THERMAL POLLUTION STUDIED BY RADIOECOLOGICAL TECHNIQUES(°)

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Abstract - The effect of a thermal increase in the environment on the trophic function of a marine gastropod (Cyclope neritea) was investigated by means of radiotracer experiments. The results showed that while temperature only affects assimilation, a combined influence of temperature and undersaturation with respect to oxygen also alters ingestion.

Resumé - L'effet d'une augmentation thermique dans l'environment sur la fonction trophique d'un gastéropode marin (Cyclope neritea) est analysé au moyen de radiotraceurs. Les résultats montrent que la température a seulement un effet sur l'assimilation, alors que l'influence combinée de la température et des basses concentrations d'oxygène modifie aussi l'ingestion.

In estuarine environments the demolition of organic matter, mainly from animal sources, appears to be very important both for the high "in situ" secondary production and for the allogenic supplies. The demolition processes begin with the activity of scavengers which must be considered true decomposers.

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A scavenger (Cyclope neritea) was studied. This gastropod is quantitatively important in the Adriatic littoral environments mainly in the Po River delta. The trophic function of this species was investigated by simulating in the laboratory variations of fundamental ecological factors such as temperature and oxygen concentration. Particular attention was paid to the thermal factor, this research being part of a project on the environmental effects of power plants[1,2].

The experimental apparatus consisted of plastic tanks, filled with 14 liters of artificial sea water (salinity 27‰), a sandy layer 1 cm thick on the bottom; the containers were equipped with air stone, stirrer and thermoregulator. During the experiments, which lasted 80-100 days, water was neither filtered nor renewed. Ten Mytilus galloprovincialis and thirty Cyclope neritea represented the animal population; filter-feeders were introduced in the aim of pointing out the possible interactions between filtration and demolition functions. In the present paper only the results of the radioecological study of the trophic function of Cyclope neritea will be discussed. Other aspects of the whole problem are dealt with elsewhere[3,4].

Two sets of experiments were performed on four tanks (A, B, C, D) with different temperature conditions. Photoperiod was always 12 hours light and 12 hours darkness; temperature variations were A) 21°C constant, B) 26°C constant, C) and D) with thermoperiod respectively synchronous and asynchronous with photoperiod (in these last two conditions the maximum temperature was 30°C for at least ten hours). In the first set of experiments the oxygen concentration was constantly kept at saturation values. In the second one it was allowed to vary rhythmically with lower concentrations during the dark period.

Gastropods were fed Tubificid worms previously labelled with ^{85}Sr to evaluate the ingestion rate. By comparing the various experimental situations some information about the assimilation efficiency were also obtained.

The results indicated that:

- a thermal increase seems not to affect the ingestion rate which, on the contrary, undergoes a strong reduction when high temperature and oxygen concentration variation are combined.
- a thermal increase favours assimilation at different levels which are related to a temperature variation in time or to a constant high value of it.

As a consequence the increased accumulation efficiency determined by high temperature, in case of rhythmic undersaturation values of oxygen concentration is masked by the altered ingestion rate.

This fact could assume particular relevance in relation to radioecological investigations in estuarine environments where extreme variations of temperature and oxygen concentration naturally occur.

References

1 - Borgese D., G. Dinelli, L. Guzzi, E. Smedile (1975) - A site study of the multiple effects of thermal releases on the aquatic life in an estuarine area. In "Combined effects of radioactive, chemical and thermal releases to the environments", IAEA, STI/PUB/404, 269-284, Vienna.

2 - Smedile E., V. Parisi (1975) - Effect of entrainment in power station cooling systems studied using periphytic communities. Ibidem, 127-142.

3 - Parisi V., M. G. Mezzadri (1976) - Thermal pollution in brackish water environments: an experimental model. Ateneo Parmense (in press).

4 - Bedulli D., M. G. Mezzadri, V. Parisi, P. Poli (1976) - Thermobiology of estuarine molluscs. Atti Soc. Ital. Sc. Nat. (in press).

19. Parisi V., Mezzadri M.G., Bedulli D., Poli P. - Thermal pollution studied by radioecological techniques.

Discussion

Kuzmić M. (Yugoslavia) : My question is not related directly to your paper but rather to your work in general. What is your opinion about using mathematical models that predict spatial distribution of temperature in studying thermal pollution in general as well as in your own work ?

Mezzadri M.G. : Mathematical models can be very useful in studying the distribution and interactions through time and space of any chemical and physical environmental factor. However, our investigation is still in an early stage and, although mathematical models might be very useful in the future, right now we don't think we have enough information to support the choice of any particular model that could improve the interpretation of our data.

Dejak C. (Italy) : Have you used Fourier analysis for the periodic study of the trend of temperature in time ?

Mezzadri M.G. : It was not necessary: we imposed a 12 hour, cold/warm, rhythm to temperature.