

The Dwindling Web

How human exploitation has reshaped a marine ecosystem

Humans have harvested the sea for tens of thousands of years, but only in the past few centuries have we begun to take a big toll on ecosystems. The two food webs below show predatory relationships among life-forms in the northern Adriatic Sea. Each web comprises humans, their prey and the prey of humans' prey, distilled into groups of species.

The webs, produced by Jennifer A. Dunne of the Santa Fe Institute from evidence compiled by Heike K.

Lotze and Marta Coll of Dalhousie University in Halifax, show that as recently as 1800 none of the Adriatic species groups had yet grown "rare," or dropped below 10 percent of their former abundance. By the late 20th century, when the global economy had replaced local trade, 10 groups had gone extinct or rare, eliminating them from the webs. —*John Matson*



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Watch a video about food webs at ScientificAmerican.com/mar2012/graphic-science

Vulnerability

A complex, tangled web is robust to changes. Species loss has degraded the Adriatic food web in recent times, paring down the number of connections and leaving surviving species vulnerable.

Species Groups

Each node represents one or more species, grouped by taxonomic similarity, as well as by habitat and by feeding style (carnivores, herbivores, and so on).

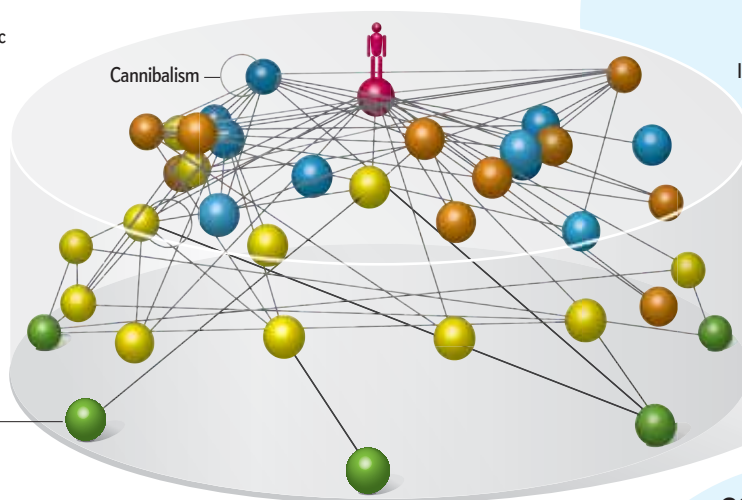
Predation

The links between nodes indicate species groups joined by predator-prey relationships.

Trophic Level

The vertical placement of a node represents how far removed that group's species are from basal food sources—such as kelp, phytoplankton and dead organic matter—which do not consume other organisms.

High
↑ Trophic level
↓ Low



A.D. 1500-1800

Human

Mammals, birds and reptiles

Fish

Invertebrates

Basal food sources

Each dot = 1 taxon

200 Years Later

Human

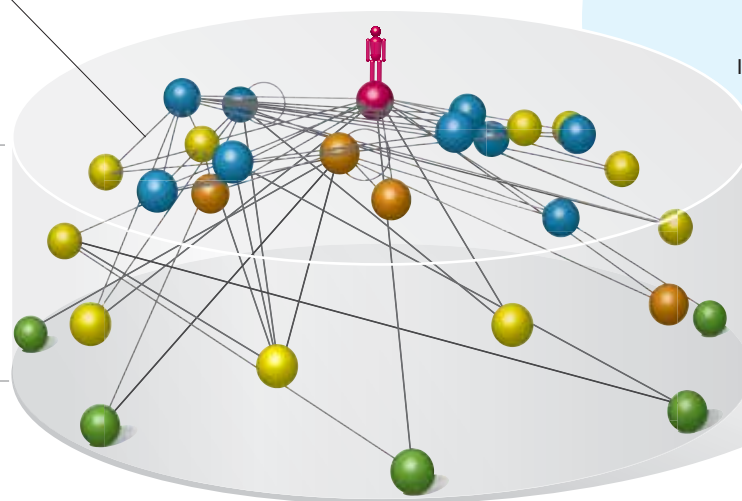
Mammals, birds and reptiles

Fish

Invertebrates

Basal food sources

This web includes an additional food source: discards from the fishing industry



SOURCES: NETWORK3D SOFTWARE, CREATED BY RICHARD J. WILLIAMS, MICROSOFT RESEARCH CAMBRIDGE, U.K., 2010 (initial generation of networks); "HISTORICAL CHANGES IN MARINE RESOURCES, FOOD-WEB STRUCTURE AND ECOSYSTEM FUNCTIONING IN THE ADRIATIC SEA, MEDITERRANEAN," BY HEIKE K. LOTZE ET AL., IN *ECOSYSTEMS*, VOL. 14; 2011 (data)