

ON THE 70TH ANNIVERSARY OF IBSS BENTHIC ECOLOGY DEPARTMENT

The autumn of 2026 marks a significant date: the 70th anniversary of the Benthic Ecology Department at the A. O. Kovalevsky Institute of Biology of the Southern Seas of RAS. At various times, it was known as the Benthos Laboratory, the Benthos Department, and the Shelf Ecosystems Department.

The history of benthic surveys in the Black Sea, specifically at the Sevastopol Biological Station (hereinafter SBS), began at the turn of the 19th and 20th centuries, when Sergey A. Zernov, who headed SBS since 1902, conducted the first regular studies in marine benthology. He revealed patterns in the distribution of benthic fauna in the Sevastopol Bay and along the Black Sea coast, described the correlations of spatial and temporal heterogeneity in benthic distribution with depth, grain-size structure of sediment, and temperature, and laid the foundations for identifying benthic biocenotic complexes in the Black Sea. In the 1920s, benthic (zoological and biocenological) research at SBS were continued under the leadership of Vasily N. Nikitin.

In 1956, during the post-war period of SBS revival, the Benthos Laboratory was organized, and the young talented zoologist Marta I. Kiseleva was entrusted with heading it. She headed the laboratory (later the Benthos Department) until 1974. M. Kiseleva became a leading expert in taxonomy, ecology, and biocenology of many groups of soft-sediment macrobenthos, including Polychaeta; later on, she successfully defended her PhD thesis and was awarded a D. Sc. degree.

In 1974–1999, the department was headed by Victor E. Zaika: Corresponding Member of NAS of Ukraine, Professor, D. Sc., and laureate of the State Prize of Ukraine. He was a world-renowned scientist in the comparative productivity of hydrobionts of various ecological groups, a specialist in the theory of growth and energy balance in hydrobionts, the functional and structural organization of macrozoobenthic communities, and their distribution.

In 2000–2014, D. Sc. Nelli G. Sergeeva was the head of the department. She was an expert in meiobenthology, particularly in biology, ecology, and taxonomy of free-living nematodes, and a recognized researcher of the deepwater fauna of the Black Sea.

Since 2015, the department is headed by PhD Alexei N. Petrov. He studies spatial and temporal variability in the structure of marine benthic communities along gradients of key environmental factors under eutrophication of water areas and anthropogenic pollution impact. A. Petrov is also concerned with analysis of the effect of various oceanographic factors and pollutants on the structural parameters and diversity of zoobenthic and microphytobenthic communities based on modern statistical methods.

In 1963, when SBS of the Academy of Sciences of the Soviet Union was reorganized into the Institute of Biology of the Southern Seas (hereinafter IBSS) of the Academy of Sciences of the Ukrainian SSR, the Benthos Laboratory was transformed into the department. In 1986,

it was renamed the Shelf Ecosystems Department. In 2006–2014, it was the Benthic Ecology Department of the Institute of Biology of the National Academy of Sciences of Ukraine. Since May 2015, the department was the part of the Institute of Marine Biological Research of the Russian Academy of Sciences. Since September 2020, the Benthic Ecology Department is the part of the Federal Research Center IBSS.

Despite all reorganizations and renaming, the main areas of the department concern have been and remain fundamental research on the biology and ecology of the key biotic components of shelf ecosystems – macrozoo-, meio-, and microphytobenthic communities, the taxonomy and morphology of individual species, as well as patterns of spatial distribution and structural transformation of benthic communities in the Sea of Azov–Black Sea basin under the long-term effect of natural and anthropogenic factors.

In its early years, the department employed many zoologists and ecologists, whose scientific results significantly contributed to increasing knowledge about the structure and functioning of the benthic ecosystem of the Mediterranean basin. Let us recall their names and areas of research:

- PhD Iraida I. Greze conducted surveys of taxonomy, morphology, biology, and ecology of amphipods and other groups of benthic crustaceans;
- D. Sc. Elena B. Makkaveeva studied taxonomy and ecology of various macrobenthic taxa, and also biocenology of zooperiphyton in thicket communities;
- D. Sc. Galina-Vantsetti V. Murina analyzed biology and taxonomy of poorly studied groups of benthos, pseudomeiobenthos, and meroplankton;
- PhD Vladislav D. Chukhchin investigated taxonomy of gastropods, their morphology, developmental biology, and ecology.

