



Where in the World?

Grade

4th–12th grade

Length

30–60 minutes

Subjects/strands

Biology, invasive species, ecology, introduced species, geography, environmental studies

Topics

Global pathways of invasive species

LEARNING OBJECTIVES

Students will gain an understanding of (a) the distribution of various aquatic invasive species, including their native ranges; and (b) *pathways* for the spread of aquatic invasive species; and will (c) use critical thinking skills to analyze common location characteristics for introduced species.

INTRODUCTION

This introductory activity uses geographical skills to understand the nature and extent of the problem of invasive species. Participants map the routes of invasive species from their native habitat to some of the regions to which the exotics have spread, on a large, laminated wall map. Lengths of colored yarn illustrate the routes of the invasives, showing how they have spread to and from all regions of the Earth. Species cards provide the students some basic information about the species and how they spread.

BACKGROUND

Biological invasions are a global problem. Human activities, especially through the movement of oceangoing ships, have distributed marine organisms to new regions worldwide. One such species, the European green crab, has spread from its origin in Northern Europe to both coasts of North America, to Africa, and Australia. Species that have had multiple introductions around the world are considered to have *cosmopolitan distributions*. *Exotic* species, or invasives, are those that become established in different regions and affect native organisms and ecosystems, often out-competing native species. They can alter nutrient regimes, develop into monocultures, or drive native species to extinction. Reducing the risk of species introduction is a difficult task, and although the risk has been recognized in many countries, measures to reduce introductions have been difficult to implement.

VOCABULARY

Cosmopolitan distribution, ecosystem, exotic species, habitat, indigenous species, nonindigenous species, pathway, region.

MATERIALS NEEDED

- Wall-sized world map (preferably laminated) or transparency projected on board (laminated map available in the Menace to the West Toolkit)
- Exotic species cards (three per species); laminated cards are included in the Toolkit, or they can be printed from the Menace to the West website (www.MenaceToTheWest.org)
- Colored thumbtacks
- Colored yarn
- Tape

PREREQUISITE SKILLS

- Ability to use and read maps

PREPARATION

- 1 Place large laminated world map on the wall, or project a transparency on the wall.
- 2 Prepare a set of species cards. You can print them out from the Menace to the West website (www.MenaceToTheWest.org) or use the cards provided in the Toolkit.
- 3 Cut pieces of yarn long enough for students to connect the movement of the species on the maps.

PROCEDURE

- 1 Ask participants if they know where their family originated before they came to the United States and if they can share the route they took before im-

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migrating. For example, some families came from Sweden, moved to Minnesota, and then to Portland, Oregon, or Seattle, Washington. Others moved from Mexico to San Diego, then to Santa Barbara, California. Share your own story as an example.

- 2 Explain that other organisms also have a route they have traveled to be introduced into our area. Distribute prepared cards to the participants. The cards contain the name and a picture of an exotic species on one side, and a geographic location, plus a few sentences about the species, on the other. Let everyone know that the cards are in sets of three and one of each set of cards will have the native location (where the organism originated) and the other two will have introduced locations.
- 3 Have students get up and circulate around the room and find the people who have the same species. Ask the students to share information on their exotic organism with each other, and then plot native and introduced locations on the map. The group attaches colored yarn from point of origin to point of arrival.
- 4 At the end, the map will be covered with lengths of colored yarn, showing how the organisms have traveled all over the globe. Have each group brainstorm a list of common features these locations share, such as latitude, temperature, and access to water.
- 5 Once everyone has pinned his or her yarn on the map, each group summarizes their species, its native distribution, and the locations to which it has been introduced.

CLASSROOM DISCUSSION AND EVALUATION

- 1 **Are there longitude or latitude similarities in the distribution pattern? Does that mean anything?**

In some cases, species will invade areas on the globe that are in the same latitude, because often the climate is very similar.

- 2 **How are species likely to have traveled these distances?**

Pathways for introduction include: traveled by ballast water, introduced for horticulture or aquaculture, introduced as a pet, as bait, or as an unintended hitchhiker, and many more.

