Wind or Whales? The Great Debate!

Subject:

Grade Level: Grade 10 Honors Biology Class

Average Learning Time: 4– 90 minutes Blocks

Lesson Summary:

This Activity is intended to apply key terms and understandings from the Honors Biology Ecology Unit to a real world situation related to the Teacher at Sea Experience.

Essential Questions:

1. What is the AMAPPs project and what is its purpose?
2. How does the work of the AMAPPS Scientists relate to Offshore Wind Farms in New England?
3. Should there be an Offshore Wind Farm off of the coast of Massachusetts and Martha's Vineyard?

Specific Concepts:

- Population Studies
- Endangered Species
- Right Whales
- AMAPOS
- Offshore Wind Farms
- Evaluation of Pros and Cons of an Environmental Issue with Human Impact
- Preparing an Argument for Debate on a particular side of an issue

Focus Questions:

See Student Activity Sheets #1 & 2

Student Learning Objectives:

Students will….

1. Use the Teacher at Sea blogs and or included Handouts to understand the research that is conducted by the AMAPPS Scientist and how it relates to the proposed Offshore Wind Farms in the area off of Martha's Vineyard.
2. Apply prior knowledge of how and why scientists study animals to a real life New England environmental issue.
3. Use several online resources to identify Right Whale Activity in the area near Martha's Vineyard.
4. Research the arguments for or against the proposed Offshore Wind Farm off the coast of Martha's Vineyard.
5. Conduct a mock debate surrounding the issue of the Offshore Wind Farm off the coast of Martha's Vineyard.

Background Information:

Prior to conducting this lesson and the lesson activities, students need to have a strong understanding of basic ecological concepts. This is a culminating activity, not an introductory activity. Generally, I teach Ecology starting with some basic topics such as understanding how and why scientists need to know how many of a particular species in a population are in a given area. That knowledge is then applied to an understanding of the hierarchy that species form populations, that live in communities with other living organisms, in an ecosystem of biotic and abiotic factors, that form large tracks of land called Biomes here in the Biosphere on Earth. Through a series of instructional strategies, the concepts of community and ecosystems are tied together by developing a strong understanding of ecological interdependence. During those lessons, habitats, food chains, and food webs are used to support the concept of ecological interdependence. This activity will allow students to draw on their understanding of ecological vocabulary and ecological concepts that have been taught. It will also allow students to apply those understandings to a local, real life environmental situation. This activity could be used as a performance based assessment.

When doing debates with a student at this level, it is a good idea to really know the student in your class. I would not do this activity at the start of the year. I find it helpful for the teacher to strategically split kids into debate groups, so there are some kids on each side that may not truly support the side they are given to defend with some that do support their side. I think this helps to encourage students to look at the facts, data, and evidence objectively as well as listen to their peers.

Preconceptions:

Students may come from a home that can either be "environmentally friendly" or "not so much." This is not a preconception as much as it is bias, but it is good to remember that students may bring some of these "environmental family values" from the home into the lesson. Prior to starting this type of lesson, I always put this on the table: "We all come from different backgrounds, and we need to be respectful of each other's opinions." In my class we "agree to disagree."

Materials:

Included Handouts

Computer Access

Paper /Journal

Technical Requirements:

Computer Access at least in pairs is a necessity

Strong computer / internet navigation skills suggested unless teacher pre determines particular sites

Teacher Preparation:

There is minimal teacher preparation. This lesson comes with links and handouts. Handouts will need to be copied. Depending on the level of the class, the teacher may want to prepare a list of designated sites for the research section prior to the debate.

Key Words:

Right Whale	Offshore Wind Farm
AMAPPS	Alternative Energy
NOAA	Endangered Species

Lesson Procedure:

1. Activity #1: Gathering Science Background:
   Using the link to the Teacher at Sea Blog below and/or the included handout that explains the **Atlantic Marine Assessment Program for Protected Species (AMAPPS),** have the students research the answers to the questions on the ***Student Activity Page # 1***. Students could work independently, or in pairs for this activity. Depending on the level of your students, plan for at least 45 minutes for this activity.

   https://teacheratsea.wordpress.com/2014/04/14/kimberly-gogan-science-spot-light-marine-mammal-observing-april-12-2014/

2. Activity # 2: Collecting and Applying Real Life Science Data:
   Visit the *Right Whale Listening Network* and *New England Fisheries Science Center* Pages using the links below. Walk the students through the direction for answering the questions on the ***Student Activity Page # 2*** for the ***Collecting Data*** section**,** these can be a little complicated and it goes a much smoother with a demonstration. I recommend attempting this once before showing the class. (As an option, the teacher can give students a copy of the data table they are to arrive at and have

them collect data off of that.) After allow students time on the computer to complete the ***Student Activity page # 2*** using the *Right Whale Listening Network* and *New England Fisheries Science Center* internet pages. Students could work independently or in pairs for this activity. Depending on the level of your students, plan for at least 45 - 90 minutes for this activity.

http://www.listenforwhales.org/page.aspx?pid=430

http://www.nefsc.noaa.gov/psb/surveys/

3. Activity # 3: Preparing the Argument.
   Preselect your two groups, for and against the Offshore Wind Farm. If you have predetermined a set of websites for students to use give them that list to do their research, or allow them time on the internet to conduct adequate research points to develop a presentable argument. Students will need time to share their arguments and to collaborate as a group for their presentation. Students could work independently or in pairs for this activity prior to group time. Depending on the level of your students, plan for at least 90 minutes for this activity.

4. Activity # 4: The Debate

   This is where each group will have a chance to present their arguments for or against the Offshore Wind Farm. The teacher should set the stage and lay out the basic ground rules that will be used in the debate. Each team should be allowed to present their argument without questions first, allowing for appropriate questions and dialog at the end.

Assessment and Evaluation:

Student will be given a chance to review and share their answers on the included **Student Activity Pages** (#1 & #2) as a class. This will be a formative grade.

Student will be graded on the preparation of the argument and debate using the ELA department rubric used for this purpose receiving a summative grade for these of the activities. (copy of ELA dept. rubric included)

Author: Kimberly K Gogan, Biology Teacher, Newport High School, Newport, New Hampshire.

Creation Date: Lesson was originally created in the spring of 2014 after returning from the Teacher at Sea Experience on the *Gordon Gunter*. The lesson was revised and refined the following year for submission.

Standards:

National Science Standards (Next Generation Science Standards):

HS-LS2- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS4- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*[Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

Ocean Literacy Principals Addressed:

The World in Spatial Terms

How to analyze the spatial organization of people, places, and environments on Earth's surface.

Places and Regions

The physical and human characteristics of places.

How culture and experience influence people's perception of places and regions.

The patterns and networks of economic interdependence on Earth's surface.

How forces of cooperation and conflict among people influence the division and control of Earth's surface

How physical systems affect human systems.

The changes that occur in the meaning, use, distribution, and importance of resources.

State Science Standards:

Life Science
S:LS2:11:1.5 Using data from a specific ecosystem explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

S:LS2:11:1.6 Explain or evaluate potential bias in how evidence is interpreted in reports concerning a particular environmental factor that impacts the biology of human

LS4.D: Biodiversity and Humans

Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ETS1.B: Developing Possible Solutions

When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts.*(secondary to HS-LS2-7),(secondary to HS-LS4-6)*

Sceince Process Skills:

SPS3– Personal, Social, and Technological Perspectives

Collaboration in Scientific Endeavors; Common Environmental Issues, Natural Resources Management and Conservation; Science and Technology, Technological Design and Application

SPS4– Science Skills for Information, Communication and Media Literacy

Information and Media Literacy; Communication Skills; Critical Thinking and Systems Thinking; Problem Identification, Formulation, and Solution; Creativity and Intellectual Curiosity; Interpersonal and Collaborative Skills; Self Direction; Accountability and Adaptability; Social Responsibility

AMAPPS:

Atlantic Marine Assessment Program for Protected Species – NE 2014

Information for NE Shipboard Observers

NOAA ship Gordon Gunter

AMAPPS:

Atlantic Marine Assessment Program for Protected Species – NE 2014

Information for NE Shipboard Observers

1 INTRODUCTION

1.1 AIM OF THE PROJECT

The Atlantic Marine Assessment Program for Protected Species (AMAPPS) is a multi-year research program designed to achieve the following objectives:

1) Collect broad-scale data over multiple years on the seasonal distribution and abundance of marine mammals (cetaceans and pinnipeds), marine turtles, and sea birds using direct aerial and shipboard surveys of U.S. northwest Atlantic Ocean waters from the shore to the EEZ;

2) Collect similar data at finer scales at several (~3) sites of particular interest to NOAA partners using visual and acoustic survey techniques;

3) Conduct tag telemetry studies within surveyed regions of marine turtles, pinnipeds and seabirds to develop corrections for availability bias in the abundance survey data and collect additional data on habitat use and life-history;

4) Explore alternative platforms and technologies to improve population assessment studies;

5) Assess the population size of surveyed species at regional scales;

6) Develop models and associated tools to translate these survey data into seasonal, spatially-explicit density estimates incorporating habitat characteristics; and

7) Develop databases and GIS based user interfaces to provide data to users.

Participating in this program is a large number of scientists and managers from the Fish & Wildlife Service (FWS), Bureau of Ocean Energy Management (BOEM), Navy, and NOAA. The NOAA/Northeast Fishery Science Center (NEFSC), NOAA/Southeast Fishery Science Center (SEFSC), and FWS are in charge of collecting data.

