An International Collaborative Project Documenting the Parasites of *Dreissena* spp. Mussels throughout Eurasia

Daniel P. Molloy

North American freshwater ecosystems have been ravaged by high densities of two invasive bivalve species from Eurasia, *Dreissena rostriformis bugensis* and *Dreissena polymorpha*. In addition, the fouling of infrastructures by these bivalves has had an economic impact in the billions of dollars. Unfortunately, there is currently no environmentally safe and economically feasible method of controlling them throughout infested waterbodies. In an attempt to develop such a control agent, a project is now underway examining parasites in Eurasian *Dreissena* populations. Several new parasites have already been discovered and will be evaluated for their virulence and host specificity. A very high priority of this project is to sample the parasites from *Dreissena* spp. endemic to the Balkans (e.g., *D. blanci*, *D. carinata*) and nearby Turkey (e.g., *D. caputlacus*, *D. anatolica*). These samples will be particularly valuable because North American dreissenid populations have not likely encountered the parasites from these latter four *Dreissena* spp., and thus infection may prove highly virulent to them. This project is an ambitious and challenging one and the collaborators participating in it will be highlighted in this presentation as their diverse expertise brings valuable contributions to it.

SCROLL DOWN TO SEE PRESENTATION SLIDES

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Daniel P. Molloy, Ph.D.

October 3, 2019

Budva, Montenegro

8th International Conference of Ecologists of Montenegro

Funding Acknowledgement

“novel” parasites & “naïve” hosts

Eastern oyster
Crassostrea virginica

Up until the 1950s, eastern oyster populations were abundant and the industry thrived

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Until a spore forming parasite killed 95% of these oysters

