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

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Science Summary: 21 – 28 September 2006

It is a steely gray morning, heavy overcast with 14 knots of wind. We are south by southwest of the Galapagos Islands by 100 nautical miles. Twenty minutes after sunrise we get our first sighting – yet another blue whale in a long series of blue whales we have sighted during the past week, as we steam east along the Equator. A fair number of these animals have been cow-calf pairs; this is a lone individual, medium-sized as far as blue whales go, and healthy-looking. And, like many of the blues we have encountered during the past week, this one is strangely and decidedly curious about the ship.

In the case of blue whales, we always try to maneuver the ship so as to obtain photographs which will allow us to identify the individual using nicks, scars, and distinct color patterns on the back and dorsal fin. And of course, we are always in pursuit of those precious skin and blubber biopsy samples which may tell us from what population this individual comes.(Blue whales spend their summers at the poles and their winters in the tropics but not much is known about the ties between these summering and wintering grounds. These blues we have been seeing may come from Antarctic populations that were severely depleted during commercial whaling times.)

In this morning's case, we are not so successful, but the whale defies our failures by cooperatively remaining half a football field's length behind the ship, placidly swimming back and forth and ever-nearing the fantail which is becoming crowded with amazed onlookers, scientists and crew alike. Amongst the audience are two of our biopsy specialists and when the whale surfaces particularly close, two skin sampling bolts are launched simultaneously – and one of them hits the whale! (Like a drinking straw hitting a tractor tire, my colleague RL Pitman has written.)

Thankfully, the more valuable of the two darts (the one with the sample – we hope) is tied to a long string which plays out as the bolt flies through the air. We need merely pull the string in from back to front and …… hey. Broken string! We instantly go into recovery mode – maneuvering a ship so that it can get close to a blue whale is difficult enough but placing an almost 300 foot steel structure within 10 feet of a 1 foot arrow is quite another feat. It takes an enormous amount of coordination and skill from all involved. Scientists on all decks of the ship instantly focus their binoculars on the bolt so as not to loose it in literally an ocean of water and waves while the officers and crew on the bridge turn the ship 180 degrees to the left to set up for the pickup. Despite the fact that finding a needle in a haystack would seem trivial next to this task, a number of us locate the bolt and track it visually while the ship comes around.

All is looking good, when suddenly out of nowhere there appears a cluster of Galapagos Storm-Petrels gathering around the bolt, which is now exuding a small slick of oil from what we can see is a tiny piece of skin and blubber the size of two pencil erasers – we need that sample! To our amazement and horror, the birds drop down on top of the business end of the bolt and start picking away at our sample! (Storm-Petrels in general make a practice of homing in on olfactory cues so as to consume oil droplets and bits of whatever items the oil is seeping from.) Minutes later, as the bolt passes down the port side of the ship, there is good news and bad news. We can

still see a bit of sample in the dart tip! And the bolt is too far away from the ship for our 20-foot dipnet poles to reach. Take two.

Again, remarkably, we maintain visual contact with the bolt (and now, two oranges floating nearby as visual aids, courtesy of the Steward's Department) as the officers and crew maneuver the ship around another 180 degrees to the left. This time, we will turn and let the wind blow us down on the dart – smart! The Storm-Petrels have left the area but – we have lost track of the bolt! Only a Swallow-tailed Gull (an inhabitant of the Galapagos Islands and one of the most lovely of all seabirds with gigantic eyes because it feeds mostly at night) is visible fluttering over the surface 300 m away. As it settles onto the water, we relocate the bolt just as the gull takes its own piece of our skin and blubber from the dart tip. Moments later, the bolt passes down the port side of the ship again, this time within reach of our two dipnetters on the stern. But wait! The superstructure of the 02 deck blocks the netting attempt of dipnetter #1 and the bolt passes aft of the net. Dipnetter #2 makes a stab. The bolt hits the metal net hoop and teeters on the edge. The whole ship holds its breath. In the silence a wave washes the wrong way and the bolt is out – now beyond our reach by a hair's breadth. Take three.

