As climate change warms the world's oceans, marine scientists have paid special attention to how this will influence the movement of fish. Recent articles have shown that fish stocks are migrating toward colder waters in the poles. In a piece published yesterday in Nature Sustainability, a group of economists, marine scientists, and I examined for the first time the economic implications of this stock shift for nations that rely on commercial fishing.

We modeled projected changes in the distribution of 779 commercial fish species under different carbon emission scenarios through 2100. Our key finding was that tropical countries — particularly Northwest African nations — are acutely vulnerable to the loss of fish stocks due to climate change. These countries stand to lose, on average, between 7% and 40% of fish species that were present in 2012. Tropical nations are most hard hit because few stocks replace those leaving their national waters, leading to a net loss. This has profound policy implications for overfishing and oceans governance.

Imagine you are the fishery minister for a tropical nation. If you know you are losing a stock, then the short-term incentive is to overfish it. What have you got to lose? The stock's going to move anyway so you might as well get as much economic benefit as you can before the inevitable loss of the fishery.

Such a situation might seem to cry out for international fisheries governance. We examined 127 agreements, including the United Nations Convention on the Law of the Sea, regional fisheries treaties, and bilateral agreements. No agreement contained text addressing the impacts of climate change. Nor, more generally, did any address what happens when fish leave a country's Exclusive Economic Zone (EEZ). This represents a major gap in international law. Perhaps surprisingly, the place to look for a solution may not be in fisheries law.

The 2015 Paris Agreement for the first time acknowledged the need to compensate for loss and damage due to climate change. While there currently aren't any provisions for assigning liability, acknowledging loss and damages was an important step in moving toward meaningful negotiations. Although fisheries have not been an explicit focus in loss and damage discussions to date, the loss of stocks in tropical nations clearly falls within the concerns of the negotiators over slow-onset events, non-economic losses, and action and support.

Indeed, this past December's UN climate conference, COP25, was intended to highlight for the first time climate's impact on oceans. Chile, the original host country, even billed it as the "Blue COP." This focus faded once the talks were moved to Madrid due to unrest in Chile. However, the conference did produce a commitment from 39 countries to include

oceans in their national climate commitments, and there were calls for ocean adaptation and mitigation to play a greater role in this year's COP26 in Glasgow.

Our research highlights the economic importance of the projected exit of fish species from countries due to climate-driven range shifts. While transboundary stocks have always required cooperation, the potential for permanent loss of fish populations challenges conventional fishery management mechanisms. This is particularly true for tropical nations that can expect no new fish species entering to replace the ones they lose, and little incentive to preserve the resource as it exits. Hence our call that these nations emphasize fishery impacts in negotiations over loss and damage in climate change talks.