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Main concepts dealing with biological recruitment in the sea

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Recruitment is a term differently used by several specialists. In the army, it defines the number of soldiers arriving every year for their military service. For a director of a company, it represent the number of workers who are beginning to work every year in its company. For a specialist in fisheries, it represents the number of animals, mainly fishes, who are caught by the nets of a fishing vessel.

But if one consider the different marine ecosystems, the significance of recruitment varies from a species to another one, and for instance, if the considered species belongs to necton, benthos or plankton.

In fact, we need to know the biological cycle characters of each step of aquatic species between the genitor to the following juvenile who ocuupy the same place in the water mass or in the marine environment.

That period of biological cycle of each species is constituted by gametes generally emitted in the sea water, by eggs, by different larval and post-larval forms, sometimes followed by metamorphosis and then by the juveniles. If, for several species, descriptive studies have been already done, the quantification of the growth and the evolution of each stage in open sea have very seldom be realized.

Gametes are transported by sea waters always in movements, and the risk of not to encounter the other gamete of the same species in a moving medium is very high.

After fecundation, the eggs are very often eaten by some predators or some filter-feeder; the eclosion occurs after the consumption of vitellic reserve, and represent also an important critical phase.

Then, each larval stage constitutes another critical step of the biological life with several difficulties concerning the food, the adaptation to a variable environment, the predators, and, for sessile species, the settlement.

The quantification of these factors, and on their effects on the survival and on the success of the individuals born in the same time is not known for almost all aquatic species, especially those producing large number of eggs.

But the study of cycles is not sufficient; all biological cycles occur in a constantly moving medium, who perturbates these cycles.

Marine ecosystems are dynamic; it is necessary to know the basic mechanisms and the laws dealing with the success of recruitment in cyclic variations of these ecosystems.

These dynamic variations are usually natural, and, sometimes, produced or induced by man activities or human industries.

One of the final aims of these studies is to reconstitute natural stocks or exploitable stocks, and to adjust them to the economic development of concerned countries.

For instance, it is absolutely necessary to quantify the natural variability of the stocks in order to predict the economical and social consequences of the catches variations, as well as the predictable losses of the industries linked to fisheries; the future of fisheries management necessitate a better knowledge of this variability.

From biological point of view, recruitment may be considered differently if on consider bivalves for instance, where recruitment is linked to metamorphosis, or if one consider fishes, where recruitment is linked to the period where they constitute a cohort, or if one consider the similar behaviour of larval in artificial propagation of marine species in extensive aquaculture for instance. Anyhow, a common effort of standardization of such

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concepts, species by species, and from one country to another, is necessary, as well as the typical detailed biological cycles of these species. We need also more fundamental knowledge of the specific effects of environmental factors on survival, growth and physiology of different steps of larval and juvenile stages of marine species, and these informations will be adcquired by experimental works in hatcheries, as well as in field observations. To cover our knowledge, we have also a profound need of the effect of environmental factors on the fecundity of genitors. Then, the theoretical critical phases of the growth have to be identified, especially where the mortality is high; we have to know also the variability of this mortality on these critical phases in order to begin to establish models of evolution of natural populations in oceans.

Finally, we have to understand the mechanism of dispersion of plankton's forms, turbulence, vertical currents, advection, who constitute the origin of the distribution of larvae in marine water masses.

The physical factors constitutes a very important aspect of the pluridisciplirary research of that field, and the use of satellite observation, as well as buoys who record currents, salinity, temperature, oxygen, salts and other physical and chemical parameters will give us the general framework where the living organisms, at different steps of their life spend their biological cycles, passing from one ecosystem to another one.

The most difficult problem to resolve is the scale of the observations and of the studies; macro-scale, meso-scale, micro-scale; we need a deep analysis of the phenomenons to plan these future studies at the appropriate levels, i. e. large scale physical processes, small scale physical processes, edimentology, chemicals processes, population studies, individual studies, physiology, biochemistry, etc. The main effort to develop is the integration of the researches and of the results of the research. These different approaches necessitates also the constitution of pluridisciplinary research group, and long term studies, at least to make the scientists understanding each other, which is not so easy that it seems.

Until now, the fisheries management have not taken great care on the recruitment problem. Actually, with the increase of the efficiency of fishing technology, and with the stocks reduction, exploitation of marine resources need a better prediction of catches, the productivity of fishing boats have to be better managed than in the past. But the transformation of coastal management will necessitate a better knowledge of natural populations, as well as the evolution of natural ecosystems when men wish, for instance to implant artificial reefs, or to use intensively different types of aquaculture, or to increase the artificial propagation of economical species. Great successes have been obtained in sea ranching of salmon, and for scallops extensive aquaculture and it will be of prime interest to know if we may control the development of other species in natural environment. We are reaching actually a new era of the use of the sea. Our seas-not yet oceans, nor ocean itself-are at the beginning of a true management, and what we are observing in some parts of coastal zones, as to take some French examples, in Vendee, in Normandy, in some parts of Mediterranean coast, or, in Japan, Kumamoto, Nagasaki, Yamaguchi Prefectures for instance, where aquaculture attains large developments, prefigures what we shall observe in the future: a true management of marine fields.

The competition for the use of coastal areas between fisheries, aquaculture, tourism, marine sports, industries, towns, airports, artificial islands, etc, will increase the pressure on the natural populations. There is no doubt that it become more and more important to evaluate with precision the specific impacts of these different uses on natural population, and especially in their younger forms.

Marine biological recruitment remains ascientific thema of a great actuality.