Salt Marsh Science

Field Guide and Data Book

Name : _____

Team: _____

Location: _____

Date: _____

Name _____ **Date** _____

Directions: Find the answers to the following questions while watching the video:
Restoring Our Wetlands - Healing Our Watersheds

1. What are 3 ways salt marshes are important to people and wildlife?

2. What are three threats to salt marshes?

3. What are things people can do to help protect and restore salt marshes?

4. What activities have you done in or near salt marshes?

5. Explain three reasons why you think the salt marsh in your town is safe or threatened.

Field Trip 1: Exploration
Salt Marsh Colors

Directions: Using colored pencils or crayons, draw the natural features of the area, capturing the different shades of color of the salt marsh. Add as much detail as possible: focusing on the different colors, rather than on every blade of grass. (Suggested time: 10-15 minutes)

Marsh Mapping: (Trip 1)

Directions: Record the following on your map:

Natural features:	**Human Impact:**
-Different Vegetation types.	-Houses, roads, parking lots
-Wildlife.	-Ditches, Culverts (Pipes)
-Water	-Litter

Create a key on your map to indicate what the symbols you are using mean.

Is this a Tidal Restriction?

Mass Audubon Scientists are studying marshes where there are tidal restrictions. Where the tide has been restricted, *Phragmites* often grows. If you discover a tidal restriction, you have found one clue explaining the growth of *Phragmites.*

Measure or estimate and record the channel width and the crossing width .
Channel Width Upstream _____ Downstream _____
Pipe or culvert width upstream _____ Downstream _____

Observe and record using the following Restriction Classification Scheme.

Classification	Channel Vs. Culvert Opening	Upstream	Downstream
1	River Width < Opening Width	**1**	**1**
2	River Width = Opening Width	**2**	**2**
3	River Width 1 to 2 x Opening Width	**3**	**3**
4	River Width 2.1 to 5 x Opening Width	**4**	**4**
5	River Width over 5x Opening Width	**5**	**5**
Classification	**Evidence of Flow Restriction/Erosion**		
1	Unrestricted/no pooling	**1**	**1**
2	Flow detained/slight erosion	**2**	**2**
3	Minor pooling/ erosion present	**3**	**3**
4	Significant pooling/significant erosion present	**4**	**4**
5	Major pooling/major erosion present	**5**	**5**

Definitions:

Erosion: Is the wearing away of sediments. (If tidal flow is restricted by a culvert, the speed of the water can increase as it goes through the culvert. This can increase erosion, as the water comes through with great force, wearing away the banks.)

Pooling: A pool of water is standing water (as opposed to flowing water in a river.) Pooling occurs when a pipe is too small. The water stands still, unable to flow through.

	Vegetation Comparison		
1	Upstream = Downstream	**1**	**1**
2	Upstream slightly different than downstream	**2**	**2**
3	Upstream different than downstream	**3**	**3**
4	Upstream much different than downstream	**4**	**4**
5	Upstream completely different than downstream	**5**	**5**

Vegetation Comparison: When the tidal range is reduced, the upstream habitat may no longer be dominated by salt marsh grasses, but instead may contain less salt tolerant species such as Common Reed (*Phragmites australis*) or freshwater species such as cattails (Typha sp.) In extreme cases, the habitat may evolve into shrub or forested swamp, and the former wetland may be invaded by upland species.

Notes:

Salt Marsh Observations:

Record your observations of the following feel free to make comparisons:

COLORS:

TEXTURES:

SHAPES:

SMELLS:

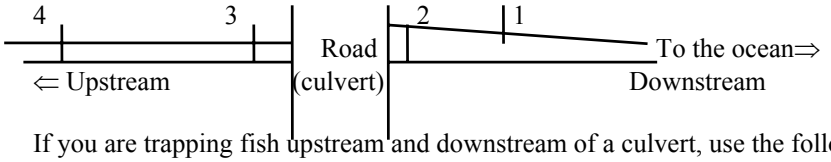
SOUNDS:

FEELINGS: (How does it feel to your feet, your skin, your emotions etc.)

FISH DATA SHEET

Location: _____Date _____ Tide: Spring Neap

Mass Audubon is studying to see if the size and species of fish differ upstream and downstream of a tidal restriction (an area where a small culvert prevents full tidal flow.)



If you are trapping fish upstream and downstream of a culvert, use the following labeling system:

1. Furthest downstream (closest to the ocean) 2. Downstream of a culvert
3. First trap upstream of a culvert 4. Furthest upstream of a culvert (Furthest away from the ocean.)

Predict: A. Will there be more fish upstream or downstream?

B. Will there be more kinds of species upstream or downstream?

C. Where will fish be bigger? Upstream or downstream?

Explain your answers._____

_____

_____

Time trap set	Time Trap Pulled	Total Time	Fish trap #	What species are present?	How many of each	Total volume of each species	Average volume of one fish. (ml)
				Downstream			
Biggest	Mummichog		Trap 1				
Smallest	Mummichog						
Set	Pulled	Total					
			Trap 2				
Biggest	Mummichog						
Smallest	Mummichog						
Set	Pulled	Total		**Upstream**			
			Trap 3				
Biggest	Mummichog						
Smallest	Mummichog						
Set	Pulled	Total					
			Trap 4				
Biggest	Mummichog						
Smallest	Mummichog						

Follow-up Compile your data and do these additional computations:

A. Find the total number of each species upstream vs downstream.

B. Where is there greater biodiversity? upstream or downstream?

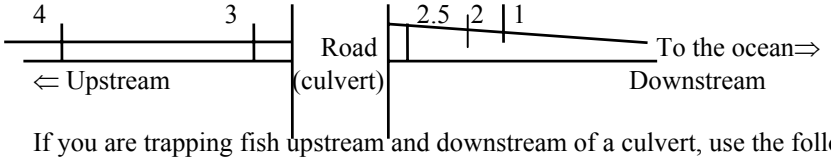
C. Find the average volume of mummichogs upstream vs. Downstream.

