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Guest editorial: Environmental studies in the Caspian Littoral States

Farhad Mashayekhi Zivar Salehi

Department of Biology, Faculty of Sciences, University of Guilan, Namjoo St., P.O.Box 1914, Rasht, Iran, Tel: 0098-9113330017, Fax: 0098-131-3233647, E-mail: umistbiology20@gmail.com; salehiz@guilan.ac.ir

The Caspian Sea is the largest land-locked body of water in the world. It is the largest enclosed water body on Earth (Roshan *et al.* 2012), constituting 44% of the global volume of lacustrine waters. Compared to other semi-enclosed and enclosed seas of the world, little is known about the Caspian Sea variability (Ibrayev *et al.* 2010). The Caspian Sea is under intense pressure from environmental threats such as changes in seawater levels, allowed excessive fishing, risk striker marine, infested industries, and agriculture, as well as developing the urban of most of the Caspian countries (Karrari *et al.* 2012; Jamalomidi 2013). The Caspian Sea is an enclosed water body that plays an important geopolitical role in the Central Asia region. During the last few decades, the joint action of natural and anthropogenic factors has been aggravating the environmental state in the Caspian Sea. Increasing human activities such as the oil and gas industries, especially in the northern part of the Caspian Sea, fisheries, agriculture, and tourism, along with decades of environmental mismanagement, have led to the severe degradation of water quality (Fathabadi *et al.* 2012; Fendereski 2014). The most typical toxicants in the Caspian Sea are petroleum hydrocarbons, heavy metals, phenol, surfactants, and chloro-organic pesticides (Aladin & Plotnikov 2004). The geographical location and presence of hydrocarbon resources (oil and gas) have made the Caspian region geopolitically important and valuable for coastal countries and major world powers. It faces significant environmental challenges due to anthropogenic pollution. Several states in the Caspian region include the five littoral states of the Caspian Sea: the Islamic Republic of Iran, Turkmenistan, Kazakhstan, the Russian Federation, and the Republic of Azerbaijan. The main challenges facing the Caspian Sea environment include the rising water level, environmental pollution, the entrance of exotic species to the Caspian Sea, loss of the flora reservoirs, and eutrophication. The analytical-descriptive study seeks to answer this fundamental question: "What is the responsibility of the Caspian littoral states for environmental damage?" It can be said that the Caspian Sea's coastal states are responsible individually or collectively for their own omission and actions resulting in environmental damage.

Because studies in various aspects of the Caspian Sea and its Littoral States are important, we are pleased to recognize the efforts of the investigators who contributed to environmental and agricultural studies. The studies in this special issue provide a broad perspective on biological, ecological, and agricultural research that should inform and inspire future research on environmental studies.

Toshbekov *et al.* (2024) contribute to this issue in "Behavioral adaptations of Arctic fox, *Vulpes lagopus* in response to climate change". Their study investigated the behavioral adaptations of Arctic foxes, Vulpes lagopus, in response to climate change, focusing on changes in hunting patterns, den site selection, and social interactions over three years (2021-2023) in northern Alaska, and employing GPS tracking of 60 foxes, 100 remote camera traps, and direct field observations.

Umirzokov *et al.* (2024) explore this issue in "Biochemical analysis of the Caspian Sea sediments: Implications for environmental pollution and bioremediation". They provide comprehensive insights into the Caspian Sea sediments' pollution status and microbial ecology, revealing significant contamination and remarkable potential for intrinsic bioremediation.

