INSTITUTE OF MARINE Engineering, Science & Technology

IMarEST Explainer:
POLAR REGIONS

The geography of the polar regions is altering dramatically as a result of a warming climate. It is changing physically, chemically and biologically. A better understanding of these processes is urgently needed for sustainable development, environmental stewardship and safeguarding human populations.

Increased human activity

The most immediate and visible consequence of warming is the melting of large ice-sheets in the Antarctic and Greenland. Receding sea-ice is opening up new passages for shipping (both for cargo transport and tourism) and making previously inaccessible sources of fossil fuels accessible[1].

This increased activity has a range of consequences. Shipping brings with it a number of risks to the regions and their ecology – invasive species, oil pollution and emissions to air and water.

Secondly there are safety implications; these regions are poorly charted and safe navigation is difficult because of this. Navigation is further impeded by climate heating causing erratic behavior of sea-ice, which moves unpredictably in comparison with historical observations. As activity increases, we therefore need more detailed charting to be undertaken and for these charts to be kept up to date.

Looking ahead, ships' hull structures will need to be designed and constructed to endure harsh conditions and crew will need to undergo specialist training[2]. Improved systems for staying in communication with vessels and tracking their movements are needed to reduce risk of a major incident causing loss of life and pollution. Increased activity will put a strain on the currently limited infrastructure in the polar regions, investment will be required in improving facilities for handling

[1] For more on exploiting resources, see the IMarEST Offshore Renewables SIG position statement on polar regions here:
https://www.imarest.org/special-interest-groups/offshore-renewables/item/5485-position-statement-polar-regions-offshore-renewables-perspective

[2] For more on the impact on humans working in the regions, see the IMarEST Human Element SIG position statement on polar regions here:
https://www.imarest.org/special-interest-groups/human-element/item/5486-position-statement-polar-regions-the-human-element

waste products, responding to emergencies and carrying out repairs.

Sea level rise

Vast amounts of meltwater flowing into the oceans from thawing glaciers and ice-sheets are accelerating global sea level rise. This threatens the people who live and work in coastal areas in many countries – not just those in high latitudes.

Sea level rise will cause widespread economic and social disruption, from the cost of constructing defences and upgrading buildings and infrastructure to make them more resilient, to the consequences of population displacement.

Changing ecosystems

The Arctic and Southern Oceans hoover up vast quantities of carbon dioxide from the atmosphere, but, in doing so, become more acidic. This affects the development of krill, corals and crustaceans that form the foundations of the marine food-web. This has knock-on effects on the sustainability of fish stocks and other seafood species, which are a major source of protein for large parts of the world's population. A link can therefore be drawn between ocean acidity and global food security.

Warmer oceans will compound the disruption to ecosystems and the food-web by allowing temperate marine wildlife to expand their range into the polar regions, displacing and constricting the habitat available for native polar species.

Summary

We aren't sure exactly how, and over what timescales, these changes will develop, as there are simply too many variables, mechanisms and feedback loops involved to make easy predictions. Much will depend on the continued rate and magnitude of climate heating at a global level.

What is clear is that the polar environment of tomorrow will look very different from today. The polar regions and their oceans may seem remote places, which for most of us are out of sight and out of mind, but the changes happening at the poles will have consequences for us all – not only those living or working in their immediate vicinity.

For this reason, we have a duty to study them closely. Only through greater understanding can we devise measures to anticipate and mitigate these changes or, if we've already passed the point where they become irreversible, to better adapt and prepare for the outcomes.

A greater understanding of the polar environment will contribute to better investment decisions on infrastructure development and more informed political choices about opening access to regional natural resources from fisheries to fossil fuels.