Under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), the National Marine Fisheries Service (NMFS) is charged with assessing the population status of protected species within U.S. waters. These Acts require periodic assessment of population status relative to management and recovery benchmarks and to evaluate threats to species and populations due to anthropogenic activities. The National Environmental Policy Act (NEPA), as well as the MMPA and ESA, requires Federal agencies to evaluate and mitigate the impacts of their activities, or those they oversee, on protected species. Detailed assessments of species abundances are a critical component of accomplishing these mandates. For NMFS, particularly under the MMPA, it is essential to have both accurate and precise estimates of population size for a given management unit or population stock. For risk assessment and mitigation of impacts and to estimate the potential for mortality or other impacts on protected species due to localized activities (e.g., military exercises, energy exploration, shipping traffic, etc.), it is necessary to have information on the seasonal and inter-annual variability in distribution at smaller spatial scales.

The Migratory Bird Treaty Act (MBTA) implements a series of bilateral agreements between the U.S. and neighboring countries that require the parties to protect migratory birds. The MBTA prohibits, through criminal sanctions, the taking of birds protected by the treaties. An opinion by the Department of Interior Deputy Associate Solicitor in 2001 concluded that the MBTA applies in national waters within three miles, and in international waters out to 200 miles, and applies to U.S citizens, and any person aboard a U.S-flagged vessel.

The overall goal of this cruise is to document the relationship between the distribution and abundance of cetaceans, sea turtles and sea birds within the study area relative to their physical and biological environment. To do so the specific objectives of this cruise are, within the study area:

(1) determine the distribution and abundance of cetaceans, sea turtles and sea birds;

(2) collect vocalizations of cetaceans using passive acoustic towed hydrophone arrays;

(3) determine the distribution and relative abundance of plankton, micronekton, and benthic species,

(4) collect hydrographical and meteorological data,

(5) document spring baleen whale migration by deploying bottom-mounted marine autonomous recording units (MARUs) and

(6) when possible, collect biopsy samples and photo-identification pictures of cetaceans.

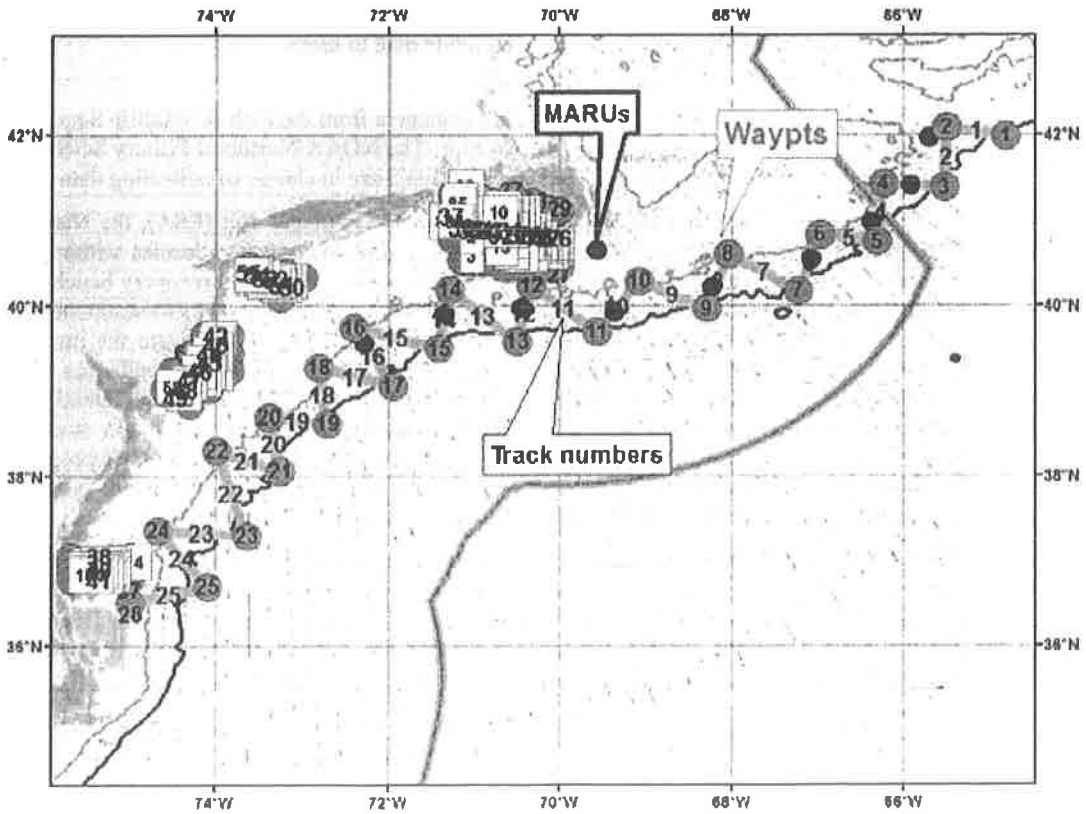
This document will focus on the procedures used for the shipboard visual teams for cetaceans and turtles. Separate documents focus on procedures for the collection of shipboard data of birds, and shipboard passive and active acoustic data.

1.2 TARGET SPECIES

The core objective of this visual team for cetaceans and turtles is to determine the abundance, distribution and habitat preferences of as many cetaceans and sea turtles, as the data allow. Data will be collected for all cetacean and sea turtle species encountered. After cetaceans and turtles, the next highest priority species are seals, sun fish (*Mola mola*), basking sharks, and other sharks. Even lower priority is fishing gear and fishing vessels.

If recording anything other than a cetacean or turtle reduces the chances of detecting other cetaceans or turtles, then do not record information on the lower priority species.

Figure 1. Proposed track lines for the shipboard and aerial survey conducted by the NEFSC during Mar - Apr 2014. Depth contours are 100 and 2000m. Red circles are the locations for the bottom mounted marine autonomous recording units (MARUs), green circled numbers are way points and black numbers on the blue lines are the track line numbers on the track lines.



1.3 OVERVIEW OF SHIPBOARD SURVEY

On the NOAA ship *Gordon Gunter*, there will be 6 teams of people:

Working during the day:

1) a team of up to 4 people on the flying bridge that will be visually searching for cetacean and turtles (upper team);
2) a team of up to 2 people on the bridge wings that will be visually searching for cetaceans and turtles (lower team);
3) a team of 2 people on the flying bridge that will be visually searching for seabirds (seabird team);
4) a team of 2 people in the acoustic lab that will be recording cetaceans via a passive acoustic hydrophone array (passive acoustic team);
5) a team of 2 people that will be collecting information on physical and biological characteristics of the water column and the distribution and abundance of plankton via backscatter data from the EK60, CTD's, bongo nets, Visual Plankton Recorder (VPR), Isaac Kidd mid-water trawls, MOCNESS tows, bottom graps and beam bottom trawls (day oceanographic team);

Working at night:

6) a team of 3 people that will be collecting information on physical and biological characteristics of the water column and the distribution and abundance of plankton via backscatter data from the EK60, CTD's, bongo nets, Visual Plankton Recorder (VPR), Isaac Kidd mid-water trawls, MOCNESS tows, bottom graps and beam bottom trawls (night oceanographic team).

The two teams of visual cetacean and turtle observers will act independent of each other. They are both to record the sightings that they detect, so some groups of animals will be seen by both teams and other groups will be seen by only one team.

The seabird observers will work independently from the cetacean and turtle observers, so seabird observers will not tell the cetacean/turtle observers about any cetacean or turtle sightings they may see, even if the cetacean/turtle observers did not see the group of animals.

Searching will be conducted during daylight hours when the "apparent" Beaufort sea state is 5 or less, preferable in Beaufort 3 or less. "Apparent" Beaufort sea state refers to the condition the water looks like, as assessed by the naked eye, in the search area ahead of the ship (not behind the ship). This apparent sea state may not be exactly the sea state as defined by the instantaneous wind speed, but is a result of wind speed, currents, and swells even from afar.

Searching will be conducted when the visibility is greater than 2 nmi and it is not raining or snowing. When visibility is below 2 nmi, consider searching by naked eye, or quitting searching until conditions improve.

1.4 OVERVIEW OF THEORY BEHIND THE VISUAL SIGHTING TEAMS SURVEY PROCEDURES

The visual survey method to be used during the shipboard abundance survey is a combination of line-transect distance sampling and mark-recapture methods. Line-transect distance sampling is based on a simple concept: the further away an animal is, the lower the probability of detecting it. The probability of detecting an animal group can be estimated by analyzing the perpendicular distances of the animal group relative to the track line. Perpendicular distance is the shortest distance between the center of the group and the track line, not the ship. However, the detection probability can be biased due to animals that are missed because they are submerged (referred to as availability bias) or missed due to a variety of other reasons, such as distance from the ship, group size, cloud cover, sun glare, observer fatigue or animals responding to the sighting ship (referred to as perception bias). For most cetaceans and turtles, especially small animals found in small groups, and larger whales that are submerged for long durations, these assumptions are unlikely to be met and thus, there is at least some degree of availability and

perception bias that could be accounted for if one wanted the best unbiased abundance estimate. These assumptions behind the line transect theory are discussed below.

Detecting animals on the track line
A key assumption in line transect sampling is that the probability of detecting animals on the track line (i.e., perpendicular distance of zero) is 100%, that is g(0) = 1. Again this assumption is unlikely to be met. Mark-recapture methods can be used to estimate g(0), rather than assuming that it is one. When covariates (distance to the animal group, group size, cloud cover, etc.) are incorporated into the analysis of two team line transect data then at least some of the perception bias can be accounted for.

Availability bias
Known dive time patterns can be used to quantify and account for availability bias. On this survey, we will not collect any information to account for this type of bias.

Responsive movement
Another key assumption is the animals are detected before they respond to the ship. If animals respond prior to being detected by moving either towards (attraction) or away from (avoidance) the track line, density will be either over- or under-estimated, respectively. If the distance at which significant responsive movement starts is incorporated in the analysis methods, then this type of perception bias can be accounted for. Recording the direction a group was swimming in when the group was initially detected by the observer can be used to determine the distance a group starts significant responsive movements.

