Cruise Report

California Current Ecosystem LTER Program

CCE-P2402 Cruise

R/V *Revelle*, 18 February – 18 March 2024

Compiled and submitted by: M. Stukel, Chief Scientist

Cruise ID: CCE-P2402 (= RR2402)

Depart: 18 Feb. 2024, 0600 (PDT), MarFac

Return: 18 Mar. 2024, 2000, MarFac

Vessel: R/V *Revelle*

Master: Captain Eric Wakeman

Chief Scientist: M. Stukel

Science Technicians: Andrew Naslund (SIO), Amber Boettiger (SIO), Brent DeVries(SIO)

Operator: Scripps Institution of Oceanography

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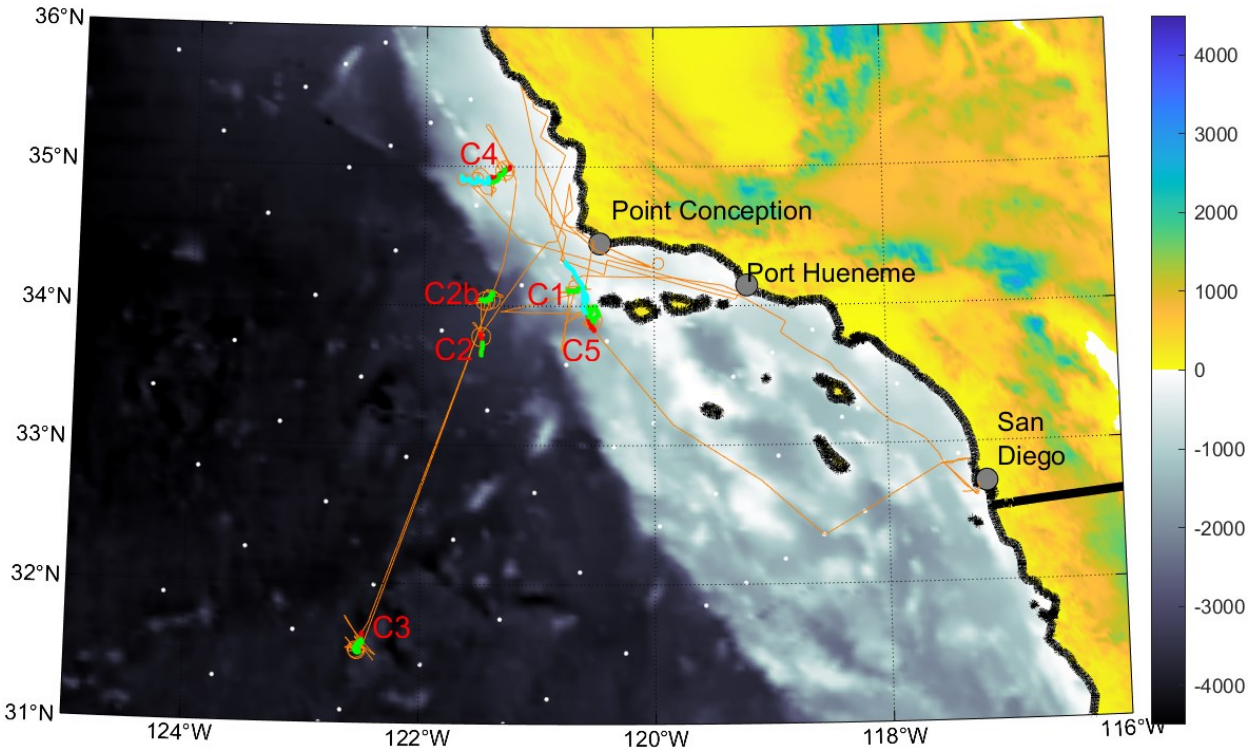

Cruise track for CCE-LTER cruise P2402 off the coast of Central and Southern California, with locations of Lagrangian Experiments also shown..

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SIO = Scripps Institution of Oceanography, FSU = Florida State University, Rice = Rice University, UAF = University of Alaska Fairbanks, CSUSM = Cal State University San Marcos

SCIENCE OBJECTIVES

This cruise, designated P2402 by CCE-LTER (or RR2402 for R/V *Revelle*), was the first process cruise in Phase IV of the *California Current Ecosystem* Long Term Ecological Research (CCE-LTER) program, supported by NSF. P2402 continued CCE LTER's long-term objective of using "Process cruises" to quantify ecosystem rates (production, growth, grazing, nutrient uptake and biogeochemical fluxes) in conjunction with standing stock measurements in order to extrapolate ecosystem rates from time-series measurements made on CalCOFI cruise. Additionally, and starting in Phase IV, P2402 had an extended focus on top-down ecosystem control, ecological stoichiometry, and multi-factorial analyses of ecosystem responses to marine heatwaves. P2402 employed a series of integrated approaches. The fundamental approach was quasi-Lagrangian experimental studies and in situ measurements carried out while following 5 discrete water parcels, spanning a productivity gradient from cold, saline, upwelled water to oligotrophic water representative of subtropical gyre conditions. These quasi-Lagrangian series of measurements (each of which we term a "Cycle" of repeated measurements) were complemented by several related activities: deployments of autonomous instruments (in situ incubation arrays, drifting sediment traps); surveys of the studied water parcels using a towed deep plankon imager (ISIIS); multi-frequency acoustical (EK-80) measurements; extensive remote sensing support (including satellite sensors and coastal high-frequency radar); sampling of California Undercurrent water; and transect surveys of the Benthic Boundary Layer over the continental shelf.

Our specific objectives were to ***quantify physiological responses to marine heatwave conditions*** *and* ***investigate predator and grazer distributions to inform top-down ecosystem analyses.*** The principal hypotheses we sought to test were:

H_1: Bacterial growth rates and protistan grazing rates show greater responses to warming than phytoplankton growth rates and net primary production.

H_1: Nutrient or food supply is of primary importance for lower trophic levels (phytoplankton, herbivorous zooplankton), which are only sensitive to expected temperature changes in the CCE when nutrients are replete.

H_3: Small-scale co-location of predators and prey lead to enhanced encounter rates relative to random distribution of organisms.

H_4: Non-selective filter feeders (e.g., pyrosomes) and taxa that can switch between feeding on different trophic levels (e.g., anchovies) promote intraguild predation thus decreasing top-down control of the ecosystem, while protistan grazing and viral lysis promote greater microbial diversity than grazing by filter-feeding and suspension-feeding metazoans.

The processes measured on this cruise included primary production, phytoplankton growth rates, nitrate uptake, secondary production by bacteria, grazing by microzooplankton and mesozooplankton, iron limitation effects on phytoplankton growth, carbon and nitrogen cycling between dissolved and particulate phases, and elemental export in both particulate and dissolved forms. The pelagic food web

was characterized by state-of-the-art measurement methods, including -omics approaches (for prokaryotic and eukaryotic microbes), high-resolution imaging (phytoplankton to mesozooplankton and micronekton), and acoustic backscatter (for mesozooplankton and nekton). Vertically stratified distributions of zooplankton were assessed using traditional net approaches (MOCNESS) and an advanced towed imaging platform (DPI/ISIIS), complemented by in situ imagery from a UVP6 mounted to the CTD-rosette. Most measurements were made in a Lagrangian reference frame while following discrete water parcels for 4-5 days at a time. These water parcels were selected to span the productivity gradient found in the CCE domain during the winter-spring transition period. A Benthic Boundary Layer (BBL) study was conducted to understand the relationship between coastal iron supply in nearshore sediments and the flux of iron into the coastal ocean via upwelling and advection. Sampling after a rainy period in Southern California will complement prior cruise measurements during typical dry periods. We also sampled the California Undercurrent to investigate the stoichiometric ratios of trace and macronutrients upwelled into the system.

Our **Broader Impacts** activities included providing seagoing research opportunities and training for 14 graduate students, one undergraduate student, six volunteers, and three postdoctoral investigators. One of the graduate students participated in the in partnership with Assistant Professor Darcy Taniguchi, a faculty member at CSUSM, a Minority-Serving, Primarily Undergraduate Institution. We communicated with the general public via an online blog created by volunteer Jameson Morrin (https://ccelter.ucsd.edu/life-aboard-the-r-v-revelle-february-20th-to-february-27th/).

OVERVIEW OF THE SCIENCE PLAN

After departure of R/V *Revelle* from Scripps' MARFAC on Feb 18 at 0600, we steamed to CalCOFI station 93-30 to use as a test station site. At that location, we completed a series of over-the-side instrument tests, including a test of the Deep Plankton Imager (ISIIS). We then steamed north to our planned starting location in the vicinity of CalCOFI Line 80. At this time there was no clear evidence of upwelling along the coast, except in the nearshelf where water depths were too shallow to permit array deployment. We were also severely restricted in our allowed deployment locations due to naval operations areas (see Appendix 1). Nevertheless, we started a Lagrangian experiment ("cycle") on 19 Feb 2024, although we did not deploy the sediment trap because navy restrictions allowed us to be in the region for only slightly longer than 48 hours. Nevertheless, we completed a cycle with two incubation array deployments and recoveries, paired day-night DPI deployments, paired day-night shallow MOCNESS deployments, and paired day-night deep MOCNESS deployments, among other experiments.

On Feb 21, most of the region was closed to us and we were restricted to either near coastal waters or waters outside of the U.S. EEZ. Consequently, we conducted a benthic boundary layer (BBL) sampling transect on the shelf from Feb. 21 – 22. During this time we also sampled a station in the Santa Barbara Basin. The BBL study consisted of a series of 9 stations on the shelf at each of which we conducted a CTD cast followed by sampling of the near bottom water by Go-Flo bottles to quantify trace metal concentrations. Notably, the BBL transect was conducted out of order, due to additional restrictions

near the Vandenburg military base that dictated when we could sample two of the stations near Point Conception.

On Feb. 23 we started a second Lagrangian experiment. At this time the only region that we were allowed to remain in for multiple days was naval area W537, a region that is relatively long in the across shelf direction but short in the north-south direction and that cuts approximately orthogonal to the coast starting just south of Point Conception (see Appendix 1). Our goal was to sample transition waters (i.e., low nutrient and moderate chlorophyll). Hence we focused on a region that was approximately 100 km from the coast and started the cycle near the middle of W537. Unfortunately, southward currents were quite strong and by ~24 hours after deployment of the sediment trap it was clear that the arrays would soon drift into naval restricted areas. Consequently, we recovered the incubation array at 2200 on Feb. 24 (experiments on the array were continued in the dark on deck) and the sediment trap at 2300. We then transited back north, this time deploying the incubation array at the far northern end of W537. Although the ship's ADCP suggested southward currents throughout the transit to the northern end, after re-deployment of the incubation array the array did not travel south, but rather moved slowly towards the east northeast. We decided to refer to this attempted extension of our second Lagrangian experiment as "Cycle 2b" (Cycle 2 was also renamed "Cycle 2a") to reflect that these Lagrangian experiments were in similar regions but distinct water parcels. Cycle 2b was continued for slightly more than 3 days and included a full suite of measurements, concluding on the morning of Feb. 28.

On Feb. 28 we transited to an offshore location (31.5N, 122.5W) that was outside of the U.S. EEZ and hence not affected by the continuing naval restricted areas. We chose this location, because satellite data showed it to be warm, low-chlorophyll water (within a ~12-hour steam from our prior Lagrangian experiment) that would serve as a good oligotrophic endmember for the cruise. The cycle commenced with sediment trap deployment at 1800 on Feb. 28 and lasted ~5 days without substantial interruptions, allowing extensive sampling of the water parcel. Operations included Deep Plankton imager transects (generally conducted in circles around the drifter location to ensure that we did not run into the drifting arrays); MOCNESS tows to sample vertically stratified zooplankton communities; CTD casts for sampling nutrients, organic matter, and bacterial and protistan communities; trace metal rosette casts; bongo tows for quantitative analyses of euphotic zone zooplankton standing stock and grazing rates; incubation array deployments including net primary production, protistan grazing, phytoplankton growth, nitrate uptake, and Fe limitation experiments; ring net tows for collecting zooplankton for experiments or species-level sorting; manta net tows for sampling neuston; daily experiments conducted in our deckboard temperature-controlled incubators; and McLane pump casts for collecting size-fractionated particles. Cycle 3 concluded on the morning of Mar. 4 with recovery of the sediment trap.

