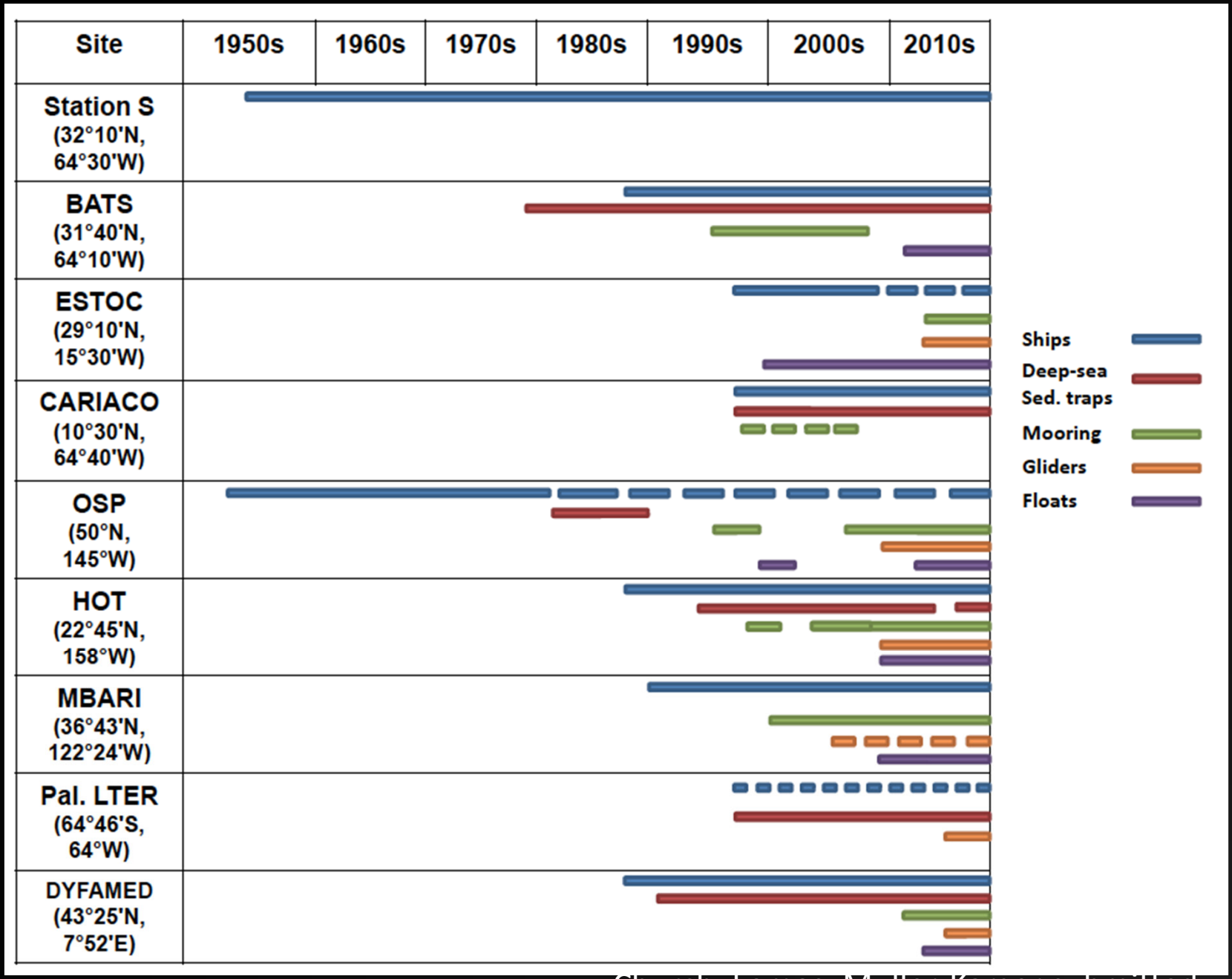
Integrating Measurements Across Multiple Time And Space Scales

Timeline Of Research Conducted At Various Ocean TS Sites Around The Globe



Church, Lomas, Muller-Karger submitted

Ocean Carbon and Biogeochemistry
Studying marine biogeochemical cycles and associated ecosystems in the face of environmental change
News
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CalCOFI – A 63-Year-Old Ocean Observing System

by Ralf Goericke and Tony Koslow (UCSD, Scripps Institution of Oceanography)