D. In the classroom, graph your results.

FISH DATA SHEET – JOPPA FLATS

Location: _____Date _____ Tide: Spring Neap

Mass Audubon is studying to see if the size and species of fish differ upstream and downstream of a tidal restriction (an area where a small culvert prevents full tidal flow.)



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1. Furthest downstream (closest to the ocean) 2. Downstream of a culvert
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Predict: A. Will there be more fish upstream or downstream?

B. Will there be more kinds of species upstream or downstream?

C. Where will fish be bigger? Upstream or downstream?

Explain your answers._____

_____

_____

Time trap set	Time Trap Pulled	Total Time	Fish trap #	What species are present?	How many of each	Total volume of each species	Average volume of one fish. (ml)
				Downstream			
Biggest	Mummichog		Trap 1				
Smallest	Mummichog						
Set	Pulled	Total					
			Trap 2				
Biggest	Mummichog						
Smallest	Mummichog						
Set	Pulled	Total	Trap 2.5				
Biggest	Mummichog						
Smallest	Mummichog						
Set	Pulled	Total		**Upstream**			
			Trap 3				
Biggest	Mummichog						
Smallest	Mummichog						
				Salt Pannes (Downstream)			
Set	Pulled	Total		**Boomerang**			
Biggest	Mummichog						
Smallest	Mummichog						
Set	Pulled	Total		**Doughnut Hole**			
Biggest	Mummichog						
Smallest	Mummichog						

Follow-up Compile your data and do these additional computations:

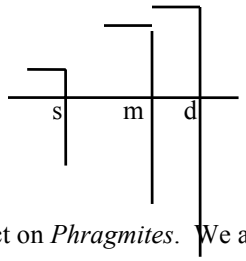
A. Find the total number of each species upstream vs downstream.

B. Where is there greater biodiversity? upstream or downstream?

C. Find the average volume of mummichogs upstream vs. Downstream.

D. In the classroom, graph your results.

SALINITY FIELD DATA SHEET



Shallow=5-20 cm
Medium=35-50 cm
Deep=65-80 cm

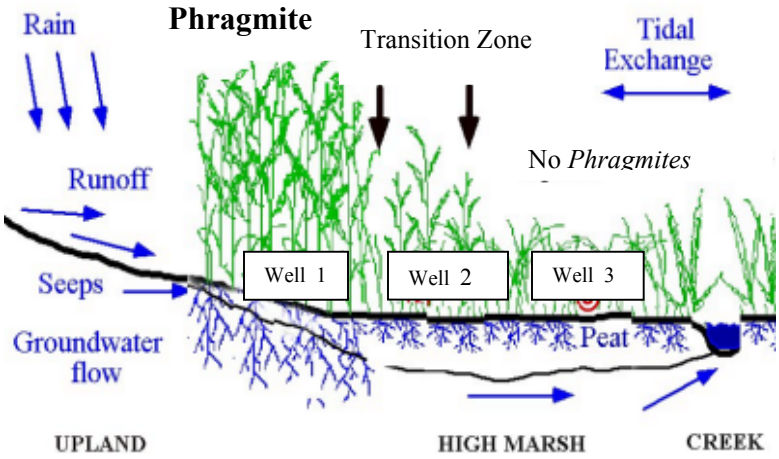
Date _____
Location: _____
Excel file name: ____well.xls

We do not know if shallow, medium, or deep water has the most impact on *Phragmites*. We are measuring salinities at different depths, and locations to see what impact it is having on the plant life.

1. Make predictions: Circle where do you think salinity will be greatest?
Shallow Medium Deep
Explain your prediction.

_____

_____



2. Wells are located at 3 different locations. (See Diagram.) Where do you think the greatest salinity levels will be found? (Circle one)

1. In the *Phragmites* 2. In the transition zone 3. In the salt marsh grasses, with no *Phragmites*

3. Explain your predictions: Why do you think so?

_____

4. Measure salinity. Be sure to double check you are reading it accurately. Have members in your group double-check your answer.

Salinity:

Well	**Transect 1**		**Transect 2**
Well 1.1 (in *Phragmites*)	Shallow _____ Medium _____ Deep _____ Notes:	Well 1.2	Shallow _____ Medium _____ Deep _____ Notes:
Well 2.1 (transition)	Shallow _____ Medium _____ Deep _____ Notes:	2.2	Shallow _____ Medium _____ Deep _____ Notes:
Well 3.1 (No *Phragmites*)	Shallow _____ Medium _____ Deep _____ Notes:	3.2	Shallow _____ Medium _____ Deep _____ Notes:
Well 5.1 (No *Phragmites*)	Shallow _____ Medium _____ Deep _____ Notes:		
Well	**Transect 3**		
1.3	Shallow ____ Medium ____ Deep _____ Notes:		
2.3	Shallow ____ Medium ____ Deep _____ Notes:		
3.3	Shallow ____ Medium ____ Deep _____ Notes:		

Salinity: Background information.

