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Review

Ecosystems of Inland Saline Waters in the World of Change

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Abstract: Ecosystems of inland saline waters play a significant role in the biosphere and human life. Various articles of this Special Issue are devoted to a wide range of issues of their study and management. This introductory article gives a general overview of the types of inland waters on the planet, as well as the features of their ecosystems, reflected in 18 articles of this Special Issue. Attention is also paid to modern problems of conservation and integrated sustainable use of aquatic ecosystems in a changing climate and increasing anthropogenic pressure on water bodies.

Keywords: inland saline waters; ecosystems; geochemical background; biodiversity; functioning; dynamics; sustainable management

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1. Introduction

This review is part of a Special Issue aimed at drawing attention to the biodiversity, the scientific, economic and social values of inland saline lakes. These unique and relatively simple natural laboratories, whose biodiversity and functionality depend on climate, salinity, and other abiotic and biotic parameters and anthropogenic activities, help understand how ecosystems produce essential services as well as evaluate the impact of anthropogenic activities on their biodiversity dynamics and limnological properties. This Special Issue contains articles dealing with trace elements, especially mercury, in the bottom sediments of Crimean lakes that affect their functioning and sustainability due to intra-ecosystem and anthropogenic processes [1,2]. Using technogenic radionuclide 90Sr as a tracer, the sedimentation rate in one Crimean hypersaline lake was estimated [3]. De Necker et al. [4] studied the resilience and recovery of the invertebrate community in Lake Nyamithi, a saline lake in South Africa that experienced a two-year supra-seasonal drought. Taxon richness reduced considerably during the drought's peak due to high salinity but recovered after the water reached suitable conditions. The zooplankton community structure of several (n = 23) shallow saline inland waters in Central Asia in an arid steppe climate changed with salinity [5]. Halophilic rotifer species predominated (*Brachionus asplanchnoides*, *Br. dimidiatus*, *Br. plicatilis*) at low salinity, while mesohaline and hypersaline waters favored halobiont crustaceans (*Moina salina*, *Arctodiaptomus salinus*, *Cletocamptus retrogressus*). Under hypersaline conditions, *Artemia* spp. is the most adapted to this extreme environment. Species richness of bisexual *Artemia* was first analyzed in the reservoir of the Crimean lakes, with four species found [6]. Shadrin et al. [7] showed significant changes in the total microphytobenthos of Bay Sivash, the world's largest hypersaline lagoon (Crimean Peninsula), such as Cyanobacteria, Ochrophyta, Haptophyta, and Miozoa, after salinity increased sharply due to anthropogenic activity. Since other changes were detected (suspended solids and dissolved organic matter), ecosystem changes cannot solely be explained by salinity. The article 'metabarcoding under brine' by Saccò et al. [8] took advantage of this rapid and reliable DNA tool to investigate the microbial ecology of five hypersaline lakes in Rottnest Island (WA, Australia). They found lake-driven microbial aquatic assemblages taxonomically and functionally characterized as moderate to extremely halophilic groups, with total dissolved solids and alkalinity being influential parameters driving the community patterns. Redón et al. [9] consider hypersaline lagoons in the Atacama Desert (23 °S) and Patagonia (53 °S), Chile, good laboratories to investigate the avian parasite (cestode), given the abundance of hosts (waterbird species and two *Artemia* species) along a broad latitudinal gradient. Parasites of flamingos and shorebirds were associated with Atacama lagoons (arid and higher salinity), while parasites of grebes and ducks were dominant in Patagonian lagoons (sub-antarctic and of lower salinity).

The anthropogenic-induced sharp salinity changes in the hypersaline Lagoon Bay Sivash (Crimea) demonstrated that this well-studied ecosystem has transited to an alternative state, which calls attention to the need to have a good database for management decisions [10,11]. Ragnvaldsson et al. [12] highlighted the challenge of monitoring water quality parameters and the need to have standardized methodologies for risk assessment of environmental quality, particularly regarding the ability of aquatic organisms to take up metals. When evaluating the state of aquatic ecosystems, we should take into account the presence of natural rhythms of their parameters that occur on different time scales, including daily ones [13]. This review provides the necessary context regarding the need to reduce the threats to saline ecosystems and the biodiversity they harbor by 2030, according to the post-2020 goals of the Convention on Biological Diversity (CBD). We specifically discuss: (1) the challenge of protecting saline lakes and their biodiversity; (2) the ecological heterogeneity of inland saline lakes and lagoons; (3) the relationship between biodiversity and services; and (4) the relationship between business and biodiversity and the social impact of anthropogenic activities. This Special Issue's primary goal is to promote research areas to reduce the knowledge gap and to highlight the need to articulate the science available with non-scientific stakeholders, including policymakers, to reach science-based decisions for the management of inland saline lakes and lagoons, their sustainable use, and conservation.

2. Diversity of Saline Inland Waters

On Earth, the main volume of saline water is concentrated (96%) in the oceans, and only 3.5% in inland waters, of which 51% is in the form of ice and snow [14]. More than 99% of these waters are underground, and 55% of their volume is saline water. The rest of the inland water volume corresponds to various types of surface and groundwater. Lakes dominate surface waters, and saline lakes in terms of total volume (85,400 km^3) are close to the total volume of fresh lakes (91,000 km^3) [15]. However, much less attention is paid to studying saline inland water ecosystems than fresh ones.

Consider the variety of existing types of inland saline waters. Let us start with saline groundwater, which includes lakes in the caves, underground mineral water horizons, and capillary-fractured and pore waters. For example, in natural and artificial salt caves, there are underground hypersaline lakes with different chemical compositions of dissolved salts [16,17]. Such lakes, most often, have a condensation origin. In summer, moisture from the air condenses, entering caves or mines when underground lakes are intensively replenished. In total, during the year, the amount of condensing water significantly exceeds its removal, which leads to the formation of saline and even hypersaline lakes, the volume of which can be significant [18]. The composition of the rock determines the chemical composition in the waters of such lakes. In artesian basins, even in their deepest parts, there are often zones of slow water exchange [19–21]. For example, in the Moscow artesian basin, hypersaline waters from 50 to 270 g/L have a significant thickness [22,23]. In the Tunguska artesian basin (Siberia), brine mineralization can exceed 360 g/L [24]. In the subsurface biosphere, a significant part of film waters in rock fissures are brines with high salinity [25–27]. Life in groundwater is found everywhere, to depths of more than 3 km [28,29]. Groundwater ecosystems interact with subterranean biota and superficial waters and ecosystems, but knowledge of those interactions is scarce and remains incomplete [8,27]. Since this Special Issue contains only articles on surface saline waters, we do not further consider the unique ecosystems of underground saline waters.