On Mar 4 we transited towards 121W, 35N to begin a Lagrangian experiment in a region identified by satellite as relatively cold and high chlorophyll (~4 $\mu g\ L^{-1}$). However, by the time that we reached the location, chlorophyll was a bit lower than this and the water parcel sampled did not show strong indications of recent upwelling. Nevertheless, a Lagrangian ("Cycle 4") was initiated with a sediment trap deployment on the morning of Mar 5th. This experiment was conducted near the shelf and hence

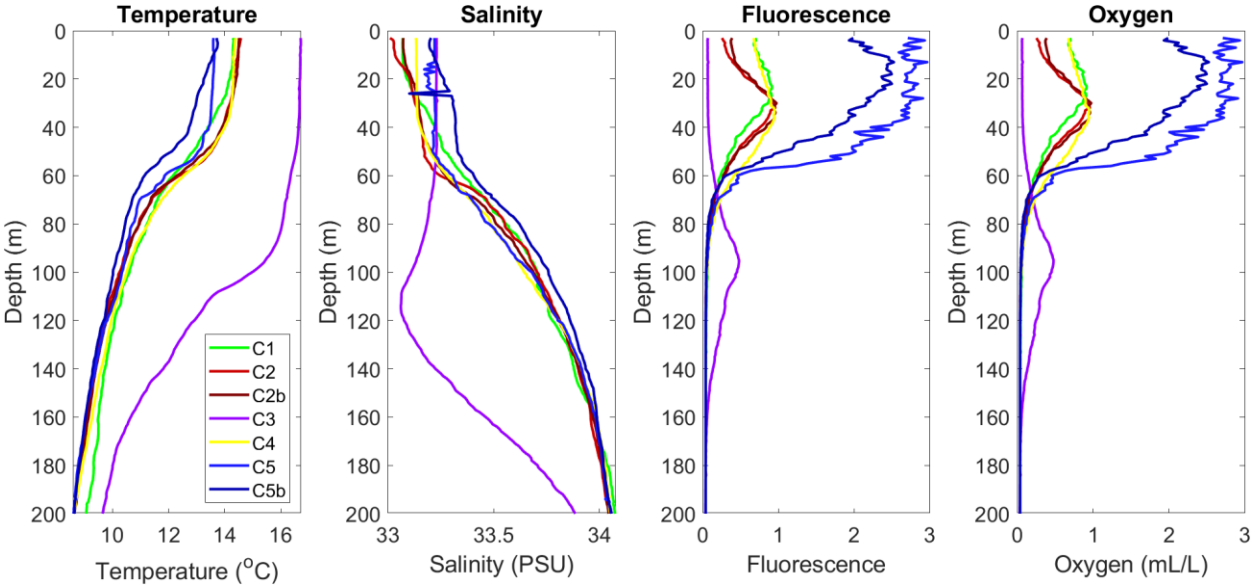
the sediment trap line was slightly (maximum depth ~300 m) shortened relative to prior experiments. On Mar. 7 windy conditions prevented all net and trace metal rosette deployments. Cycle 4 was heavily impacted by naval restrictions which prevented us from sampling the study area (or having instrumented arrays in the water) from 1000 – 1700 on Mar 8, 0700 – 1300 on Mar 9, or 0700 – 1300 on Mar 10. Consequently on Mar. 8 we recovered the incubation array at 0400 and immediately deployed an "expendable array" which consisted of a surface satellite-enabled drifter attached to a holey sock drogue centered at 15-m depth. This allowed us to continue tracking the water parcel of interest, without violating navy restrictions. Immediately after deploying the expendable array we recovered the sediment trap. The rest of cycle 4 proceeded with reasonably normal operations, but without the sediment trap or incubation array and with the timing of daytime operations substantially altered due to the navy restrictions. Cycle 4 was terminated on the morning of Mar. 11 and we transited to Port Hueneme for a mid-cruise personnel transfer.

After the personnel transfer, we conducted a surface transect heading north along approximately the 500 m isobath, while monitoring the ship's flowthrough data to identify the location that was most indicative of recently upwelled water, because none of our prior Lagrangian experiments had sampled a true upwelling endmember. The highest chlorophyll patch was identified near Point Conception. Again, Navy restrictions limited our activities in the region, this time restricting activities from 0830 – 1800 on Mar. 13 and 14. Consequently, we initiated Cycle 5 in late morning of Mar 12 with deployment of an expendable array, rather than the incubation or sediment trap arrays. We sampled near the expendable array for approximately 24 hours, before naval restrictions (and windy conditions) forced us to leave the study region. Because we could not sample within our study region between 0830 and 1800 on Mar 13 and a scientist who had joined the cruise at the mid-cruise transfer was interested in sampling deep water, we utilized this time to transit offshore and conduct a deep CTD cast (to 3000 m depth) before returning to our sampling location in the early afternoon. Mar 13 was very windy, leading to strong southward currents, and extensive mixing. By the time that we returned to our expendable drifter, the conditions at the drifter were lower chlorophyll and higher temperature, leading us to wonder if conditions had substantially changed in our water parcel or if the upper mixed layer was traveling faster than the rest of the mixed layer. In the time remaining before we could begin sampling again at 1800, we conducted a brief (~1-hour) surface transect northwards from the current drifter location towards the site of the initiation of Cycle 5. At that location we found colder and higher chlorophyll water that more closely resembled the waters found at the beginning of the Lagrangian experiment (and that more closely resembled the upwelled waters that we hoped to study). Consequently, we chose to recover the expendable drifter and redeploy it at that location. We referred to the subsequent experiment as Cycle 5b, although we note that the conditions sampled during 5b closely resemble the conditions sampled during 5a on Mar 12. On the morning of Mar 14, we recovered the expendable drifter and immediately deployed the incubation array, followed by the sediment trap array. We continued following these arrays until the morning of Mar 17 when we recovered the arrays before heading back towards San Diego.

In the evening of Mar 17 (and into the morning of Mar 18) we conducted a DPI transect along CalCOFI line 93 from station 93-45 to station 93-30. This line was chosen both for logistical reasons (it would end near San Diego) and because line 93 is heavily influenced by El Niño conditions. The length of the

sampled transect was determined by the time remaining in the cruise and was situated to be conducted almost entirely at night to avoid aliasing introduced by diel vertical migrations. After the conclusion of this transect, we sampled station 93-30 with both a CTD and a trace metal rosette to investigate nutrient concentrations in the subsurface California Undercurrent. After sampling this station, we proceeded towards the seabuoy where the ship conducted emissions testing for several hours prior to heading to land at ~1900.

P2402 was, in general, a successful cruise. We overcame several challenges in pursuit of our science objectives – chief of which was an extensive naval operation that severely restricted the regions in which we could operate. This was particularly problematic given our Lagrangian sampling plan which both required us to stay within a general region for an extended period of time (which was not allowed in most of our study domain during much of the cruise) and which made us dependent on circulation patterns that at times carried our instruments towards restricted areas. Despite these difficulties, we were able to complete our primary science mission and also address a number of ancillary questions which will foster new directions and new scientific collaborations within our program. The assistance of the Captain, STS personnel, and crew was instrumental in maintaining a close schedule of round-the-clock operations, and addressing the sometimes impromptu nature of our scientific inquiries.



Brief Chronology of Cruise P2402

(see Daily Activity Schedule at the end of this document, and Event Log for details and accurate times)

18 Feb 2024	Depart MarFac (departure accelerated for high tide)
18 Feb 2024	Test Station (CalCOFI 93-30)
19 Feb 2024	Start Cycle 1 (no sediment trap, Navy restrictions)
21 Feb 2024	End Cycle 1 (start BBL transect)
22 Feb 2024	Continue BBL & Santa Barbara Basin Station
23 Feb 2024	Start Cycle 2a (transition zone)
24 Feb 2024	Recover arrays before drifting into restricted areas
25 Feb 2024	Start Cycle 2b (no sediment trap)
28 Feb 2024	End Cycle 2b / Start Cycle 3 (offshore endmember)
04 Mar 2024	End Cycle 3
05 Mar 2024	Start Cycle 4 (near shelf, north of PC)
11 Mar 2024	End Cycle 4 / Mid-cruise personnel transfer at Port Hueneme
12 Mar 2024	Start Cycle 5a (upwelled water near Point Conception)
13 Mar 2024	Start Cycle 5b (full cycle with both arrays)
17 Mar 2024	End Cycle 5b / Start DPI transect along coastal section of line 93
18 Mar 2024	Complete DPI section / sample CUC water / Land ho!

GROUP REPORTS

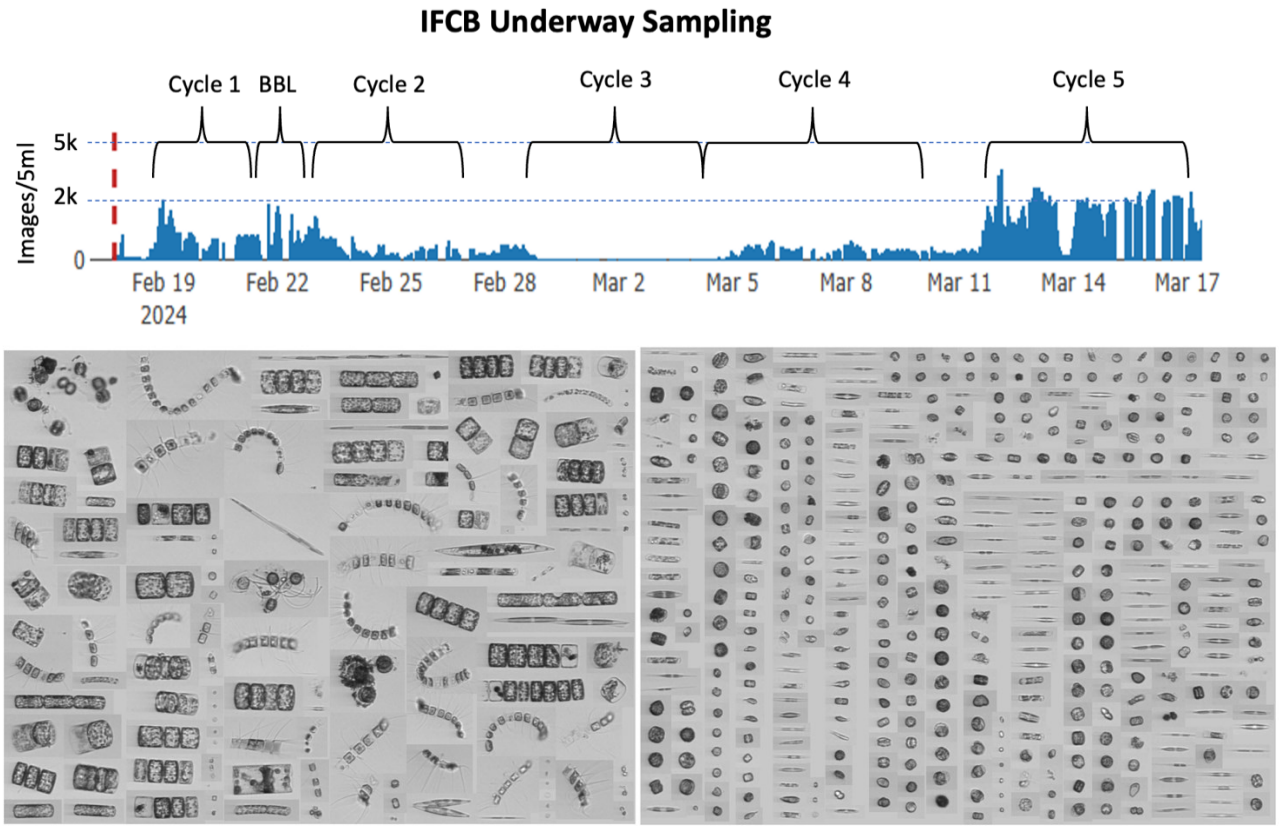
Allen Lab (Vivian Hou, Hsin-ting Li, Mingguang Xue)

General Method:

1. DNA/RNA filtration and process steps: Certain volumes of seawater were filtered through a 0.22 µm Sterivex filter using a peristaltic pump. Excess water from the Sterivex filters was removed using a syringe; the filters were then sealed with putty, flash frozen with liquid nitrogen, and stored at -80°C. On shore, the both DNA and RNA from the filters will be extracted, converted to cDNA, and sequenced for 16S, 18S V4, and 18S V9. In addition, RNA will be used for meta-transcriptomics analysis.

2. Metabolites Sampling and process steps: (will collaborate with Aluwihare lab for LC/MS analysis) Metabolites are collected with solid phase extraction cartridge. Each SPE cartridge is primed with 6 times with HC/MS graded methanol and 6 times with acidified H2O (pH2). After filtering, the samples were then frozen with liquid nitrogen, and stored at -80°C. On shore, the samples will be first dried with nitrogen gas and process for LC/MS analysis. DA will be targeted for the analysis along with the general metabolomics

(1) Imaging FlowCytobot survey of phytoplankton communities (Vivian Hou, Allen Group) The Allen lab group deployed an Imaging FlowCytobot (IFCB) for the duration of P2402, sampling near-continuously from the uncontaminated seawater system and running discrete samples from the conventional CTD rosette casts, grazing, and multiple incubation experiments. The IFCB generated over 1 million images of fluorescent particles (<5–150 µm) over the course of the cruise. Different distinct taxonomic groups were identified at genus and species level including major taxas like diatoms, and dinoflagellates taxa. Additional groups imaged include Acantharea, Appendicularia, Bicocoecales, Ciliophora, Crustacea, Dictyochophyceace and Prymnesiophyceae. A significantly higher amount of images were collected for cycle 5, near point conception and the shelf near the channel island. Based on the images, the bigger cells and chains were mostly consisted centric diatoms (especially Chaetoceros, Laderia, Detonula, Dactyliosolen). Thalassiosira, small singular centric diatoms, pennate diatoms and dinoflagellates contribute to the smaller cells.