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Jalalova *et al.* (2024) address this issue in “Impacts of environmental factors on milk starter culture performance in sustainable dairy production.” They investigated the impact of environmental factors on milk starter culture performance in sustainable dairy production, particularly temperature fluctuations and water quality. Their study demonstrates the critical importance of temperature control and water quality in optimizing starter culture efficiency, which significantly influences dairy production's environmental footprint and economic viability. The findings offer valuable insights for enhancing sustainability in the dairy industry through microbial optimization.
Khayitov *et al.* (2024) participated in this issue in “Comparative analysis of antimicrobial properties of medicinal plants used in veterinary medicine.” The intent behind this research was to weigh the bacteria-thwarting efficacies of five medicinal plants commonly used in veterinary practice. The investigated curative botanicals, particularly *T. vulgaris* and *A. sativum*, demonstrate significant pathogen-inhibiting properties. These findings suggest promising avenues for developing plant-based antimicrobial agents in veterinary medicine, potentially offering alternatives to synthetic antibiotics and addressing antimicrobial resistance concerns.
Rakhmatova *et al.* (2024) worked on “Comprehensive analysis of amino acid profile in camel milk: Implications for nutrition and sustainable development”. Their investigation aimed to provide a detailed and extensive examination of the amino acid profile in camel milk, exploring its nutritional value and implications for sustainable development. The unique amino acid profile and high protein digestibility of camel milk suggest its potential as a valuable nutritional resource, particularly in arid regions facing environmental and nutritional challenges. These findings support the promotion of camel husbandry as a sustainable agricultural practice in challenging environments, aligning with global sustainable development goals.
Demin *et al.* (2024) worked on “Conservation and rational use of the gene pool of mountain horses of Dagestan”. The research results have shown that the Indigenous mountain horses of the Dagestan population have sufficiently balanced indices of physique and structure of the exterior. The analysis of the research results has shown the expediency of proving the homogeneity, distinctiveness, and stability of the Dagestani horse population for further work on its inclusion in the State Register of Breeding Achievements of the Russian Federation as an independent breed or type.
Balabanov *et al.* (2024) studied the “Influence of design parameters of reclamation rippers on the improvement of agrophysical properties in treated soil.” The studies have shown that passive V–type rippers have competitive advantages over rack rippers when achieving the best indicators of loosened soil structure (soil density decreased by 28.8%, porosity increased to 43.4%). The creation of a working body with the studied angle parameters will reduce the traction resistance by 1.3 times.
Ivanov *et al.* (2024) worked on “Impact analysis of cow skin cleaning methods on heat stress”. This study compared three types of skin cleaning: dry, wet, and wet cleaning with special cleaning agents. Experiments proved that the researched skin cleaning methods decreased the elevation in body surface temperature, increased heat transfer and sweat evaporation, increased heat exchange between cows and the environment, and reduced the impact of heat stress. The most effective methods of decreasing heat stress are wet cleaning and wet cleaning with special cleaning methods compared with dry cleaning methods.
Imanbayeva *et al.* (2024) investigated “Adaptation of woody and fruit berry plants in arid conditions of the Mangyshlak Experimental Botanical Garden, Aktau, Kazakhstan”. This study examines the adaptation and cultivation of woody plants in the arid conditions of the Mangyshlak Experimental Botanical Garden. The results underscore the necessity of specific diagnostic indicators to assess plant resistance and guide the selection of species suitable for arid regions. This study contributes valuable insights for improving phytointroduction methods, thereby enhancing green construction quality in the extreme climate of Mangystau.
Salmurzauly *et al.* (2024) worked on “Fraxinus sogdiana Bunge forests in Charyn Canyon, Kazakhstan”. This research investigates the biodiversity and ecological status of the Fraxinus sogdiana Bunge forests within Charyn Canyon, Kazakhstan, a unique ecosystem known for its high biodiversity and geological significance. The critical findings of this research underscore the urgent need for conservation efforts and provide a wealth of information that can guide these efforts, enlightening us about the state of these unique ecosystems and the measures needed to preserve them.
Torabian *et al.* (2024) investigated the “Effect of consuming blood-substitute feed on the transcriptome of the medicinal leech, *Hirudo orientalis* Utevsky and Trontelj, 2005 (Clitellata: Hirudinida)”. They sequenced the transcriptome of the primary salivary glands of Hirudo orientalis Utevsky and Trontelj, 2005 using short-read sequencing (Illumina) technology. Their results provided information on the genes related to head formation and

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insights into the function of proboscis-related genes during organogenesis with the potential roles of genes not yet characterized.

Barakbayev *et al.* (2024) studied the "Current state of Aral bastard sturgeon, Acipenser nudiventris Lovetsky, 1828 populations as a rare and endangered species distributed in native water bodies and domestication in artificial conditions". At present, as a result of human activities, the relic valuable species of sturgeons, Aral bastard sturgeon, *A. nudiventris* Lovetsky, 1828 in its natural habitat has died out, and in the acclimatization reservoir is on the verge of extinction, the only effective measure to restore its abundance and stocks can only be its artificial reproduction.

