# Title: Fish do not need Visas: the transboundary nature of world fished species (70/96 character maximum )

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## One Sentence Summary (~ 125 characters)

- Field code: *Fisheries*

## Abstract (~125 words)

Species are not randomly distributed in the world. The area in space and time where a stable population lives and reproduces is determined by the species' fitness response to a series of environmental variables such as temperature, salinity, and oxygen (fundamental niche), as well as interactions with other species (realized niche) (**???**). Thus, species distributions are key elements in marine resources management and policy, as human-made spatial boundaries are an indispensable part of the fisheries management system, from small marine protected areas to nation's economic exclusive zones (EEZs), to Regional Fisheries Management Organizations (**???**).

However, incorporating the concept of species distribution has not allays been the case in fisheries management as in the case of EEZs where 90% of wild fish is catched [@]. From 1973 to 1982 the members of the United Nations held a series of meetings to discuss a series of regulations regarding the high seas, a region of international common property, which, at that time, represented waters after 12 miles from shore (**???** and Munro, 1989). The third Conference on the Law of the Sea resulted the UN Convention on the Law of the Sea (UNCLOS) which allowed coastal states to claim jurisdiction over 200 nautical mile Exclusive Economic Zones (EEZs) of their coasts (**???**). Despite intended to improve fisheries management, this arbitrary delimitation of management area had no input from biogeography, ignoring species distributions, and thus creating what we know today as shared stocks. Share stocks, as their name suggest, are fish stocks that live within the waters of two or more nations. The Food and Agricultural Organization of the UN (FAO) recognizes three types: (*i*) transboundary stocks, those stocks that are shared by 2 or more neighboring coastal nations (e.g. Pacific halibu *Hippoglossus stenolepsis*); (*ii*) straddling, those stocks that are shared by two or more nations and also the high seas (e.g. Atlantic cod, *Gadus morhua*); (*iii*) highly migratory stocks; species that are found in the EEZs of coastal nations that are not necessarily neighbors, and the high seas (e.g. all tunas and tuna-like species); and (*iv) discrete high seas stocks; those species that are only found in the high seas.

Despite previous attempts, is still not clear how many shared species exist and what is their contribution to global economy and protein production. It was estimated in 1997, that is 10 years after UNCLOS, that there could be up to 1,500 transboundary fish species in the world, however, such estimation lacked a proper assessment due to limited information at the time (**???**). More recently, it was estimated there were 344 shared species, representing a capture of $34.2 \times 10^6$ t and a global landed value of USD $30.7 \times 10^9$ (*1*). While this represents a good baseline to start, the analysis was based on a literature review of shared species and did not include a mechanistic way of determine the species distribution (*1*). Therefore, 40 years after UNCLOS, the question of how many transboundary species exists in the world is still unanswered. This is of uppermost need as the fisheries management approach differs substantially between EEZ-discreet and shared species (**???**).

We combined a series of datasets and species distribution models to estimate the number of transboundary fished species and their contribution to food security and economics of the world. We adopted the UN definition of transboundary stocks (shared by neighboring EEZs) but carried the analysis at the species

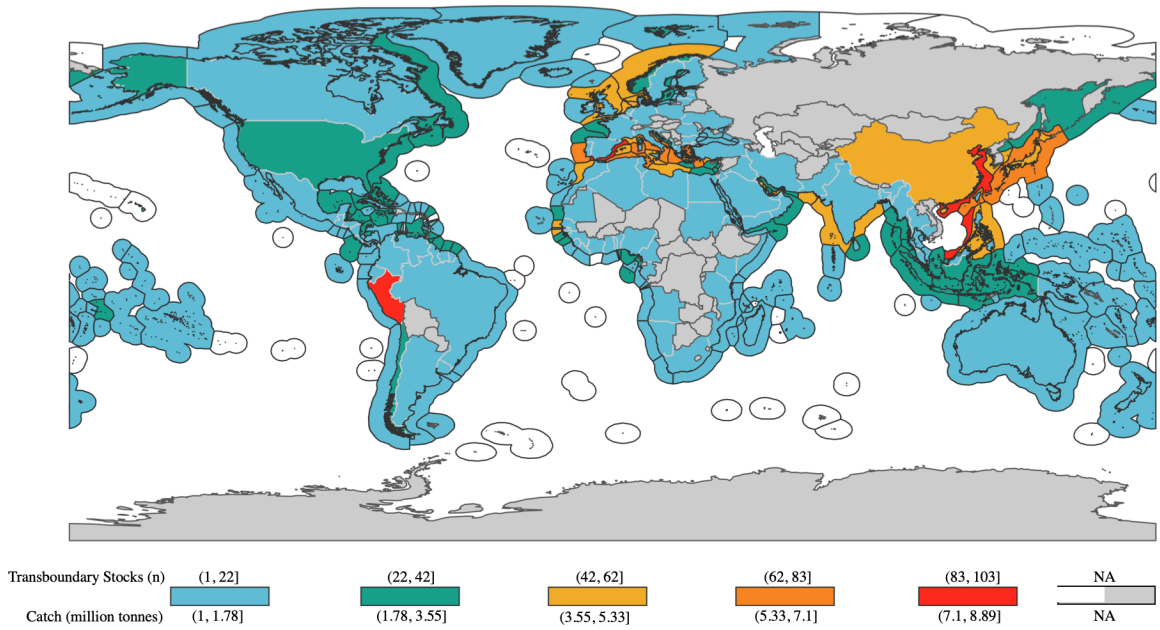


Figure 1: **Number of transboundary species by EEZ and their production by country**

level, rather than stocks (populations within a species), due to lack of stock-specific spatial and ecological information on all of the fished species. Our results suggest that there are XXX transboundary species in the world that account for XXX t landings generating USD xxx in fishing revenue to a total of USD xxxx in the fishing sector. Regional variation show higher frequency of transboundary species within EEZs along the South China sea, western central Atlantic, and the Mediterranean sea, followed by the Eastern north Atlantic (Fig 1). The overall fish production of transboundary species is relative lower than the number of species within each EEZ, with the exception of some punctual cases like Peru, Chile, Norway, and Ireland where fewer species produce higher landings (Fig 1).

It is not surprising then, that countries within this regions hold the most amount of transboundary species. Some African, Asian, and European countries house over 100 species within their EEZs. Only the US presents over 100 transboundary species outside those continents, once all three sub-EEZs (Atlantic and Pacific coast as well as Alaska arctic and subarctic) are accounted for (Fig. 2).


There is no clear visual pattern regarding transboundary and discrete species, however, from the three countries that house the most amount of discrete stocks, Australia, New Zeland and the US are among the larger in terms of EEZ lenght, in the other hand, Brazil has only two neighbors along its large latitudinal coast, suggesting not a lot of connection points for sharing species.

Species

# References (up to 40)

# **Acknowledgments* *

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1. L. Teh, U. R. Sumaila, Trends in global shared fisheries. *int-res.com.* **530**, 243–254 (2015).


Figure 2: **Figure 3. Number of countries shared by transboundary species**