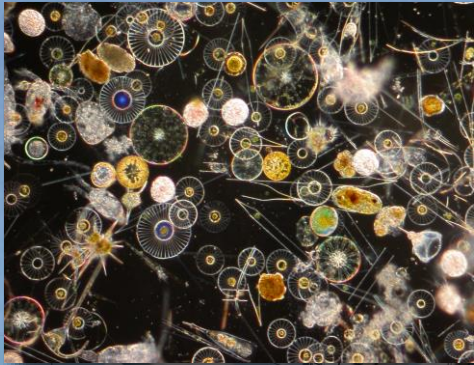


SEA SEMESTER

at Woods Hole and at Sea



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SEA SEMESTER VOYAGES

Multi-disciplinary approaches to
critical environmental issues:

- ☸ **Climate Change** (Oceans and Climate, Climate & Society)
- ☸ **Sustainability** (Sustainability in Polynesian Island Cultures & Ecosystems)
- ☸ **Biodiversity** (Marine Biodiversity & Conservation)
- ☸ **Human Impacts on the Environment** (The Global Ocean)
- ☸ **Environmental Justice** (Colonization to Conservation in the Caribbean)
- ☸ **Ocean Conservation** (Protecting PIPA, MBC)
- ☸ **Coral Reef Health** (Caribbean Reef Expedition)



RESEARCH THEMES

- Climate Change
- Marine Biodiversity
- Ocean Plastics and Marine Pollution
- Coral Reef Ecology
- Environmental Sustainability and Policy
- Conservation Policy
- Marine Environmental History
- Cultural Sustainability
- Maritime History and Culture



Affiliated Institutions

California University of San Diego **Colorado** University of Denver University of Northern Colorado **Connecticut** Connecticut College **District of Columbia** George Washington University **Florida** Eckerd College Jacksonville University **Indiana** DePauw University Purdue University **Massachusetts** Boston University Northeastern University Stonehill College University of Massachusetts, Dartmouth **Minnesota** Carleton College **New Hampshire** University of New Hampshire **New York** Barnard College Colgate University Cornell University Hamilton College Ithaca College Rochester Institute of Technology SUNY College of Environmental Science and Forestry Syracuse University **North Carolina** University of North Carolina, Chapel Hill **Ohio** Oberlin College **Oregon** Oregon State University Reed College **Pennsylvania** Drexel University Franklin & Marshall College Lafayette College University of Pennsylvania Ursinus College Villanova University **Rhode Island** Roger Williams University University of Rhode Island **South Carolina** College of Charleston **Texas** Rice University **Washington** Evergreen State College **Wisconsin** Lawrence University Ripon College

Sending Institutions

Albion College American University Amherst College Bard College Bard College at Simon's Rock Bates College Beloit College Bentley College Boston College Bowdoin College Bowling Green State University Brandeis University Bridgewater State College Brown University Bryn Mawr College Bucknell University Butler University California State University Carnegie Mellon University Catholic University of America Central Michigan University Chaminade University of Honolulu Chapman University City College of New York Claremont McKenna College Clark University Coe College Colby College College of the Atlantic College of the Holy Cross College of William & Mary College of Wooster Colorado Christian University Colorado College Colorado State University Columbia University Community College of Rhode Island Concordia University, Quebec Creighton University Dartmouth College Davidson College Denison University DePaul University Dickinson College Dickinson College Earlham College Emerson College Endicott College Eugene Lang College Fairfield University Florida Atlantic University Florida Gulf Coast University Florida Institute of Technology Florida State University Franklin W. Olin College of Engineering Furman University Georgetown University Georgia Institute of Technology Gettysburg College Gonzaga University Gordon College Grinnell College Goucher College Hampshire College Hampton University Harvard University Haverford College Hawaii Pacific University Hendrix College Hobart & William Smith Colleges Illinois Institute of Technology James Madison University Johns Hopkins University Juniata College Kent State University Kenyon College King College Knox College Lake Forest College LaSalle University Lehigh University Lesley University Lewis & Clark College Loyola College Luther College Lynchburg College Macalester College Marist College Marlboro College Mary Baldwin College Maryland Institute College of Art Massachusetts Institute of Technology McGill University Memorial University of Newfoundland Miami University of Ohio Michigan State University Middlebury College Millikin University Millsaps College Montana State University Morehouse College Mount Holyoke College Mount St. Mary's University Muhlenberg College New York University North Carolina State University Northern Arizona University Northwestern University Norwich University Occidental College Ohio State University, Columbus Ohio Wesleyan University Oklahoma State University Pacific Lutheran University Pennsylvania State University Pitzer College Prescott College Princeton University Providence College Randolph College Rhodes College Richard Stockton College of New Jersey Rollins College Saint Mary's College Salve Regina University San Francisco State University Santa Clara University Sarah Lawrence College Scripps College Sewanee: University of the South Siena College Simmons College Skidmore College Smith College Spelman College St. Francis Xavier University St. John's University St. Lawrence University St. Mary's College of Maryland St. Michael's College St. Olaf College Stanford University State University of New York, Maritime College State University of New York, Oswego State University of New York, Plattsburgh State University of New York, Stony Brook Swarthmore College Sweet Briar College The Citadel Temple University Towson University Trinity College Trinity University Tufts University Tulane University Unity College University of Alaska, Anchorage University of Arizona University of British Columbia University of California, Berkeley University of California, Los Angeles University of California, Riverside University of California, San Diego University of California, Santa Barbara University of California, Santa Cruz University of Chicago University of Colorado, Boulder University of Connecticut, Avery Point University of Connecticut, Storrs University of Delaware University of Florida University of Hawaii, Hilo University of Hawaii, Manoa University of Idaho University of Kentucky University of Maine, Orono University of Maryland, College Park University of Maryland, Eastern Shore University of Mary Washington University of Massachusetts, Amherst University of Miami University of Michigan, Ann Arbor University of Nebraska, Lincoln University of New Brunswick, Saint John University of New England, Biddeford University of New Mexico University of North Carolina, Wilmington University of Oregon University of Puget Sound University of Redlands University of Richmond University of Rochester University of South Carolina, Columbia University of Southern California University of Southern Maine, Portland University of Tampa University of Texas, Austin University of Vermont University of Virginia University of Washington University of Wisconsin, Madison Valparaiso University Vanderbilt University Vassar College Virginia Polytechnic Institute & State University Villanova University Wake Forest University Warren Wilson College Washington and Jefferson College Washington & Lee University Washington University in St. Louis Wellesley College Wells College Wesleyan University Western Illinois University Wheaton College Whitman College Willamette University Williams College Worcester State College Yale University

SEA SEMESTER CAMPUS

Woods Hole, Massachusetts



WOODS HOLE

is a world-renowned oceanographic research community with a rich maritime history



SEA

- ☼ Home to six research institutions
- ☼ Close to Providence, Boston & New Bedford
- ☼ More to explore!



SEA SEMESTER VOYAGES



LIFE AT SEA





SSV Corwith Cramer

- 134-foot steel brigantine
- Constructed by ASTACE in 1987 in Bilbao, Spain
- Single combined wet/dry lab





SSV Robert C Seamans

- 134-foot steel brigantine
- Built in 2001 in Tacoma, WA
- Includes wet lab, dry lab, and larger science hold



Shipboard equipment

- Markey Hydrographic Winches with ~4000m ¼" 3x19 wire rope
- Hydraulic j-frame
- Knudsen 3260 CHIRP
- RDI Ocean Surveyor 75kHz
- Octans fiber optic gyro-compass (Cramer), Ashtech ADU-5 (Seamans)
- SBE 32 carousel with (12) Niskin bottles, SBE 90208 Auto Fire Modules
- Flow-through system with TSAL fluorometer
- Multiple seabird SBE 19+ CTDS
 - Chl-a, CDOM fluorometers, RBR sensor
 - Transmissometer, O2 probe
- Comprehensive set of plankton nets
- McLane Large Volume Water Transfer System
- Shipek grab
- Gravity core
- Dissecting microscopes
- Epifluorescent microscopes
- Chemical analyses for common nutrients

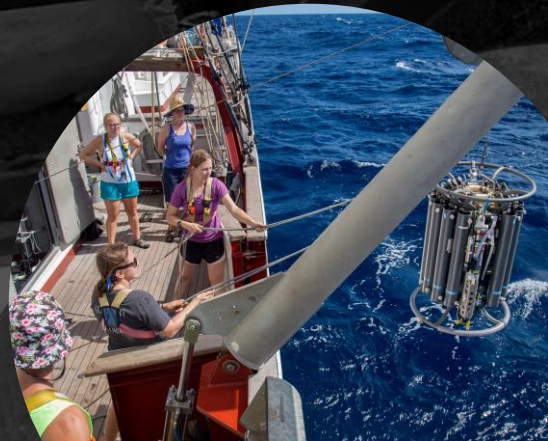




Photo credit: Tane Sinclair-Taylor

A person with long, wavy hair, seen from the back, is using a sextant on a ship. The background shows a sunset over the ocean with a blue sky and white clouds. The person is wearing a light-colored shirt and a watch.

Crew structure

- 10-11 professional crew
 - Captain
 - Chief scientist
 - 3 mates
 - 3 assistant scientists
 - 1-2 engineers
 - Steward
 - Assistant steward



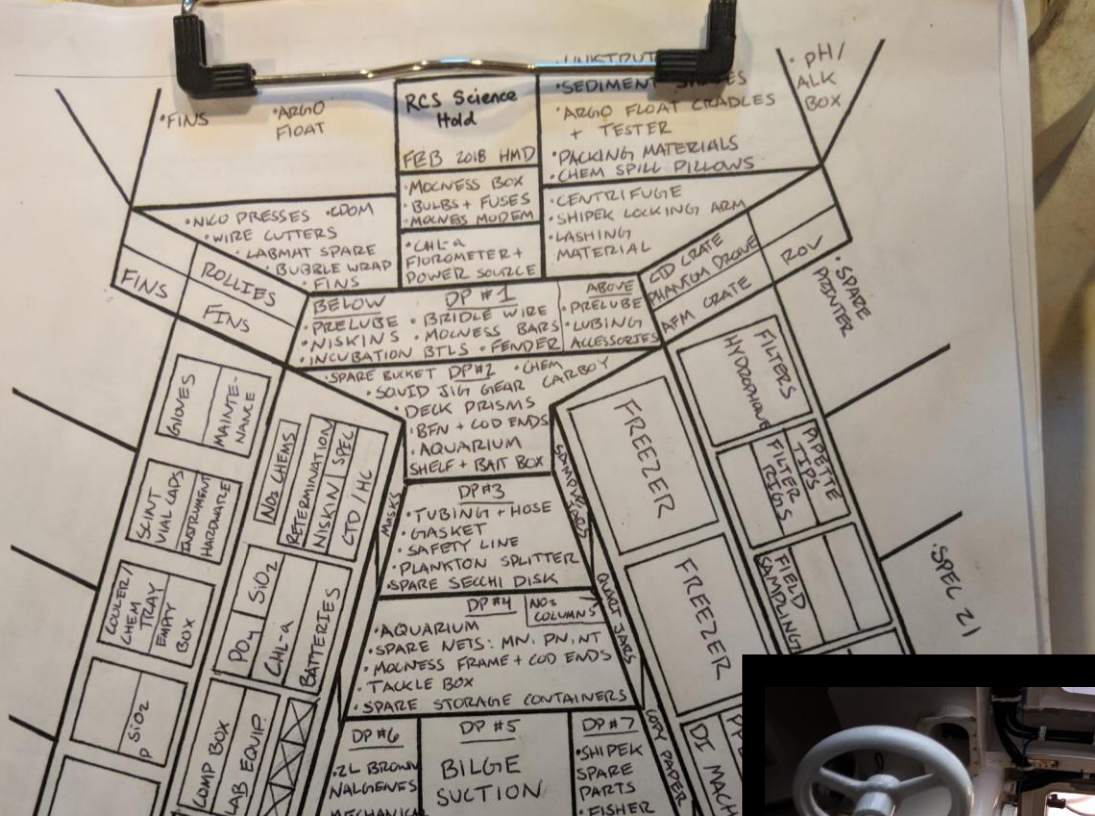
- 18 assistant scientists currently on staff
 - 8 long-term contracts (at least 6 months)
 - 10 short-term contracts (typically 3 months)
- 11 SEA alumni
- 5 had no SEA experience before becoming assistant scientists
- 7 Wilderness First Responders
- 5 AB
- 4 200T NC Mate
- 3 concurrently in graduate programs
- 3 have master's degrees
- 3 dual citizens
- Most assistant scientists move to new opportunities after 3-4 years



