2011 Teachers on the Estuary (TOTE) at Waquoit Bay NERR

Course description: This course is a pilot for the Teachers on the Estuary program, a research and field-based teacher training initiative of the National Estuarine Research Reserve System, part of the National Oceanic and Atmospheric Administration (NOAA). The goal of TOTE is to improve teachers' and students' understanding of the environment using local examples and to provide resources and experience to support the incorporation of estuary and watershed topics into classroom teaching. The course is also designed to promote stewardship of watersheds and estuaries.
The course will introduce teachers to information, research, and classroom activities about watersheds, estuaries, and coastal systems. The course incorporates investigations in the field and using on-line data. Course content and activities will be aligned with Massachusetts state science and math frameworks.

Credit: The course is offered for 2 graduate credits or 45 Professional Development Points. Graduate credit is optional and is available from Framingham State College for $65.00 per credit. PDPs are free and granted through Waquoit Bay Research Reserve.

Grade levels: The course is designed for science and math teachers in grades 9 through 12. Others are welcome to apply.

Schedule:	Monday August 8	1:00 pm – 7:00 pm
	Tuesday, August 9,	8:30 am – 4:00 pm
	Wednesday, August 10	8:30 am – 4:00 pm
	Thursday, August 11	8:30 am – 3:30 pm
Follow-up:	Saturday, November 19	9:00 am – 1:00 pm

Location: Waquoit Bay National Estuarine Research Reserve, Falmouth, MA

Cost: Thanks to support from a NOAA Bay Watershed Education and Training grant, the course is offered without charge.

Support: Each participant will receive a $200 grant for education and stewardship projects related to course topics, as well as $150 in teaching materials. A $100 stipend will also be awarded to each teacher after the follow up session for successful completion of the course requirements.

Lodging and meals: Optional local lodging for 3 nights will be provided for participants during the course for those traveling from beyond daily commuting distance. Breakfast snacks and lunch will be provided.

Application: Space is limited and participation is by application. Application may be downloaded at www.waquoitbayreserve.org or www.estuaries.gov

Instructor:

Joan Muller, Waquoit Bay National Estuarine Research Reserve

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Course objectives: Participants will be able to

1. Describe the NERRS system and explain two NERR research projects.
2. Access and use the on-line Estuaries 101 curriculum and other NERRS/NOAA educational products with students.
3. Describe major physical, biological, chemical and geochemical estuarine processes as well as impacts of human activities on coastal systems.
4. Locate, download, and graph data relevant to lessons about estuaries.
5. Teach basic estuarine concepts by guiding students in using field and laboratory research techniques analogous to those used at Research Reserves.
6. Explain the six Estuarine Principles and Concepts listed below.
7. Lead students in learning activities related to stewardship of the environment.

Estuarine Principles and Concepts

1. Estuaries are interconnected with the world ocean and with major systems and cycles on Earth.
2. Estuaries are dynamic ecosystems with tremendous variability within and between them in physical, chemical, and biological components.
3. Estuaries support an abundance of life, and a diversity of habitat types.
4. Ongoing research and monitoring is needed to increase our understanding of estuaries and to improve our ability to protect and sustain them.
5. Humans, even those living far from the coast, rely on goods and services supplied by estuaries
6. Human activities can impact estuaries by degrading water quality or altering habitats; therefore, we are responsible for making decisions to protect and maintain the health of estuaries.

Course expectations: Participants will be expected to:

1. Review pre-course materials.
2. Attend all components of the four-day session plus the follow-up session.
3. Complete a pretest and post test and have at least one class of students complete a pretest and post test.
4. Complete in-class assignments.
5. Participate in activities and discussions
6. Develop or adapt a lesson plan incorporating NERRS data, using a standard format, and submit by November 19, 2011.
7. Undertake a stewardship project with their students.
8. Participate in evaluation of the course including a focus group, on-line evaluation, and phone interview.
9. Post information and photos of student activities and stewardship projects on a group internet shared site.