Inland surface saline waters (lagoons, estuaries, puddles, lakes, rivers, streams, springs, and bogs) are widely represented in all climatic zones and on all continents, including Antarctica: Europe [30,31], Asia [32], Australia [33], Africa [34,35], North America [36] and South America [37], and Antarctica [35]. The main volume of surface saline inland waters is concentrated in lakes and lagoons, and all the articles in this Special Issue are devoted to them. The reasons for the formation of saline lakes can be different. For example, freezing processes lead to their formation in Antarctica and the Arctic [35,36]. In Africa, Tibet, and some other regions of our planet, their occurrence is due to tectonic processes, volcanic activity, or erosion of ancient salt deposits [30,32,33]. The causal origin of most saline lakes and lagoons is the arid climate [30]. Arid regions, where potential evaporation is greater than precipitation, occupy about 40–45% of the total land surface and are projected to increase in the coming decades [30,37,38]. Most of the world's saline and hypersaline water bodies occur in arid regions. The climatic conditions of their formation include several geophysical factors [30,39,40]. Climatic conditions of a particular region influence the hydrophysical and hydrochemical structure of saline lakes and directly depend on the interaction of the lake with the atmosphere, that is, on heat and moisture flows [41,42]. It should be noted that during the exchange of saline water bodies with the atmosphere, evaporation exceeds the amount of precipitation; however, the resulting water inflow (underground runoff, filtration) can partially compensate for this difference. The accumulation of dissolved salts in a lake or lagoon increases the salinity of the water body [40]. Therefore, assessing territory aridity requires monitoring both precipitation and surface evaporation, which are influenced by weather conditions and salinity. As salinity increases, evaporation decreases [41,43]. The ratio between the annual, monthly or seasonal amount of precipitation and its evaporation determines the humidity coefficient of the territory. The heat exchange between a water body and land is an insignificant value and can be ignored. Therefore, an amount of heat equal to the annual balance of irradiation may be spent on annual evaporation in a given area, and the irradiation index during the year is determined as follows [41,44]:

$$K\delta = B/LP \tag{1}$$

where Kδ is the dryness radiation index, B is the annual radiation balance, P is the total annual precipitation, and L is the heat of evaporation.

The dryness radiation index (Equation (1)) indicates how much of the balance's irradiation is used to evaporate precipitation. It is believed that if the value exceeds the dryness limit, $K\delta = 3$, the climate in the area is arid, which contributes to the accumulation of salts and the formation of saline and hypersaline lakes/lagoons [42].

Saline/hypersaline lakes and lagoons are widespread in all continents, primarily in arid and semi-arid basins [15,45,46], and they are ecologically diverse, with salinity varying from brackish to hypersaline. Their diversity of inland saline lakes in terms of size, geochemical, chemical-physical, and biotic characteristics is enormous. The largest and deepest saline lake is the Caspian Sea (area 390,000 km^2, volume 78,000 km^3, maximum depth 1025 m) [15]. The altitudes they are at also vary significantly [30,34], such as hypersaline lagoons over 2300 m above sea level in the Chilean Andes [9] and lake Dangxiong Co in Tibet, China, over 4000 m [47]. Moreover, some hypersaline lagoons occur in unusual latitudes (33 °S in Argentina and from 5 to 53 °S in Chile). The geochemical diversity of saline lakes concerning the structure of their ecosystems is the subject of three articles in this Special Issue [1,2,5].

In addition to natural saline water bodies, various artificial ones are likely formed due to the extraction of fossil salt [48,49]. Due to the aridization of many territories and anthropogenic activities, natural and artificial freshwater bodies are being salinized [50–53]. In China and India, people began to extract salt from saline water, creating systems of hypersaline ponds (salt evaporation pond, saltern, saltworks) as early as 4000–6000 BC, and a little later, they also appeared in the Mediterranean [54]. Salt pond systems now occupy large areas and are widely used worldwide in various arid/subarid regions. Salt is also obtained in evaporation ponds created by pumping underground saline water into them, for example, in southern India [55]. There are also saline lakes of other anthropogenic origins. Mining fossil salts may be accompanied by forming such lakes [49]. Examples are the Solotvino Lakes (Transcarpathian region, Ukraine) and Slavic lakes (Donetsk region), which arose due to the subsidence of rocks during salt extraction. The hypersaline lakes of Sol-Iletsk (Orenburg region, Russia) [48] and some lakes in Romania [56] are of the same origin. The development of irrigated agriculture led to the discharge of drainage water from fields into relief depressions, which also led to the appearance of several saline reservoirs, such as the Salton Sea in the USA (an area of about 1000 km^2) [57] and lakes of the El Fayoum oasis in Egypt [53,58,59].

The existence and long-term dynamics of the structure and functioning of saline lake ecosystems are determined jointly by climate variability and anthropogenic activity [53,58]. Saline lakes are among the most variable water habitats on the planet; now, researchers often talk about their tragedy and the Aral Sea natural-technogenic disaster is one example of this [60–62].

Lagoons and estuaries are transit water bodies, where inland and sea waters mix. There are many lagoons throughout the world with a wide range of salinity. They are primarily between fresh and oceanic salinity [63,64], and only a few are hypersaline [65,66]. Usually, their increased salinity is caused by isolation or weak connection with the seas, high evaporation, and/or low freshwater inflow. In the coming decades, climate change, influencing the frequency and magnitude of precipitation, as well as the height of the sea level, could potentially affect the growth of areas of saline and hypersaline lagoons in different parts of the world [65]. Anthropogenic activity can also lead to this [66–69]. The world's largest hypersaline lagoon, Bay Sivash (area 2560 km^2), is undergoing dramatic changes under anthropogenic influence. Two articles in this Issue are devoted to this problem [7,11].

Saline rivers are rare aquatic ecosystems primarily found in arid zones. However, the highly mineralized rivers flowing into the hypersaline lake Elton (South Russia) represent a unique hydroecosystem of the natural territorial complex in the Elton region, which belongs to the Caspian drainless basin [70]. Another example would be the Mediterranean hypersaline Rambla Salada in the Fortuna sedimentary basin, belonging to the watershed of the Segura River (southeast of the Iberian Peninsula), an ecosystem whose structure and dynamics have been studied by Velasco et al. [71].

In saline and hypersaline waters, species diversity is higher at lower salinity, while the opposite occurs at higher salinities [72]. One of the articles in this issue shows a negative correlation between zooplankton diversity and salinity in the lakes of Kazakhstan [5]. In the largest hypersaline lagoon in the world, as a result of anthropogenic activity, there has been a sharp increase in salinity, a decrease in biodiversity, and a change in species composition; two articles in this collection show this for microphytobenthos [7] and fauna [11]. The effect of dry years on salinity and biota structure in South African lakes is discussed in one of the papers in this issue [4]. An article in this Special Issue analyzes factors affecting species diversity and abundance of parasites in *Artemia* in different regions of South America [9]. The main conclusion of these articles is that salinity is undoubtedly an important factor determining the biotic structure of ecosystems of saline lakes and lagoons, but not the only one. In some instances, other factors, including the factor of chance, may mask the salinity factor's effect, which requires a more profound approach in future studies.

