

STAR 2006: NOAA Ship *David Starr Jordan* Weekly Science Report

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30 November 2006

Science Summary: 23 - 29 November 2006

This weekly covers our last two days in Manzanillo and four days of transit to the southwest through the core area of the STAR 2006 study. On the week's final day of effort, we turned and surveyed to the northwest, and everyone began thinking of home.

As Manzanillo faded in the distance behind us, we waved a fond farewell to a stalwart team member, Ernesto Isaac Vasquez Morquecho, who unexpectedly needed to return home. The remaining mammal team, now a rotation of five, is covering his position for the remainder of Leg 6. Ernesto, you are missed! Mammal team, heaps of thanks from all of us for your extra efforts on behalf of the project.

On the first full day of effort, seas were so calm that the caudal fins of flying fish left trails on the water as they took flight and diving turtles left undulating wakes behind them. We were anxious to make up for lost time and the good conditions just kept getting better throughout the day. Twelve hours later, we had logged sightings of animals with scales, scutes, skin, feathers, fur and antennae (see the new section on winged migrations below). We recorded 17 sightings of 7 different cetacean species: spinner, spotted, rough-toothed and Risso's dolphins, dwarf sperm whales, pygmy killer whales, and pygmy beaked whales (*Mesoplodon peruvianus*). Among these was an unusual mixed species school of Risso's dolphins and rough-toothed dolphins, a first for the senior observers on board. The turtle group was incredibly busy, collecting data from 32 different individuals, a record for STAR 2006. The turtle report below also shows the latest movements of the turtles tagged on earlier legs and tracked by satellite.

As mentioned in previous weeklies, it's patchy out here. Species composition, behavior and oceanography (see report below) can change rapidly day to day. In addition to abundance estimation, understanding this variation, and the impacts of scale, occupy much of our time between STAR years. After Sunday's extravaganza, on Monday we recorded half the sightings and $\frac{3}{4}$ of these were so elusive they could not be identified to species. The turtle team caught just one turtle today. As we transited westward on Tuesday and Wednesday, the winds came up a bit and more time elapsed between sightings. The most common species were spotted, spinner and mixed spotted/spinner schools, often foraging.

The big mammal news of the week came on Wednesday and it sounded like"boing". On a day dominated by Beaufort 4 conditions and few marine mammal sightings, a minke whale surfed the swells around the ship for over a half hour, enabling mammal observer and acoustician Laura Morse to make a rare and visually verified recording of what might indeed be an eastern minke whale call on the bow hydrophone! This is the first confirmed minke sighting of the cruise. Read more in the report below.

The trackline Tuesday and Wednesday took us over the Mathematicians Seamount Range. This extensive area, extending from Socorro and San Benedicto Islands in the north to the Clipperton Ridge in the south, was discovered and named by researchers from Scripps Institution of Oceanography during investigations in the East Pacific Ocean in the 1950's. The range is comprised of over 20 seamounts, rising 2000-3000m from the sea floor. We sailed over seamounts named after Fourier, with Descartes to port and Newton and Euler to starboard. It's a good topography for sperm whales, and sure enough, we recorded the first sperm whale sighting in several weeks. The seamounts sit on an abandoned sea floor spreading center, a site where lava pumping out from the depths of the earth rises to form new oceanic crust. Volcanic

seamounts are pretty common at mid-oceanic ridges where lava sometimes concentrates in one region and builds up into seamounts, instead of spreading out evenly to form new oceanic crust.

At this writing, we have begun our own northward migration toward San Diego. We are “six days and a wake up” from home.

