

Vulnerability to Shocks in the Global Seafood Trade Network

Jessica A. Gephart (University of Virginia, Charlottesville, USA)
 Elena Rovenskaya (Advanced Systems Analysis Program, IIASA; Moscow State University, Russia)
 Ulf Dieckmann (Evolution and Ecology Program, IIASA)
 Michael L. Pace (University of Virginia, Charlottesville, USA)
 Åke Brännström (Evolution and Ecology Program, IIASA; Umeå University, Sweden)

Objective

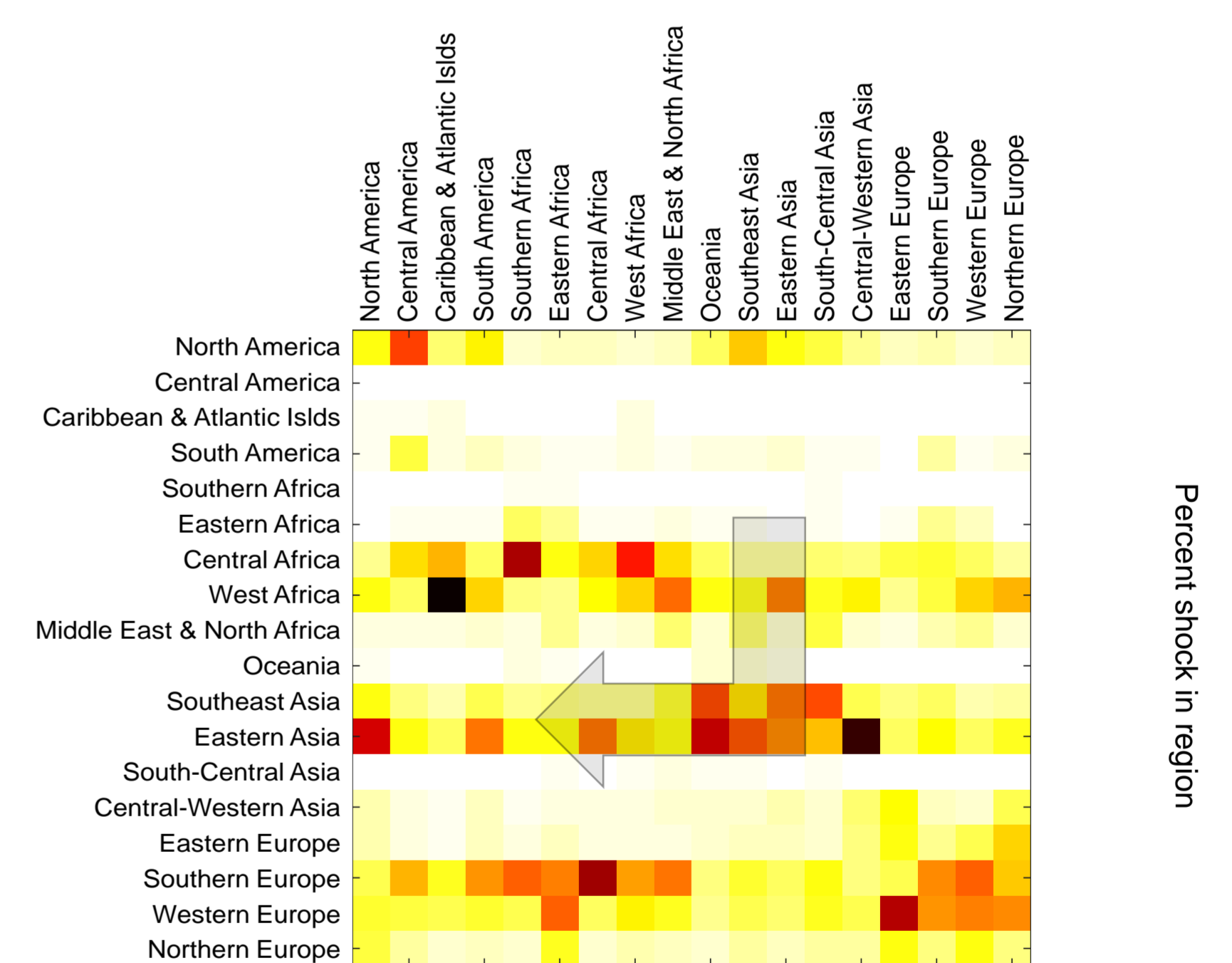
We analyze how seafood trade flows are redistributed under a range of shock scenarios and assess the food-security implications by comparing changes in regional fish supplies to indices of each region's nutritional fish dependency.

Approach

We introduce a model of shock propagation and distribution among regions on a network of historical bilateral seafood trade data from UN Comtrade using 205 reporting territories grouped into 18 regions. Shocks originate from decreased exports from one region, reducing the flows to importing regions. Regions with reduced imports either reduce their own exports, thus passing on a fraction of the shock, or reduce their domestic fish supply, thus absorbing the shock locally. For increased realism, we account for a larger willingness to pay when supplies drop in regions with higher GDP per capita.