In response to a collapse of the California Sardine fishery in the latter half of the 1940s, fisheries managers and stakeholders implicated either environmental degradation or overfishing. Although they did not reach consensus on the primary driver of this collapse, they did employ a typical political solution: "to study the problem," hence the birth of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program, a partnership of the Scripps Institution of Oceanography (SIO), the NOAA National Marine Fisheries Service (NMFS), and the California Department of Fish & Game. Thus far, nothing unusual had happened; in response to an environmental crisis, a political solution had been implemented. This, however, changed once scientists were charged with planning the program. At a meeting at Stanford University in 1947, the objective of the program was defined as

"*...investigating the sardine in relation to its physical and chemical environment, its food supply, its predators and its competitors, in attempting to evaluate the findings in terms of the survival of the young, and in terms of the distribution and availability of the sardines when they reach commercial size.*" (California Cooperative Sardine Research Program Progress Report, 1950).

This statement was drafted only 5 years after the publication of the classic paper "*The trophic-dynamic aspects of ecology*" (Lindeman, 1942), the birth of ecosystem ecology. It predates the concept of ecosystem-based management of fisheries by 4 to 5 decades. This partnership between fishery agencies and an oceanographic institution established a program to meet the ongoing needs for stock assessment and fishery management within an ecosystem and ocean observation context. Underlying the CalCOFI program today remains a community of scientists who hold an annual symposium, publish a journal (*CalCOFI Reports*), and collaborate on a wide range of topics of relevance to understanding the California Current ecosystem. Today CalCOFI data, publications, information about the CalCOFI cruises and the

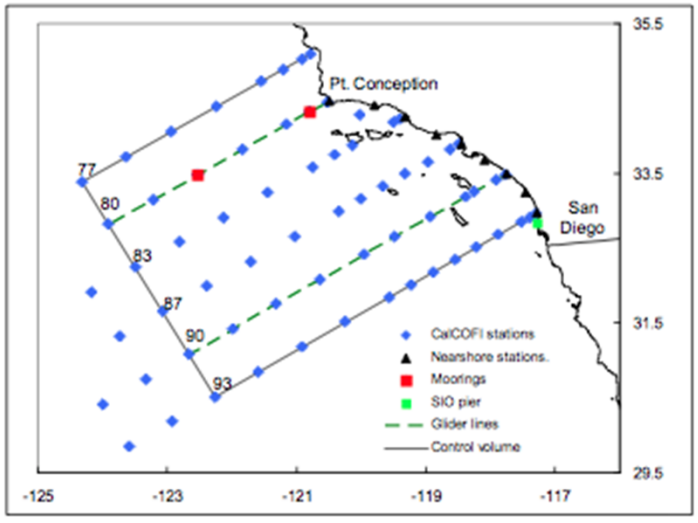
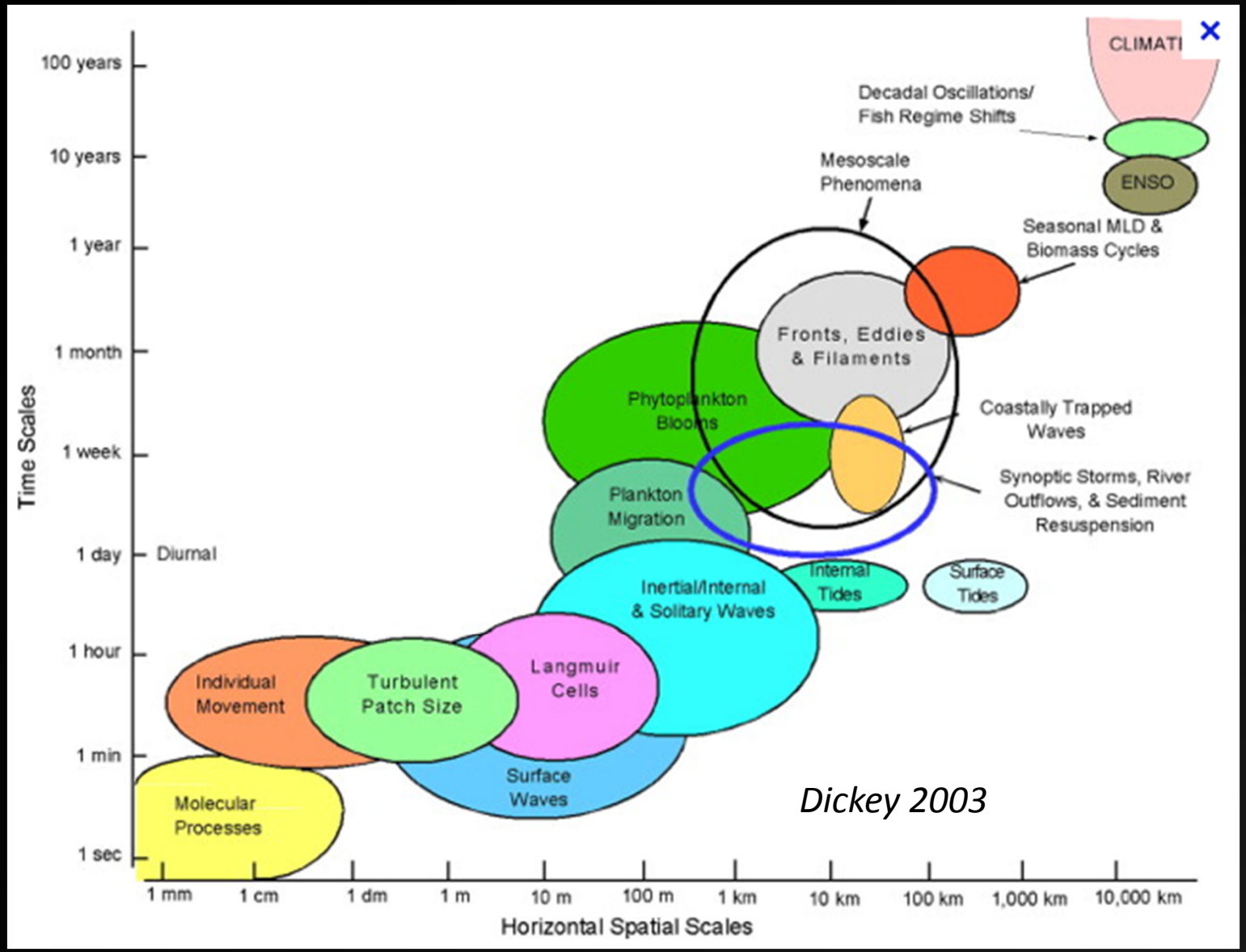


