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

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Science Summary: 19-25 October 2006

As you may recall, last week your intrepid explorers were being swept into a vast whirlpool while they wrestled with a giant squid for control of the helm. No, just kidding. Last week we were doing science, and this week it is more of the same. Although seeing sheets of flying fish rise from the water and watching blue whales glide through green waters may beat the view from your office or home, at times out here, the science we do seems only remotely related to any conservation goals. Although there is no doubt that solid, objective science is the best friend that true conservation ever had, that benefit is intangible on a day-to-day basis. Once in a great while we have an opportunity to make a small contribution of great tangible benefit. This week we encountered and released two turtles that were hopelessly entangled in a section of fishing line (see our TAG Team report, below). These olive ridleys were far offshore of their normal haunts, and they have probably been drifting helpless for some time. One can only wonder what was going on in their reptilian minds. What comprehension did they have of the plastic that bound them. Were they considering their fate? It is hard not to anthropomorphize, but they seemed pretty excited about being released. We all felt warmed to know that these two would not meet their doom by slow starvation. We made a difference, however small. Thanks to everyone involved.

The most noteworthy physical and biological feature we crossed this week is the Costa Rica Dome. We found the western edge of the Dome on Saturday. This feature is caused by the upwelling of nutrient-rich deep water over a broad region. This causes a "bump" in the depth of the thermocline – that rapid transition from warm surface waters to cool deep waters rises from 50 m or more to less than 15 m. The water color changed from the deep blue of tropical pelagic waters to a distinct green due to the enhanced phytoplankton growth. The marine mammal fauna changed from striped dolphins and pilot whales to common dolphins and blue whales. Work by John Calambokidis, Bruce Mate, and Kate Stafford has shown that, in winter, the blue whales of the Costa Rica Dome are predominately (or possibly entirely) Northern Hemisphere animals. Hopefully one of the pictures we took will help determine who is there in Fall.

We launched three ARGO[1] buoys this week. Ok, so we don't know what ARGO stands for. But Scripps Institution of Oceanography gave us these really neat SOLO buoys and we put them in the water. Mindy tells me that they are programmed to fall through the water to a pre-programmed depth (actually a particular density of water, which increases with depth). They measure temperature and salinity on their round trip to the abyss, and they phone home with the information they've collected when they return to the surface.

[1] ARGO - Association of Retired Gorillas and Orangutans per D.S.

John Gilson at Scripps tells us that he's gotten good information from all three. We have one more to go.

TAG Team Report (Yin, Howie Goldstein, Mindy Kelley & Kruger Loor).

After the initial spotting by the flying bridge crew, the Turtle And Gear team (aka the 'TAG' team) set off in the RHIB to rescue two entangled olive ridley turtles. With excellent boat handling by coxswain Dave Hermanson, we discovered that both turtles had multiple wraps of line around the neck and flippers. The tangled mess consisted of several different types of line, a hook, and an onion sack with a plastic motor oil bottle. After approximately 10 minutes of cutting, we were able to free the larger turtle and release it into the ocean. The smaller turtle took a bit more time, as it had significantly more wraps around the neck. This smaller animal had had a close call with trouble before, as it was missing its entire right flipper, though the wound was completely healed. We took a small bit of skin for a genetic sample and sent the turtle on its way unharmed. An unexpected bonus of the mission, besides releasing the two turtles, was bringing back a few small crabs and two remoras, which are now residing in the onboard ship's aquarium.

Sightings and Effort Summary for Marine Mammals

DATE	Start Stop Time	Position	Total Distance	Average Beaufort
101906	0557	N03:12.79 W092:46.51	98.1 nmi	5.7
	1755	N04:44.10 W093:34.77		
102006	0608	N05:47.55 W094:10.31	74.9 nmi	4.9
	1753	N07:11.96 W094:59.43		
102106	0604	N08:18.00 W095:37.96	46.8 nmi	4.0
	1734	N09:36.87 W096:28.04		
102206	0622	N08:42.23 W097:06.23	67.1 nmi	4.3
	1728	N07:43.61 W097:51.81		
102306	0617	N06:50.98 W098:30.66	84.0 nmi	4.8
	1740	N05:33.61 W099:23.01		
102406	0631	N04:38.85 W100:32.42	103.4 nmi	4.7
	1829	N03:58.97 W102:11.74		
102506	0635	N03:11.99 W103:24.36	111.3 nmi	4.0
	1818	N02:16.85 W105:06.65		