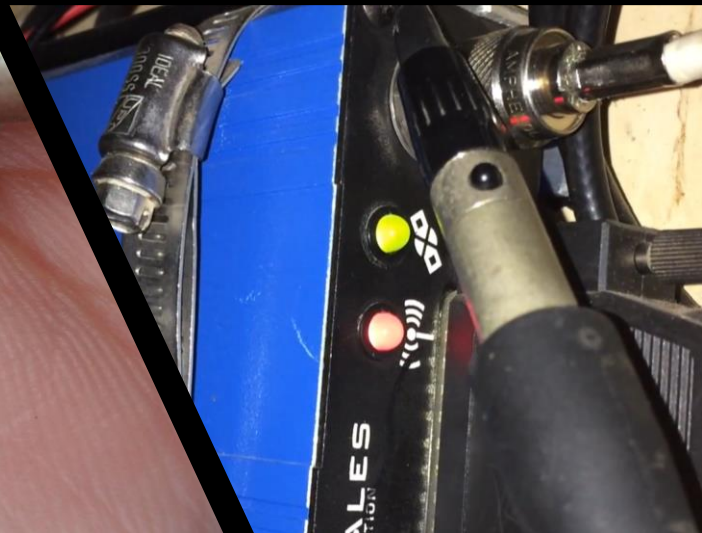


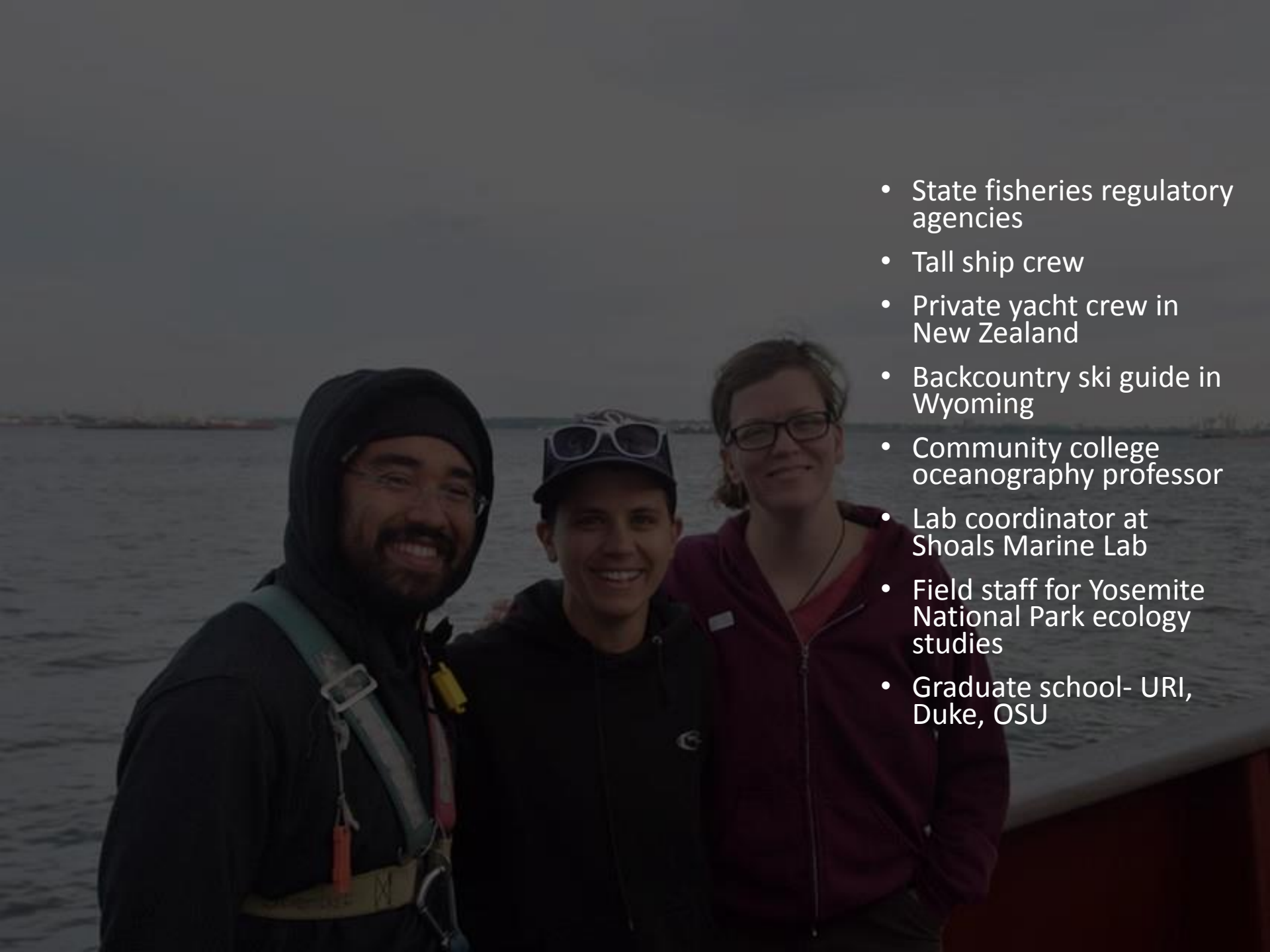
Sail evolutions before
each science station



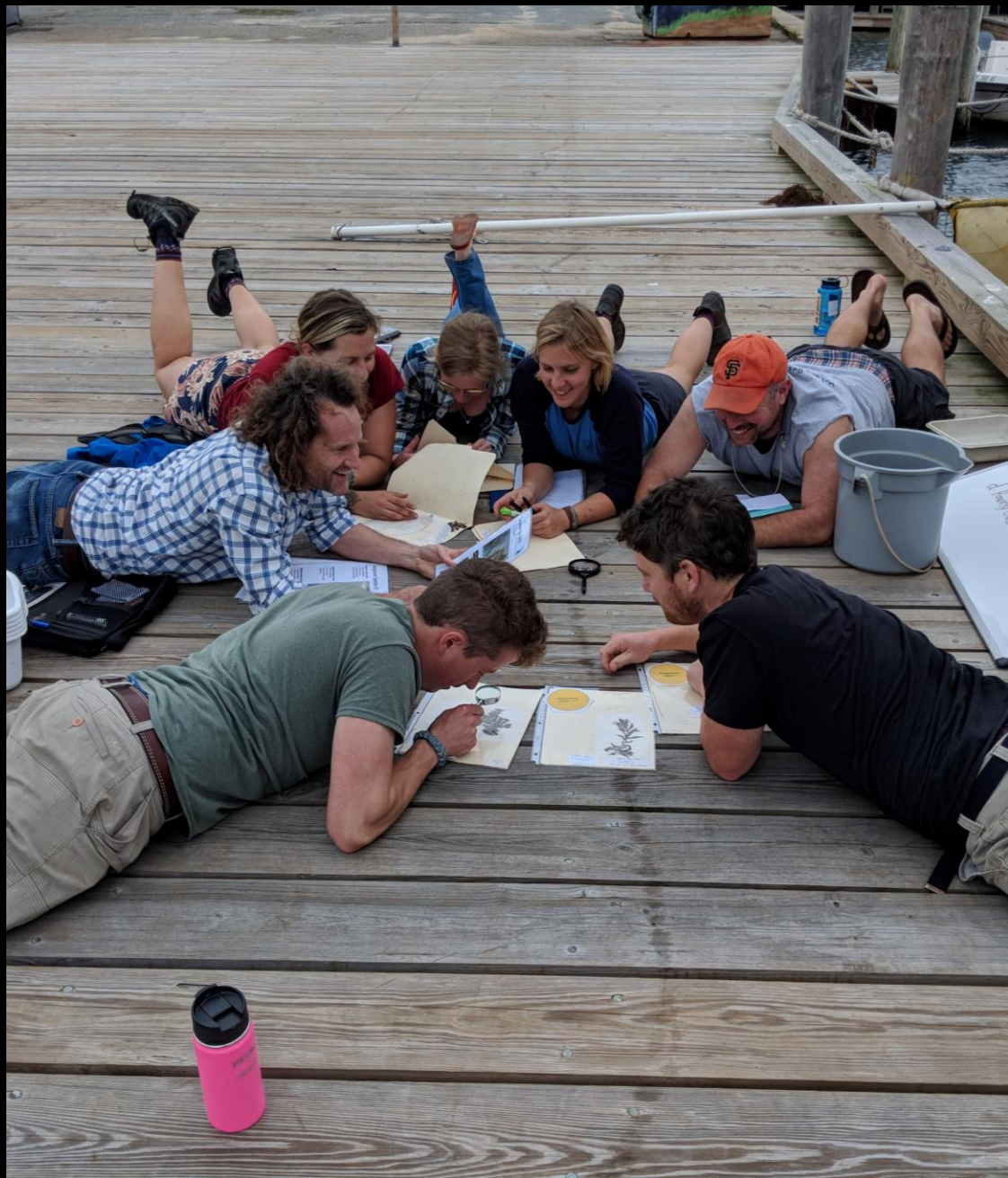








- State fisheries regulatory agencies
- Tall ship crew
- Private yacht crew in New Zealand
- Backcountry ski guide in Wyoming
- Community college oceanography professor
- Lab coordinator at Shoals Marine Lab
- Field staff for Yosemite National Park ecology studies
- Graduate school- URI, Duke, OSU





