WHERE are zebra and quagga mussels native?

Make a prediction...
Zebra mussels are native to the Black, Caspian, and Azov Seas. The Volga-Don Canal connects them. 13 locks move the shipping vessels (89% are WESTWARD).
Quagga mussels are native to the Dnieper River
WHAT makes these mussels so invasive?

Water enters the incumbent siphon

Waste and gametes exit the excurrent siphon

Byssal threads attach to surfaces
WHAT makes these mussels so invasive?
How did the invasive mussels get to the United States?

Cargo ships released contaminated ballast water into the Great Lakes!
Make a prediction: Where do you think the zebra mussels spread to first?
Initial Quagga Mussel Detection
Where did the invasive mussels actually spread to initially?
5 years later...
They quickly spread by traveling from their points of origin and by a ride.
They quickly spread by traveling DOWNSTREAM from their points of origin and by HITCHHIKING a ride.
15 years later...
20 years later...
They crossed the continental divide! 21 years later...

30-second brainstorm...
List the ways in which invasive mussels can move and spread to new areas?
How Do Invasive Mussels Spread?

What do all of these photos have in common?
Inspection stations appear in the northwest!
Detection in Montana

30 years later...
Are the inspection stations and clean, drain, dry campaigns in the northwest working? 32 years later...
32 years later...

List the states the invasive mussels have NOT spread to.
32 years later...

What are some invasion barriers that could cause a mussel invasion to fail?
The Columbia River Basin is the last major watershed without invasive mussels!

A **river basin** or **watershed** is an area of land drained by a river and its tributaries to a common outlet.
Select a point of introduction on the Flathead Region Map
Describe **where** the mussels would disperse from that location.
How could the **aquatic environment** of the Flathead Watershed be impacted by a mussel invasion?
Think of a **personal connection**…
How could a mussel invasion impact someone you know?
Select a topic. Use the map to explain how the Columbia River Basin economy could be impacted by a mussel invasion?

Economy = System of how to make money
We live near the headwaters of the Columbia River Basin...

Why should we care about a potential mussel invasion?
| Slide #1: Map of invasive species threat by Jeffrey Dukes at Purdue University |
| Slide #2: Photo of zebra mussels on shell by Randy Westbrooks (Bugwood.org / Public Domain) |
| Slides #3-4: Photo of Black and Caspian Seas by Google Earth |
| | Photo of Volga-Don Canal by Дмитрий Николенко (public domain) |
| Slide #5: Photo of quagga mussels by Great Lakes Environmental Research Laboratory (CC BY-SA 2.0) |
| Slide #6: Photo of zebra mussels on posts by thirdwavephoto (Wikimedia Commons / CC BY 4.0) |
| | Photo of mussels on propeller by NPS (public domain) |
| | Diagram of zebra vs. quagga mussels by Minnesota Sea Grant (photos by John Karl) |
| Slide #7: Drawing of cargo ship by Holly Church at FLBS (2019) |
| Slide #8: Diagram of Great Lakes by On The World Maps |
| Slide #11: Diagrams of the ports along the Great Lakes by the Chamber of Marine Commerce |
References

Slide #31:  Photo of paddle boarder by U.S. Dept. of Agriculture (Wikimedia Commons)
            Photo of water skier by Isiwal (Wikimedia Commons / CC BY-SA 4.0)
            Photo of boats at Lake McDonald by David Restivo (Wikimedia Commons / CC BY-2.0)
            Photo of fly fisherman by Paul Nute (Wikimedia Commons / CC0 1.0)

Slides #8-30/32-44:  Mussel detection maps by Natalie Poremba/FLB

Slide #45:  Photo of Columbia River by U.S. Forest Service (Wikipedia Commons)

Slides #46-49:  Flathead Lake Region map by Natalie Poremba/FLBS

Slide #50:  Columbia River Basin map by Natalie Poremba/FLBS

Slide #51:  Photo of zebra mussels on shell by Randy Westbrooks (Bugwood.org / Public Domain)