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# Site-Specific Oyster Survey Protocol

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## 1. Background/ overview

- a. Title:
- b. Protocol summary:
- c. Investigators:
- d. Collaborators:
- e. Funding source:

## 2. Introduction/objectives

- a. What will be surveyed (resource or ecological indicator)
  - i.
- b. Where the survey will be conducted (geographic location and type of environment)
  - i.
  - ii.
- c. When will it be surveyed
  - i. Depending on the warmth of the winter and salinity levels of the river, the survey dive(s) should take place between April and July due to environmental ranges. (Oysters' Life Cycle).
    - a. Water temp: 74-86 F
    - b. Salinity >10 ppt
- d. Current state of knowledge about project topic
  - i.
- e. Justification for study
  - i. The goal of this project is to gain a deeper understanding of the current population and growth of the eastern oysters (*Crassostrea virginica*) at the \_\_\_\_\_ reef in the \_\_\_\_\_. A successful oyster reef will decrease the amount of phytoplankton, including harmful algal blooms and suspended solids in the surrounding water, ultimately improving bottom dissolved oxygen and increasing the water clarity (Nelson et al. 2004). As one of the most effective filter feeders in the Chesapeake Bay (Newell and Koch 2004), it is imperative that the \_\_\_\_\_ and the public understands the health and status of the eastern oyster in the \_\_\_\_\_. In order to determine if a sanctuary reef is successful, annual population surveys are necessary.
- f. Gear
  - i. Dive buoy and flag
  - ii. Exposure suit
  - iii. Dive gloves
  - iv. Mask, fins, and snorkel
  - v. Dive knife



- vi. Dive flashlight
- vii. Time/depth instrument
  - 1. Submersible pressure gauge
- viii. Quick release devices
  - 1. Weight belts
- ix. Buoyancy Compensator
  - 1. Must achieve and maintain positive buoyancy
  - 2. Must be equipped with exhaust valve, an oral and mechanical inflation device
- x. Regulator with primary second stage and alternate air source
- xi. Scuba cylinder air tank
- g. Milk crate(s) with fine mesh around so spat is not lost and buoy(s) attached to crate with rope
- h. 5 buckets (one bucket per sample collection)
- i. .25 x .25 meter quadrat
  - i. Neon tape around edges



Image 1: A .25 x .25 m quadrat used for oyster sampling

### 3. Personnel requirements and training

- a. PADI or NAUI Open Dive Certification for at least two divers or scientific diver certification for one diver

### 4. Operational requirements

- a. Collection permit from Department of Natural Resources
- b. USL&H insurance if in house or outsource the collection dive



- c. Dive vessel legally operational under relevant regulations of the US Coast Guard and Maryland Department of Natural Resources.
- d. The attribute actually measured or estimated (e.g., body size, cover, density)
  - i. Oyster budget
    - 1. Collect data on live and dead oysters
    - 2. Subtract: Live – Dead = Oyster Budget
    - 3. Higher oyster budget = healthier reef
  - ii. Oyster shell length and width in mm
  - iii. Black shell percentage
    - 1. Estimate how much black is on the bundles of shell (%)
    - 2. Count spat set and scars on each oyster bundle
  - iv. Oyster sex ratio
    - 1. Sex information on 25 random oysters (5 per random sample collection) if and only if there are >25 mature oysters in collection if possible
- e. The target response from management (direction of resource change)
  - i. Reef health, maturity, and potential growth
- f. The measurable state or amount of change in the attribute (quantity/status)
  - i. Enter data into Excel document. Track data in Excel to measure the state of change in each attribute (budget, shell length and width, black shell percentage, sex ratio, etc.) annually.
- g. When you expect to see a response to the management action (time frame)
- h. Desired accuracy of estimates
- i. Magnitude of change one wants to detect
  - i. Attributes will ideally have a positive change annually.
- j. Chance of error you are willing to accept
  - i. 95% confidence interval
  - ii. Create true random sampling generator
    - 1. Randomly choose five coordinates on the Sanctuary Reef for collection
- k. Power to detect a change of a specified magnitude

## 5. Field methods and sample processing

- a. Weather
  - i. Plan and dress accordingly:
    - 1. Check forecast
      - a. No thunderstorms in area
      - b. No gale warnings
    - 2. Tides
      - a. Best dive time one hour-45 minutes before high tide