Independence
Another line-transect assumption is the location of transects are to be independent of the animal locations. Passing mode (after a sighting is detected the ship continues on the track line and does not divert to investigate the group) is a method that ensures this assumption is valid. However, passing mode also results in lower rates of positively identified species and possibly in lower estimates of group size. To positively identify the species and confirm the group size, closing mode (after a sighting is detected, the ship breaks survey effort and approaches the group) can be used. In an attempt to make up some of the lost time due to closing mode surveys, some investigators do not return to the original track line but continue to survey from the point of the group on a parallel track to the original track line. This procedure can bias the abundance estimates because the track lines can be drawn into high density areas; thus, the locations of transects are not independent of the animal locations. In this survey, in an attempt to get the most benefits from both of these two survey modes, a **delayed closing mode** will be used. That is, a group will be closed upon if there is a question on the species identification and the group is within 2 nmi of the track line. But the ship will go off effort to approach the group only when the group is nearly abeam (70° from the track line) and thus both teams have had a fair chance to have seen the group, so that the estimate of g(0) is not biased. In addition, after the group is closed upon, the survey will resume only after the ship is back on the original track line near to the point where the ship left the track line.

Accurate data
To obtain reliable perpendicular distances, it is important that angles and radial distances are recorded as accurately as possible and are not rounded – this is especially important for small angles which give short perpendicular distances. To allow observers to calibrate distances and gain practice at accurately recording these data there will be distance training at the beginning of each leg and at other times, as necessary. This is explained in more detail below.

It is important to obtain exact times of sightings and re-sightings and record the swim direction. These data assist in identifying which groups of animals were seen by both teams (termed duplicate sightings).

Surveying will operate when weather conditions allow, which will generally be in Beaufort sea states of 4 or less and visibility is greater than about two nautical miles.

Data collection methods
A survey mode that allows the estimation of g(0), includes covariates, and can account for responsive movement (if it occurs) is a combination of line-transect and mark-recapture methods which uses double platform procedures

(Borchers et al. 2007). Specifically, two teams independently conduct a line transect survey, where both teams search the same waters using high powered binoculars (25x150) and naked eye. This method requires the determination of which groups of animals were seen by both teams. These data will then be analyzed to determine if there is responsive movement by using the recorded initial swim direction and analysis methods described in Palka and Hammond (2001). If responsive movement is occurring then the methods presented in Palka and Hammond (2001), which are a modification of the Buckland and Turnock (1992) methods, will be used to estimate abundance. If significant responsive movement is not present then double platform track line conditional independence procedures (Palka 1995; Borchers et al. 2007) will be used to estimate abundance.

Hydrophones, which can detect the presence of animals by recording their vocalizations, are to be towed during the daytime visual survey. These acoustic data are like having another sighting team and so the two team analysis methods (described above) could potentially be used to combine the visual and acoustic data to enhance the abundance estimation. Comparing the acoustic and visual data will also provide information on whether it is possible to use acoustic data as a monitoring technique.

1.5 DATA COLLECTION

Data will be collected in Beaufort 5 or less, preferable Beaufort 3 or less. On a full day of surveying, searching starts after sunrise and ends before sunset, which at this time of year is about 7 am to 7 pm, with an hour break for lunch where all observers are off-effort. Before 7 am, during lunch, and again after 7 pm, a CTD and bongo cast will be conducted. Depending on where we are, the day time oceanographer team may deploy some other instrument in addition. The ship will start surveying at the end of lunch at the same location it stopped surveying at the start of lunch.

Line-transect data will be recorded on computers (one per team) using the computer program VisSurv_NE. Some data, such as the location of the ship, will be recorded automatically into the database from a GPS receiver that is inside the data entry computer or from the ship's SCS system. In addition to the environmental data collected with VisSurv_NE, other environmental data will be recorded into the data entry computer via the ship's SCS system.

The environmental effort type data will be recorded by the upper team only. The lower team will be responsible for recording when they are on and off effort, the permit "take" information on all groups that are approached, and recording the biopsy information.

In addition, other location, environmental and weather conditions will be recorded on a separate computer via the ship's SCS system. After the data are collected, these separately recorded SCS data will be merged with the VisSurv_NE data. For further details on the data collection system refer to the VisSurv_NE user manual.

Effort and weather data are recorded regularly (usually every half hour) and when an 'event' changes, such as when the observers rotate positions within their team, the track line changes, the teams return back on effort, or when weather/environmental conditions change.

All sightings and effort data will be downloaded and printed every night. Each observer will be responsible for reviewing and correcting all information collected on sightings they recorded. Corrections should be made on the paper copies. The corrections will be entered in the database at a later time, such as on bad weather days.

Paper data sheets and comment forms will be available to jot down data, notes, or comments.

Information to be collected and the codes that are used (i.e., species codes, behavior codes, etc.) are described in the VisSurv_NE user manual. It is important that observers are familiar with this information.

2 SURVEY PROCEDURES FOR THE TWO CETACEAN/TURTLE TEAMS

2.1 PLATFORM AND OBSERVER CONFIGURATION

The two main teams (flying bridge (upper) and bridge wings (lower) teams) are nearly audibly and visually isolated. Because we have a larger oceanography team we had to reduce the size of the lower visual team, so in essence the lower team will be an independent observer, not independent team. The upper team can function as usual. That is, the flying bridge will have 2 observation stations which will be using the port and starboard big eye binoculars (25x150 powered). The lower team will have only one big eye observer who will be using either the starboard or port big eye on the bridge wings, depending on conditions.

The lower team's recorder has to be on the bridge (the only source of electricity) and so the lower big eye observer will radio the data collected or the recorder can carry the Toughbook computer outside and utilize its battery power. The upper team's recorder can either work on the flying bridge and so receive data verbally or can work inside the bridge and so receive data via the radio. If there are not too many sightings it is possible we have only one recorder who records data from both teams and so there would be an additional off-effort position.

If there is one recorder for both teams, then people could be on-effort for 2 hrs and off-effort for 1 hr by rotating every half hour from port big eye flying bridge to starboard big eye flying bridge to inside recorder to big eye bridge wing to off-effort.

If there are two recorders and two separate teams, then the lower 2 person team could work for 1.5 hrs trading positions between recorder and observer every 0.5 hr, then both team members go off-effort for 0.5 hr and so there is no one on the lower team for that 0.5 hr. The upper 4 person team could work for 1.5 hrs and then be off-effort for 0.5 hr. When working they would rotate every half hour between port big eye flying bridge to recorder to starboard big eye flying bridge to off-effort and then back again to port big eye flying bridge.

The recorder on all of the teams will search with naked eye (when not recording data) and should concentrate on distances close to the ship (within approximately 1000 m), which is where the high powered binoculars cannot see.

Rotation order will be randomly chosen at the beginning of each leg. The order can continue in the same order over the rest of the cruise. That is, for example, if at the end of a day an observer is at the port big eye position, then that observer will start the next survey day at the next station in the rotation order, which in this case is the center recorder station. The order of the observers can change when needed or wanted. For example, every week a new rotation order can be generated, though this is not necessary.

If weather or closing on a school causes effort to shut down for part of a day, then when teams go back on-effort, the teams will go back on-effort into the position that they would have been on if there was no break, given the normal rotation schedule. That is, the rotation schedule has the time of each change, even if the team is not on-effort. So, for example, after being off-effort for 42 minutes due to closing on a group, one looks at the schedule, find the time of day effort will start back up at, and then follow the location of each observer for that time.

To allow observers to calibrate distances there will be distance training at the beginning of each leg and at other times, as necessary. This is explained in more detail below.

Observers who are on duty at the beginning of the day must set up the platforms, so they have to be on the platform some 15 minutes before the start of the day (say 6:45am) to set up the platform. At the end of the day we will have to save dinners for those that will be working through the entire scheduled dinner. If you have a break during the scheduled dinner then eat at that time and assist getting meals for those that will be working through the entire dinner time.

It is critical that the bridge officers, crew members, and off-effort observers should not indicate the presence of any sightings to any of the on-effort team members, even if the group has gone behind the ship. Additionally, it is important that observers who are about to go on-effort not pass through the dry lab to obtain information on acoustic detections or detections from the other team before beginning surveying.

2.2 SCANNING PROCEDURES

The search pattern for each team member is as follows:

- Port observer: searches the area from 90° port to about 10° on the starboard side, where 0° is straight ahead on the track line.
- Starboard observer: searches the area from 90° starboard to about 10° port.
- Center recorder: searches the entire area, concentrating on the central section, from 30° port to 30° starboard and near the ship, from 0 to 1000m from the ship.

As an animal group approaches the ship, it may be necessary to abandon the big eyes and use 7x50 binoculars and/or naked eye to confirm the species identification and group size.

When using the big eye binoculars, an observer should scan from the horizon to as close to the ship as possible. Do not spend much time concentrating on either the horizon or very close to the ship. Center your view from about 2/5th to 4/5th of the way to the horizon, while still scanning the entire area.

When in the recorder position and not recording data, it is your responsibility to be scanning close to the ship, since this is the area the binoculars can not see. Do not neglect the rest of the ocean, but spend about 80% of the time scanning within 1000m of the ship. If you miss a blow farther out, it is OK; most likely someone using the binoculars will see it. But if the recorder sees an animal group far away, then record the group under your name and, if needed, ask the help of an observer at the big eyes to assist in determining the species identification and an accurate group size. Remember, the people scanning with the binoculars can not see close to the ship, so it is the responsibility of the recorder to cover this area.