IFCB data from cycle 5. (left) Examples of larger cells. (right) examples of smaller cells.

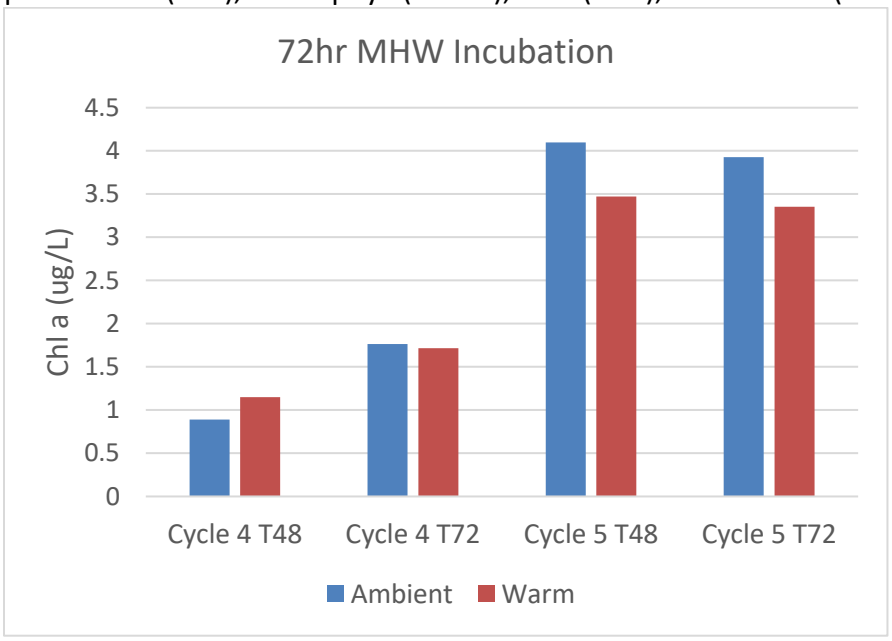
(2) Microbial Community Composition (Vivian Hou, Hsin-ting Li, Mingguang Xue, Allen Group) :

In order to understand the microbial community composition in the CCE, DNA and RNA Samples for microbial community were collected from the "noon" CTD casts for Cycles 1 – 5 (6-7 depths), and during BBL stations 1,2,3,7,and 8. Samples were also collected on the deep cast. For each RNA sample, 4 L (above 170m) to 6L (at 170m and 515m) of seawater were collected. For each DNA sample, 2 L, and sometimes 4L dependent, of seawater were collected. The seawater was filtered and will be processed following the "DNA/RNA filtration and process steps". The microbial composition extracted from the DNA and RNA can be compared with the IFCB imaging data for more analysis.

(3) Grazing Effecting on the Microbial Community activities- (Vivian Hou, collaboration with Stukel Group) : RNA samples were collected from the dilution experiment on the in-situ array for depth 1,3,6. The samplings were performed 2 times per cycle for cycle 1-5. At T0, 2L of seawater at the selected depth (1,3,5) from the 2am CTD cast were filtered for RNA. At T24, about 2.5L of seawater were filtered from each dilution bottles (100% and 30%) for RNA. The samples were filtered and will be processed following the "DNA/RNA filtration and process steps". IFCB data(5ml) is also taken for each sample. The sequence will be used to study the effects of meso-zooplankton grazing on the microbial community and look at the intra- and interspecies difference in response to grazing pressure.

(4) MHW and Grazing on Microbial Community activities and DA production (Vivian Hou, Allen Group, collaboration with Stukel Group): Both RNA and metabolites samples were collected from the on-deck MHW dilution experiments 2 times per cycle for cycle 1-5. At T0, 2L seawater for RNA and 1L seawater for Metabolites were collected from the 6pm CTD. At T24, 500ml seawater for Metabolites and 1.5 L seawater for RNA were collected from all the experiment bottles (2.7L) (16 samples in total: 4 dilution rates 100%, 70%, 30% and 8%, +/- nutrients, MHW and Ambient Tanks). The RNA and Metabolites samples were collected and will be processed following the "DNA/RNA filtration and process steps" and the "Metabolites filtration and process steps". IFCB data(5ml) is also taken for each sample. The 2 major questions to tackle are *1)How would the microbial community respond to MHW and grazing pressure? And 2) How would MHW and grazing pressure effect DA productions?* Previous lab experiments and field data have shown positive correlations between grazing effects from copepod and DA production from Pseudo-Nitzschia. Moreover, the high DA event during the MHW in 2014/15 in Central and North CCE brought people's attention on the potentially significant effects of warming on PN bloom and DA production. Data from MHW incubation will provide us with more insights into these processes.

(5) 72-hr MHW incubations and DA analysis (Vivian Hou, Allen Group): To further understand the effects of MHW on DA production, one 72hr MHW incubation experiments were conducted for Cycle 4 and 5. The experiments were conducted for the last 2 cycles because I observed increasing abundance of Pseudo-Nitzschia cells in the seawater, mostly within the mixed layer, using IFCB data. MHW and ambient Incubations were conducted from the same depth as the on-deck MHW and dilution experiment. All the 1L bottles were spiked with nutrient, 250ml of each: phosphate, nitrate, and silica. Samples were taken as triplicates for the following analyses at 0 hour (initial), 48 hour, and 72 hour (final) time points: IFCB (5ml), chlorophyll (200ml), RNA (1.7L), metabolites (500ml) (DA analysis).



(6) In situ array iron addition/removal incubations (Hsin-Ting Li, Allen Lab): At cycles 1, 2, and 3, we exposed 1 L natural phytoplankton communities from chlorophyll maximum to iron addition (+100 nM FeCl 3) or iron removal (+100 nM of the iron chelator desferrioxamine B). We incubated them in trace metal clean conditions. At cycle 4 and 5, we exposed 1 L natural phytoplankton communities from the deep chlorophyll maximum to iron addition (+10 nM FeCl 3) or iron removal (+100 nM of the iron chelator desferrioxamine B). We incubated them for 24 hours in their ambient environment on the in situ quasi-Lagrangian drifter. Evaluation of the mRNA, nutrients, and chlorophyll from these incubations will allow us to evaluate the phytoplankton communities' responses to changes in iron bioavailability under near-natural conditions. These experiments were also conducted on the 2014, 2017, 2019, and 2021 CCE LTER process cruises allowing us to compare across years with different Fe concentration addition.

(7) Deck board upwelling simulation incubations (Hsin-Ting Li, Allen Lab): We took 250ml of surface natural phytoplankton communities and mixed it with 2.5 L of filter sterilized surface sea water or 2.5 L of filter sterilized deep water (density around 26.2 kg/m3) or 2.5 L of filter sterilized deep water (density around 26.2 kg/m3) with Fe addition. We incubated them in trace metal clean conditions. At cycles 1, 2, and 3, the FeCl 3 addition is 100 nM and we incubated them for 48 hours on deck with flowthrough surface water. At cycles 4 and 5, the FeCl 3 addition is 10 nM and we incubated them for 48 hours on deck with flowthrough surface water with temperature controlled at 15 degree Celsius. Samples are taken at 0 hour, 24 hours, and 48 hours. Extra metabolites samples are taken at 0 hours and 48 hours at Cycle 4 and 5. Evaluation of the mRNA, nutrients, chlorophyll, and metabolites from these incubations will allow us to evaluate the phytoplankton communities' responses to upwelling and iron bioavailability under near-natural conditions.

Taniguchi Lab (M. Hinz, with help from the Stukel Lab)

The objective for this cruise was to investigate how planktonic growth and grazing mortality rates and community composition vary with temperature over day-night cycles. To achieve this goal, a total of nine 24-hour deck board incubations were conducted over the course of the cruise. Seawater was collected from the mixed layer (12 meters), usually at 6am to set up dilution experiments. The dilution experiments included three distinct water treatments: 100% seawater without nutrients, 100% seawater with nutrients, and diluted seawater with nutrients. The diluted bottles contained 80% filtered seawater and were mixed with 20% whole seawater. Ammonium, phosphate, and silicate were added to the nutrient amended bottles to determine their impact on plankton growth and grazing. 14 incubation bottles were placed in an incubator that was kept at ambient water temperature. The other 14 bottles were placed in an incubator that was kept at 2 °C higher than ambient. Samples were collected at three time points: initial, 12-hour, and 24-hour. Samples taken included epifluorescence slides, acid Lugol's, and chlorophyll *a* to analyze for community composition. Flow cytometry was sampled to determine the abundance of *Prochlorococcus*, *Synechococcus,* picoeukaryotes, and heterotrophic bacteria. DNA metabarcoding samples were also collected but were only taken at the initial and 24-hour time points.

Kranz Lab (S. Kranz, M. Baker)

The objectives for P2402 were the following:

1) Determine Net Primary Productivity (NPP), a core parameter for the CCE-LTER dataset, on the drift array during each cycle.

2) Analyze NPP under Marine Heat Waver conditions (short term-24h) in on-deck incubators.

3) Measure the growth of the phytoplankton community, NPP, $^{15}NO_3$ - uptake and photophysiology under long term (up to 7 day) MHW conditions.

4) Aiming to "revive" sinking phytoplankton caught in the sediment trap and measure the community composition and productivity.

5) Continuously measure photophysiology and estimate GPP of the phytoplankton community continuously, using the ships flow-through system seawater system.

6) Characterize Net Community Productivity (NCP) using an Equilibration-Inlet Mass-spectrometer

1) **<u>In-situ NPP:</u>** NPP was measured using radiolabeled carbon ($H^{14}CO_3^-$). Water from 6 depths throughout the photic zone was spiked with $H^{14}CO_3^-$ at ~10 µCi. Three clear 260ml (light) bottles and one dark bottle were prepared. These incubations were deployed on the in-situ array at the depths the respective samples were taken. Experiments ran for 24 hours. In total, 15 experiments (15 arrays) were conducted throughout 5 experimental cyles. The experiments were performed according to the CALCOFI protocol. POC and DOC were analyzed.

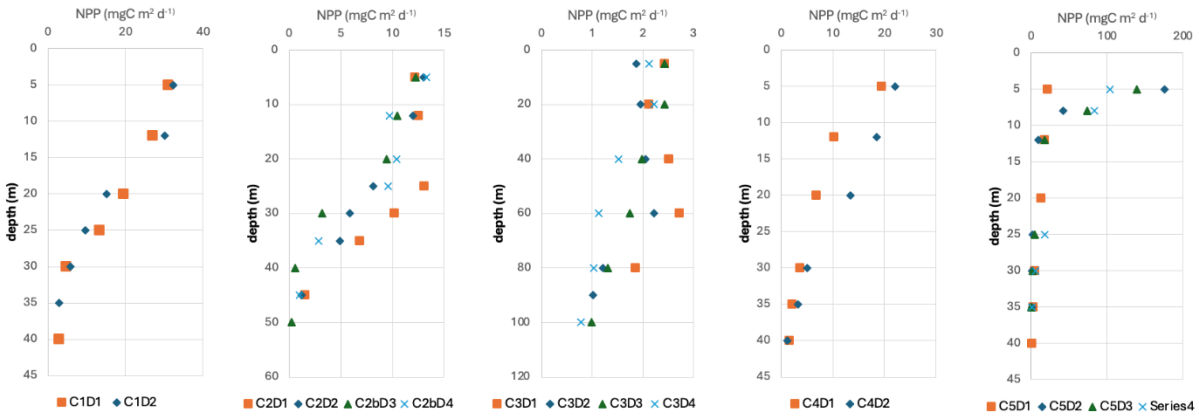


Figure SK-1 Preliminary data of depth profile from the in-situ NPP (mg C m^2 d^{-1}) from cycle 1 through 5.

Preliminary data analysis: Cycle 1, 4 and 5 were high productivity regions. Cycle 1 and 3 were similar in productivity throughout the photic zone. Cycle 5 had the highest productivity and light was a limiting factor below 15 m. Cycle 3 was a clearly oligotrophic cycle while cycle 2 was intermediate productive.

2) **24-h MHW response:** Seawater from the surface mixed layer (12-20m) was sampled from the evening CTD (18:00 - 19:00) and spiked with C14 $H^{14}CO_3^-$. In total 15 experiments were run. Samples were incubated in the on-deck incubators (light-level mimicking ~12m water depth). One set of samples was incubated under ambient temperature conditions while a second set was incubated under elevated temperatures (+2 C). Temperatures were monitored using each two temperature data-loggers (one floating, one on the bottom of the incubator). Incubations lasted 24 hours. These incubations were set up in parallel with Dr. Stukel's grazing incubations and will complement each other. In cycle 3 (see Fig below), surface and deep chlorophyl maximum communities were investigated. Additionally, size fractionated (3,8, 20 µm) NPP of the community was measured where it deemed to be appropriate.

Due to temperature issues in the incubators, some of the data form cycle 1 and 2 might have been affected.

