

## Red Water in the Lake of Pergusa (Sicily, Enna)

De Francesco M.\*, Pulicanò G.\*, Termine R.\*\*\*, Bruni V.\*

\* Dipartimento di Biologia Animale ed Ecologia Marina, Università di Messina, Salita Sperone n° 31, 98166 Messina

\*\* Sicilia Ambiente S.p.A, via Roma n° 353, 94100 Enna

The lake of Pergusa (Enna), famous from the ancient times (Ovidio, "*Metamorphosis*", I century A.C.; Claudiano, "*The rape of Proserpina*", IV century A. C.), is situated in the centre of Sicily. It is 667 metres above sea level, between the basins of the Southern Imera river and the Simeto river. Its depression comes from tectonic origin and the surrounding hills form the peak of Mount Carangiaro with an altitude of 921 metres above sea level.

Bearing water tables and atmospheric precipitations form a closed basin deprived of tributaries and emissaries. Its water, with high values of salinity, sometimes turns red due to the proliferation of phototrophic sulphur-bacteria.

The lake of Pergusa is a Special Natural Reserve (Sicilian Regional Law n° 71/ 95) managed from the Regional Province of Enna. It has a total extension of 402.5 hectares. This important biotope has been inserted in the "Carta dei Biotopi d'Italia" (1971), in the "List of Damp Zones of International Importance" (Convention of Ramsar, 1971), within the zones of special protection (Z.P.S.) (Directive 79/ 409/ E.E.C.). It has also been included in the sites of community importance (S.I.C.) and the lake itself is classified "dystrophic" [code: NUTS of the Sicilian Region; ITA 060002 of the statute community protection S.I.C./ Z.P.S. ; NATURA 2000 IT05 (1310, 6240, 1410, 3160)] to the senses of the Directive 92/ 43/ E.E.C.

Over the course of time the lake's surface area has increased and decreased dramatically. The data from the lake of Pergusa originate from a local author by the name of "Lo Menzo", whose studies and research date back from the 18th century. Lo Menzo reported that the perimeter of the lake stretched beyond 7 miles; in the summer 2002, the perimeter of the waters edge decreased to 1.2 kilometres. The depth of the lake was 2.4 metres in 1977 (Genovese *et al.*) and stooped to a 34.5 centimetre low during July 2002. The water reduction is caused by decreasing rain precipitation and public and private wells, which in turnover decades have impoverished the bearing ground water tables. From 1988 the extraction of water has ceased and levels measured by piezometers have begun to slowly rise.

Investigations have been put forward to compare the data results from a study performed between May 1978 and July 1979 (A.A., 1992) from the Istituto di Idrobiologia (University of Messina) on the funding of the Ministry of Instruction, University and Research (MIUR). The comparison will be made with the information and results obtained between July 2001 and July 2002 (Termine, 2002) from the Sicilia Ambiente society and the Department of Animal Biology and Marine Ecology of the University of Messina, on the funding of the Regional Province of Enna.

**METHODS:** Physical and chemical parameters were determined according to APHA Standard Methods (2000). Sulphur bacteria cultures were performed according to Pfennig and Trüper (1991) and Trüper and Pfennig (1991). Direct counts were carried out as described by Maugeri *et al.* (1990).

**RESULTS AND DISCUSSION:** The results showed an evident deterioration of the lake ecological conditions which were characterized by a high increase of the salinity, total nitrogen and phosphorus, and a strong depletion in the oxygen concentration (july-october 2001). This critical situation produced a conspicuous bloom of phototrophic sulphur bacteria (> 10<sup>8</sup> cells/ml). Spectral analysis of concentrated Lake water clearly showed the signature of phototrophic purple bacteria; the absorption maxima was obtained near 800 and 850 nm, characteristic of bacteriochlorophyll *a* (see picture and spectrum).

*Thiodictyon elegans* Winogradsky was the predominant species. Previous researches (Forti, 1933; Bruni and Pulicanò, 1978) showed that *Thiocapsa roseopersicina* Winogradsky cells were instead the cause of the red water in the past. Further and more in-depth studies should be undertaken in order to know, from a genetic point of the view too, the diversity and ecology of the phototrophic sulfur bacteria in the Lake of Pergusa.

**REFERENCES:** A.A. (1992) – Il Lago di Pergusa. Osservazioni dal 18 maggio 1978 al 7 luglio 1979 – Dip. Biol. Anim. Ecol. Marina-Università di Messina. Rapporti, 5, pp.58; APHA (2000) - *Standard Methods for the Examination of Water and Wastewater*. 17th edn. APHA Washington, DC; BRUNI V., PULICANO' G. (1978) – Nuovi dati sulle condizioni fisico-chimiche e microbiologiche del lago di Pergusa. Atti Soc. Pelorit. Sc. Fis. Mat. E Natt., Messina, XXIV; ELETTRONCONSULT MILANO (1986) – Piano per la salvaguardia del Lago di Pergusa. Inquadramento geologico idrogeologico-morfologico. Studio di prima fase; FORTI A. (1933) – Nuove notizie sull'arrossamento delle acque avvenuto nel lago di Pergusa in settembre 1932 ed ulteriori considerazioni sui fenomeni di arrossamento in generale. Boll. Pesca Piscic. Idrobiol., 6, 998-1051; GENOVESE S., BRUNI V., FARANDA F. (1977) – Sulle attuali condizioni del lago di Pergusa. Riv. Idrobiol., 16, 245-268; LONGO A. M. (1993) - Il Lago di Pergusa , analisi conoscitiva e proposte di tutela. Ila Palma; MAUGERI T.L., ACOSTA POMAR L., BRUNI V. (1989) - Picoplancton. In: " Metodi per lo studio del plancton marino". *Nova Thalassia*, 10: 199-205, *Suppl.* 2; PFENNIG N., TRÜPER H.G. (1991) - The Prokaryotes. Vol. IV, pp. 3200-3221, Springer-Verlag New York; TERMINE R. (2002) – Ambiente. Enna Provincia - Mensile di Informazione della Provincia Regionale di Enna, 7/8, 30; TRÜPER H.G., PFENNIG N. (1991) - The Prokaryotes. Vol. IV, pp. 3583-3592, Springer-Verlag New York.