Sightings and Effort Summary for Marine Mammals

Date	Start/ Stop Time	Position	Total nmi	Average Beaufort
112306		Manzanillo – In port		
112406		Manzanillo – In port		
112506	1423	N19:02.92 W104:23.23	23.7 nmi	3.0
	1736	N18:47.26 W104:41.82		
112606	0720	N19:08.18 W105:52.12	23.4 nmi	1.8
	1747	N18:26.35 W106:24.12		
112706	0726	N17:20.99 W107:36.21	59.6 nmi	3.5
	1829	N16:15.83 W108:25.37		
112806	0735	N15:03.57 W109:18.07	49.9 nmi	3.4
	1840	N14:05.76 W110:00.09		
112296	0731	N13:59.43 W111:28.44	76.4 nmi	4.4
	1717	N14:51.80 W112:35.56		

Code	Species	Number of Sightings
001	<i>Mesoplodon peruvianus</i>	2
002	<i>Stenella attenuata (offshore)</i>	12
101	<i>Stenella longirostris orientalis</i>	5
013	<i>Stenella coeruleoalba</i>	3
015	<i>Steno bredanensis</i>	3
017	<i>Delphinus delphis</i>	1
021	<i>Grampus griseus</i>	2
032	<i>Feresa attenuata</i>	1
033	<i>Pseudorca crassidens</i>	1
046	<i>Physeter macrocephalus</i>	1
048	<i>Kogia sima</i>	2
049	<i>Ziphiid whale</i>	1
051	<i>Mesoplodon sp.</i>	1
071	<i>Balaenoptera acutorostrata</i>	1
077	<i>unid dolphin</i>	4
078	<i>unid. small whale</i>	1
079	<i>unid. large whale</i>	1
TOTAL		42

Photography (Cornelia Oedekoven, Laura Morse, Adam Ü)

Late in the game but nonetheless we had two very exciting newcomers for our photographic catalog. On the third day of the week we caught a dwarf sperm whale that was logging *Kogia*-style at the surface near the ship on digital 'film'. On the last day of the week we found our first minke whale for the cruise which happened to be curious about the ship and circled us well enough for a few good pictures. Overall it was a very diverse week including also a sperm whale and false and pygmy killer whales for more highlights.

Species Code	Species	This week	Total
002	<i>Stenella attenuata</i> (offshore)**	3	33
003	<i>Stenella longirostris</i> (unid.)		6
006	<i>Stenella attenuata graffmani</i>		11
010	<i>Stenella longirostris orientalis</i> **	2	27
013	<i>Stenella coeruleoalba</i>	1	12
015	<i>Steno bredanensis</i>	3	15
017	<i>Delphinus delphis</i>	1	32
018	<i>Tursiops truncatus</i>		34
021	<i>Grampus griseus</i>	2	10
032	<i>Feresa attenuate</i> **	1	4
033	<i>Pseudorca crassidens</i>	1	4
036	<i>Globicephala macrorhynchus</i>		12
037	<i>Orcinus orca</i>		45*
046	<i>Physeter macrocephalus</i>	1*	21*
048	<i>Kogia sima</i>	1	1
049	<i>Ziphiid whale</i>		2
063	<i>Berardius bairdii</i>		3
071	<i>Balaenoptera acutorostrata</i>	1	1
072	<i>Balaenoptera edeni</i>		3
074	<i>Balaenoptera physalus</i>		2*
075	<i>Balaenoptera musculus</i>		23*
076	<i>Megaptera novaeangliae</i>		6*
090	<i>Stenella attenuata</i> (unid.)		1
099	<i>Balaenoptera borealis/edeni</i>		6

* Individual whales photographed

** Samples for tissue culture

Biopsy (Juan Carlos Salinas Vargas and Ernesto Isaac Vázquez Morquecho)