Protecting the Phoenix Islands

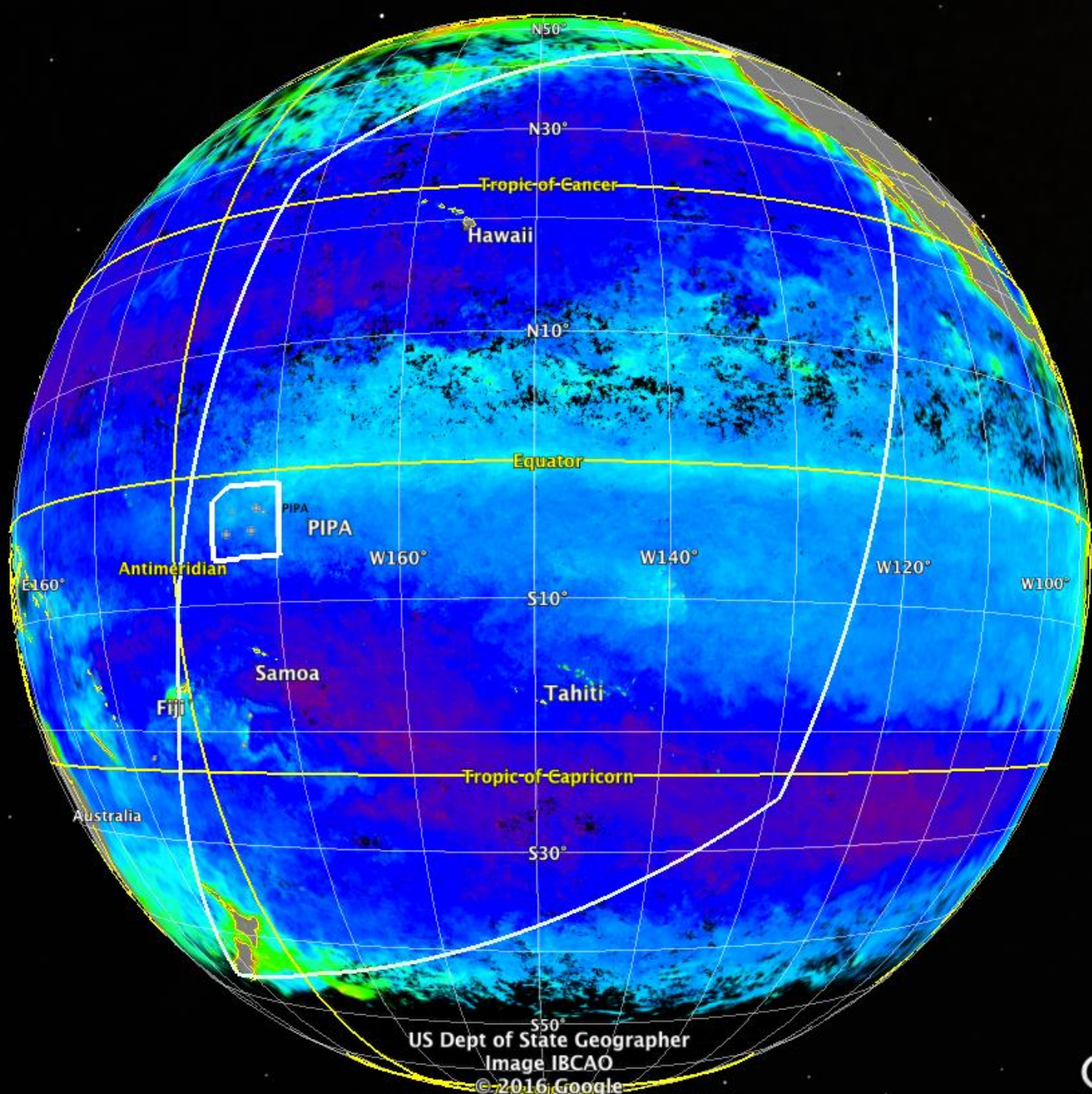
BOSTON
UNIVERSITY

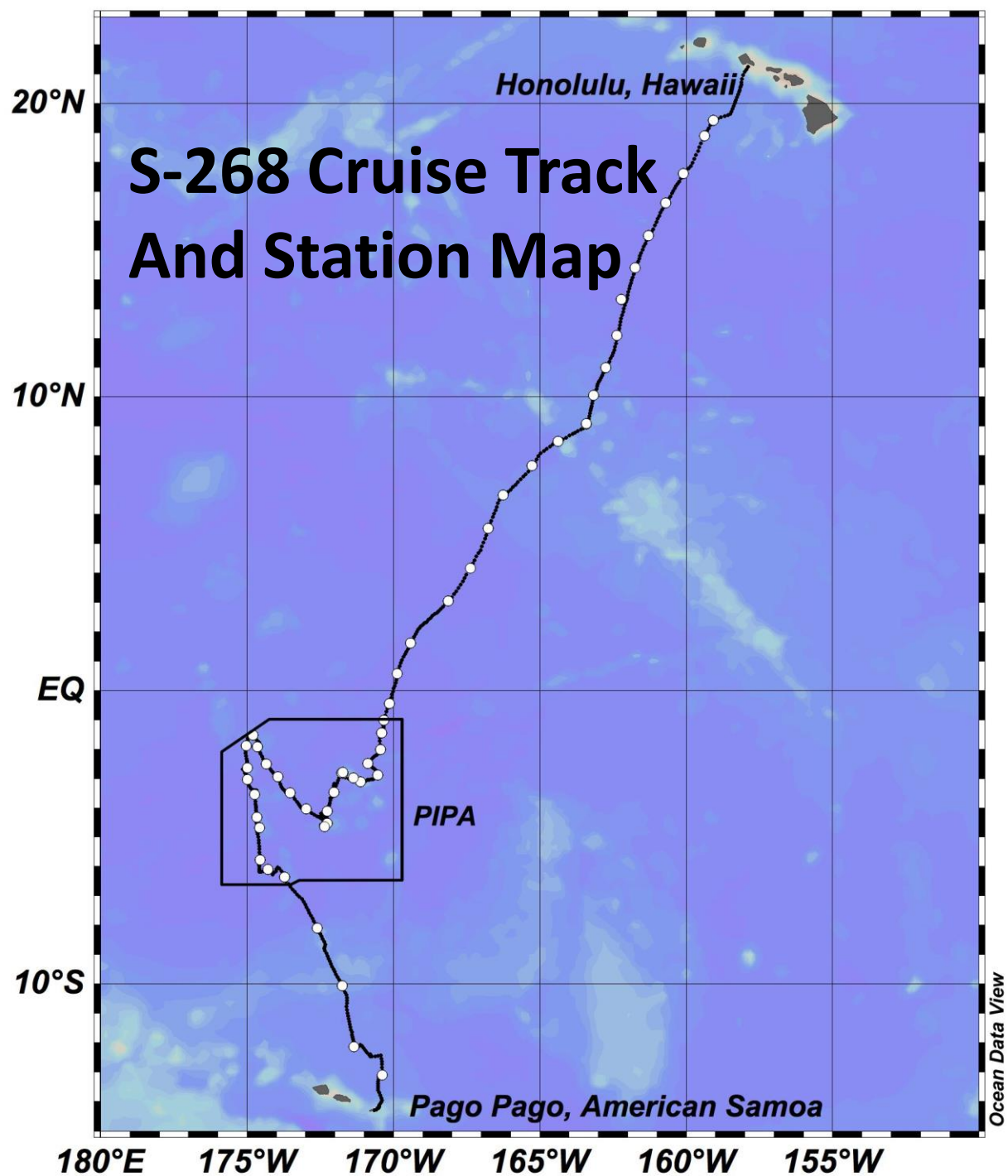


New England
Aquarium

Protecting the blue planet



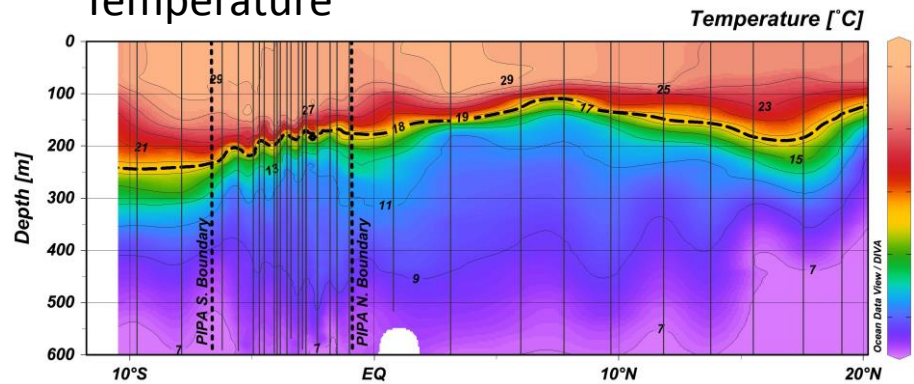




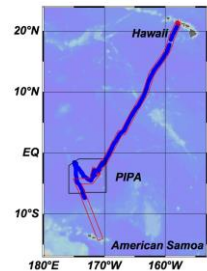
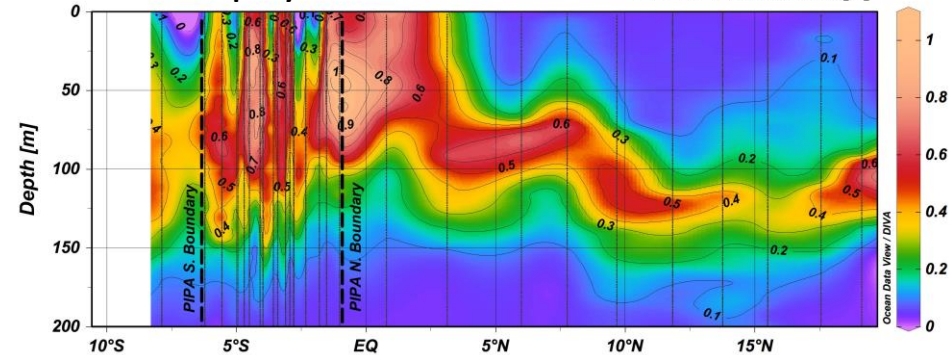