3. The Relationship between Biodiversity and Services

Since the total volume of inland saline lakes is approximately equal to that of freshwater (91,000 km^3), saline inland waters play an essential landscape role and provide multiple economic resources, such as salt, mining, and *Artemia* biomass in the case of Great Salt Lake (GSL) in Utah, USA, and non-economic services such as a habitat and nesting sites for migrant waterbirds [37,47]. Likewise, social services include cultural, aesthetic, and recreational [8,15,71,72]. Despite such importance, they have received less attention, likely due to their invisible invertebrate diversity (to the inexpert eye), even though they are the most abundant food web community, besides microbial diversity, as articles in this issue attest. The filter-feeder brine shrimps *Artemia* spp. (Crustacea, Branchiopoda) are the keystone species in hypersaline environments controlling the physicochemical properties and the abundance of phytoplankton and bacterioplankton [47,73–75]. *Artemia* species are the intermediate hosts of helminth parasites of important migratory waterbirds such as flamingos, grebes, gulls, shorebirds, and ducks [9]. The availability of cyst banks (*Artemia* Reference Centre in Ghent, Belgium, and the Asian Reference Centre in Tianjin, China) facilitates laboratory studies and inter-population and species comparisons with samples from all over the world. Moreover, *Artemia* is a good indicator of waterbird abundance in saline lakes, as the intentional introduction of *Artemia sinica* in Lake Dangxiong Co in Tibet, China, demonstrated [37,47]. Such intentional colonization had favorable environmental consequences for avian biodiversity as the number of waterbirds using the lake increased dramatically. The lake also began to produce *Artemia* cysts (resistant diapause embryos) and biomass to benefit local communities [47]. *Artemia* is also an excellent scientific model for studying adaptation to critical life conditions in the field and laboratory conditions [76]. Finally, *Artemia* is an excellent model organism for different disciplines (ecology, evolutionary genetics, toxicology, radiation biology), and so it is regarded as a sort of aquatic Drosophila [77].

Preserving ecosystem biodiversity and services requires a gene, population, and species analysis over time and space. Biodiversity stability is tightly linked to the ecological conditions to which species are adapted, and the maintenance over time of such conditions is a proxy for ecosystem health and sustainability. Saline inland lakes contain the three domains of life, Archaea, Bacteria, and Eukarya [72,78]. Diverse phytoplanktonic and zooplanktonic species (Ostracoda, Copepoda, Branchiopoda) are abundant at low salinities, but as salinity increases, diversity is reduced, with the brine shrimp *Artemia* playing a critical ecological role. This relatively simple food web is sensitive to environmental conditions; hence, interseason and interannual biodiversity differences occur. Due to the difficulty of monitoring such variations over time, partly due to the remoteness of most saline ecosystems, particularly those at high altitudes, there are few systematic studies on the relationship between biodiversity and ecosystem functioning over time, except for a few cases [79]. However, *Artemia* is known to be a good predictor of waterbird's presence [37,47], the most significant non-economic service (a monetary value not yet calculated) of saline lakes, which is why the Ramsar Convention protects several saline wetlands. In turn, waterbirds provide the service of dispersing *Artemia* to new suitable habitats [6,80]. This virtuous cycle favors *Artemia* distribution to some extent, which is done by carrying cysts in their feathers or the digestive tube, and are released to the environment by their feces [80,81]. Another form of *Artemia* distribution stems from an indirect consequence of its use in the aquarium trade and marine larviculture [82], the North American brine shrimp *Artemia franciscana* being the most traded species for mariculture. Vietnam, China, and other Asian countries exemplify a flourishing *Artemia* biomass and cyst production business integrated with solar saltworks to support the aquaculture of important regional shrimp and fish species [83,84]. On another front, studying host–parasite interactions over geographic variation [9] contributes to biodiversity conservation as they mitigate the impact of emerging diseases and facilitate the use of parasites as biogeographic indicators. In turn, *Artemia* abundance can be controlled by copepods, ostracods, and amphipods species at lower salinities [85].

4. Saline Lakes, Bioresources, and Business

According to CBD, biodiversity is essential for human health and well-being, economic prosperity, food safety, security, and individual and collective thriving, provided its use is sustainable. Nevertheless, due to a lack of corporate responsibility, the relationship between biodiversity and business has become uncomfortable (One of the reasons would be the lack of cooperation among industry and conservation biologists for developing effective biodiversity protection strategies. In saline lakes, this conflict is exacerbated by their shrinking due to climate change and water diversion [73,86,87]), with Great Salt Lake (GSL) being an iconic management case.

Great Salt Lake (GSL), the large and permanent hypersaline lake in Utah, US, has high economic value stemming from salt mining in evaporating ponds and from harvesting resting eggs (cysts) of the brine shrimp, which has turned into a multibillion-dollar business [88]. Consequently, the business benefits from long-term monitoring of ecosystem processes in the lake, such as nutrient and phytoplankton dynamics, brine shrimp, and bird abundance [89,90]. Therefore, the *Artemia* business and waterbird abundance (eared grebe in particular) are interrelated and contribute to maintaining global bird diversity foraging mainly on *Artemia*. About 1.5-million eared grebes (*Podiceps nigricollis*), representing half of the North American population, stop on Utah's GSL during autumn migration to forage on *Artemia.* To minimize the risk of birds' persistence, managers consider scientific data, for example, the daily energy requirements of eared grebes, so that regulations governing brine shrimp cyst harvest reflect the foraging needs of grebes. Accordingly, cyst harvest is suspended when densities fall below 20,000 cysts/m^3 in order to ensure food availability and energy requirements (nearly 30,000 adult brine shrimp daily) for the 1.5 million grebes using the lake during their autumn migration to the Southern Hemisphere [91]. The opposite situation (to be discussed in Section 5) occurs in high-altitude Andean hypersaline lagoons of the Atacama Desert in northern Chile), where the large world deposit of lithium exists. These lagoons are an integral part of lithium exploitation from brine pumped from beneath the surface, which raises concern about the risks such volume of brine extracted, and freshwater shortage caused by lithium and other mining companies operating in one of the world's driest deserts might have on the dynamics of hypersaline lagoons and the associated waterbirds [37,72,92–94].

Besides *Artemia,* other valuable bioresources of saline and hypersaline water bodies are the green filamentous algae *Cladophora* (Figure 1), chironomid larvae (Figure 2) [37,72,95]. Saline and even hypersaline lakes and lagoons provide a large potential to developing different kinds of aquaculture, e.c. fish, shrimps, various other invertebrates, and micro- and macroalgae [96]. Ecology and aquaculture perspectives of some Cladocera, the prawn *Palaemon adspersus* and *Ephydra hians* (Diptera) in the saline/hypersaline lakes were also discussed in this Special Issue [97–100].

Figure 1. The mats of filamentous green alga *Cladophora siwaschensis* K.I. Meyer, 1922 in the hypersaline lagoon Sivash (Crimea).

Figure 2. Special boat for harvesting chironomid larvae in the hypersaline lagoon Sivash (Crimea).

5. Risks and Challenges of Protecting Inland Saline Lakes and Their Biodiversity

Biodiversity and ecosystem loss due to climatic and human-driven perturbations remain among the most challenging problems for sustainable development. After a failed biodiversity decade aimed at safeguarding ecosystems and their biodiversity, as established in the Nagoya strategic CBD plan 2011–2020 (www.cbd.int/sp/targets/ (accessed on 22 November 2022)), and the post-2020 goals and targets under negotiation by the CBD parties, transformative actions are required to reduce threats to both ecosystems and biodiversity at all levels (gene, population, species) in the coming decade (2021–2030) [101,102]. In this regard, inland saline and hypersaline lakes or lagoons (salinity over 3 g/L) deserve consideration because of their unique biodiversity and limnological properties and because they reflect climatic conditions, i.e., they shrink and grow with natural climatic variation [103]. As such, they are good natural laboratories for understanding how relatively simple ecosystems (in terms of the food web) function to produce economic and non-economic services. Policymakers need this knowledge to understand why these ecosystems should be monitored and conserved over time [104].

