P02/Leg 1 Weekly Report

Eastward Ho!
May 8-May 15, 2022

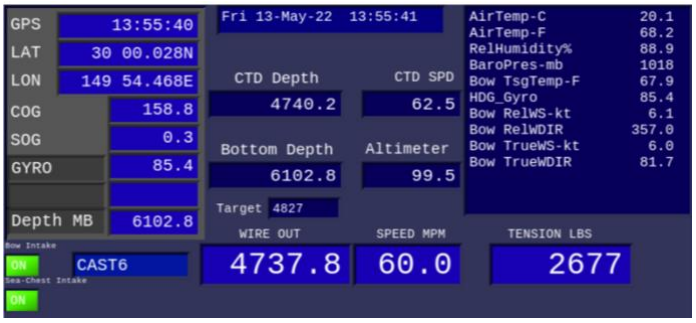


Figure 1: WinchMet readout from the early morning on May 14 (ship time) as the rosette goes down Station 33 - our eighth 6000 m station.

We left you last week as we crossed the Kuroshio's large meander with speeds of greater than 1 m/s and turned directly eastward along 30°N (Fig. 2). The first half of this week was a race against time. Our goal was to occupy as many stations as possible inside Japanese waters before our clearance period ran out on May 10th. Meanwhile, back on land, in both the US and Japan, many people on the ground worked nights and over the weekend to try to get our clearance extended. By May 8th, we had finished the stations located on the western slope of the Izu-Ogasawara (I-O) Ridge. Preliminary velocity profiles from LADCP measurements suggest the existence of a deep (below 1500 m) southward flow at speed of about 5 cm/s (Figure 3), which was also observed by the LADCP during the 2004 and 2013 occupations (Figure 4). This flow is speculated to be a deep eastern boundary current and a component of the Philippine Basin's abyssal circulation.

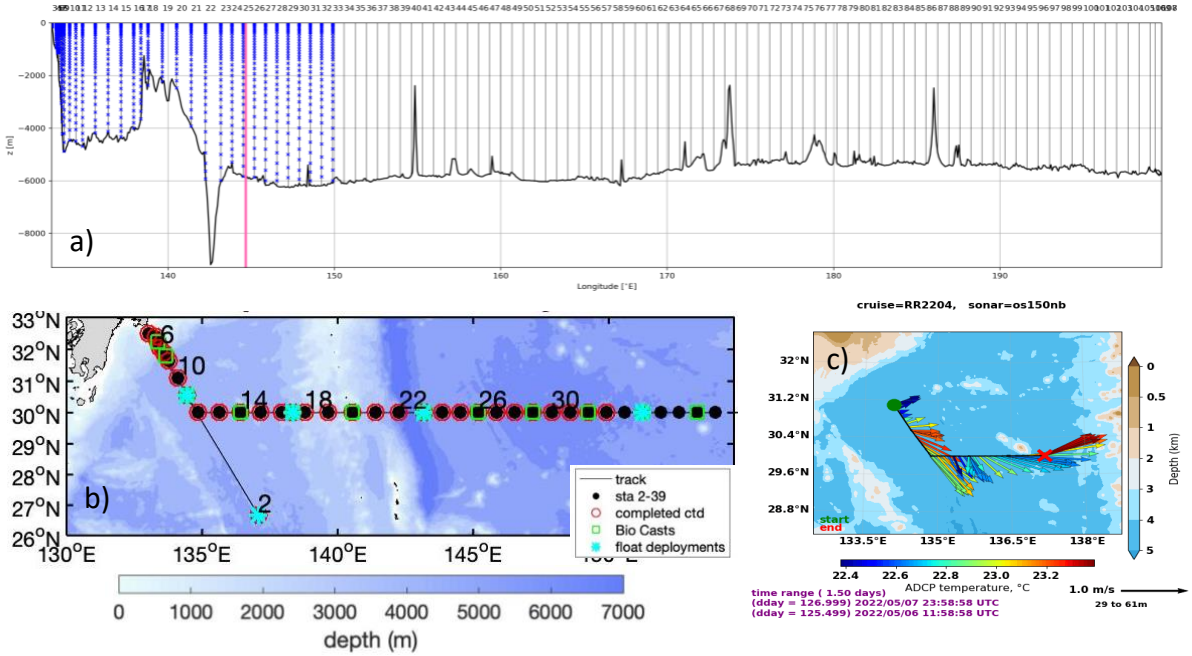
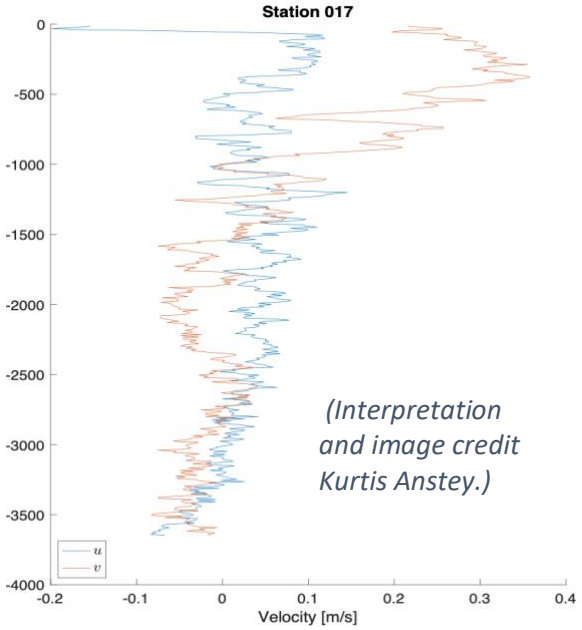