2014 survey results

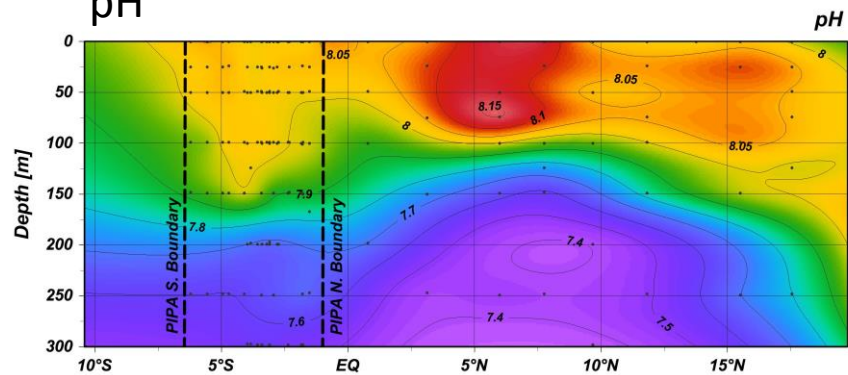
Temperature



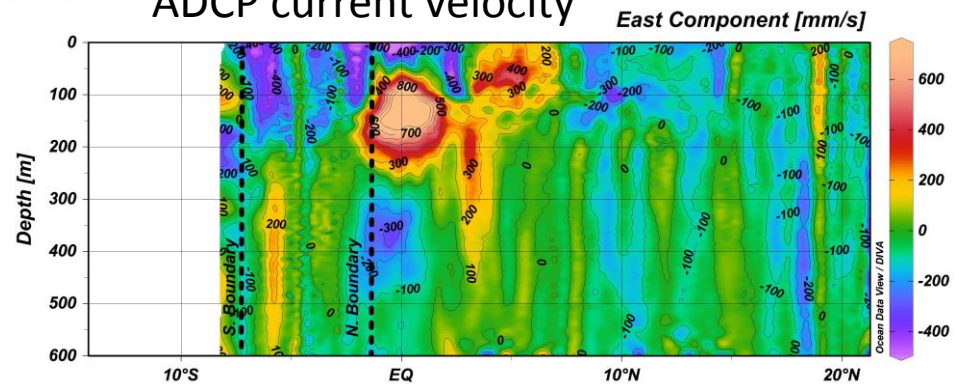
Chlorophyll a fluorescence

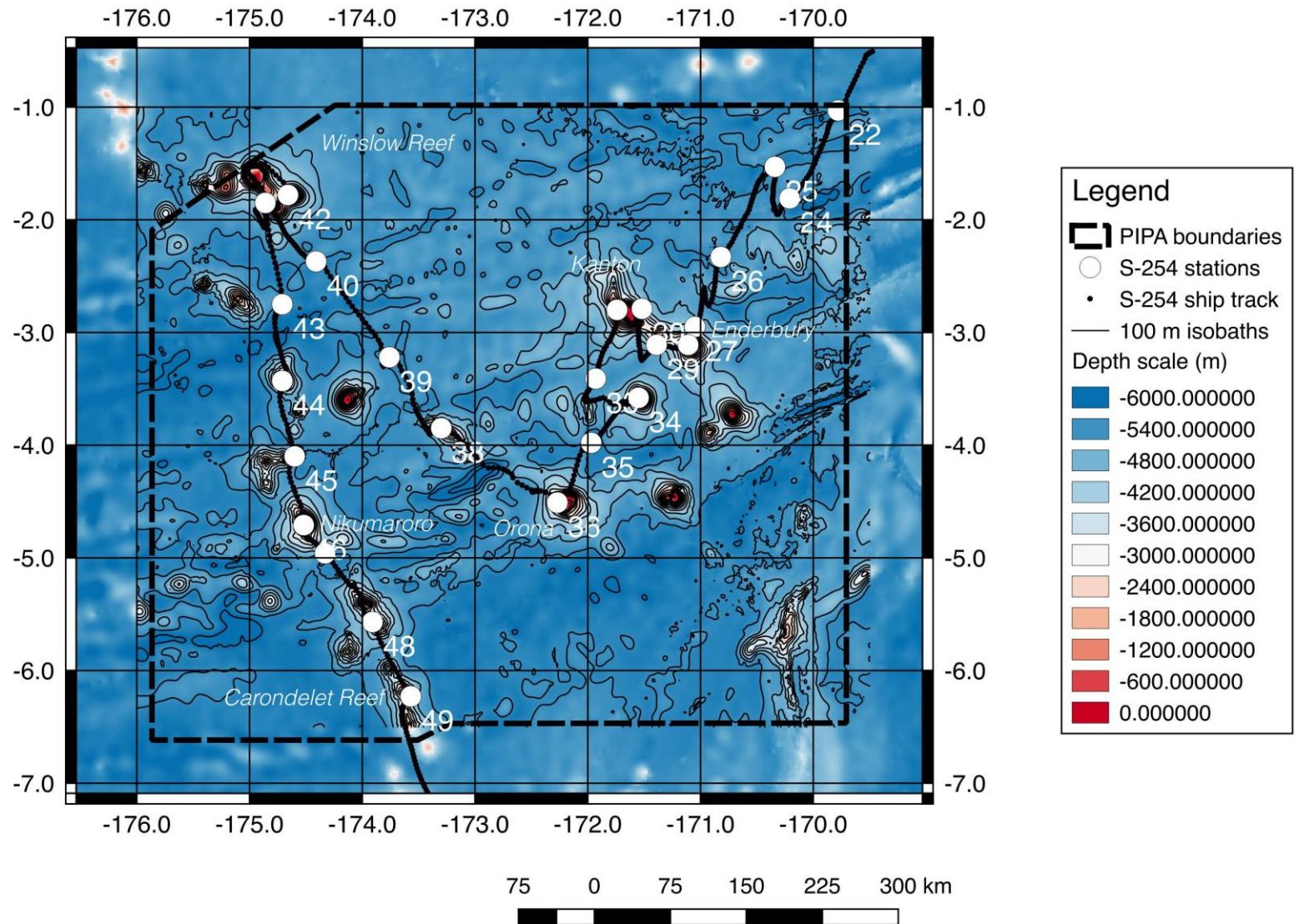


pH

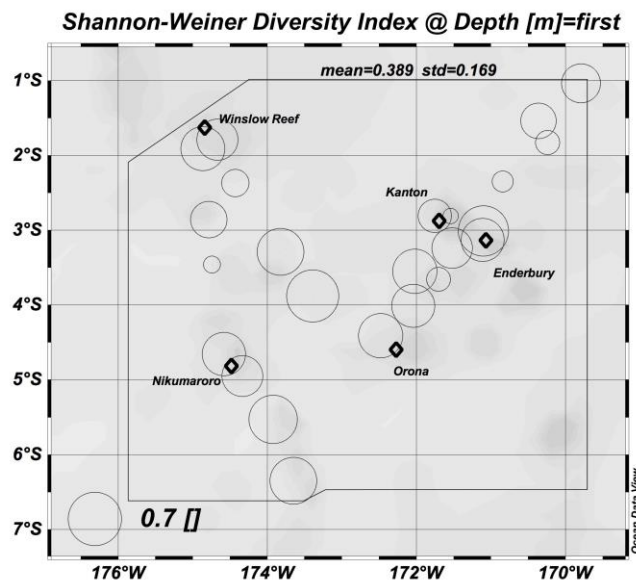
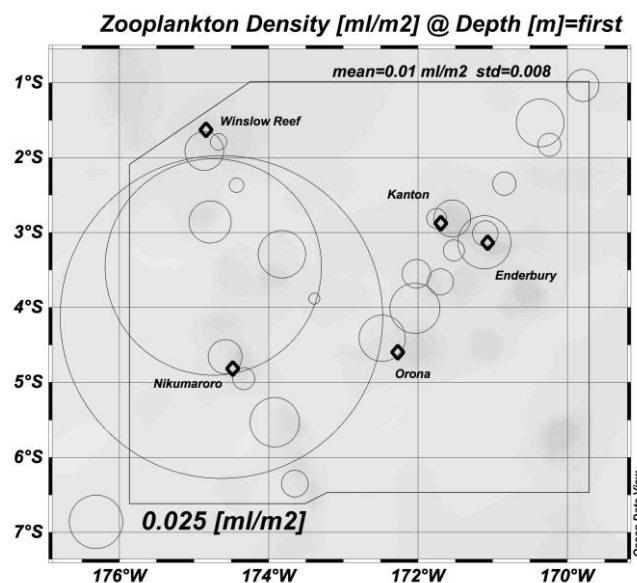
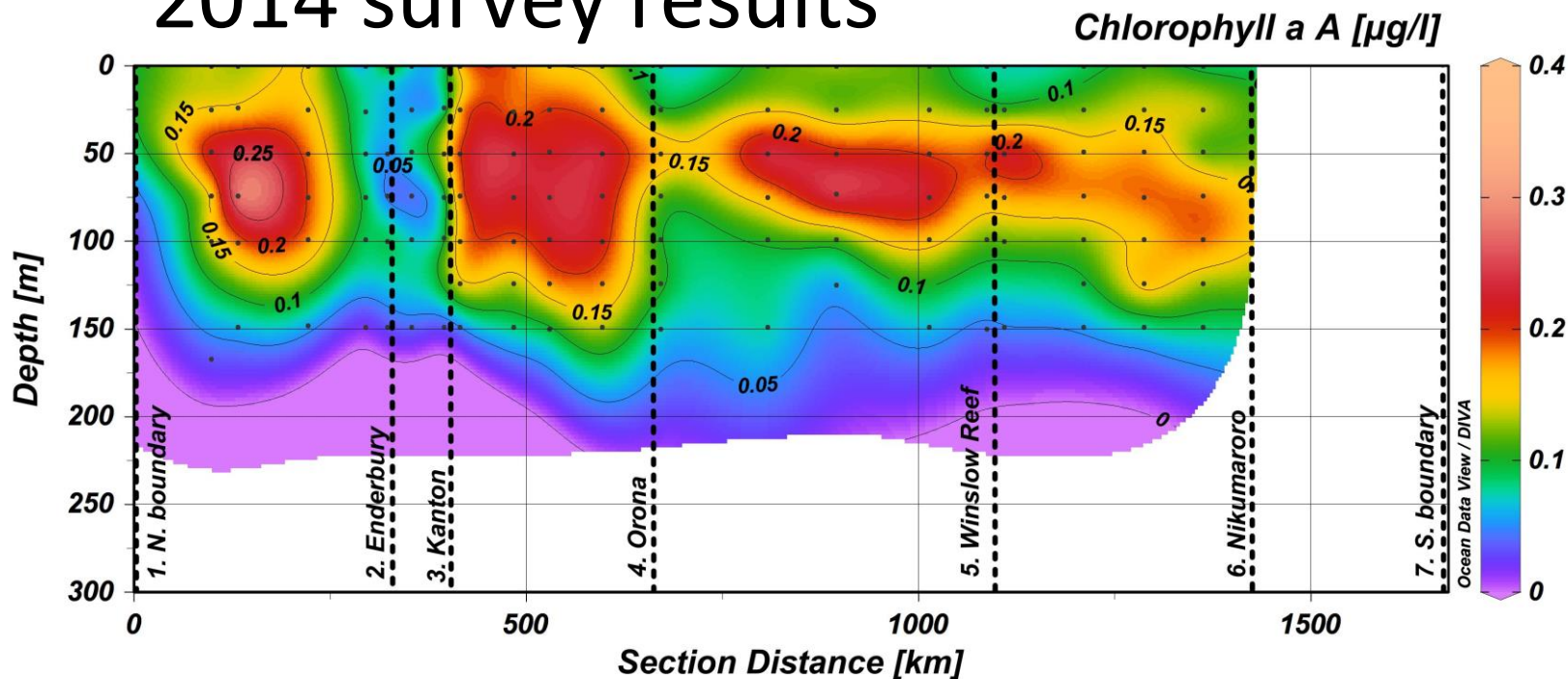


ADCP current velocity

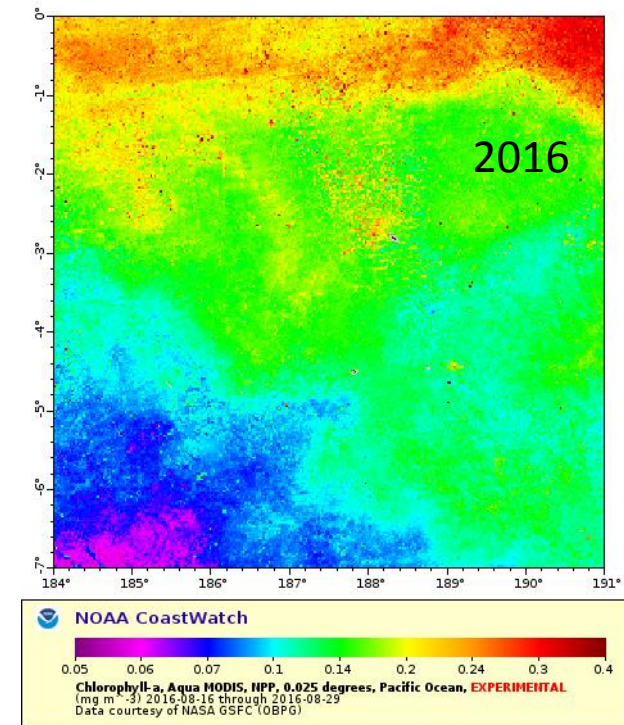
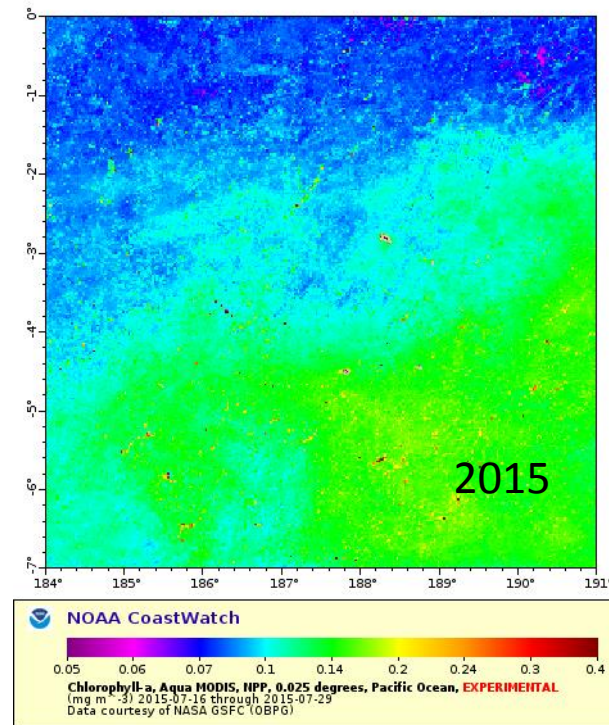
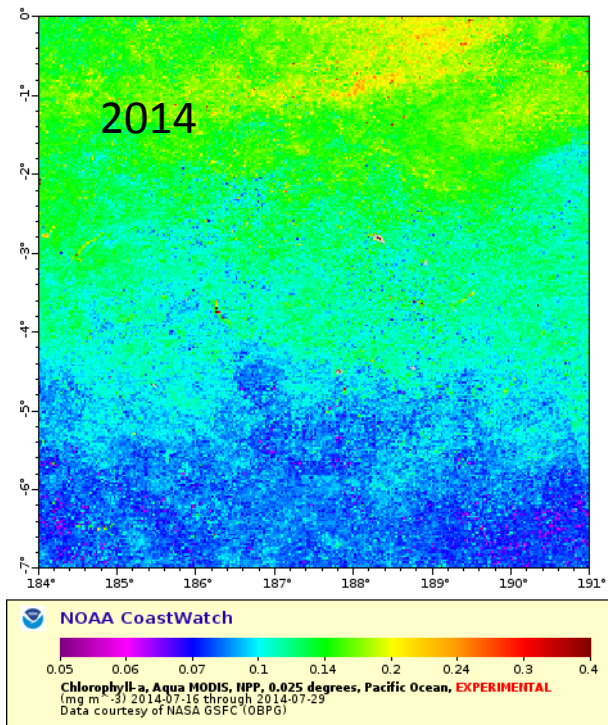




