BITMAX Video Narrative

"Science on the Chesapeake Bay: a BITMAX Program Research Cruise"

Filmed, Edited and Produced by Elizabeth W. North

This video contains footage from a BITMAX (Bio-physical Interactions in the Turbidity MAXimum) research cruise that is part of a multi-investigator, interdisciplinary effort to understand how physical conditions in the upper Chesapeake Bay trap particles, retain zooplankton, create larval fish nursery areas, and influence the survival of juvenile fish like white perch and striped bass. Principal investigators include Dr. Edward Houde (larval and juvenile fish) from University of Maryland Center for Environmental Science (UMCES) Chesapeake Biological Laboratory, Drs. Mike Roman (zooplankton), Larry Sanford (physical oceanography), Shenn-Yu Chao (physical numerical modeling), and Raleigh Hood (biological numerical modeling) from UMCES Horn Point Laboratory, and Dr. Carl Friedrichs (physics and sediment dynamics) from the Virginia Institute of Marine Science. Dr. Elizabeth North (biological-physical interactions) is a post-doctoral researcher on this project stationed at UMCES Horn Point Laboratory. This project is funded by the National Science Foundation Biological Oceanography Program.

The following provides a narrative description of the 9-minute BITMAX video. The footage was shot on a 9-day research cruise in May 2002 that took place in upper Chesapeake Bay on board the *Research Vessel Cape Henlopen*. Although scientific operations appear to take place in two days, this film is a compilation of nine days of operations. The *RV Cape Henlopen* is a UNOLS research vessel owned and operated by the University of Delaware. BITMAX researchers would like to thank the Captains and crews of the *RV Cape Henlopen*, *RV Orion*, and *RV Coot* for their capable field support during BITMAX research cruises.

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RV Cape Henlopen docks in Cambridge, MD. We conduct our research cruises in spring, summer, and fall on board the *Research Vessel* (*RV*) *Cape Henlopen*, a 120 foot UNOLS (University-National Oceanographic Laboratory System) vessel that is operated by the University of Delaware. This cruise is in May 2002.

Horn Point Laboratory researchers load equipment. The *RV Cape Henlopen* hails from Lewes, Delaware, and sails to Sailwinds Park in Cambridge, MD where zooplankton ecologists and physical oceanographers from UMCES Horn Point Laboratory load their gear and board the vessel.

Arrive at Chesapeake Biological Laboratory in Solomons, MD. The vessel steams across the Chesapeake Bay to UMCES Chesapeake Biological Lab in Solomons, MD where we load the fisheries scientists and their gear.

Steaming to upper Chesapeake Bay. Once all the gear is loaded, we depart Solomons and steam to the upper Chesapeake Bay where we start sampling. Our first survey station starts at the

Chesapeake Bay Bridge and we work north to the head of the bay in order to locate the salt front (where freshwater from the Susquehanna River meets salt water from the ocean) and find the estuarine turbidity maximum (ETM), the place where turbidity (water cloudiness) is highest because sediment is mixed up into the water and trapped by tides and currents near the salt front.

Setting the moorings. Once we have located the salt front and ETM, we set moorings that will remain in a fixed location for the nine day cruise. These moorings continuously collect information on salinity, temperature, turbidity, and water currents. On this cruise, we set our moorings near the northern Bay CBOS (Chesapeake Bay Observing System) buoy. First we set our guard buoy (the big yellow one). This buoy protects the other moorings from shipping traffic and contains an instrument to measure current speed. The guard buoy is attached to a chain which is secured to an anchor, a 700 lb railroad wheel. The buoy is dragged behind the ship and once the Captain of the research vessel indicates that we are at the right location, the oceanographic technician pulls the trip mechanism and the railroad wheel is released.

We also set a taut-wire mooring. The railroad wheel is put in the water first and a series of instruments that measure salinity, temperature and turbidity are strung on the cable between the anchor and a subsurface float. This subsurface float (the big blue ball) has more than 300 lbs. of buoyancy that keeps the wire taut. A small orange buoy is attached to the subsurface float so we can retrieve the mooring.

CTD survey and zooplankton sampling. After the moorings are in place, we conduct a thorough hydrographic survey along the channel of the upper Chesapeake Bay. We use a CTD (conductivity-temperature-depth recorder) that is attached to a yellow frame called a rosette. Other instruments to measure light, turbidity, and zooplankton biomass are also attached to the frame. Zooplankton are small animals that are close to the base of the food chain and are important food for larval fish like striped bass and white perch.

We're interested in how physical conditions influence the abundance and distribution of zooplankton near the ETM, so we collect them at specific depths in areas of the upper Bay. We attach a hose to the CTD rosette, lower the CTD to the specified depth, and pump water up to the ship and into a net. The sample is then concentrated and preserved so we can identify and count the organisms back in the laboratory.

We also do plankton tows with the starboard davit off of the stern of the vessel. We use these collections for genetic analyses and for egg production experiments.