Because the animals are often found in clusters, it is important to continue scanning even as you are collecting information on a detected school. There is a trade-off that you must manage. The trade-off is getting accurate information on an already detected school of animals and detecting other schools in the near vicinity or other animals within the same school. That is, often the animals are in loosely associated groups so it is important to scan the area around a detected school so that you can identify the entire school. Also, especially for blows detected near the horizon, which is miles away, you can detect and start recording data on an animal, but after you record the location and as much other data values as you can determine at that time, you should continue scanning for other schools and then record periodic updates of the initially detected animal(s), referred to as follow up sightings.

It will be assumed that the most recent update of a sighting will have the most accurate information of species id, group size, and calf count.

2.3 SIGHTING DATA

Refer to the VisSurv_NE Users Guide for more details about the sightings type data.

Data from a team should be recorded on the same computer(s). Each computer is independent so all of the data collected on that computer are recorded on only that computer. The computers are labelled "upper team", "lower team", "seabird team", and "client". There are two additional "backup" computers that have been set up for all of the teams and so can be used by any team. The Client computer will display a copy of the upper team's sighting data. This computer will be located in the dry lab and will be used by the acoustic team to assist them in determining if a group that was acoustically detected is a group also visually detected by the upper team.

The main responsibility of the visual observers is to obtain accurate estimates of the time, bearing angle, radial distance, species identification and school size of as many cetacean and turtle sightings as possible. It is important to get estimates of the bearing angle and distance to the initial sighting location. This minimizes bias arising from responsive movement of the animals to the ship. So even if you are not sure if it was a sighting, initiate the data collection process by recording the time and location of the cue. If necessary, initially use the "Unknown" species id. If it turns out the cue was a bird or splash or debris or something else, then use the species code "Delete"

and the data line will be deleted from the database at a later time. It is **most important** to have an accurate time for a sighting, for both the initial sightings and follow-up sightings.

Hand-held binoculars, 7x50's, will be available to be used by any of the observers, particularly the recorder, to confirm the species identification or group size. Remember, when a group is farther away, it is easier to miss an animal and thus underestimate the group size. Binoculars **should not** be used for searching by the recorder.

Paper sighting forms, comment forms, and pencils will be available to be used as needed or to just jot down comments to help remember information.

A 2-way radio will be available to talk to the other team, the bridge, and acoustic team, as needed.

It is important that observers on each team constantly talk with their team members to ensure that a group of animals is only recorded as one sighting. When the density is high, this can be difficult, so team members must communicate that they have a sighting and its direction of travel. Thus, helping insure a group is recorded as only one sighting. If there is uncertainty if a group was recorded as two sightings, add this as a comment, and if possible decide later.

Bearing angles from the trackline to the sightings should be read from the angle ring at the base of each big eye or by using the pointers on the mounted angle boards that will be in front of the recorder. Record to the nearest one degree. **Do not round the angles.**

The big eye observers should estimate the radial distance (distance between themselves and the group) by using either the reticles in the eye piece of the binoculars or by using the naked eye. The recorder can estimate the radial distance either by eye, by using a measuring stick (pencil - see Appendix B), or by asking a big eye observer to get the radial distance using reticles. The measuring stick can be calibrated during the distance training exercises.

A re-sighting of a group that has already been recorded is called a "follow-up" sighting. If a group changes swim directions, it is important to record a follow-up sighting. This information will make determining duplicate sightings much more precise.

If possible, record the species identification and school size of the animals for each recorded follow-up of that group. It is assumed that the species identification and group size of the **last** follow-up sighting is the best judgment of the data value.

On detecting a cue (a possible sighting), the observer should call "Sighting" and the recorder presses the "New Sighting" button on the right side of the data entry display. This will automatically record the date and time. It is important to record the bearing (using the angle ring beneath the big eyes) and reticle distance as soon as possible to insure the recorded location is the initial distance.

Observers on the team can cooperate to ensure all data fields are completed and correct. The name associated with the data from a sighting is the person that initially detected the group, though the data values can come from any observer on the team.

If the density of groups is too much for one recorder, then the off-effort person can help by using another computer or by using paper, where the data would be entered later into the computer. For example, during a busy time period, the recorder can record on the computer the initial time of each group detected and no other variables. Then the primary recorder records the other pieces of information for one sighting on the data entry computer, while the other recorder can record the other pieces of information for another sighting on a piece of paper, in addition to the sighting id number. Then when there is a more peaceful lower density time period, the other pieces of information for the sighting that was recorded on paper can be entered into the data entry program.

2.4 EFFORT DATA

Refer to the VisSurv_NE Users Guide for more details about the effort type data.

Data from a team should be recorded on the same computer(s). Each computer is independent so all of the data collected by the say the upper team should be recorded on the computer labelled "upper team" or one of the back up computers.

Each team is responsible to fill in the effort fields on the Team tab (location of observers, on/off effort, survey mode, and station location) and to use the Start/End Trackline and Course/Speed Change buttons to record the track line effort fields.

The flying bridge (upper) team is responsible for filling out the environmental fields on the Environment tab. The bridge wing (lower) team can just click the "Update changes" on the Environment data form and not fill in any of the variables (the defaults will be recorded in the Access Effort table).

When on effort click the Rotate Observers button on the Team 1 tab to fill in the name of the person at each position (Left, Center, and Right). The left position means the left side of the boat (port side) when facing the bow. Center is the recorder position.

When your team is ready to start collecting data and we are on effort, then choose the "On Effort" option button. Whenever your team goes off effort, choose the "Off Effort" option button. Examples of times that you could go off effort include: breaking to investigate a group of animals, breaking for lunch, breaking at the end of the day, and breaking due to fog or rain.

2.5 ENVIRONMENTAL/WEATHER DATA

Refer to the VisSurv_NE Users Guide for more details about the environmental/weather type data.

Environmental and weather conditions need only to be recorded by one team, since the conditions apply to both teams. Thus, the flying bridge (upper) team is responsible for filling out the environmental fields on the Environment tab or the Environment data form.

These data should be updated at the beginning of each on-effort time period, every 30 minutes when observers rotate (on the half hour xx:00 and xx:30), and at times when the weather or environmental conditions change. For example, the Beaufort conditions are recorded to one decimal place and are constantly changing. So update this field when the Beaufort conditions change substantially, which means definitely when the conditions cross over to the next whole number (for example, from Beaufort 2.6 to 3.1) or when the conditions change from a low to a high value within the same integer (for example, from Beaufort 2.2 to 2.7). This is more important than you think because the probability of detecting a group changes rather substantially even when the Beaufort changes from 2.2 to 2.7. So please try to track these condition changes, though recording sightings data are higher priority.

The environmental/weather data that we will be collected are on the Environment tab when already on effort and on the Environment data form when just going on effort. The cloud cover, rain/fog and glare magnitude fields are drop down lists, while the rest of the fields require you to type in the value. The bottom couple fields are automatically filled in by the ship's SCS system.

2.6 APPROACH DATA

When the ship breaks to investigate a group of animals, we need to collect some basic information that will be reported to the NMFS Permit Office, as required by our permit. These data need only be recorded by one team, since the data apply to both teams. Thus, the lower team will record these data.

The recorder on the bridge wing (lower) team is responsible for recording information on all "permitted takes" on the approach data sheet. There are paper copies of the data sheet and an electronic copy on the ToughBook assigned to the lower team. A recorder can use either of these media. Though eventually all the approach data need to be in the electronic data sheet.

A "approach" that leads to a permitted take is defined as "a continuous sequence of maneuvers involving a vessel, including drifting towards a group of cetaceans closer than 100 yards for baleen and sperm whales and 50 years for all other cetaceans". In other words, if a group of animals comes to bow ride but the ship did not alter its course and the survey is still on-effort and on the track line, then this group of animals is not considered a take and so does not have to be recorded on the Approach Datasheet. To be considered a "take" the ship has to alter its course to approach a group and be within 100/50 m of an individual of the group.

2.7 RECORDING SIGHTINGS DATA PROCEDURES

The upper team will use the ToughBook labelled "upper team" and the lower team will use the ToughBook labelled "lower team".

Only the on-effort observers should initially detect a school of animals. After a school has been detected, anyone can assist in providing the most accurate data related to that school. If there is any disagreement, the opinion of the person that initially detected the school are recorded.

For all sightings the absolute minimum information to be included is the accurate time, bearing angle, radial distance, species identification, and school size.

On initial detection of a sighting cue, the big eye observer could keep their eyes on the group and while not taking their eyes from the binoculars:

1) **Say "SIGHTING". Then the recorder presses the "New Sighting" button**, even if it is uncertain as to whether it is a target species or not. This assigns a sighting number, time and ship's position to the sighting.
2) The **recorder should acknowledge** that they have heard and recorded the new sighting. This is important since the big-eye observer may be keeping their eyes in of the binoculars and on the cue.
3) **Immediately** after saying "Sighting", the big eye observer should determine the **bearing angle** to the sighting using the angle ring on the base of the big eyes before the sighting moves. This can be read by either a) the big eye observer slightly pulling their head from the eye pieces and moving their eyes, not the binoculars, to see the angle ring or b) by the recorder looking at the angle ring as the observer continues to keep their eyes on the sighting. The observer can keep a finger on the angle ring to assist the recorder to get the angle to the initial location of the group not the location where the binoculars are now pointed to. Do not round the bearing angle measurement. Record the bearing angle to the nearest degree.
4) Estimate and record the **sighting distance** to the sighting by using either the reticles in the eye piece (record in reticles) or visually (record in meters). Do not round the measurement. Reticles should be to the nearest 0.1 unit. Remember to mark the correct unit: Reticles or Meters. The default is reticles.
5) Then enter the values of the rest of the variables. Refer to the VisSurv_NE Users Guide for more details about the variables.
6) If the data on the school changes or if you realize that you made an error in the original recorded data or you now have more accurate information, then you can use the **"follow-up or fix it"** button.
7) If the school is far from the ship, and even if you cannot yet positively identify the species, you should not solely watch this school every second. It is recommended to record as much information as you can, then start scanning for additional schools and the entire extent of the current school. When you pass by the already detected school, then record a "follow-up" sighting with the updated information, especially the location. You can use the circle map on the right hand side of the screen to determine if it is highly likely that you have the same school. If you are not sure, record the new location as either a follow-up or a new sighting using the big-eye observer's and recorder's best judgement, but use the Comment Log to indicate if you are unsure if this is a follow-up.
8) After the school has passed abeam, resume searching for new sightings by starting to search at the trackline or at the other side of the track line.