Threats to saline and hypersaline lakes are diverse, including climatic and atmospheric changes, water surface diversion and salinization, mining, recreation development, hydro-technical constructions, pollution, and biological disturbances (introducing non-native species). Since 2002, many authors have alerted that changes in the limnological properties and dynamics of saline lakes could affect their unique biodiversity and services in the 21st century [15,45,46]. Sadly, such a prediction has become a reality as saline lakes and lagoons are shrinking worldwide at alarming rates, reducing waterbird habitat and economic benefits [73,87]. Migratory waterbirds would be the red flag of this ongoing tragedy. As discussed later in this article, a new threat is lithium exploitation to support electromobility, which may be affecting Andean saline lagoons in the Atacama Desert in northern Chile, where the world's largest lithium reserve exists [37].

The relatively simple food web makes these lagoons more sensitive to climate change and water diversion compared to more complex ecosystems where redundancy of species provides a sort of insurance against functionality loss if one or more species perform similar ecological functions [86]. Thus, conserving these lagoons' unique biodiversity and limnological properties requires long-term monitoring, including keystone taxa like the brine shrimp *Artemia*, and this is particularly relevant in the Atacama Desert, northern Chile, one of the world's largest lithium deposits and exploitation [37]. An obvious question is how such unique biodiversity will be conserved in a scenario of increasing lithium demand to support the expected increase of electromobility. The answer needs a transdisciplinary approach in the science-policy interphase, i.e., involving non-scientific stakeholders [104], such as policymakers, governmental bodies, lithium, and other mining company representatives. The conceptual framework proposed (Figure 3) summarizes the risks encountered by any perturbed inland saline ecosystem worldwide, particularly those intensively exploited for mining.

It considers the threats to biodiversity and the ecosystem, and the need for regularly monitoring the ecosystem dynamics and services using key biodiversity indicators (*Artemia*, waterbirds) to develop a science-based adaptive management plan and regulations. A critical aspect is a need to articulate the scientific knowledge available, albeit limited, with stakeholders, including the communities affected, to produce a consensual management plan and regulations. Indigenous communities settled in the territory are of concern not only because lagoons are part of their cultural heritage, but also because water shortages cause severe friction over water rights between them and mining companies [94,105,106]. Mining and indigenous mobilization in the territory have translated into ambivalences and consensus, as indigenous people have strategically adapted to lithium companies despite the persisting tensions. A new approach to solving the socio-environmental and energy '(in)justices' in the Andes territory considers lithium and solar energy as a form of 'produced nature' [107], which refers to a self-sustained cycle of energy transition that can enlarge energy access in remote areas. Thus, it represents an opportunity for sustainable development through a process of commodification of nature led by the interplay of lithium, energy, and other stakeholders. The development of an integrated saline lake management is an urgent task now.

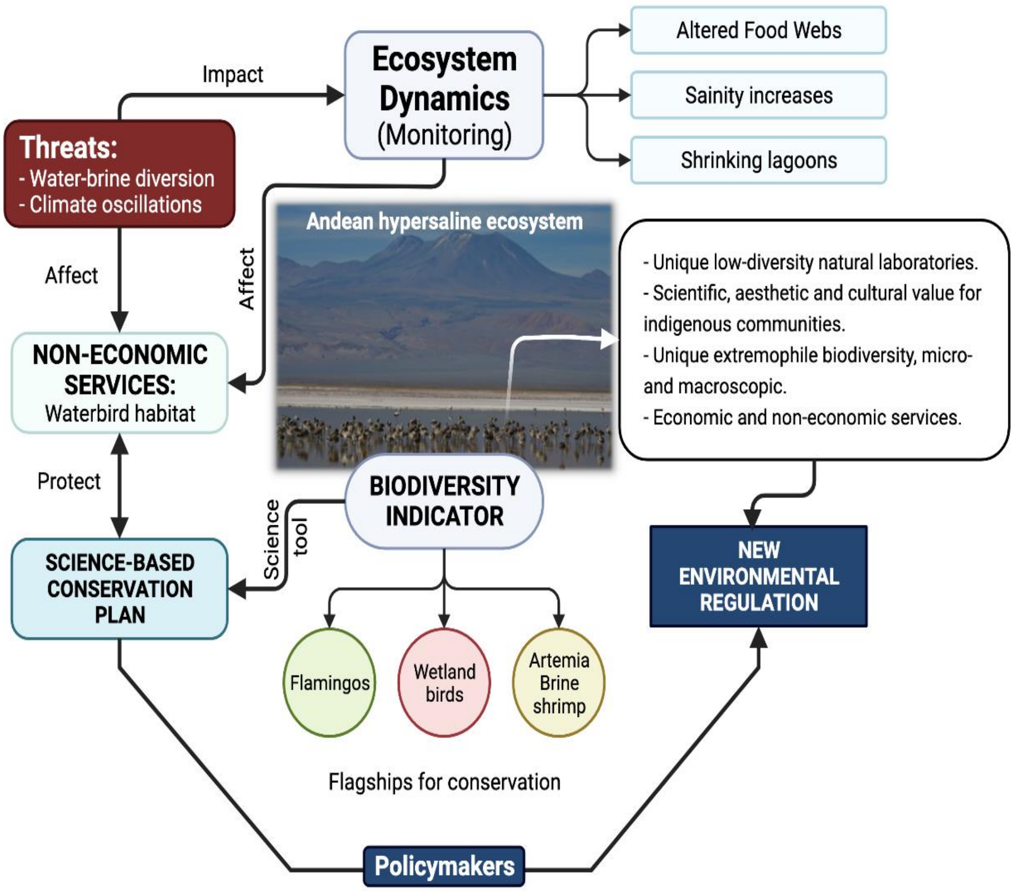

Figure 3. A conceptual framework for conserving Andean high-altitude hypersaline lagoons, biodiversity, and non-economic services (waterbird biodiversity) that are affected by climate oscillations, increasing lithium extraction from brine, and freshwater diversion. Flamingos, other waterbirds, and the brine shrimp *Artemia* are flagships for conservation. A transdisciplinary approach involving non-scientific stakeholders, including policymakers, lithium companies, and indigenous communities, should help to articulate the scientific knowledge with these stakeholders to produce a validated science-based conservation plan and environmental regulations. Figure modified from [37].

Finally, the contrasting management and fates of two sister lakes such as Great Salt Lake (USA) and Lake Urmia (Iran), two of the world's largest saline lakes, are also discussed in this issue, alerting to the impact of climate change and management decisions [87].

