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THE MEDPOL JELLYFISH PROGRAMME - A REVIEW (SUMMARY)

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In 1983, as a result of the regional concern regarding the recent occurrence of coastal aggregations of jellyfish, with special reference to Pelagia noctiluca UNEP launched a 'Project on Jellyfish in the Mediterranean'. The overall objective of this project is to assess the importance and implications of this phenomenon on fisheries, human health and recreation and to identify the possible causes with the aim to control or possibly minimize its negative effects (UNEP, 1984). 28 centres and national institutes are participating in this programme through 30 projects. The aim of the present paper is to review the more relevant data produced so far Most of the data referred to here, was presented in various progress project reports submitted to UNEP by January 1986.

The monitoring of coastal aggregations of several jellyfish species with special reference to Pelagia noctiluca was undertaken by several institutes utilizing both systematic plankton sampling as well as the collection of sighting reports from volunteers (UNEP,1983). Moreover, a chronology of past occurrences was established through a bibliographic search from several sources (Goy, 1984). So far, the following characteristics of Pelagia aggregations were identified: The occurrence of coastal jellyfish 'blooms' is not of recent origin and has been shown to occur since at least 200 years ago. The pattern of fluctuations in Pelagia populations is essentially that of abundance for several successive years, with little inter-year variations, followed by a period of absence or very low population densities. The recent occurrence of this phenomenon was first recorded in 1977 and reached maximum intensity and the largest geographical extent in 1980-1983 to include most of the French and Italian coastline, the central Mediterranean,the Adriatic and Greek waters. In 1985,large numbers of Pelagia were mostly reported from the Adriatic and there are indications that the geographical extent of the problem is decreasing.

Field observations from the Adriatic made by Maley (Progress Report,1985) distinguished two types of aggregation of Pelagia, ie 'passive' aggregations characterized by surface groups of randomly orientated individuals of limited mobility and 'active' aggregations in which individual medusae were orientated in the same direction and swimming actively. Both types of aggregations were found in coastal as well as offshore waters in the Adriatic. The ecological significance of such observations is still being discussed.

Laboratory studies indicate that both temperature (Rottini-Sandrini, 1982) and salinity (Catalano et al,) affects the motility of Pelagia. Maley (Progress report,1985) have shown that metabolic and excretory rates were significantly influenced by temperature. It has been argued that during the summer months, taking into account the food availability in the Adriatic, Pelagia would exhibit a negative index of energy budget. Other studies by the same author indicate that the caloric value of Pelagia is rather low (3.1 to 4.1 J mg^{-1} dry weight) but the high abundance and considerable biomass render this species a significant food energy source for possible predators.

Temperature also greatly influences the rate of development of this species, so that at 13.5°C the rate of early development is almost half that at 19°C (Avian,1984). At present, a number of laboratory and field investigations are in progress to elucidate the reproductive strategy of this species and the manner in which it may be affected by the prevalent environmental conditions in the Mediterranean. Other investigations on the cytological and biochemical aspects of the stinging mechanism of Pelagia are being undertaken.

Several hypothesis have been proposed to account for this 'Pelagia phenomenon'. These include localized increase in productivity due to eutrophication or pollution; changes in the populations of predators/competitors of Pelagia; major displacement of water masses to explain the appearance of Pelagia in new areas and major hydroclimatic changes which might influence natural population controlling factors normally normally acting in the field. Data resulting from this programme is being used to disprove or confirm such hypothesis as well as to assess the likely impact of this phenomenon on human health, recreation and other activities including fisheries. It is likely however that the most significant impact is in fact on the whole pelagic ecosystem.

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A POSSIBLE CAUSE OF MASS APPEARANCES OF PELAGIA NOCTILUCA (CNIDARIA SCYPHOMEDUSA) IN THE NORTHERN ADRIATIC SEA

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Summary

Mass appearances of the scyphozoan *Pelagia noctiluca* in the Northerh adriatic Sea is related to the general current system of the Adriatic Sea and specific water movements in the northern Adriatic. Such specific water movement is corresponded to persistence of the species great accumulation in the northern zones.

