

# Got Mussels?

## Freshwater Mussel Surveys and Recovery Program



# What kind of mussels are we talking about?

Umm..  
Not  
these!





And not these  
either –  
(Saltwater mussels-  
yummmmmm)



# Freshwater mussels!

- Bivalves (meaning “2 shells”)
- Some species live 80-100 years!
- Not at all good to eat (unlike their delicious, shorter-lived saltwater cousins).
- Provide incredible eco-services:
  - Water filtration (10+ gallons/day per adult mussel in warm seasons)
  - Streambed physical complexity/habitat/bioturbation
  - Increased biodiversity including benefits to marcos

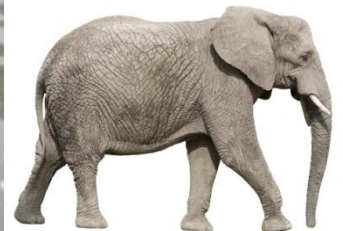
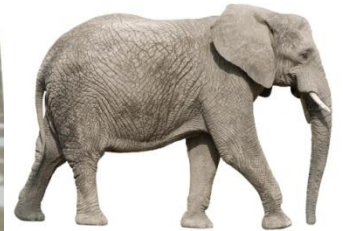
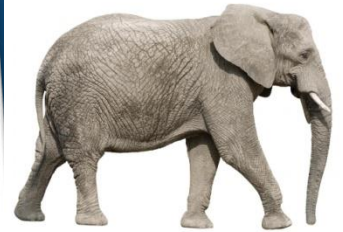
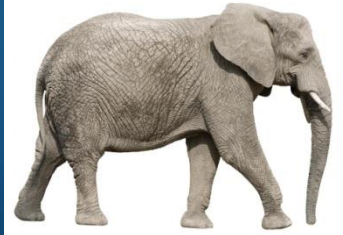




Once commonly found in local creeks, rivers and ponds – you may have stepped on one & didn't even know it!



**A healthy population of freshwater mussels does the work of a small water filtration plant, capable of removing an estimated 26 metric tons of sediment from a 6-mile stream segment in a single summer season.**



It's not hard to see...





...that streams without freshwater mussels are  
at a SERIOUS disadvantage.