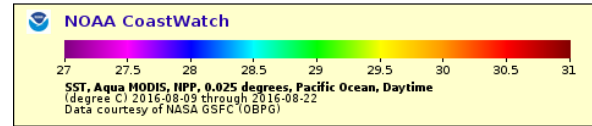
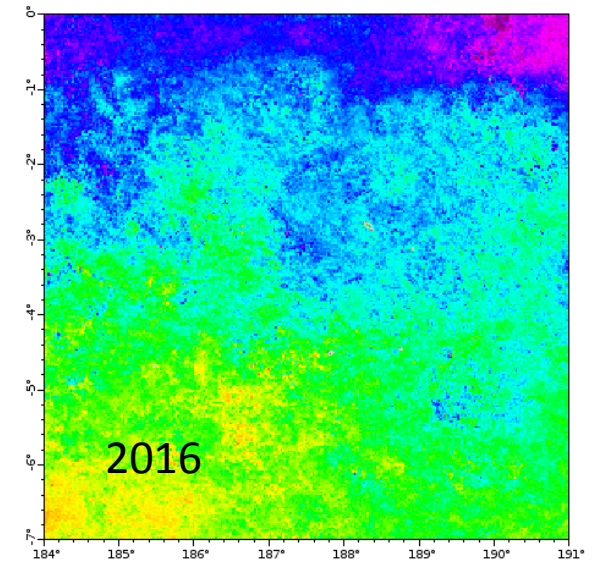
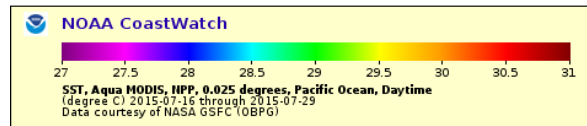
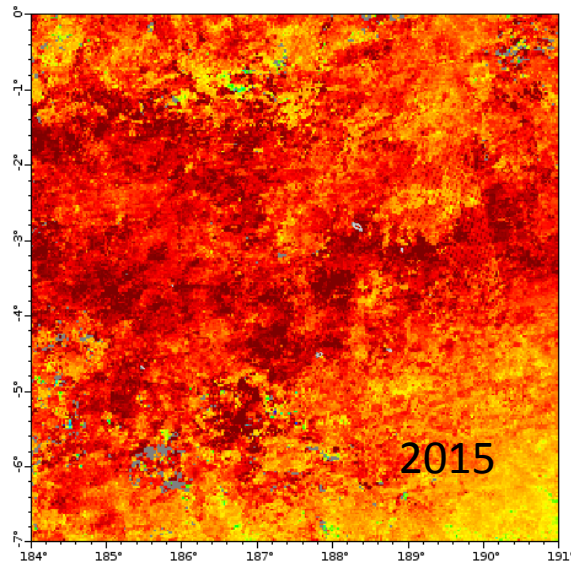
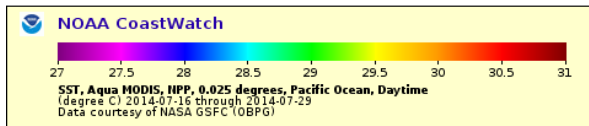
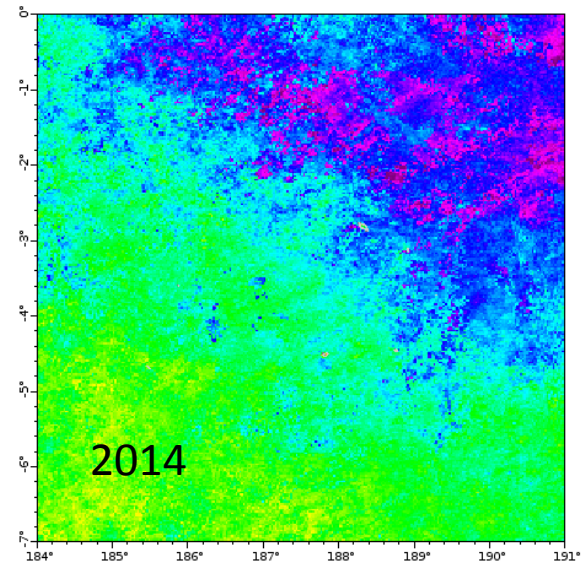
2014 survey results



Aqua MODIS chlorophyll *a* concentrations in PIPA

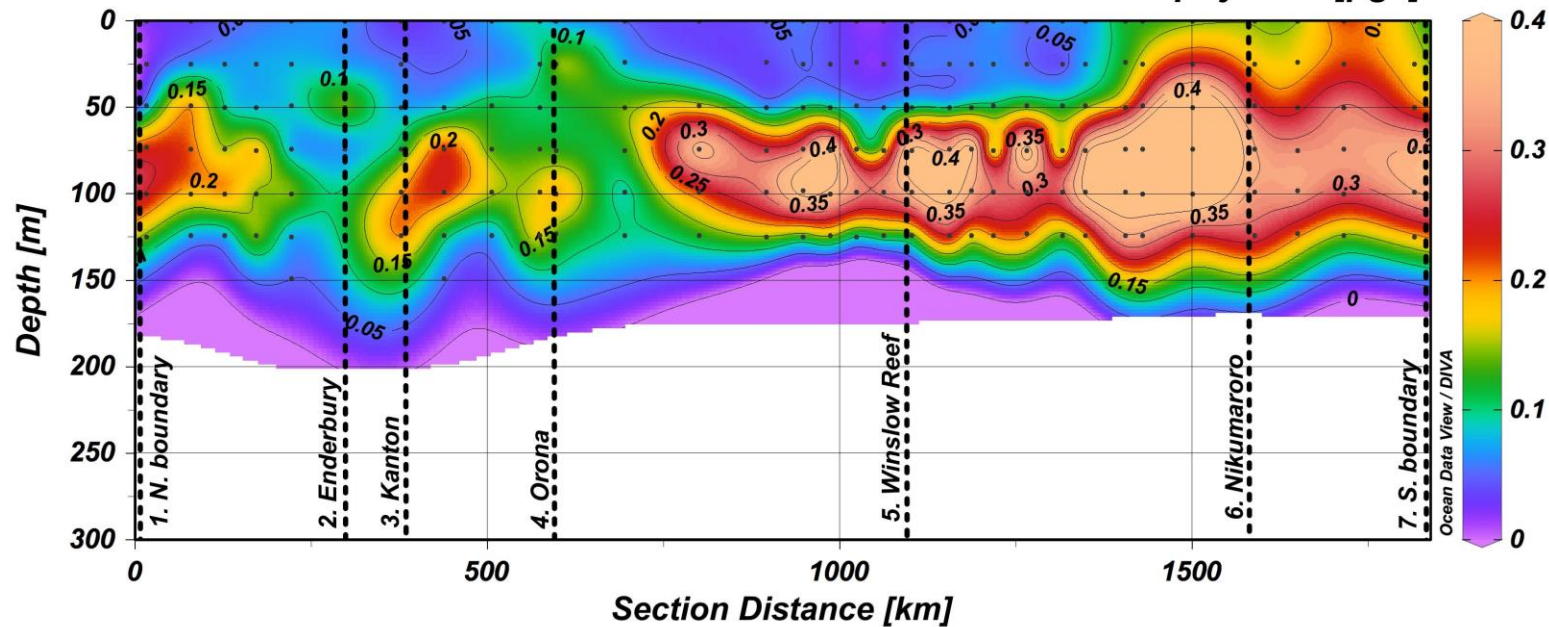


Aqua MODIS SST in PIPA , 2014-2016



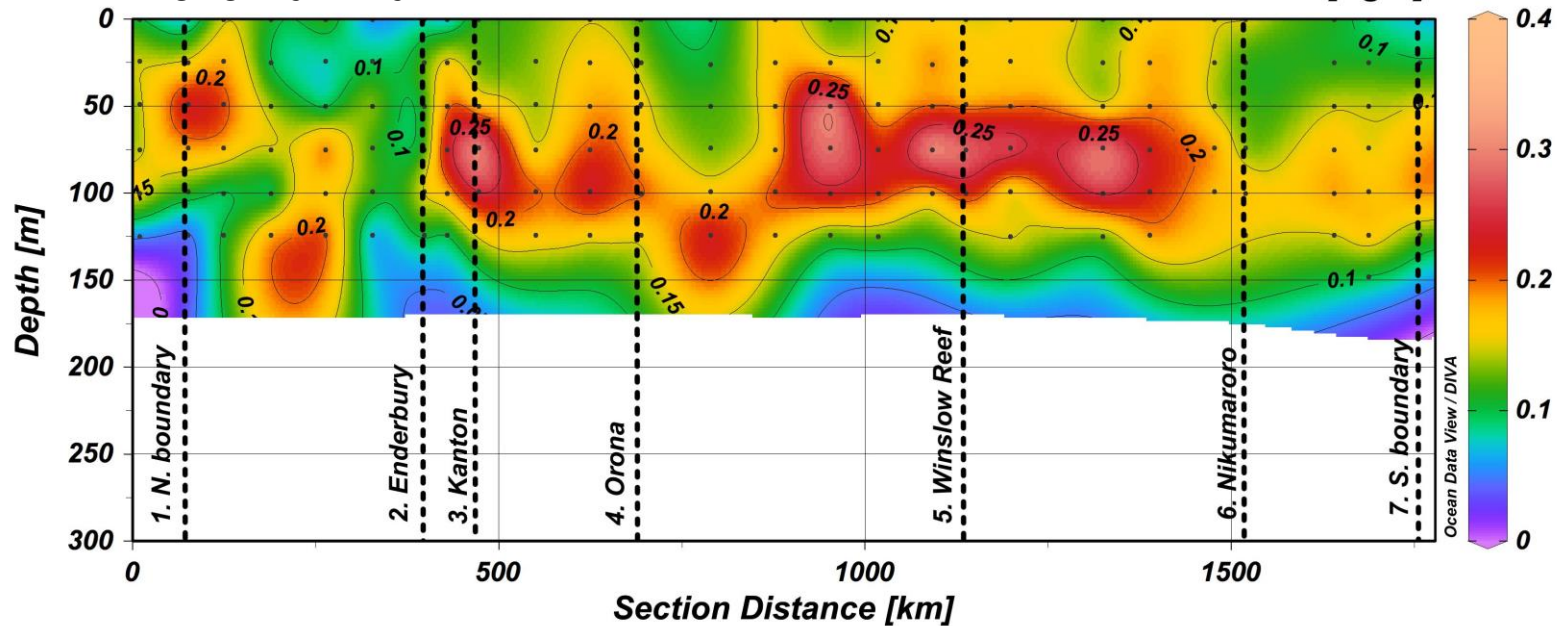
2015: El Nino

Chlorophyll a A [$\mu\text{g/l}$]

