**PRELIMINARY CRUISE REPORT**

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| U.S. Dept. of State CRUISE No.: | F2020-035 |
| SHIP NAME: | *SSV Corwith Cramer* |
| OPERATING INSTITUTE OR AGENCY: | Sea Education Association |
| PROJECT TITLE: | **Cruise C294** |
| CRUISE DATES (INCLUSIVE): | 10 October to 18 November, 2020 |

| CHIEF SCIENTIST: | |
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| CLEARANCE COUNTRIES: | **Requested:** Bermuda, Turks and Caicos, Dominican Republic, Haiti, Bahamas<br><br>**Not Received:** None, though significant scientific sampling restrictions for the Bahamas. |
| FOREIGN PARTICIPANTS: | None |

DESCRIPTION OF SCIENTIFIC PROGRAM (include page-sized chart showing cruise track):

**Data Description C294**

The cruise track for C294 (Figure 1) departed from Woods Hole, MA, USA and concluded in Stock Island, FL, USA 40 days later. During the nearly six-week voyage we had no port stops; though we did sail through the waters (within 200nm exclusive economic zone) of several island nations, including: Bermuda, Turks and Caicos, Dominican Republic, Haiti and Bahamas. We also sailed within the EEZ boundary of Cuba during which we suspended all scientific deployments and collection of scientific data not used for navigational purposes.

Our cruise track traversed several major oceanographic provinces (Figure 1): a) the cooler less saline waters of the Gulf of Maine, b) the productive coastal waters around Cape Cod and the islands, c) the warm waters of the Gulf Stream current, d) the comparatively cool, salty, oligotrophic waters of the North Atlantic Gyre/Sargasso Sea, and eventually as we crossed the Antilles Current, a return to e) warmer, less saline waters with evidence of increased

production around the northern Caribbean islands and shallow banks.

We collected data with 185 individual deployments from 56 discrete geographic stations along our cruise track. Comparison of the physical, chemical, geological and biological features of these regions represented the major scientific theme of this Sea Semester.

1. Physical oceanographic studies focused on the characterization of surface hydrographic features, ocean frontal boundaries and sub-surface water masses. Evidence of cyclonic and anticyclonic eddies associated with the Gulf Stream and Antilles currents were evaluated with ACDP data while associated areas of upwelling and downwelling were assessed with our continuous seawater flow-thru system measuring temperature and salinity and examination of mixed layer depth and thermocline position using CTD deployments.
2. Chemical oceanographic studies focused on broad characterization of water productivity using measurements of nutrients (phosphate and silicate) and chlorophyll-*a*; as well as water quality using measurements of incubated *Escherichii coli* bacteria and pH. These chemical parameters were related to patterns in physical hydrography at various scales: nearshore to offshore transitions, ocean fronts and eddies associated with ocean currents and water column stratification.
3. Biological studies focused the biogeographic patterns, abundance and diversity of charismatic megafauna (seabirds, sea turtles, flying fish, and marine mammals), several nektonic organisms (lantern fish – Family *Myctophidae*, and gelatinous organisms >2cm – i.e salps), meroplanktonic larvae including spiny lobster (phyllosoma) and eels (leptocephali), the floating macrophyte – *Sargassum* spp., the marine insect *Halobates*, and the density (mL/m2) and diversity (i.e. Shannon-Weiner index) of the aggregate zooplankton and phytoplankton communities were related to patterns in physical and chemical properties at various scales: nearshore to offshore transitions, ocean fronts and eddies associated with ocean currents and water column stratification.

Sea surface temperature, salinity, fluorescence (chlorophyll-*a* and CDOM) and transmissivity levels; along with barometric pressure, winds, bathymetry, and geographic position were recorded continuously along the cruise track. Surface samples (n=79) of nutrients (phosphate and silicate), chlorophyll-*a*, and pH were collected in conjunction with all noon and midnight neuston net tows, as well as dawn (0500) and dusk (1700) collections. From a subset of Surface Stations we assessed water quality by measuring *Eschericia coli* bacteria samples (n=12).

Routinely we visually observed and enumerated marine mammals, seabirds, flying fish, sea turtles, *Sargassum* abundance, and floating plastic debris. These hourly observations occurred only during daylight hours 0700-1900 and lasted only six minutes (n=174). Periodically, opportunistic sightings were also recorded when notable megafauna or marine debris were present (n=235). Additionally, nighttime observations of surface bioluminescent activity was periodically recorded (n=21). On several occasions we deployed a hydrophone to record the marine soundscape in hopes of identifying presence of marine mammals (2 stations).

The density structure of the water column (maximum depth 1500 m) was determined using a Seabird CTD with attached *in situ* chlorophyll-*a* fluorescence and dissolved oxygen sensors (26 stations). On five occasions a carousel equipped with a CTD, PAR sensor, and 12 nisken bottles was deployed allowing the collection of water samples at depth which were analyzed for nutrients (phosphate, silicate), chlorophyll-*a*, and pH.

Surface neuston net tows (39 stations, 335 µm mesh net) a several sub-surface net tows (3 stations, 335 µm mesh 1-meter diameter net) were conducted regularly to examine plankton assemblages along with the floating macrophyte *Sargassum* spp., marine debris and tar balls. These net deployments revealed the biogeographic patterns of the marine insect *Halobates*, eel (leptocephali) and spiny lobster (phyllosoma) larvae, lantern fish (Myctophidae), pteropods, and general zooplankton diversity and taxonomic composition in relation to numerous environmental parameters. Surface drift net collections for phytoplankton (21 stations, 63 µm mesh net) occurred regularly and were examined for abundance and diversity of diatoms and dinoflagellates.

Discrete samples of *Sargassum* clumps (n=33) and marine plastic debris were collected with a dip net (17 stations each with numerous replicate collections for a total of 33, 335 µm mesh). Shrimp, crab, fish, and snail specimens were rinsed from collected samples. Abundance and diversity of associated biota were related to mass (g) and species form of *Sargassum* and geographic location. Three distinct morphological forms of *Sargassum* were recognized (*S. fluitans III*, *S. natans I*, and *S. natans VIII*) and clear differences in associated fauna were observed; even when different *Sargassum* forms were collected from the same station location.

Water clarity and light attenuation along our cruise track was also measured. We routinely deployed a secchi disc (26 stations) to estimate depth of the 1% light level.

On nine occasions we collected seafloor sediment using a shipek grab to determine grain size distribution and examine benthic invertebrate assemblages.

Jeffrey Schell, Associate Professor – Chief Scientist, C294

| SCHEDULE OF DATA DELIVERY: | |
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| Data Description | Date of Expected Delivery to Dept. of State |
| Final Cruise Report | 18 May 2021 |
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Figure 1: CRUISE TRACK for C294 (insert here):