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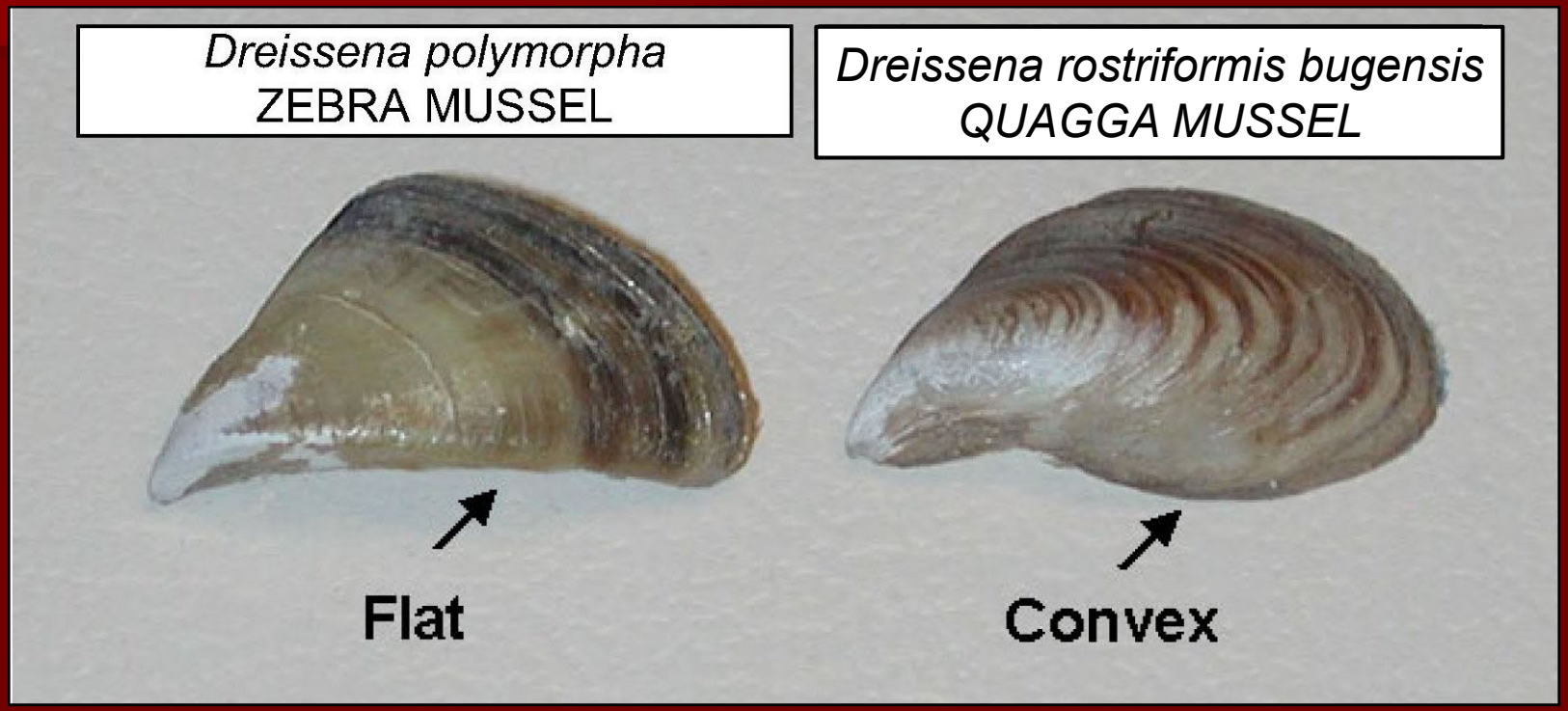
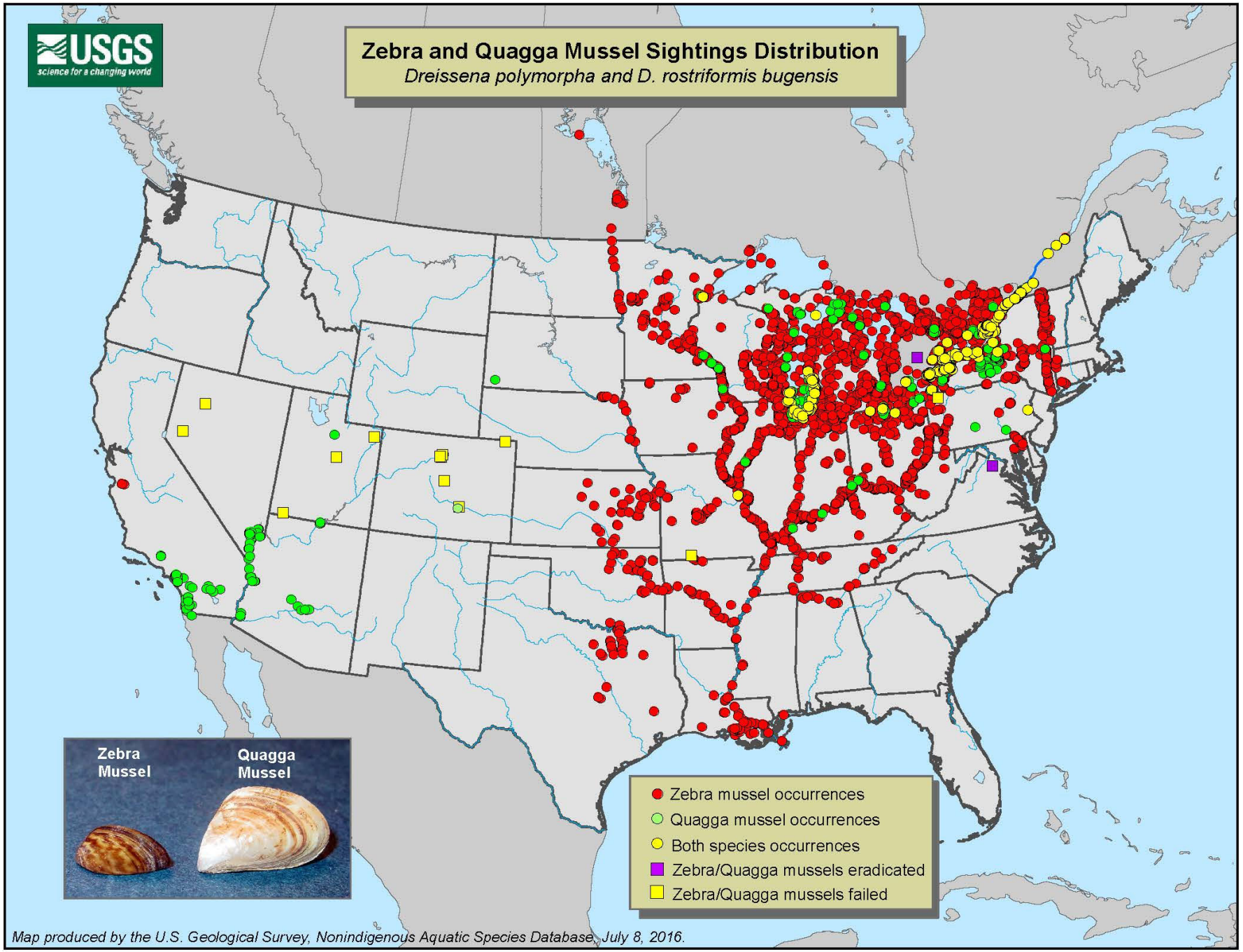