# Mussels are in trouble

Patchy, Impaired



*Eastern Elliptio*  
*Elliptio complanata*

Rare



*Creeper*  
*Strophitus undulatus*

Endangered

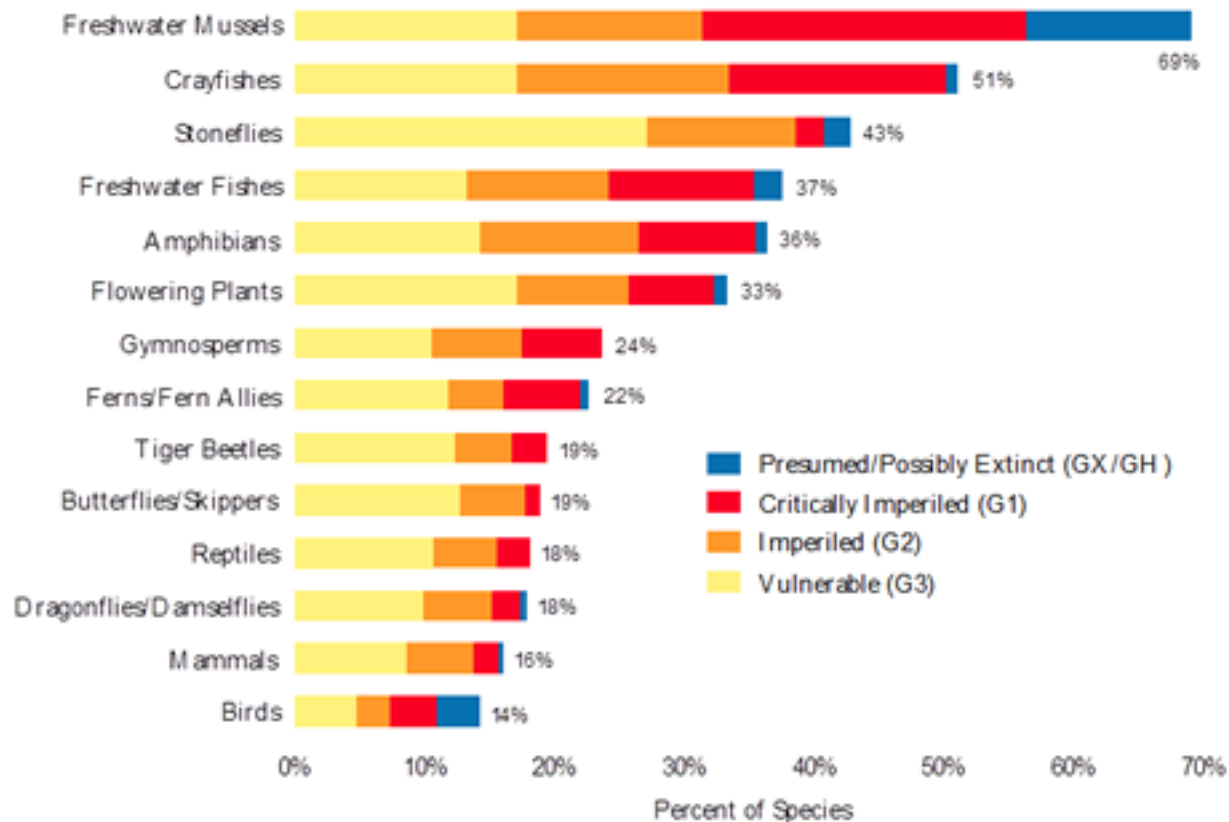


*Dwarf Wedgemussel*  
*Alasmidonta heterodon*

State Conservation Status of Freshwater Mussel Species

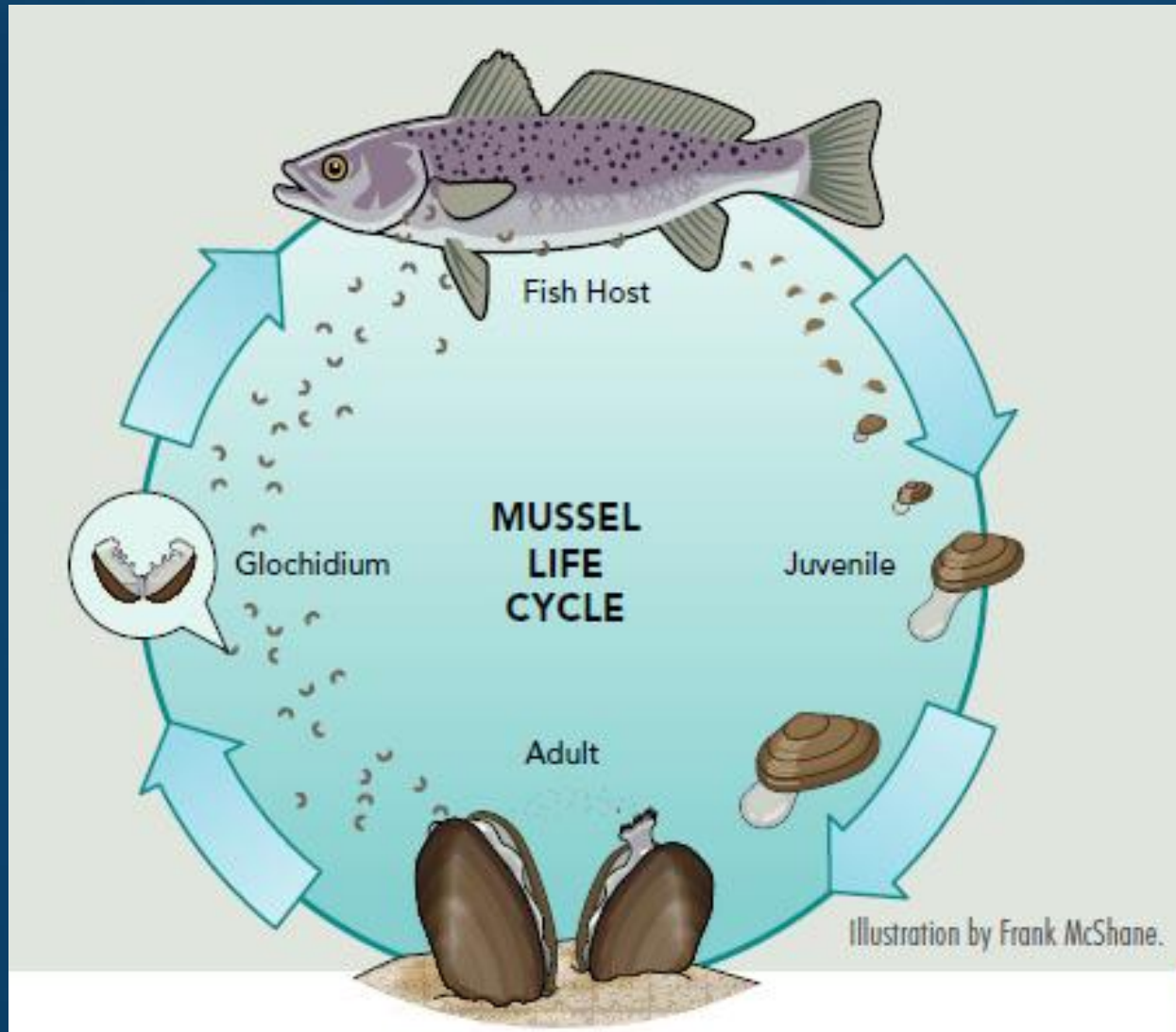
		State Conservation Status		
Scientific Name	Common Name	DE	NJ	PA
<i>Alasmidonta heterodon</i>	Dwarf Wedgemussel	Possibly Extirpated	Endangered	Critically Imperiled
<i>Alasmidonta undulata</i>	Triangle Floater	Possibly Extirpated	Threatened	Vulnerable
<i>Alasmidonta varicosa</i>	Brook Floater	Extirpated	Endangered	Critically Imperiled
<i>Anodonta implicata</i>	Alewife Floater	Critically Imperiled	Secure	Vulnerable
<i>Elliptio complanata</i>	Eastern Elliptio	Secure	Secure	Apparently Secure
<i>Lampsilis cariosa</i>	Yellow Lampmussel	Possibly Extirpated	Threatened	Apparently Secure
<i>Lampsilis radiata</i>	Eastern Lampmussel	Critically Imperiled	Threatened	Critically Imperiled
<i>Lasmigona subviridis</i>	Green Floater	no data	Endangered	Imperiled
<i>Leptodea ochracea</i>	Tidewater Mucket	Critically Imperiled	Threatened	Critically Imperiled
<i>Ligumia nasuta</i>	Eastern Pondmussel	Critically Imperiled	Threatened	Imperiled
<i>Margaritifera margaritifera</i>	Eastern Pearlshell	no data	no data	Critically Imperiled
<i>Pyganodon cataracta</i>	Eastern Floater	Apparently Secure	Secure	Apparently Secure
<i>Strophitus undulatus</i>	Creeper	Critically Imperiled	Special Concern	Secure