Tens of minutes and a few more tries later we are still at red alert, painstakingly maneuvering to bring the dart within reach while scientists dotted around the ship at every level struggle to maintain visual contact with our precious dart, which by now is floating amongst a veritable fruit salad of oranges. After yet another unsuccessful attempt, the Captain calls a halt to this foolishness and orders the launch of the small boat. (Editor's note – the number of unsuccessful passes is in no way a reflection of the ship-handling abilities of our bridge watch. Their efforts are complicated by the fact that we are towing a 1000-foot acoustic array behind us which prevents sharp turns, slowing below 3 knots, or twisting using our bow thrusters.)

Time is precious. If the birds don't eat the entirety of the sample, we will lose it in the peaks and troughs of the waves. The deck department musters to their stations to complete the safety check for the launch, to lower the boat to the rail, to load the coxswain and two scientists, and to drop the boat in the water. Gads – where is the dart?! (Gee – that blue whale sure is close, having continued to circle around the ship throughout this entire episode it has been almost impossible for us to remain focused on the dang dart and not on the magnificent whale – now it's literally within feet of the small boat.) There! And the boat is off. But wait! They miss it on the first pass. Where is it? Have they run over it? No! It's in the hand! And???? **We have our sample!!** Against all odds.

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Each of these 30-day legs is like a single episode of a mini-series – a complete story, yet with clear intrigues to come. This report is the last to chronicle Leg 2, during which time we have traveled from Hawaii to Ecuador, half of the breadth of the largest ocean on the planet – sampling over 10,000 linear km of trackline and crossing three major surface currents and perhaps the world's most prominent geographical feature in the process. This habitat diversity has translated into biological diversity: 18 cetacean species seen during the past four weeks and a whopping record of 23 seabird species seen in a single day, both of which may be all-time highs for a single leg of an eastern tropical Pacific cruise. Notable were the high number of blue whales, their friendly demeanor, and the presence of very small calves, a "grand slam" for blackfish – with every species in this group sighted this leg, and the paucity of sperm whales in an area where we expected to be overwhelmed with them (only a single sighting for the entire leg). Here's the teaser – Leg 3 brings a jog to 15 degrees S before heading into the heart of spotter and spinner country, with a new Cruise Leader and two new visiting scientists. Tune in next week, same time, same place.

Sightings and Effort Summary for Marine Mammals

Date	Start/ Stop Time	Position	Total nm	Average Beaufort
092106	0653	S02:10.98 W103:43.92	74.8	5.0
	1801	S02:17.71 W102:19.22		
092206	0639	S02:24.65 W100:51.79	63.7	4.4
	1815	S02:31.04 W099:30.06		
092306	0623	S02:38.28 W097:58.17	79.1	4.0
	1819	S02:45.40 W096:29.21		
092406	0616	S02:52.31 W095:02.65	51.5	4.7
	1629	S02:57.52 W093:55.28		
092506	0713	S02:57.42 W092:23.98	66.9	4.1
	1810	S02:43.80 W091:07.21		
092606	0654	S02:30.59 W089:52.44	66.4	4.1
	1736	S02:15.01 W088:45.12		
092706	0643	S02:03.37 W087:18.99	95.8	4.9
	1815	S01:45.27 W085:36.90		
092806	0633	S01:28.07 W083:59.78	70.2	4.0
	1807	S01:14.50 W082:39.78		

Code	Species	Number of Sightings
002	*Stenella attenuata* (offshore)	1
011	*Stenella longirostris* (whitebelly)	1
013	*Stenella coeruleoalba*	4
017	*Delphinus delphis*	3
018	*Tursiops truncatus*	12
021	*Grampus griseus*	1
033	*Pseudorca crassidens*	1
036	*Globicephala macrorhynchus*	16
046	*Physeter macrocephalus*	1
049	Ziphiid whale	1
061	*Ziphius cavirostris*	1
070	*Balaenoptera* sp.	9
072	*Balaenoptera edeni*	2
075	*Balaenoptera musculus*	6
077	Unid. Dolphin	3
078	Unid. Small whale	1
079	Unid. Large whale	3
099	*Balaenoptera borealis/edeni*	2
Total		68