Since 1977, a number of public and scientific reports have pointed out the mass occurrences of the scyphozoan *Pelagia noctiluca* in different zones of the Mediterranean Sea, with special attention to the Maltese, Greek, French,Italian and Yugoslav coastal waters. While recently in the eastern and central Mediterranean waters a decrease of *P. noctiluca* is noted, in other regions, and in particular in the Northern Adriatic Sea, the species is still present in larger quantities (UNEP, 1986). Knowing pelagic origin of the species and environmental characteristics of the Northern Adriatic Sea, it was expected that the massive appearances of *P. noctiluca* would not persist over a long period of time.

Analysis of 1984-85 monitoring data (Table 1) shows the shift of *P. noctiluca* from the southern Adriatic waters towards the northern zones. The same effect was noted in 1983 (Benovic, 1983). Mass occurrences of jellyfish in the southern zones approached the coast is noted only during the stronger S and SE winds. Current regime of the Adriatic Sea in the cold seasons (Zore-Armanda, 1967, Fig. 1) obviously supports the import of jellyfish swarms into the northern zones,as was suggested by Vucetic and Rotinni-Sandrini (1983). The specific northern Adriatic water movements, above the connecting line between Pula and Ravenna, act as a slightly separate system. The currents follow general circulation system, but transversal and circular flows (Fig. 2), supported by winds, keep in the water masses and *P. noctiluca* within the basin. Larger accumulations of jellyfish near Pula and Porec-Piran, is also confirmed by the existence of the specific current regime in the Northern Adriatic (Vucak, 1985). Obviously, such separate system in the Northern Adriatic is a kind of a "trap" for jellyfish and other jelly-plancton species. Causes of *P. noctiluca* disappearance from the Northern Adriatic may be due to two factors : to dying and the shift towards the middle and southern Adriatic when the current regime changes (Zore-Armanda, 1967). This conclusion supports the small number of *P. noctiluca* throughout the winter, spring and early summer in 1985 (Malej, pers. com.).Since environmental characteristics of the Northern Adriatic are not favourable for life and reproduction of *P. noctiluca*, we believe that the only possible cause of each year mass appearance of jellyfish and other similar plankton organisms, is an annual large input of specimens from the southern Adriatic zones. Magnitude of the phenomenon is due to the size of input into Adriatic Sea. Wind and current forces in southern and middle Adriatic can destroy the moving swarm and because of that the size of mass occurrences in the Northern Adriatic Sea.

A forecast of a possible bloom of jellyfish in the Northern Adriatic would be possible by continuous monitoring in the Southern Adriatic in the regions of Budva, Dubrovnik and Korcula.

Table 1. Monitoring data on mass appearance of Pelagia noctiluca in the Adriatic Sea during 1984 - 1985. Data origin from coastal guard and tourist authorities.

Budva	Dubrovnik	Mljet	Korcula	Hvar	Zirje	Losinj	Pula	Rovinj	Porec	Piran
1984										
5.10.	6.10.	7.10.	8.10.							
4.11.	6-10.11.	13.11.	20.11.							
19.11.	24-29.11.	25.11.	29-30.11							
			1-3.12.							
1985										
23.03.	8-11.4.		5-6.5.	8.5.						
1-8.05.	29-30.4.		7-12.6.	16-20.5.	7-10.6.					
8-10.6.	1-7.5.									
	21-23.5.									
	26-29.5.					20.7.-		13-31.7.	25.7.	
	13-22.6.					- 27.8.				
	15-20.8.									
							Sept.		1-2.9.	25.9.
							Oct.			10.10.

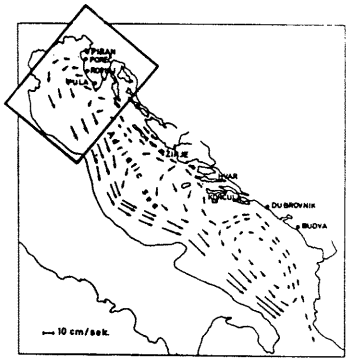

Fig.1. General current system in warmer seasons in the Adriatic Sea (from Zore-Armanda,1967)

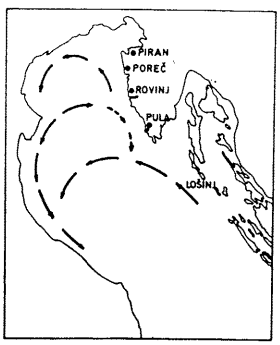

Fig.2. Specific water movements in the Northern Adriatic Sea (from Vucak,1985)

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