Cruise 1630 Weekly Cetacean Biopsy Report for 11/23/2006 to 11/29/2006					
Species	Common Name	# Weekly samples	# Weekly Takes	Total Samples	Total Takes
<i>Balaenoptera edeni</i>	Byrde's whale	0	0	4	4
<i>Balaenoptera musculus</i>	Blue whale	0	0	9	17
<i>Delphinus delphis</i>	Short-beaked common dolphin	0	0	19	40
<i>Feresa attenuate</i>	Pygmy killer whale	1	4	1	4
<i>Globicephala macrorhynchus</i>	Short-finned pilot whale	0	0	62	137
<i>Megaptera novaeangliae</i>	Humpback whale	0	0	2	5
<i>Orcinus orca</i>	Killer whale	0	0	19	44
<i>Physeter macrocephalus</i>	Sperm whale	0	0	8	8
<i>Pseudorca crassidens</i>	False killer whale	0	0	1	7
<i>Stenella attenuata</i>	Pantropical spotted dolphin	5	7	110	186
<i>Stenella attenuata graffmani</i>	Coastal spotted dolphin	0	0	27	42
<i>Stenella coeruleoalba</i>	Striped dolphin	0	0	2	8
<i>Stenella longirostris orientalis</i>	Eastern spinner dolphin	9	17	73	186
<i>Stenella longirostris subsp.</i>	unidentified spinner dolphin	0	0	25	42
<i>Steno bredanensis</i>	Rough-toothed dolphin	1	2	13	25
<i>Tursiops truncatus</i>	Bottlenose dolphin	0	0	48	78
<i>Unid</i>	Unidentified small delphinid (e.g., <i>Delphinus</i> , <i>Lag</i>)	0	0	2	2
Total		1	2	410	807

Marine Mammal Acoustics (Laura Morse)

Boing.....boing.....boing..... What is that you may be asking? Let me explain. The boing is a sound that has been heard for many years in the North Pacific. Though well recognized by Navy sonar techs and acoustic researchers working in these waters, no one knew what was producing this unusual sound. Many had suspicions but it was not until recently, on these very ships in fact, that finally our research efforts “cracked the code” so to speak, and determined that the smallest of baleen whales, the lovable minke whale, was the source of these very cool vocalizations. (Rankin, S. and Barlow, J. 2005. Source of the North Pacific “boing” sound attributed to minke whales. *J. Acous. Soc. Am.* 118:5 3346-3351). Two types of boings have been described as a result, a central and an eastern boing, and may eventually prove to be an indicator of distinct populations in the North Pacific. However, more data are needed so minke whale recordings remain a high priority for acousticians on these cruises.

That said, on November 29th a lone Minke whale was spotted breaching over a mile away. As we closed the whale showed an apparent interest in us, and was seen within a few hundred meters off the bow. Excitedly, I made a quick exit from the flying bridge, turned on the bow-hydrophone and tossed a sonobuoy. Given that only a few boing’s were recorded previously on the bow-hydrophone, I was not expecting success with that instrument. Generally the animals are not close enough to hear. Not this time though!!!! Multiple boing’s were recorded off the bow-hydrophone as the whale remained within 400

meters of the bow ship. On cursory review, the boing's appear to be of the eastern type and may be the farthest southeast recordings of this type to date. Exciting indeed!

Seabirds, Winged Migrations and Marine Debris (Rich Pagen and Chris Cutler)

Heading out of Manzanillo for what would seem (cross your fingers) to be the final time during STAR 2006 meant a teary goodbye to Magnificent Frigatebird, Laughing Gull, Royal Tern and street tacos. As we steamed offshore, the Black Terns and Brown Boobies transitioned into Sooty Terns and Masked Boobies. Jaegers of all three species were present this week, with Pomarine Jaegers greatly outnumbering the other two species.

The end of the week brought us some tuna/dolphin schools, several of which had large and interesting feeding flocks in attendance. One major component of these flocks the Sooty Tern, a species which has been largely absent from much of the area covered by the David Starr Jordan on this cruise (they've been asking about you, Nacho). Wedge-tailed Shearwaters and an assortment of boobies also dominated the flocks, with a smattering of less common species such as Brown Noddy, Christmas Shearwater and Pink-footed Shearwater. A distant small *Pterodroma* petrel (likely a Cook's Petrel) was also seen with a tuna/dolphin school.

Much of our time on transect was in the company of Leach's Storm-petrels (a mixture of both white-rumped and dark-rumped varieties), and a cohort of ship-following boobies (Brown, Red-footed and Masked). A Flesh-footed Shearwater passed by in good light on the 29th, and a probable White-bellied Storm-petrel was seen briefly during a minke whale sighting (photos were taken; stay tuned for more details in next week's report). Perhaps the image most vividly etched in our minds from the week was a Short-eared Owl (far from its preferred grasslands and marshes), whose gleaming yellow eyes could not have appeared more intense as it flew into the low angle morning light.