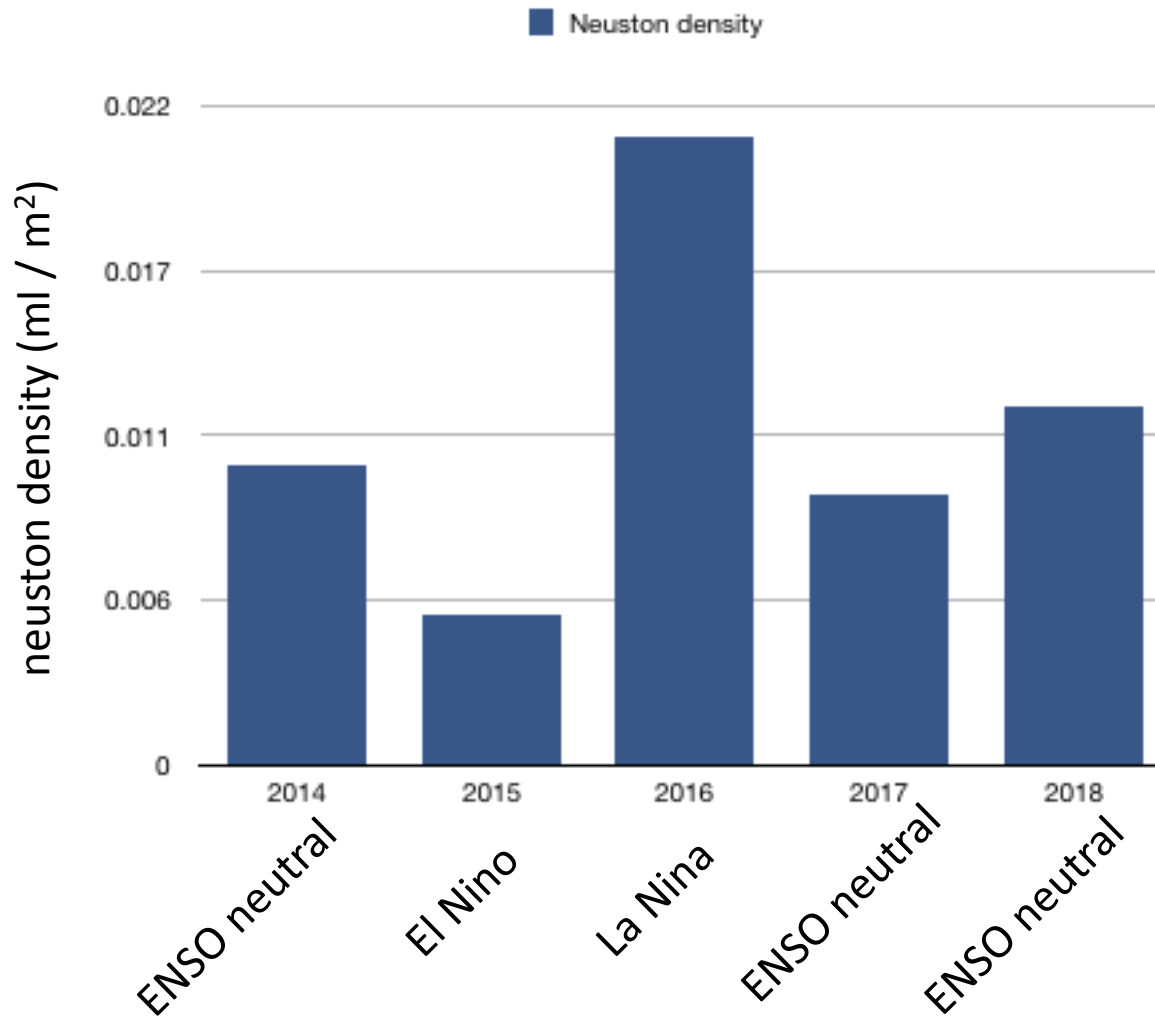


2016: La Nina

Chl-a [$\mu\text{g/L}$]



Zooplankton density in PIPA



Tracking Larval Tuna in the Phoenix

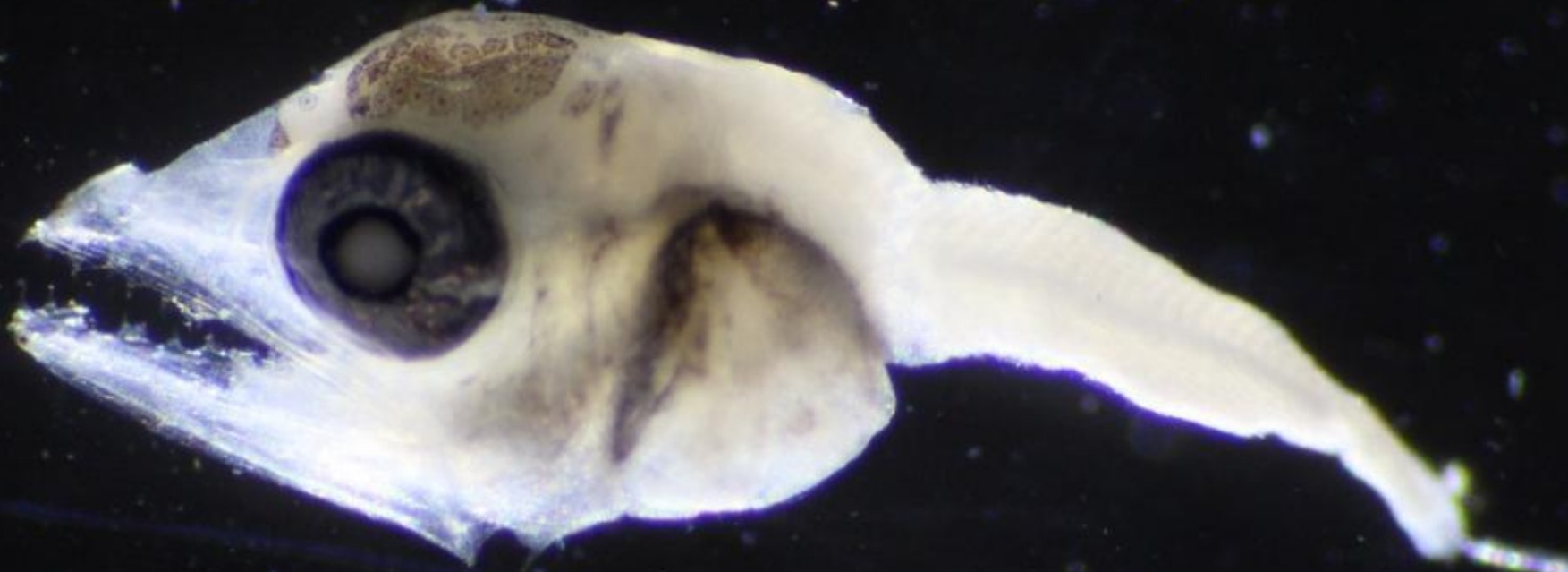
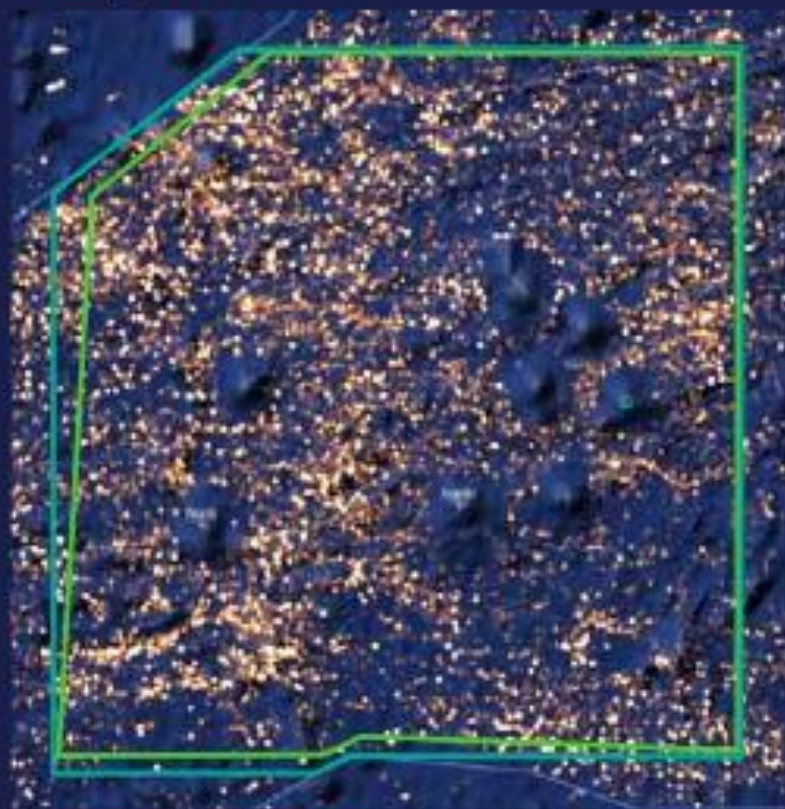


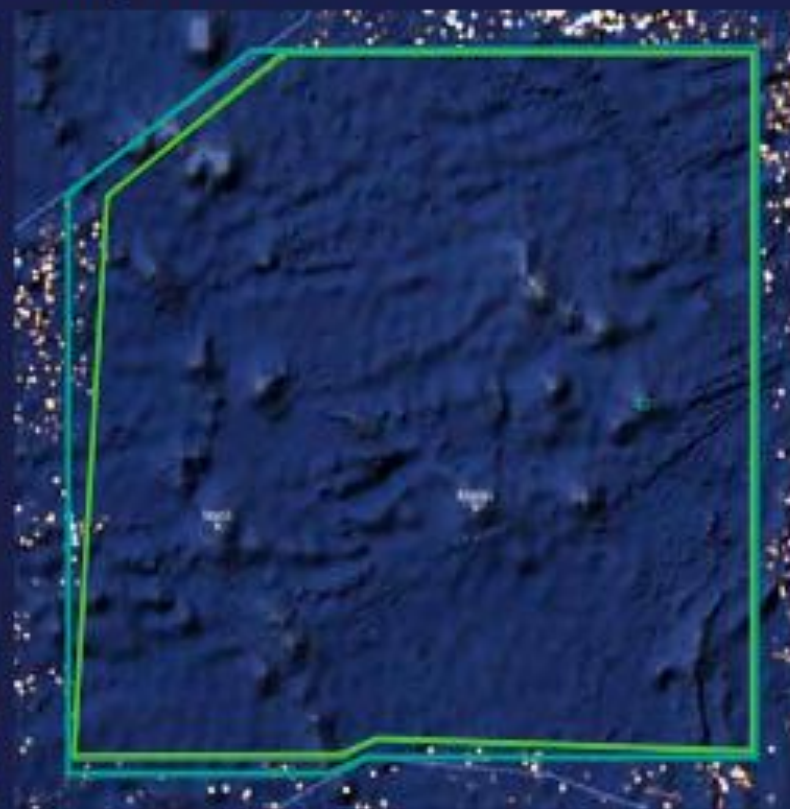
FIGURE 6 BEFORE AND AFTER THE FISHING BAN