Berkinbay *et al.* (2024) studied "Acclimatization influence on the formation of the maral, Cervus elaphus Linnaeus, 1758 parasites fauna in the Northern Tien Shan, Kazakhstan." Their research and analysis of the literature have shown that 53 species of parasites are parasitized in marals living in Kazakhstan: 6 species of protozoa, 3 trematodes, 5 cestodes, 36 nematodes, and 3 ectoparasites.

Abdibay *et al.* (2024) studied "Assessment of water-salt regime of irrigation system". The primary source of water for the irrigation of agricultural crops in the Shieli area is the Syrdarya River in Central Asia. The main part of the river water intake originates in the Tomenaryk town through the trunk channel New Shieli. Due to their lowland and highland location, a change was noticed in soil mechanical composition. The article presents the current state of irrigated lands in the lower reaches of the Syrdarya River in Kyzylorda Province, as well as the results of work on the regulation of the water-salt regime.

Assylbekova *et al.* (2024) worked on "Optimization of the process of cryopreservation of Beluga, Huso huso semen using various cryoprotectants". In this study, the optimization of beluga (*Huso huso*) semen cryopreservation was carried out by testing four different cryoprotectants. Using a 3% DMSO resolution resulted in the best sperm motility (79%) and activity time (305 s) that were significantly ($p < 0.05$) higher when compared to other cryoprotectants.

Tulesheva & Yessimov (2024) studied "Role of soil biota in the formation of soil fertility in agricultural landscapes of Akmola region, Kazakhstan". This article evaluated the effect of cultivation rate and biota on the fertility of agricultural lands in the Akmola region, Kazakhstan, using soil analysis under different conditions. Therefore, they found that microorganisms have a major controlling role in the cycling and loss of nutrients from the soil. They also regulate the availability of nutrients and many other transformation processes in the soil.

Zhautikova *et al.* (2024) worked on "Morphometric changes in the heart of rats with alloxan and streptozotocin diabetes". In diabetes mellitus (DM), the ability of the myocardium to fully relax and fill with blood during diastole is impaired. Clinical observations by various authors confirm the presence of myocardial hypertrophy in patients with diabetes; in particular, an increase in the thickness of its posterior wall and interventricular septum has been established. This study aimed to study morphometric changes in the heart in animals at different stages of development using models of experimental alloxan and streptozotocin diabetes.

Sadvakassova *et al.* (2024) worked on "Natural factors of formation and development of geosystems in the Qaratal River basin, Kazakhstan". Given the effects of hydrology on geomorphology and changes in the land body by water flow and the creation of runoff flow, as well as the effect of the shape of the basin, the type of basin in terms of geology, the slope of the basin, etc., research on this matter becomes important. This research aimed to identify the factors that are effective in forming and developing geosystems in the Qartal River basin. In this study, the potentials of the basin in terms of climate and water supply were identified and determined, which can be further exploited with careful management and planning.

Turekeldiyeva *et al.* (2024) worked on "Ecological monitoring of the biodiversity sustainability in the regions of Southern Kazakhstan during observed drought". Environmental protection assessment is one of the main procedures in the sustainable environment planning process, and therefore, paying attention to it in policymaking and planning is inevitable. In this study, some geographical, biodiversity, and environmental assessments were conducted by extracting information on precipitation, temperature, and drought in the study area. It was also indicated that the southern regions of Kazakhstan are in a semi-stable and relatively unstable position in terms of environmental sustainability and require greater priority for implementing targeted and sustainable development programs for environmental diversity.

Tumenov *et al.* (2024) examined the "Method for environmental protection of fish from going into water discharge facilities". High volumes of discharged water characterize Spillway structures of hydroelectric power plants, dams, and other large hydroelectric facilities. Moreover, the discharge can also go in a volley way - when a large

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volume of water mass is passed in a short period. They conclude that active acoustics frightening fish and juveniles make it possible to displace them from the danger zone effectively. This protects the fish from drifting into the spillways of large waterworks.