The results of their work remain important and scientifically relevant.

Among benthologists who worked in the department in 1980–2017, it is worth mentioning a number of our colleagues, and also indicating their areas of scientific interest. Those are:

- D. Sc. V. Grintsov, development of taxonomy, ecology, and morphology of amphipods;
- D. Sc. L. Ryabushko, ecology of marine microphytobenthos;
- PhD N. Shalovenkov, field and underwater experimental studies of the seasonal aspects of sedimentation and distribution of detrital flows in the benthic ecosystem, and also assessment of the effect of detritus as a trophic factor on benthic communities;
- PhD Yu. Prosvirov, experimental underwater study of features of the formation of benthic communities on soft-bottom substrates;
- PhD V. Kholodov, biology of mussels, and development of theoretical and practical foundations of aquaculture;
- PhD G. Kiseleva, ecology and taxonomy of macrozoobenthic larvae;
- PhD A. Povchun, investigation of the hierarchical organization and trophic interactions of components of the benthic community, and assessment of commercial mussel resources in the Black Sea using submersible removed vehicles;
- PhD E. Kolesnikova, biology of harpacticoids and their taxonomy, and also trophic aspects of the ecology of meiobenthic organisms inhabiting areas with extreme environmental conditions;
- PhD V. Logachev, assessment of commercial stocks of mytilids in the Black Sea using manned underwater vehicles, and analysis of long-term changes in benthic communities due to overfishing and trawling;

- PhD T. Mikhailova, biology of clams and other bivalves and the structure of benthic communities in the Ponto-Caspian basin;
- PhD S. Mazlumyan, biocenology of zoobenthic communities and assessment of their sustainability under long-term technogenic impact;
- PhD M. Gulin, effect of hydrogen sulfide, methane, and hypoxia on the biodiversity and structure of meiobenthic communities in extreme ecotopes, including mass-mortality zones and gas emission fields;
- PhD A. Bobkova, relationships between the chemical composition of bottom sediments and bottom water layers and the condition of benthic communities;
- PhD L. Smirnova, features of the development of microbial cenoses on artificial substrates;
- PhD O. Oskolskaya, morphological and functional adaptations in hydrobionts of various ecological and taxonomic groups;
- junior researcher L. Bondarenko, taxonomy, ecology, and morphology of crustaceans;
- junior researcher E. Ivanova, taxonomy of poorly studied groups of meiobenthos, and assessment of the state of meiobenthos in extreme ecotopes;
- leading engineer Yu. Petukhov, application of a landscape-ecological approach to the analysis of zoobenthos spatial distribution pattern along the Black Sea shelf;
- leading engineer T. Nikolaenko, taxonomy and biology of bryozoans and other poorly studied groups of Black Sea zoobenthos.

Until 1983, the department carried out both zoobenthic and phytobenthic studies. Comprehensive surveys of Black Sea macroalgae at IBSS began with the establishment of a non-structural phytobenthos laboratory in the Benthos Department headed by D. Sc. A. Kalugina-Gutnik, an expert in taxonomy of macrophytes, their floristry, and ecology. The laboratory staff included:

- PhD N. Kulikova, who specialized in taxonomy and ecology of seaweeds and aquatic vegetation;
- PhD N. Milchakova, who studied structural and functional changes in macrophytobenthos, and conservation of water bioresources;
- PhD I. Evstigneeva, N. Mironova, and I. Tankovskaya, who analyzed composition and distribution of coastal macrophytobenthos;
- junior researcher A. Korotkov, who investigated physiology of microalgae and macrophytes.

Since the late 1970s, a diving group consisting of S. Bazanov, S. Chetverikov, and A. Firsov was organized as part of the Benthos Department. For several years, the group members carried out year-round, highly qualified sampling of phyto- and macrozoobenthos, conducted underwater observations, and performed other tasks. In 1983, the Phytobenthos Laboratory was separated into an independent structure. On its basis, the Phytobenthos and Algae Cultivation Department was established. Its scientific objectives included research on the mariculture of Black Sea macrophytes and the biotechnology of micro- and macroalgae cultivation.