Times a follow-up sighting would be the most useful are:

1) When the group initially was far from the ship. Even if the group is traveling in a straight line, record a follow-up every five minutes or so.
2) Or, when the group changes its swim direction. At the time the group changes directions, make a follow-up sighting and indicate the new swim direction and location (bearing angle and sightings radial distance).
3) Or, when the group appears to split or join another group, some animals just surfaced after a long dive, or the group appears to have grown in size. At this time, record a follow-up sighting updating the location and the data that changed.

4) The **final** follow-up sighting should have the best estimate of group size, calf count and species id. It's acceptable if the earlier follow-ups have incorrect data since it was the best guess at that particular time. In other words, the follow-up sightings record the progression of getting the correct id and group size.

What to do when there are possible duplicate sightings within a team:

1) If another group is detected that might be a previously recorded group, then it is the responsibility of the recorder to talk to the original observer to get an update on the position of the previously seen group. The recorder makes the final judgment as to whether the new group is unique.
2) If not sure, record both groups, do not close on it, make a comment on the status of the group(s), continue to evaluate if this is a duplicate, and if need be delete it at the end of the day.

What to do in high density areas:

1) The recorder goes to the person that saw the first group.
2) When the other observer sees a group, the recorder must decide the best way to record all the sightings. But it is ESSENTIAL to get the correct time for all initial sightings.
3) An initial sighting has priority over a follow-up sighting.
4) If the density is very high, suspend follow-up sightings for a little while, except when adding more correct information for a sighting.
5) Other possible options include:
    a) The recorder starts recording the first group, saves that sighting, clicks the new sighting button to get the time and sighting number for the second group, saves this second sighting, then goes back to the original group and finish filling out the data form, then finally goes over to the second observer who has been collecting the data fields but keeping the data in their mind and record the data for the second sighting.
    b) Get help from the off-effort person so that each binocular observer has a recorder.
    c) The second person records their own data on paper.

In any case, it is important to get the time of the initial sighting as accurate as possible.

2.8 SCHOOL SIZE DEFINITION

The distance and angle measurements should be estimated to the geometric center of the group. The geometric center can be considered the central mass of the group (Figure 2).

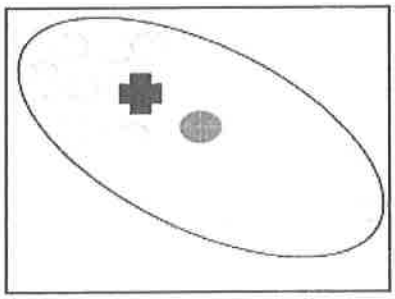


Figure 2.- The blue circles (●) represents animals in a group, where the black oval represents the area covered by the group. The red cross (✚) represents the geometric center of the group, while the pink circle/cross (✹) represents the physical center of the group. The geometric center of the group is the center of the weight of the group, so it is pulled closer to the larger cluster of animals within the group.

A group can be thought of as the smallest unit that can be tracked as a unit. A convenient rule is to define a group as containing individuals not more than 2 – 3 animal lengths from each other. The group may be exhibiting the same swimming pattern and/or general behavior such as travelling, milling or resting, although not necessarily with a synchronized surfacing pattern.

Difficulties arise when groups are not distributed in tight, easily defined clusters, but in loose aggregations whose boundaries, and size, must be determined subjectively. This is some times referred to as a super group. It is better to identify smaller, homogeneous groups within the aggregation, each associated with a precise distance, angle and group size estimate. Isolated individuals should be recorded as group size one (1). It should however be noted in a comment that the groups belong to the same aggregation.

Problems can also arise when a group is formed of animals swimming in a long line at relatively equal distance from each other without clear 2 – 3 body length separation between them (e.g., pilot whales and Risso's dolphins). In this case, group boundaries can be taken at any convenient discontinuities in the distribution.

It is possible to encounter large groups of some species of dolphins which may comprise several hundreds of animals. Very often these groups are compact, forming a single large unit and it is not possible to identify subgroups. Sometimes subgroups can be identified in a given moment but they usually last for a very short time, with frequent fission and fusion of subgroups. Single animals may be among them, making it very difficult, if not impossible, to identify relatively stable subgroups. In this case, it is better to consider the whole group as a single unit and try to record the distance and angle to its geometric center.

If a group splits, then identify this as a follow-up sighting and mention the group split in the comments. The group sizes recorded on the re-sightings should reflect that the group has split and is now smaller than the original sighting. It is essential that you record in the comments that the group has split.

2.9 CLOSING PROCEDURES

At times surveying will be suspended (go off-effort) to redirect the course of the ship towards a group of animals to determine/confirm the species identification and group size. It is not always necessary to actually go all the way to the group to confirm the species identification and group size. Sometimes it is only necessary to get closer to the group. The least time spent off the track line the better. But we also want to make sure the data that are collected is as correct as possible.

When the species identification and group size are determined then return to the original track line, preferable as close as possible to the point at which effort was broken off.

To avoid confusion, limit the number of people talking to the bridge. Perhaps have only the cruise leader or a designated person use the radio to call to the bridge to redirect the ship.

A group of animals for which an observer has detected but cannot identify the species is a candidate group to close on. A group that is less than 2 nautical miles away can be closed on. The following steps can be used to determine the species identification and group size.

1) After the initial detection of an animal group by an observer, say by observer member M of say the upper team, the recorder from upper team and observer M should attempt to identify the species id and group size. At the same time, the other observer on the team continues to scan in an attempt to find additional groups of animals. Remember when there is one group of animals there may very well be other groups of the same or different species, so keep looking around.

2) If observer M and the upper team recorder are having difficulties, then ask the other big-eye observer (called observer O) on the upper team to look at the animal group in an attempt to identify the species id and obtain an accurate group size. The observer O should spend as little time as is necessary to identify a group of animals originally detected by observer M, since observer O needs to be looking for other groups of animals.

3) If it is still not possible to identify the species and the group is within 2 nmi of the ship, then when the animal group goes beyond about 60° or 70° abeam of the track line, the recorder from the upper team can use the VHF radio to contact the recorder from the other team (lower team) to determine if they have positively identified that group.

4) If the lower team has a species identification that the upper team agrees with, then the upper team can record that species id and both teams independently record their own best estimate of the group size. In this situation, the ship continues on the original track line and surveying is still "on-effort".

5) If the lower team does not have a species id, or the upper team does not agree with the species id made by the lower team, then:

   a) The recorder of one of the teams should use the radio to call to the bridge and passive acoustic team to let them know that they want to close on a group. For example the recorder would say: "upper team to bridge and dry lab, we would like to close on a group that is about X nautical miles away at a bearing of Y degrees to the starboard (or port). To intercept this group turn the ship Z degrees to the starboard (or port)". That is, the recorder should identify the location of the group and a suggested best angle to travel to intercept the group which is travelling.

   b) The acoustic team and Bridge should then verify over the radio that they received the information about breaking track; if not, the visual team should contact them again to ensure that they heard the transmission (this is important as when the acoustic team is wearing headphones, often part of a radio transmission will not be heard).

   c) During this time the observer that originally detected the group absolutely must keep the group in view in the big eyes or via naked eye. That is, do not lose the location of the group.

6) As the ship starts turning to close on the group:

   a) Recorders from <u>both</u> teams must record "off effort" in the data collection program.

   b) The lower team recorder should also fill out the approach datasheet (either paper or computerized version).

7) As the ship is travelling to intercept the group:

   a) <u>Both</u> observers on the upper team (the original team) should keep the group within view in the big eyes or via naked eye, especially as the ship is turning. This is not an easy thing to do, which is why it is recommended that at least two people keep the group within view.

   b) The recorder on the original team (in this example the upper team) should explain to the other team via the radio where the group is so that observers from both teams can find the group and then help determine the species identification and group size.

   c) If another group of animals was already detected while on-effort by either team, then some observers will need to be dedicated to determine the best data for this other group of animals. The recorder will assign people to each group of animals.

   d) Until the bridge crew can see the group that is being closed upon, one person should continue to update the bridge as to what direction the ship should turn to intercept the group. For example say "turn an additional 15° to starboard (or to the right)". Only one person should talk to the bridge. Also say turns in large increments at first since the animals travelling can quickly get away as the ship slowly turns.

   e) Since some people are better at talking on the radio to relay the needed information, each team should determine who these people are and designate them as "radio people". After the initial request for the ship to close on the group, the recorder that is talking to the bridge may want to pass the radio to one of the "radio people" and then take over one of the big eyes to determine the species id and group size. Remember only one person talks to the bridge.