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References

1. Shadrin, N.; Mirzoeva, N.; Kravchenko, N.; Miroshnichenko, O.; Tereshchenko, N.; Anufriieva, E. Trace elements in the bottom sediments of the Crimean saline lakes. Is it possible to explain their concentration variability? *Water* **2020**, *12*, 2364. [CrossRef]
2. Shadrin, N.; Stetsiuk, A.; Anufriieva, E. Differences in Mercury Concentrations in Water and Hydrobionts of the Crimean Saline Lakes: Does Only Salinity Matter? *Water* **2022**, *14*, 2613. [CrossRef]
3. Mirzoeva, N.; Shadrin, N.; Proskurnin, V.; Arkhipova, S.; Moseychenko, I.; Anufriieva, E. The Sedimentation Rate in the Crimean Hypersaline Lake Aktashskoye Estimated Using the Post-Chernobyl Artificial Radionuclide 90Sr as a Radiotracer. *Water* **2022**, *14*, 2506. [CrossRef]
4. De Necker, L.; Brendonck, L.; Van Vuren, J.; Wepener, V.; Smit, N.J. Aquatic invertebrate community resilience and recovery in response to a supra-seasonal drought in an ecologically important naturally saline lake. *Water* **2021**, *13*, 948. [CrossRef]
5. Zsuga, K.; Inelova, Z.; Boros, E. Zooplankton community structure in Shallow Saline steppe inland waters. *Water* **2021**, *13*, 1164. [CrossRef]
6. Lantushenko, A.; Meger, Y.; Gadzhi, A.; Anufriieva, E.; Shadrin, N. *Artemia* spp. (Crustacea, Anostraca) in Crimea: New Molecular Genetic Results and New Questions without Answers. *Water* **2022**, *14*, 2617. [CrossRef]
7. Shadrin, N.; Balycheva, D.; Anufriieva, E. Microphytobenthos in the hypersaline water bodies, the case of bay Sivash (Crimea): Is salinity the main determinant of species composition? *Water* **2021**, *13*, 1542. [CrossRef]
8. Saccò, M.; White, N.E.; Campbell, M.; Allard, S.; Humphreys, W.F.; Pringle, P.; Sepanta, F.; Laini, A.; Allentoft, M.E. Metabarcoding under brine: Microbial ecology of five hypersaline lakes at Rottnest Island (WA, Australia). *Water* **2021**, *13*, 1899. [CrossRef]
9. Redón, S.; Gajardo, G.; Vasileva, G.P.; Sánchez, M.I.; Green, A.J. Explaining Variation in Abundance and Species Diversity of Avian Cestodes in Brine Shrimps in the Salar de Atacama and Other Chilean Wetlands. *Water* **2021**, *13*, 1742. [CrossRef]
10. Shadrin, N.; Kolesnikova, E.; Revkova, T.; Latushkin, A.; Chepyzhenko, A.; Dyakov, N.; Anufriieva, E. Macrostructure of benthos along a salinity gradient: The case of Sivash Bay (the Sea of Azov), the largest hypersaline lagoon worldwide. *J. Sea Res.* **2019**, *154*, 101811. [CrossRef]
11. Anufriieva, E.; Kolesnikova, E.; Revkova, T.; Latushkin, A.; Shadrin, N. Human-Induced Sharp Salinity Changes in the World's Largest Hypersaline Lagoon Bay Sivash (Crimea) and Their Effects on the Ecosystem. *Water* **2022**, *14*, 403. [CrossRef]
12. Ragnvaldsson, D.; Herting, G.; Jönsson, A.; Odnevall, I. Applying Generic Water Quality Criteria to Cu and Zn in a Dynamic Aquatic Environment—The Case of the Brackish Water Formation Strömmen-Saltsjön. *Water* **2022**, *14*, 847. [CrossRef]
13. Shadrin, N.; Anufriieva, E.; Latushkin, A.; Prazukin, A.; Yakovenko, V. Daily Rhythms and Oxygen Balance in the Hypersaline Lake Moynaki (Crimea). *Water* **2022**, *14*, 3753. [CrossRef]
14. Gleick, P.H. *Water in Crisis*; Oxford University Press: New York, NY, USA, 1993; 504p.
15. Williams, W.D. Environmental threats to salt lakes and the likely status of inland saline ecosystems in 2025. *Environ. Conserv.* **2002**, *29*, 154–167. [CrossRef]
16. Pinneker, E.V. *Brines of the Angara-Lena Artesian Basin*; Nauka: Moscow, Russia, 1966; 332p. (In Russian)
17. Beltyukov, G.V. On the chemical characteristics of underground salt lakes. *Peshchery* **1969**, *7*, 44–51. (In Russian)
18. Maksimovich, G.A.; Beltyukov, G.V.; Golubev, B.M. Salt formations of underground lakes. *Peshchery* **1966**, *6*, 25–32. (In Russian)
19. Zhukov, V.A.; Tolstoy, M.P.; Troyansky, S.V. *Artesian Waters of the Carboniferous Deposits of the Paleozoic Basin Near Moscow*; GONTI: Moscow, Russia; St. Petersburg, Russia, 1939; 216p. (In Russian)
20. Lebedeva, N.A. *Natural Resources of Underground Waters of the Moscow Artesian Basin.*; Nauka: Moscow, Russia, 1972; 148p.
21. Sidkina, E.S. The brines of the western part of the Tunguska artesian basin. *Geokhimiya* **2015**, *8*, 743. (In Russian) [CrossRef]
22. Ward, J.A.; Slater, G.F.; Moser, D.P.; Lin, L.H.; Lacrampe-Couloume, G.; Bonin, A.S.; Davidson, M.; Hall, J.A.; Mislowack, B.; Bellamy, R.E.; et al. Microbial hydrocarbon gases in the Witwatersrand Basin, South Africa: Implications for the deep biosphere. *Geochim. Cosmochim. Acta.* **2004**, *68*, 3239–3250. [CrossRef]
23. Onstott, T.C.; Colwell, F.S.; Kieft, T.L.; Murdoch, L.; Phelps, T.J. New horizons for deep subsurface microbiology. *Microbe* **2009**, *4*, 499–505. [CrossRef]
24. Colman, D.R.; Poudel, S.; Stamps, B.W.; Boyd, E.S.; Spear, J.R. The deep, hot biosphere: Twenty-five years of retrospection. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 6895–6903. [CrossRef]
25. Borgonie, G.; García-Moyano, A.; Litthauer, D.; Bert, W.; Bester, A.; van Heerden, E.; Möller, C.; Erasmus, M.; Onstott, T.C. Nematoda from the terrestrial deep subsurface of South Africa. *Nature* **2011**, *474*, 79–82. [CrossRef] [PubMed]
26. Ino, K.; Konno, U.; Kouduka, M.; Hirota, A.; Togo, Y.S.; Fukuda, A.; Komatsu, D.; Tsunogai, U.; Tanabe, A.S.; Yamamoto, S.; et al. Deep microbial life in high-quality granitic groundwater from geochemically and geographically distinct underground boreholes. *Environ. Microbiol. Rep.* **2016**, *8*, 285–294. [CrossRef] [PubMed]
27. Saccò, M.; Blyth, A.J.; Venarsky, M.; Humphreys, W.F. Trophic Interactions in Subterranean Environments. In *Reference Module in Earth Systems and Environmental Sciences*; Elsevier: Amsterdam, The Netherlands, 2021.
28. Golubkov, S.M.; Shadrin, N.V.; Golubkov, M.S.; Balushkina, E.V.; Litvinchuk, L.F. Food chains and their dynamics in ecosystems of shallow lakes with different water salinities. *Russ. J. Ecol.* **2018**, *49*, 442–448. [CrossRef]