Salinity is how salty the water is. The saltier the water is, the higher the salinity. Most refractometers measure salinity in parts per thousand. Something that is 20 grams salt out of a total 1000 ml of water is written 20 $^{0}/_{00}$. We think that *Phragmites* has difficulty growing in high salinities (greater than 20 $^{0}/_{00}$) (20 $^{0}/_{00}$ is the same as 2 %.)

Common Plants of the Salt Marsh Identification Key

By Elizabeth Duff 1997

Please note: not all salt marsh plants are included in this key.
You may want to adapt this key, as you find additional species on your site

1a Plant has long grasslike leaves. (Leaves grow straight to a point.) 8

1b Leaves are not straight and grasslike, or plant does not have a recognizable leaf.....2

2a Plant is fleshy. (If you squeeze a leaf or segment, your fingers get wet from the stuff inside) 3

2b Plant is not fleshy. 4

3a Plant does not have an obvious leaf.....Common Glasswort (*Salicornia europea*)

3b Plant has numerous small leaves.....Sea blite (*Suaeda*)

4a Plant has a twig-like brown stem, and is a small shrub.....Marsh Elder (*Iva frutescens*)

4b Plant does not have a woody stem.....5

5a Leaves are triangular..... Orach (*Atriplex*)

5b Leaves are not triangular.....6

6a Plant grows straight with leaves growing along stem.....7

6b Leaves grow at the base of the plant. The top branches and grows many tiny lavender flowers.....Sea Lavender (*Limonium carolinianum*)

7a Plant grows single stem. Leaf is narrow, then widens, then narrows again to a rounded point. Plant grows golden yellow flowers in the fall. .....Seaside goldenrod .....(*Solidago sempervirens*)

7b Stems are single or forked. Leaf is straight and narrow, tapering to a point. Plant grows purple daisy-shaped flowers in the fall .... Aster (*Aster*)

8a Plant stem is triangular. The plant grows flowers that resemble miniature pine cones. .....Saltmarsh Bulrush (*Scripus*)

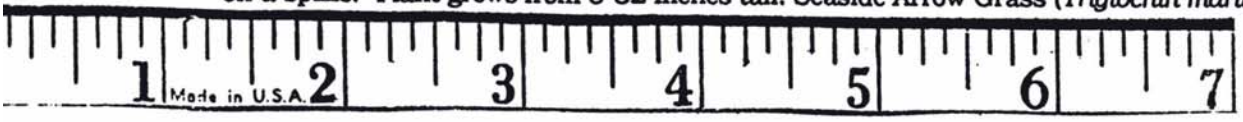
8b Stem is not triangular.....9

9a Leaves grow only from the base of the plant. 10

9b Leaves grow along the stem.....11

10a Leaf grows ¼ to ½ inch wide, and up to 6 feet high. Plant grows brown spikes at the top.....Narrow leaved cattail (*Typha angustifolia*)

10b Plant leaf is less than ¼ inch wide, and grows numerous small greenish flowers on a spike. Plant grows from 8-32 inches tall. Seaside Arrow Grass (*Triglochin maritimum*)



11a Plant has numerous leaves growing all the way up the stem.....12

* 11b Plant has few leaves (4 or less) and/or leaves grow only part way up the stem.....13

*Please note: Salt marsh hay may have more than 4 leaves, but the leaves are widely spaced.

12a Plant leaf is wide, greater than ½ inch. Stem is round and hollow. Plant grows a large silky plume at the top. Plant can be 6 ½- 14 feet high... Phragmites (*Phragmites australis*)

12b Plant leaf is narrow. (Less than 1/8 inch.) Plant has many leaves growing in two directions, like a lot of V's on the stem. Leaves are light green, and can be flattened out. ..... Spikegrass (*Distichlis spicata*)

12c Plant leaf is about ¼- ½ inch wide. Plant grows 1-8 feet high. Plant grows tall close to water. Leaves are dark green or yellowish green Leaves feel rough. Plant flower and seeds grow hugging the center of the plant. Saltmarsh cordgrass (*Spartina alterniflora*)

13a Plant stem is, solid, and round. Flower/seed pods are round, and form from the side of the stem, rather than at the very end. .....Black Grass (*Juncus gerardi*)

13b Live plant stem is generally green and jointed. Plant flower and seeds grow on the very end of the stem..... 14