## Proportion of species at risk by plant and animal group

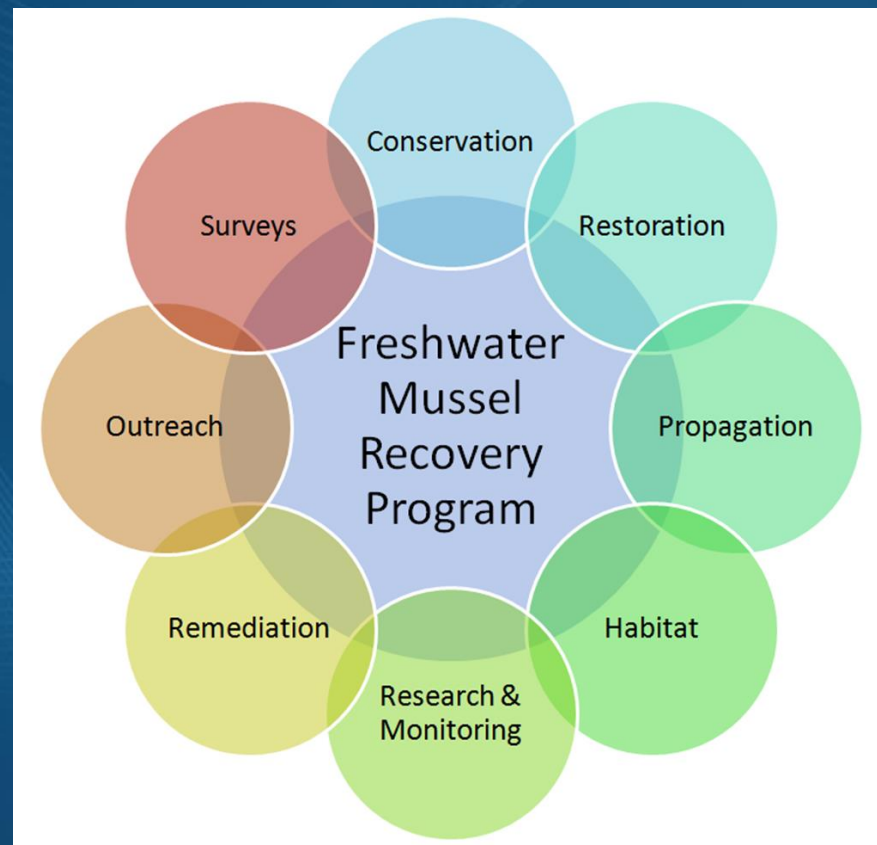




# Reproduction: Interesting and Complex



# Because of the decline in mussel population...





# Surveys

- PDE and Academy of Natural Science staff found 7 native species in the Delaware River in May 2010 –
- Some of which were believed to be extinct in PA (imagine finding a dinosaur!)