CODE	SPECIES	TOT#
002	Stenella attenuata (offshore)	4
003	Stenella longirostris (unid. Subsp.)	1
013	Stenella coeruleoalba	6
017	Delphinus delphis	3
018	Tursiops truncatus	1
021	Grampus griseus	1
033	Pseudorca crassidens	1
034	Globicephala sp.	1
036	Globicephala macrorhynchus	4
049	ziphiid whale	1
061	Ziphius cavirostris	1
075	Balaenoptera musculus	2
077	unid. dolphin	1
078	unid. small whale	1
079	unid. large whale	2
099	Balaenoptera borealis/edeni	2
101	Stenella longirostris (southwestern)	1
177	unid. small delphinid	6
277	unid. medium delphinid	1
377	unid. large delphinid	1
	TOTAL	41

Biopsies (Suzanne Yin and Erin LaBrecque)

Species	Common Name	Weekly		Total	
		Samples	Takes	Samples	Takes
Balaenoptera edeni	Bryde's whale			1	1
Balaenoptera musculus	Blue whale			9	10
Delphinus delphis	Short-beaked common dolphin			2	3
G. macrorhyncus	Short-finned pilot whale			18	21
Pseudorca crassidens	False killer whale			3	5
Stenella attenuata	Pantropical spotted dolphin			1	1
Tursiops truncatus	Bottlenose dolphin	3	5	23	46
Total		3	5	57	87

Photo Project (Isabel Beasley and Jim Cotton)

Another slow week for photography, however, the good ol' reliable blue whales featured again for the fifth week running.

Species Code	Species	This week	Total
002	*Stenella attenuata* (offshore)		2
011	*Stenella longirostris* (whitebelly)		6
101	*Stenella longirostris* (southwestern)		3
013	*Stenella coeruleoalba*	3	10
015	*Steno bredanensis*		1
017	*Delphinus delphis*	1	10
018	*Tursiops truncates*		13
021	*Grampus griseus*		1
026	*Lagenodelphis hosei*		2
031	*Peponocephala electra*		1
033	*Pseudorca crassidens*		5*
036	*Globicephala macrorhynchus*		25*
037	*Orcinus orca*		4*
046	*Physeter macrocephalus*		3
072	*Balaenoptera edeni*		8*
075	*Balaenoptera musculus*	2	17*
076	*Megaptera novaeangliae*		1
TOTAL		**6**	**112**

* Individual whales photographed

Seabird and Marine Debris (Michael Force and Sophie Webb)

We can't go on living a life of riches forever, especially in a pelagic ecosystem characterized by patchy resource distribution. After last week's record-setting pace, this week seemed pedestrian in comparison. Twenty-eight species flapped and swam past our observation station on the McArthur II's flying bridge, eight less than last week. However, our daily average of 14 species was the same. Nevertheless, we have a few highlights to pass on to our faithful readers. Our first Nearctic boreal migrant, a juvenile Great Blue Heron, briefly visited the ship during a heavy rain squall about 500 NM north-northwest of the Galapagos. After flying around the ship several times, satisfied that there weren't any suitable sand bars, it quietly slipped behind the rain curtain and vanished. An adult Elegant Tern seemed out of place about 350 NM north-northwest of the Galapagos. This Middle American cousin of the familiar Caspian and Royal Terns normally has a more coastal distribution.

We are getting close to the ETP core study area, marked by the arrival of a flock of ship-following Red-footed Boobies. The observers on the flying bridge had to endure the fecal rain as 35-40 boobies rode the bow-generated wind currents in their search for flying fish flushed by the ship. Of course, the wind is in our faces; the net result of this combination is obvious. Fortunately, the arrival of a party-pooper, a South Polar Skua, scattered the boobies in all directions, providing a brief reprieve. If only we could summon a skua on command when things get messy!

Marine debris was hard to come by this week, although this will certainly change as we approach the mainland. We only saw a single plastic bottle, used as a fishing float. This and the associated line was enough to ensnare two unfortunate Olive Ridley Sea Turtles (see our TAG team report of a successful release).

