Attendees at ICRS 2022 came from across the world. This is a Latino group photograph. ▸

Struggling Corals in a Disturbed Ocean

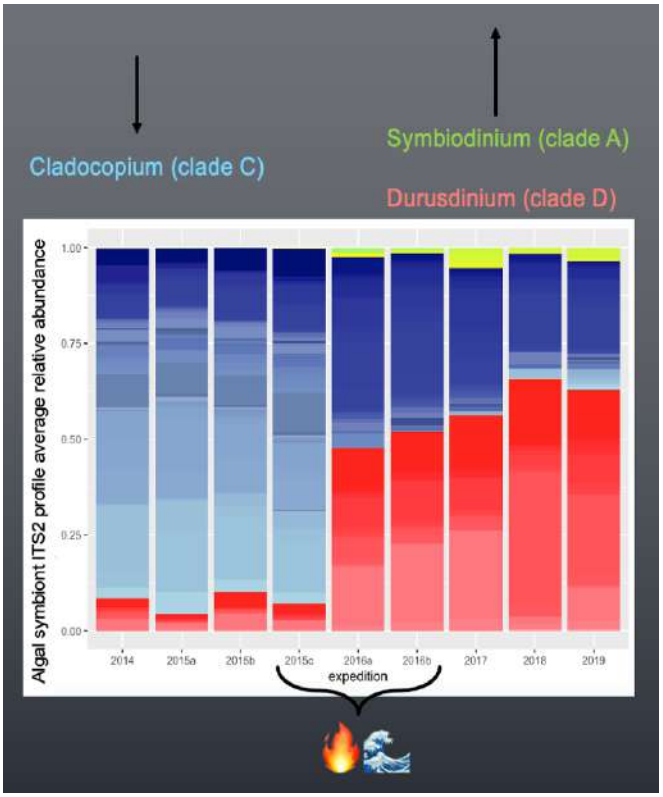
Rebecca Campbell Gibbel DVM (MS Graduate Student)
(RebeccaCampbellGibbel@gmail.com)

The ICRS 2022 conference was a triumph of organization, aided by additional years of preparation time and a very efficient and motivated German support team. The planners' mission of educating, feeding, and entertaining all the participants seemed flawlessly executed. It was quite a challenge for me to choose which presentations to attend from the impressive breadth of conference offerings and it was wonderful to be able to meet in person again.

I joined a conference-sponsored tour of the Center for Marine and Environmental Sciences (MARUM) lab at the University of Bremen, which specializes in deep sea exploration. MARUM houses Bremen's International Ocean Discovery Program's core repository, one of three academic sites in the world that safeguards drilled sediment samples from the ocean floor. A sediment core on display captures the geologic K/T boundary layer from 65 million years ago. This seabed core from the Yucatán records the "fireball layer" of cataclysmic global environmental changes thought to have been produced by a massive asteroid strike. In the layers before this abrupt transition, the sediment contains microfossils from the rich Cretaceous period of complex plants and dinosaurs. After the impact, the Tertiary period sediment records 100,000 years of a scorched earth nearly devoid of life. It was sobering to see this tangible evidence of an utterly devastated environment.

Sediment core including the K/T boundary at the Bremen International Ocean Discovery Program's seabed core repository.

The ICRS' program had an appropriately large focus on climate change's effects on the ocean and its inhabitants, since this is the largest menace that today's coral reefs have ever faced. Although diseases and thermal bleaching may be the proximate cause of much coral mortality, no amount of research will mitigate them if the underlying ultimate cause of climate change is not addressed. As all of the conference attendees are well aware, human activities are the fireball of the



Annual community distribution of *Durusdinium* and *Symbiodinium* before and after environmental stressors

Anthropocene, causing untenably rapid environmental degradation.

I sought out presentations about coral disease and attended the workshop and lectures exploring the complexities of coral-Symbiodiniaceae associations. I found a number that seemed particularly notable. Daisy Buzzoni gave a dynamic talk describing how chronic local disturbances of human origin, such as sewage pollution and overfishing, as well as acute global heat stress events, drive Symbiodiniaceae-coral relationships in the Pacific. She and her colleagues studied >1000 coral colonies surrounding Kiritimati Island, spanning a major heat wave in 2015-2016. The corals' Symbiodiniaceae were sampled at different times across a gradient of sites with varying levels of chronic human disturbance. Buzzoni described how stressors can shape Symbiodiniaceae diversity by causing a differential loss of susceptible symbionts and corals, and by breaking down the original coral-symbiont partner specificities. Overall, the Kiritimati coral community changed from *Cladocopium* to the more heat tolerant *Durusdinium* over the course of the acute heat wave, as well as in the chronic disturbance locations, although there were some exceptions by coral genus. The corals that switched to *Durusdinium* and *Symbiodinium* dominance maintained those new relationships for the three years of study following the heat wave. Some corals, both heat sensitive *Montipora* and heat tolerant *Porites*, maintained their original symbiont fidelity through the heat wave years. However, heat sensitive *Platygrya* colonies that changed to *Durusdinium* in chronic stress environments, did not survive better in the heat wave, making it difficult to predict survival solely based on Symbiodiniaceae associations in "an increasingly disturbed ocean". Buzzoni concluded by discussing the putative metabolic disadvantages of a "hangover" or long-term maintenance of stress-tolerant symbionts like *Durusdinium*, which have been shown to reduce the nutritional subsidy of photosynthates transferred to the coral host.

In separate presentations, Katherine Eaton and Sonora Meiling both discussed topical treatments for virulent coral diseases. Eaton et al.'s work found that the undisclosed antiviral and antimicrobial ingredients in a newly developed product named "Coral Cure" arrested black band disease (BBD) in wild *Pseudodiploria* corals in St. Croix, US Virgin Islands. BBD is a polymicrobial disease, with the characteristic black band consisting of a mat of cyanobacteria, sulfate-reducing bacteria, and sulfide-oxidizing bacteria. Previous attempts at treating BBD lesions have included removing the bacterial mat using suction and applying topical pastes such as chlorinated epoxy, but treating the lesion line typically results in one third of treated colonies developing new lesions within several months. Eaton et al.'s study tested 13 different combinations of treatments, including "Coral Cure" impregnated into ropes affixed to the BBD lesion line. Although the sample sizes were small, **two different formulations of "Coral Cure" saturated ropes halted lesion progression, with no sign of reinfection within 3-5 months in 100% of the corals treated.** This encouraging report is likely to open new avenues of study, once the chemical composition of the compound is shared.