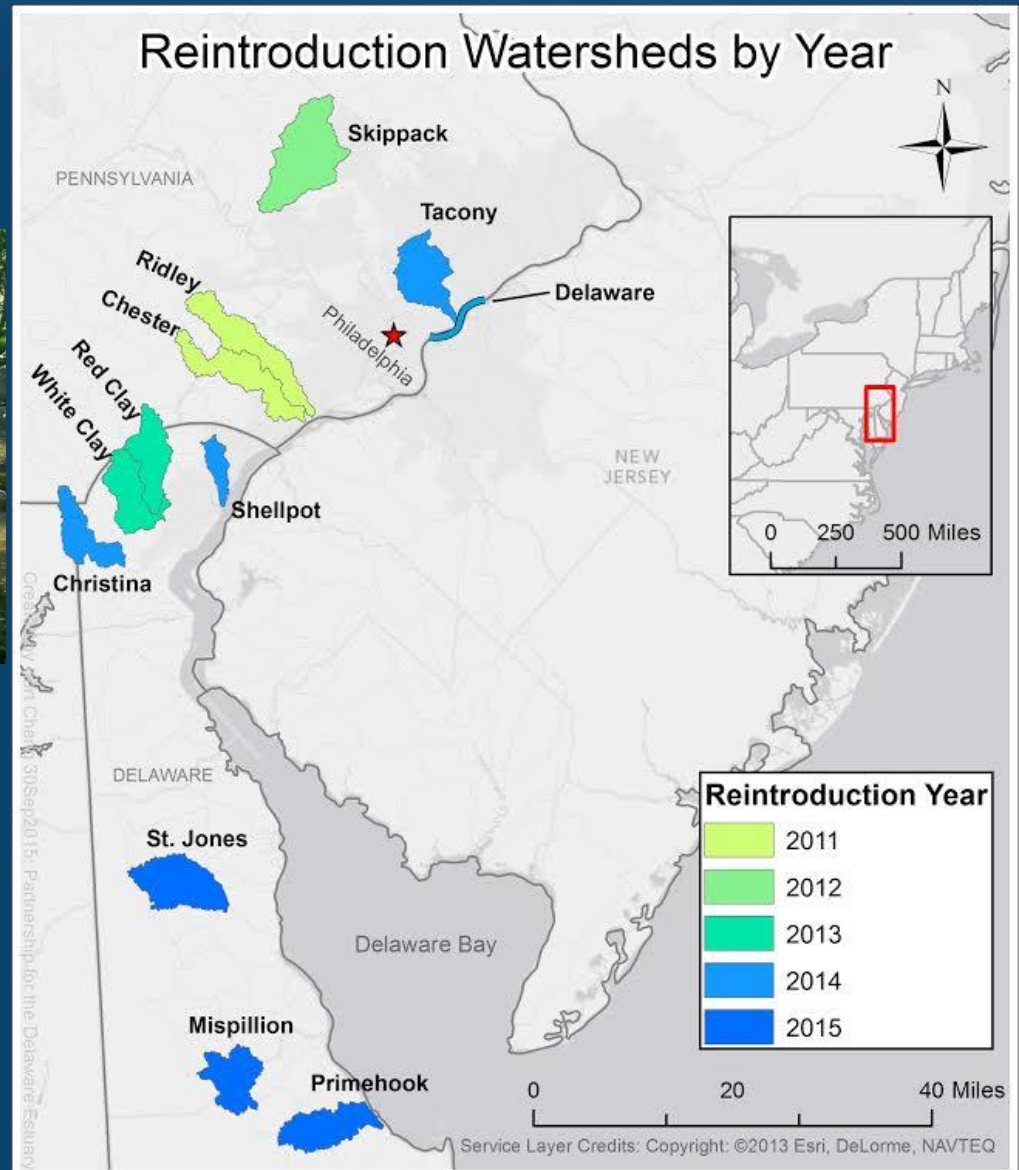
Then we really got excited...



# Conservation and Restoration



Working with DNREC,  
State DEP's to conserve  
mussel populations





# Propagation

Fairmount Water Works: Outreach  
Hatchery

Harrison Lake National Fish Hatchery

Cheyney University

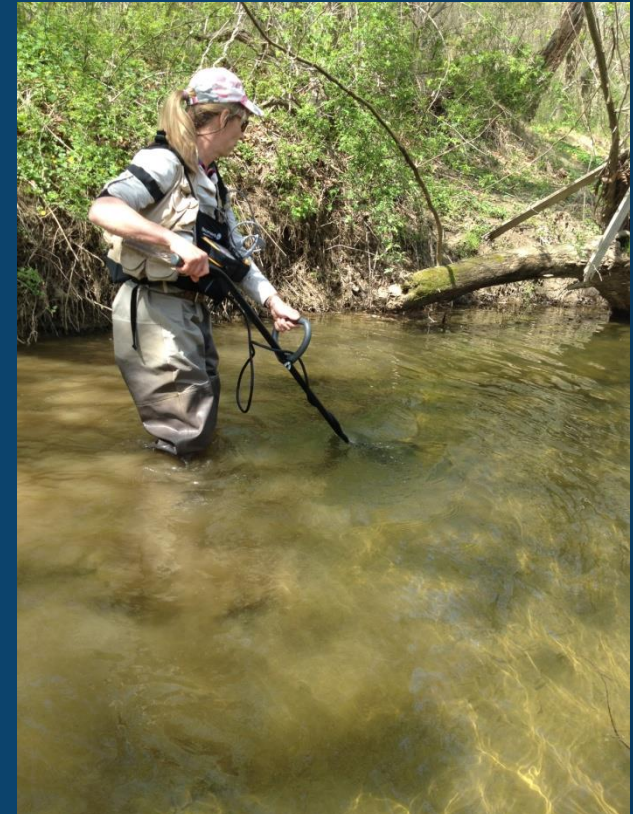


# Habitat

Stream bottom habitat efforts joining shoreline stabilization work to recruit mussels and provide habitat

Stream bottom dynamics and structure

Investigating what is best suited to bivalves





## Bad Mussel Habitat



## Good Mussel Habitat



# Monitoring and Research

## Caging

From streams w/ mussels to streams where mussels absent, health assessed annually

## Physiology

Feeding rates by monitoring particle count 3-100 microns in size, metabolic demands





# Outreach

Enormous  
watershed –  
nearly 6,500  
square miles

Last in-depth  
freshwater  
mussel  
surveying took  
place in 1919.



## Problem(s):

- Too few scientists
- Too few dollars
- Too many stream miles

## Solution:

Show us your mussels...

A call for trained volunteers!!!







### How to Survey Mussels:

1. Download a data sheet from [www.Delawareestuary.org/musselsurvey](http://www.Delawareestuary.org/musselsurvey).
2. Choose a section of creek to survey. Do not trespass on private property. Always walk upstream (against the current), so cloudy water stays behind you.
3. **Fill out Section 1 of the data sheet.** This section is VERY important. If you have a GPS, record a beginning point.
4. Decide what type of search you will do:
 

**Shoreline Search** — Most effective when water levels are low. Walk along the shoreline and look for shells that have washed up or were discarded by predators.