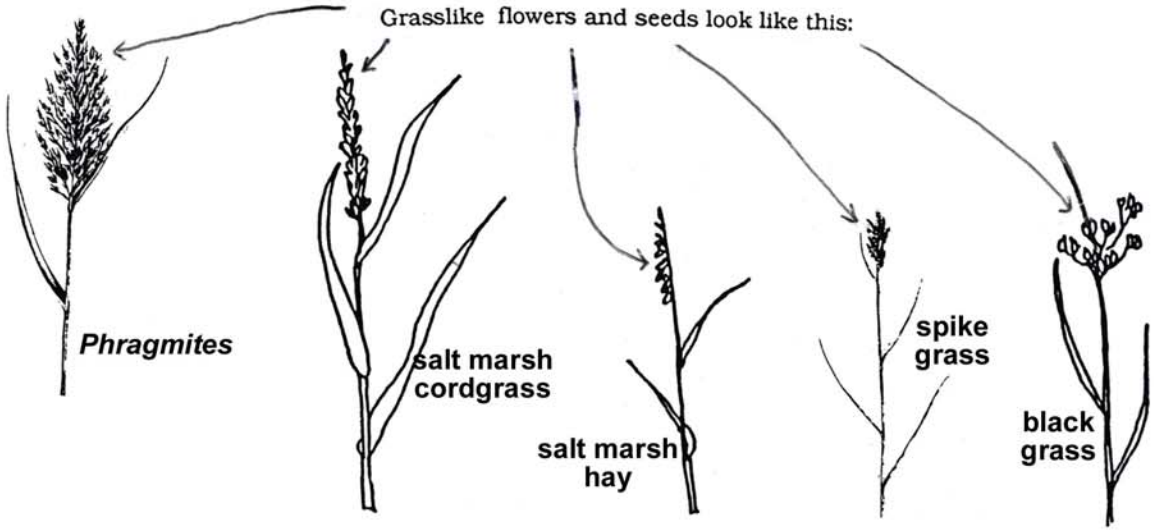
14a Plant leaf is about ¼- ½ inch wide. Plant grows 1-8 feet high. Plant grows tall close to water. Leaves are dark green or yellowish green Leaves feel rough. Plant flower and seeds grow hugging the center of the plant. Saltmarsh cordgrass (*Spartina alterniflora*)

12b Leaf is extremely skinny (It looks like it might fit through a needle eye.) Its sides curve inward. Plant flower and seeds grow on one side of a stalk, (like the teeth on a comb.)

..... Salt Marsh Hay, also known as ..Saltmeadow cordgrass (*Spartina patens*)

Additional saltmarsh/brackish water plants not included in this key are: Purple loosestrife, marsh fern, silverweed, amaranth, and numerous upland grasses, and upland species.

Grasslike flowers and seeds look like this:



FIELD DATA SHEET For VEGETATION TRANSECT

LOCATION _____ Date _____ Teacher _____

Directions:

1. On your data sheet, circle the meter assigned to you. Record all of your data in that row.
2. Find your meter.
3. Look directly below the meter tape for plants.
4. Notice how many different plants are on your meter.
5. Identify each different kind of plant, using the identification key, pictures, or field guide.
6. If you have a question, ask!
7. Record on the sheet P for present in the row your meter is , when a plant is present.
8. If an "other" plant is present, record the name of the plant at the top of the column and mark P for present.
9. Measure the two tallest plants on your meter, record the type, and height in cm.
10. Give your group leader your data.

We are particularly interested in the height of the following plants: *Phragmites*, purple loosestrife, cattail and salt marsh cordgrass. Please record the height of the tallest of these species on your transect.

Distance	Height of tallest *Phragmites on each meter.*	Phragmites (*Phragmites australis*)	Saltmarsh cordgrass (*Spartina alterniflora)*	Saltmarsh Hay (*Spartina patens*)	spike grass (*Distichlis spicata*)	other	other	other	other	other	other
along line											
0 to 1											
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FIELD DATA SHEET For VEGETATION TRANSECT TEACHER VERSION

LOCATION _____ Date _____ Teacher _____

Directions:

1. On your data sheet, circle the meter assigned to you. Record all of your data in that row.
2. Find your meter.
3. Look directly below the meter tape for plants.
4. Notice how many different plants are on your meter.
5. Identify each different kind of plant, using the identification key, pictures, or field guide.
6. If you have a question, ask!
7. Record on the sheet P for present in the row your meter is , when a plant is present.
8. If an "other" plant is present, record the name of the plant at the top of the column,
   a. and mark P for present.
9. Measure the two tallest plants on your meter, record the type, and height in cm.
10. Give your group leader your data.

We are particularly interested in the height of the following plants: *Phragmites*, purple loosestrife, cattail and salt marsh cordgrass. Please record the height of the tallest of these species on your transect.

Distance	Height of tallest *Phragmites on each meter.*		Phragmites (*Phragmites australis*)		Saltmarsh cordgrass (*Spartina alterniflora)*		Saltmarsh Hay (*Spartina patens*)		spike grass (*Distichlis spicata*)		other		other		other		other		other		other	
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If you are collecting data on more than one day, copy student's data into one column on one day, and the other column on the next, so you can compare. On the second day (or later) have student double-check any discrepancies.

Sample Sheet Filled in: FIELD DATA SHEET For VEGETATION TRANSECT

LOCATION _____ Date _____ Teacher _____

Directions:

1. On your data sheet, circle the meter assigned to you. Record all of your data in that row.
2. Find your meter.
3. Look directly below the meter tape for plants.
4. Notice how many different plants are on your meter.
5. Identify each different kind of plant, using the identification key, pictures, or field guide.
6. If you have a question, ask!
7. Record on the sheet P for present in the row your meter is , when a plant is present.
8. If an "other" plant is present, record the name of the plant at the top of the column and mark P for present.
9. Measure the two tallest plants on your meter, record the type, and height in cm.
10. Give your group leader your data.

We are particularly interested in the height of the following plants: *Phragmites*, purple loosestrife, cattail and salt marsh cordgrass. Please record the height of the tallest of these species on your transect.