Marine debris was once again thick this week, with logs dominating our first few days out, followed by an assortment of anthropogenic debris later in the week. As usual, many sea turtles were observed associating with debris of all types. One interesting association involved an olive ridley turtle which was particularly fond of a white plastic bucket. The turtle had its head in the bucket (who wouldn't if a 172-ft long ship was barreling down upon them) and when it decided to dive because of the approaching vessel, the bucket went down with it. We called back to the small boat to be on the lookout for this turtle, which might be entangled in some way with the bucket. Happily, the turtle was free of his "security blanket" when he and the white bucket resurfaced, and we all breathed a sigh of relief.

While some of the ETP's seasonal denizens, such as the Juan Fernandez Petrel, are now for the most part on their breeding islands thousands of miles to the south, less predictable migrants continue to grace us with their presence. This week, for at least two days, a lost female Monarch butterfly (*Danaus plexippus*), with her bold wing veins, traveled along with us while we were more than 100 miles off the Mexican coast. Most likely she was a North American migrant headed for the central Mexican highlands to spend the winter. There, in the oyamel fir forests of the Transvolcanic Range, in a remarkably small geographical area with limited specialized habitat and unique ecological constraints, millions of monarchs overwinter en masse prior to their springtime journey northward. Our butterfly seemed to make use of drafts to help her fly, gliding and occasionally flapping near the flying bridge and above the foc'sle, for hours and hours. Monarchs are thought to use the angle of the sun as well as polarized light to orient. We have no idea if our half-gram wayward visitor, with wings untouched by the beak of a bird, ever found her way back to land but she seemed to do just fine for the time she was with us. She was indeed an unexpected pelagic wanderer.

Turtle Operations (Lindsey Peavey, et al.)

You'll be happy to read I have more to report than last week, which was just short of nothing. We did actually see many olive ridleys during our detour past Acapulco and back up to Manzanillo last week, however weather and time restraints prevented us from conducting small boat operations. Considering this, when we left Manzanillo to officially start Leg 6, everyone, including our eager visiting scientists, wonderful crew, enthusiastic cruise leader, two sea bird observers turned assistant sea turtle biologists, and myself were chomping at the bit to catch some turtles.

Let's just say our thirst was quenched. On 26 November we experienced our busiest day yet and processed 32 – YES 32 olive ridleys. There are three reasons we were able to process so many turtles in one day. The first being we were in a remarkably thick patch of juvenile olive ridleys. Seventy-two percent of our records for the day were small turtles under 35 cm straight carapace length. As you can imagine, small turtles are easier to handle and manage on deck, and they can generally be processed faster and with less manpower (adult turtles are very strong and sometimes need more than one person to maneuver during data collection).

Secondly, we turtlers are extremely fortunate to have amazing support from our talented deck department. Small boat operations take a lot of the deck's time and energy during a busy turtle day: one coxswain to drive the boat and two others to be on deck to transfer turtles to the ship. Our deck department, led by Chief Bosun Chico Gomez, is outstanding. In addition to standard mammal biopsy and photography efforts, they direct small boat launching and retrieving in minutes, hand turtle captures, and personnel and turtle transfers with the safety of all involved as top priority, with nothing less than a smile. I am amazed everyday with their professionalism, work ethic, and support for the turtle project. I cannot thank them enough for their greatness this entire cruise; we have had a lot of fun!

Speaking of greatness, the third reason we were able to handle so many turtles on the 26th was due to our stellar processing team. In addition to the usual suspects: Rich Pagen, Chris Cutler and Candice Hall, we recruited four dynamite turtle hungry visiting scientists who jumped into a more or less crazy day head first. They gladly hand captured turtles, recorded turtle data or held animals as needed with fresh energy and excitement. It was truly a pleasure to work with this group of people, and we are all hoping to get more turtling opportunities during our *last* (sniffle sniffle) week of effort as we steam up the coast of Baja towards San Diego through prime loggerhead habitat.

