

The Lionfish Invasion!

Student Guide

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Elsewhere on the Web

Lionfish-A New Invasive Species for the East Coast

<http://shrimp.ccfhrb.noaa.gov/lionfish/index.html>

A central Web site for information about the ongoing lionfish research at NOAA's Center for Coastal Fisheries and Habitat Research in Beaufort, North Carolina.

Marine Bioinvasions

<http://massbay.mit.edu/exoticspecies/index.html>

Here is a wealth of information about marine alien invaders from the MIT Sea Grant Center for Coastal Resources. Follow the links on this page to additional resources on marine introductions, including information on ballast water, aquaculture, rapid assessment surveys, and so on.

Invasivespecies.gov

<http://www.invasivespecies.gov/>

Invasivespecies.gov is the gateway to Federal and state government efforts concerning invasive species. On this site you can learn about the impacts of invasive species and the Federal government's response, as well as select species profiles. There are also links to agencies and organizations dealing with invasive species issues.

ESCAPE-Exotic Species Curriculum for Agricultural Problem-



An adult lionfish in all its glory! Note the fan-like pectoral fins and slender, straight dorsal spines. (Photo credit: John Randall; U.S. Geological Survey)

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solving Education

<http://www.unk.edu/acad/biology/hoback/escape/home.html>

This site allows students to play the role of scientist and to test various hypotheses about alien invaders. It also provides information on what makes alien invaders successful in their new habitats. After learning about them, students become an active participant in reducing the impact of alien species by learning how to tell a native thistle from an exotic one. Includes quizzes!

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Exotic Introductions

<http://darwin.bio.uci.edu/~sustain/bio65/lec09/b65lec09.htm>

A hypertextbook from an online UC-Irvine course. This Web site provides an introduction to exotic (or alien) species, information on exotic plants, invertebrates, and vertebrates, a description of their secondary effects, and an explanation of how these species are introduced to new areas.

Environmental Protection Agency's Invasive Species Site

http://www.epa.gov/owow/invasive_species/index.html

The home page of the Environmental Protection Agency's (EPA) Web site on invasive species. This Web site has links to many resources on alien species.

Animal Diversity Web-*Pterois volitans*

http://animaldiversity.ummz.umich.edu/site/accounts/information/Pterois_volitans.html

Detailed information about the biology, ecology and classification of the lionfish (*Pterois volitans*), including photos and movies.

Biological Profiles: Red Lionfish

<http://www.flmnh.ufl.edu/fish/Gallery/Descript/RedLionfish/RLionfish.html>

A detailed biological profile of the lionfish from the Florida Museum of Natural History.

Lionfish in North Carolina

<http://www.atlantischarters.net/lionfish.htm>

A chronicle of original lionfish sightings in the Atlantic Ocean by divers on a charter boat in 2001.

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Problems with the Release of Exotic Fish

http://nas.er.usgs.gov/fishes/dont_rel.html

This Web site explains why you should not release aquarium life, including fish, into natural waters, and suggests alternative means to get rid of unwanted pet fish.

The Problem

<http://globallast.imo.org/problem.htm>

Many alien species have "hitched a ride" in the ballast tanks of large ships. A concise explanation of how exotic species are introduced to new areas when ships discharge their ballast water.

Nova's Deep Sea Invasion

<http://www.pbs.org/wgbh/nova/algae/>

This Web site features the NOVA television program on the toxic aquarium plant that was accidentally released into the Mediterranean Sea, overwhelming the marine life and threatening to spread worldwide. This "killer alga" could become a serious threat to America's warmest coastlines. Includes interviews, interactive games, and general background materials on invasive species.

Ecosystem Services Fact Sheet

<http://www.esa.org/education/edupdfs/ecosystemservices.pdf>

An excellent introduction to the services that ecosystems provide to humans from the Ecological Society of America.

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<http://oceanservice.noaa.gov/education/stories/lionfish/student.html>

Best viewed in Internet Explorer 5+ or Netscape 6+.



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Glossary of Terms

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A

Acetylcholine—a [neurotransmitter](#) released at [neuromuscular junctions](#) and autonomic synapses.

Alien Species—any species, including its seeds, eggs, spores, or other biological material capable of propagating that species that is not [native](#) to that ecosystem (from Executive Order 13112 on Invasive Species). Also called an [exotic species](#), non-native species, non-indigenous species or [introduced species](#).