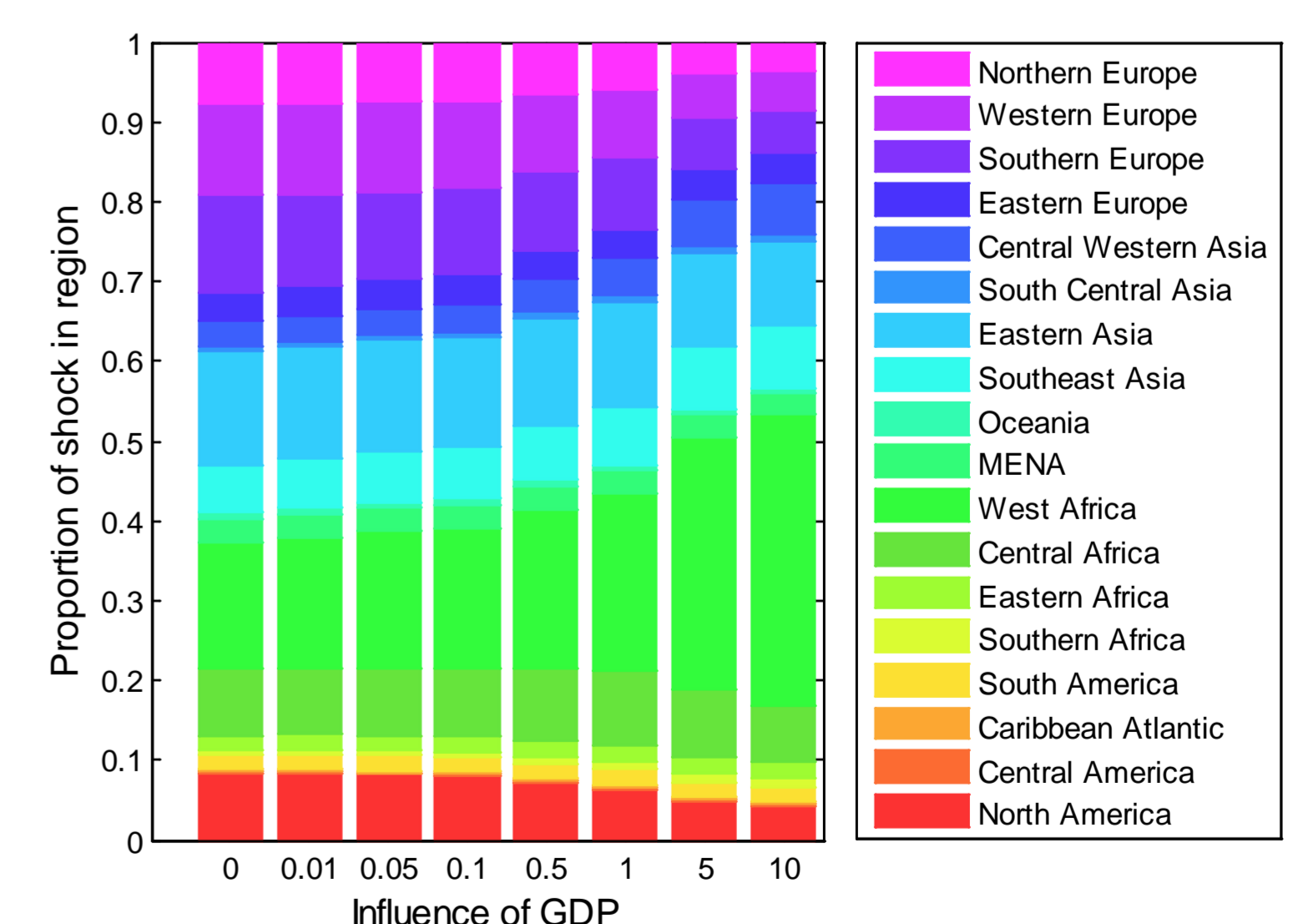
Result 1: Shock exposures are highly heterogeneous

The figure on the right shows how each region along the vertical axis is exposed to shocks originating from each other region along the horizontal axis. Exposure is measured by the percentage of the initial shock in the latter region ending up in the former region. Central and West Africa, Southeast and Eastern Asia, and Southern and Western Europe exhibit the highest exposures.



Result 2: Poor regions' exposures are exacerbated by rich regions' willingness to pay

The figure on the right shows how increasing the influence of GDP per capita on the willingness of affluent regions to pay higher prices when faced with shortfalls in supply increases the proportion of shocks ending up in West and Southern Africa.



Result 3: West and Central Africa are most vulnerable

The figure on the right shows the relative vulnerabilities of regions by comparing their exposures and sensitivities. Exposure is measured by a region's per capita decrease in seafood intake resulting from a 1000-tonne shortfall in supply, while sensitivity is measured by a region's percentage of animal-protein nutrition derived from fish. With relatively high exposures, high sensitivities, and low adaptive capacities, we find West and Central Africa to be the regions most vulnerable to shocks in the global seafood trade network.

