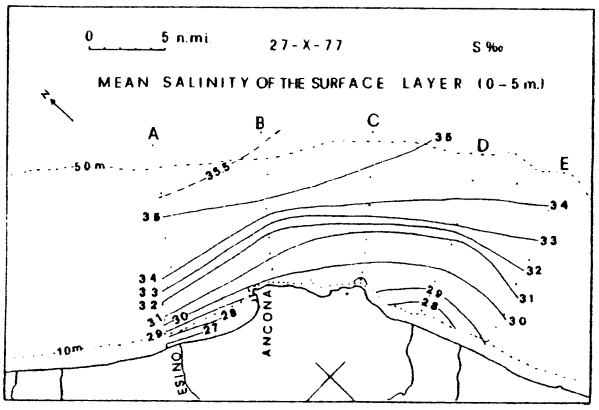

Fig. 1

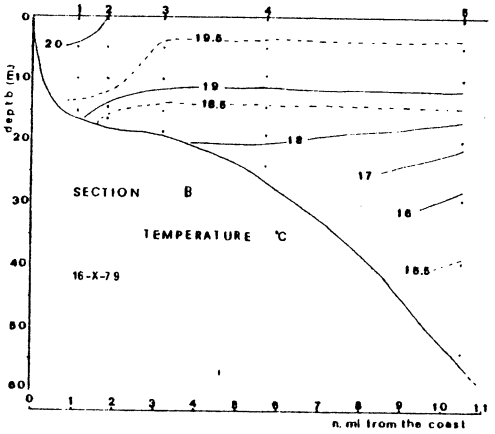

Fig. 2

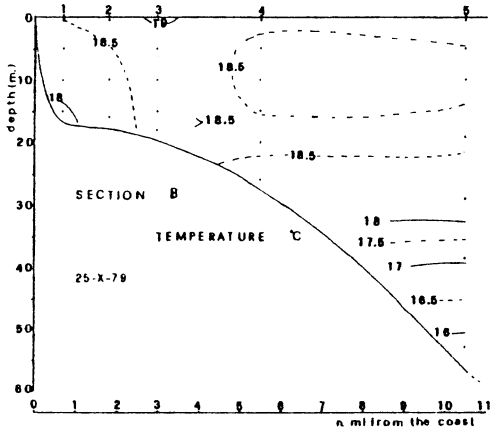

Fig. 3

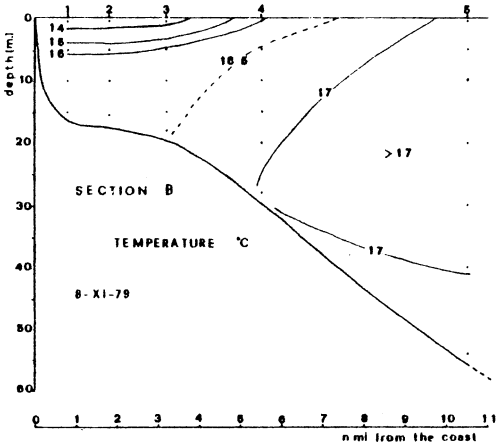

Fig. 4

The seasonal situation is given by the temperature values on the Ancona section, repeated 3 times at 9 and 14 days intervals.
It is a typical transitional situation with disappearence of the thermocline.
Infact the off shore (B5) superficial temperature decreases from 19.9°C to 17.5°C whilst on the bottom it increases from 15.1°C to 16.8°C, thus transforming a situation of a slight thermocline into one of homogeneity around 17°C (fig.2,3,4). Under coast the cooling is stronger.The superficial temperature passes from 20.4°C to 13.9 in 24 days, producing a thermal inversion (16.3°C on the bottom).The presence of the higly hypoaline water (fig.5) prevents the formation of mass instability generally associated to this situation.

On October 16, section B and section D (10 miles to the south of Ancona) had salinity uniform in depth and increasing from off-shore towards the coast (36.7‰ on B5 and 37.5‰ on B1) (Fig.6). This situation which might be due to the combined influence of the Esino river and the wind, had changed a great deal in October 25 (Fig.7). The under-shore salinity decreases by 6 tenths on the surface and by one unit on the bottom, while in the off-shore station there was an increase of about a 4 tenths on the superficial layer. This induces a complete vertical homogeneity on the first three stations and the presence of two distinct masses of water off-shore.
On November 8 the Ancona section showed a sector of a relative sweet water (surface minimum, 26.2‰) extending up to 5 miles from the coast and about 5 meters in depth, while off-shore the salinity reaches 38.6‰ (Fig.8), almost uniform over the whole column.

