

PRELIMINARY RESULTS OF A ENVIRONMENTAL STUDY ON A BRACKISH LAKE

by

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Summary. The results reported are the preliminary ones of a research program, aimed at ascertaining the present ecological state of a brackish lagoon (Lago Patria) with a long-standing fish-growing tradition.

Resumé. Premiers résultats d'une étude du milieu ayant pour but la valorisation d'une lagune saumâtre (Lac Patria) utilisée traditionnellement pour l'aquaculture.

Lago Patria has long been used for the cultivation of high-quality fish, thanks to the high fertility of its waters. Average yearly catches amount to about 35-40 tons of fish and 16-17 tons of eels. It is accordingly an important supply source for the Neapolitan fish market. However, the ecology of Lago Patria experiences periodic dystrophic crises, to the considerable detriment of its fish population. Thus, the assessment of its present ecological state is a necessary prerequisite to the planning of suitable protective measures and engineering works to safeguard its conditions and enhance its economical potential.

Lago Patria is a small brackish lagoon, lying on the Tyrrhenian coast of Campania, WNW of Naples. Over 2-km² in area, it is connected to the sea by an outlet channel 1.5-km long. It is the southernmost of the Pontine lagoons, which were formed behind coastal dunes as a result of gradual lowering of the littoral plain⁽¹⁾. A common feature of all these lagoons is the difficulty of their exchange with sea water. Recurring clogging of their outlets requires frequent clearing to keep them active.

In addition to the above general characteristics, which render the ecological balance of all Pontine lagoons critical, Lago Patria has other unfavourable factors due to its scarce and inhomogeneous depth and the accumulation of material, which in recent years has affected almost the entire length of the arm of its outlet to the sea. The resulting raising of the bottom of this arm has brought the water head to no more than 75-80 cm.

The present maximum depth of the lagoon is about 2.5 m. The inflow of

fresh water is due to a series of sources originating from a tufaceous terrace and to a number of canals conveying to the lagoon wash-out water from the surrounding, mainly agricultural, terrain.

This communication shows preliminary results obtained with water sampling carried out in June, through September 1980. The comprehensive research program will include monthly water sampling and one surface sediment sampling a year.

Eight sampling stations were selected, namely, one at the centre of the lagoon, where the water is at a maximum depth (M.L.); one at each inlet of the three main alluvial-water canals (C₁, C₂, C₃); three in the outlet section close to the inlet of three fresh-water sources (S₁, S₂, S₃), and the last two in the terminal section of the outlet (F₁, F₂).

At each station, samples were taken of both surface and bottom water, and their chemical and physical characteristics as well as their nutrient and chlorophyll "a"⁽²⁾ concentrations were determined.

