

STAR 2006: NOAA Ship *McArthur II* Weekly Science Report

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Science Summary: 31 August – 6 September 2006

Welcome to Leg 2 of STAR aboard the *McArthur II*. We are headed on one long line from Honolulu to the Humboldt Current, about 9,000 km of Pacific ocean in front of us, then a short jog of a mere 1500 km from 15° S up to the coast of Ecuador, where we will refuel and re-provision one month from now. Our departure was slightly delayed so that we could wait for our last incoming engineer (a critical component of a full ship's complement). We also have 3 additional engineers and 1 deckhand, all new to the ship this leg, plus a host of returning or acting Chiefs (Lacey O'Neal, Stan Sinclair, Jim Johnson, Ray Storms), long-time *McArthur* veteran Dave Hermanson, and last and most importantly, our Captain – Greg Hubner. On the science side, we welcome representatives of Peru, Ignacio García-Godos Naveda, and Ecuador, Maria Elena Tapia.

Naïve sea-goers will think the ocean is more or less all one single unit – a large mass of water freely mixing, essentially one big place in which marine animals live. This particularly seems to be the case once the big island of Hawaii slips out of view as we sail southeastward into the middle of the largest body of water on the planet. Not so, our oceanographers and biologists will tell you, and this week we experienced a classic textbook case of this. Habitats out here are as different as the desert of the southwest is from the forests of coastal Washington, and those two from the Rocky Mountains of Colorado. This week we crossed the boundary between the large westward-moving N Equatorial Current, and the large eastward-moving N Equatorial Countercurrent. The former is cooler and saltier than the latter. Most telling is the thermocline ridge (a shallower boundary between warm surface water and cooler water below that) that develops where the two currents meet, the result of divergence of surface waters pulled by Coriolis Forces. We could see all of this oceanographically (through measurements made by our various instruments aboard). But the signal doesn't stop there. Spotted and spinner dolphins accompanied by flocks of seabirds (and tunas, although less easy to see) are known to aggregate at this boundary and Bingo! – we encountered a pile of them just as our XBT confirmed we were right on the ridge. An hour before (and during all previous hours of our survey, we had encountered virtually no cetaceans, and upon crossing the ridge we were overwhelmed with school after school after school – all spotted and spinner dolphins. A few hours later, we crossed back into the NEC (the boundary between these two currents is not a straight east-west line, but meanders just like a river) and Presto! – the dolphins were gone. The next day, we crossed over the ridge again and went from rags to riches (cetacean-wise), encountering spotters and spinners all over again. We marine ecologists are well aware of the patchy nature of the ecosystem out here. Yet it is difficult not to be astounded when you experience patches in full force out here.

Weather dues seem to have been paid in full last leg. This past week, we have experienced only a couple of squalls from the often days of transit-wide Inter-tropical Convergence Zone, and hey! Check out our average sea states for the week (see the table below)!

Other notable events: A probable *Indopacetus* makes an appearance in the midst of a clump of Bryde's whales stubbornly holding position at the wet edge of one of the two squalls of this week and RA Rowlett (known for his obsession with these animals) sees to it that the ship (and on-

watch observers) get a thorough fresh-water wash down. The seabirders experience numerous and mysterious problems with data collection hardware; MP Force really earns his salary dealing with these problems while S Webb is forced to stoop to data collection on paper for a few hours. Ignacio ticks off a number of life birds on his list and his first green flash. And the Royal Shellbacks hold their first meeting to prepare for the crossing of the ship into King Neptune's realm (that's the crossing of the equator, for all you Pollywogs).

Sightings and Effort Summary for Marine Mammals

| Date | Start/ Stop Time | Position | Total nm | Average Beaufort |
|--------|------------------|----------------------|----------|------------------|
| 090206 | 0618 | N19:28.97 W156:55.51 | 115.9 | 4.6 |
| | 1831 | N17:41.29 W155:58.95 | | |
| 090306 | 0611 | N16:01.74 W155:07.26 | 119.5 | 5.3 |
| | 1815 | N14:14.79 W154:12.01 | | |
| 090406 | 0658 | N12:37.48 W153:17.16 | 105.0 | 4.2 |
| | 1813 | N10:58.40 W152:31.66 | | |
| 090506 | 0659 | N09:57.31 W151:25.52 | 59.7 | 3.2 |
| | 1855 | N09:32.19 W150:09.60 | | |
| 090606 | 0648 | N09:07.50 W148:59.33 | 87.6 | 4.0 |
| | 1827 | N08:37.85 W147:32.08 | | |