Distance along line	Height of tallest *Phragmites on each meter.*	Phragmites (*Phragmites australis*)	Saltmarsh cordgrass (*Spartina alterniflora)*	Saltmarsh Hay (*Spartina patens*)	spike grass (*Distichlis spicata*)	Other Black grass	other Glass-wort	other Purple Loose-strife	other Sea Lav-ender	other	other
0 to 1	250	P						P 167			
1 to 2	244	P						P 165			
2 to 3	256	P						P 164			
3 to 4	225	P									
4 to 5	225	P									
5 to 6	220	P									
6 to 7	213	P		P							
7 to 8	200	P		P			P				
8 to 9				P			P				
9 to 10	175	P		P							
10 to 11				P							
11 to 12				P					P		
12 to 13				P		P					
13 to 14				P		P					
14 to 15				P		P					
15 to 16				P							
16 to 17				P		P			P		
17 to 18				P		P					
18 to 19			P 33	P		P	P				
19 to 20			P 34	P			P				
20 to 21			P 35	P							
21 to 22			P 37	P							
22 to 23			P 38	P							
23 to 24			P 38	P							
24 to 25			P 39	P							

FIELD DATA SHEET For VEGETATION TRANSECT: Brackish Marsh

LOCATION _____ Date _____ Teacher _____

Questions: Is *Phragmites* spreading? Is the area that is a monoculture (where only *Phragmites* is growing) spreading? How fast? Is it growing tall and healthy or short and stunted? Did restoration efforts help?
Compare your data to past years to notice.
Directions:

1. Observe your plant sample closely. Be sure you know recognize the traits that are unique to your plant. Note how it looks both when in blossom (or with seed head) and without.
2. Look along the transect for your plant. If you do not see it immediately in a meter, pull aside other plants or wrack to look more closely. If you are in doubt ask for help!
3. Record a "P" in every meter that you find it.
4. Report your findings to your group leader. Make sure they record your data accurately.
5. If you are doing Phragmites, Make sure you measure the height in centimeters.
6. If you are doing some other plant, and it is the tallest plant on some meters, measure it's height too.
7. If you have extra time, do another plant.

Distance along line	Ht. of tallest *Phragmites* (in cm.) (Star which plant is tallest.)	Phragmites (*Phragmites australis*)	Cattail *(Typha angustifolia)* **Please record Height.**	Creeping Bent Grass *(Agristus stolinifera)*	Golden-rod *(Solidago sempervirens*)	Silver-weed (Potentila anserina)	Salt marsh Bulrush	Salt-marsh sedge	Salt-marsh Cord-grass (*Spartia alerniflora*)	other	other
0 to 1											
1 to 2											
2 to 3											
3 to 4											
4 to 5											
5 to 6											
6 to 7											
7 to 8											
8 to 9											
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19 to 20											
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24 to 25											

We are particularly interested in the heights of: Phragmites, purple loosestrife, cattail, and saltmarsh cordgrass.

FIELD DATA SHEET For VEGETATION TRANSECT: Brackish Marsh Teacher's Version

LOCATION _____ Date _____ Teacher _____

Questions: Is Phragmites spreading? Is the area that is a monoculture (where only *Phragmites* is growing) spreading? How fast? Is it growing tall and healthy or short and stunted? Did restoration efforts help? Compare your data to past years to notice.

Teacher Directions:

- Make sure you are familiar with the plants and can help the students identify them accurately. Assign each pair one or two plants. (Assign similar plants to the same pair, pointing out differences, to avoid confusing one with the other.)
- Review the site prior to your visit, and bring in plant samples that you do not recognize to identify in advance.
- **Suggested book:** A Field Guide to Coastal Wetland Plants of the Northeastern United States by Ralph W. Tiner Jr.
- *Use the double columns to double check one group against another*. You want to compile one set of accurate data.
- Know your students. Who needs an "easy" plant. Who is attentive to details and will look hard for a rare one.
- **Remember: What is most important is we get the *Phragmites* data accurately. Double check that data yourself.**

1. Observe your plant sample closely. Be sure you know recognize the traits that are unique to your plant. Note how it looks both when in blossom (or with seed head) and without.
2. Look along the transect for your plant. If you do not see it immediately in a meter, pull aside other plants or wrack to look more closely. If you are in doubt ask for help!
3. Record a "P" in every meter that you find it.
4. Report your findings to your group leader. Make sure they record your data accurately.
5. If you are doing Phragmites, Make sure you measure the height in **centimeters.**
6. If you are doing some other plant, and it is the tallest plant on some meters, measure it's height too.
7. If you have extra time, do another plant.

Distance along line	Height of tallest plants in cm	Phragmites (*Phragmites australis*)		Cattail *Typha angustifolia*		Creeping Bent Grass *(Agristus stolinifera)*		Golden-rod *(Solidago sempervirens*)		Silver-weed (Potentilla anserina)		Salt marsh Bulrush		Salt-marsh sedge		Salt-marsh Cord-grass *Spartina alerniflora*		other		other	
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We are particularly interested in the heights of: Phragmites, purple loosestrife, cattail, and saltmarsh cordgrass.

Bird and Vegetation Observations:

The Massachusetts Audubon Society and Dr. Charles Redington author of *Plants in Wetlands Redington Field Guide* are interested in knowing how birds interact with different plants (vegetation.) Please observe how birds are using plants. Are they nesting in cattails and Phragmites in the cordgrasses, do they use blades of these grasses to make nests, are they resting on these plants. Do they use these plants to hide in?

If you have many species of birds that you are observing have people in your team choose different species to observe, so you can collect information on each species.

