Invasion of the Crabs!

Are green crabs invading Oregon estuaries and causing harmful impacts?

Overview

European green crabs are a non-native species that were first found in Oregon in 1998. In other estuaries where they have invaded, green crabs have caused declines in shellfish (clams, oysters, crabs) and eelgrass meadows (foundational habitat important for many organisms). Scientists have been tracking green crab abundance, and abundance of other crabs, in five Oregon estuaries since 2001. Green crab abundance waxed and waned for the first 15 years, but in the last six years, abundances have increased each year.

Essential Questions

- *What are green crabs?*
- *Why do we care about invasive species?*
- *How do we measure the abundance of green crabs?*
- *What is the trend over time in green crab abundance in Oregon estuaries?*
- *How do we meaure variability among locations or sampling sites?*

Learning Goals

Students will learn the following:

- *Green crabs are an invasive species that we accidentally introduced from western Europe.*
- *Invasive species can harm native species and our environment.*
- *We monitor green crabs to measure the abundance through time.*
- *We can use basic statistics to understand and summarize the green crab invasion.*

Learning Objectives

Students will be able to:

- *communicate the importance of invasive species.*
- *understand and calculate the mean and variability (as standard deviation) in abundance of green crabs.*
- *construct a graph showing changes in mean abundance over time.*
- *compare abundance trends over time for two estuaries.*

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Grade Level

9-11

Anchoring Phenomenon
Invasion of the Crabs

Driving Question
Are green crabs invading Oregon estuaries and causing harmful impacts?

Standards

Next Generation Science Standards
LS2.A – Interdependent Relationships in Ecosystems
LS2.C – Ecosystem Dynamics, Functioning, and Resilience

Common Core Math Standards
HS.DR.C
HS.DR.D

Green crab - photo by Oregon Sea Grant

Introduction

European green crabs are native to the coast of Europe and Northern Africa. However, in the past few years, they have been observed in several locations on the west coast of North America. In the ecosystems where they have been newly detected, native species of plants and animals are declining. Some of the affected native species, like Dungeness crab, are of economic importance to people. Other species are known to be keystone species. In this lesson, students will explore the presence and impacts of non-native green crabs in Oregon estuaries. Are these crabs in our local waters? If they show up, do we expect that they will cause ecological damage and how much? What can we do to protect our resources and habitats?

Lesson Procedure

ENGAGE

Begin the unit by showing students the TED-Ed video *The threat of invasive species*. Following the video, have students discuss the difference between native species and non-native species, and define the term invasive species.

To focus generally on the issue of invasive green crabs in the U.S., show the video *Recipe for Disaster: Green crabs in the Great Marsh*, which not only depicts the problem of invasive green crabs in a Massachusetts estuary, but also a potential solution.

Then, show students a short *video of green crabs* collected in Coos County, Oregon. Discuss what the presence of these crabs might mean for Oregon coastal communities.

EXPLORE

In this section, students learn more about the history and abundance of European green crabs in Oregon.

Activity: Introduction to Invasive Green Crabs in Oregon

Researchers have been monitoring invasive green crabs in Coos Bay and South Slough. In the narrated presentation *European green crab invasion of Coos Bay*, Dr. Shon Schooler from South Slouth National Estuarine Research Reserve provides a summary of the history, identification, abundance, and management options for invasive green crabs.

Green crabs found in Coos Bay

LESSON RESOURCES

Definitions

- ***Indigenous*** *– Characteristic to or of specific place.*
- ***Native species*** *– A type of plant or animal that is indigenous to a particular area.*
- ***Non-native species*** *– A type of plant or animal that is not indigenous to a particular area.*
- ***Invasive species*** *– type of plant or animal that is not indigenous to a particular area* ***and*** *causes economic or environmental harm.*
- ***CPUE*** *– the catch per unit effort is an indirect measure of abundance.*

Introduction Videos

- *The threat of invasive species [4:46]*
- *Recipe for disaster [6:22]*
- *Green crabs in Oregon [0:10]*

Invasive green crabs in Oregon

- *Narrated Presentation: European green crab invasion of Coos Bay [9:19]*
- *Presentation slides (ppt)(pdf)*

Career Connection

- *Researcher Bio (pdf)*
- *NPR interview, Nov. 2021*

Dr. Shon Schooler, South Slough Reserve

Activity: Species on the Move
To learn more about European green crabs in Oregon, have students read *Species on the Move*, an article which appeared in Oregon State University's *Terra* magazine in October 2019. Check understanding with a student worksheet containing *Review Questions*.