Course Outline (to be confirmed) Teachers on the Estuary August 8-11, 2011 WBNERR

Monday August 8 1:00 – 7:00 pm

Introductions

- Introductions of participants and presenters; overview of course

- Introduction to NERRS system, mission
- Estuary principles and concepts
- Estuaries 101 curriculum overview
- Definition of estuary and watershed
- Evaluation strategies
- Google Earth tutorial and (Estuaries 101 activity- Waquoit Bay watershed)
- How to use data loggers
- Tour of Waquoit Bay Reserve

Dinner: Traditional Wampanoag Clam Chowder
Evening presentation: people and estuaries

Tuesday August 9 8:30 am – 4:00 pm
Earth and Physical Science in Estuaries
Morning

- Presentation on System Wide Monitoring Program data by research technician
  How people study coastal systems, how data informs local issues
- Variability in estuaries: SWMP introduction from estuaries.gov
- SWMP graphing tool for students and teachers
- Investigating estuaries with E101: labs, data, and activities for earth science.
- Coastal features and geologic processes: GIS images
- Wind, waves, and currents
- Land and sea interactions: from watersheds to the coast
- Interpreting earth science data: examples and discussion

Lunch

Afternoon

- Introduction to water chemistry and water quality in estuaries
- E101 and water chemistry data
- NODE and other student-friendly NOAA websites
- Student research and experimental design: groups define testable question, deploy data loggers
- Model field studies: groups visit different estuary habitats to observe, test, and record conditions using equipment suitable for students

Evening
Dinner on your own

Wednesday, August 10: Research in the Field 8:30 am – 4:00 pm
Life Science in Estuaries
Morning

- Presentation on a WBNERR biology research project by a scientist
  Why we always need more data
- Field studies with Waquoit Bay Reserve scientists: biological monitoring for a salt marsh restoration project.

- Discussion on strategies to incorporate field studies with students

Lunch

Afternoon
- Estuarine species and tolerance ranges; E101 lesson
- Energy flow and productivity in estuaries
- Phytoplankton and zooplankton
- Retrieve data loggers, graph, interpret and discuss results
- Planning your own student field studies and research projects

Thursday August 11 8:30 am – 3:30 pm
Watershed Field Study and Wrap Up
Morning
- Presentation by fisheries biologist on water quality and habitat restoration
- Watershed study: model how to set up classroom and field studies of an estuary or river and its watershed.
  Background information and resources; framing a question; sampling plan; data collection; data interpretation; reporting results
- Site visits in Waquoit Bay watershed with WBNERR Stewardship Coordinator

Lunch

Afternoon
- Discuss stewardship projects
- Sustaining the learning: materials, equipment, data management, ongoing support and resources available from Research Reserve system and NOAA
- Post test
- Evaluation
- Making it practical: discussion with teachers from TOTE 2010 on using TOTE activities in the curriculum

Follow up class
Saturday 19 November, 9:00 am – 1:00 pm
Presentations by teachers on lessons and stewardship projects
Focus groups: reflections and suggestions for TOTE course

Course texts and materials: Readings and reference materials will be drawn from the following sources, as well as from NOAA and many other web sites. In addition, many lesson plans and curriculum materials for teaching about estuaries will be provided.

Bowen, J.L., and I. Valiela. 2001. The ecological effects of urbanization of coastal watersheds: Historical increases in nitrogen loads and eutrophication of Waquoit Bay estuaries. *Can. J. Fish Aquat. Sci.* 58:1489-1500.

Estuaries 101 http://www.estuaries.gov/estuaries101/Teachers/Home.aspx
Geist, M. The Ecology of Waquoit Bay
Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change 2007.UNEP.
Lambert, K.F. 2005. Nitrogen Pollution: From the Sources to the Sea. Hubbard Brook Research Foundation
Northeast Fisheries Science Center.2007. Ecology of the Northeast Continental Shelf.
US Global Change Research Program. 2001 New England Regional Assessment.

Course requirements: Participants will be expected to:

1. Review pre-course materials.

2. Attend all components of the four-day session plus the follow up session.

3. Complete a pretest and post test and assign a pretest and post test to their students.

4. Complete in-class and homework assignments

5. Participate in activities and discussions including using Google Earth, and accessing and graphing data from www.estuaries.gov and other NOAA websites.

6. Develop or adapt a lesson plan incorporating NERRS data and implement.

7. Undertake a stewardship project with their students.(See below)

8. Participate in evaluation of the course including some on-line and phone interviews.

9. Post information and photos of the class activities and stewardship project on group internet shared site.

Grading criteria
Participants earning graduate credit and those earning PDPs must complete exercises assigned as part of class work. The computer-based activities completed during the course will be worth 20 percent of the grade, participation and contributions to discussions will be worth 20 percent, the lesson plan will be worth 30 percent and the stewardship project will be worth 30 percent.

Participants taking the course for PDPs but not for graduate credit will not be graded, but should complete all assignments.