Figure 1. Map of current CalCOFI stations. The 66 standard stations have been occupied quarterly since 1984. A set of nearshore stations was established in 2004, providing the opportunity to characterize nearshore processes in the context of larger-scale dynamics. The CCE-LTER program carries out basic sampling at all 66 stations, with more focused sampling at stations on lines 80 and 90. Gliders operate continuously on these two lines. The CCE-LTER program and others operate two moorings at stations on line 80.

- CalCOFI / CCE -LTER

Long term Biogeochemical data over larger spatial areas



These shipboard time series studies and integration of autonomous sampling platforms allow researchers to integrate and synthesize data over multiple temporal and spatial scales

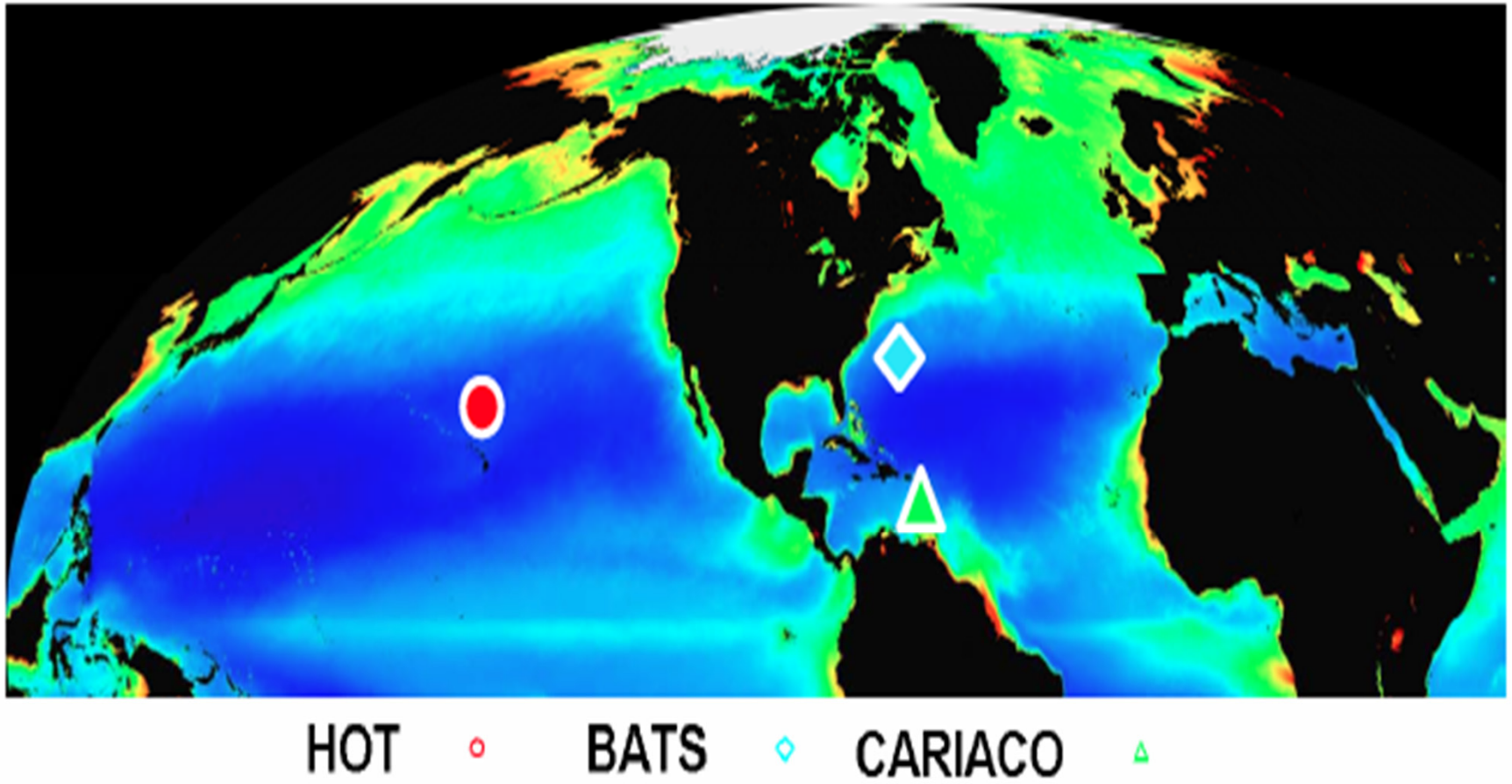
Integrating Measurements Across Multiple Time And Space Scales

Steve Emerson – Net Community Production in the Ocean from a time series perspective

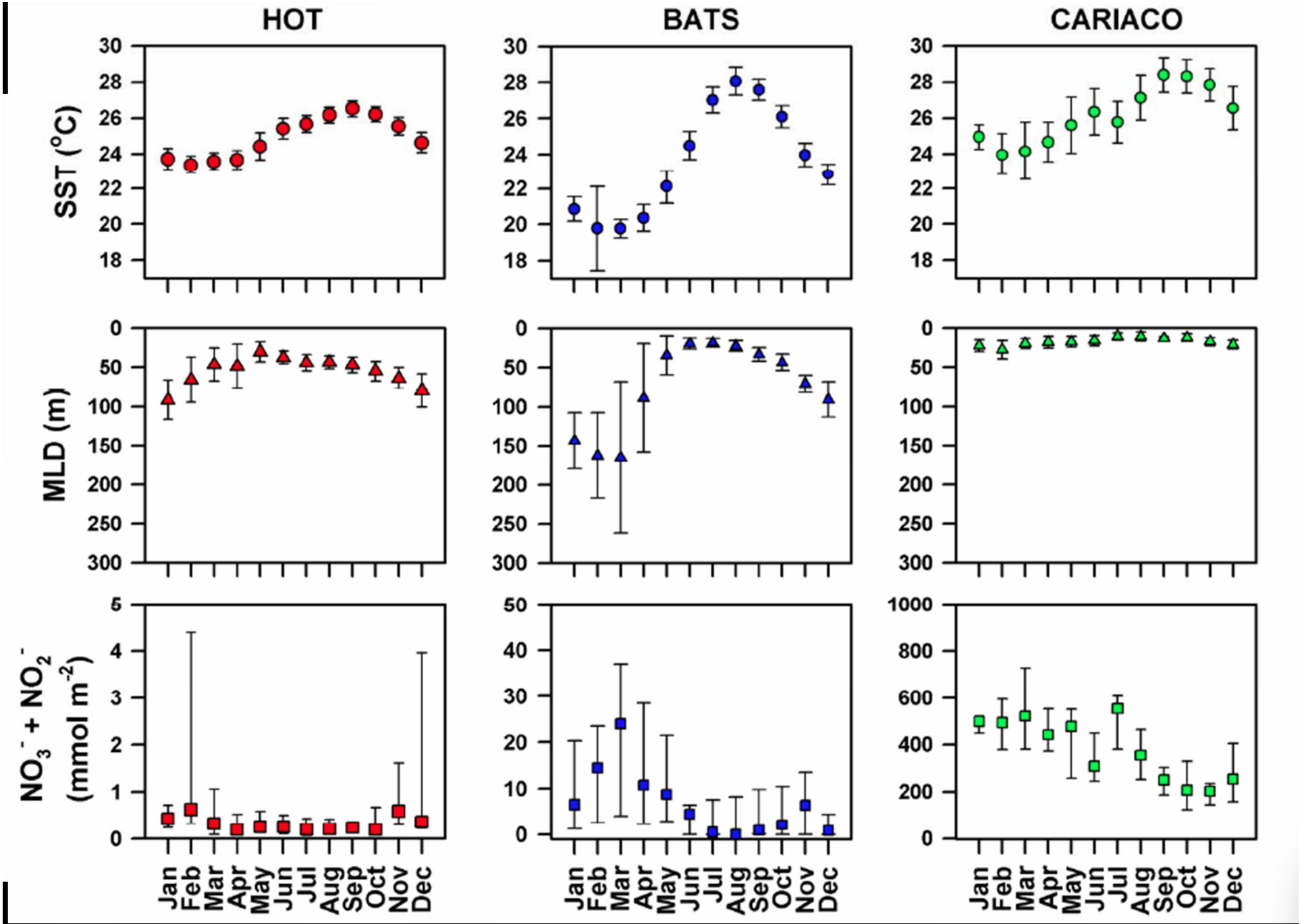
Mark Ohman- California Current Ecosystem Dynamics