8) When the team or teams that detected the group while on-effort get a sufficient look to determine the species id (or ids if there are multiple species in the group), then:

   a) The team or teams should record the data as a follow-up sighting to the original sighting. You can just update the values of species, group size and calf count. The location and swim travel direction information are relative to the ship's position, so it is not necessary to update the location and swim travel direction.

   b) The lower team should fill in the approach data sheet. This information can be put into a computerized datasheet at some other time, say at night or on a bad weather time period.

c) Via the radio, the radio person should tell the acoustic team what the species is. The acoustic team will report whether the ship is close enough to obtain good recordings and whether recordings are needed for that particular species. The acoustic team will attempt to collect good recordings of each species encountered during the survey.

d) If the ship is too far from the group to obtain good recordings, or if recordings are not needed, then the radio person should inform the bridge to return to the track line to a point near where the ship left the track line. For example say: "lower team to the bridge, we would like to return to the track line". The bridge already knows we want to return to the point where the ship left the track line.

e) If the ship is close to the group and this is a group for which better recordings are needed, then:

   i) The radio person or acoustic team should inform the bridge that they want to travel in a straight line for 3 – 5 minutes (hopefully in the general direction of the track line) so that the array (300 m behind the ship) will be close to or within the group. For example say: "upper team to the bridge, we would like to pass through the school to get a good recording. To do this turn X degrees to the port and travel for 3 minutes." In general, travelling in a straight line is more important than passing directly through the group.

   ii) The bridge crew may suggest the best bearing to go through the group and if possible head in the general direction to the track line.

   iii) The acoustic team will announce, via the VHF radio, that they now have a good recording, and may ask the visual team for information on their sighting number and group size.

   iv) The bridge crew will then take the ship back to the track line in the most efficient way and announce about how long it will take to get to the track line.

f) When the ship is about 3 – 5 minutes from the track line, the bridge will announce this fact on the radio, so that the observers will be ready to start surveying when the ship gets back to the track line.

g) Given the time survey effort will start up again, the observers should rotate (if needed) to the station that they would have been at that particular time of the day.

2.10 PHOTOGRAPHING PROCEDURES

There will be at least one camera body and a variety of lenses that belong to PSB. Anyone can use this camera to take pictures. The resulting pictures are the property of PSB but anyone can have copies of the pictures as long as they are not sold. Use the paper log book that is in the camera case to document which frames were taken.

Anyone with their own camera can also take pictures. Again, the resulting pictures are the property of PSB but anyone can have copies of the pictures as long as the photographs are not sold.

Take as many photos as you want when you are off-effort, as long as you do not disturb the on-effort observers.

All pictures from the PSB camera should be downloaded to computer that is to be determined when on the ship. Pictures from personal cameras can also be downloaded. There will be a directory set up to store the pictures.

At the end of the survey, we will make a CD of the "Best of Pictures" that will include pictures from the PSB and other personal cameras that people can take home with them.

If survey effort is broke to close on a group, then someone should use the PSB camera to take pictures of the group that we are closing on. Use whichever platform will lead to the best quality of pictures.

2.11 BIOPSING FROM THE BOW

When the ship closes on a group, there may be an opportunity to collect biopsy samples from the bow. There will be a box at the bow that stores the biopsy equipment, along with cameras.

When leaning over the rails, the person must follow safety procedures that will be determined while on board.

When someone is attempting to collect biopsies another person must be designated the data recorder and helper to the biopsier.

3 OTHER ACTIVITIES

3.1 ESTIMATED DISTANCE AND ANGLE TRAINING AND EXPERIMENT

Accurate distance estimation is essential to the collection of reliable sighting data. Therefore, there will be training in angle and distance estimation.

At least on the first day of each leg distance training and testing will be conducted using two scenarios. First is the feedback/training scenario. A bumper (a simulated dolphin) is tossed into the water from a small boat and the distance between the bumper and the ship is measured, nearly simultaneously the observers use either naked eye or binoculars to estimate the distance between them and the bumper. During training the actual distance is relayed to the teams after all observers record their estimate. This training helps observers learn and improve their distance and angle estimates. During scenario two, a test, the actual distance will not be relayed to the visual team members until after the test. The purpose of the test is to document the accuracy of each observer, and so be able to correct the data collected.

The protocol is:

1) The ship is anchored or using dynamic positions to stay in one place in a location where the bow points in a direction so that there is an un-obscured view of the horizon from at least 60° starboard to 60° port.
2) Needed:
    a. Radio for each team, the bridge, the small boat operator, and the computer operator.
    b. Black bumper or "Harry the hapo"
    c. Computer program to get the distances
    d. Distance Training data sheets and pencils, one per person on the visual teams
    e. Distance above the water line to the average eye height of each visual team
    f. GPS position of the each team on the ship and GPS position of black bumper.
3) In the Excel computer program that converts the pair of GPS locations to a distance between those locations uses Excel macros called geofunc.xla. Originally I put this macro in c:\distance.calcs.

    When the program is first opened, the macros may be disabled. To enable the macros, one way is to put the cursor inside one of the cells that says "#NAME?" where you will see the full name of the macro, including the directory names. Then, in Explorer, go to that file and double click the file name. A Microsoft Office Excel Security Notice window will pop up where you can click on the "Enable Macros" button. This should allow the calculations to be made and the cells should fill in with numbers instead of the "#NAME?".
4) A small boat with two crew members (1 driving and 1 deploying the black bumper) goes out in front of the ship with the black bumper (a simulated dolphin). The bumper is put into the water.
5) The distance between the bumper and the ship is recorded by using the laser binoculars (only go to 1000 m), the ship's radar, or a GPS on both the small boat and the Bigelow. For example, the small boat reports over the radio the latitude and longitude of their location, which the computer operator types into the computer program.
6) Then the small boat drives away from the bumper and radios to the visual teams "ready."
7) The visual observers find the bumper, then estimate and record the distance and angle to the bumper using either naked eye, binocular reticles, or both (as appropriate).
8) When every one on the team has recorded their estimate, then someone on the team radios they are complete. For example, the upper team would say "upper team done".

9) When both teams are done and have announced so on the radio, then the actual distance and angle are announced over the radio by the computer operator who reads these distances from the computer program which calculated the distances from the locations of the observers and the small boat.

10) Do this many times until every one is comfortable using the reticles and estimating close distances using the naked eye.

11) After training, get a new data sheet, label it test #1 (or whatever) and do at least 10 distances and angles where the actual distances and angles are not relayed back to the teams.

12) During training and testing, the angles and distances should vary as much as possible, from 20 m in front of the ship to some 5 nmi, with an emphasis on distances from 200 m to 3 nmi.

13) Finish up, bring the small boat back on board, and let the small boat participants go to the head.

3.2 DATA BACKUP AND VALIDATION

The data collected during the day will be backed up onto another computer and data stick and also validated to ensure that it is accurate and complete. Data backup and validation will be performed the same evening the data were collected so that the sightings are relatively fresh in the observers mind.

One person per team or the cruise leader should dump the data from all the computers onto a data stick, and print out all the sightings for each team.

Each observer should check the sightings they detected for completeness and accuracy. Corrections should be made neatly on the paper print out. Each observer should place a small, neat check mark by each of their sightings to indicate they have inspected and possibly made corrections to that sighting.

When all sightings have been checked give the paper print out and data stick to the Chief Scientist (CS) or the designee. This person will then file the paper printouts. Corrections indicated on the paper printouts will be put into the computer database by either the chief scientist or some other designated person(s).

The corrected data will then be validated using computer programs that checks for missing or obviously incorrect data values.

APPENDIX A. LIFE ON A SHIP

GENERAL

Your cruise leader is responsible for implementing the survey methods the best he/she can. He/she is not responsible for any weather conditions, ship vibrations, or ship protocols, etc. The weather rules the survey! The cruise leader must maximize the time available for observations in order to complete the survey trackline. He/she decides upon the daily schedule for the next day and will aim to post it the evening before. However, weather constraints can modify it at any time. The cruise leader can call a meeting at any time, even awakening sleeping observers!

Survey methods and procedures have been fixed in advance, and need to be kept standardized. If you can think of improvements, discuss them with the cruise leader **first**, before implementing.

Even if you are very experienced with computer databases and programming, do not modify any software or computer settings. Discuss possible changes with the cruise leader first.

The survey is not a whale watching cruise but a dedicated survey to estimate abundance so we cannot spend long periods of time with a single group of animals.

During periods of good weather, the work may extend from sunrise to sunset even for several days in a row. Be prepared! When there is bad weather the time will be yours (and the cruise leader's) for resting and, of course, data corrections.

All scientists are responsible to ensure all survey gear are secured during off-effort time periods, especially during bad weather. Please do your part.

SURVEY PROCEDURES

Communication with the captain or the crew on work matters is the sole responsibility of the cruise leader. Please do not discuss the specific survey plans (e.g., expected start time, transect, weather, etc.) with the captain unless asked to do so by the cruise leader.

There are two visual observation platforms on the ship. Observers should not swap between platforms, if that is not in the pre-arranged protocols. Your cruise leader will assign you to a platform (taking into account your wishes, experience, etc.). The cruise leader may decide to switch observers between the teams.

Mobile phones and music on headsets are not allowed on the survey platform during on-effort time periods. Take as many photos as you want when you are off-effort, as long as you do not disturb the on-effort observers. If available, when you are off-effort use the NMFS cameras or make your pictures available to NMFS during the survey.

No smoking on the observation platforms!

Arrive on your platform a few minutes before your watch. You are responsible for awakening in time for your watch. At the end of a watch, always wait for your replacement to arrive before leaving the platform, even if the replacement is late (so you can hear them apologize).

The aim is to validate the data at the end of each day. So make any corrections on the data sheets as soon after dinner as possible.

During your break from observation work, you may sometimes be asked to do something else (e.g., data entry, data validation, or help with the oceanographic data collection). If you are not needed, use your rest time well!

LIFE ONBOARD

Information on 'housekeeping' (e.g., cleaning responsibility, alcohol policy, safety rules) will be given when you arrive at the ship. Always follow the ship's safety procedures and rules.