Dreissena polymorpha
ZEBRA MUSSEL
Dreissena rostriformis bugensis
QUAGGA MUSSEL
Flat
Convex

Only freshwater mussels now in North American with byssal threads enabling them to attach on to ANY hard surface


S. van Mechelen


1988
CANADA
Washington
Oregon
California
Nevada
Idaho
Montana
Wyoming
Utah
Arizona
Colorado
New Mexico
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Wisconsin
Illinois
Michigan
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Virginia
West Virginia
Pennsylvania
New York
Maine
Vermont
New Hampshire
Massachusetts
Connecticut
New Jersey
Delaware
MEXICO
Zebra / Quagga Mussel Location
Source: U.S. Geological Survey, Nonindigenous Aquatic Species Database, April 2011


USGS
science for a changing world
Zebra and Quagga Mussel Sightings Distribution
Dreissena polymorpha and D. rostriformis bugensis
Zebra Mussel
Quagga Mussel
Zebra mussel occurrences
Quagga mussel occurrences
Both species occurrences
Zebra/Quagga mussels eradicated
Zebra/Quagga mussels failed
Map produced by the U.S. Geological Survey, Nonindigenous Aquatic Species Database, July 8, 2016.


S. van Mechelen

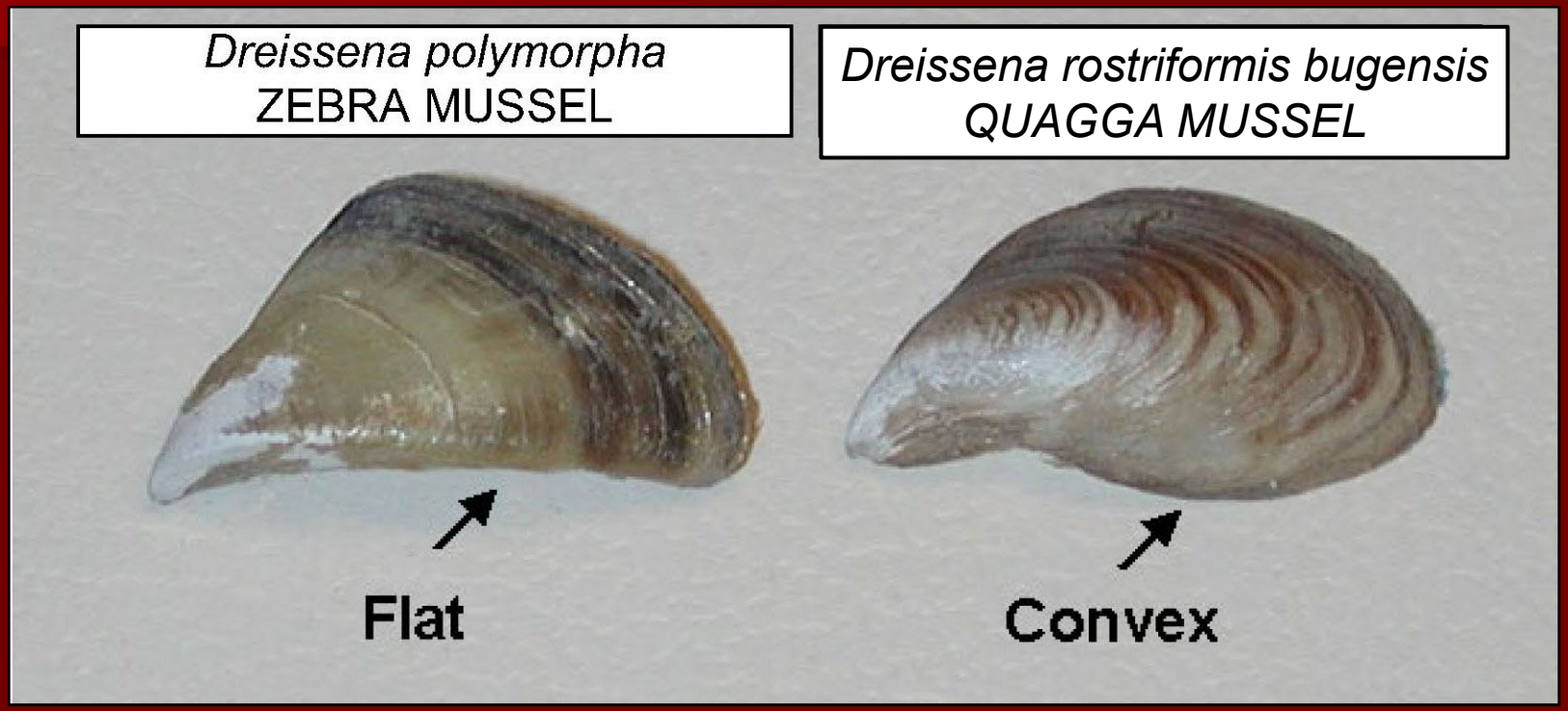
BASICALLY THREE MAIN
TYPES OF IMPACTS WITHIN WATER BODIES….

ECOLOGICAL

RECREATIONAL

INDUSTRIAL

Specific Problem to Discuss Today:
Inability to control these two invasive mussels in "open waters" (lakes, rivers, etc.)



Treating an entire water body is currently:

- Too expensive

and/or

- Too environmentally degrading

To be economically feasible the control agent ideally must be:

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-- applied only in a small part of the water body

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-- self-perpetuating

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-- self-spreading

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This control agent must be LIVE

To be economically feasible the control agent ideally must be:

-- applied only in a small part of the water body

-- self-perpetuating

-- self-spreading

This control agent must be LIVE

It must be a **BIOCONTROL** agent…

……but what kind of biocontrol agent…???

The control agent must be a **PARASITE**

…. because among all types of natural enemies,

parasites are the most host-specific killing agents

…. And not any host-specific parasite will do…

…. It's got to be a **HYPERVIRULENT PARASITE**

This project is an extremely ambitious one.

This project is an extremely challenging one.