| Code | Species | Number of Sightings |
|--------------|---------------------------------------------|---------------------|
| 002 | <i>Stenella attenuata</i> (offshore) | 7 |
| 003 | <i>Stenella longirostris</i> (unid. Subsp.) | 1 |
| 011 | <i>Stenella longirostris</i> (whitebelly) | 6 |
| 013 | <i>Stenella coeruleoalba</i> | 1 |
| 015 | <i>Steno bredanensis</i> | 1 |
| 018 | <i>Tursiops truncatus</i> | 1 |
| 034 | <i>Globicephala</i> sp. | 1 |
| 049 | Ziphiid whale | 1 |
| 070 | <i>Balaenoptera</i> sp. | 1 |
| 072 | <i>Balaenoptera edeni</i> | 3 |
| 077 | Unid. Dolphin | 1 |
| 079 | Unid. Large whale | 3 |
| 099 | <i>Balaenoptera borealis/edeni</i> | 1 |
| 101 | <i>Stenella longirostris</i> (southwestern) | 2 |
| Total | | 30 |

Biopsies (Susanne Yin and Erin LaBrecque)

| Species | Common Name | Weekly | | Total | |
|---------------------------|-----------------------------|---------|-------|---------|-------|
| | | Samples | Takes | Samples | Takes |
| <i>Delphinus delphis</i> | Short-beaked common dolphin | - | - | 2 | 3 |
| <i>Stenella attenuata</i> | Pantropical spotted dolphin | - | - | 1 | 1 |
| <i>Turisops truncatus</i> | Bottlenose dolphin | - | - | 6 | 9 |
| Total | | 0 | 0 | 9 | 13 |

Photo Project (Isabel Beasley and Jim Cotton)

Photography has done well this week, with more good images obtained in one day than during the entire last leg. In particular, we obtained good lateral photographs of whitebelly and southwestern spinner dolphins, a nice change from the hind-end only photos of last leg.

| Species | Weekly Photographs | | Total-to-date | |
|-------------------------------------------|--------------------|---------|---------------|---------|
| | Individuals | Schools | Individuals | Schools |
| <i>Stenella attenuata</i> (offshore) | - | - | - | 1 |
| <i>Stenella longirostris</i> (whitebelly) | - | 4 | - | 6 |
| <i>Stenella coeruleoalba</i> | - | - | - | 2 |
| <i>Delphinus delphis</i> | - | - | - | 5 |
| <i>Tursiops truncatus</i> | - | - | - | 3 |
| <i>Globicephala macrorhynchus</i> | - | - | - | 2 |
| <i>Orcinus orca</i> | - | - | 6 | 1 |
| <i>Balaenoptera edeni</i> | - | 1 | - | 1 |
| <i>Physeter macrocephalus</i> | - | - | - | 1 |
| <i>Balaenoptera musculus</i> | - | - | 1 | 1 |
| Total | 0 | 5 | 7 | 23 |

Seabird and Marine Debris (Michael Force and Sophie Webb)

It was a short week. But if one is to judge the success of our week by the number of species we saw, then one could say we came out on top. Twenty-two species passed through, or close by, our 300 metre strip transect survey zone. Put another way, we averaged 11 species per day, slightly lower than the final two weeks of Leg 1. Ocean currents and their effects on what we find out here were frequent topics for discussion. The dynamic nature of the physical oceanography of the eastern tropical Pacific never ceases to amaze us—or are we simply incredulous that we actually understand anything at all about the mechanics driving this fascinating system? Seabird diversity and abundance definitely increased when we entered the North Equatorial Countercurrent, finding 12 species on Monday, including White-necked, Juan Fernandez, Kermadec, Black-winged, and Bulwer's Petrels. We finally found flocks of feeding seabirds (mostly dark morph Wedge-tailed Shearwaters, Juan Fernandez Petrels and Sooty Terns) associating with Spotted and Spinner Dolphins. Most of the feeding flocks that we've seen so far have been over fish. As expected, Sooty Shearwaters are beginning to pass through (our first since leaving San Diego), winging their way south to New Zealand nesting burrows. A Pycroft's Petrel and a Pink-footed Shearwater (both firsts for Leg 2) were noteworthy sightings; the petrel was expected whereas the shearwater was not. The perils of a trans-oceanic migration undertaken by tundra-nesting Pacific Golden-Plovers as they navigate to their wintering grounds on central Pacific islands and atolls