Anal fin—the fin on the median (i.e. middle) line behind the vent (i.e. the anus).

Anterior—relating to the front portion of an organism.

Aquarist—a person who keeps or maintains an aquarium.



An adult lionfish in all its glory! Note the fan-like pectoral fins and slender, straight dorsal spines. (Photo credit: John Randall; U.S. Geological Survey)

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Aquarium Trade—the selling of aquatic life for public or private display.

Aquatic—growing or living in, or frequenting water.

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B

Ballast Water—water carried in special tanks (ballast tanks) of ships used to provide stability needed when carrying less than a full load of cargo and to keep the ship at the proper depth in the water. When the ship is loaded with cargo, the ballast water is released to surrounding waters; when the ship is empty, it takes on more water to keep it upright. Some vessels use sand as ballast rather than water.

Benthic—bottom-dwelling, living on the seabed.

Bilge—another term for [ballast water](#).

Biodiversity (or Biological Diversity)—the variety of species, their genetic make-up, and the natural communities which they compose. All the different kinds of organisms living in an area.

Biological Classification—the hierarchical grouping of organisms into categories based on evolutionary relationships. Seven hierarchical levels (or taxa) are commonly used: kingdom, phylum, class, order, family, genus, and species.

Biological Control (or Bio-control)—using one kind of organism to help manage a harmful species. For example, certain beetles feed on purple loosestrife, an [invasive species](#), and help control its spread.

Biome—major regional ecological [community](#) of plants and animals associated with a particular climate. Examples include: tropical rainforest biome, desert biome, lake biome, and estuarine biome.

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C

Community—an association of living organisms that have mutual relationships among themselves and with their environment, and thus function, to some degree, as an ecological unit.

Competition (or Compete)—any interaction that is mutually detrimental or harmful to both participants, occurring between

species that share limited resources such as food or space. The struggle for limited resources.

Competitor—a species that may compete with another species for the same resources, such as food, water or space.

Continental Shelf—the relatively shallow portion of the sea floor that adjoins and surrounds most parts of the continents.

Coral Reef (or Reef)—a massive, wave-resistant structure, built largely by coral, and consisting of skeletal and chemically precipitated materials.

Cycloid Scales—fish scales that are oval or elliptical in shape with a smooth edge. In this type of scale, the [anterior](#) part of each scale is usually overlapped by the [posterior](#) portion of the scale in front of it, giving the fish greater flexibility than fishes with other types of scales. There are four main kinds of scales (placoid, cosmoid, cycloid and ctenoid, and ganoid,) and numerous variations of each kind.

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D

Dispersal (or Disperse)—the spread of a [species](#), population, or individual's offspring over time.

Distribution—where organisms live in an area; the geographical area (i.e., range) within which a species or other group of organisms occurs.

Dorsal—pertaining to the back or upper surface of an organism. In vertebrates, it means nearest to the spinal column. Dorsal is the opposite of [ventral](#).

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E

Ecology—the study of the relationship among organisms and between organisms and their physical environment.

Ecologist—scientist who studies the interactions between species of organisms and their environment (studies the ecosystem).

Ecosystem—all organisms in a community and the associated non-living environmental factors (i.e. the physical and chemical environments) with which they interact.

Ecosystem Services—the fundamental life-support processes necessary for life, including human, to thrive. Ecosystems

provide "services" that:

- moderate weather extremes and their impacts
- disperse seeds
- mitigate drought and floods
- protect people from the sun's harmful ultraviolet rays
- cycle and move nutrients
- protect stream and river channels and coastal shores from erosion
- detoxify and decompose wastes
- control agricultural pests
- maintain biodiversity
- generate and preserve soils and renew their fertility
- contribute to climate stability
- purify the air and water
- regulate disease carrying organisms
- pollinate crops and natural vegetation

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Endangered Species Act—President Richard Nixon signed the Endangered Species Act (ESA) into law in 1973. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered throughout all or a significant portion of their range and the conservation of the ecosystems on which they depend. "Species" is defined by the Act to mean a species, a subspecies, or, for vertebrates only, a distinct population. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species.

Endemic—restricted to a given region. A term applied to populations or species that are found in a particular locality, such as an island, and nowhere else.

Envenomation—the process by which [venom](#) is injected from a venom gland into the recipient.

Environment—the physical and biological conditions that surround an organism or a group of organisms.