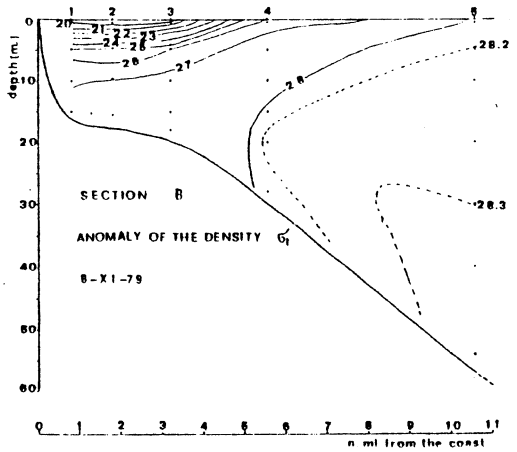

Fig.5

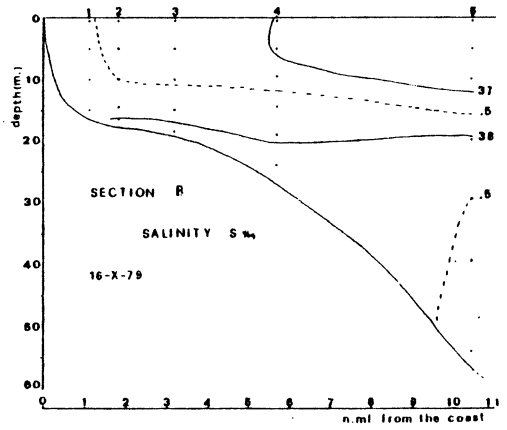

Fig.6

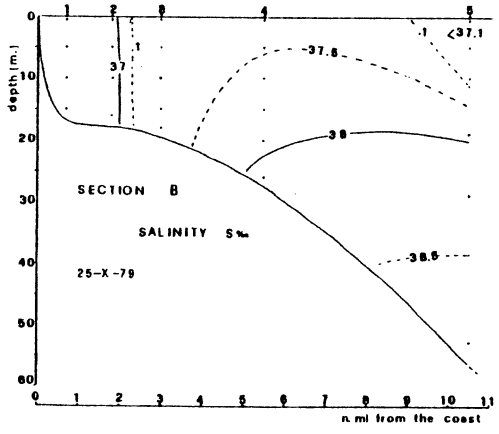

Fig.7

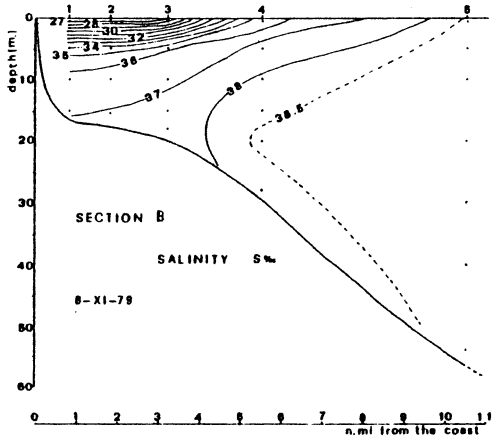

Fig.8

On November 9, over Falconara, Senigallia and Fano sections, the presence of a layer of "sweet" water with a surface minimum of about 26.5‰ was observed (Fig.9,10,11).The vertical and orizontal aline gradient is weaker than in section B. On this section the 35‰ isoaline has its mean depth around 5 meters and cuts the surface at about 5 miles off-shore while on the Falconara section, the same isoaline is deeper (10 m.) and cuts the surface at just under 8 miles. On the other two more northern sections the 35‰ isoaline passes from about 10 m. in depth, under coast, to the surface over 9 miles off-shore.