Heavy fishing activity was detected by Global Fishing Watch in PIPA from January to October 2014, before the ban was enacted. Fishing activity was nearly non-existent in the first 10 months following the closure of PIPA to commercial fishing. Data was collected through October 15.*

January - October 2014



January - October 2015



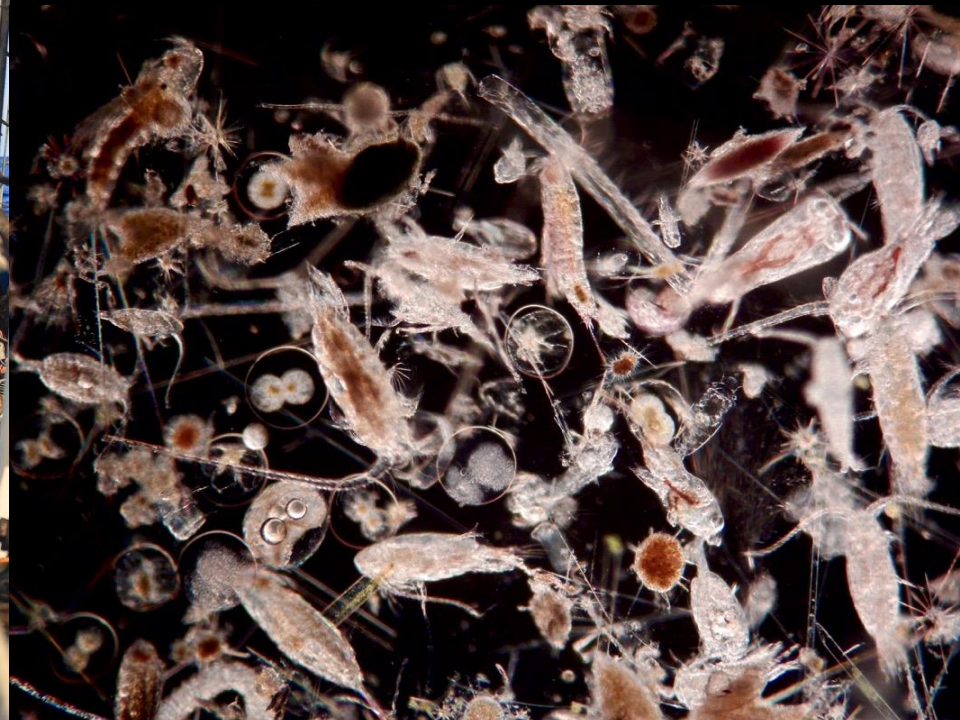
LEGEND

-  Management Plan Boundary
-  Enforcement Boundary
-  Fishing Effort



Source: Global Fishing Watch

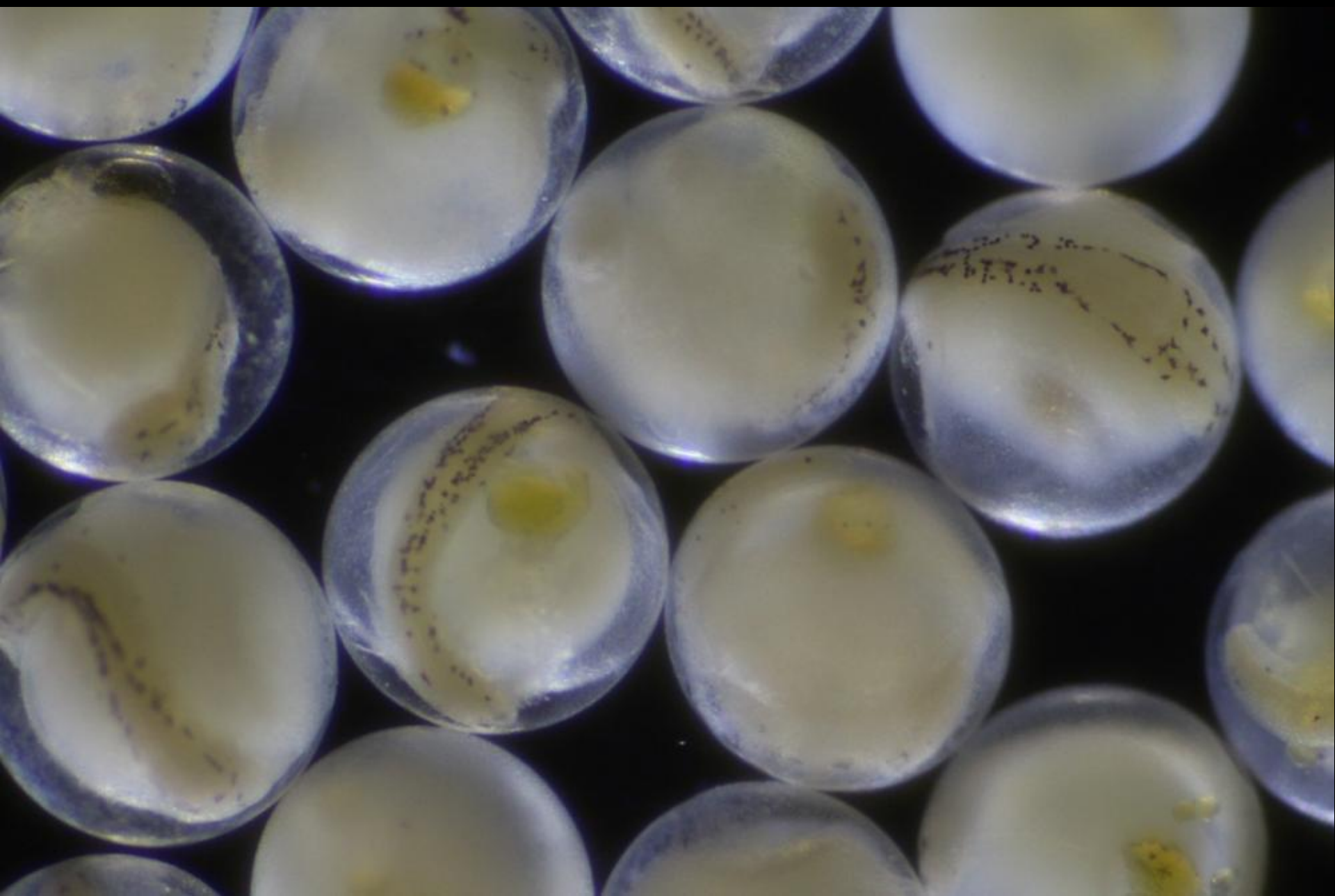
*The closure boundary given to the Forum Fisheries Agency does not perfectly align with the boundary mapped out in PIPA's management plan due to shifts in EEZ delineations at the northwest edge of Kiribati's central region. A gap exists between the two boundaries, excluding Winslow Reef in the northwest corner of the EEZ. There appears to be some continued fishing in that area. Oceana understands that Kiribati and the PIPA Trust intend to resolve this issue.



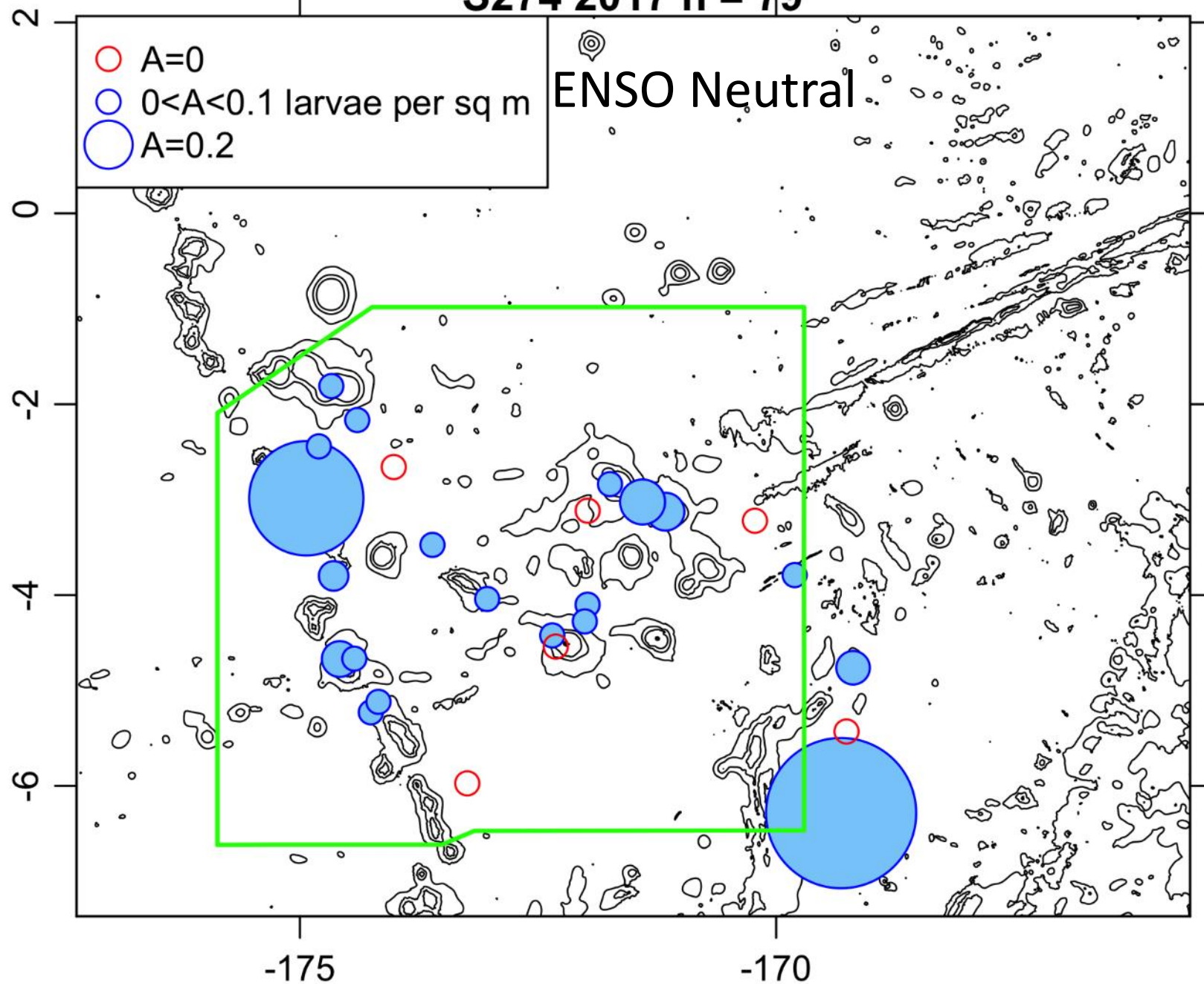
Larval tuna:



Hernandez et al. in prep



S274 2017 n = 79



Escale et al. 2018 PNA FAD analysis

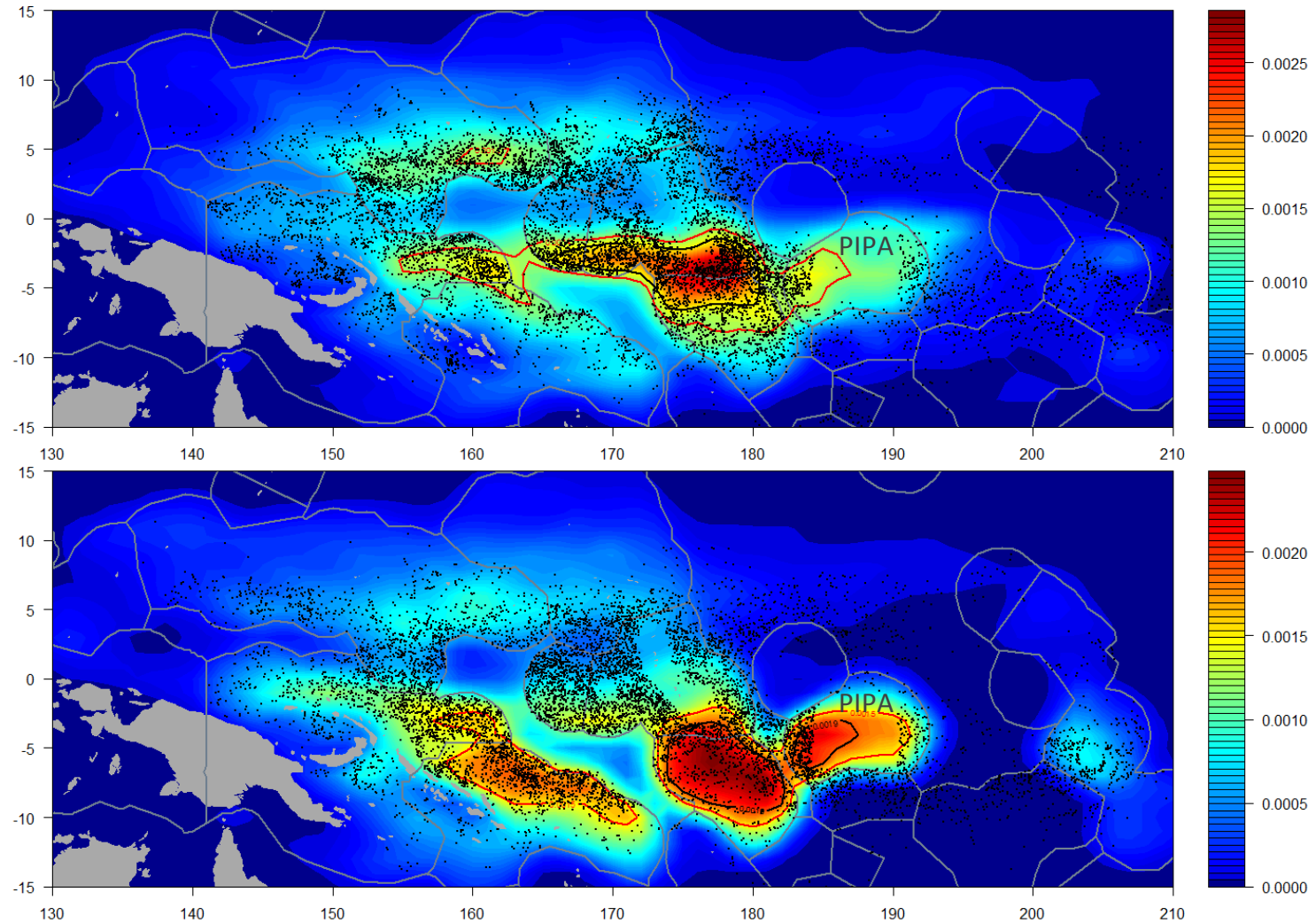


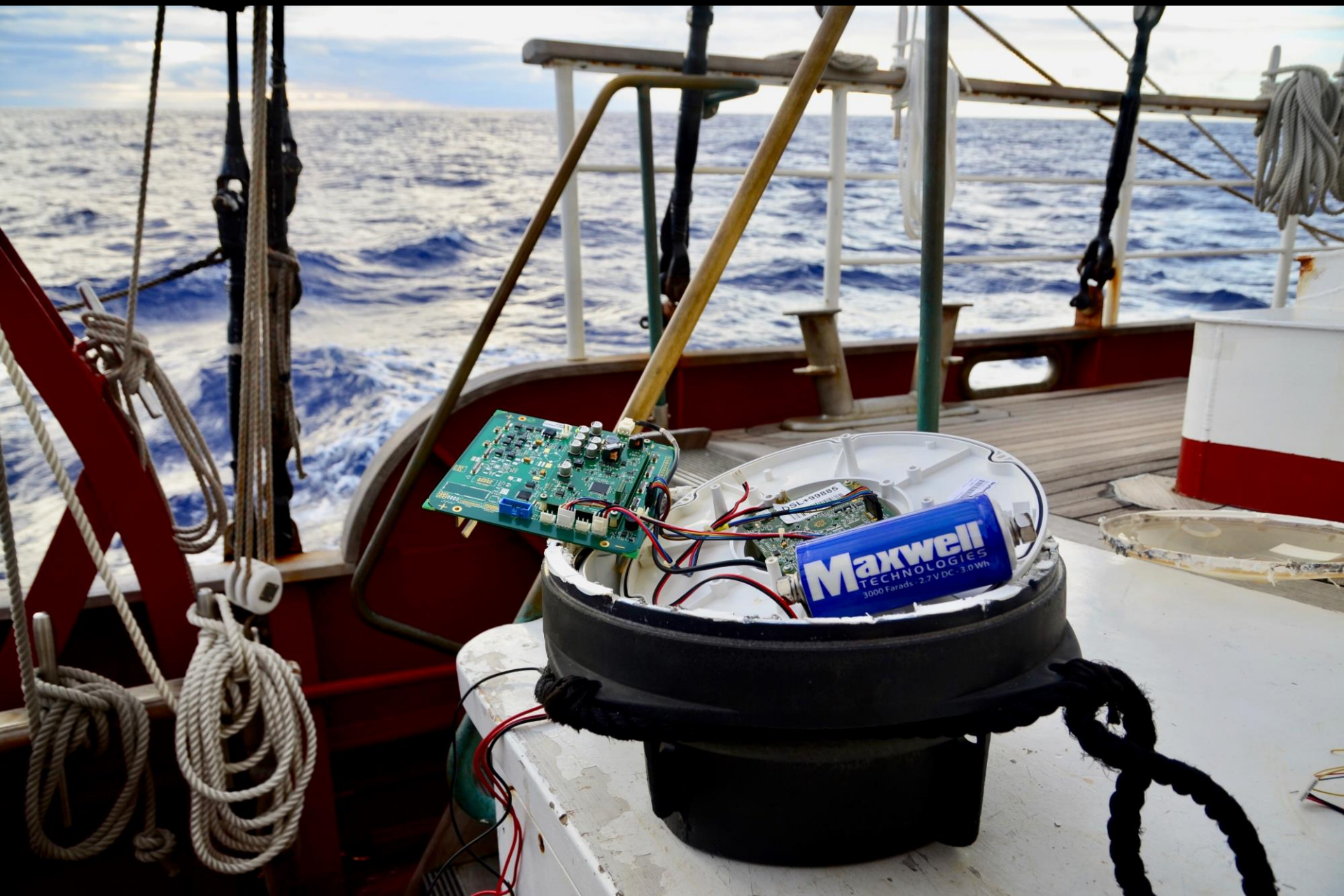
Figure 12. Smoothed standardised kernel density of FAD satellite buoys transmitting at least once per day and per 1° grid cell during 2016 (top) and 2017 (bottom) (maximum number per cell of 3000 in 2016 and 5000 in 2017), with position of associated sets recorded in logsheet data shown as black dots (see Figure A3 for densities maps only). Red lines correspond to the 95th quantile. Colour scale corresponds to the proportion of transmitting per 1° cell.











Escale et al. 2018 PNA FAD analysis

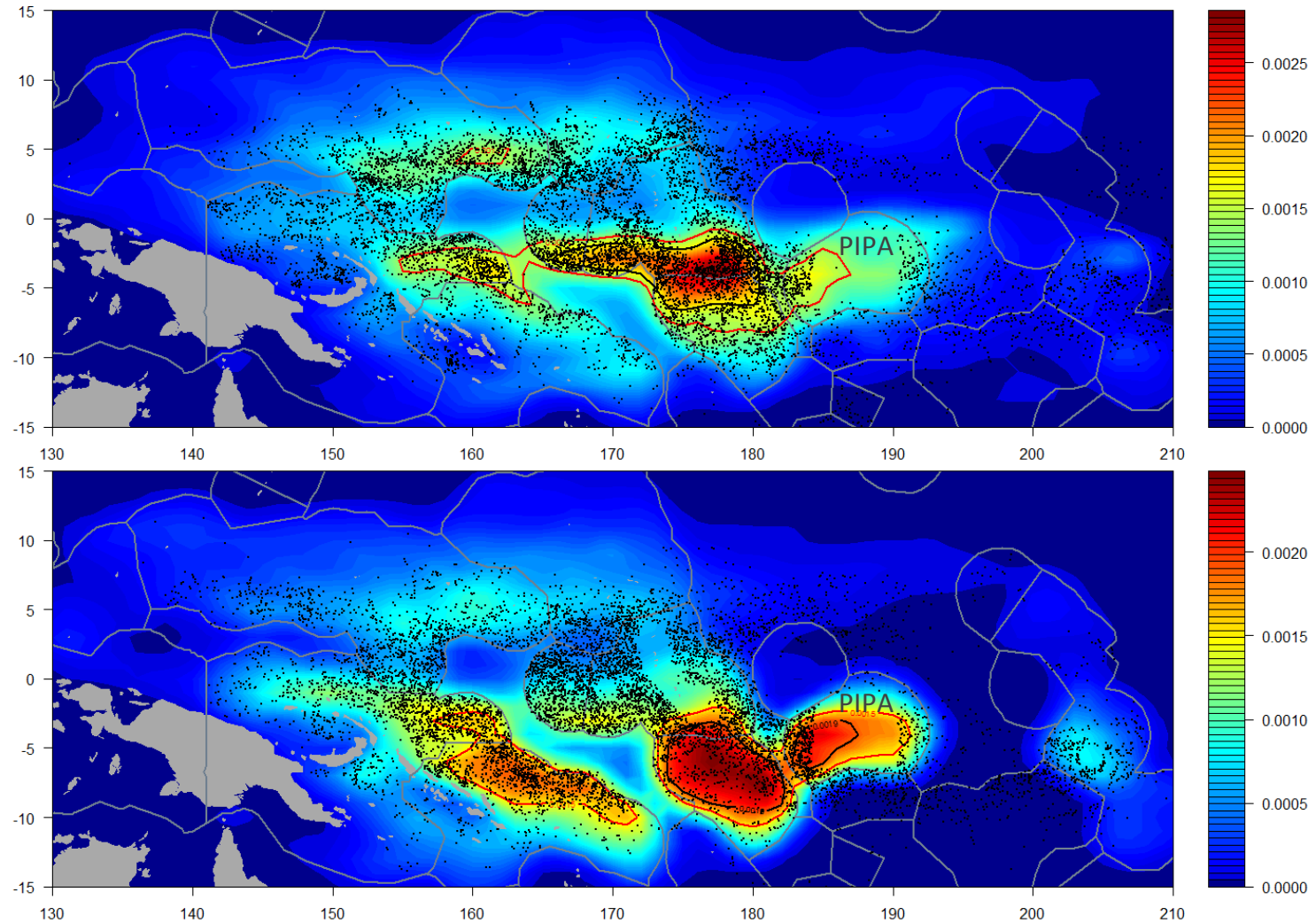



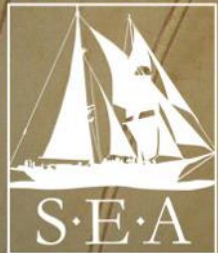
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