Type of Bird	How many do you see? (Keep a tally.)	What is it doing?	What type of plant is it using/on/near? (A short grass, Phragmites, upland)	What is it using the vegetation for? (Nesting, resting, hiding, eating etc.)

SOILS FIELD DATA SHEET (Optional Activity)

Location _____ Date _____

Soil Sample 1: in the *Phragmites*
2: transition zone (Where both Phragmites and salt marsh grasses grow.)
3: in the salt marsh grasses

Use the auger to take samples in each of the three locations marked by orange flags and record your findings on the following chart.

Observations	Sample 1 (Phrag)	Sample 2 (trans.)	Sample 3 (marsh)
Number of Soil Layers			
Color/s			
Smell			
Texture			
Presence of living organisms			

Rate the composition of the samples using this scale:

0 (none) 1 Very little 2 (medium) 3 Over ½

	Sample 1	Sample 2	Sample 3
Small pebbles			
Sand			
Organic matter			
Silt (fine particle soil)			

Write a short paragraph describing soil sample(s)

Soils Data Sheet

Materials: Russian Peat Borer, Meter Sticks,

Well Depth
Shallow=5-20 cm
Medium=35-50 cm
Deep=65-80 cm

Phragmites towers above other plants. It also can reach far below them in the soil. It may avoid stressful conditions by reaching below them. Restoration efforts have shown different results at different sites. Soil type may have been a factor. Help us determine how deep *Phragmites* is growing, and what soil types it is growing in.

Procedure:

A. Record your location on the data sheet.
B. Note what vegetation is growing at this soil sample site.
C. Using the Russian Peat Borer take a soil sample. To 50 cm.
D. Describe the soil at each level (First sample will correspond with shallow and medium wells.)
E. Match it with a soil chart.
F. If possible, take a photo of it, with a meter stick next to the soil probe.
G. Identify the roots in the sample. How deep do living *Phragmites* roots go? How deep do other living plant's roots go?
H. Take a second sample to 80 cm. Do living *Phragmites* roots go this low? What is the soil type.

Describe the Soil found at each level. If it is a combination of different soil types, write % of each type.

A. Peat (Organic matter, roots, soft soil.)
B. Sand (Gritty and grainy)
C. Clay (sticks to your hand. Moldable.)

Location: Town _____ Site_____ Transect # _____

Well # _____

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Location: Town _____ Site_____ Transect # _____

Well # _____

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Location: Town ___________ Site_____________ Transect # _____Name _____________________

Well # ____________________

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Well # ____________________

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Well # ____________________

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Well # ____________________

Depth	Soil Type	Vegetation Present	Depth of living *Phragmites* roots	Depth of other living plant's roots	Depth of Peat
Shallow (5-20 cm)					
Medium (35-50)					
Deep (65-80)					

Materials list for Russian Peat Borer:

Monsell Soil Chart

Meter Stick (Mark different depths with electrical tape.)
Towel
Gallon of Fresh water
Two adjustable Wrenches
Knife or other soil probe to start a hole
Root Key
White card board for taking a photo.
Camera.
Metal File
Newspaper to wrap sample in.
Zip lock bags.

Suggestions:

- Mark the different depths with electrical tape.
- Sharpen the cutting blade prior to each day's use.
- Turn clockwise to take the sample.
- It's better to take at low tide.
- When lifting out the sample: Use your legs, get your shoulder under it (With one extension rod.)
- Wipe it off after each sample.

When you are done for the day:

- It can seize up firmly after use. The two wrenches are to get it apart again. (Put a towel on it to prevent scratching.