Figure 2: a) Along-track bathymetry and designed stations (numbered vertical lines). Depths of tripped bottle as of May 13 are indicated in blue crosses. The pink vertical line indicates the longitude of the Japanese EEZ. (Image credit: Shuwen Tan); b) Map of station locations (black dots), completed stations as of the morning of May 14, 2022 (red circles), bio casts or combined core/bio casts (green squares) and float deployments (cyan asterisks). Note, the 1500 m Sta. 1 at 21N, 140E which included core & bio casts and a float deployment is not included. (Image credit: A. Macdonald); c) SADCP-based surface (29 m to 61 m average) current velocities (arrows) and temperature (colormap). (Source: RR2204 shared drive)



(Interpretation and image credit Kurtis Anstey.)

Figure 3: Meridional/ Zonal (v/u, red/blue) velocity profiles from preliminary processing of LADCP data at Sta. 17 (30.0°N, 138.36°E on the western side of the I-O Ridge, see Fig. 2). Predominate southward flow at a speed of ~5 cm/s is found at depths below 1500 m.

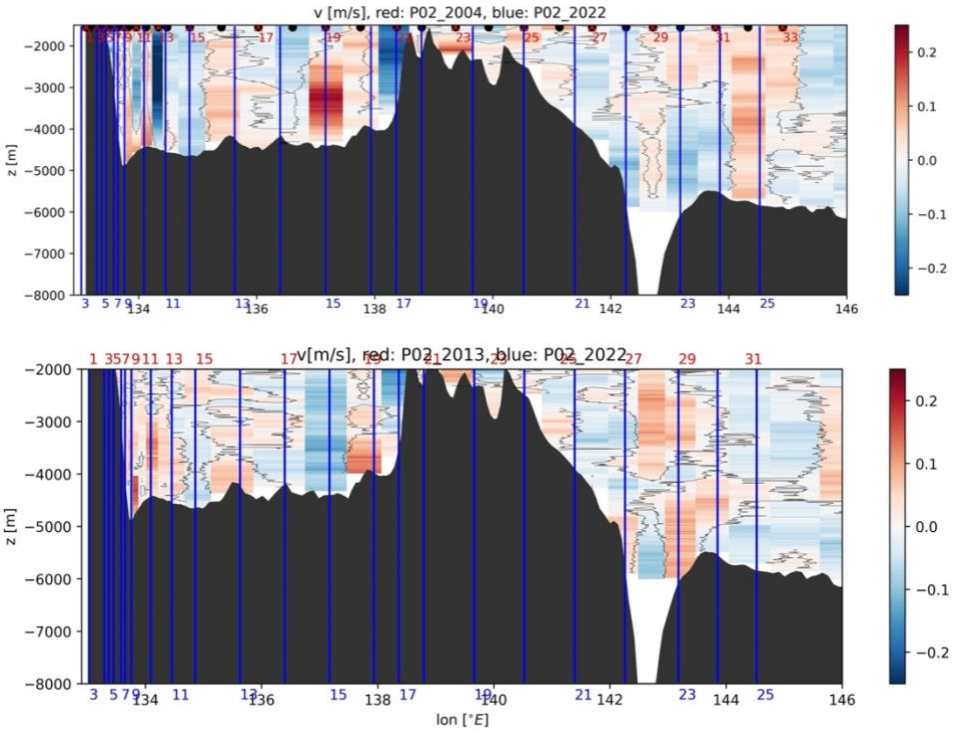


Figure 4: LADCP measured meridional (v) velocities from 2004 (a) and 2013 (b). Red dots and numbers at the top of the panels indicate the station locations from the earlier occupations. Blue lines and numbers at the bottom of the panes indicate the 2022 station locations. (Image credit Shuwen Tan.)

Coming up and over the shallow (< 2500 m) the (I-O) Ridge (May 8th-9th, Figs. 2, 4) we came to our first nearly 6000 m station on the western side of the I-O Trench. We sailed eastward, hoping for the extension before we reached the station over the 9000+ trench abyss. We waited until we were within a mile from the station location, before deciding, that with Japan's time zone an hour behind us it would be a no-go. We left this mid-trench location in favor of a 6000 m station on the eastern side of the I-O Trench twenty miles away, which we completed (sending our first batch of cups down with it, Fig. 5) before sailing eastward.

Figure 5: Shrunken Styrofoam cups and waters from the Trench. Photo credit. A. Macdonald.

