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Fisheries Oceanography in the Virgin Islands: Preliminary Results from a Collaborative Research Endeavor

Ryan H. Smith and Elizabeth M. Johns
Atlantic Oceanographic and Meteorological Laboratory
National Oceanic and Atmospheric Administration, Miami, Florida

John Lamkin and Trika Gerard
Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration, Miami, Florida

Nelson Melo, Estrella Malca, Akihiro Shiroza
Cooperative Institute for Marine and Atmospheric Studies
University of Miami, Miami, Florida

Overview and Motivation

A multi-species spawning aggregation located on the banks south of St. Thomas includes several economically important fish species, including dog snapper, yellowfin grouper, Nassau grouper, and tiger grouper. Increased fishing pressure on these banks has prompted the Caribbean Fisheries Council to take actions such as seasonally closing fishing grounds and establishing Marine Protected Areas (MPAs). Due to a lack of biological and oceanographic data for the region, these management decisions have been based on professional judgment rather than scientific data.

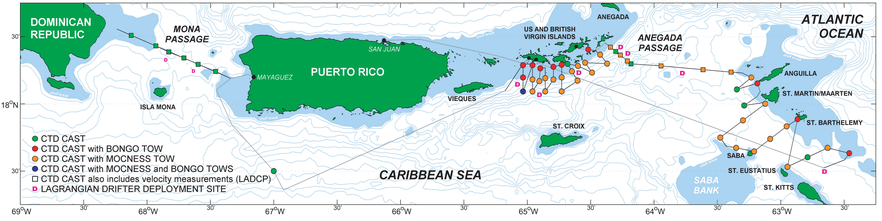
In response to this situation, scientists from NOAA's Southeast Fisheries Science Center (SEFSC) and Atlantic Oceanographic and Meteorological Laboratory (AOML), and from the University of Miami's Cooperative Institute for Marine and Atmospheric Studies (CIMAS) began an interdisciplinary field study in the region in 2007. Research cruises utilize biological sampling techniques such as MOCNESS, neuston, and bongo trawl tows simultaneously with standard physical sampling methods such as CTD/LADCP casts, hull-mounted water velocity measurements, and Lagrangian drifter deployments. The three year project aims to determine how the unprotected banks of the Virgin Islands and surrounding region, the seasonally closed banks and MPAs, and near-shore areas are ecologically linked in terms of larval dispersal, transport, and life history patterns. This collaboration should produce an assessment, based on scientific data, of the effectiveness of Caribbean Research Council management decisions and suggest modifications and improvements to current policy. Additionally, this project will also provide fisheries independent data, and develop ecological indices which can be integrated into stock assessment models.

Analysis of data gathered during the project's first research cruise is yielding preliminary results. A total of 26,809 fish larvae were collected from the Grammanik and Hind Banks and surrounding regions. Of this total, 585 Serranidae (grouper) and 93 Lutjanidae (snapper) larval specimens were collected. Typical sampling transects included near-shore, shelf-break, and offshore regimes. The most economically important species were recovered at the near-shore sites, south of St. Thomas, St. John, and British Virgin Islands and not on the reef /shelf-break sites as expected. Concurrent Lagrangian drifter trajectories and shipboard ADCP measurements showed a high degree of variability in regional surface water flow. Data from the project's second research cruise, conducted in March of 2008, are also presently being analyzed.

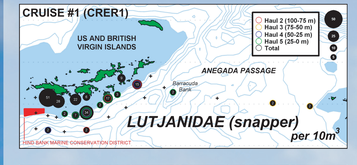
Completed Cruise Track, Station Locations, and Drifter Deployment Sites

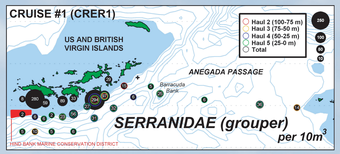
CORAL REEF ECOSYSTEM RESEARCH - CRUISE #1 (CRER1) - March 28 - April 9, 2007