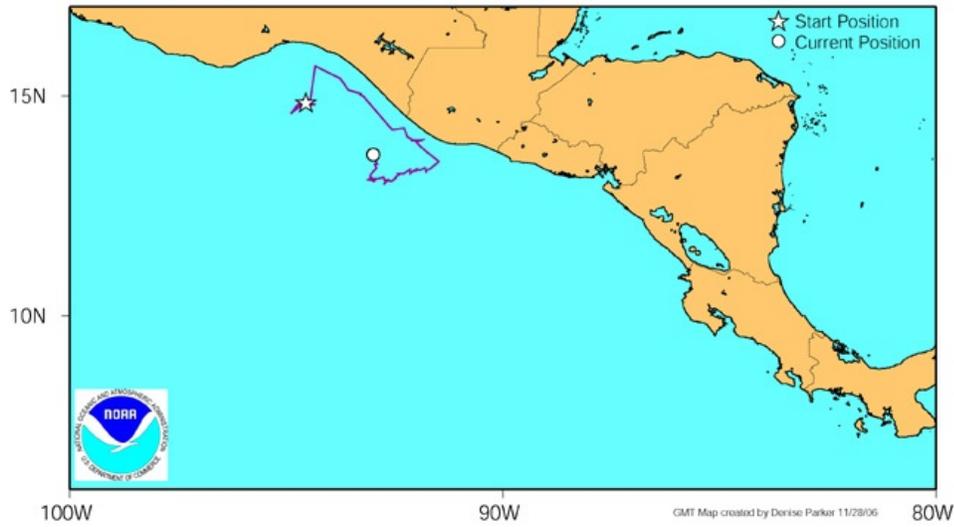
Take a look at what our satellite tagged turtles have been up to! After release, Annette made a beeline to productive coastal waters then followed currents back offshore. After migrating south, Iliana has slowed and remained in deeper waters off the continental shelf.

Species	Common name	Number sampled	
		Weekly	Total
<i>Caretta caretta</i>	Loggerhead	0	8
<i>Eretmochelys imbricata</i>	Hawksbill	0	1
<i>Lepidochelys olivacea</i>	Olive ridley	32	345
Total		0	354

2006 movement of hand captured male olive ridley, Ernesto (Argos 44363)
SDR T-16 Deployed: 9/20/2006 Days since first Transmission: 27 days



2006 movement of hand captured Iliana female olive ridley (Argos 44364)
SDR T-16 Deployed: 10/9/2006 Days since first Transmission: 47 days



2006 movement of hand captured Annette female olive ridley (Argos 44365)
 SDR T-16 Deployed: 11/05/2006 Days since first Transmission: 22 days



Fish Sampled for Diet and Isotope Analysis

Species	Samples	
	Weekly	Total
Yellowfin tuna	0	25
Skipjack*	0	13
Wahoo	0	3
Mahi mahi	0	11

*includes black skipjack

Oceanographic Operations – Candice Hall; weekly written by guest writer Adam Ü

Finally shrugging off the trappings of land, Leg 6 commenced with a trackline perpendicular to the Mexican coast. Leaving behind coastal SST's (sea surface temperatures) and SSS's (sea surface salinities) of ~29 °C and ~33 psu, we sailed from the region of the subsurface West Mexican Current. Vertical profiles have shown a drop, and subsequent rise, in the thermocline depth ($TD_{max} = 73m$, $TD_{min} = 52$) as we headed offshore, indicating that we may have clipped the edge of the Tehuantepec Bowl again. Making the northward turn for home as we have, the effects of the California Current will soon become apparent; which will be easily identifiable by the increase in the clothing layers being worn aboard.

An important oceanographic achievement this week has been the deployment of our last three SOLO Argo floats (# 2615; 2614 & 2613). Argo is a global array of 3,000 free-drifting profiling floats that will measure the temperature and salinity of the upper 2000 m of the ocean. This will allow continuous monitoring of the temperature, salinity, and velocity of the upper ocean. Perfect deployments, with more than enough helping hands, have turned our small contribution to this venture into a huge success, as shown by the float trajectories in the figure below.