29. Moscatello, S.; Belmonte, G. Egg banks in hypersaline lakes of the South-East Europe. *Saline Syst.* **2009**, *5*, 1–7. [CrossRef]
30. Zheng, M. *Saline Lakes and Salt Basin Deposits in China*; Science Press: Beijing, China, 2014; 321p.
31. Timms, B.V. Saline lakes of the Paroo, inland New South Wales, Australia. *Hydrobiologia* **1993**, *267*, 269–289. [CrossRef]
32. Ashton, P.J.; Schoeman, F.R. Limnological studies on the Pretoria Salt Pan, a hypersaline maar lake. *Hydrobiologia* **1983**, *99*, 61–73. [CrossRef]
33. Schagerl, M.; Renaut, R.W. Dipping into the soda lakes of East Africa. In *Soda Lakes of East Africa*; Schagerl, M., Ed.; Springer: Cham, Switherland, 2016; pp. 3–24.
34. Hammer, U.T. *Saline Lake Ecosystems of the World*; Springer Science & Business Media: Berlin, Germany, 1986; 616p.
35. Laybourn-Parry, J.; Quayle, W.; Henshaw, T. The biology and evolution of Antarctic saline lakes in relation to salinity and trophy. *Polar Biol.* **2002**, *25*, 542–552. [CrossRef]
36. Thomas, D.N.; Dieckmann, G.S. Antarctic sea ice–a habitat for extremophiles. *Science* **2002**, *295*, 641–644. [CrossRef]
37. Gajardo, G.; Redón, S. Andean hypersaline lakes in the Atacama Desert, northern Chile: Between lithium exploitation and unique biodiversity conservation. *Conserv. Sci. Pract.* **2019**, *1*, 1–8.
38. Berdugo, M.; Delgado-Baquerizo, M.; Soliveres, S.; Hernández-Clemente, R.; Zhao, Y.; Gaitán, J.J.; Gross, N.; Saiz, H.; Maire, V.; Lehmann, A.; et al. Global ecosystem thresholds driven by aridity. *Science* **2020**, *367*, 787–790. [CrossRef]
39. Yao, N.; Li, L.; Feng, P.; Feng, H.; Li Liu, D.; Liu, Y.; Jiang, K.; Hu, X.; Li, Y. Projections of drought characteristics in China based on a standardized precipitation and evapotranspiration index and multiple GCMs. *Sci. Total Environ.* **2020**, *704*, 135245. [CrossRef] [PubMed]
40. Kjerfve, B.; Schettini, C.A.; Knoppers, B.; Lessa, G.; Ferreira, H.O. Hydrology and salt balance in a large, hypersaline coastal lagoon: Lagoa de Araruama, Brazil. *Estuar. Coast. Shelf Sci.* **1996**, *42*, 701–725. [CrossRef]
41. Shadrin, N. Hypersaline lakes as the polyextreme habitats for life. In *Introduction to Salt Lake Sciences*; Zheng, M., Deng, T., Oren, A., Eds.; Science Press: Beijing, China, 2018; pp. 180–187.
42. Efimov, V.V.; Timofeev, N.A. *Heat Balance Studies of the Black and Azov Seas*; VNIIGMI MCD: Obninsk, Russia, 1990; 236p. (In Russian)
43. Salhotra, A.M.; Adams, E.E.; Harleman, D.R. Effect of salinity and ionic composition on evaporation: Analysis of Dead Sea evaporation pans. *Water Resour. Res.* **1985**, *21*, 1336–1344. [CrossRef]
44. Khromov, S.P.; Petrosyan, M.A. Meteorology and Fundamentals of Climatology. Publishing House of Moscow University: Moscow, Russia, 2001; 527p.
45. Jellison, R.O. Conservation of saline lakes in the 21st century. In Proceedings of the Environmental Future of Aquatic Ecosystems Conference, Zurich, Switzerland, 23–27 March 2003; pp. 23–27.
46. Shadrin, N.; Zheng, M.; Oren, A. Past, present and future of saline lakes: Research for global sustainable development. *Chin. J. Oceanol. Limnol.* **2015**, *33*, 1349–1353. [CrossRef]
47. Jia, Q.; Anufriieva, E.; Liu, X.; Kong, F.; Shadrin, N. Intentional introduction of *Artemia sinica* (Anostraca) in the high-altitude Tibetan lake Dangxiong Co: The new population and consequences for the environment and for humans. *Chin. J. Oceanol. Limnol.* **2015**, *33*, 1451–1460. [CrossRef]
48. Abdrakhmanov, A.R.; Budkova, G.A.; Abrakhmanov, A.A. *Salt Lakes of the Sol-Iletsk Resort*; Soyuz: Orenburg, Russia, 2008; 196p. (In Russian)
49. Shadrin, N.; Anufriieva, E.; Galagovets, E. Distribution and historical biogeography of *Artemia* Leach, 1819 (Crustacea: Anostraca) in Ukraine. *Int. J. Artemia Biol.* **2012**, *2*, 30–42.
50. Williams, W.D. Salinisation: A major threat to water resources in the arid and semi-arid regions of the world. *Lakes Reserv. Res. Manag.* **1999**, *4*, 85–91. [CrossRef]
51. Van Meter, R.J.; Swan, C.M. Road salts as environmental constraints in urban pond food webs. *PLoS ONE* **2014**, *9*, e90168. [CrossRef]
52. Mabidi, A.; Bird, M.S.; Perissinotto, R. Increasing salinity drastically reduces hatching success of crustaceans from depression wetlands of the semi-arid Eastern Cape Karoo region, South Africa. *Sci. Rep.* **2018**, *8*, 5983. [CrossRef]
53. Anufriieva, E.V.; Goher, M.E.; Hussian, A.M.; El-Sayed, S.M.; Hegab, M.H.; Tahoun, U.M.; Shadrin, N.V. Ecosystems of artificial saline lakes. A case of Lake Magic in Wadi El-Rayan depression (Egypt). *Knowl. Manag. Aquat. Ecosyst.* **2020**, *421*, 31. [CrossRef]
54. Kurlansky, M. *Salt: A World History*; Penguin Books: New York, NY, USA, 2002; 484p.
55. Shadrin, N.V.; Gerasimenko, L.M.; Mikhodyuk, O.S.; Marian, M.P. Bottom cyanobacteria of hypersaline reservoirs in India. *Naukovi Zapisky Ternopil Gosudarstvennogo Pedodologicheskogo Universiteta imeni. V. Gnatiuk. Ser. Biol.* **2005**, *4*, 27–31. (In Russian)
56. Mara, S.; Deákb, Ş.; Deákb, G.; Stefanescu, L.; Vlad, S.N. Salt Mining Lake Pits in Romania, a Sustainable Heritage. In *Mine Water and the Environment, Proceedings of the 10th International Mine Water Association Congress, Karlovy Vary, Czech Republic, 2–5 June 2008*; VŠB-Technical University of Ostrava, Faculty of Mining and Geology: Ostrava, Czech Republic, 2008; pp. 595–598.
57. Cohen, M.J.; Morrison, J.I.; Glenn, E.P. *Haven or Hazard: The Ecology and Future of the Salton Sea: A Report*; Pacific Institute for Studies in Development, Environment, and Security: Oakland, CA, USA, 1999; 64p.
58. El-Shabrawy, G.M.; Dumont, H.J. The Fayum depression and its lakes. In *The Nile*; Dumont, H.J., Ed.; Springer: Dordrecht, The Netherlands, 2009; pp. 95–124.
59. Embabi, N.S. The Fayum Depression. In *Landscapes and Landforms of Egypt. Landforms and Evolution*; Embaby, N.S., Ed.; Springer International Publishing: Cham, Switzerland, 2018; pp. 153–162.
60. Null, S.E.; Wurtsbaugh, W.A. Water development, consumptive water uses, and Great Salt Lake. In *Great Salt Lake Biology*; Baxter, B.K., Butler, J.K., Eds.; Springer: Cham, Switzerland, 2020; pp. 1–21.