- i. Better visibility conditions
    - 3. Currents
      - a. No strong currents that can be a danger to the boats and/or divers
    - ii. Use best and safe judgement
  - b. Safety
    - i. At least two certified SCUBA divers or one certified scientific diver must complete collection dives.
    - ii. Pre-dive checks
      - 1. Equipment checks
    - iii. Signals
- 6. Sampling design and collection**
  - a. Day of collection dive:
  - b. Collect tidal data
    - i. Hydrolab or YSI data and atmospheric data if possible
    - ii. Visit predetermined random coordinates
    - iii. Diver(s) lay milk crates with buoy attached near proposed coordinates
    - iv. Once milk crates are set, start the diving excursion
    - v. If available, lay bright orange line reel next to milk crate and drag the rest of the line with you to the area you are sampling. Once there, lay the quadrat down and start the collection.
    - vi. Bring as many oysters as you can to the milk crate by following the orange line and repeat until all oysters are collected.
    - vii. Visibility will get bad as soon as you start the collection. Be aware of your buoyancy and location. Always know where the orange line is. If lost, resurface and wait for your dive buddy or return to crate and start over.
    - viii. One sample per bucket, keep samples separate from each other for accurate data. Label buckets according to sample number.
      - 1. 5 random samples
      - 2. Set .25 x .25 m quadrat at random place on reef. Collect oysters inside quadrat and place in the crate to bring on board dive vessel.
      - 3. One sample per bucket, keep samples separate from each other for accurate data
- 7. SCUBA diving Steps (8 Tricks for a Perfect Descent when Scuba Diving)**
  - a. Descent
    - i. Check with diver (ask diver: “are you okay to dive?”)
    - ii. Check your weighting
    - iii. “Diver, are you okay to dive?”
      - 1. “Yes, I am okay to dive”



2. "No, I am not okay to dive"
  - iv. Signal that you and your dive buddy are ready to start your dive
  - v. Orient yourself on the descent line
  - vi. Regulator in.
  - vii. Check the start time of your dive
  - viii. Head up/feet down position during descent to vent air effectively from Buoyancy Control Device (BCD).
  - ix. Do not kick or wave arms during descent
  - x. Breathe regularly during descent
  - xi. Equalize ears regularly as you go down water column
  - xii. Add small amount of air to BCD so you do not hit bottom
  - xiii. Signal to dive buddy that you are okay
  - xiv. Achieve buoyancy at milk crate before you follow orange line so you do not disturb the visibility.
- b. Ascent
  - i. Air cylinder - ascend if reaching 1000 psi
  - ii. Do not let air cylinder go below 1000 psi
- c. Post-dive checks
  - i. Check dive end time
  - ii. Physical problems (ear ache, sinus issues, nervousness, muscle or bone ache)
  - iii. Symptoms of decompression sickness
  - iv. Equipment malfunctions
- d. Gear rinse
  - i. Properly rinse, and stowed
- e. Termination of a dive
  - i. See weather
  - ii. Check that all gear holds up to standards
  - iii. Diver: use best judgement

## 8. Data management and analysis

- a. Collect data on attributes (budget, shell length and width, black shell percentage, sex ratio, etc.) annually.
- b. Use caliper to measure length and width of spat and length, width, depth, and hinge axis of mature oysters. (image 2)



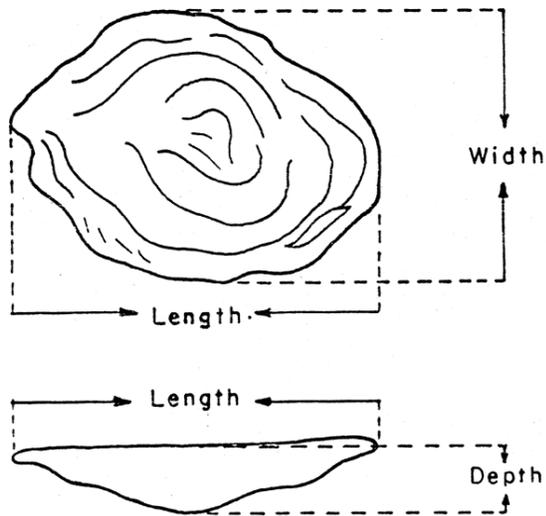


Image 1: Correct way to measure an oyster using this protocol (Warren, P.J., 1958).

- c. Input all data into Excel document and compare to each annual collection.
- d. Make graph trend of oyster shell size, oyster budget, and sex ratio
- e. Compare data to water quality from the past sampling season
- f. Use data analysis to present to Marylanders Grow Oysters and other interested audiences
- g. Present data on website and social media

Complete oyster population survey annually to keep a well documented understanding of your Sanctuary Reef.



### Work Cited

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