Sampling for fish eggs and larvae. We use a large, one square-meter plankton net (a Tucker Trawl) to collect eggs and larvae of fish because they swim too fast to be collected with the pump or small plankton nets. This trawl has a 200 lb lead bar at its base so we use the *RV Cape Henlopen*'s hydraulic frames to deploy it. The Tucker Trawl has two nets that can be opened and closed at specific depths. Once the tows are complete, the eggs and larvae are washed into the base of the nets, poured into buckets and through sieves until they are concentrated, and then preserved so we can identify and count the eggs, larvae and zooplankton in a laboratory after the cruise We'll compare the distribution of fish eggs and larvae to CTD and zooplankton data to learn what prey characteristics and physical conditions make the best larval fish nursery area. The sample that is shown, and most samples for that matter, contain mostly zooplankton and relatively few fish eggs and larvae.

RV Orion. We also conduct coordinated studies in areas of the upper Bay that are too shallow for the *RV Cape Henlopen*. We use the *RV Orion*, an UMCES ship that is operated out of Solomons, MD. After we load gear and scientists on board the *RV Orion*, they steam off for a night of zooplankton and fish sampling in the shoals.

Ship tour: bridge and galley. While the *RV Orion* is preparing to start work, Captain Bill Byam prepares the ship for a night of mid-water trawling. In the galley, the scientists and ships crew enjoy a delicious meal before the trawling begins.

Sampling for juvenile fish. Mid-water trawling starts when the sun goes down. It's hard to catch juvenile fish near the surface during the day, so we have to wait until night falls to collect them. We fish an 18 square-meter mid-water trawl for twenty minutes from the surface to the bottom in different locations near the ETM to try to learn what physical conditions create the best juvenile fish nursery area. Even if we start at sunset, it's usually night by the time we pull the trawl back onto deck. Everyone is interested in our catch! We caught many fish in this trawl including American eel, striped bass, white perch, catfish, croaker, and bay anchovy. We measure and weigh the fish as quickly as possible so we can return some of them to the Bay. We keep and preserve some fish for laboratory analysis so we can learn about what they are eating, how fast they are growing, and what diseases they might have. These trawling operations continue all night until we hang up the net at dawn.

RV Coot. The *RV Coot* is a research vessel operated by the Virginia Institute of Marine Science.

Cooperative turbulence studies. On this day researchers on the *RV Cape Henlopen* and *RV Coot* will conduct a coordinated study to learn about small-scale turbulence. Understanding turbulence, or mixing, is important because it influences circulation patterns and suspension of sediment and plankton in estuaries like Chesapeake Bay. The *RV Coot* will deploy and instrument called a SCAMP that measures turbulence as it rises through the water. Scientists on board the *RV Cape Henlopen* will use the DIFIK to measure turbulence at specific depths for several minutes. After a long day of sampling, we'll compare measurements by each instrument to better understand mixing during flood, slack and ebb tide.

Sediment studies. We are also trying to understand how sediment is transported, eroded, deposited and buried in the ETM region of the upper Bay. The spider-like device is called a multi-core. When it hits the bottom a mechanism is triggered that drives the four plastic cylinders into the bottom and collects four cores of sediment. We chose the best core for erosion studies so we can learn what current speeds resuspend sediment.

We also conduct sediment studies in the wet lab. These stands are filtration apparatuses that allow us to collect suspended sediment on large circular filters and, using radioisotope techniques, learn how recently the sediment has been resuspended or deposited.

We also use an Owen Tube (it looks like a rocket) to collect suspended sediment near the bottom. The ends of the tube are cocked open when it is lowered into the water. We send a metal messenger down the rope to trip a mechanism that closes the ends of the tube. After we pull it on deck, we turn it upright and measure the settling speed of different sizes of sediment.

End. Once the daytime sampling is complete, the physical oceanographers break down their equipment and another night of trawling begins . . . *the end*.

Video super-stars, in order of appearance:

James Warrington, RVCH Chief Mate
Chuck Baird, RVCH Assistant Engineer
Sergey Babakov, RVCH Marine Advance Technology Education Center intern
Tim North, RVCH Chief Engineer
Mike Papovich, RVCH First Mate
William Keefe, retired Director of UMCES Marine Operations
Dr. David Kimmel, UMCES HPL post-doctoral researcher
Shannon Freeman, RVCH Chef
Timothy Deering, RCVH senior Oceanographic Technician
Dr. Larry Sanford, UMCES HPL principle investigator
Steve Suttles, UMCE HPL senior faculty research assistant
Captain William Byam, RVCH Master
Adam Spear, UMCES HPL faculty research assistant
Angela Padeletti, UMCES HPL faculty research assistant
Scott Lloyd, UMCES HPL graduate student
Patrick Dickhudt, UMCES HPL faculty research assistant
Doug Craige, UMCES CBL faculty research assistant
Dr. Edward Houde, UMCES CBL principle investigator
Dr. Jun Shoji, post-doctoral researcher, visiting from Japan and working at UMCES CBL
Toby Auth, UMCES CBL graduate student
Dr. Mike Roman, UMCES HPL principle investigator
Howard Day, visiting graduate student from England
Captain Bob Gammisch, RV Coot Captain
Wayne Reisner, RV Coot Mate
Dr. Carl Friedrichs, VIMS principle investigator
Lorraine Brasseur, VIMS graduate student
Dr. John Brubaker, VIMS scientist
Heidi Romine, VIMS graduate student

Questions, comments?

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