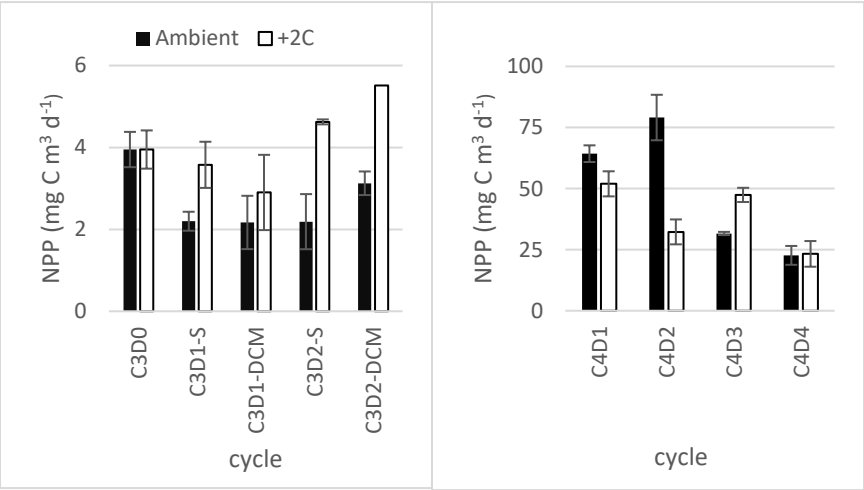


Fig SK-2: NPP of two cycles (cycle 3 and 4) under ambient (black bars) and MHW (white bars) conditions.

Preliminary data: Cycle 3, the oligotrophic community, showed a strong response to warming, both in the surface as well as DCM. In cycle 4, a more coastal region, temperature effects on NPP seemed to be inconclusive and could be related to grazing pressure.

3) **Long term MHW incubations**. In order to identify effects of MHW on the community over a longer duration, incubations were set up which lasted 5-7 days. During the first evening CTD at each start of a new cycle 3 x 4.7L polycarbonate bottles were filled with seawater from the upper mixed layer (12 or 20 m). An initial (t=0) was immediately set-up and placed into the on-deck incubators. $^{15}NO_3$ uptake and 14C-NPP were measured in the t=0 samples. Additionally, samples for chlorophyl, photophysiology, quantitative protein analysis, flow cytometry (Julie D.) and IFCB (Vivian) were taken. The 4.7L PC bottles were spiked with additional macronutrients (~2µM NO3, ~2M Si and 0.3 µM PO4) and subsequently placed in the respective on-deck incubators. One of these bottles from each temperature incubator were harvested approx. every other day to and Chl a, protein content, $^{15}NO_3$ uptake and 14C-NPP and photophysiology were analyzed.

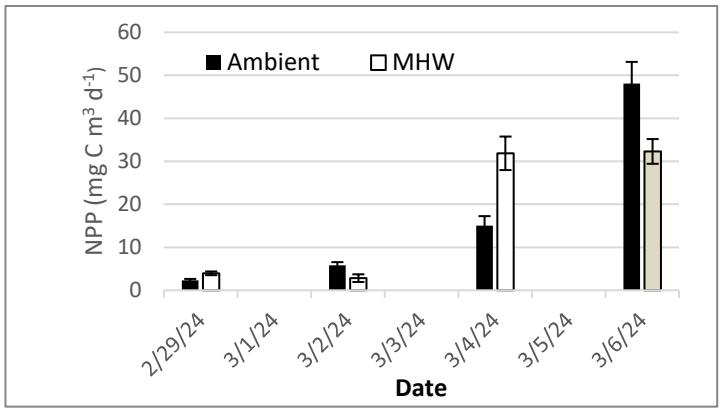


Fig. SK-3 Long term MHW acclimation (ambient (black) and MHW (white bars). The grey bar indicate the transplant of the MHW community into ambient temperature.

Preliminary data: Changes in community composition (IFCB, flow cytometry) and growth rates were observed in some of the cycles. In cycle 3 (see Fig. SK-3, the MHW community showed increased productivity after 5 days. After transplanting the MHW community into ambient temperatures, NPP stayed constant while the ambient temperature acclimated community continued to grow/be productive. Data on photophysiology and protein expression will be analyzed over the coming months.

4) **Sinking particle revival:** In the CCE system, sinking particles might be caught by the deep upwelling water masses and brought back to the surface. Phytoplankton, entrapped in fecal

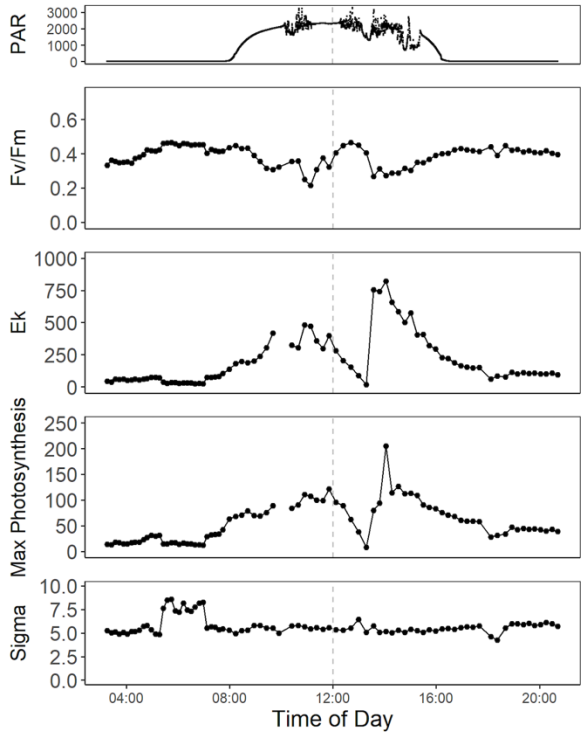
pellets as well as other aggregates might survive a long time without light, but in a nutrient enriched environment and act as a seeding community once upwelled near the coast. In order to test this hypothesis, we conducted grow out experiments using samples collected from the sediment trap array. Samples were collected in polycarbonate tubes from 200m depth for cycle 1-4. After recovery of the sediment trap at the end of each cycle, the sample was split into 3 x 260ml and diluted with 4.5L filtered seawater from 200m depth. Samples were placed into 4.7 l polycarbonate bottles. The samples were kept in the dark for 2 days at 10-14C. Photophysiology, Chl a, flow cytometry, IFCB and genetics samples were taken from one of the replicates after 2 days. The residual 2 bottles were moved to the 1% light level on-deck incubator for another 2 days after which similar data were acquired. The last bottle was subsequently moved to the surface light incubator and kept there for 2 days after which the same parameters were taken.

Preliminary data: During cycle 1 & 2, which seemed to be dominated by cyanobacteria and small phytoplankton, we did not measure any growth in the grow out experiments. IFCB data and photophysiology from cycle 3,-5 indicated grow out of chain forming diatoms.

5) **Flow-through measurements:** Throughout the cruise, continuous samples were taken from the flow-through seawater system and measured using two Fast Repetition Rate fluorometry systems (Chelsea Fast Act, Fast Trakker 2, Chelsea LabSTAF). Parameters such as quantum yield (Fv/Fm), light acclimatization values, Ek, and estimates of electron transport rate (tau and JVPII) can be obtained from these samples. In general, 2-3 samples per hour were taken through an automatic sample exchange. Measurements throughout diurnal cycles will help to interpret how the surface community acclimate to light stress and/or nutrient limitation a

In addition to the *in situ* and deck-board primary productivity incubations and the long term MHW acclimation experiments, we also measured the diurnal photophysiology of surface phytoplankton throughout the cycles. Two Fast Repetition Rate Fluorometers (FRRf, LabSTAF & FastOcean, Chelsea Technologies Ltd.) were connected to the *Revelle*'s inline flow through system for the duration of the cruise. Every ~20 minutes, measurements of phytoplankton photophysiology were recorded. Parameters included photosynthetic quantum efficiency (Fv/Fm, Figure 2), the light acclimation point (Ek, Figure 3), and maximum photosynthesis (Pmax, Figure 4). Gross primary productivity will be estimated using additional photophysiological parameters. In each cycle, the LabSTAF FRRf unit was disconnected from the flow through to measure a depth profile from the daily noon

Fig



SK-4: PAR and photophysiological parameters measured during one of the 24 cycles.

hour

many

<u>Preliminary data:</u> A clear diurnal pattern in of the photophysiological parameters (Fv/Fm, light acclimation index (Ek) and maximum achievable photosynthesis was measured while the size of the light harvesting antenna (sigma) did not change.

A

similar photosynthetic adjustment was visible in the noon CTD depth profile data

(Fig. SK-5)

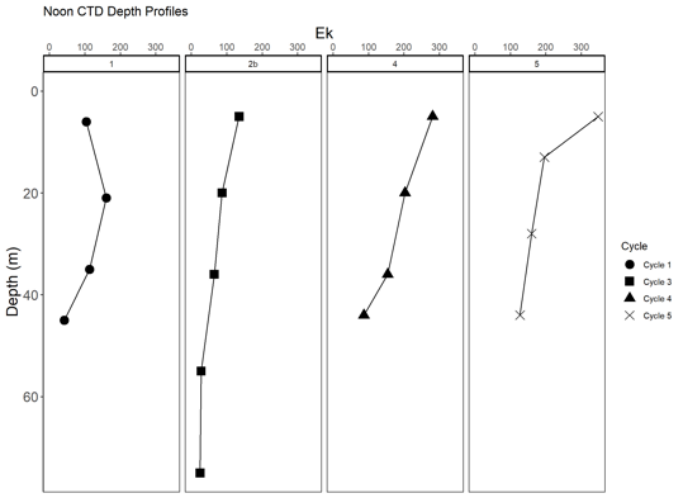


Fig SK-5: Light saturation index Ek during cycles 1 through 4.

6) **Net community production** as measured via Equilibration Inlet Mass spectrometer:

We measured O2/Ar ratios during cycle 1 and half through cycle 2 using the flow-through water system. Unfortunately, the instrument broke due to some power failure and was damaged beyond repair. The existing data will be evaluated and compared to GPP, NPP and export production.

Barbeau Lab (K. Barbeau, M. Padilla Villa, M. Fenton, K. Forsch)

Iron (Fe) is a critical micronutrient that limits biological processes in significant areas of the ocean. The California Current upwelling region has been described as a mosaic of Fe limitation, with areas and mesoscale features that range from Fe replete, to Fe co-limited, to Fe limited. We seek to understand how Fe supply shapes the composition and productivity of the phytoplankton community, the activities of the bacterial community, and related impacts on biogeochemistry. The Barbeau group also carries out biogenic silica (bSi) sampling, as previous cruises have shown that Si dynamics in this region are strongly impacted by the Fe stress status of the diatom community. We are expanding our investigations to other biologically active trace metals, and eventually to Fe isotopes. On this cruise we also conducted measurements of Fe binding capacity using a new Fe sensor being developed by the Barbeau and Martz groups. The P2402 trace metal group included Kathy Barbeau, Kiefer Forsch, Max Fenton and Minerva Padilla-Villa. The trace metal group also supported the experimental activities of the Allen and Dinasquet groups.

Sampling Activities - We made 43 casts with the trace metal rosette. Multiple profiles for trace metal analysis have been obtained at all cycles, as well as profiles at Santa Barbara Basin and CalCOFI Station 93.30 (19 profiles total). A total of 22 casts were made to obtain water for trace metal-related experiments. Biogenic Si sample profiles have been taken at the noon casts at all cycles, and from some iron addition incubation and zooplankton experiments. The trace metal group also deployed collection tubes on each of the sediment traps used on this cruise, and will process bSi samples from each sediment trap.

A 9-station along-shelf transect for benthic boundary layer (BBL) sampling was also carried out, with combined CTD and GO Flo casts at each station. This continues a BBL time series which began on the P1604 and P1706 process cruises. This cruise follows some recent winter rain events, and unusually prominent BBLs were seen via beam attenuation at BBL8 (CalCOFI station 80.51), BBL 7 (Pt. Arguello), and BBL1 (Cambria).

Analytical Activities – The Fe ion-selective electrode (Fe-ISE) was used by Max Fenton to explore variations in apparent Fe binding capacity in different water samples from the trace metal rosette. This was the first opportunity we have had to utilize the Fe-ISE on oceanographic profiles in a field setting. Initial findings indicate significant variations in Fe binding capacity spatially and with depth that are independent of pH or temperature, supporting the development of the sensor as an indicator of Fe binding properties intrinsic to different ocean water masses. These findings will be further explored with complementary shore-based analyses of cruise samples.

***In situ* array iron addition/removal incubations -** At each cycle, we exposed natural phytoplankton communities from the near-surface or deep chlorophyll maximum to Fe addition and/or Fe removal (adding the Fe chelator desferrioxamine B) and incubated them for 24 hours in their ambient environment on the *in situ* quasi-Lagrangian drifter. Evaluation of the mRNA from these incubations will allow us to evaluate the phytoplankton and bacteria communities' responses to changes in Fe bioavailability under near-natural conditions. These experiments were also conducted on the 2014,

2017, 2019 and 2021 CCE LTER process cruises allowing us to compare across years and conditions. On this cruise both the Allen and Barbeau groups set up on-array incubations, covering several days on each cycle.