**Wading Survey** — Use polarized sunglasses, or a clear bottomed bucket or plastic container in shallow waters. This method is better than shoreline surveys because you can find live animals more easily.
5. **Look for mussels:** If wading, zig-zag to cover the entire bottom. Mussels may be visible on the stream bottom, or slightly buried in the silt or sand. You may only see a black line, which is the gap between their shells. If you find a mussel, search the area to see if there are any others, since they tend to congregate.

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6. When removing mussels from the streambed to identify and be gentle! Note which end is pointing up out of the sand as you can put it back exactly as you found it (see page 10). **Section 2 of data sheet.**
7. If you have a GPS, record the location. Take 3 pictures of it on a light background (such as the palm of your hand). If you have an empty shell, photograph it inside and out. Record which pic are on the data sheet.
8. Return the mussel to where you found it, in as close to the same place as possible with the hinge and down (see page 10). If you place the mussel on top of sand or mud in slow moving water.
9. Record the number of empty shells and live mussels on your data sheet. For empty shells, note if the shell halves are still connected to each other.
10. When you stop surveying, **fill in Section 3 on the data sheet.** Describe the place that you stopped surveying, and if you have a GPS, record an end location and at least 2 pictures of the end site. Record the length of stream you covered and the amount of time you spent.
11. Go over the data sheet and make sure you have filled in all the information before leaving.
12. Upload information from the data sheet and pictures to [www.delawareestuary.org](http://www.delawareestuary.org) or give it to your coordinating organization. Be sure to submit data sheets for searches that did not turn up any mussels or shells. This helps target streams in need of mussel restoration.



## Freshwater Mussels of the Delaware Estuary



Identification Guide &  
Volunteer Survey Guidebook

## Project Product – The first ever Delaware Estuary Freshwater Mussel Guidebook!

- 24-page, spiral bound, laminated for easy field use
- Created with input from watershed organizations

DOWNLOAD at <http://www.delawareestuary.org/science-and-research/freshwater-mussels/>





**Sometimes we find mussels  
in very unexpected places!**



**Sometimes- LOTS of Elliptios  
(common)**

**Youngest volunteers find the  
MOST! (and squeal the  
loudest)**

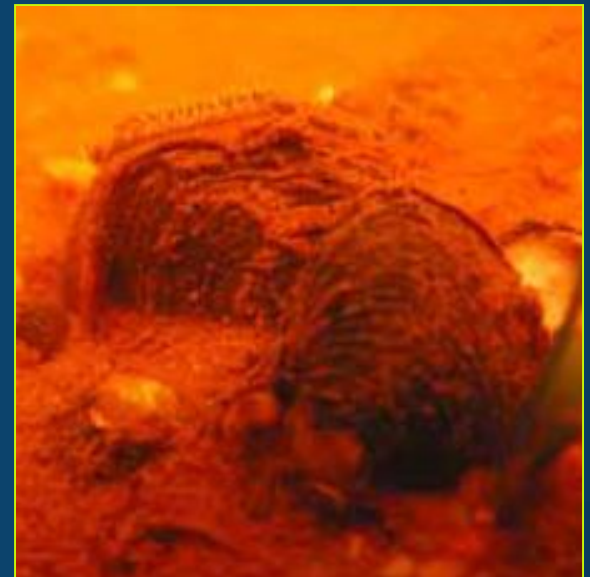




Other places,  
ZERO mussels found  
– but creeks are  
analyzed for future  
reintroduction  
potential.



The mussels we are  
looking for-  
Not always easy to spot!





CAN YOU SPOT THE  
MUSSEL? YOU HAVE 12  
SECONDS!





**How about this one? Hurry!**





# No Mussels???

No worries...  
This information is  
every bit as  
important to us.



✿ No mussels means that perhaps THIS stream can be a future restoration location!

But chances are excellent  
that you will find these...

They are NOT mussels,  
but we will want to know  
where you find them – so  
be sure to list them on  
your field datasheet.

Invasive (non-native)  
freshwater clams – We see a  
lot of these!





# Other things you might find include....





# "TOOLS OF THE TRADE"

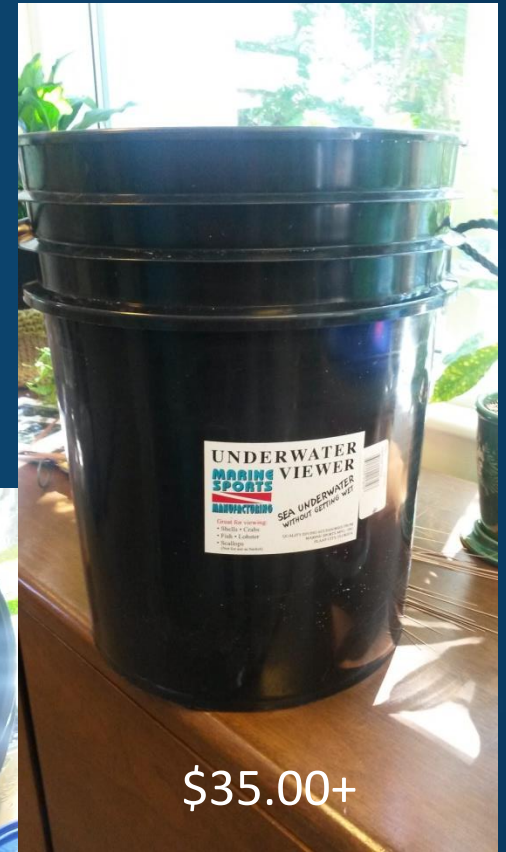


\$100.00 +

BATHYSCOPE



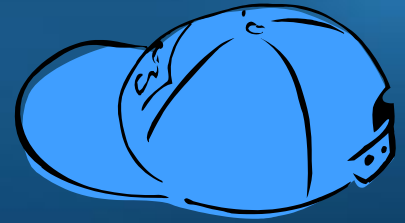
VIEWING BUCKET



\$35.00+

Other important and helpful “tools”:

