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A review of oceanographical and biological investigations of HVAR Expedition

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The present scientific paper contains review of oceanographic and biological research of the HVAR Expedition, that gave extremely valuable results upon which many studies of the Adriatic Sea were based on. The obtained results are related to the temperature data, salinity and the data of sea-bottom characteristics, as well as to a great number of samples of phytoplankton, zooplankton, ichthyoplankton, bacterioplankton, phytobenthos and zoobenthos.

From today's point of view, the HVAR Expedition special importance lies in the fact that obtained data got used for determination of the "zero state in the Adriatic" as indispensable base for further development of marine biology and for biological and physical oceanography of the Adriatic Sea.

Key words: Biological investigations, HVAR Expedition

Although the Expedition HVAR was primarily performed with the aim of examination of composition, density, expansion and annual fluctuation of the bottom fish settlements, the rest of numerous oceanographical and biological data were obtained. These were the data of temperature, salinity and the data of sea-bottom characteristics, as well as the great number of samples of phytoplankton, zooplankton, ichthyoplankton, bacterioplankton, phytobenthos and zoobenthos, which resulted with a great new foundings at these investigated areas, as well.

Unfortunately, because of various reasons, mainly due to organizational changes that occurred at the Institute shortly after the end of the HVAR Expedition (the number of employees was reduced by half), a great number of samples collected failed through or remained unexplored.

Nevertheless, it is necessary to emphasise that the part of explored material, gave good results, on which the important concepts of the Adriatic Sea were based on.

A great number of salinity data helped BULJAN (1953) to observe a phenomenon of long-term fluctuations of salinity in the Adriatic Sea, which was the basis for the"Adriatic ingression" phenomenon. Even though, the data obtained by the Expedition HVAR in comparison with the data collected during previous investigations enabled BULJAN to come to the conclusion that the salinity increase of the Adriatic water occurs, and is connected with the extremely cold winters. This occurrence BULJAN links with a salinity fluctuation in the Mediterranean because he observed that the increase of salinity of the Adriatic coincides with intensified inflow of the East-Mediterranean waters into the Adriatic. The intensified penetration of the East-Mediterranean, BULJAN tries to explain with the influence of the Atlantic on the Mediterranean, actually with strong atmospheric depressions over the Mediterranean. Later on, during the observations that was proved by ZORE-ARMANDA (1969), and confirmed by

many local and international scientists. BULJAN also examines the influence of the Adriatic on the Mediterranean, considering that with the inflow of the Adriatic waters the Mediterranean becomes richer with oxygen. It is important to mention that in that time, as an ecologist, BULJAN links the"Adriatic ingressions" with the appearance of new species in the Adriatic, mainly phytoplankton and zooplancton species, as well as, with the increased catch of sardine. The results of GAMULIN (1954) are very important, also. Based on the material collected by the HVAR Expedition the author brought up the "first global picture of sardine spawning and spawning areas in the Adriatic". GAMULIN determines three strictly limited areas of spawning in the middle and north Adriatic by analyses of ichthyoplankton samples. According to these analyses, the greatest spawning area was discovered at the open sea, west of Dugi Island. The second spawning area was discovered in the waters on the outside edge of the middle Dalmatian islands, while the third one was discovered in the area around the little Palagruža Island. GAMULIN also establishes specific ecological factors at which, the spawning is performed. Author observes very important fact regarding sardine that usually sustains greater fluctuations of temperature and salinity, in the period of reproduction becomes distinctly stenothermal and stenohaline. At the same time, GAMULIN observes that the spawning areas during more intensive spawning are very rich with mesozooplankton (larger zooplankton) and this particular period is correlated with the density fluctuations of this group of organisms.

From the same material of the HVAR Expedition, KARLOVAC, J.(1962) investigated the nutrition of post-larvae of mackerel, and determined that in nutrition of post-larvae of mackerel the most represented are copelates and larvae of various fish species, from which some of them are commercialy very important. One of them is sardine, where is obvious that the earliest developmental stages of mackerel are predators of earliest developmental stages of sardine.