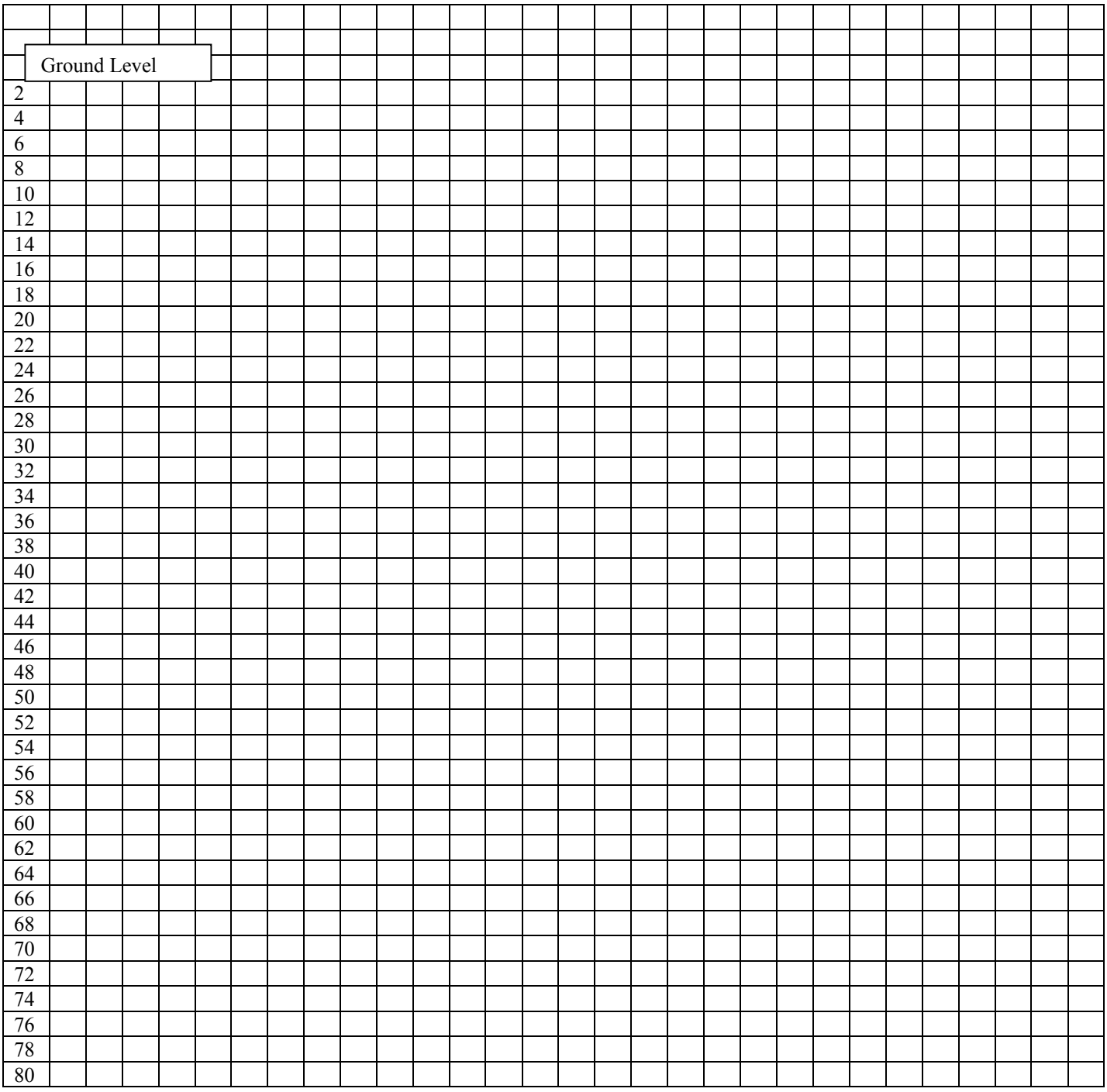
To prevent corrosion:

- Wash it completely off with fresh water and dry it with a cloth before putting it away.

Location: Town _____ Site Name _____ Transect Number _____

Make a key for the soil types ☐ Peat ☐ Sand ☐ Clay ☐ *Phragmites* root

☐ Other plant root



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Well # _____ Well # _____ Well # _____

Location: Town _____ Site Name _____ Transect Number _____

Invertebrates/Vegetation Study

Date _____

Many creatures live on the salt marsh. A closer look will help you observe them.
Using a hula hoop or rope to de-mark the area you are studying, count how many creatures you can find on the vegetation , on the surface of the marsh, and in the mud. You might find spiders, insects, snails, crabs and more!

ANIMALS

Draw and/or name what you see.	How many? (Keep a tally)	Where did you find it? (On the surface of the ground, in the mud, under water)	How is it interacting with plants? (Eating, walking on, resting, making a nest/web, hiding in, etc.)	What kind of plant is it using? (Please be as specific as you can.) (What kind of grass)

Additional Questions:

What additional scientific questions do you have? How could you investigate those questions. Think of at least 3 questions including:

A) A question you could research on the internet or elsewhere.

B) A question you could ask a professional scientist.

C) A question you can design a study to investigate.

D) Explain the method of your study. (Use additional paper if necessary.)

List 5 things that are good (+) and bad (-) about this salt marsh.

_____(+) _____(-) _____

Explain one of your (+) and one of your (-) answers.

(+):

(-):

Marsh Memories:

How has your knowledge and feelings about salt marshes changed?

I used to think salt marshes were ……

And now I know the salt marsh is……

What actions do recommend to take to help improve and protect the salt marsh in your town.

a. _____

b. _____

c. _____

What additional questions would you like to investigate on the salt marsh?

a. _____

b. _____

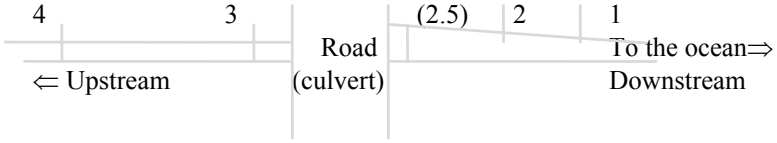
c. _____

FISH : CLASS COMPARISON

Name _____ Date _____

Location _____ Class _____

Class comparison:
Write the number of fish present in each trap location:



Location	Trap 1		Trap 2		Trap 3		Trap 4.	
Fish Species	Number	Ave. Vol.	Number	Ave. Vol.	Number	Ave. Vol.	Number	Ave. Vol.
Mummichog								
Silverside								
3 Spined Stickleback								
4 Spined Stickleback								
9 Spined Stickleback								
Sand Shrimp								
Shore (grass) shrimp								
Eel								
Crab								
Other:								
Total # organisms								
Total Volume								
Total # of species								

1. Which trap had the most fish? _____
2. Which trap had the greatest average volume of fish? _____
3. Which trap had the greatest variety of species?
4. What are possible explanations for these results?

5. Design a graph that would be helpful in communicating your results. Graph this data.

CLASS VEGETATION ANALYSIS

Name _____

LOCATION _____ Date data taken _____ Class _____

Make a graph showing the vegetation present along the total transect. Be sure to make a key for your graph.