The staff needed to continue underwater studies of zoobenthos, and it became necessary to organize its own diving group in the Benthos Department. By the mid-1980s, the newly formed team included 7–8 hydrobiologists: postgraduate students and junior researchers, all certified divers. Diving skills and multi-hour experience in benthic sampling, performing landscape-ecological mapping of bottom complexes, and carrying out underwater experiments with various macrozoobenthos objects were reflected in PhD theses of Yu. Prosvirov, A. Petrov, N. Shalovenkov, N. Revkov, and N. Boltachova. Unfortunately, in 1992, this diving group in the department was disbanded.

Over the years, invaluable assistance in expeditionary sampling, experimental work, and laboratory processing of benthic samples was provided by technical assistants and engineers: O. Slavina, K. Selivanova, N. Malinochka, I. Yakusheva, L. Usik, L. Tretyakova, L. Buren, N. Ivanova, G. Dobrotina, and L. Lukyanova. Their contribution to supporting benthic research and obtaining new scientific results is undoubtedly significant and worthy of deep gratitude.

The researchers of the department defended 7 D. Sc. dissertations and over 30 PhD theses. Currently, the Benthic Ecology Department has 19 employees. Out of them, there is one D. Sc., E. Nevrova, an expert in benthic diatoms, and there are nine PhDs: I. Bondarev, N. Boltachova, N. Revkov, A. Petrov, M. Kovaleva, V. Kopiy, M. Makarov, A. Nadolny, and V. Timofeev, and also junior researcher D. Podzorova. They study various aspects of biology, taxonomy, and ecology of macrozoobenthos. Researchers O. Anikeeva and T. Revkova carry out ecological and taxonomic surveys of poorly studied meiobenthic groups. Leading engineers I. Anninskaya, V. Kopytova, S. Trofimov, Yu. Litvin, S. Strokova, and N. Vasina provide significant assistance in sampling, initial processing, and analyzing benthic material, in conducting experiments, and in carrying out technical maintenance for the department equipment.

Over 70 years of the department activity, its main research areas have altered according to modern knowledge on the composition of benthic fauna and biocenology of benthic communities in the Mediterranean basin. Besides, areas of scientific scope have enlarged with the development of instrumental methods, the extension of RV cruises routes, and organizational and technical opportunities for coastal expeditions.

In the early period of the department work (the 1950s–1970s), studies were based on grab and dredge sampling, and it was aimed at expanding knowledge on the taxonomic composition and quantitative development of various groups of zoo- and phytobenthos. Comprehensive benthic surveys were conducted in coastal areas of the Black and Aegean seas. Those resulted in the compilation of detailed lists of benthic species, clarification of their taxonomic status, determination of biomass and abundance, and calculation of similarity and diversity ecological indices. The department luminaries, M. Kiseleva, V. Chukhchin, E. Makkaveeva, and A. Kalugina-Gutnik, made significant contributions to these studies. The results obtained formed the basis for many monographs on the composition and structure of benthic communities, which remain relevant even decades later.

In the 1980s–1990s, the staff studied the benthos of the Black Sea deepwater zone (down to 1,000 m) under hypoxic conditions and near-bottom emission of hydrogen sulfide and methane. Research was also aimed at identifying species resistant to these conditions. A theoretical generalization was completed, and a unified concept for the zonal distribution of marine life in the Black Sea was formulated. Two distribution belts of benthic organisms were identified. The first belt, from the water's edge to a depth of 120–150 m, is inhabited by macro-, meio-, and microbenthic organisms. The second belt, from 120–150 m to maximum depths, is inhabited by meio- and microbenthic organisms only. During this same period, a revision of the composition of macro- (more than 570 species) and meiozoobenthos (more than 500 species) in coastal marine waters was performed. The ontogenesis, chorology, and intraspecific variability of hydrobionts acting as edificators were investigated. Their trophic and ecological relationships in benthic communities were analyzed. Field instrumental and underwater methods for exploring benthos became widely used. Landscape-ecological studies were carried out, and the heterogeneity of the distribution of coastal benthic communities was mapped.