- 3 **How species travel is often referred to as pathways. Which species were transported by the same pathway, and which pathway is the most common one?**

Answers will vary, depending on the species cards used.

- 4 **What characteristics, if any, do the successful invasive species share?**

Successful invaders will have the ability to withstand a variety of harsh conditions, are sticky and can easily attach as a hitchhiker, or have a valuable trait that would make someone want to introduce them.

VOCABULARY WORKSHEET KEY

- **Cosmopolitan distribution:** Range of an organism that extends across all or most of the world in appropriate habitats.
- **Ecosystem:** A system formed by the interaction of biological and physical components. That is, a community of organisms interacting with their physical environment.
- **Exotic species:** A species that is not native to a designated ecosystem or geographic area.
- **Habitat:** Area where a species has the necessary food, water, shelter, and space to live and reproduce.
- **Indigenous species:** Naturally occurring in a specific geographic area or ecosystem. Synonyms include *native species*.
- **Nonindigenous species:** With respect to a particular ecosystem, any species—including its seeds, eggs, spores, or other biological material capable of propagating that species—that is not native to a specific area or ecosystem. Because some nonindigenous species may be harmful or invasive while others are not, this term should be used with great care. Synonyms include *nonnative, foreign, alien, and exotic species*.
- **Pathway:** Natural and human connections that allow movement of species or their reproductive propagules from place to place.
- **Region:** An area of animal and plant distribution having similar or shared characteristics throughout.

EXTENSION

Have students think of three things they can do to prevent the spread of invasive species when they go outside or travel to another place.

STUDENT RESEARCH QUESTION

Are there common habitat characteristics between native regions and the regions of introduction?

Students may want to look up a map of world biomes or ecoregions and utilize the species guide for their species (available in the Menace to the West Toolkit).

RESOURCES

Colton, J., and J. B. Geller. 1993. Ecological roulette: The global transport of nonindigenous marine organisms. *Science* 261(5117):78–82.

Ruesink, J., I. M. Parker, M. J. Groom, and P. M. Kareiva. 1995. Reducing the risks of species introductions: Guilty until proven innocent. *Bioscience* 45(7):607–615.

Additional resources**NOAA Aquatic Invasive Species Fact Sheet**

www.habitat.noaa.gov/pdf/best_management_practices/fact_sheets/Aquatic%20Invasive%20Species%20Facts.pdf

USFS Pacific Northwest Research Station, Invasive Species

U.S. Forest Service, Pacific Northwest Research Station website.

www.fs.fed.us/pnw/invasives/index.shtml

Bio-invasions: Breaching Natural Barriers

Washington Sea Grant Program.

aqua.ucdavis.edu/DatabaseRoot/pdf/WSG98-01.pdf

USGS Nonindigenous Aquatic Species (NAS)

U.S. Geological Survey website.

nas.er.usgs.gov

Washington Sea Grant

Publications on marine ecosystem health, including aquatic invasive species reports and fact sheets.

wsg.washington.edu/about-wsg/publications/marine-ecosystem-health/#ais

STANDARDS**Common Core****Reading:**

- Key Ideas and Details: 3.3, 4.3, 5.3, 6.1, 7.1, 8.1, 9.1, 10.1, 11.1, 12.1
- Craft and Structure: 4.5, 5.5
- Integration of Key Ideas and Knowledge: 3.7, 3.8

Speaking and Listening:

- Comprehension and Collaboration: 3.1, 4.1, 5.1, 6.1, 7.1, 8.1, 9.1, 10.1, 11.1, 12.1
- Presentation of Knowledge and Ideas: 3.4, 4.4, 6.4, 9.4, 10.4

Next Generation Science Standards**Earth and Human Activity (Grade 5)**

- ESS3-1

Ecosystems: Interactions, Energy, and Dynamics

- MS-LS2-2, HS-LS2-7

National Geography Standards

- Grades 3–12: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information.
- The characteristics and spatial distribution of ecosystems and biomes on Earth's surface.
- The characteristics, distribution, and migration of human populations on Earth's surface.
- How human actions modify the physical environment.