Still hoping to hear positive news, I (Alison) went to bed, only to be woken up 3 hours later (now 2 pm in Japan), to be told no extension had been received, so Shuwen and I planned a half station between the Japan EEZ (144.67E) and last trench station. Back in bed, I was awoken by the *brrrng* of my phone telling me an email had arrived. It was from the State Dept in Japan, with the extension attached and permission to use an electronic version, we suddenly had more time than we could use in Japanese waters. A quick trip to the bridge then down to Shuwen sampling copping in the staging bay. Two more stations inside the EEZ were re-added to our itinerary and I went to bed happy that we would not have an 80nm gap in our data set. We are now completing 3+ stations a day, so by the end of May 13th, we had 30 stations out of the designed 105 stations (Fig. 2a), and by May 14, 33 stations (Fig. 2b). We now working with 35 nm spacing, which should allow us a little buffer for further technical difficulties and not leave us too far west of our original intended cut-off before heading to Hawaii.

Now that we are in deep waters, we have started running double casts for bio and core measurements. These are working well and are becoming more fluid, now that we all know what needs to be done to sample from the bio cast. The one issue that has arisen and it has taken a few days to understand is that the UVP does not seem to be capable of doing back-to-back casts. It will do the 1000 bio cast, but then shut off at about 2000 m on the core cast. It has therefore been decided that we will not run the UVP on the bio casts but turn it on for the core cast so the full depth of the ocean is measured. See Fig. 6 for some preliminary UVP photos.

Most other challenges have been fleeting and correctable: a problem with the rosette spinning on recovery with the tendency to unwind the wire; issues with particular bottles in relation to each other, to the rosette frame, and to various cables that caused bottles not to close properly have been fixed; a miscommunication between shifts caused the intended short (bio-cast) blackout test on the transmissometer to continue to the following full depth core-cast; the SBE oxygen sensor has been replaced after continuing issues with up and downcast differences; the LADCP uplooker was replaced after it stopped responding. But all in all, we are doing well and continuing eastward.

Back with more news and science next week,

Shuwen Tan and Alison Macdonald
co-Chief and Chief Scientists for
2022 P02/Leg 1 (33RR20220430)

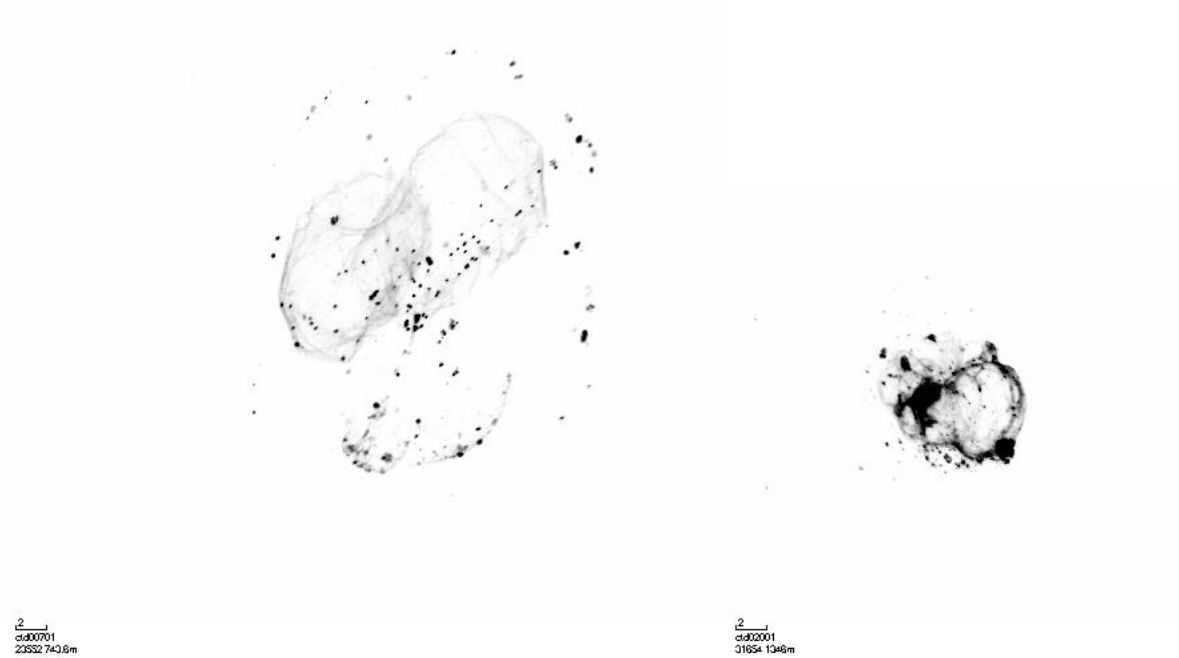


Figure 6: Two UVP photos of discarded larvacean houses. The scale bar is 2mm. Larvaceans form mucus houses and pump water through the mucus, which captures particles that they eat. They regularly discard their houses, which are large and more densely aggregated with particles, so they can be associated with high export events. The UVP does a good job capturing these large, delicate particles. Here you can see a discarded house with fewer particles and one with more particles. They're characterized by having twin lobes and lateral symmetry. Text and *Image credit – Stephanie O'Daly.*