On-deck experiments -

Fe addition grow-outs – On-deck Fe addition grow-out experiments (3 days) were conducted by the Barbeau group at Cycles 4 and 5 following wind mixing events. Some evidence of Fe limitation was apparent at Cycle 4, less so at Cycle 5, based on initial chl results from the incubation.

Mixing experiments – The Allen group carried out on-deck incubation experiments mixing deep water with mixed layer water at all Cycles. The Barbeau group also attempted a similar experiment at Cycle 2.

Temperature-controlled experiments – The Barbeau group carried out 24-hour Fe-addition experiments in the ambient and elevated temperature-controlled tanks at Cycles 3, 4 and 5, using water from the chlorophyll max at each station. Experiments involved triplicate controls and +Fe treatments in both ambient and elevated temperature tanks. These will be analyzed via transcriptomics to identify differences in gene expression related to temperature and/or Fe stress in both the eukaryotic and prokaryotic communities.

Aluwihare Group (Ralph Torres, Benjamin Granzow, Irina Koester)

(1) Suspended particulate organic matter (POM) and stable isotopes

Samples were collected on 25mm GF/F filters to measure particulate organic carbon (POC) and particulate organic nitrogen (PON) concentrations and the ^{15}N and ^{13}C content of suspended POM, as measured by isotope ratio mass spectrometry coupled to a CHN analyzer.

Samples were collected from the "noon" CTD casts for Cycles 1-5 (6 depths), the BBL Transect (3 depths), during the Santa Barbara Basin Station and at CalCOFI Station 93-30.

Volumes of 2L to 4L (depending on particle load) were drawn from the CTD Niskin bottles using Masterflex tubing into carboys (rinsed 3x) covered with black plastic bags to prevent influences due to light. Samples were drawn by vacuum pump at low vacuum and the filters were immediately stored at -80°C. As noted below, these measurements serve to provide baseline information for interpreting carbon and nitrogen isotopes in different food web compartments.

(2) $^{15}NO_3^-$

Samples were collected into 60ml HDPE bottles from a 47mm GF/F filter holder attached directly to the Niskin bottle's nozzle and immediately frozen at -20° C (within 20 min of collection). These samples were taken to measure the ^{15}N and ^{18}O composition of nitrate in the seawater, which serves as an important control on nitrate isotopes recorded throughout the food web (of broad interest to the CCE).

Samples were collected from the "noon" CTD casts for Cycles 1 – 5 (8 depths), during the Santa Barbara Basin Station, during the BBL transect (3 depths), and at CalCOFI Station 93-30.

(3) TOC/DOC

Samples were collected into 40mL pre-combusted clear borosilicate vials to later measure either the total or dissolved organic carbon concentrations. The primary intent from the TOC/DOC measurement is to quantify one of the largest reactive organic reservoirs in the ocean. 40mL volumes for DOC were collected by passing seawater through a pre-combusted 47mm GF/F filter holder attached directly to the Niskin bottle's nozzle. 40mL volumes for TOC were collected directly from the Niskin bottle nozzle. Samples were immediately acidified to a pH of 2 using trace metal grade hydrochloric acid upon collection (within 30 min).

Samples were collected from the "noon" CTD casts for Cycles 1 – 5 (8 depths), Santa Barbara Basin, during the BBL Transect (3 depths), during the Deep Cast during Cycle 5, and at CalCOFI Station 93-30.

(4) FDOM

Samples were collected into 40mL pre-combusted amber borosilicate vials to later measure the fluorescent properties of DOM – which offers a coarse description of DOM composition. Samples for FDOM were collected from the "noon" CTD casts for Cycles 1 – 5 (8 depths), Santa Barbara Basin, during the BBL Transect (3 depths), and at CalCOFI Station 93-30.

(5) Metabolites

To analyze marine community metabolomes, we enriched metabolites from acidified seawater samples and separated them from salts using solid phase extraction (PPL) cartridges. After drying the cartridges with compressed N_2 gas, we stored them at – 80°C until further processing ashore. Samples for marine community metabolomes were collected from "noon" CTD casts for Cycles 1 – 5 (8 depths), Santa Barbara Basin, during the BBL Transect (3 depths), and at CalCOFI Station 93-30. Samples were also collected on the 3000 m deep cast (40 L volume).

Ashore, we will elute metabolites with methanol from the cartridges and analyze them via Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS).

(6) C-P lyase Activity and Methane Production

Previous studies have shown levels of dissolved methane (CH_4) are elevated in the lower euphotic zone (maximum at 50-150 m), exceeding the atmospheric equilibrium value by 2-5 times. While biogenic methane production is traditionally associated with archaeal methanogenesis, recently, the importance of aerobic methane production via the degradation of organic phosphonate compounds has been recognized as the major source of methane to the surface ocean. Phosphonate degradation and euphotic methane production is mediated by the C-P lyase enzymatic pathway. While several studies have examined the distribution of C-P lyase activity (CLA) in the marine water column in oligotrophic regions of the ocean, no studies have been conducted in productive coastal and upwelling regions.

Samples for CLA were collected from the "noon" CTD cast every other day for cycles 1-4 (8 depths). 250 mL samples were collected in triplicate and incubated with a fluorescent phosphonate tracer (n-dansyl-propyl-phosphonate; n-DPPh) for 24 hours. The tracer was then extracted and separated from salt using solid phase extraction (ENV cartridges). The cartridges were frozen at -20^{o}C for further analysis on shore. A total of 184 CLA samples were collected.

Methane samples were collected from six depths on the first day of cycles 1-4 at the "noon" CTD cast. Water samples were collected into 110 mL serum vials and preserved with $ZnCl_2$ (2% w/v final concentration). Vials were caped with air-tight seals and stored in the dark for analysis on shore. A total of 54 CH_4 samples were collected.

(7) Phosphonates in Marine Zooplankton

There are very few known sources of phosphonates to marine DOM. One study identified the mucin of jellyfish as organic matter rich in phosphonates, while another study found phosphonates in the glycans of marine snails. As zooplankton biomass was plentiful on this cruise, it seemed an excellent opportunity to collect samples to screen for phosphonates. Samples included pyrosome exudate, salps, and ctenophores. All samples were immediately frozen at -80^{o}C for analysis on shore.

(8) Heterotrophic metabolism of β-carotene

We are interested in understanding the pathways by which carotenoids are utilized and metabolized by marine heterotrophic bacteria. On P2402, we are interested in discovering which taxa of bacteria can utilize β-carotene (BC) as a carbon source. To do this, 250 mL of seawater was filtered onto 0.22 µm nucleopore filters. The filters were then placed filtrate-side-down on artificial seawater agar plates layered with a BC film. The plates were incubated for 9 days before harvesting the cells in DNA/RNA shield for microbial diversity analysis based on 16S genes. The samples were flash frozen in LN_2 and stored at -80°C for analysis on shore.

(9) Additional investigations

(a) *Santa Barbara Basin:* We have had a long-standing interest in nitrate isotopes and below sill-DOC dynamics at the Santa Barbara Basin. During the summer, oxygen in the basin is drawn down, and in addition to sediments being anoxic, the deep water column can also become anoxic. These conditions result in detectable DOC buildup (albeit 1-3 uMC) and clear impacts on the isotope signature of water column nitrate. Learning the composition of DOC that is released from sediments under these conditions may shed light on the long-term DOC cycle, whereas the nitrate isotopes provide a snapshot into the complexity of nitrate reduction and re-oxidation in the basin. As such, we took the opportunity to collect a profile for nitrate isotopes, TOC, DOC, and metabolites at 34° 16.50' N, 120° 1.12' W In addition, CALCOFI was not able to sample this station during their winter cruise, so a full profile of TOC was taken to obtain this station's seasonal profile.

(b) *3000 m cast:* We also took the opportunity during cancelled operations due to adverse wind conditions and Navy restrictions on Cycle 5 to head offshore and sample down to 3000 m with the CTD Rosette, with the goal of obtaining a DOM sample from within Pacific Deep Water and radiocarbon samples from the surface (12m) and deep (3000 m). Approximately 40 L of seawater from 3,000 m, was acidified to pH 2, and then slowly extracted onto a total of 2, 5g PPL cartridges. Approximately 1L of surface seawater (12m) was collected directly from the Niskin bottle nozzle for radiocarbon measurement. Approximately 1L of deep water (3000 m) were collected by passing seawater through a pre-combusted 47mm GF/F filter holder attached directly to the Niskin bottle's nozzle for radiocarbon. Both samples for radiocarbon measurements were immediately frozen in -20°C. This cast was also used to shrink some cups!

(c) *Submersible Ultraviolet Nitrate Analyzer (SUNA):* The Aluwihare Group, Jamee Adams (Diaz Lab) and Shonna Dovel monitored the SUNA mounted on the CTD Rosette frame. The SUNA was only functional for ~20 casts. After troubleshooting, a faulty cable line was found to be the cause of its malfunction, however no spare cable was available for use.

(d) *Macronutrients "Noon" Cast:* Macronutrient samples were taken during the "noon" cast for Cycles 1-5, the BBL Transect and Santa Barbara Basin Station in collaboration with Shonna Dovel.

(e) Copepod Exometabolome: Together with Grace Cawley (Decima Lab), copepods were isolated from seawater and incubated in filtered seawater obtained at 515 meters (1L). After 24 hours, the incubation was acidified and sampled onto solid phase extraction (PPL) cartridges as described above. The

incubation was done in hopes of isolating an exometabolomic signature of copepods to compare with the marine community metabolome samples.

Diaz Lab (Jamee Adams)

Phosphorus (P) is a vital nutrient for life, and essential for the proliferation and productivity of marine microorganisms. In certain regions of the global ocean, however, easily accessible orthophosphate is a biologically limiting nutrient that constrains marine primary production. In these areas, marine microorganisms express various metalloenzymes, such as alkaline phosphatase (AP), to acquire phosphorus instead from the less accessible pool of dissolved organic phosphorus (DOP), including inorganic polyphosphates such as tripolyphosphate. However, in recent years numerous accounts of AP activity in regions replete in orthophosphate have begun to challenge this historical view of APs as only important in P deplete regions, and suggest an important role for APs in more productive regions like the CCE. This makes the CCE an interesting region for AP enzyme activity measurements along with total P pool measurements, such as total dissolved and particulate P. The Diaz lab studies transformations within the major phosphorus pools in the ocean as well as coupled cycling of phosphorus with trace metals and carbon cycling.

Total Dissolved Phosphorus (TDP) **-** Samples were collected in 2L HDPE bottles and filtered in triplicate through 25mm GF/F filters into acid clean 60mL HDPE bottles. Samples were frozen at -20˚C. These samples were taken to measure TDP and dissolved organic P (DOP) by subtracting inorganic P from TDP. Samples were collected on all Cycles during every day of each cycle during the so called "noon cast", as well as at the Santa Barbara Basin and five of the eight Benthic Boundary Layer (BBL) stations sampled, including Stations: 1, 2, 3, 7, and 8. Each set of samples was from an eight-depth CTD profile with samples taken at each depth with the exception of Santa Barbara Basin and the BBLs, where only three depths were sampled.

Soluble Reactive Phosphorus (SRP) – Samples were collected in the same manner as TDP at identical depths for analysis of inorganic orthophosphate. These measurements will also be used in the calculation of DOP, as explained in the above TDP section.

Total Particulate Phosphorus (TPP) - Samples were collected in 2L HDPE bottles and filtered in triplicate through 25mm GF/F filters. Each sample received ~2L of particulate, and were frozen at -80˚C. Filtrate from these samples was used for TDP, and SRP samples. Samples were collected during the same cycles, days and depths as for TDP and SRP.

Particulate Tripolyphosphate (3polyP) **–** Samples were collected in 2L HDPE bottles and filtered in triplicate through 25mm GF/F filters. Each sample received ~2L of particulate, and were frozen at -80˚C. Samples will be used to assess the ratio of TPP:3polyP with depth to determine if 3polyP is used as a significant P source in the CCE. Samples were collected during the same cycles, days and depths as for TDP, SRP and TPP.

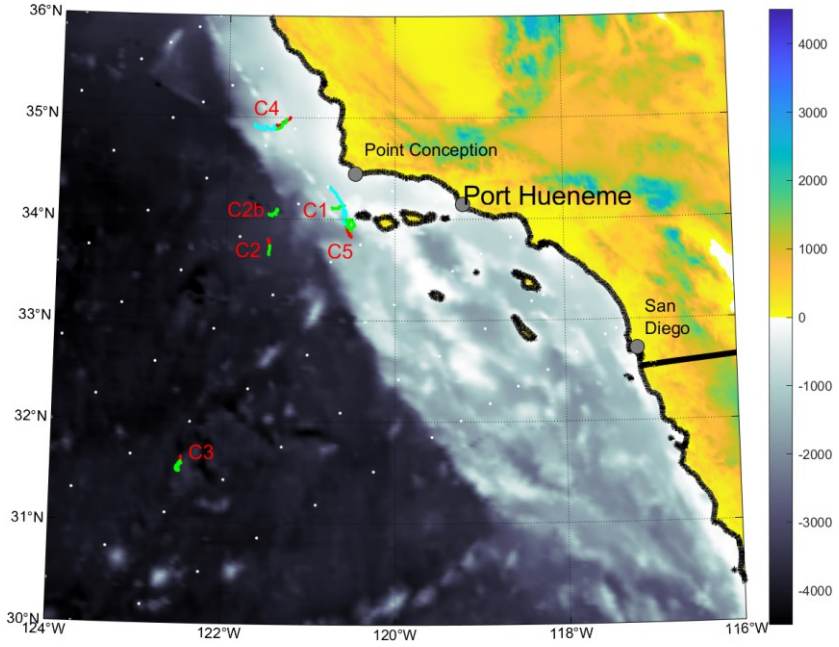
Alkaline Phosphatase Activity (APA) - *Kinetic plates*: Samples were collected from 2L HDPE bottles from all eight CTD depths during all Cycles including Santa Barbara Basin and the BBL stations. Duplicate samples were run in black 96 well plates on a Molecular Devices multi-mode plate reader. Fluorescence was measured from the fluorogenic phosphatase substrate methylumbelliferyl phosphate (MUF-P),

using a MUF-P gradient from 0-10uM for each depth. APA, Km, and Vmax kinetic parameters were measured for each depth.