Biopsies (Suzanne Yin and Erin LaBrecque)

Species	Common Name	Weekly		Total	
		Samples	Takes	Samples	Takes
Balaenoptera edeni	Bryde's whale	0	0	1	1
Balaenoptera musculus	Blue whale	3	4	4	5
Delphinus delphis	Short-beaked common	0	0	2	3
Globicephala macrorhynchus	Short-finned pilot whale	14	14	14	14
Stenella attenuata	Pantropical spotted dolphin	0	0	1	1
*Tursiops truncatu*s	Bottlenose dolphin	8	22	14	31
Total		25	40	36	55

Photo Project (Isabel Beasley and Jim Cotton)

Seven cetacean species were photographed this week. The best photographs were obtained from several very inquisitive blue whales, all of which frequently rolled on their sides and pirouetted, right in front of our ship's bow.

Species	Weekly		Total	
	Individuals	Schools	Individuals	Schools
Stenella attenuata (offshore)	-	-	-	1
Stenella longirostris (whitebelly)	-	-	-	6
Stenella longirostris (southwestern)	-	-	-	1
Stenella coeruleoalba	-	2	-	4
Delphinus delphis	-	1	-	6
Tursiops truncatus	-	6	-	9
Steno bredanensis	-	-	-	1
Lagenodelphis hosei	-	-	-	2
Peponocephala electra	-	-	-	1
Pseudorca crassidens	-	1	2	4
Globicephala macrorhynchus	9	8	11	16
Orcinus orca	-	-	5	1
Physeter macrocephalus	-	-	-	1
Balaenoptera edeni	2	2	5	6
Balaenoptera musculus	4	4	13	9
TOTAL	**15**	**24**	**36**	**68**

Seabird and Marine Debris (Michael Force and Sophie Webb)

This week began where last week left off: very slow with low diversity and abundance. Our daily species totals last week could be counted on one hand. However, as we slowly made our way eastward, diversity inched upward into double digits; our daily total on Tuesday peaked at an impressive 15 species. For those of you keeping track, our weekly species total was 24, pretty well average. During the second half of the week we were fortunate to pass within 150 nmi of the Galapagos, the source of several of our avian treats. There were a number of species this week that were new for STAR 2006: Waved Albatross, Galapagos (Audubon's) Shearwater,

Markham's Storm-Petrel, Nazca and Blue-footed Boobies, Parkinson's Petrel, Red-necked Phalarope, Barn Swallow and, always a crowd favourite, Swallow-tailed Gull. The piping whistles and chortling rattles of these gorgeous gulls created a surreal aural and visual backdrop for dipnetters during the evening stations—up to 25 birds at times wheeling and dipping down to the surface to feed on myctophids and other small fish attracted to the ship's lights. The Parkinson's Petrel put in a good showing, faithfully attending almost all of the pilot whales seen this week (their affinity for feeding with "blackfish" in the eastern tropical Pacific is well documented). The question, "Anybody see the animals?" was almost invariably answered with, "Just follow the Parkinson's Petrels!".

Yes indeed. Our faithful feathered friends. On the other hand, during a prolonged attempt to retrieve a biopsy dart filled with valuable blue whale tissue, a flock of Galapagos Storm-Petrels materialized out of thin air and began to feed on the sample! A Swallow-tailed Gull promptly arrived on the scene and joined in and crashed the free lunch. The mammal team could do nothing but watch and hope that there would be something left for analysis. Fortunately, the ravenous feathered fiends decided to leave some for science after all.

As for marine debris, there was hardly any. A couple of fishing floats and a 55 gallon drum. This part of the Pacific appears to be swept clear by the South Equatorial Current, depositing whatever junk there is on various islands and atolls off to the west.

We want to thank our Cruise Leader extraordinaire and Chief Scientist, Lisa Ballance, for all her enthusiastic support and dedication. And, of course, for bringing on board her celebrated good luck. Thank you Lisa!