Katja Fennel- Patterns of Phytoplankton Limitation and Hypoxia in the Northern Gulf of Mexico: Observation, Simulations and Predictability

Galen McKinley- The Regional Carbon Cycle Assessment and Processes (RECCAP) Effort

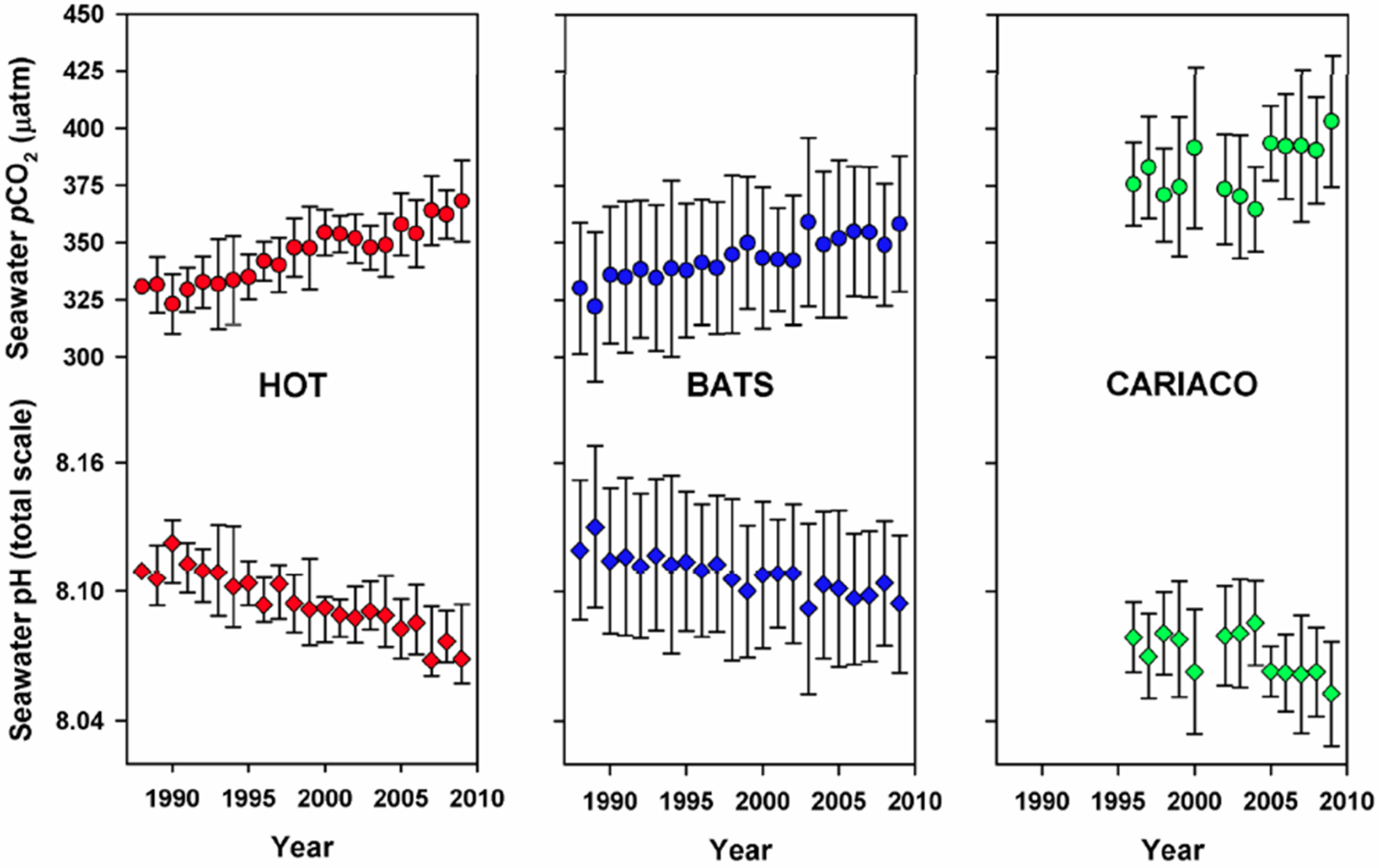


HOT ~24 years
BATS ~ 24 years
CARIACO ~ 17 year



Church, Lomas, Muller-Karger submitted

Long-term Trends in *p*CO2 and pH at HOT, BATS and CARIACO



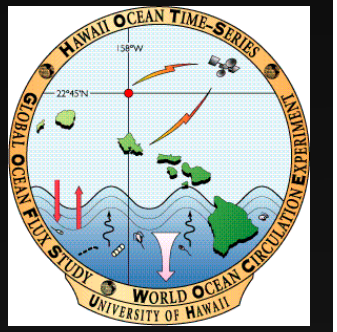
Church, Lomas, Muller-Karger submitted

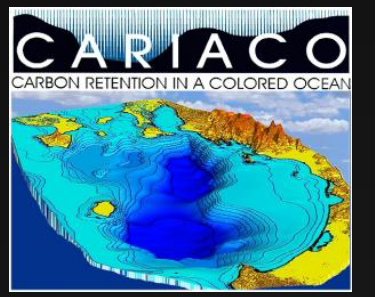
Sea Change: Charting the course for ecological and biogeochemical ocean time-series research

(OCB Scoping Workshop, Honolulu, HI, Sept. 2010)

WORKSHOP OBJECTIVES

- Provide a synthesis of ongoing research and knowledge obtained at HOT, BATS, and CARIACO Time-series sites
- Highlight current capabilities of each time-series site
- Obtain community input on the time-series sites
- Discuss new opportunities for future research at HOT, BATS, and CARIACO





DEEP SEA RESEARCH II

- Workshop report and new papers from HOT, BATS and CARIACO will be published in volume of Deep Sea Research II- *Editors Lomas, Church, Muller-Karger*

KEY RECOMMENDATIONS FROM OCB COMMUNITY

1. Shipboard Time-series programs are vital community resource and need to continue to resolve decadal variability of key C and biogeochemical variables

1. Continue to provide core measurements and infrastructure and allow individual & integrated process studies to develop and push new science frontiers

2. Utilize time-series to implement, test and validate new observing technologies

KEY RECOMMENDATIONS FROM OCB COMMUNITY

4. Promote the use of Time Series data to develop and validate numerical ecosystem models

5. Create network where data and data products from TS around the globe are centralized and publicly accessible

6. Maintain high-quality measurements (staff training and retention)

International Time-Series Methods Workshop

Co-Chairs – Laura Lorenzoni, Kathy Tedesco, Heather Benway

November 28-30, 2012

Bermuda Institute of Ocean Sciences (BIOS)

Rationale

Growing need in the community to *inter-compare* data collected at different ocean time-series sites in order to achieve an improved understanding of our changing global ocean

Objectives

- Review current time-series sampling and analytical methods
- Define standard methods across time-series (when/where possible)
- Examine new techniques available, including the use of autonomous sensors

Participation

- 30 representatives (invitation only) from established international time-series sites making biogeochemical measurements
- Representation from OceanSITES and Repeat Hydrography programs

Anticipated Outcomes

- Best Practices publication on biogeochemical sampling and measurement protocols (for broad community distribution)
- Increased communication, coordination and data/methods-sharing among international sites