(NF0705) *NOAA Ship Nancy Foster*



LUTJANIDAE (snapper) and SERRANIDAE (grouper) DISTRIBUTION AND ABUNDANCE

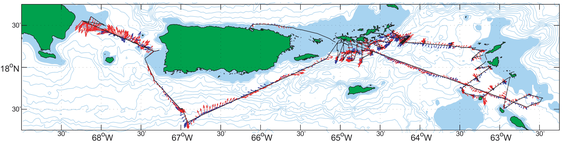


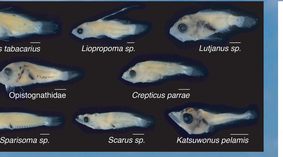


Stations with only solid black circles are bongo net tows (0.9m) taken inshore. Stations in deeper water with colors indicating hauls are MOCNESS tows collected from 100 meters to the surface at 25 meter intervals. Snapper larvae were abundant inshore and at one reef edge station. Few individuals were collected across the Anegada passage. Serranidae (grouper) larvae were abundant both inshore and along the reef edge. Almost all of the serranid species collected belong to the subfamily Serraninae. This group consists of small, reef fish species utilized mainly in the aquarium trade. The distribution of this group was more wide spread than the snapper, with consistent catches extending across Anegada Passage. Grouper were distributed across all depths but were most abundant in the 50-25 meter range.

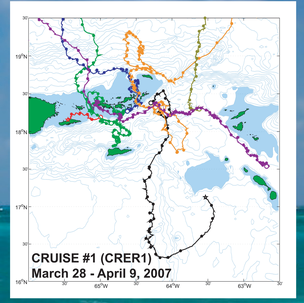
Cruise #1 (CRER1) Hull-Mounted ADCP Velocity Vectors

Red = Surface Blue = 200m





Above, a few larval fishes collected during CRUISE #1 (CRER1). Samples are shown in phylogenic order from top left to bottom right. The white bar indicates the length of one millimeter in photo.

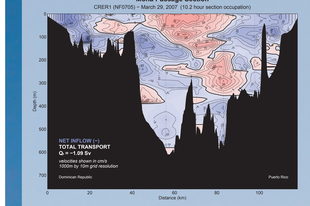


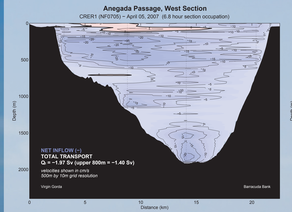
Passage Transport Measurements: Mona Passage Anegada Passage

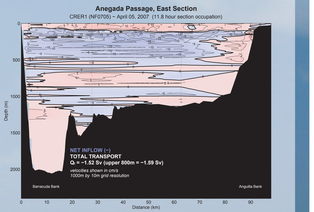
In addition to CTD measurements and net tows, water column velocity profiles were obtained using a 300kHz Lowered Acoustic Doppler Current Profiler (LADCP) at stations across Mona (CRER1) and Anegada (CRER1 and CRER2) Passages. These LADCP data were combined with continuous hull-mounted ADCP measurements of the near-surface flow to calculate section transports for these two passages. During CRER2, the stations across Anegada Passage were occupied twice. These transports are shown below.

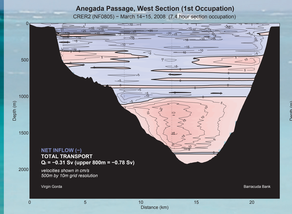
March / April 2007 (CRER1)
Mona Passage:
1.1 Sv *INFLOW*
Anegada Passage:
3.5 Sv *INFLOW* (3.0 Sv in the upper 800m)

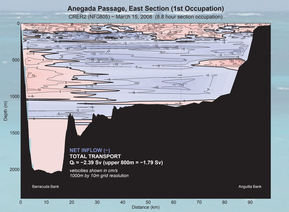
March 2008 (CRER2)
Anegada Passage (1st occupation):
2.7 Sv *INFLOW* (2.6 Sv in the upper 800m)
Anegada Passage (2nd occupation):
0.6 Sv *INFLOW* (1.1 Sv in the upper 800m)