On the zooplanktonic material VUČETIĆ (1963) was investigating seasonal biomass fluctuations of macrozooplankton and determined that the highest values of biomass are noted in the winter-spring period (February, March, April), after which significant decrease of biomass appears during the summer period. In the summer-autumn period minimum of biomass is noted after which the winter increase appears. Moreover, VUČETIĆ compares results for the same periods in 1948 and 1949, and establishes significant differences in the size of biomass of zooplankton. These differences VUČETIĆ links with the "Adriatic ingressions" phenomenon, because 1948 was a year of intensified inflows of the Mediterranean waters into the Adriatic Sea, while 1949 was an ordinary year. VUČETIĆ determines the copepod species (*Euchaeta hebes*) as the indicator for following the movement of water masses from South to North of the Adriatic, which in the period of ingression from south Adriatic waters, penetrates to Jabuka Pit.

A part of zooplanktonic material was analysed by HOENIGMAN (1953, 1963). His researches were directed toward the appearance of new species of zooplankton, unnoticed in the Adriatic Sea, so far.

PUCHER-PETKOVIĆ (1966) elaborated a great number of phytoplanktonic materials collected by the HVAR Expedition, in fact, the whole area of middle Adriatic. Unfortunately, because of the sensitivity of a great number of phytoplanktonic organisms, with no possibility to sustain in formaldehyde for a longer time, PUCHER-PETKOVIĆ was unabled to elaborate the whole material. Therefore, she analysed only the group of diatoms. However, as diatoms are the most dominant group in the Adriatic phytoplankton, these data are very significant in the quantity manner. Apart from the taxonomic classification, the author gives their distribution in the area of middle Adriatic, and characterizes ecological factors, which influence on the seasonal and spatial distribution of particular species.

The valuable contribution to knowledge of the Adriatic microfauna is given by ALFIREVIĆ (1998), who analysed a great number of samples of HVAR Expedition. Based on the obtained results , the author made the first inventarization of benthic and pelagic

foraminifera and described their distribution and presence connected with analyses of ecological relationship at particular areas and seasons.

The bacteriological data of HVAR Expedition have been used by CVIIĆ (1955) for studying of horizontal and vertical distribution of heterotrofic bacteria in coastal and open-sea waters of the middle Adriatic, where the author examines particular ecological factors, which stimulate such distribution. Furthermore, as a part of these investigations the author isolated the culture of sea bacteria at 60 stations and performed laboratory experiments that helped author to examine physiological activities of the Adriatic bacteria, as well as their morphological characteristics. It is important to mention that this is the first whole survey of bacteria in the Adriatic and very valuable contribution to scientific knowledge in the field of marine microbiology, considering that the methodological possibilities of investigations were limited at that time.

A significant biological contribution to the Adriatic represents a work of ERCEGOVIĆ (1960) also, who used the material collected at this expedition for a very detailed description of vegetation of algae at the sea-bottom. ERCEGOVIĆ analysed algological material collected by an otter-trawl at all stations of this expedition. For each station he gave a list of the species collected and data of depth and horizontal growth (extension) for each species in the Adriatic, as well as analysis of ecological factors that influenced the growth of individual species.

PAX (1952) described 11 species of Cnidaria collected by HVAR Expedition, from where some of them were unknown in the Adriatic Sea, so far. For all of these species, he gave vertical and horizontal distribution, and their dependence of specific substratum and level of their relation for specific biocenosis.

During the elaboration of catalogue of the Adriatic Echinodermata VIDOVIĆ-MATVEJEV (1978) used data marked in diary of the HVAR Expedition in details.

In 1995, ŠIMUNOVIĆ analysed Prosobranchiata from the HVAR Expedition material and elaborated new samples from the same stations at the same time. These investigations are particularly interesting because, detailed analysis of the data could offer very important information of changes that occurred during the last 50 years.

Even though it could be stated that the HVAR Expedition, as the majority of similar expeditions, was very demanding project that couldn't be completely realised. Nevertheless, it had a greate meaning for further development of fisheries biology and for biological and physical oceanography of the Adriatic Sea.

From today's point of view, particular importance of the data collected is in the fact that these data can be used for determination of the "zero state in the Adriatic", which today, in the time of greater interest for research of long-term changes, is of a significant importance.

