

SUMMER DISTRIBUTION OF NITROGEN AND PHOSPHORUS IN MEDITERRANEAN SPAWNING AREAS OF TUNA FISHES

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SUMMARY

In the summer of 1994, the concentration of nutrients (ammonia, nitrate, nitrite, orthophosphate, and total phosphorus) was surveyed in 281 stations in the Mediterranean spawning areas of tuna fishes. The surface waters have an overall fairly homogeneous, low concentration of nutrients. As expected, in the summer time, the Levant and Algerian-Provençal Basins are definitely oligotrophic.

RESUME

Pendant l'été 1994, la concentration d'éléments nutritifs (ammoniaque, nitrate, nitrite, orthophosphate et phosphore total) a été suivie dans 281 stations dans les zones de frai des thons en Méditerranée. Les eaux de surface présentent une faible concentration, assez homogène, d'éléments nutritifs. Comme on s'y attendait, les Bassins Levantin et Algérien-Provençal se sont avérés clairement oligotrophiques.

RESUMEN

En el verano de 1994 se realizó una prospección de 281 puntos en las zonas de desove de los túnidos en el Mediterráneo, respecto a la concentración de nutrientes (amoníaco, nitrato, nitrato, ortofosfato y total de fósforo). Las aguas superficiales tienen una baja concentración general de nutrientes bastante homogénea. Como se pensaba, durante el verano las cuencas de Levante y la Argelina-Provenzal son definitivamente oligotróficas.

INTRODUCTION

The present survey was carried out using samples collected in the summer 1994, during a cruise to detect the Mediterranean spawning areas of tuna fishes and the distribution of their eggs and larvae. Water samples were collected from the sea surface in 281 stations, from the 17th June to the 5th August 1994, in the Algerian-Provençal Basin (47 samples), Tyrrhenian Sea (67 samples), Sicilian Channel (50 samples), Ionian Sea (67 samples), and Levant Basin (50 samples) (Table 1).

Sampling started in the Eastern Mediterranean Sea and went on in the Western Basin. The sampling stations were chosen 15 nautical miles apart from each other.

The present survey concerns the rates of concentration of the following chemical parameters in the surface waters of the Mediterranean Sea: ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, ortho-phosphate phosphorus, and total phosphorus.

MATERIALS AND METHODS

The determination of nutrients was carried out on water samples collected by 5-litre Niskin bottle. Subsamples to determine the different parameters were saved in PET bottles.

The following analytical methods were applied:

AMMONIA NITROGEN (Strickland & Parsons, 1972). At pH 10.4-11.3, ammonia reacts with a sodium hypochlorite solution to form chloramine. In the presence of phenol and sodium nitroprusside catalyser, chloramine forms a coloured complex compound named blue-indophenol, the absorbance of which is read in a 10 cm cell at 640 nm wavelength. When this cell is used, reading ranges from 1 to 300 µg/l.

NITRATE NITROGEN (Strickland & Parsons, 1972). Sulphanilamide is deazotized by nitrous acid at pH 1.5-2.0; the cherry-red coloured diazo compound so formed is read in a 10 cm cell at 543 nm wavelength. Reading ranges from 1 to 25 µg/l.

NITRITE NITROGEN (Strickland & Parsons, 1972). Following reduction by a copper-cadmium reductor column. When 10 cm cells are used, reading ranges from 8 to 500 µg/l.

ORTHO-PHOSPHATE PHOSPHORUS (Strickland & Parsons, 1972). Ortho-phosphates react with ammonium molybdate and ammonium potassium tartrate, under acidic conditions, forming a

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heteropolyacidic complex compound, which is reduced to molybdenum blue by ascorbic acid. When 10 cm cells are used, reading is in the range 0.3-15 µg/l.

TOTAL PHOSPHORUS (Strickland & Parsons, 1972). This procedure involves the complete mineralization of the organic dissolved matter, in autoclave at 1 atm and 120°C for 15', under acidic conditions by potassium persulphate. The final pH, after mineralization, has to be in the range 5 to 6 before the colorimetric staining. Afterwards, the total phosphorus is determined as ortho-phosphate phosphorus following the above reported procedure.

The analytical instrumentation used includes:

-) Double-grating Perkin Elmer "Lambda 16" UV/VIS spectrometer. Wavelength range: 190-900 nm; spectral bandpasses 0.1-10 nm; optical pathlength: 1-10 cm.
-) Technicon "Minilyzer" Colorimeter.

RESULTS

The results show that in the summertime, in the spawning areas of tuna fishes, the Mediterranean surface waters have an overall fairly homogeneous, low concentration of nutrients. However, as it was expected, the Levant Basin turned out to be definitely oligotrophic; similar results were found in the sampled area of the Algerian-Provençal Basin. The data on phytoplankton (Rizzi *et al.*, this volume) corroborates the supposition of overall oligotrophic conditions of the Mediterranean waters, which are markedly oligotrophic in the Levant Basin.