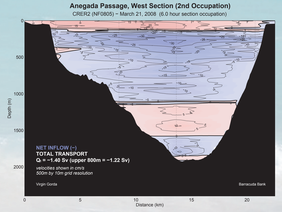


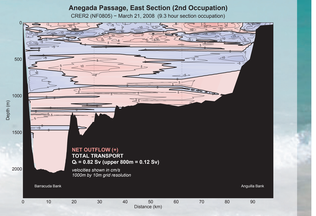








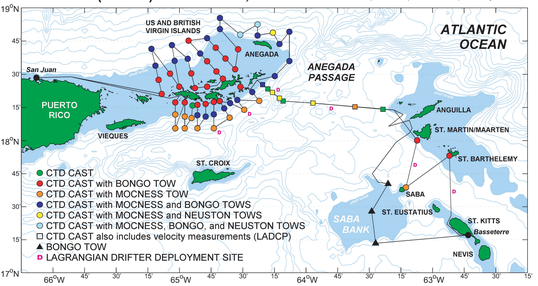




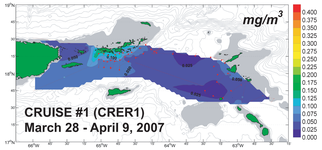
Completed Cruise Track, Station Locations, and Drifter Deployment Sites

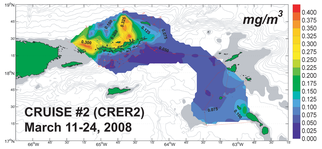
CORAL REEF ECOSYSTEM RESEARCH
CRUISE #2 (CRER2) - March 11-24, 2008

(NF0805) *NOAA Ship Nancy Foster*

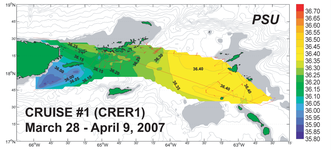


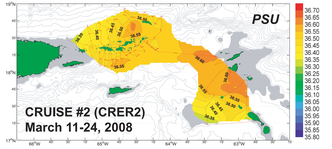
Sea Surface Chlorophyll-a





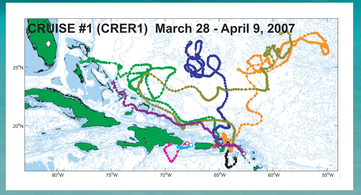
Sea Surface Salinity



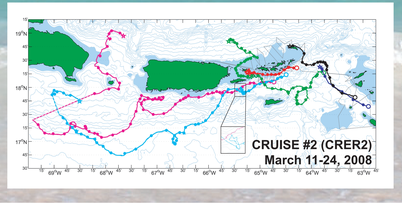


Continuous measurements of sea surface temperature, salinity, and chlorophyll-a were recorded via the *Nancy Foster's* shipboard flow-through system. Chlorophyll-a concentration and regional distribution is shown in the left panel. Sea surface salinity is shown on the right. Chlorophyll flow-through values were calibrated using extracted chlorophyll-a samples collected at CTD station locations.

Satellite-tracked Lagrangian drifters were deployed during both CRER1 and CRER2. In the upper right-hand panel, a close-up of Anegada Passage and the Virgin Islands is shown, where trajectories of drifters deployed on the 2007 cruise exemplify the highly variable transport pathways in the region. A broader view can be found in the plot directly to the right, with drifter trajectories plotted through January 1st of 2008. Circles indicate deployment locations and stars indicate the most recent fix of a drifter. Solid dots along the track are plotted approximately once every 24 hours.



Drifter trajectories from CRER2 (March 2008) are shown in the bottom panel below. Tracks are updated through mid May 2008. A dotted line indicates a gap in the satellite data.



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For further information, contact Ryan Smith
tel: 305-361-4328 email: ryan.smith@noaa.gov

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