Aljaramany *et al.* (2024) reviewed "Somatic hybridization in agricultural crops improvement: An environmentally amiable era in biotechnology". The successful application of somatic hybridization is mainly due to the transfer of biotic and abiotic stress resistance genes from related species into crops of high economic value, such as potato, eggplant, tomato, citrus fruit, mango, banana, strawberry, wheat, etc. Protoplast fusion allows for unique gene combinations, developing new plant kinds through somatic hybridization.

Khussainov *et al.* (2024) reviewed "Epizootic measures against infectious and viral animal diseases in Kazakhstan". Due to the occurrence of a disease, an animal imposes more costs and losses on society than the value of the animal itself. Vaccination is one of the effective methods of controlling and preventing animal diseases. By maintaining livestock's health through vaccination, livestock's productivity and production power increase. Healthy livestock have the ability to grow fast and produce better products. Vaccination also provides the basis for reducing medical costs because disease prevention prevents the costs associated with their treatment. Vaccination should be considered as a basic preventive method in livestock health management. This method maintains livestock health, reduces disease transmission, and reduces disease treatment costs associated with diseases.

Zaruk *et al.* (2024) reviewed "Environmental and socio-economic factors in the location of organic crop production". The study aimed to substantiate a methodological approach to the optimal location of organic crop production throughout the territory, considering soil-climatic, environmental, economic, and social conditions. Using cluster analysis made it possible to identify with a high degree of accuracy seven groups with different conditions for agricultural production and potential for developing organic production, which, according to their characteristics, are suitable for producing certain agricultural products.

Uazhanova *et al.* (2024) worked on "Ensuring quality and safety in the production and storage of poultry meat". This study presented methods for packaging and storing poultry meat to increase food safety and health. Then, the effect of packaging and storage conditions on preserving white meat's health and shelf life is investigated using the method of testing microorganisms in poultry meat. The results show that packaging should provide the necessary handling, transportation, and storage conditions.

In another study, Kulazhanov *et al.* (2024) worked on "Ensuring quality and safety in producing and storing grain crops". Grain storage and preservation is a complex and active process because, after harvesting, grain grains can also perform all apparent vital functions, such as respiration, metabolism, and growth, as a living organism, and are subject to chemical and biological changes such as reduced strength, increased acidity, gluten weakening, enzymatic decomposition, loss of nutrients and apparent changes such as breakage and perforation and germination. In general, the main goal during storage and warehousing is to maintain the quantity and quality of grains so that the main properties of the grain are preserved during storage, and its change is prevented. Therefore, it is necessary to control moisture, temperature, contamination by storage pests, and the internal activity of grains, which are living structures.

In a short paper, Tumenbayeva *et al.* (2024) worked on "Biological protection of black currant from phytophages". Protecting fruits from tick damage can lead to increased productivity of agricultural products and the production of healthy products. Using biological protection methods against ticks, which are considered organic and healthy methods, is presented in this article. For this purpose, in the studies conducted in 2020-2022, data were collected on three types of plant mites on fruit trees in Kazakhstan.

Tileshova *et al.* (2024), in a short paper, worked on "Phytochemical study of milk thistle, *Silybum marianum* (L.) Gaertn.". The milk thistle is one of the medicinal plants with many therapeutic properties. Silymarin is the active ingredient of the milk thistle plant, which is rich in flavonoid and flavonolignan compounds, and its therapeutic effects have been widely mentioned in medicine. The finding illustrated that the highest amount of total flavonoids was found in the seeds and stems, followed by the leaves of the plant. It can be concluded that the highest rate of activity in neutralizing free radicals of cancer cells was observed in the seed extract of the plant.

Ginzburg *et al.* (2024) investigated "Waste-free technology for the production of hydrolyzed beef collagen from leather production waste." The problem of both the processing and the rational use of leather production waste in recent years has become relevant throughout the world. This is explained by the fact that a large amount of waste (30-50% of the mass of raw materials) is generated in manufacturing leather. It contains up to 50% of protein

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substances and many other by-products. It is proposed that cattle hides be used as the primary raw material to obtain collagen proteins used in the food industry. The research aimed to develop a technology for processing raw split leather. The development makes recycling up to 50% of leather production waste possible. Split leather waste isolates collagen materials suitable for the food industry.

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