LETTERS

Salt crystals accumulate on the shore of the Persian Gulf, where discharge from desalination plants has increased salinity.

PHOTO: TALEB SHADI

Edited by **Jennifer Sills**

Brine discharge disrupts Persian Gulf ecosystems

The Persian Gulf is home to a diverse marine ecosystem with a variety of species that rely on the delicate balance of saltwater and freshwater to survive (*1*). However, the growing demand for freshwater in the region has led to the construction of seawater desalination plants, which discharge brine (highly concentrated saltwater) into the Gulf. This brine discharge increases salinity levels and disrupts the natural balance of the Gulf's waters, threatening the marine ecosystem's sustainability (*2*).

Because the Gulf has a low rate of water refreshment and a high rate of evaporation (*3*), increases to salinity are difficult to reverse. High salinity levels can cause stress and death in many Gulf species of fish and other sea creatures. Increased salinity, and the resulting decrease in oxygen levels (*4*), can also threaten plankton (*5*), which form the base of the food chain. In coral reefs, high salinity levels can cause coral bleaching and death, which can have cascading effects throughout the ecosystem (*6*). The substantial harm to marine life could have implications for human wellbeing, including food security and livelihoods in coastal communities (*7*).

Given the harmful effects of increased salinity, it is essential to find solutions that minimize brine discharge from seawater desalination plants in the Persian Gulf. Government agencies, desalination plant operators, environmental organizations, and local communities should monitor salinity levels regularly and adjust desalination plant operations accordingly. Instead of dumping brine back into the Gulf, plants could use alternative storage options such as deep well injection or evaporation ponds, or they could arrange for the brine to be used for industrial purposes such as mining (*8*). In addition to monitoring and repurposing current levels of brine, Iran's long-term strategy should include the development of desalination technology that produces less waste by using more efficient membranes or other filtration methods (*9*). The region should also maximize the use of sources of freshwater that do not rely on seawater desalination, such as rainwater harvesting (*10*) and wastewater recycling (*11*), which have been used effectively in other Middle Eastern countries (*12*).

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Prioritize wild species abundance indicators

In addition to adopting the Kunming-Montreal Global Biodiversity Framework (GBF), the Parties to the Convention on Biological Diversity (CBD) agreed to an accompanying monitoring framework to assess progress (*1*). However, the metrics in the monitoring framework do not adequately align with the GBF's Goal A, one of the four overarching GBF goals (*2*), which states that "the abundance of native wild species [should be] increased to healthy and resilient levels." The emphasis on the abundance of wild species is appropriate, as it constitutes a fundamental aspect of biodiversity (*3*). However, a corresponding abundance metric is not among the 25 "headline indicators," on which the parties are required to report. The headline indicators, which include important metrics such as the extinction risk of species and the extent of natural ecosystems, are intended to capture the overall scope of and progress toward the goals and targets of GBF at both global and national levels (*1*). To meet the GBF's objectives, abundance should be added to the list of headline indicators.

Tracking abundance at the national level will require an increase in national and international support for monitoring efforts (*4*, *5*), an investment the parties to the CBD have committed to by agreeing to the GBF. However, given that countries are only required to report on the headline indicators, monitoring efforts will likely be restricted to tracking the metrics listed. As a result, data on abundance of wild species would be insufficient in some countries.

The Living Planet Database (*6*) could serve as the foundation for an abundance indicator. This still growing database currently includes more than 38,000 individual vertebrate population time series, providing a unique window into changes in species abundance since 1970 (*6*). It has been the backbone of some of the most important assessments of the successes and shortcomings of the CBD (*7*–*10*). In line with the CBD's commitment to headline indicators that are meaningful at the country level, the abundance data have also been used to develop national population abundance indicators such as the China Biodiversity Observation Network (*11*) and community-based biodiversity indicators for East Africa (*12*). Such data could be incorporated into reports required by the GBF monitoring framework.