Proteomics – McLane Pumps - Samples were collected from a large volume McLane pump onto a filter stack containing 50um Nitex, 3um Verapore, and 0.2um Supor filters for proteomic analysis. One sample from the chlorophyll maximum and one sample from below the chlorophyll maximum was taken during Cycles 2-5. No samples were taken during Cycle 1 or at Santa Barbara Basin or the BBL stations. Samples were flash frozen in liquid nitrogen and stored at -80˚C.

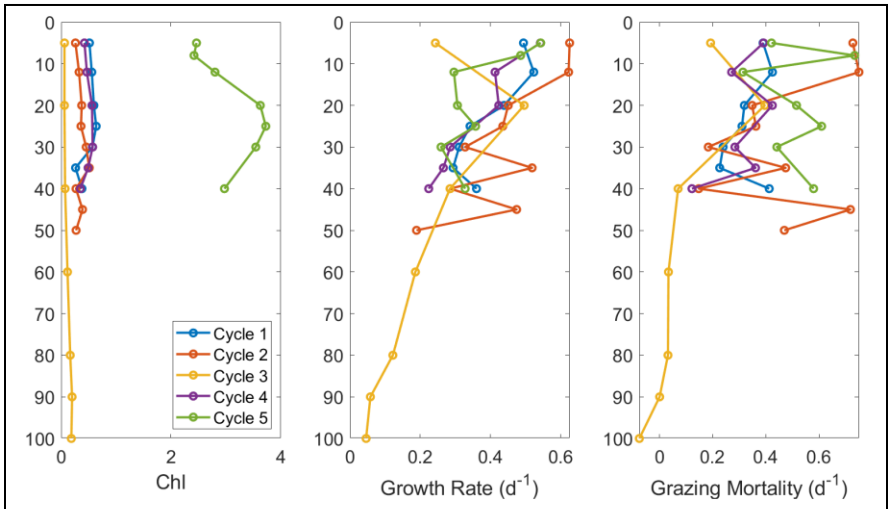
Stukel Lab (M. Stukel, N. Yingling, J. Irving, C. Fender, K. Opeyemi, M. Roadman with substantial help from Sydney Plummer, Anissa Garcia, and Moira Decima)

We had three goals for this cruise: 1) quantify phytoplankton production and growth rates and protistan grazing rates, both under natural and temperature amended conditions, 2) quantify the balance new and export production, and 3) determine the composition of sinking material and the processes driving the biological pump. In addition to these primary goals, we also deployed an in situ array to track water parcels during Lagrangian experiments and maintained the temperature controlled deckboard incubators.



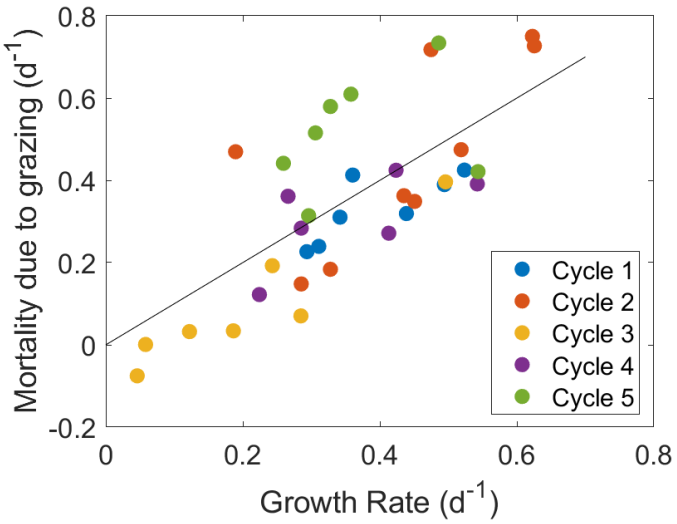
Lagrangian Cycle Drifter Tracks. Red is sediment trap. Green is in situ array. Cyan is expendable drifter

We conducted two-point microzooplankton grazing dilution experiments in situ. These experiments were conducted daily at six depths spanning the euphotic zone on the in situ array during our Lagrangian experiments. We conducted a total of 90 two-point dilution. Samples from each of the dilution experiments were taken for bulk chlorophyll a and flow cytometry. Growth was typically relatively well matched by productivity, although there was substantial variability between cycles. For instance, during Cycle 3, which was the most oligotrophic cycles with a deep subsurface chlorophyll maximum and very low chlorophyll concentrations in the surface waters, growth was consistently higher than protistan grazing, which is surprising in water that was likely dominated by Prochlorococcus, which is typically closely balanced in its growth by nanoflagellates and other protistan grazers. In contrast, Cycle 5, which was conducted in cold waters,



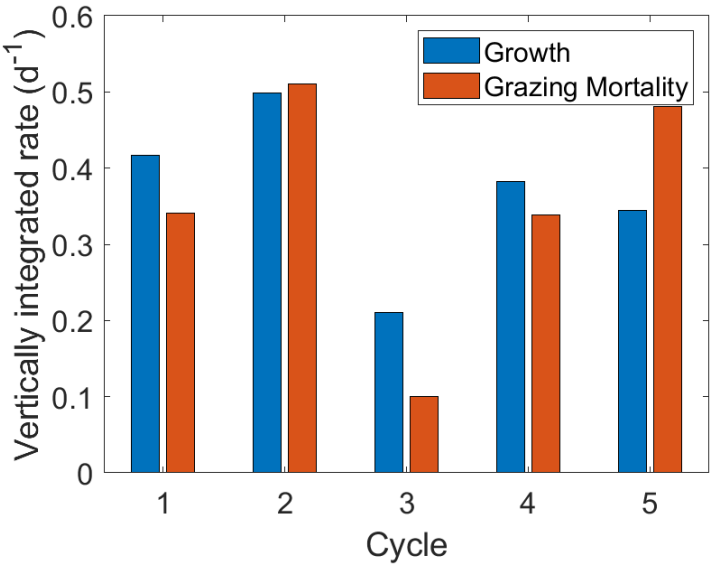
Results from in situ "mini"-dilution experiments.

believed to be recently upwelled and nutrient rich, grazing substantially exceeded growth. The reasons for these results are not yet known, although analysis of the flow cytometry-derived growth rates will likely yield further insights.



Growth-grazing balance calculated from in situ "mini"-dilution experiments.

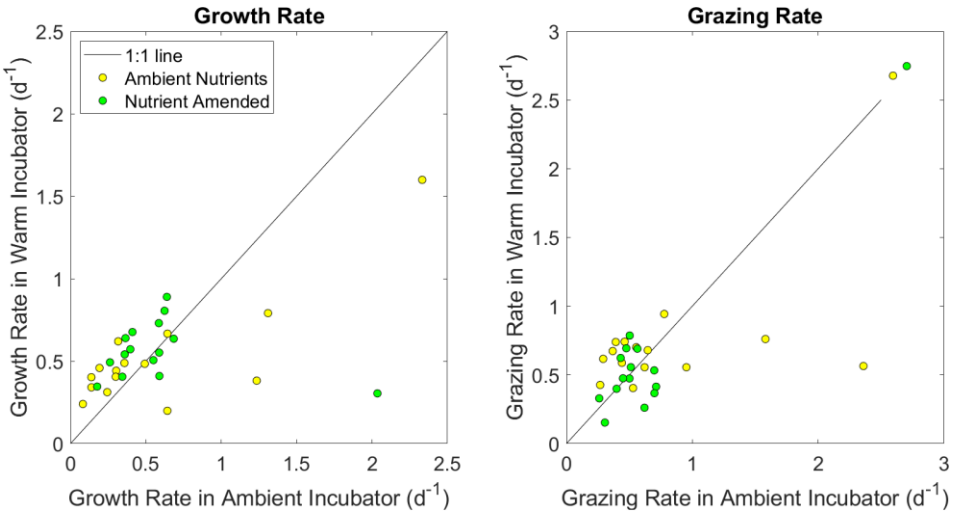
In addition, we conducted several full dilution experiments in paired deckboard incubators, one of which was maintained at near ambient temperatures and the other of which was set to ambient +2°C. The purpose of these experiments was to investigate the physiological responses of phytoplankton and protistan grazers to marine heatwave disturbances and to support measurements assessing diel variability in grazing, size specificity of grazers, and the impact of reactive oxygen species on grazing. These experiments were all conducted with both nutrient amended and natural nutrient conditions. Preliminary result showed a distinct phytoplankton growth response in the "warm" incubator, with most experiments exhibiting distinctly higher phytoplankton growth rates in the warm incubator. Grazing rates, however, showed no clear response over these 24-hour experiments.



Vertically integrated growth and grazing rates calculated from in situ "mini"-dilution experiments.

We also deployed sediment traps during each of four out of five Lagrangian cycles (not Cycle 1 because of navy restrictions). Vertex-style sediment trap cross-pieces (8:1 aspect ratio, with a baffle on top of similar 8:1 aspect ratio) were typically shortly below the base of the euphotic zone and at depths of 100 m, 150 m, and 440 or 450 m. We subsampled the sediment trap samples for a multitude of measurements including: C and N, particulate Si, δ^{13}C and δ^{15}N, Chl *a* and phaeopigments, trace metals, organic molecules, microscopy, genomics, and transcriptomics (transcriptomics sediment trap tubes deployed with RNA Later in tubes to preserve RNA contained in organisms on sinking particles). We also deployed tubes containing

acrylamide gel to preserve aggregates and other sinking particles in their in situ shapes for microscopic analysis.



Results from deckboard temperature controlled dilution experiments.

CCE-P2402 DAILY ACTIVITY SCHEDULE

(18 Feb – 18 Mar, 2024) ***R/V Revelle***

All times given in local time

Listed times are estimates; consult Event Log for actual times.

----------Plan of the day – 2/17/2024----------

0500 – All aboard

0600 – Departure

Ship proceed to first way station (CalCOFI Station 93-30 = 32° 51.0'N, 117° 31.8'W)

~0800 (or whenever we arrive on station):

Bongo Tow (~0800) - Decima Group

CTD Cast (~0900) - Stukel, Kranz, Allen, Diaz, Aluwihare, & Dinasquet Groups

Go-Flo Casts (~1000) - Barbeau Group

Trace metal Cast (~1100) - Barbeau Group

Manta Net Tow (~1200) - Decima Group

DPI Test Deployment (~1300) - Hopcroft Group

MOCNESS Tow (~1600) - Decima Group

~1800 (or whenever test station is completed) – transit towards station 34° 7' N, 120°45' W

----------Plan of the day – 2/18/2024 (Sunday)----------

0000 – DPI Test Deployment

~0200 (or whenever DPI is recovered) – transit towards station 34° 7' N, 120°45' W

~2000 (or on arrival) – CTD Cast (Kranz)

~2100 – Bongo Tow (Quantitative, Decima)

~2200 – MOCNESS (Shallow, Decima)

----------2/19/2024 (Monday)----------

0200 – CTD (Array Setup, Stukel)

0300 – Trace Metal Cast (Array Setup, Barbeau)

0415 – Array Deployment (Stukel)

0600 – CTD Cast (Dilution Experiments, Hinz)

0700 – Trace Metal Cast (Barbeau)

0800 – Bongo Tow (Quantitative, Decima)

0900 – MOCNESS Tow (Shallow, Decima)

1200 – CTD Cast (Noon, Torres)

1300 – DPI Deployment (Hopcroft)

2000 – Trace Metal Cast (experimental setup)

2200 – Bongo tow (quantitative, Decima)

----------2/20/2024 (Tuesday)----------

0200 – CTD (Array Setup, Stukel)

0300 – Trace Metal Cast (Array Setup, Barbeau)

0415 – Array Recovery & Re-deployment (Stukel)

0600 – CTD Cast (Dilution Experiments, Hinz)
0700 – Trace Metal Cast (Barbeau)
0800 – Bongo Tow (Quantitative, Decima)
1100 – Noon CTD (Torres)
1200 – MOCNESS Tow Shallow (Quantitative, Decima)
1800 – Trace Metal Cast (experimental setup)
1900 – CTD (Dilution experiments, Stukel)
1930 – Bongo tow (live organisms, Decima)
2000 – Bongo tow (quantitative, Decima)