In 1990–2015, the primary research activity of the Benthic Ecology Department was comparative, including retrospective, studies of the biodiversity and bathymetric distribution of the Black Sea benthos. Multiscale spatial and temporal variability of the state and structure of benthic communities under abiotic environmental factors was analyzed. Using modern methods of multivariate statistical analysis, combinations of key abiotic factors were identified: the ones determining the structural features of macrozoo- and microphytobenthic communities under varying anthropogenic load on marine coastal areas. Long-term structural and functional reorganizations of zoobenthos off the Crimean coast during the crisis of the Black Sea ecosystem in the last decades of the 20th century due to increased eutrophication were analyzed. A shift in the dominance of common zoobenthic species was demonstrated, while the typical faunal composition of waters remained generally consistent. A shift to a lower depth of the most productive benthic belt to a shallow area was revealed: from the mussel silt zone (30–50 m) to the silty-sand zone (13–25 m).

In the current period (since 2015), following IBSS incorporation into the Russian scientific community, the department team carries out diverse surveys of taxonomy, structural organization, and ecology of benthic communities, analyzes biology and distribution of individual species (including invaders), and studies the biodiversity of various taxa of benthic organisms in the Sea of Azov–Black Sea basin. Interbiotic (*inter alia* consortial) relationships between key species from different ecological and taxonomic groups of zoobenthos are also analyzed.

Over the past 10–15 years, in addition to fundamental research, the department has been conducting surveys on applied scientific issues. These are:

- predictive assessment of the development of faunistic diversity and bioresource levels of benthic fauna (including commercial species) under the effect of climate change, landscape-geological factors, and anthropogenic load;
- application of bioindication methods to monitor the state of shelf ecosystems under increasing anthropogenic load, as well as development of recommendations for maintaining the self-purification capacity of the benthic zone and preserving biodiversity;
- identification of tolerance levels of various benthic diatoms and invertebrates to the effects of key pollutants common in the marine environment (surfactants, heavy metals, and petroleum products) applying biotesting methods;
- experimental study of the effects of ultrasound on microphyto- and zooperiphyton of artificial substrates to protect technical water supply systems of nuclear power plants from undesirable biofouling.

The department staff have participated in numerous coastal expeditions, as well as cruises on RV of IBSS and other oceanographic institutions. Extensive benthic surveys have been carried out in the Mediterranean basin, in the Red Sea, the Gulf of Guinea, in the shelf areas of the North, Bering, and Kara Seas, in the Sea of Japan, and off the coast of Vietnam. The department employees participated in Antarctic expeditions and 1-year wintering at the Vernadsky Research Base. The extensive hydrobiological data accumulated during expeditions allowed obtaining important scientific results on biology, taxonomy, and ecology of benthic communities; those have been reported in numerous scientific articles and monographs.

Over the past decades, the department employees were involved in many national and international programs, participated in research grants in marine ecology, and conducted studies and completed internships at marine biological institutes in several European and Asian countries. Also, the staff

provided scientific consulting and expert support for projects assessing risks of hydrotechnical construction and recreational activity on the near-shore marine environment and benthic communities under current maritime management conditions.

The department team have performed dozens of surveys in various areas of benthology, and their results have earned a significant place in the system of hydrobiological knowledge. Highly qualified researchers and engineers have been trained. Scientific hypotheses regarding the distribution of benthos in the Black Sea, *inter alia* in the deepwater redox zone and hypoxia zone, have been put forward and validated. The structural characteristics of benthic communities have been studied, and patterns of their distribution and transformation under current environmental conditions have been analyzed.

The anniversary of the Benthic Ecology Department comes at a challenging time for Russian science and the entire country. Despite these difficulties, the staff continue their research, participate in training young specialists, actively publish their results in high-scored scientific journals, and collaborate with colleagues from marine scientific institutions in Russia and abroad. We wish the team comprehensive success and new scientific achievements.

A. Petrov, PhD, head of the Benthic Ecology Department

К 70-ЛЕТИЮ ОТДЕЛА ЭКОЛОГИИ БЕНТОСА ФИЦ ИНБЮМ

В 2026 г. исполняется 70 лет отделу экологии бентоса ФИЦ «Институт биологии южных морей имени А. О. Ковалевского РАН». Данные, накопленные сотрудниками отдела за годы его существования, и результаты, полученные в ходе научных исследований, обогатили отечественную и мировую гидробиологию.