| Stat. | Depth m | t°C water | pH | O ₂ mg/l | O ₂ % | Cl%• | NH ₄ -N mg/l | NO ₂ -N mg/l | NO ₃ -N mg/l | PO ₄ -P mg/l | Ch."a" mg/l |
|----------------|------------|--------------|------|------------------------|------------------|-------|----------------------------|----------------------------|----------------------------|----------------------------|----------------|
| M.L. | 0 | 26.8 | 8.05 | 6.52 | 86.1 | 9.95 | .122 | .038 | .027 | .011 | 11.47 |
| | 2.5 | 26.8 | 8.05 | 5.34 | 71.0 | 10.78 | .188 | .032 | .018 | .009 | 13.54 |
| C ₁ | 0 | 25.9 | 7.85 | 6.48 | 82.8 | 8.28 | .122 | .056 | .075 | .015 | 2.64 |
| | 1.5 | 25.9 | 7.95 | 6.90 | 89.6 | 10.05 | .126 | .042 | .033 | .011 | 3.33 |
| C ₂ | 0 | 27.0 | 7.85 | 4.24 | 56.1 | 9.87 | .327 | .052 | .033 | .018 | 3.50 |
| | 1.5 | 27.0 | 7.90 | 4.94 | 65.3 | 9.87 | .328 | .047 | .022 | .024 | 3.46 |
| C ₃ | 0 | 28.0 | 8.00 | 5.50 | 73.1 | 8.85 | .162 | .047 | .288 | .040 | 3.39 |
| | 1.5 | 27.0 | 8.05 | 5.42 | 71.7 | 9.59 | .189 | .049 | .177 | .017 | 4.63 |
| S ₁ | 0 | 24.6 | 7.75 | 5.86 | 73.1 | 8.17 | .075 | .038 | .270 | .056 | 4.72 |
| | 1.3 | 26.0 | 8.05 | 6.22 | 81.2 | 10.23 | .099 | .029 | .100 | .009 | 5.62 |
| S ₂ | 0 | 26.2 | 8.05 | 6.30 | 81.9 | 9.48 | .083 | .031 | .166 | .013 | 6.70 |
| | 1.3 | 26.2 | 8.10 | 6.62 | 86.9 | 10.37 | .096 | .028 | .190 | .009 | 7.93 |
| S ₃ | 0 | 25.1 | 8.00 | 6.36 | 81.3 | 9.57 | .150 | .030 | .383 | .065 | 4.68 |
| | 1.5 | 26.2 | 8.05 | 6.62 | 88.0 | 11.56 | .180 | .033 | .112 | .009 | 5.78 |
| F ₁ | 0 | 26.3 | 8.00 | 7.70 | 100.6 | 9.91 | .081 | .031 | .073 | .009 | 6.06 |
| | 1 | 25.9 | 8.05 | 7.06 | 92.2 | 10.37 | .129 | .030 | .071 | .013 | 9.22 |
| F ₂ | 0 | 25.5 | 8.05 | 5.67 | 73.1 | 9.86 | .145 | .030 | .138 | .022 | 4.61 |
| | 1.5 | 26.0 | 7.95 | 6.36 | 83.7 | 10.95 | .118 | .019 | .201 | .028 | 7.96 |

Table 1 shows time averages of these parameters, taken over the four sampling sessions. In an environment where fluctuations are so large, the significance of such averages is open to question.

The temperature values measured came very close to the seasonal maxima of Lago Patria, which is subject, owing to its shallowness, to marked cooling in winter and overheating in summer⁽¹⁾. It would seem from the table that seasonal temperature extremes are locally mitigated by the influence of tides in the terminal section of the outlet and by the fresh-water supply near the lagoon shore.

Considering the summer season, the measured dissolved-oxygen contents may be deemed satisfactory. They range from 3.44 to 7.08 mg/l at the lagoon centre, from 3.76 to 8.24 mg/l at the shore stations, and from 4.40 to 10.48 mg/l at the sea-outlet stations. Only once, namely in August, and only at the C₂ station, did oxygen-concentration measurements come as low as 0.72 and 2.16 mg/l (at the surface and on the bottom respectively), accompanied by high values of hydrogen sulphide and ammonia-nitrogen, probably caused by occasional spilling of waste water.

Throughout the lagoon the vertical chlorinity profile was found to be fairly steady except at the sea outlet where surface-water values of this parameter followed the ebb and flow of tides; comparatively more salty pockets were present near the bottom, particularly at the S₃ station at about 1.5 m depth. A similar situation was also observed at the C₁ station, with a layer of fresh water a few centimeters deep above the lagoon water.

Nitrogen compounds were found, at times at high concentrations. From their distribution, it would seem that a fraction of them does not originate from Lago Patria itself, they probably reach the lagoon with alluvial water from the surrounding area.

The distribution of phosphates, though much less, is similar to that of nitrogen compounds. A portion of them clearly reaches the lagoon with alluvial waters.

Chlorophyll "a" concentrations measured at the centre of the lagoon also point to a good trophic state. Due to the influence of the diluting effect of fresh-water inflow, the values recorded at peripheral sampling stations were much lower than at the center.

More definite conclusions must, of course, be postponed until completion of the entire research program.

Research carried out at the Zoological Station of Naples and at G. Donegani Institut Research Centre of Naples.

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