----------2/21/2024 (Wednesday)----------
0200 – CTD (Array Setup, Stukel)
0300 – Trace Metal Cast (Array Setup, Barbeau)
0400 – Array Recovery (Stukel)
Proceed to BBL Stations----------
0700 - BBL Station 8 - line 80.51 34.463 -120.521
CTD
Go-Flo Cast
0900 – BBL Station 7 - Pt. Arguello 34.563, -120.684
CTD
Go-Flo Cast
1600 - BBL Station 1 - Cambria 35.579 -121.168
CTD
Go-Flo Cast
1800 - BBL Station 2 - Pt. Estero 35.475 -121.057
CTD
Go-Flo Cast
2000 - BBL Station 3 - Morro Bay 35.36 -120.926
CTD
Go-Flo Cast
2200 - BBL Station 4 - Shell Beach 35.084 -120.772
CTD
Go-Flo Cast
----------2/22/24 (Thursday)----------
0400 – BBL Station 9 - Gato 34.282 -120.025
CTD
Go-Flo Cast
0600 – **Santa Barbara Basin Station** - 34° 16.49’ N, 120° 1.51’ W
0600 - CTD (Stukel)
0800 – MOCNESS (Decima)
1100 – Manta Net (The Grace)
1200 - DPI

1600 - CTD (Torres)
1700 – Trace Metal Cast (Barbeau)
2000 - BBL Station 5 (If Navy Permits) - Vandenberg 34.881 -120.737
CTD
Go-Flo Cast
2200 - BBL Station 6 (If Navy Permits) - Santa Ynez 34.691 -120.71
CTD
Go-Flo Cast

----------**2/23/24 (Friday)**----------

0000 – Transit towards 33.8°N, 121.5°W

Start Cycle 2 (Day 0)

0700 – CTD Cast (Kranz)
0800 – Bongo (Quantitative, Decima)
1000 – Sediment Trap Deployment (Stukel)
1200 – CTD (Noon, Torres)
1300 – MOCNESS (Deep, Decima)
1800 – CTD (Experimental Setup)
1900 – Salp/Ringnet (Live, Decima)
2000 – Bongo (Quantitative, Decima)
2100 – MOCNESS (Deep, Decima)

----------**2/24/24 (Saturday)------Cycle 2, Day 1**----------

0200 – CTD (Array Setup, Stukel)
0300 – Trace metal cast (Array setup, Barbeau)
0430 – Array deployment (Stukel)
0600 – CTD Cast (Experimental setup, Hinz)
0700 – Trace Metal Cast (Barbeau)
0900 – Manta Tow (Quantitative, Decima)
1000 – Bongo Tow (Quantitative, Decima)
1100 – CTD (Noon, Torres)
1200 – DPI (5 nmi radius circle around drifter, Hopcroft)
1800 – CTD (Experimental Setup)
1900 –Manta Tow (Quantitative, Decima)
2000 – Bongo (Quantitative, Decima)
2030 - Salp/Ringnet (Live, Decima)
2200 – Array Recovery
2300 – Sediment Trap Recovery

----------**2/25/24 (Sunday)------Cycle 2b, Day 2**----------

Transit to 34N, 121.5W

0200 – CTD (Array Setup, Stukel)

0500 – Array Deployment (Stukel)
0700 – Trace Metal Cast (Barbeau)
0800 – Bongo Tow (Quantitative, Decima)
0900 – McLane pump (Decima)
1100 – CTD (Noon, Torres)
1200 – MOCNESS (Shallow, Decima)
1600 – McLane pump (Adams)
1800 – CTD (Experimental Setup)
1830 – Trace Metal Cast (Barbeau)
1900 – Salp/Ringnet (Live, Decima)
2000 – Bongo (Quantitative, Decima)
2200 – MOCNESS (Shallow, Decima)
----------2/26/24 (Monday)------Cycle 2b, Day 3----------
0200 – CTD (Array Setup, Stukel)
0300 – Trace metal cast (Array setup, Barbeau)
0430 – Array deployment (Stukel)
0600 – CTD Cast (Experimental setup, Hinz)
0700 – Trace Metal Cast (Barbeau)
0800 – McLane pump (Adams)
1000 - Bongo Tow (Quantitative, Decima)
1100 – CTD (Noon, Torres)
1200 – DPI (Hopcroft)
1800 – CTD (Experimental Setup, Stukel)
1900 – Salp/Ringnet (Live, Decima)
2000 – Bongo (Quantitative, Decima)
2100 – DPI (Hopcroft)
----------2/27/24 (Sunday)------Cycle 2, Day 4----------

0200 – CTD (Array Setup, Stukel)
0430 – Array recovery/deployment (Stukel)
0600 – CTD Cast (Experimental setup, Hinz)
0630 – Trace Metal Cast (Barbeau)
0730 – McLane pump (Adams)
1000 - Bongo Tow (Quantitative, Decima)
1100 – CTD (Noon, Torres)
1200 – Small boat ops (Dinasquet, if calm) – Otherwise, Deep CTD (Torres, once done sampling)
1800 – CTD (Experimental Setup, Stukel)
1900 – Salp/Ringnet (Live, Hopcroft)
2000 – Salp/Ringnet (Live, Decima)
2100 – Bongo (Quantitative, Decima)
2200 – DPI (Hopcroft)
----------2/28/24 (Wednesday)------Cycle 2b, Day 5----------

0200 – CTD (Array Setup, Stukel)
0400 – Array recovery/deployment (Stukel)

TRANSIT TO CYCLE 3 - 31.5N, 122.5W

----------Cycle 3 – Day 0

1800 – Sediment Trap Deployment (Stukel)
2000 – Bongo (Quantitative, Decima)
2100 – Salp net/Ring net (Live, Decima)
2200 – MOCNESS (Deep, Decima)

----------2/29/24 (Thursday)------Cycle 3, Day 1----------

0200 – CTD (Array Setup, Stukel)
0300 – Trace metal cast (Array setup, Barbeau)
0430 – Array deployment (Stukel)
0600 – CTD Cast (Experimental setup, Hinz)
0700 – Trace Metal Cast (Barbeau)
0800 – McLane pump (Adams)
1030 – Bongo Tow (Quantitative, Decima)
1200 – CTD (Noon, Torres)
1300 – MOCNESS (Deep, Decima)
Ship pump sewage before returning to drifter
1800 – CTD (Experimental Setup)
1900 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2000 – Bongo (Quantitative, Decima)
2100 – DPI (Hopcroft)

----------3/1/24 (Friday)------Cycle 3, Day 2----------

0200 – CTD (Array Setup, Stukel)
0430 – Array recovery/deployment (Stukel)
0600 – Trace Metal Cast (Barbeau)
0700 – McLane pump (Decima)
1000 – Bongo Tow (Quantitative, Decima)
1100 – CTD (Noon, Torres)
1200 – DPI (Hopcroft)
1730 – CTD (experimental setup, Stukel)
1800 – Trace Metal Cast (Experimental Setup)
1830 – McLane pump (Adams)
2100 – Bongo (Quantitative, Decima)
2200 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2300 – MOCNESS (Shallow, Decima)
Ship pump sewage before returning to drifter

----------3/2/24 (Saturday)------Cycle 3, Day 3----------

0200 – CTD (Array Setup, Stukel)
0430 – Array recovery/deployment (Stukel)

0530 – CTD Cast (Experimental setup, Hinz)
~~0600 – Trace Metal Cast (Barbeau)~~
0600 – McLane pump (Adams)
0930 – Bongo Tow (Quantitative, Decima)
1000 – McLane pump or nets (to be decided by the Décima)
1200 – CTD (Noon, Torres)
1300 – MOCNESS (Shallow, Decima)
Ship pump sewage before returning to drifter
1600 – Ringnets (Hopcroft)
1730 – CTD (Experimental setup, Stukel)
1800 – Trace Metal Cast (Barbeau)
2000 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2100 – Bongo (Quantitative, Decima)
2200 – Small boat ops (Grace Cawley) / Could become a MOCNESS If no pyrosomes present
----------**3/3/24 (Sunday)**------**Cycle 3, Day 4**----------
0200 – CTD (Array Setup, Stukel)
0300 – Trace Metal Cast (Barbeau)
0430 – Array recovery/deployment (Stukel)
0530 – Trace Metal Cast (Barbeau)
0600 – CTD Cast (Deep, Stukel/Torres)
1000 – Bongo Tow (Quantitative, Decima)
1100 – CTD Cast (Noon, Torres)
1200 – Manta Tow (Graceful Grace Cawley)
1300 – DPI (Hopcroft)
1800 – CTD (Decima)
1830 – Trace Metal Cast (Barbeau)
1900 –Ringnet (Hopcroft)
2000 – Manta Tow (Grace)
2100 – Bongo Tow (Decima)
2130 – DPI (Hopcroft)

----------**3/4/24 (Monday)** ------**Cycle 3, Day 5**----------
0230 – CTD (Cycle 3 Finals, Stukel)
0330 – Trace Metal Cast (Barbeau)
0400 – Recover Drift Array (Stukel)
0500 – Trace Metal Cast (Barbeau)
0600 – Recover Sediment Trap
0800 – Transit towards next location (tentatively 121W, 35N, 20 hr steam)
----------**3/5/24 (Tuesday)**------**Cycle 4, Day 0**----------
0400 – CTD Cast (Stukel)
0500 – Sediment trap deployment (Stukel)
0700 – Trace Metal Cast (Barbeau)

0800 – McLane pump (Adams)
1030 – Bongo Tow (Quantitative, Decima)
1200 – CTD (Noon, Torres)
1300 – MOCNESS (Deep, Decima)
Ship pump sewage before returning to drifter
1800 – CTD (Experimental Setup)
1900 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2000 – Bongo (Quantitative, Decima)
2100 – MOCNESS (Deep, Decima)

----------3/6/24 (Wednesday)------Cycle 4, Day 1----------
0200 – CTD (Array Setup, Stukel)
0300 – Trace metal cast (Array setup, Barbeau)
0430 – Array deployment (Stukel)
0600 – CTD Cast (Experimental setup, Hinz)
0700 – Trace Metal Cast (Barbeau)
0800 – McLane pump (Decima)
1000 – Bongo Tow (Quantitative, Decima)
1100 – CTD (Noon, Torres)
1200 – DPI (Hopcroft)
1800 – CTD (experimental setup, Stukel)
1900 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2000 – Bongo (Quantitative, Decima)
2100 – DPI (Hopcroft)

----------3/7/24 (Thursday) ------Cycle 4, Day 2----------
0200 – CTD (Array Setup, Stukel)
0300 – Trace metal cast (Array setup, Barbeau)
0430 – Array recovery/deployment (Stukel)
0600 – Trace Metal Cast (Barbeau)
0700 – McLane pump (Decima)
~~0900 – Bongo Tow (Quantitative, Decima)~~
~~1000 – Small boat ops (Dinasquet, if calm)~~
1200 – CTD (Noon, Torres)
~~1300 – MOCNESS Tow (Shallow, Decima)~~
1600 - McLane Pump (Adams)
1800 – CTD (experimental setup, Stukel)
1900 – Trace Metal Cast (Barbeau0
2000 – Bongo (Quantitative, Decima)
2100 – Salp/Ringnet (Live, The Esteemed Grace Cawley)
2200 – MOCNESS (Shallow, Decima)

----------3/8/24 (Friday)------Cycle 4, Day 3----------

0200 – CTD (Stukel, Initials, but no experimental setup)

0300 – Trace Metal Rosette

0400 - Recovery Array & Deploy expendable drifter

0500 - Recover Sediment trap

0800 – Trace Metal Cast

0900 – Bongo Tow (Quantitative, Decima)

1000 - Depart study region (Navy restricted areas)

1700 – Return to study region

1800 – CTD (experimental setup, Stukel)

1900 – Salp/Ringnet (Live, The Esteemed Grace Cawley)

2000 – Bongo (Quantitative, Decima)

2100 – DPI (Hopcroft)

----------3/9/24 (Saturday)------Cycle 4, Day 4----------

0300 – CTD (Initials only, Stukel)

0400 – Trace metal cast (Barbeau)

0500 – CTD Cast (Experimental setup, Hinz)

0600 – Trace Metal Cast (Barbeau)

0700 - Depart study region (Navy restricted areas)

1230 – Drill, followed by group picture on bow

1300 – Return to study region

1300 – CTD (Noon, Torres)

1400 – DPI (Hopcroft)

1900 – CTD (experimental setup, Stukel)

2000 – Salp/Ringnet (Live, The One and Only Grace Cawley)

2100 – Bongo (Quantitative, Decima)

2200 – MOCNESS (Shallow, Decima)

----------3/10/24 (Sunday)------Cycle 4, Day 5----------

0300 – CTD (Initials only, Stukel)

0330 – Trace metal cast (Barbeau)

0400 – McLane pump (Decima)

0700 - Depart study region (Navy restricted areas)

1300 – Return to study region

1300 – CTD (Noon, Torres)

1400 – Bongo (Quantitative, Decima)

1430 – MOCNESS (shallow, Decima)

1800 – CTD (experimental setup, Stukel)

1900 – Trace Metal Cast (Barbeau)

2000 – Bongo (Quantitative, Decima)

2100 – Salp/Ringnet (Live, The Kind-of-Maybe-Acceptable Grace Cawley)

2200 – DPI (Hopcroft)

----------3/11/24 (Monday) ------Port Call----------

0200 – CTD (Stukel, End Cycle)

0245 – Expendable array recovery (Stukel)

Transit to Port Hueneme - ~11 hour transit

1500 – Small boat transfer

Transit to surface underway sampling transect line

Proceed along surface underway sampling line looking for good location to start cycle 5

34.2667 N, 120.433 W
34.4 N, 120.667 W
34.5 N, 120.767 W
34.8 N, 121.033 W
35.133 N, 121.033 W

----------3/12/24 (Tuesday)------Cycle 5, Day 0----------

0900 – CTD Cast (Stukel)

0930 – Expendable drifter deployment (Stukel)

1000 – Trace Metal Cast (Barbeau)

1100 – Bongo Tow (Quantitative, Decima)

1200 – CTD (Noon, Torres)

1300 – MOCNESS (Deep, Decima)

Ship pump sewage before returning to drifter

1900 – CTD (Experimental Setup)

2000 – Salp/Ringnet (Live, The Garrulous Grace Cawley)

2100 – Bongo (Quantitative, Decima)

2200 – MOCNESS (Deep, Decima)

----------3/13/24 (Wednesday)------Cycle 5, Day 1----------

EXPECT WINDY WEDNESDAY TO FOLLOW TACO TUESDAY!!!! SECURE THINGS!!!!