- Hat with a visor
- Polarized sunglasses
- Gloves and closed toe water shoes
- Towels, sunscreen, bug spray
- Waterproof Camera or phone case
- Clip board and pen for datasheets
- Change of clothes

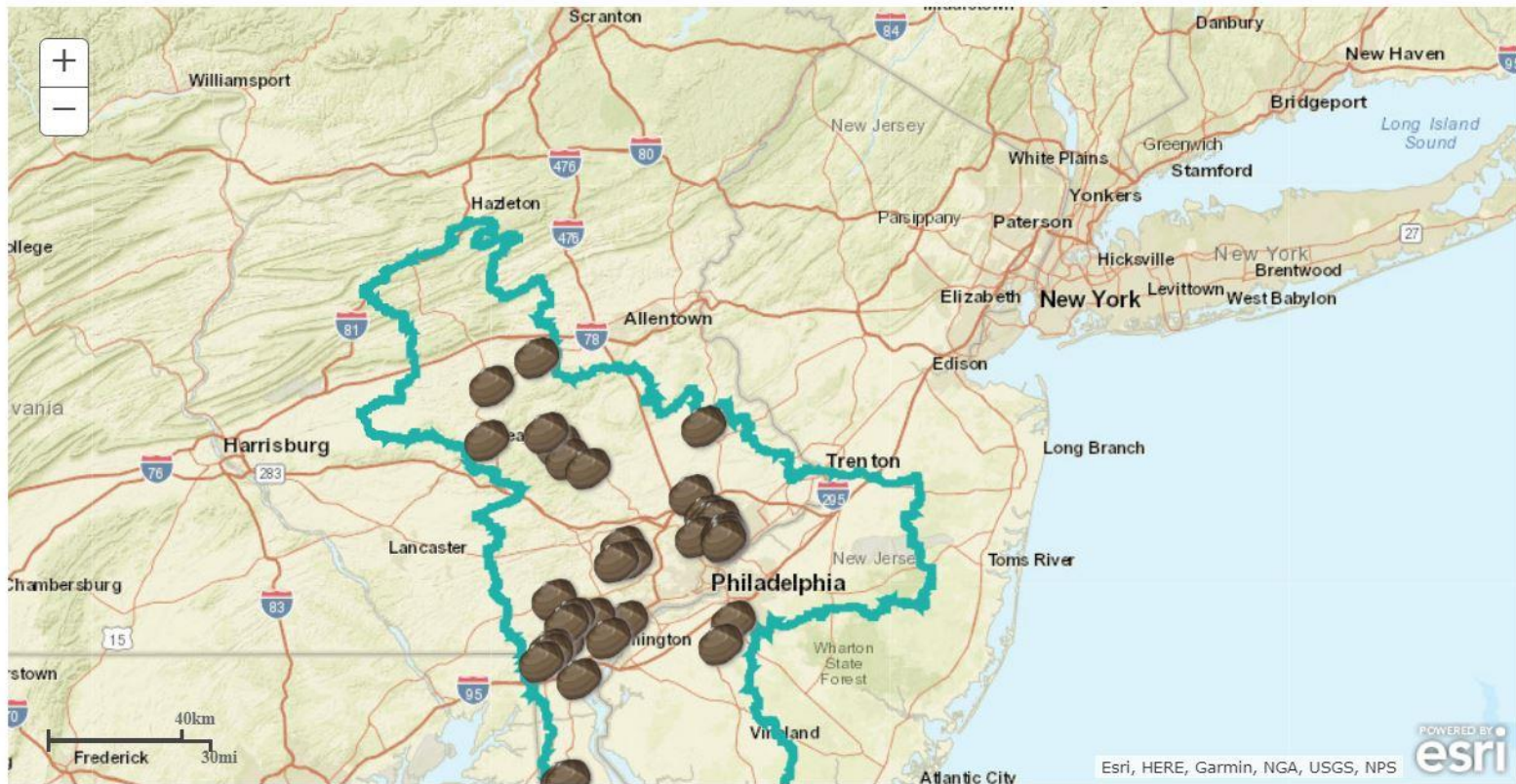




# After this workshop – what's next??

Map: Where have volunteers looked so far?

Mussel icons indicate approximate locations of where mussel surveys were performed, not whether freshwater mussels were found there. For more information about where mussels were found, please contact [kcheng@DelawareEstuary.org](mailto:kcheng@DelawareEstuary.org).



<http://www.delawareestuary.org/science-and-research/freshwater-mussels/>

## Freshwater Mussel Survey Data Sheets



### Section 1: General Information

Please complete 1 data sheet per location and survey day!