61. Zadereev, E.; Lipka, O.; Karimov, B.; Krylenko, M.; Elias, V.; Pinto, I.S.; Alizade, V.; Anker, Y.; Feest, A.; Kuznetsova, D.; et al. Overview of past, current, and future ecosystem and biodiversity trends of inland saline lakes of Europe and Central Asia. *Inland Waters* **2020**, *10*, 438–452. [CrossRef]
62. Foroumandi, E.; Nourani, V.; Kantoush, S.A. Investigating the main reasons for the tragedy of large saline lakes: Drought, climate change, or anthropogenic activities? A call to action. *J. Arid Environ.* **2022**, *196*, 104652. [CrossRef]
63. Kjerfve, B. Coastal lagoons. *ElsevierOceanogr. Ser.* **1994**, *60*, 1–8.
64. Pérez-Ruzafa, Á.; Marcos, C.; Pérez-Ruzafa, I.M. Recent advances in coastal lagoons ecology: Evolving old ideas and assumptions. *Transit. Waters Bull.* **2012**, *5*, 50–74.
65. El-Shabrawy, G.M.; Anufriieva, E.; Shadrin, N. Tintinnina (Ciliophora) and Foraminifera in plankton of hypersaline Lagoon Bardawil (Egypt): Spatial and temporal variability. *Turk. J. Zool.* **2018**, *42*, 218–229. [CrossRef]
66. Tweedley, J.R.; Dittmann, S.R.; Whitfield, A.K.; Withers, K.; Hoeksema, S.D.; Potter, I.C. Hypersalinity: Global distribution, causes and effects on the biota of estuaries and lagoons. In *Coasts and Estuaries: The Future*; Wolanski, E., Day, J., Elliott, M., Ramesh, R., Eds.; Elsevier: Amsterdam, The Netherlands, 2019; pp. 523–546.
67. Roberts, D.A.; Johnston, E.L.; Knott, N.A. Impacts of desalination plant discharges on the marine environment: A critical review of published studies. *Water Res.* **2010**, *44*, 5117–5128. [CrossRef]
68. Uddin, S.; Al Ghadban, A.N.; Khabbaz, A. Localized hypersaline waters in Arabian Gulf from desalination activity—An example from South Kuwait. *Environ. Monit. Assess.* **2011**, *181*, 587–594. [CrossRef]
69. Anufriieva, E.; Shadrin, N. The long-term changes in plankton composition: Is Bay Sivash transforming back into one of the world's largest habitats of *Artemia sp.* (Crustacea, Anostraca)? *Aquac. Res.* **2020**, *51*, 341–350. [CrossRef]
70. Zinchenko, T.D.; Golovatyuk, L.V.; Abrosimova, E.V.; Popchenko, T.V.; Nikulina, T.D. Changes in macrozoobenthos communities under a mineralization gradient in the rivers of the basin of the hyperhaline lake Elton (2006–2013). *Izv. RAS SamSC* **2017**, *19*, 140–156. (In Russian)
71. Velasco, J.; Millán, A.; Hernández, J.; Gutiérrez, C.; Abellán, P.; Sánchez, D.; Ruiz, M. Response of biotic communities to salinity changes in a Mediterranean hypersaline stream. *Saline Syst.* **2006**, *2*, 12. [CrossRef] [PubMed]
72. Saccò, M.; White, N.E.; Harrod, C.; Salazar, G.; Aguilar, P.; Cubillos, C.F.; Meredith, K.; Baxter, B.K.; Oren, A.; Anufriieva, E.; et al. Salt to conserve: A review on the ecology and preservation of hypersaline ecosystems. *Biol. Rev.* **2021**, *96*, 2828–2850. [CrossRef] [PubMed]
73. Wurtsbaugh, W.A.; Miller, C.; Null, S.E.; DeRose, R.J.; Wilcock, P.; Hahnenberger, M.; Howe, F.; Moore, J. Decline of the world's saline lakes. *Nat. Geosci.* **2017**, *10*, 816–821. [CrossRef]
74. Intriago, P.; Jones, D.A. Bacteria as food for *Artemia*. *Aquaculture* **1993**, *113*, 115–127. [CrossRef]
75. Tkavc, R.; Ausec, L.; Oren, A.; Gunde-Cimerman, N. Bacteria associated with *Artemia* spp. along the salinity gradient of the solar salterns at Eilat (Israel). *FEMS Microbiol. Ecol.* **2011**, *77*, 310–321. [CrossRef] [PubMed]
76. Gajardo, G.M.; Beardmore, J.A. The brine shrimp *Artemia*: Adapted to critical life conditions. *Front. Physiol.* **2012**, *22*, 185. [CrossRef] [PubMed]
77. De Los Ríos, P.A.; Gajardo, G.O. The brine shrimp *Artemia* (Crustacea; Anostraca): A model organism to evaluate management policies in aquatic resources. *Rev. Chil. Hist. Nat.* **2004**, *77*, 3–4. [CrossRef]
78. Oren, A. Halophilic microbial communities and their environments. *Curr. Opin. Biotechnol.* **2015**, *33*, 119–124. [CrossRef]
79. Golubkov, S.; Kemp, R.; Golubkov, M.; Balushkina, E.; Litvinchuk, L.; Gubelit, Y. Biodiversity and the functioning of hypersaline lake ecosystems from Crimea Peninsula (Black Sea). *Fundam. Appl. Limnol.* **2007**, *169*, 79–87. [CrossRef]
80. Green, A.J.; Figuerola, J. Recent advances in the study of long-distance dispersal of aquatic invertebrates via birds. *Divers. Distrib.* **2005**, *11*, 149–156. [CrossRef]
81. Green, A.J.; Sánchez, M.I.; Amat, F.; Figuerola, J.; Hontoria, F.; Ruiz, O.; Hortas, F. Dispersal of invasive and native brine shrimps *Artemia* (Anostraca) via waterbirds. *Limnol. Oceanogr.* **2005**, *50*, 737–742. [CrossRef]
82. Sorgeloos, P.; Dhert, P.; Candreva, P. Use of the brine shrimp, *Artemia* spp., in marine fish larviculture. *Aquaculture* **2001**, *200*, 147–159. [CrossRef]
83. Le, T.H.; Van Hoa, N.; Sorgeloos, P.; Van Stappen, G. *Artemia* feeds: A review of brine shrimp production in the Mekong Delta, Vietnam. *Rev. Aquac.* **2019**, *11*, 1169–1175. [CrossRef]
84. Van Stappen, G.; Sui, L.; Hoa, V.N.; Tamtin, M.; Nyonje, B.; de Medeiros Rocha, R.; Sorgeloos, P.; Gajardo, G. Review on integrated production of the brine shrimp *Artemia* in solar salt ponds. *Rev. Aquac.* **2020**, *12*, 1054–1071. [CrossRef]
85. Shadrin, N.; Yakovenko, V.; Anufriieva, E. Suppression of *Artemia* spp. (Crustacea, Anostraca) populations by predators in the Crimean hypersaline lakes: A review of the evidence. *Int. Rev. Hydrobiol.* **2019**, *104*, 5–13. [CrossRef]
86. Panwar, R.; Ober, H.; Pinkse, J. The uncomfortable relationship between business and biodiversity: Advancing research on business strategies for biodiversity protection. *Bus. Strateg. Environ.* 2022; *in press*. [CrossRef]
87. Wurtsbaugh, W.A.; Sima, S. Contrasting Management and Fates of Two Sister Lakes: Great Salt Lake (USA) and Lake Urmia (Iran). *Water* **2022**, *14*, 3005. [CrossRef]
88. Wright, J. Artemia, the 'Magic Powder' Fueling a Multi-Billion-Dollar Industry. Global Aquaculture Advocate. 2017. Available online: https://www.globalseafood.org/advocate/artemia-the-magic-powder-fueling-a-multi-billion-dollar-industry/ (accessed on 19 December 2022).
89. Belovsky, G.E.; Stephens, D.; Perschon, C.; Birdsey, P.; Paul, D.; Naftz, D.; Baskin, R.; Larson, C.; Mellison, C.; Luft, J.; et al. The Great Salt Lake Ecosystem (Utah, USA): Long term data and a structural equation approach. *Ecosphere* **2011**, *2*, 1–40. [CrossRef]

