PRELIMINARY CRUISE REPORT

U.S. Dept. of State CRUISE No.:	F2019-052
SHIP NAME:	*SSV Corwith Cramer*
OPERATING INSTITUTE OR AGENCY:	Sea Education Association
PROJECT TITLE:	**Cruise C289**
CRUISE DATES (INCLUSIVE):	24 November to 23 December, 2019

CHIEF SCIENTIST:	
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CLEARANCE COUNTRIES:	**Requested:** British Virgin Islands, Anguilla, Saba-Sint Maarten (Dutch), Saint-Martin (French), Saint-Barthélemy (French), Antigua and Barbuda, St. Kitts and Nevis, Montserrat, Guadeloupe (French), Dominica, Martinique (French), St. Lucia, St. Vincent and the Grenadines, Grenada **Not Received:** Dominica, St. Lucia, St. Vincent and the Grenadines
FOREIGN PARTICIPANTS:	N/A

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

Data Description C289

Faculty and students from C289 spent six weeks in Woods Hole, MA followed by ten days in St. Croix, USVI. The cruise track for C289 (Figure 1) departed from Christiansted, St. Croix, USVI on 24 November 2019 and arrived in Christiansted 30 days later at the conclusion of the program. During the four-week voyage, we had three port stops: 1) St. George's, Grenada, 2) Little Bay, Montserrat, and 3) Falmouth Harbor, Antigua.

Our cruise track traversed the Lesser Antilles (Fig. 1), following similar cruise tracks from previous SEA Semester Caribbean Reef Expeditions. We collected physical, chemical, and

biological oceanographic data with 38 individual deployments from 23 discrete geographic stations along our cruise track. While the major theme of this SEA Semester was examining the seawater chemistry and biology of coral reefs located in the Lesser Antilles, oceanographic data was collected along our cruise track and compared to data from cruises C276 (2017) and C283 (2018) to study changes in oceanographic features over time.

During our visit in St. Croix and during three port stops we conducted snorkel-based surveys of five coral reefs: 1) Isaac Bay, St. Croix, 2) Cane Bay, St. Croix, 3) Flamingo Bay, Grenada, 4) Little Bay, Montserrat, and 5) Rendezvous Bay, Montserrat. While snorkeling, we recorded seafloor substrate cover (e.g., coral, macroalgae, sand, rock), coral health (live, bleached, diseased), and fish and invertebrate abundance and diversity. In addition, environmental data including sea surface temperature and salinity as well as various chemical properties (pH, alkalinity, nitrate, phosphate, and *E. coli* bacteria) were measured. In addition, we collected microplastics in the water column above the reef, scooped sediments inside and outside the reef for analysis of grain size distributions, surveyed fish behavior, and measured reef rugosity (i.e., measurement of structural complexity). Students conducted seventeen independent or collaborative hypothesis-driven research projects using this coral reef data.

While underway, sea surface temperature, salinity, fluorescence (chlorophyll-*a* and CDOM) and transmissivity levels were recorded continuously. Barometric pressure, wind direction and speed, current direction and speed, bathymetry, and geographic position were also recorded continuously. We routinely observed and enumerated marine mammals, seabirds, flying fish, clumps of *Sargassum* spp., and floating plastic debris. These hourly observations lasted six minutes and occurred only during daylight hours 0700-1900. Periodically, opportunistic sightings also were recorded when notable megafauna or marine debris were present.

Surface plankton assemblages along with the floating macrophyte *Sargassum* spp., and marine debris were sampled regularly (n=20 stations) with a neuston net (335 µm mesh). 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 samples of nutrients (phosphate and nitrate), pH, total alkalinity, and chlorophyll-*a* were collected every twelve hours associated with most neuston net tows (n = 19 geographic stations) and during our coral reef surveys (n = 9-15 samples per reef).

Surface phytoplankton samples (n=4) were collected with a near-surface (1-3 m) drift net (30cm frame, 63 µm mesh) from the *Cramer* quarterdeck. Relative abundance of diatoms and dinoflagellates were recorded.

Water clarity and light attenuation along our cruise track was also measured. We deployed a secchi disc at three geographic stations to estimate depth of the 1% light level.

The density structure of the water column (maximum depth 1400 m) was determined using a Seabird CTD with attached *in situ* chlorophyll-*a* fluorescence and dissolved oxygen sensors (3 stations). In addition, four hydrocasts of the carousel equipped with the CTD and 12 Niskin bottles were deployed to examine the vertical distribution of nutrients (phosphate and nitrate), pH, alkalinity, and chlorophyll-*a*. Also, a free-standing CTD equipped with an oxygen sensor was deployed once to a depth of 1800 m at the end of the cruise.

We sampled zooplankton diversity and abundance at depth by towing a plankton net with a circular frame that is 1m diameter (335 μm mesh) at a depth of 580 m at night (n=1 geographic station). This was done for educational purposes as well as training for professional science crew.

Heather N. Page, Assistant Professor – Chief Scientist, C289

SCHEDULE OF DATA DELIVERY:	
Data Description	Date of Expected Delivery to Dept. of State
Final Cruise Report	May 8, 2020

Figure 1: CRUISE TRACK for C289 (insert here):