Cabins have two or four berths. If you get your own cabin enjoy it!

If you have problems, including medical or personality problems with a crew or scientist, please speak to your cruise leader or team leader directly and openly as soon as possible. A delay may make matters worse or cause ill feelings.

APPENDIX B ESTIMATING DISTANCES

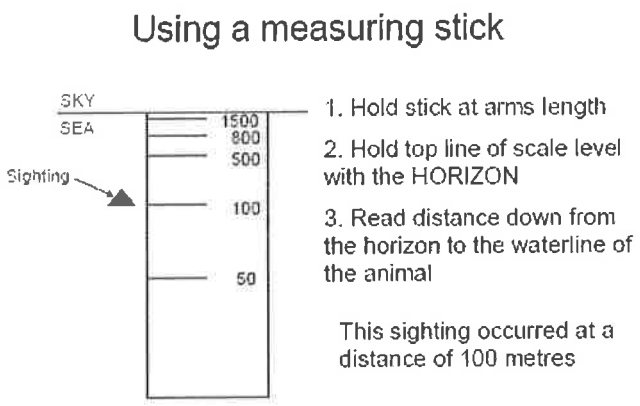
It is important that distances to sightings are estimated accurately. There are a number of devices to help with this. Measuring sticks help to gauge distance when using the naked eye, while reticles are used with the big eye binoculars.

B.1 READING A RETICLE

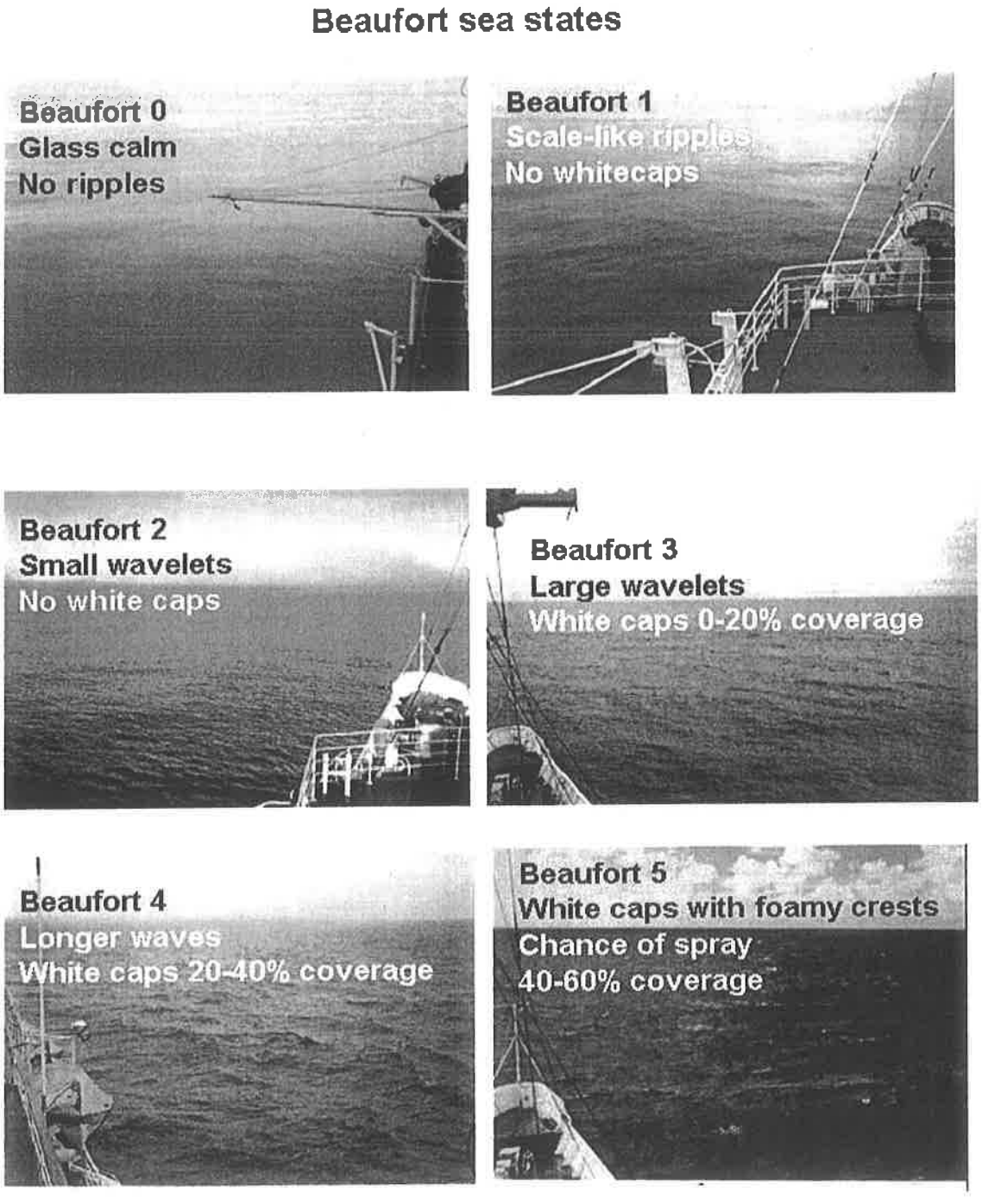
Radial distances for sightings made by the observers using the big eyes can be estimated using reticles which are marks on the binocular lenses. The top reticle must be on the horizon. While the top reticle is on the horizon, the observer counts the number of marks from the waterline of the animal up to the horizon. This number can then be transformed to a radial distance between the animal and observer. Note that the reticles are different in different powered binoculars and the reticles in the 20x60 binoculars have positive and negative values.

B.2 USING MEASURING STICKS

Measuring sticks will be made for observers who want one, as the scale on the stick depends on the eye level of the observer above sea level. To use the stick, hold with an outstretched arm so that the top line on the scale is level with the horizon. Then read down to the waterline of the animal. The numbers on the scale show the distance in meters away from the ship.