In this first note, it was established that the concentration of nutrients, especially that of nitrogen salts, is quite low with respect to data from other Mediterranean basins (Regione Emilia Romagna, 1996. De Ruggieri *et al.*, in press). Such differences may be ascribed to the survey period. Indeed in the summertime, because of the warming up of surface waters and the presence of a thermocline, in the Mediterranean Sea certain oceanographic conditions become established that limit the presence of upwelling currents.

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IONIAN SEA

	N-NO ₃ (µM/l)	N-NO ₂ (µM/l)	N-NH ₃ (µM/l)	P-PO ₄ (µM/l)	Ptot(µM/l)
Mean	1.25	0.02	0.64	0.26	0.72
Standard deviation	0.38	0.01	0.38	0.12	0.31
Min value	0.67	0.01	0.00	0.07	0.19
Max value	2.65	0.08	2.28	0.58	1.69

LEVANT BASIN

	N-NO ₃ (µM/l)	N-NO ₂ (µM/l)	N-NH ₃ (µM/l)	P-PO ₄ (µM/l)	Ptot(µM/l)
Mean	1.22	0.02	0.68	0.24	0.67
Standard deviation	0.38	0.02	0.47	0.11	0.28
Min value	0.56	0.01	0.00	0.06	0.13
Max value	2.26	0.09	2.39	0.53	1.36

SICILY CHANNEL					
	N-NO ₃ (μM/l)	N-NO ₂ (μM/l)	N-NH ₃ (μM/l)	P-PO ₄ (μM/l)	Ptot(μM/l)
Mean	1.09	0.02	0.88	0.28	0.76
Standard deviation	0.26	0.02	0.60	0.11	0.30
Min value	0.63	0.01	0.12	0.11	0.30
Max value	1.85	0.06	2.96	0.50	1.39
TYRRHENIAN SEA					
	N-NO ₃ (μM/l)	N-NO ₂ (μM/l)	N-NH ₃ (μM/l)	P-PO ₄ (μM/l)	Ptot(μM/l)
Mean	1.12	0.02	0.78	0.27	0.73
Standard deviation	0.29	0.01	0.73	0.12	0.31
Min value	0.47	0.01	0.02	0.08	0.17
Max value	2.00	0.06	4.51	0.58	1.48
ALGERIAN-PROVENÇAL BASIN					
	N-NO ₃ (μM/l)	N-NO ₂ (μM/l)	N-NH ₃ (μM/l)	P-PO ₄ (μM/l)	Ptot(μM/l)
Mean	1.00	0.02	0.67	0.27	0.70
Standard deviation	0.33	0.02	0.48	0.12	0.28
Min value	0.43	0.01	0.14	0.11	0.33
Max value	1.92	0.07	2.48	0.67	1.40

Table 1 - Mean values and ranges of nutrient concentration in five Mediterranean areas.

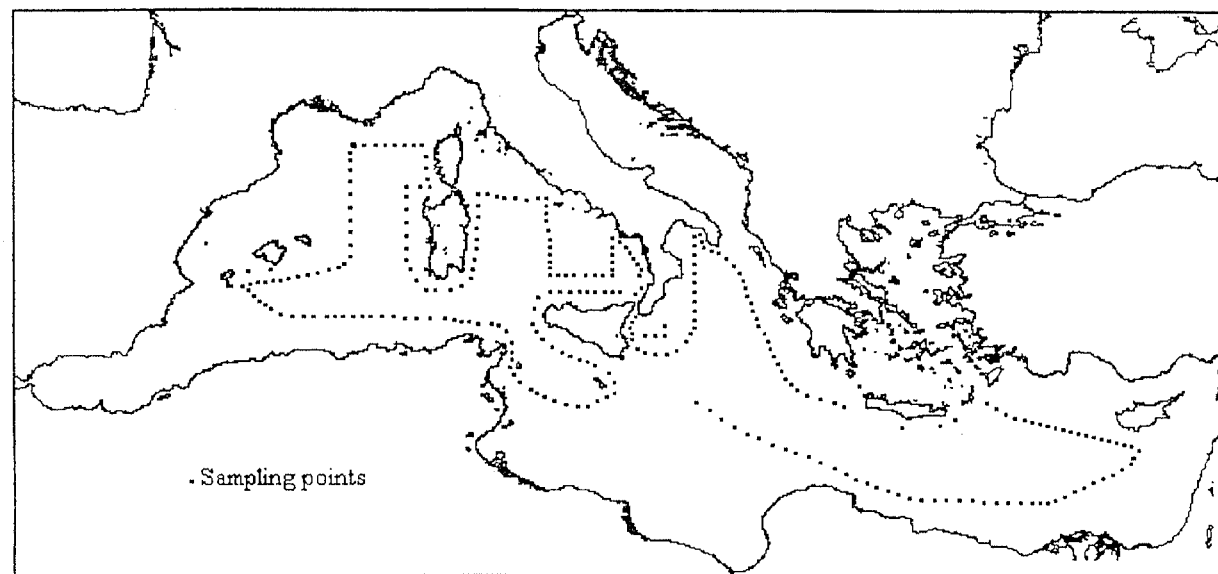


Fig. 1 - Sampling stations for nutrient concentrations in the Mediterranean Sea.