Oceanographic Operations (Melinda Kelley)

Date Range	Day	CTD	XBT	Bongo	Manta
Leg 3 10/19 to 10/25	Thursday	2	3	1	1
	Friday	2	3	1	1
	Saturday	2	3	1	1
	Sunday	2	3	1	1
	Monday	2	3	1	1
	Tuesday	2	3	1	1
	Wednesday	2	3	1	1

This week the sea surface temperature and thermocline depth has fluctuated quite a bit. To start out the week, we headed northwest and away from the equator. We observed an average thermocline depth of 49 meters, and average sea surface temperature of 27.40^{o} Celsius. As we continued into the second and third day of the week, we watched the thermocline depth come up to a shallow 16 meters with sea surface temperatures at 26.5^{o} Celsius. This shallow thermocline depth was observed around 9 degrees north and 96 degrees west. The remaining days of the week have directed us southeast where we have observed thermocline depths of 60 - 70 meters while sea surface temperatures average 27^{o} Celsius.
There also has been variability with chlorophyll and net tow samples throughout the week. As we found ourselves close to the Costa Rica Dome, we noticed an increase in chlorophyll readings, and more abundant net tow samples. The increase in chlorophyll and net tow samples coincides with the shallow thermocline depths.

Net Tows and Squid Report
Danna Shulman
10/26/06

This week brought another day of remarkable squid abundance, this time not in the form of carcasses strewn across the deck, but in a full cod end. On Sunday night, when we towed our nets near the Costa Rica Dome, the bongo net cod ends were filled as I had never seen them before. As I sorted the port end I extracted no less (or more) than forty-eight individual squid.

Forty of these looked to be very recent hatchlings, and as the Costa Rica Dome is a putative spawning area for *Dosidicus*, it is highly likely that they are indeed of that species. The final DNA analysis will have to wait until I (and the specimens) are back in the lab.

But other squid catches have been meager indeed this week. We've only jigged a couple of *Sthenoteuthis* and one *Dosidicus*. ("We" includes our heroic cruise leader Jay, who turns out to be an excellent hand with a jig.) The dippers got two juveniles (not identifiable to species).

Squeakly Report (Shannon Rankin and Liz Zele)

My initial reflection on the week was that this was a slow week; Liz even managed to go an entire shift without a peep or squeak! There were only two sonobuoys the entire week! Then I looked at the numbers. In total, acoustics detected 74 cetacean groups, of which 18 were sighted by the visual team. We averaged over 12 acoustic detections per day, and yet there were 9 visual sightings that were silent. One of our goals is to use passive acoustics as a tool to determine if the visual detection methods accurately account for animals missed within the effort area. Why the great discrepancy? Why did so many dolphins go undetected by the visual team this week? Are there species for which passive acoustics may be necessary in order to obtain reasonable abundance estimates?

It is all rather intriguing, and frustrating, for all involved. Except maybe the dolphins. Based on an abundance of anecdotal evidence, I would like to share my personal and professional observations. I think that dolphins congregate in areas such as the trade winds and the squalls of the Inter-tropical Convergence Zone, in order to maximize frustration to the visual observation team. Ask your local observer: how frequently have you noted that cetaceans will run towards the nearest squall? I can verify that many of the "missed" dolphin schools were hiding within the aforementioned squalls. In fact, I think I have detected a unique vocalization attributed to this behavioral phenomenon, a vocalization disturbingly similar to a mocking laugh. Future plans include quantification of these anecdotal observations, with consideration of possible plots towards revenge.

Dippers' Doldrums (Jim Cotton)

The downstream influences of the highly productive Costa Rican Dome water was unmistakable at one evening station where the dipping team bagged a whopping 12 specimens of the four winged variety of flyingfish, the highest one night take of the leg so far. In this same greenish, chlorophyll-laden water mass, several two winged flyingfish, lantern fish and short winged flyingfish were also collected.

The remaining dipping stations were typical of this leg with clear blue water, windy conditions and pushing against a one to two knot current; on a good night, two or three fliers were added to the collection.

Halobates and the purple back squid were present at all stations but few in number. Other notable sightings this week was a single snake mackerel, and a 39 inch Mahi-Mahi. Thanks to the fishing prowess of Les Cruise the Mahi made its way to the table for all to enjoy.

Isabel continues to dote over our two aquarium residences which are competing for food; so far the pilot fish is winning the food race and will soon overtake the puffer fish in size.

This week's net totals:
23 Four wing flyingfish
12 Two wing flyingfish
26 Short wing flyingfish
15 Lantern fish

Fish Sampled for Diet and Isotope Analysis

	Samples	
Species	Weekly	Total
Mahi mahi	2	3
Wahoo	-	1