Producing national abundance indicators from the Living Planet Database poses challenges in data representation and analysis (*4*). However, this database provides a model for measuring changes in species abundance using the approach and methodology of the Living Planet Index. Countries could also deposit data in the database.

Parties to the convention have now given a mandate to an Ad Hoc Technical Expert Group to advise on the further implementation of the monitoring framework, including filling gaps (*1*). We urge this body to add a headline indicator on abundance. Emphasizing the need to assess trends in species abundance and providing a plan to do so effectively will increase the likelihood that countries prioritize and invest in abundance tracking, allowing each goal to be adequately measured.

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Clinical trials can adapt for refugees

Since Russia invaded Ukraine in February 2022, 8.2 million Ukrainian refugees—mostly women, older men, and children—have fled to neighboring countries (*1*–*3*). These refugees included cancer patients (*4*), some of whom were enrolled in international clinical trials (*5*, *6*). Restarting clinical trials with new participants can be expensive and time consuming, and delays to progress affect all cancer patients. To minimize trial disruptions, cancer clinical trial oncologists, researchers, regulatory authorities, and industry partners should bring the trial to the patient by using satellite (decentralized) trial sites with patient navigators and remote technology.

Many countries that host refugees, such as the United States, Germany, Romania, and South Africa, have existing clinical trial infrastructure (*7*). Ukrainian trial participants were able to access care at previously established trial sites in neighboring countries (*8*). Other countries hosting displaced trial participants should also facilitate transfers to local trial sites. Trained patient navigators, who understand the clinical trial process and digital technologies, can help guide, educate, and assist displaced patients through the decentralized clinical trial landscape. In the case of a trial site with no or low enrollment of citizens, researchers should collaborate to determine if the eligibility criteria can include refugees.

Decentralized digital solutions, such as remote access to healthcare providers, can enable seamless and sustainable information sharing between trial sites. Online tools can translate electronic consent forms, allow patients to report outcomes and adverse events remotely, and automate invoice generation. Contract research organizations can assess the cancer medicine supply in real time. Trial researchers in home and host countries can share their assessments of the patients' and researchers' needs.

Many refugee populations are hosted by countries with inadequate clinical trial infrastructure or in locations without easy access to trial sites. In some cases, loaning WiFi-enabled tablets to trial participants could help reduce the digital divide. Participants without easy access to care could also benefit from local collection of blood or biospecimens, which could then be transported to central sites for biomarker monitoring.

In addition to protecting the integrity of ongoing trials, academic decentralized clinical trials could improve cancer care equity and consistency in care delivery. Adding flexibility to cancer care (*9*, *10*) will improve diversity and inclusion in trial enrollment and mitigate the impact of war and other disasters on trial completion. Changes to trial infrastructure could also serve as a model for continuity of care beyond clinical trials, potentially improving cancer treatment for all underserved citizens and refugees.

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COMPETING INTERESTS

A.H. and I.B. are members of the Ukraine Clinical Research Support Initiative.

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TECHNICAL COMMENT ABSTRACTS

Comment on "Exceptional preservation of organs in Devonian placoderms from the Gogo lagerstätte"

Bjarke Jensen *et al.*

Trinajstic *et al.*, (*Science*, 16 September 2022, p. 1311–1314) describe exceptionally well-preserved organs in fossilized Devonian placoderms to infer the early evolution of the vertebrate heart. We argue that the report has numerous shortcomings and examples of mixed specimen codes. Further, we question whether there indeed is any evidence for a mineralized chambered heart in these placoderms.

Full text: dx.doi.org/10.1126/science.adg2748

Response to Comment on "Exceptional preservation of organs in Devonian placoderms from the Gogo lagerstätte"

Kate Trinajstic *et al.*

Jensen *et al*. question evidence presented of a chambered heart within placoderms, citing its small size and apparently ventral atrium. However, they fail to note the belly-up orientation of the placoderm within one nodule, and the variability of heart morphology within extant taxa. Thus, we remain confident in our interpretation of the mineralized organ as the heart.

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