Assignments: Lessons and stewardship projects should be sent to Joan Muller via e-mail at joan.muller@state.ma.us .
Course requirements:

There are two major assignments for the course. One is for teachers to develop a **lesson** for teaching estuary and watershed content for their own classes. The lesson should be based on material presented in the course and incorporate NERRS data. The lesson does not have to be original. Teachers can choose to modify an E101 lesson or another existing lesson for use with their classes. The goal is for teachers to develop a lesson that they will use and that relates to their class's stewardship project. Teachers will present a summary of one of their lessons on the course follow up day, November 19, 2010. A draft of the lesson plan should be sent to the instructor for review and feedback two weeks prior to the follow up date.

Suggested format: the lesson plan should include sections on:

1. Title
2. Grade level and subject area
3. Main concepts
4. Learning objectives or expected outcomes
5. Relevant science or math standards
6. Relevant estuarine concepts and principles
7. Materials and equipment
8. Background information (description and/or links to what the teacher should know to teach this lesson)
9. An outline of the lesson
10. Tips and hints for other teachers and lessons learned/reflection
11. Your sources of information and recommended references

The second requirement is for teachers to complete a **stewardship project** with their students. Stewardship projects can be thought of as service projects that will benefit a local watershed or water body. Examples of stewardship projects include adopting a water body near the school by making a commitment for monitoring and/or cleanup, starting a sustainable practice (such as recycling) in your school, and teaching others in the community what was learned from the project. Participants will submit a summary and review of their students' stewardship project at the follow up meeting (and samples or photos of student work if appropriate), or an overview, if the project is in the planning stage, with a summary to follow after project activities have taken place.

Teachers may work alone or with one or two other participants to develop and carry out the stewardship project. The plan for the project is due on or before the follow-up day, Saturday November 19, 2011 (with a draft for review and feedback due two weeks before), but participants have until the end of the 2011-2012 school year to complete projects. The plan will be graded and will also serve as your proposal for the stewardship stipend. Stewardship project proposals should be sent to Joan Muller at joan.muller@state.ma.us.

The **stewardship project proposal** (for credit/grade and to apply for stewardship stipend) should include the following sections:

- Goals, objectives, and/or expected outcomes

- Estuary Principles and Concepts addressed by the project
- Description of the project
- How the project idea was developed
- Number of students involved and description of the students (grade level, class, club, etc.)
- Time line
- How stewardship project money will be spent
- How the stewardship project will address the 6 stewardship project criteria (listed below)

1) Address a resource management need in the students' own watershed.
2) Be student driven.
3) Include outreach to a broader community (beyond the students' own class).
4) Utilize knowledge or practice skills learned through the TOTE training.
5) Involve collaboration with a community organization or volunteer expert in the community.
6) Be an integral part of the instructional program.

Stewardship Project Notes and Context

An effective way to guide students to conduct a stewardship project is to use the format for a **Meaningful Watershed Educational Experience (MWEE)** as described in NOAA's Bay Watershed Education and Training grant guidelines. These experiences include three phases:

1. A preparation phase which involves students in discussions about a question, problem or issue.
2. An action phase which includes an outdoor experience where students make observations and collect data. This phase could include helping with projects that result in positive impacts to the environment.
3. A reflection phase which includes evaluating the activity, analyzing conclusions and sharing the results. The stewardship project could be incorporated into the action phase or could be designed by the students during the reflection stage as a culminating follow up activity.

The stewardship project is an important activity that provides an opportunity for teachers to integrate and apply with their students the skills learned through the Teachers on the Estuary course.

The following TOTE goals and outcomes can be addressed and achieved through stewardship projects:

TOTE Program Goal: Teachers and students have knowledge and appreciation of estuary and watershed environments and the necessary skills to act as stewards of estuary and watershed resources.

Mid-Term Outcomes (application of new knowledge):

- Teachers incorporate experiential learning in their classes and are effective in teaching their students about estuaries and watersheds.
- Students are able to explain how their actions in watersheds affect estuaries.
- Students gain a better understanding of their own watersheds and/or estuaries.

Long-Term Outcomes (effect or change in secondary target audience)

- Teachers act as stewards of estuaries.
- Students act as stewards of estuaries.

$100 Participation Stipend: Teachers will be awarded a $100 participation stipend upon completion of the above requirements.

$200 Stewardship Mini Grant: This grant money may be spent on materials, buses, stipends for speakers or anything needed for the students to accomplish their stewardship projects. Teachers submit their stewardship proposal which includes how they plan to spend their $200 stewardship mini grant. After their proposal is accepted by the instructor, they may make their purchases. Once they send in receipts, teachers will be reimbursed for their purchases.