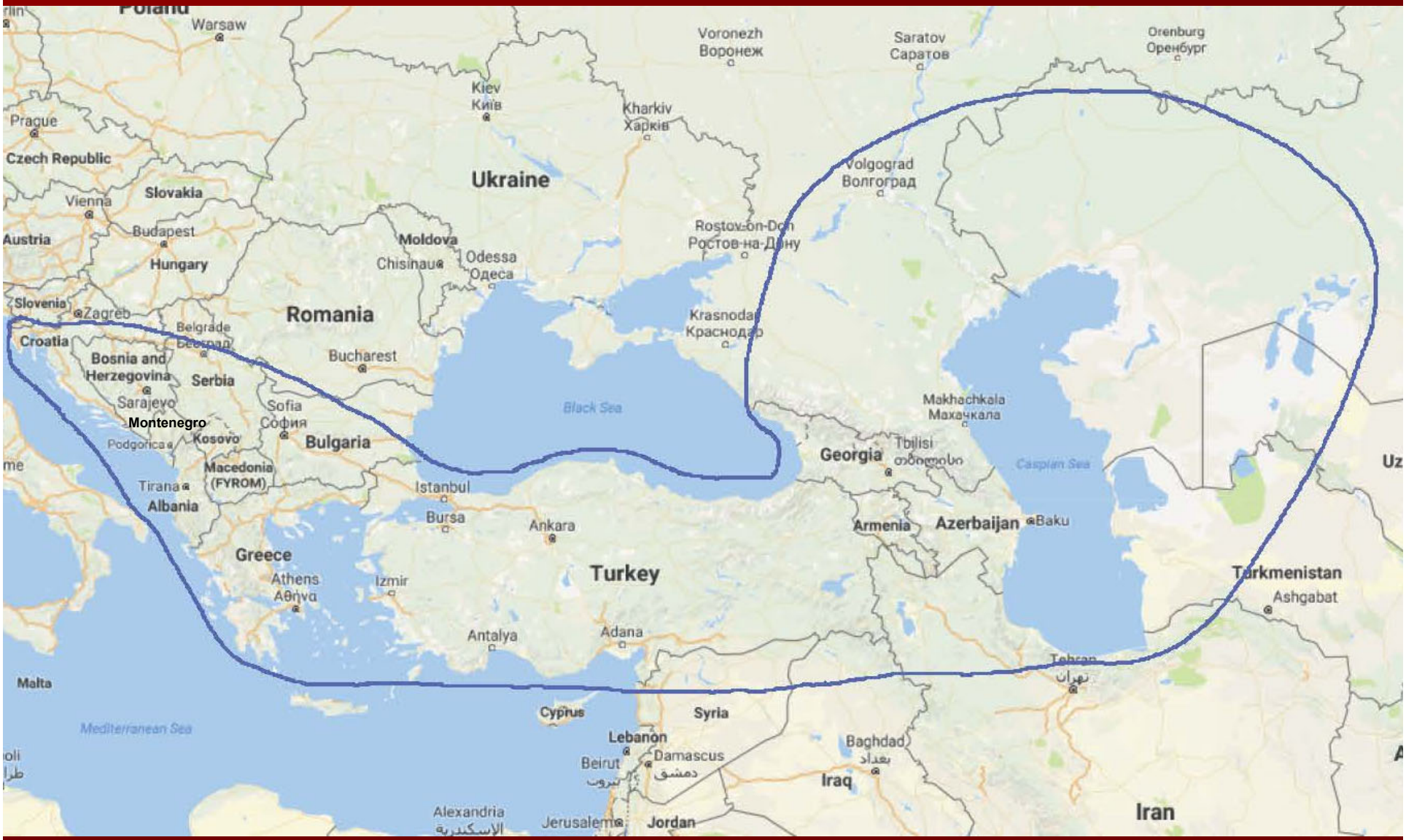
But I am confident there is a parasite already existing in nature that could be this future biocontrol agent

So where have we concentrated on looking to find this parasite…. this control agent?

… and we have found a variety of parasites in zebra and quagga populations… <u>but none with evidence of hyper-virulence</u>

“novel” parasites & “naïve” hosts


Area we have switched to… focusing on possible "novel" parasites from other "cousin" dreissenid species
United Kingdom
Ireland
France
Germany
Poland
Belarus
Ukraine
Romania
Italy
Spain
Portugal
Greece
Turkey
Kazakhstan
Uzbekistan
Turkmenistan
Afghanistan
Iran
Iraq
Georgia
Armenia
Azerbaijan
Bulgaria
Serbia
Hungary
Slovakia
Czech Republic
Austria
Switzerland
Netherlands
Belgium
Denmark
Moldova
Tunisia
Morocco
Malta
Cyprus
Syria
Lebanon
Jordan
Black Sea
Caspian Sea
Mediterranean Sea
Baltic Sea
North Sea