Activity: Green Crab Abundance
In this activity, students use a real *Green Crab Dataset* to explore changes in green crab abundance in two Oregon estuaries over time. Using a *student worksheet*, they calculate the average 'catch per unit effort' (CPUE) and standard deviation, and plot the data on a graph. For detailed teacher guidance, see the *Activity Synopsis* and *Answer Key*.

EXPLAIN

Students use data to describe trends in green crab abundance and learn about techniques used to trap and remove invasive green crabs.

Activity: Data Analysis
Have students present their graphs and explain what is going on in the two estuary study sites. Do they see differences in the invasions of Coos Bay and Yaquina Bay? Are there differences in the quality of the data of the data for each estuary? To summarize, teachers can present the graphs provided in the *Activity Synopsis*.

Activity: Field Trip
Take a field trip to look at and learn about green crabs and/or another invasive species of local interest. If you plan to trap crabs, be sure to obtain a shellfish *license* from Oregon Department of Fish and Wildlife (ODFW) and are able to *identify* the crab species you catch.

Activity: Field Data Collection
If your classroom is located near a place where green crabs may be present, consider setting up a green crab sampling site. Watch this *How to trap green crabs* video for guidance.

ELABORATE

Given the students' analysis of green crab data in the previous section, ask students where they would start looking for any negative effects of green crabs. Challenge students to:

- design experiments that would tell researchers what effect green crabs are having on 1) bivalves and/or 2) native crabs;
- design a trap that would best capture green crabs.

Species on the Move

- *Article: Species on the Move*
- *Worksheet: Review (pdf)(doc)*

Green Crab Abundance

- *Student crab dataset (xls)*
- *Student worksheet: Mean and Standard Deviation (pdf)(doc)*
- *Teacher activity synopsis (pdf)*
- *Teacher key (xls)*

Student sets a crab trap

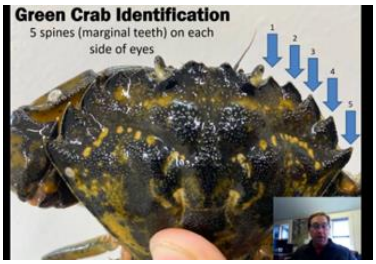
Field trips and Resources

- *South Slough Reserve*
- *Hatfield Marine Science Center*
- *ODFW: licenses and crab ID*
- *Recipes: Mealtime Management culinary guide*
- *Video: How to trap green crabs*

EVALUATE

Assessment of student learning

- Science Communication – Students create a poster with information on green crabs, how to identify them, and what to do if you see one.
- Scientific Methodology – Students create a scientific poster with findings from their data analysis.
- Engineering – Design and build a trap to capture green crabs.



Identifying the European green crab

Next Generation Science Standards

Performance Expectations:

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affectinvg biodiversity and populations in ecosystems of different scales.
HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Science & Engineering Practices:

Using Mathematics and Computational Thinking

Disciplinary Core Ideas:

LS2.A – Interdependent Relationships in Ecosystems
LS2.C – Ecosystem Dynamics, Functioning, and Resilience

Crosscutting Concepts:

Stability and Change
Scale, Proportion, and Quantity

Common Core Math Standards

Math Standards:

HS.DR.C – Analyze, summarize and describe data
HS.DR.C8 – Identify appropriate ways to summarize and then represent the distribution of univariate and bivariate data with graphs and or tables. Use technology to present data that supports interpretation.
HS.DR.D – Interpret data and answer investigative questions
HS.DR.D11 – Use statistical evidence from analysis to answer statistical investigative questions and communicate the findings in a variety of formats to support informed data-based decisions.

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See more lessons on the ORSEA webpage: oregoncoaststem.oregonstate.edu/orsea