Date:	Number of Participants:
Organization(s) (if applicable):	Phone # / E-mail (if we have questions):
Names of Participants:	Air Temperature (°F):
Weather (e.g. sun, clouds, wind):	
Water Condition (clear, cloudy, mix):	Surveying technique used (Check all that apply): <input type="checkbox"/> Shoreline (on bank) <input type="checkbox"/> Wading (in creek) <input type="checkbox"/> Snorkel (underwater)
My/our experience mussel surveying is: <input type="checkbox"/> I'm new at this <input type="checkbox"/> I've done it 2-5 times <input type="checkbox"/> I dream of mussels I do this so often	

TIP: Always go upstream: the creek should be running from in front of you to behind you. This will keep the cloudy water you kick up behind you. If safe and possible, try to spend equal time on both sides of the creek and middle.

### Section 2: Start Location Information

\*Take a picture of the start point, facing upstream\*

Starting time (am/pm):	
Name of Water Body/Creek:	
Description: Are there any nearby landmarks? Please provide names and description to help us find the exact location (e.g. roads, bridges, trails, feeder streams, other):	Longitude:
Location Coordinates (if possible) Latitude:	
Photo name/number that shows start position:	
Notes:	

Freshwater mussel survey data sheet

### Section 3: End Location Information

\*Take a picture of the ending point, facing upstream\*

Ending Time (am/pm):	
Description: Are there any nearby landmarks? Please provide names and description to help us find the exact location (e.g. roads, bridges, trails, feeder streams, other):	Longitude:
Location Coordinates (if possible) Latitude:	
Photo name/number that shows ending position:	

Deepest part surveyed: <input type="checkbox"/> Ankle deep <input type="checkbox"/> Above the hips <input type="checkbox"/> Knee deep <input type="checkbox"/> Stayed out of water	Average depth of surveyed area: <input type="checkbox"/> Ankle deep <input type="checkbox"/> Above the hips <input type="checkbox"/> Knee <input type="checkbox"/> Stay
section(s) of the creek were surveyed? (if that apply) <input type="checkbox"/> Right side <input type="checkbox"/> Middle <input type="checkbox"/> Left side	Describe the slope of the creek: <input type="checkbox"/> Gradual <input type="checkbox"/> Sharp
any fish or other wildlife? if applicable:	Please estimate the length of (in feet):

the creek during the survey?	What was along the section (check all that apply): <input type="checkbox"/> Homes <input type="checkbox"/> Park Or Describe: <input type="checkbox"/> Lawns <input type="checkbox"/> Industry
they engaged in? <input type="checkbox"/> Walking <input type="checkbox"/> Kayaking	

its individual valve, or 2 valves attached at the:	Did you find any non-native clams? (Asian clam, Rangia clam) <input type="checkbox"/> No <input type="checkbox"/> Yes
How were the LIVE mussels spaced in the creek? <input type="checkbox"/> No LIVE mussels found <input type="checkbox"/> Densely clumped <input type="checkbox"/> Patchy and spread out <input type="checkbox"/> Patchy in some areas; Dense in others	

Freshwater mussel survey data sheet

### Section 5: Individual Mussel Specimen Data

If you found any mussel specimens, please record up to 4 of your most interesting

Mussel Specimen #1		
Describe the creek's depth where specimen was found: <input type="checkbox"/> Ankle deep <input type="checkbox"/> Above the hips <input type="checkbox"/> Knee deep <input type="checkbox"/> Stayed out of water	Describe the creek's bottom (check all that apply): <input type="checkbox"/> Mud <input type="checkbox"/> Pebbles <input type="checkbox"/> Silt <input type="checkbox"/> Rocks <input type="checkbox"/> Sand <input type="checkbox"/> Boulders	Where was the specimen found? <input type="checkbox"/> Bank (out of water) <input type="checkbox"/> Middle of creek <input type="checkbox"/> Sides of creek
Describe the exterior color of the shell (check all that apply): <input type="checkbox"/> Green/Olive <input type="checkbox"/> Brown <input type="checkbox"/> Nacre/Pearl exposed <input type="checkbox"/> Yellow <input type="checkbox"/> Red <input type="checkbox"/> Tan <input type="checkbox"/> Black	What mussel species can the shell possibly be from? (Check all that apply): (The mussel field guide can help with identification!) <input type="checkbox"/> Brook Floater <input type="checkbox"/> Eastern Pondmussel <input type="checkbox"/> Eastern Floater <input type="checkbox"/> Yellow Lamproshell <input type="checkbox"/> Tidewater Mucket	Describe the shape of the shell: <input type="checkbox"/> Elongate <input type="checkbox"/> Ovale <input type="checkbox"/> Broken shell <input type="checkbox"/> Subovate
Location Coordinates (if possible) Latitude:	Longitude:	
Picture of shell(s) found? <input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, photo file name/number:	
Notes:		

