

Ecological processes and chemical ecology of the Mediterranean sea

by

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As well known, a great variety of marine life forms is naturally subdivided into classes of communities, the major of which are plankton and nekton in the thickness of water, benthos — on the bottom and neuston — on the surface. This is a kind of momentary photography of the reality.

Among studied species the attachment to only one class of communities is a rare exclusion. So, the whole life of oceanic Halobates go in neuston namely in epineuston of open zone of tropical area. Sargassum algae (*S. natans* and *S. fluitans*) and crustaceans (Pontellidae and *Idothea stephensi*) live also only in neuston but in hyponeustonic position.

During their life the majority of marine organisms pass, as a rule, from one class of communities to another. Let us call for abbreviation the stay of hydrobiont in one class of communities as ecological state or phase. Then, for example, life of flat-fishes (*Solea* a.o.) goes through three ecological phases : neustonic (eggs, larvae), planktonic (early young fishes) and benthic (adult specimens). Ontogenesis of crabs (*Carcinus mediterraneus* a.o.) flows through neustonic (zoea and megalopa) and benthic phases (adults and eggs); with this early larvae going up to near-surface biotope and sinking megalopas do not stay long in the thickness of water. Larvae of *Physalia* and *Velella* develop in the deep layers of pelagial but adults lead a water-air (pleustonic) life. Eggs of tunas develop in neuston whereas larvae and adult specimens do in the pelagic thickness. It follows at the present time it is perspective to consider the life of the Ocean as an ecological process which is a regular change of ecological states or phases [ZAITSEV, POLIKARPOV, 1967]. With this every ecological phase (respectively : neustonic, planktonic, nektonic and benthic) is regarded as the definite period of equilibrium on the way of ecological process. Coincidence of ecological states of representatives of different taxonomic categories leads to their grouping in classes of associations till the next regrouping when changed ecological phases bring to change of a biotope.

From analyses of change of ecological states it follows that the living way of the majority of marine organisms goes through neuston phase.

Two main types of transition from one phase to another are observed : a. in the process of daily food and reproductive migrations — let us designate it as circadian migrations (in terms of biological clock) and b. in the process of ontogenesis — ontogenetic migrations.

The question arises : why hydrobionts do suffer such compound ecological metamorphosis? This process connected with change of biotope, with spend of energy for overcoming of great distances, with necessity of adaptation to every from changed biotopes, with avoiding dangers — appears as biologically unexpedient. At first sight stenotopy seems to be the most advantageous. Why nevertheless in the process of evolution did the ecological metamorphosis take unmeasurably bigger spreading (with reaching, as a rule, extreme — neustonic state)?

One of the important events in modern oceanography is discovery of great amounts of unliving organic matter in sea water [BOGOROV, 1967].

It is important that this matter is not distributed evenly, creating considerable concentrations in the interphase « sea-athmosphere ». As we observed in the region of Rone estuary in 1968 where the foam reached great concentrations on a hydrofront. The same situation was marked by us on the hydrofont

of Danube. Influx of this matter to the surface of the ocean is caused by phenomenon of foam-formation in the process of which, as known, are formed particles, or aggregates of organic matter, — marine foam. The other mechanism of enriching of near-surface biotope by organics is so-called « anti-rain » of dead bodies of hydrobionts and their fragments [ZAITSEV, 1968].

Organic matter and connected with it biologically active compounds (microelements, vitamins, growth substances a.s.o.) are the powerful ecological factor of chemical nature.

In the process of interaction between chemoecological factors and organisms, their populations and biocenosis, chemical substances influence on the living systems and the latter in their turn, change chemical environment. If the distribution of concentrations of life and ecological factor of chemical nature are topographically coincided (neustonic and benthic maximum) in the ocean, the direction of their action is opposite. So, for example, the influx of organics to the surface is balanced by migrations of organisms after finishing the neustonic phase of their ecological process. Sedimentation of organic matter is balanced with vertical flux of living beings, migrating to higher situated biotope, in planktonic or neustonic phases.

Therefore, ecological metamorphosis is realized in the space between thickenings of doses of ecological factor of chemical nature. This way it is secured of maximum usage of energetical resources of the ocean. Surface microhorizon, besides that, is differed from other layers of thickenings with the whole complex of conditions : intake of organic and mineral substances with air flows, presence of middle and far ultraviolet and infrared rays and intensive insolation. All together it makes especially favourable situation for development of hydrobionts in early stages. And so hyponeuston is the main incubator of the sea delivering of replenishment of organisms to down-lying biotopes [ZAITSEV, 1968]. Therefore it is unsurprisingly that J. BERNAL [1961] made a conclusion that... « life no longer comes straight from Poseidon but like Aphrodite it was born of the sea foam » (p. 108) because of accumulation of organic matter in near-surface biotope.

From the stated it follows that neuston may be considered as a kind of limiting system in the glosphere, regulating, on the one hand, the quantity of replenishment, and hence biological productivity, of different systematic groups from bacteria till vertebrata for whom it is a nursery and, on the other hand, returning proper doses of transformed chemical factor in the form of living matter passing on to planktonic and benthic phases.

Creating material wealth the man at the same time is losing control of more and more (numbers as well as power) artificial factors which have injurious effect on living nature. It was calculated that during the first 18 centuries A.D. 33 species of animals had been annihilated, the same quantity of species (33) had been destroyed in the XIXth century., this XXth century till now 44 species have been annihilated and 600 species of animals are on the verge of extermination at present time.

Antropogenic factors became global. After G.M. WOODWELL [1967] Sr⁹⁰ and perhaps other aerosols (pesticides, smokes a.s.o.) cover all the face of our planet. By the way the major density of it is on latitude of the Mediterranean sea, including the Black sea.

Hence, it is necessary to defence actively the nature including the cradle of life on the earth — seas and oceans in which there will be also the future of mankind. Therefore quite naturally that pioneers of the era of hydrospace the outstanding oceanographers aquanauts COUSTEAU [1963] & PICCARD (after FRYE, 1962, p. 45] are actively fighting for the purity of hydrosphere.

As it was shown previously, the most sensitive and vulnerable phase is neustonic one, because of its topography and age structure. Consequently in the present conditions of growing influence of man on the ocean and seas [POLIKARPOV, 1966] the special attention ought to be paid to the defence of neustosphere against the defeat by man-made ecological factors.