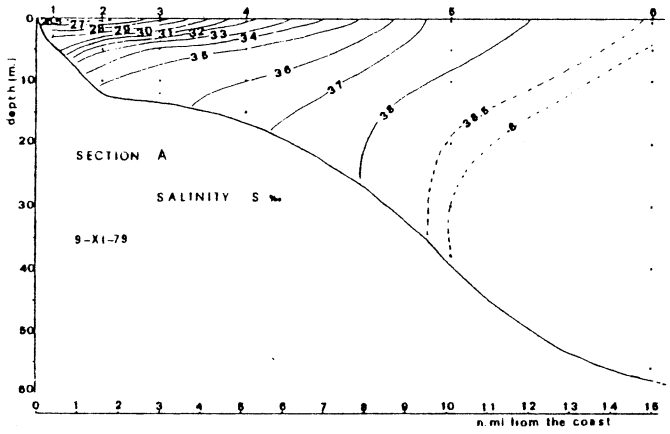

Fig.9

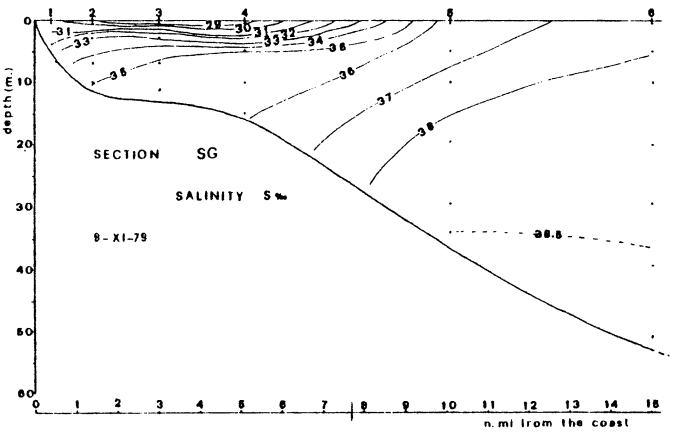

Fig.10

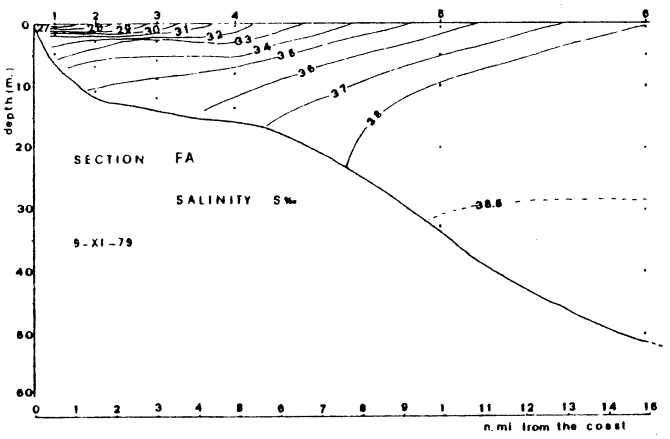

Fig.11

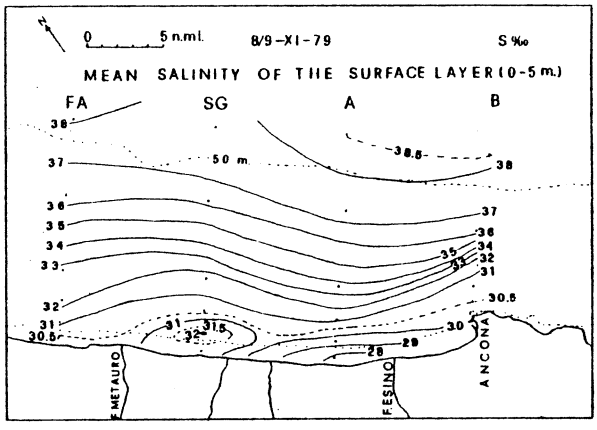

Fig.12

CONCLUSIONS

The object of this work was to demonstrate that the presence of the "sweet" water in front of Ancona, registered in October 1977, was not due to the flow of the local rivers, but was a larger scale phenomenon connected to the exceptional Po flood.
The superficial layer (0-5 m.) salinity distribution map (Fig.12) shows the dimension of the phenomenon and limits the Esino influence on the thin sweet water strip which extends from its estuary towards north close to the shore.
Calculating the time taken by the flood front to reach the Ancona section, one obtains a velocity of about 10 cm/s, close to the approximate velocity estimates of the autumnal descending current.

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