APPENDIX C BEAUFORT SEA STATES



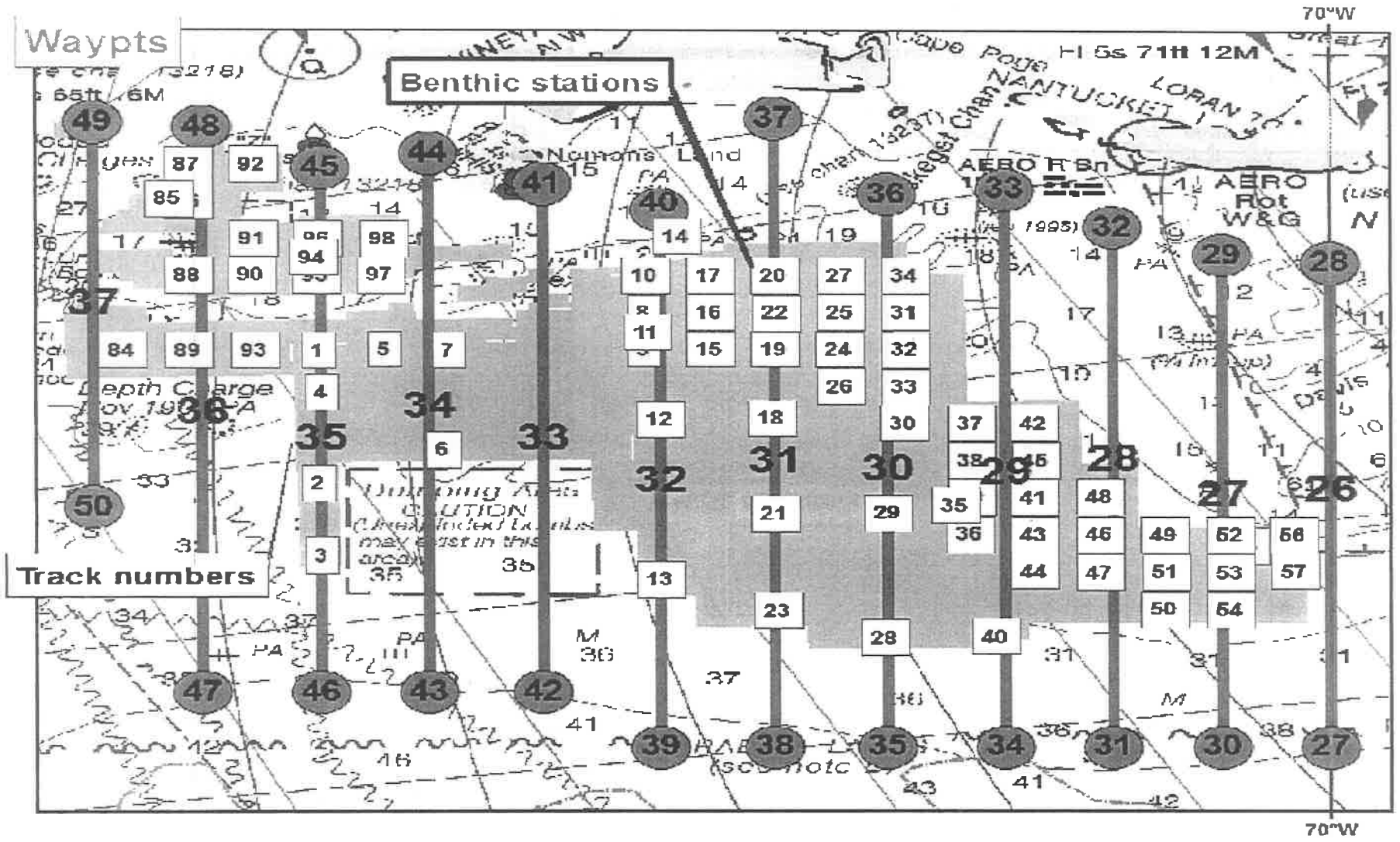


Figure 2. MA-RI wind energy area

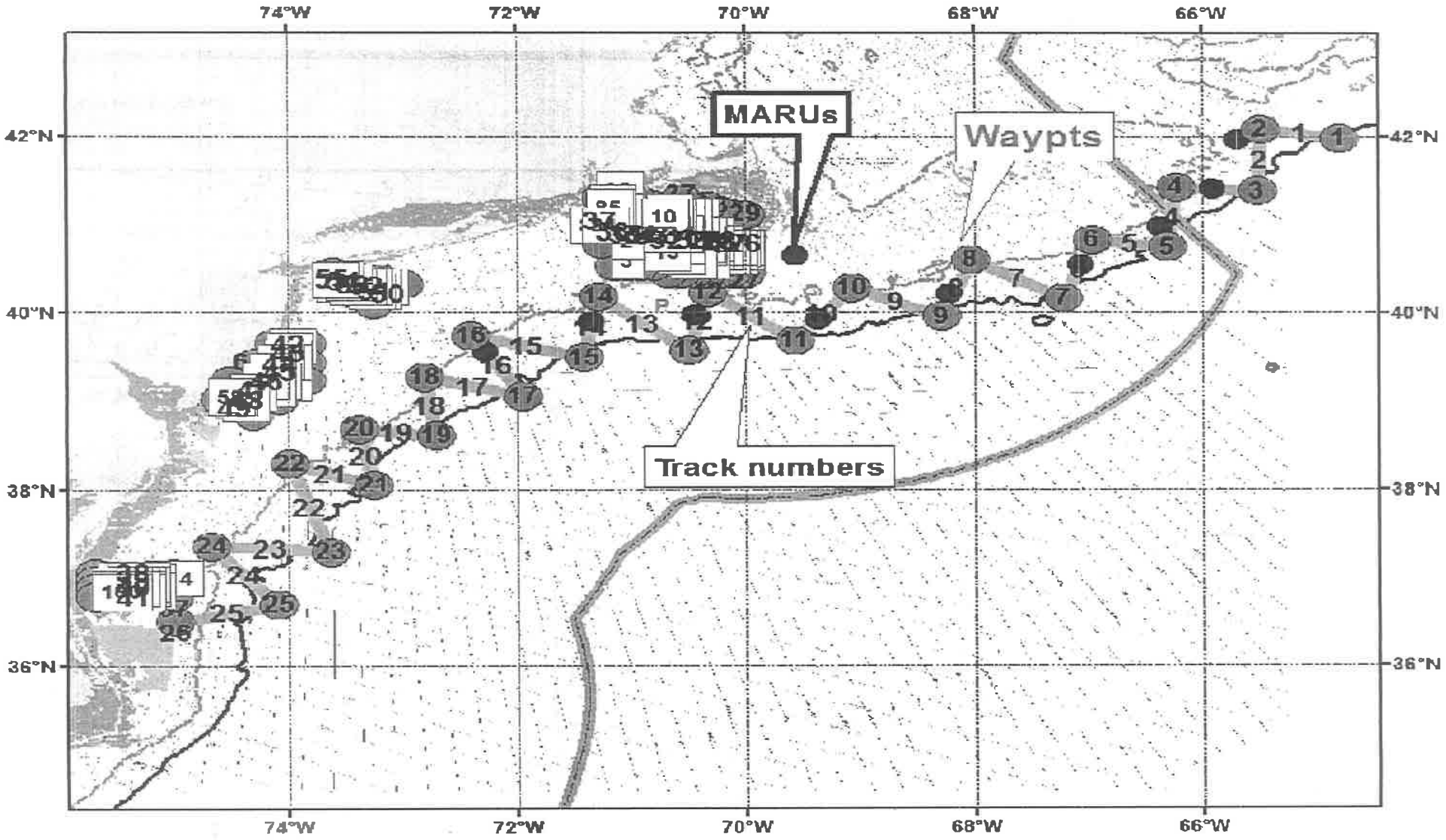


Figure 1. All tracklines and benthic stations

Student Activity Page # 1

Using the link to Mrs. Gogan's Teacher at Sea Blog and/or the AMAPPS handout given to you, answer the following questions.

https://teacheratsea.wordpress.com/2014/04/14/kimberly-gogan-science-spot-light-marine-mammal-observing-april-12-2014/

1. What Does **AMAPPS** stand for?

2. What are the goals or primary objectives of the multi-year **AMAPPS**?

3. What Government Acts are the **AMAPPS** Scientists working under and why?

4. What sort of Scientist would you expect to be collecting data that work under the **AMAPPS**?

5. What sort of data does the **AMAPPS** Scientist Collect? How do they collect it?

6. What will they do with the data they collect? (There are links embedded in the blog that will help you, or you can search the internet using the following acronyms: NOAA, BOEM, NEFSC)

7. What is one of the primary ***animals of interest*** or ***endangered species*** studied by the AMAPPS Scientist?

8. How does the **NOAA Corps** support the work of the **AMAPPS** Scientist?

9. Describe what ***Effort Data*** is. The blog refers to this as being "***On Effort***."

10. Define and Describe a ***Reticle*** and the ***Beaufort Scale*** that scientists would use for shipboard data.

11. What is so special about the area of interest off the coast of Martha's Vineyard? (if not using the blog use the attached survey map)

12. Define ***Alternative Energy***:

13. What is an ***Offshore Wind Farm***? (if not using the blog you will need to do an internet search for this)

Student Activity Page # 2

Using the link to Right Whale Listening Network, answer the following questions:

1. Using the "**About Right Whales**" tab, highlight some of the fact about **Right Whales**.
   Quick facts

   Appearance

   Migration

   Whaling

2. Using the "**Threats**" tab describe some of the human general activities that are a threat to Right Whales.

   Ship strike

   Entanglement

   Noise Pollution

3. What are scientists doing to help the **Right Whale** in terms of these specific threats?

4. How do scientists know if **Right Whales** are in the area?

Collecting Data: Using the following website, investigate how many Right Whales are in the areas of the Proposed Offshore wind Farm.

http://www.nefsc.noaa.gov/psb/surveys/

First use the drop down arrow to select a month. Select "**April**."

1. Check the box that says "**35nm S Providence RI DMA – active though April 15 2015**"
2. Then click on the "**map"** tab to the right of the month you selected "**April**." You should see a large number of whale's tails populate the screen.
3. Zoom in using the **+ button** to the left of the map to just bring in the Dynamic Management Area boxed in yellow. This is the area of the proposed Offshore Wind Farm.
4. Then click on the "**table"** tab that is above the month of April drop down. This should bring up a screen with all of the whales that were spotted in that area during the month of April (Even 2014 the month Mrs. Gogan was a Teacher at Sea and in that area!)
5. Students will use that table to fill in the chart below which shows how many endangered Right Whales were spotted by a ship possibly carrying Scientists collecting data under the AMAPPS, by looking for the category **"Dedicated ED Shipboard, Opportunistic, Coast Guard, or Whale Watch**". Students will see collected data for the years 2015 – 2010 for whales that were spotted in the **Southern New England Area (SNEA) or the Great South West Channel (GSWC) ONLY**. Students may want to print and share copies of this data

Data Chart

Sight date	Group size	Area SNEA or GSWC	Species Cert	Category

Summarize: Give the total # of **Right Whales** that were spotted in this area of interest just in the month of April. Given that information, what is your opinion about having this as a site of an Offshore Wind Farm?

Class Debate Rubric

Category	5	4	3	2	1	Totals
Respect for Other Team	All statements, body language, and responses were respectful and were in appropriate language.	Statements and responses were respectful and used appropriate language, but once or twice body language was not.	Most statements and responses were respectful and in appropriate language, but there was one sarcastic remark.	Statements, responses and/or body language were borderline appropriate. Some sarcastic remarks.	Statements, responses and/or body language were consistently not respectful.	
Information	All information presented in this debate was clear, accurate and thorough.	Most information presented in this debate was clear, accurate and thorough.	Most information presented in the debate was clear and accurate, but was not usually thorough.	Some information was accurate, but there were some minor inaccuracies.	Information had some major inaccuracies OR was usually not clear.	
Rebuttal	All counter-arguments were accurate, relevant and strong.	Most counter-arguments were accurate, relevant, and strong.	Most counter-arguments were accurate and relevant, but several were weak.	Some counter arguments were weak and irrelevant.	Counter-arguments were not accurate and/or relevant.	
Use of Facts/Statistics	Every major point was well supported with several relevant facts, statistics and/or examples.	Every major point was adequately supported with relevant facts, statistics and/or examples.	Every major point was supported with facts, statistics and/or examples, but the relevance of some was questionable.	Some points were supported well, others were not.	Every point was not supported.	
Organization	All arguments were clearly tied to an idea (premise) and organized in a tight, logical fashion.	Most arguments were clearly tied to an idea (premise) and organized in a tight, logical fashion.	All arguments were clearly tied to an idea (premise) but the organization was sometimes not clear or logical.	Arguments were not tied well to an idea.	Arguments were not tied to an idea at all.	
Understanding of Topic	The team clearly understood the topic in-depth and presented their information forcefully and convincingly.	The team clearly understood the topic in-depth and presented their information with ease.	The team seemed to understand the main points of the topic and presented those with ease.	The team seemed to understand the main points of the topic, but didn't present with ease.	The team did not show an adequate understanding of the topic.	
Presentation Style	Team consistently used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Team usually used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Team sometimes used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	One or more members of the team had a presentation style that did not keep attention.	The team's presentation style did not keep the attention of the audience.	
					Totals: _____	