REFERENCES

ALFIREVIĆ, S. 1998. The taxonomy, distribution and ecology of Adriatic Foraminifera. Acta Adriat., 39 (2): 251 pp.

BULJAN, M.1953. Fluctuations of salinity in the Adriatic. Izvješća – Reports. The M.V."Hvar" cruises - researches into fisheries biology 1948-1949, 2 (1) : 64 pp.

CVIIĆ, V. 1955. Distribution of bacteria in the waters of the mid Adriatic sea. Izvješća - Reports. The M.V."Hvar" cruises - researches into fisheries biology 1948-1949, 4 (1): 43 pp.

ERCEGOVIĆ, A.1960. La végétation des algues sur les fonds pêchereux de l'Adriatique. Izvješća-Reports. The M.V."Hvar" cruises - researches into fisheries biology 1948-1949, 6 (1): 203 pp.

GAMULIN, T. 1954. Mrješćenje i mrijestilišta srdele (*Sardina pilchardus* Walb.). Izvješća – Reports. The M.V."Hvar" cruises -

researches into fisheries biology 1948-1949, 4 (4 c) : 67 pp.

HOENIGMAN, J. 1953. Présence de deux espèces de Mysidacés dans l'Adriatique: *Anchialina agilis* G.O. Sars 1877; Leptomysis gracilis G.O. Sars 1864. Bilješke – Notes, Inst.oceanogr. i rib., Split, 8: 8 pp.

HOENIGMAN, J. 1958. Sur la découverte de quelques espèces zooplanctoniques nouvelles pour l'Adriatique, de deux épibiontes nouveaux pour les Mysidacés, et de deux espèces de parasites nouvelles pour le domaine méditerranéen. Rapp. Com. int. Mer Médit., 14 : 263 – 264.

KARLOVAC, O.1959. Istraživanje naselja riba i jestivih beskralježnjaka vučom u otvorenom moru. Izvješća-Reports. The M.V. "Hvar" cruises – researches into fisheries biology 1948-1949, 5 (1): 203 pp.

KARLOVAC, J. 1962. Ispitivanje sadržaja probavnog trakta kod planktonskog stadija skuše (*Scomber scombrus L.*). Izvješća – Reports. The M.V. "Hvar" cruises – researches into fisheries biology 1948-1949, 4 (4 a) : 15 pp.

PAX , P. 1952. Die Antipatharien , Zoantharien und Actinarien der "Hvar" Expedition. Izvješća-Reports. The M.V. "Hvar" cruises – researches into fisheries biology 1948-1949, 6 (1): 24 pp.

PUCHER – PETKOVIĆ, T. 1966. Végétation des Diatomées pélagiques de l'Adriatique moyenne. Acta Adriat., 13 (1) : 99 pp.

ŠIMUNOVIĆ, A. 1995. Ecological study of Prosobranchiata (Gastropoda) in the eastern part of the Adriatic Sea and their relationship to benthic biocenoses. Acta Adriat., 36 (1/2): 162 pp.

VIDOVIĆ-MATVEJEV, A. 1978. Catalogue of the Adriatic echinoderms. Acta Adriat., 12 (15): 24 pp.

VUČETIĆ, T. 1963. Sur la quantité de macrozooplankton du large de l'Adriatique. Expédition Hvar 1948-49. Rapp. Com int. Mer Médit., 17 (2) : 513 – 521.

ZORE-ARMANDA, M. 1969. Water exchange between the Adriatic and Eastern Mediterranean. Deep Sea Res., 16 : 171 – 178.

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Pregled oceanografskih i biologijskih istraživanja ekspedicije HVAR

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SAŽETAK

U radu je dat pregled oceanografskih i biologijskih istraživanja ekspedicije HVAR, a koja su dala izuzetno vrijedne rezultate na kojima su se temeljile mnoge važne spoznaje o Jadranskom moru. To se u prvom redu odnosi na podatke o temperaturi i salinitetu, podatke o karakteristikama morskog dna, te na čitav niz podataka o fitoplanktonu, zooplanktonu, ihtioplanktonu, bakterioplanktonu, fitobentosu i zoobentosu, što je rezultiralo brojnim novim spoznajama na svakom od ovih područja istraživanja.