90. Wurtsbaugh, W.A. The Great Salt Lake Ecosystem (Utah, USA): Long term data and a structural equation approach: Comment. *Ecosphere* **2014**, *5*, 1–8. [CrossRef]
91. Conover, M.R.; Caudell, J.N. Energy Budgets for Eared Grebes on the Great Salt Lake and Implications for Harvest of Brine Shrimp. *J. Wildl. Manag.* **2009**, *73*, 1134–1139. [CrossRef]
92. Marconi, P.; Arengo, F.; Clark, A. The arid Andean plateau waterscapes and the lithium triangle: Flamingos as flagships for conservation of high-altitude wetlands under pressure from mining development. *Wetl. Ecol. Manag.* **2022**, *30*, 827–852. [CrossRef]
93. Gutierrez, J.S.; Moore, J.N.; Donnelly, J.P.; Dorador, C.; Navedo, J.G.; Senner, N.R. Climate change and lithium mining influence flamingo abundance in the Lithium Triangle. *Proc. R. Soc. B Biol. Sci.* **2022**, *289*, 20212388. [CrossRef] [PubMed]
94. Alam, M.A.; Sepúlveda, R. Environmental degradation through mining for energy resources: The case of the shrinking Laguna Santa Rosa wetland in the Atacama Region of Chile. *Energy Geosci.* **2022**, *3*, 182–190. [CrossRef]
95. Prazukin, A.V.; Anufriieva, E.V.; Shadrin, N.V. Is biomass of filamentous green algae Cladophora spp. (Chlorophyta, Ulvophyceae) an unlimited cheap and valuable resource for medicine and pharmacology? A review. *Rev. Aquac.* **2020**, *12*, 2493–2510. [CrossRef]
96. Anufriieva, E.V. How can saline and hypersaline lakes contribute to aquaculture development? A review. *J. Oceanol. Limnol.* **2018**, *36*, 2002–2009. [CrossRef]
97. Calderón-Arreola, J.B.; Alcocer, J.; Oseguera, L.A. A Note of a Unique Inland, Saline Water Fishery: Brine Flies (Diptera: Ephydridae) of Lake Cuitzeo, Mexico. *Water* **2022**, *14*, 900. [CrossRef]
98. Wang, L.; Zhao, W.; Huo, Y.; Yin, X.; Wei, J.; Wang, S.; Wang, Y. Influence of Seawater Salinity on the Survival, Growth, Development and Neonate Production of *Scapholeberis mucronata* (O. F. Müller) (Crustacea: Cladocera). *Water* **2022**, *14*, 3706. [CrossRef]
99. Yakovenko, V.; Shadrin, N.; Anufriieva, E. The Prawn *Palaemon adspersus* in the Hypersaline Lake Moynaki (Crimea): Ecology, Long-Term Changes, and Prospects for Aquaculture. *Water* **2022**, *14*, 2786. [CrossRef]
100. Shadrin, N.; Yakovenko, V.; Anufriieva, E. Feeding of the Amphipod *Gammarus aequicauda* in the Presence of the Planktonic Cladoceran *Moina salina* and the Benthic Chironomid Larvae *Baeotendipes noctivagus*. *Water* **2022**, *14*, 3948. [CrossRef]
101. Laikre, L.; Hoban, S.; Bruford, M.W.; Segelbacher, G.; Allendorf, F.W.; Gajardo, G.; Rodríguez, A.G.; Hedrick, P.W.; Heuertz, M.; Hohenlohe, P.A.; et al. Post-2020 goals overlook genetic diversity. *Science* **2020**, *367*, 1083–1085. [CrossRef]
102. Hoban, S.; Bruford, M.; Jackson, J.D.U.; Lopes-Fernandes, M.; Heuertz, M.; Hohenlohe, P.A.; Paz-Vinas, I.; Sjögren-Gulve, P.; Segelbacher, G.; Vernesi, C.; et al. Genetic diversity targets and indicators in the CBD post-2020 Global Biodiversity Framework must be improved. *Biol. Conserv.* **2020**, *248*, 108654. [CrossRef]
103. Gajardo, G.M.; Sorgeloos, P.; Beardmore, J.A. Inland hypersaline lakes and the brine shrimp *Artemia* as simple models for biodiversity analysis at the population level. *Saline Syst.* **2006**, *2*, 1–5. [CrossRef] [PubMed]
104. Rigolot, C. Transdisciplinarity as a discipline and a way of being: Complementarities and creative tensions. *Humanit. Soc. Sci. Commun.* **2020**, *7*, 1–5. [CrossRef]
105. Garcés, I.; Alvarez, G. Water mining and extractivism of the Salar de Atacama, Chile. *WIT Trans. Ecol. Environ.* **2020**, *245*, 189–199.
106. Lorca, M.; Olivera Andrade, M.; Escosteguy, M.; Köppel, J.; Scoville-Simonds, M.; Hufty, M. Mining indigenous territories: Consensus, tensions and ambivalences in the Salar de Atacama. *Extr. Ind. Soc.* **2022**, *9*, 101047. [CrossRef]
107. Forget, M.; Bos, V. Harvesting lithium and sun in the Andes: Exploring energy justice and the new materialities of energy transitions. *Energy Res. Soc. Sci.* **2022**, *87*, 102477. [CrossRef]