Mussel Specimen #2		
Describe the creek's depth where specimen was found: <input type="checkbox"/> Ankle deep <input type="checkbox"/> Above the hips <input type="checkbox"/> Knee deep <input type="checkbox"/> Stayed out of water	Describe the creek's bottom (check all that apply): <input type="checkbox"/> Mud <input type="checkbox"/> Pebbles <input type="checkbox"/> Silt <input type="checkbox"/> Rocks <input type="checkbox"/> Sand <input type="checkbox"/> Boulders	Where was the specimen found? <input type="checkbox"/> Bank (out of water) <input type="checkbox"/> Middle of creek <input type="checkbox"/> Sides of creek
Describe the exterior color of the shell (check all that apply): <input type="checkbox"/> Green/Olive <input type="checkbox"/> Brown <input type="checkbox"/> Nacre/Pearl exposed <input type="checkbox"/> Yellow <input type="checkbox"/> Red <input type="checkbox"/> Tan <input type="checkbox"/> Black	What mussel species can the shell possibly be from? (Check all that apply): (The mussel field guide can help with identification!) <input type="checkbox"/> Brook Floater <input type="checkbox"/> Eastern Pondmussel <input type="checkbox"/> Eastern Floater <input type="checkbox"/> Yellow Lamproshell <input type="checkbox"/> Tidewater Mucket	Describe the shape of the shell: <input type="checkbox"/> Elongate <input type="checkbox"/> Ovale <input type="checkbox"/> Broken shell <input type="checkbox"/> Subovate
Location Coordinates (if possible) Latitude:	Longitude:	
Picture of shell(s) found? <input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, photo file name/number:	
Notes:		

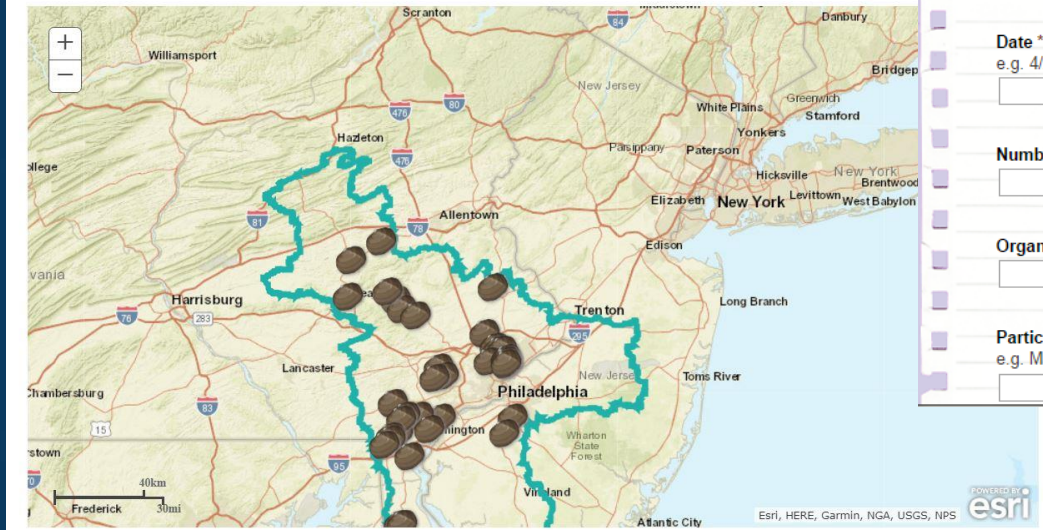
Freshwater mussel survey data sheet



## Downloadable data sheets & web portal to upload survey findings.

Map: Where have volunteers looked so far?

Mussel icons indicate approximate locations of where mussel surveys were performed, not whether freshwater mussels were found there. For more information about where mussels were found, please contact [kcheng@DelawareEstuary.org](mailto:kcheng@DelawareEstuary.org)



### Freshwater Mussels - Data Portal

Enter your data to help PDE scientists identify where freshwater mussels can and cannot be found in the Delaware Estuary. Your information will be used to identify important mussel populations or areas to target future mussel restoration projects.

Entering your data will take about 10 minutes. There are 4 pages to this form with some \*required fields. Before you SUBMIT on the last page, you can go BACK to edit previous pages. Make sure you press SUBMIT once you have entered all information.

Please, email your photos to [PCole@DelawareEstuary.org](mailto:PCole@DelawareEstuary.org).

\* Required

#### Section 1: General Information

Complete one data sheet per location

Date \*

e.g. 4/21/2012

Number of Participants \*

Organization

Participants

e.g. Mary Smith, Ed Harris

<http://delawareestuary.org/mussel-survey-program>

# Next Steps

- Get other watershed organizations involved, seek grant funds to train new volunteer groups
- Continue to analyze data – both volunteer and scientific.
- Plan for the mussel hatchery
- Determine best streams for restoration of freshwater mussel species.
- Reintroduce native mussels to their native waters.





## Volunteer Mussel Surveying Safety Reminders!

- Any activity that takes place in or near water should never be done alone. Mussel surveying should be done in groups of at least two or more people.
- Do not go into the stream if you cannot swim.
- Avoid contact with water that has unsafe levels of bacteria or other pollutants.
- Never go into a stream that is flooded or moving rapidly, especially after rain or snow melt. Be aware that water currents can be powerful even in normal conditions.
- Other hazards are poison ivy, briars, rocks, sharp objects such as broken glass, and deep mud. Always wear protective shoes and gloves.
- Be respectful of all wildlife in the area, and do not harm or collect live mussels.
- Do not trespass on private property.





Partnership for the  
**DELAWARE  
ESTUARY**

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*Connecting people, science, and nature  
for a healthy Delaware River and Bay*

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