0300 – CTD (Stukel)

~~0400 – Trace metal cast (Array setup, Barbeau)~~

0430 – CTD Cast (Experimental setup, Hinz)

0500 – Ship Transit to 33.9 N, 121.6 W

NAVY: Science activities in the vicinity of the drifter will likely have to halt from 0830 - 1800

10:00 – Deep CTD (3000 m, Koester)

1300 – Ship Transit back to Drifter Location

1830 – Recover expendable drifter

Cycle 5b

1930 – Redeploy expendable drifter at 34°5.9'N, 120°36.2'W

2000 – CTD (experimental setup, Stukel)

2100 – Salp/Ringnet (Live, The Middling Grace Cawley)

2200 – Bongo (Quantitative, Decima)

----------3/14/24 (Thursday) ------Cycle 5b, Day 2----------

0300 – CTD (Array Setup, Stukel)
0400 – Trace metal cast (Array setup, Barbeau)
0530 – Array deployment (Stukel)
0600 – Trace Metal Cast (Barbeau)
0700 – Sediment Trap Deployment (Stukel)
0900 – Manta Net (The once and future Grace Cawley)
1000 – Bongo Tow (Quantitative, Decima)
1200 – CTD (Noon, Torres)
1300 – MOCNESS Tow (Shallow, Decima)
1600 - McLane Pump (Adams)
1900 – CTD (experimental setup, Stukel)
2000 – Trace Metal Cast (Barbeau)
2100 – Salp/Ringnet (Live, Grace “the ocean is just a big bucket” Cawley)
2200 – Bongo (Quantitative, Decima)
2300 – MOCNESS (Shallow, Decima)

----------3/15/24 (Friday)------Cycle 5b, Day 3----------

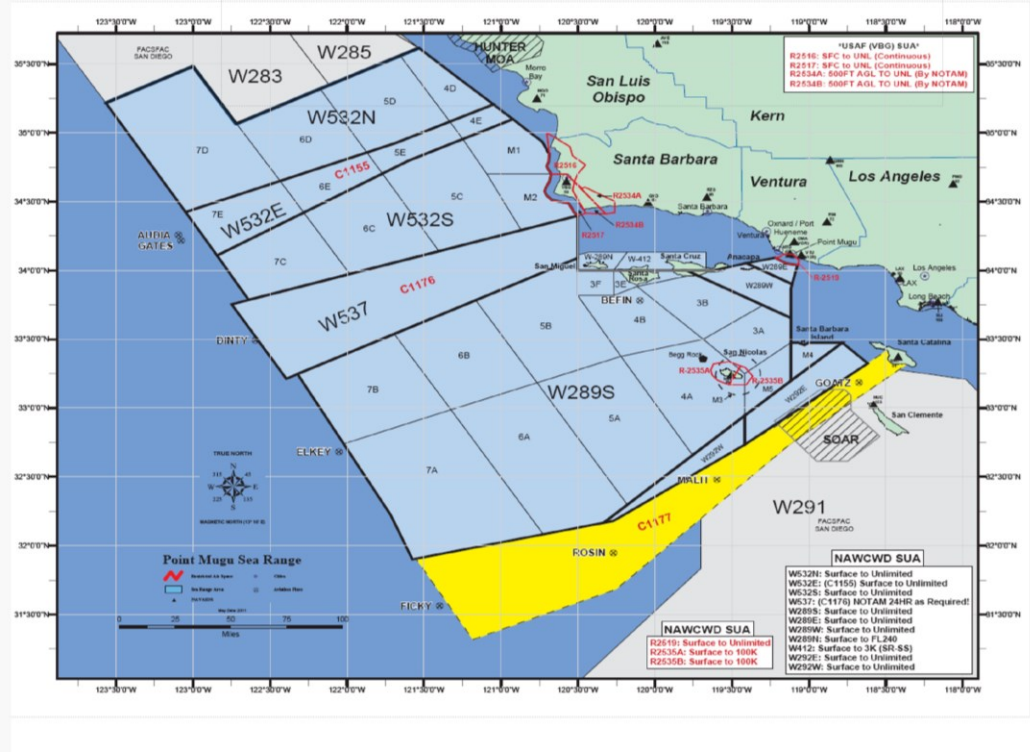
0300 – CTD (Array Setup, Stukel)
0400 – Trace metal cast (Array setup, Barbeau)
0500 – Array recovery/deployment (Stukel)
0600 – Trace Metal Cast (Barbeau)
0630 – CTD Cast (Experiments, Hinz)
0700 – McLane Pump (Decima)
1000 – Bongo Tow (Quantitative, Decima)
1200 – CTD (Noon, Torres)
1300 – DPI (Cousin)
1900 – CTD (experiment setup, Stukel)
2000 – Salp/Ringnet (Live, The Unsupervised Grace Cawley)
2100 – Bongo (Quantitative, Decima)
2200 – DPI (Cousin)

----------3/16/24 (Saturday)------Cycle 5b, Day 4----------

0300 – CTD (Array Setup, Stukel)
0400 – Trace metal cast (Array setup, Barbeau)
0500 – Array recovery/deployment (Stukel)
0600 – Trace Metal Cast (Barbeau)
0700 – McLane Pump (Decima)
1000 – Bongo Tow (Quantitative, Decima)
1100 – Manta Net (Decima)
1200 – CTD (Noon, Torres)

1300 – MOCNESS (Deep, Decima)
1900 – CTD (The Unfiltered (but now needs to filter) Grace Cawley)
2000 – Salp/Ringnet (Live, Just Grace Cawley, No more. No Less.)
2100 – Manta Net (Decima)
2200 – Bongo (Quantitative, Decima)
2300 – MOCNESS (Deep, Decima)
----------3/17/24 (Sunday)------Cycle 5b, Day 5----------
0300 – CTD (Cycle Finals, Stukel)
0400 – Trace metal cast (Array setup, Barbeau)
0430 – Array recovery (Stukel)
0530 – Trace Metal Cast
0630 – Sediment Trap Recovery
Transit to CalCOFI Station 93-45 (32° 20.78'N, 118° 33.25'W)
~2000 – Start DPI Transect at Station 93-45, tow to station 93-30
DPI Transect to CalCOFI Station 93-30 (32° 51.0'N, 117° 31.8'W)
----------3/18/24 ------Land ho!----------
CalCOFI Station 93-30 = 32° 51.0'N, 117° 31.8'W
11:00 CTD
11:30 Trace Metal
1430 – Emissions Testing
2000 –Land!

Appendix 1 – Naval Operations Warnings



Note for below: Warning Areas are areas that we were allowed to operate in. The following details the restrictions placed on us by the Navy.

Feb 18-23 1200-1200LT
33-48.0'N, 120-30.0'W - Naval area W-289 - 5B
35-00.0'N, 120-30.0'W - Naval area W-532
35-00.0'N, 121-18.0'W - Naval area W-532 - 4E
33-48.0'N, 121-18.0'W - Naval area W-537
33-48.0'N, 120-30.0'W - Naval area W-289 - 5B

0600L on 18 FEB 2024 – 1800L on 20 FEB 2024, SR 836700
Warning Areas: W289S (5B), W537, W532E (4E)

0600-1800L on 21 FEB 2024, SR 836718
Warning Area: W532E (4E)

0600-1800L on 22 FEB 2024, SR 836722
Warning Area: W537

Feb 23-29 1200-1200LT
33-30.0'N, 121-00.0'W - Naval area W-289 - 5B
34-30.0'N, 121-00.0'W - Naval area W-532 - M1
34-30.0'N, 122-00.0'W - Naval area W-532 - 6E

33-30.0'N, 122-00.0'W - Naval area W-537
33-30.0'N, 121-00.0'W - Naval area W-289 - 5B

0600-1800L on 23 FEB 2024, SR 836723
Warning Areas: W537 and W532S/E (4E, 6E, M1)

0600-1800L on 24 FEB 2024, SR 836739
Warning Areas: W289S (5B) and W537

0600-1800L on 25 FEB 2024, SR 836740
Warning Areas: W289S (5B), W537 and W532S/E (6E, M1)

0600-1800L on 26 FEB 2024, SR 836742
Warning Areas: W537 and W532S/E (6E, M1)

0600-1800L on 27 FEB 2024, SR 836755
Warning Areas: W289S (5B), W537 and W532S/E (6E, M1)

0600 on 28 FEB 2024 – 1800L on 29 FEB 2024, SR 836745
Warning Areas: W532S/E (6E, M1)

Another correction. Looks like W289S (5B) will be unavailable on 27 FEB.
I have removed it from the scheduled event.
0600-1800L on 27 FEB 2024, SR 836755
Warning Areas: W537 and W532S/E (6E, M1)

Mar 6-9 1200-1200LT
33-00.0'N, 122-00.0'W - Naval area W-289 - 7B
34-00.0'N, 122-00.0'W - Naval area W-532 - 6C
34-00.0'N, 123-00.0'W - Sea Area 33 Oakland Oceanic CTA/FIR
33-00.0'N, 123-00.0'W - Sierra Mars Oakland Oceanic CTA/FIR
33-00.0'N, 122-00.0'W - Naval area W-289 - 7B

After our scheduling meeting, here's what I have for the week of March 6-9:
06 MAR – 7B is available after 1300 through 07 MAR at 0600
1300L on 06 MAR – 0600L on 07 MAR
SR 837297
06 MAR – 6C is available all day
0000L on 06 MAR – 1100L on 08 MAR
SR 837290
07 MAR – 7B is available after 1130 through 08 MAR at 0730
1130L on 07 MAR – 0730L on 08 MAR
SR 837299
07 MAR – 6C is available through 08 MAR at 1100
This has been scheduled with 06 MAR

SR 837290

08 MAR – 7B is available after 1800 through 09 MAR; 6C is available after 1700 through 09 MAR

1800L on 08 MAR – 2359L on 09 MAR

SR 837294

Please note: 6C is available at 1700

09 MAR – 7B is available all day; 6C is available all day

I lumped this together with 09 MAR

SR 837294

Here's what I can schedule for the new request (the blanks are fully available at this time):

DATE	W289S (5B)	W537	W532S (M1)	W532S (M2)	W532S (5C)	W532E (4E)	W532E (5E)	W53 (4
5-Mar-2024	available after 1500	available after 1500		available after 1500				
6-Mar-2024	available after 1500	available after 1500		available after 1500				
7-Mar-2024	available after 1130	available after 1130						
8-Mar-2024	available after 1800	available after 1800	available before 11 & after 1700	available before 1100 & after 1700	available before 1100 & after 1700	available before 1100 & after 1700	available before 1100 & after 1700	avail before & a 17
9-Mar-2024								
10-Mar-2024								

DATE	W289S (5B)	W289 (6B)	W537	W532S (M1)	W532S (M2)	W532S (5C)	W532S (6C)	W532E
12-Mar-2024								
13-Mar-2024	not available 0830-1900	not available 0830-1900						
14-Mar-2024	not available 0830-1900	not available 0830-1900						
15-Mar-2024								

16-Mar-2024								
17-Mar-2024								

SR 838790	0000L on 12 MAR - 0830L on 13 MAR
SR 838793	0830L on 13 MAR - 2359L on 17 MAR
SR 838795	1900L on 13 MAR - 0830L on 14 MAR
SR 838794	1900L on 14 MAR - 2359L on 17 MAR

Also, tomorrow you're free to start going into W289S (5B), W537 and W532S (M2) at 1130L instead of 1500L.
I'll try to see if there are any other updates for this week.