Exotic Species—a species that has been transported by human activities, either intentionally or accidentally, into a region where it did not occur previously. Also called an [alien species](#), non-indigenous species, or [introduced species](#).

Extinct—the *complete* global disappearance of a species from existence.

Extirpate—the local disappearance of a species, as opposed to extinction, which is global disappearance.

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F

Food chain—the flow of energy and nutrients from sunlight to plants to predators.

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H

Habitat—the surroundings in which individuals of a particular species usually live (i.e. their address).

Hard-bottom Habitat—(or sometimes called “**Live-bottom**” **Habitat**) an area of rocky outcroppings, also referred to as ledges, which are surrounded by a relatively thin veneer of sand, which varies in vertical relief.

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I

Introduced Species—another term for an [alien species](#), [exotic species](#) or non-indigenous species.

Invasive Species—a species that has been transported by natural processes or human activities, either intentionally or accidentally, into a region where it did not occur previously, and reproduces and spreads rapidly into new locations, causing economic or environmental harm or harm to human health (from Executive Order 13112 on Invasive Species).

Invertebrate—an animal that lacks vertebrae (i.e., a spinal column).

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J

Juvenile—a sexually immature organism that resembles an adult.

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M

Mitigate—taking action to avoid or reduce damages or to make less severe or harsh.

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N

Native Species (or **Indigenous Species**)—applied to a species that occurs naturally in an area, and therefore has not been introduced by humans either accidentally or intentionally.

Neuromuscular—relating to nerves and muscles; jointly involving or affecting nervous and muscular components.

Neurotransmitter—a substance that transmits nerve impulses across a synapse (i.e. the gap between two neurons or nerve cells).

Niche—the functional role of a species in an ecosystem. The sum of physical and biological factors necessary for an organism's or species' existence. The environmental factors that influence growth, survival and reproduction of a species.

NOAA—the National Oceanic and Atmospheric Administration (NOAA), a U.S. federal agency that conducts research and gathers data about the global oceans, atmosphere, space, and sun, and applies this knowledge to science and service that touch the lives of all Americans. NOAA provides these services through five major organizations: the National Weather Service, the National Ocean Service, the National Marine Fisheries Service, the National Environmental Satellite, Data and Information Service, and NOAA Research; and numerous special program units. In addition, NOAA research and operational activities are supported by the nation's seventh uniformed service, the NOAA Corps, a commissioned officer corps of men and women who operate NOAA ships and aircraft, and serve in scientific and administrative posts.

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O

Overfishing—harvesting an [aquatic](#) population below its reproductive capacity to replenish itself.

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P

Pectoral Fins—either of the two fins of a fish that correspond to the forelimbs of a quadruped (a four-legged animal). Pectoral fins are those situated on the chest.

Posterior—towards the hind end of the fish.

Predator—an animal that preys on others. [Also see [Top Predator](#)]

Prey—an animal that is preyed upon by a **predator**.

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R

Ray—a jointed rod which supports a fin.

Reef (or Coral Reef) —a massive, wave-resistant structure, built largely by coral, and consisting of skeletal and chemically precipitated materials.

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S

Species—a group of individuals or populations that are similar and are able to mate and have offspring.

Stressor—five stressors are identified as affecting coastal and marine ecosystems: pollution, [invasive species](#), climate change, extreme events, and land or resource use.

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T

Taxonomist—someone who studies the taxonomy, or orderly classification of plants or animals, according to their presumed evolutionary (natural) relationships.

Terrestrial—living on or in or growing from land (rather than in the air or water).

Top Predator—a species eaten by nothing else in the food web.

Toxin—a poisonous substance that is a product of an organisms metabolic activities and is harmful or fatal when introduced into tissues.

Transect—a line across an area to be sampled, marked by a tape measure. Often permanent markers at the ends of line are left so that the line is easily found upon return.

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V

Vector—an organism or force of nature that spreads an organism to a new area; a path, or method, of invasion. For example, a major vector in zebra mussel invasion is ballast water; the zebra mussels travel from their native waters into

new regions when ballast water collected in their [native](#) ranges is discharged into non-native waters.

Venom (or Venomous)—poisonous matter normally secreted by some animals (snakes, scorpions, bees, and some fish) and transmitted to [prey](#) or an enemy chiefly by biting or stinging.

Viability—the capability of surviving outside the mother’s womb. In the case of eggs or seeds, it means the capability to grow and develop.

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