Fish Sampled for Diet and Isotope Analysis

	Samples	
Species	Weekly	Total
Wahoo	-	1

Oceanographic Operations (Melinda Kelley)

This week sea surface temperatures fell to 22.5º C (72.5º F). As we moved southeast of the Galapagos, sea surface temperatures warmed a degree, and are currently holding steady at 23.6º C (74.5º F). The mixed layer has had an average depth of 30 m.

The cooler waters have allowed for diversity in our net tow samples. The manta tows continue to deliver wonderful specimens. We had the chance to enjoy and photograph a very large and beautiful blue button (*Porpita porpita*), 4.5 cm in diameter. Also found in the manta tow was a familiar purple gastropod *Janthina prolongata*, easily identified by its purple-colored shell and air bubble raft suspended at the surface. Our *Janthina* specimen had a shell about 3 cm in length, a large specimen. It seems that the dinner choice of *Janthina* is *Velella*, also found in the sample.

I would like to thank Ignacio, Maria, Kevin, and the bridge for their help during Leg 2. Evening operations were fun, exciting, and a breeze with your help.

CTD casts and XBT deployments were smooth as ever. We conducted the final CTD cast of Leg 2 on Wednesday evening. This was evident with observed celebration of the deck crew. XBT

casts continue to be dropped through Thursday evening.

Date	CTD	XBT	Bongo tow	Manta tow
21 Sept	2	2	1	0
22 Sept	2	3	1	1
23 Sept	2	3	1	1
24 Sept	2	3	1	1
25 Sept	2	3	1	1
26 Sept	2	3	1	1
27 Sept	2	3	1	1
28 Sept	0	5	1	1
Total	14	25	8	7

Squeakly Report (Shannon Rankin and Liz Zele)

This week's incredible squeakly report was brought to you by your friendly neighborhood mixed layer (shallow and well-mixed, thank you very much). With each day, this feature became more dramatic, and our detection distance bordered on the ridiculous, as our 48 detections of non-sighted dolphins will attest to. These detections are in addition to most (but not all) of the visual sightings. Along with increased detection of dolphins is an increased intensity of our received ship noise (Turbo Mac?), and we are grateful for the port call to rest our weary ears.

Our success finally (!) extended to the realm of the great beasts, as we deployed successful sonobuoys on every whale sighting (both Bryde's and blue). And-- here is the real kicker-- we heard whale calls on nearly every sonobuoy. In typical years, we have trouble juggling both the array and sonobuoys, and we may deploy sonobuoys on one of five whale sightings. This year we have had the good fortune of having a stock of good sonobuoys, and consistently competent help (great thanks to Liz and Ignacio).

Dippers' Doldrums (Jim Cotton)

It was a good week for collecting specimens as we cruised eastwardly a few degrees south of the equator in the South Equatorial Current. Numerous lantern fish were collected early in the week but as we approached the Galapagos Islands and within the range of the nocturnal feeding Swallow-tailed Gull we were out-competed by these skilled fishers; few fish made it past the gull barricade.

Two-winged flyingfish (*Exocoetus*) were commonly seen under our lights but seldom do we see more than five or six a night and often these are all juveniles. This Monday past was the exception when hundreds of adults showed up to challenge us to a game of tag, we tagged a few but they won the game. Final score; Dippers 5 : Fish 800.

The new species for this week's collection was the Banded flyingfish (*Hirundichthys marginatus*). Once again short-wing flyingfish were few in numbers but we managed to net nine specimens. Other flyingfish collected this week were: Blackspot flyingfish (*Cheilopogon dorsomacula*), Whitetip flyingfish (*C. xenopterus*), Two-wing flyingfish (*Exocoetus volitans*) and Barbel flyingfish (*E. monocirrhus*).

Lemon squids and Humboldt squids were seen at all the stations except for the last two nights, where a single large Humboldt squid was hauled onto the deck with a flyingfish that it had bitten in half.

Non flyingfish recorded this week include; Snake mackerel, Mahi-Mahi, and a large bait ball of several hundred Bullet tuna (*Auxis* sp.).

Thank you Howie, Isabel and Sophie for making this another successful dipping leg and kudos to Isabel for giving up sleep to do the predawn stations!