Our previous floats have exhibited a varied array of directional translocation. It is important to remember that these floats spend the majority of their time at 1000m and so represent the water movement typical of that depth. Float # 2621 seems to be oscillating back and forth from its deployment location, while # 2619 appears to be heading northwards in the eastern branch of the North Equatorial Countercurrent (NECC). Float's # 2618 and 2616 both look as if they are moving along with the NECC/Costa Rica Dome. An internationally vital component of the Argo initiative is that all data returned from our floats are immediately available to the public on the Scripps website (sio-argo.ucsd.edu), while universal float data are freely available on the Argo website (http://www.coriolis.eu.org/coriolis/cdc/tsg_and_buoy_data.htm). Many thanks go to the Scripps team of Dean Roemmich, Glenn Pezzoli, John Gilson and Justine Afghan for supplying and facilitating our floats.

Date	CTD	XBT	Bongo Tow	Manta Tow
23 Oct	In port			
24 Oct	In port			
25 Oct	1	1	1	1
26 Oct	3	3	1	1
27 Oct	2	3	1	1
28 Oct	2	3	1	1
29 Oct	2	3	1	1
Week Total	10	13	5	5
Grand Total	169	263	70	73

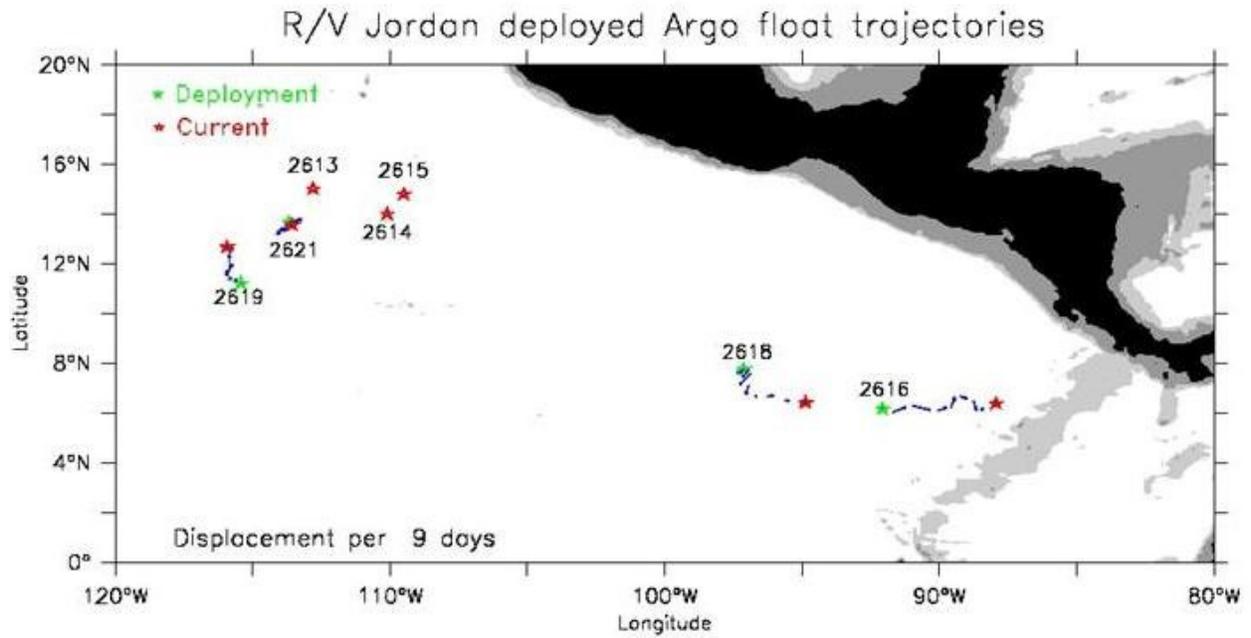


Figure: Argo float trajectories from the David Starr Jordan during STAR 2006 (Gilson, 2006).