Warsaw
Voronezh
Воронеж
Saratov
Саратов
Orenburg
Оренбург
Kiev
Київ
Kharkiv
Харків
Prague
Czech Republic
Ukraine
Volgograd
Волгоград
Slovakia
Vienna
Austria
Budapest
Hungary
Moldova
Chisinau
Odessa
Одеса
Rostov-on-Don
Ростов-на-Дону
Slovenia
Zagreb
Romania
Krasnodar
Краснодар
Croatia
Belgrade
Bucharest
Bosnia and
Herzegovina
Serbia
Sarajevo
Sofia
София
Black Sea
Makhachkala
Махачкала
Montenegro
Podgorica
Kosovo
Bulgaria
Tbilisi
Georgia
Caspian Sea
Macedonia
(FYROM)
Tirana
Albania
Istanbul
Bursa
Ankara
Armenia
Azerbaijan
Baku
Greece
Athens
Αθήνα
Izmir
Turkey
Turkmenistan
Ashgabat
Antalya
Adana
Malta
Cyprus
Syria
Mediterranean Sea
Lebanon
Beirut
بيروت
Damascus
دمشق
Baghdad
بغداد
Iraq
Iran
Alexandria
الإسكندرية
Jerusalem
Jordan

“cousin” Dreissena spp…….

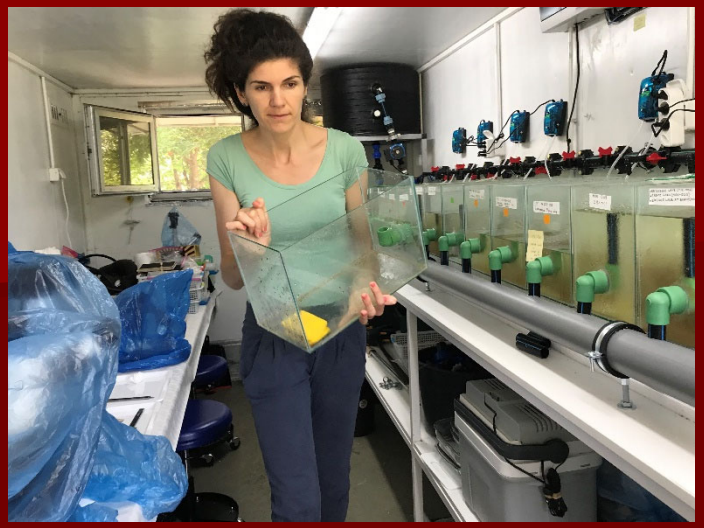
-- the Balkans (e.g., *D. blanci*, *D. carinata*)

-- Turkey (e.g., *D. caputlacus*, *D. anatolica)*

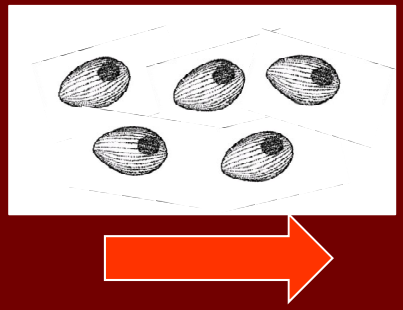
Lake Ohrid

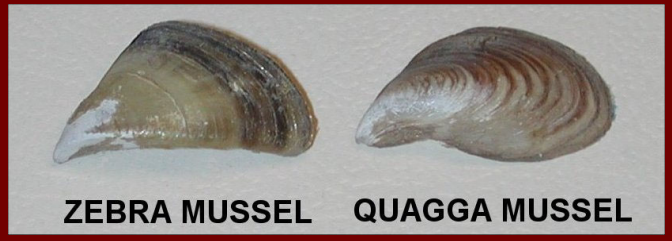
Skadar Lake

There’s only one dreissenid species in these lakes: *D. carinata*



D. carinata





International Team of Collaborating Scientists

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MONTENEGRO
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USA
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USA
Yale Passamaneck

USA
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TAKE HOME MESSAGE

Will there ever be lake-wide biocontrol of dreissenids in North American waterbodies?

Don’t give up on the use of parasites for that purpose, as they can have long-term devastating impacts on naïve host populations.