Distance in M	0-1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Phragmites																									
Cordgrass																									
Saltmarsh Hay																									
Spike Grass																									
Glasswort																									
Bulrush																									
wrack																									
Sea blite																									
Orach																									
Goldenrod																									
Other:																									

1. In how many meters is phragmites present? _____
2. What percent of the total number of meters, is phragmites present in? _____
3. Compare this graph with information collected last year, or to information from anther school.

How are they the same? How are they different?

_____

_____

4. We are investigating whether *Phragmites* is spreading, and how fast. What do you think the vegetation will look like next year? Use a code, or different color to draw in your prediction. Explain why you think it will look like that.

_____

_____

5. What are 2 questions you can answer from looking at this graph?

_____

_____

6. What more do you want to know, now that you have seen this information?

_____

_____

CLASS SUMMARIES

Summarize your findings:
See below for an example of a summary of the vegetation data.

Sample Vegetation Summary:

At the Rockport site, near route 127, MAS staff found 5 meters of *Phragmites* on their 25 meter vegetation transect. Twenty percent of the total transect had *Phragmites* present. The tallest *Phragmites* plants were 306 cm and 269 cm. MAS staff noticed three other grasses present, and two other herbaceous plants. Wrack was present along 9 meters (36%) of the transect. Cordgrass was present on 52% of the transect (13 meters) and saltmarsh hay was present on 92% of the transect (23 meters) . Spike grass was present on 8 meters, or 32%.

Discussion: Because a ditch is present along this transect at 9-10 meters, bringing in water with high salinity, I expect that the *Phragmites* stand will not expand much further into the marsh, unless further sedimentation raises the elevation further. Nearby storm drains are access points for sedimentation (sand and dirt is pushed onto the marsh from the road), raising the elevation (height) of the marsh. This seems to cause favorable conditions for the growth of *Phragmites*. Questions to investigate include: How large an area did this increased sedimentation impact and how high has sedimentation raised the elevation ? Taking soil cores to compare the sediments and measuring elevation on the marsh will help answer these questions.

Wrack is spread far along the transect. This may indicate that the tide flows into the *Phragmites* stand at least occasionally. Some wrack was just a few strands of grasses, others were large mats of mixed grasses. In the future, I want to record comments to indicate these differences. Large mats of wrack will kill vegetation underneath, if left there for long periods of time. This may lead to changes in vegetation over time.

1. Write paragraphs summarizing your fish data, vegetation data, and salinity data.

2 What patterns are you finding, through studying your data?

3 What additional questions do you have?

4 Which of these questions could you investigate, and how?

5 What interactions between plants and animals have you observed on the salt marsh?

6 What special project would your school like to investigate, in addition to this study?

7 What questions do you want students in other schools to investigate with you?

When you have summarized the information, please send it to MAS. We will share it with other schools.

Post-trip activities:

Have students compile and discuss the data:

Vegetation

1. Post all vegetation data on the board, and have students graph it, and answer the questions at the bottom of the vegetation analysis page. You may have students work individually, in pairs, or in groups.
2. Discuss their findings. Was the data collection accurate? (Did students collect the same information from the same sites?)
3. If you have data from a previous year: Is the phragmites area growing? What are students predictions for the future?
4. What more do students want to know?

Fish data:

1. Have students who have data from different fish traps post the information on the board.
2. Note which fish traps had the most fish. Discuss possible reasons why. List all hypotheses.
3. What is impacting your fish traps?

Salinity:

Notice patterns: Where was the salinity the highest? Lowest? What was the highest salinity in the phragmites stand?

Tides:

Did the tide enter the transition zone (where there are mixed vegetation and phragmites)? Did it enter the phragmites stand? How high was the tide? Use the tide chart to figure: how many days of the year have a tide that height, or greater?

Summarize and share: Summarize and share what you are learning. Students may choose the best summaries to post to other schools . Use the graphs to help illustrate your points.

Additional Questions:

Discuss:
(Owning the questions)
What are additional questions that students have? Which questions can you answer through observation? Research using books, internet or interviews, or through further investigation.

Design a new study:
Decide which question(s) are ones students can investigate, and with them design a study to investigate that question. If you have questions about the design of your study, feel free to contact Liz Duff and Robert Buchsbaum, at Massachusetts Audubon for advice.

Conduct your study.

Analyze your data: Summarize what you are finding.

Share your methods and results with others: Use email or the internet to let other schools know what you are studying. They may be able to help you collect data!

Optional Extensions:
(Useful for assessment)
A Plan out and create a slide show of your site.
Take photographs of your site. Get the photos on a floppy shot disk. Add text to the disk, and create a slide show of your site.

B. Make a field guide to the creatures and plants that you find on your site.

C. Make an identification key for identifying animals, or upland plant species on your site .

D. Design a poster or brochure explaining why this area is important to your town. Include historical uses, and current day uses. Explain possible threats to this habitat, and ways of protecting and restoring it.

E. Design a project of your own, get it ok'd by your teacher, and do it!

Technology:

Teachers have found this project provides excellent reasons to integrate technology.

The following is a brainstorm created by Rockport teachers for creating a web site. Also enclosed is an assignment, using the internet for research purposes.

The Massachusetts Audubon Salt Marsh Science Web site provides an opportunity for you to learn more about Salt Marsh Science, to compare your data with data collected by other schools, and to link your web site to.

This web site includes a "Salt Marsh Murder Mystery" for your students to investigate, Upcoming Events, Data Summaries, Graphs, and Additional Resources.