were highlighted this week when one came aboard (now into its third day). It appears to be well past its “best before date” and will likely soon expire. Resources are fatally limited out here for this endearing shorebird, closely related to the familiar Killdeer of North America. As for trash and junk, we found a noticeable concentration when we entered an area believed to have been a zone of divergence between the North Equatorial Current and the North Equatorial Countercurrent. Plenty of plastic bottles, fishing floats, bits of Styrofoam, plastic barrels and a hard hat “graced” the ocean surface.

Fish sampled for diet and isotope analysis (for Bob Olson, IATTC)

| | Yellowfin Tuna | Skipjack* | Wahoo | Mahi Mahi |
|----------------------|-----------------------|------------------|--------------|------------------|
| Weekly Total | 0 | 0 | 0 | 0 |
| Total-to-date | 0 | 0 | 1* | 0 |

* From 24 August

Oceanographic Operations (Melinda Kelley)

The first week of Leg 2 has been a success for oceanography. Operations began slowly as we left Honolulu. This offered the perfect time for Cruise Leader Lisa Ballance to settle into the XBT driver’s seat during the noon and 3 PM sample times. We moved into full operations on Tuesday as we entered the study area. Thanks to the arrival of a new set of sensors in Hawaii, we now have a set of primary and secondary sensors on the CTD. The first CTD cast was deployed with much excitement and anticipation. The result was nothing but a perfect profile to celebrate in the end with both sets of sensors right on the mark.

Net tow operations also began as we entered the study area on Tuesday. For Leg 2, we have two visiting scientists who have been very eager to lend helping hands, Ignacio Garcia-Godos Naveda and Maria Elena Tapia. With their help, we have been wrapping up net tows at record time and taking more time to enjoy looking at what is in our glass jars. Ignacio and Maria have also been assisting with the noon and 3 PM samples, thanks to both of you for your help.

| Date | CTD | XBT | Bongo tow | Manta tow |
|--------------|---------------|------------|------------------|------------------|
| 31 Aug | In Port | In Port | In Port | In Port |
| 1 Sept* | 0 | 0 | 0 | 0 |
| 2 Sept* | 0 | 3 | 0 | 0 |
| 3 Sept* | 0 | 3 | 0 | 0 |
| 4 Sept* | 1 (test cast) | 3 | 0 | 0 |
| 5 Sept | 2 | 3 | 1 | 1 |
| 6 Sept | 2 | 3 | 1 | 1 |
| Total | 5 | 15 | 2 | 2 |

* Passing mode and no dedicated oceanographic operations conducted.

Squeakly Report (Shannon Rankin and Liz Zele)

Upon leaving Honolulu, the repair of the towed hydrophone array began in earnest. The senseless death of the previous array was caused by water intrusion through a small leak in a splice. I shall

spare the readers of the graphic description of the killings, hydrophone by hydrophone, as the water crept up the cable through its Kevlar core. It had all the horrific qualities you might find in one of Stan's movies-of-the-night. Upon departing Honolulu, we began piecing together a new array, Liz proving to be a great student in splicing. In our two days of effort, we managed to hear no less than 18 groups of dolphins, including several groups of spotted and spinner dolphins. In fact, in these two days we had less than 3 hours in which we were NOT hearing dolphins! Finally, to shake things up a little, we deployed two sonobuoys on Bryde's whales (although we were too busy to check for sounds!).

Dippers' Doldrums (Jim Cotton)

During the transit from Hawaii to the study area several species of flyingfish including black wing, pink wing, yellow-stripe, two-winged, and my favorite, the magenta-winged flyingfish were seen in moderate numbers in patchy distribution. Unfortunately our schedule did not allow us to sample this area. Within the study area, very few flyingfish have been seen this week except for the times when we crossed the frontal boundary between the North Equatorial Current and the Equatorial Countercurrent. Our three evening dipping sessions have only produced one sample, a juvenile four-winged variety of the genus *Hirundichthys*. Seen but not caught were two *Exocoetus* (two-winged flyingfish) and one *Oxyporhamphus* (short-winged flyingfish). The most memorable event this week was watching a school of 30 puffer fish pass beneath our nets last night. Hopefully there will be more to report next week so stay tuned.