ORCAWALE 2008: Weekly Report

Report Dates: 2 -15 Nov 2008 Chief Scientist: *Jay Barlow* Leg 5 Cruise Leader: *Lisa T. Ballance*

Weekly Science Summary
Lisa T. Ballance

Sailing under the Golden Gate Bridge on a beautiful afternoon, Leg 5 begins.

We are now in the last few weeks of this 4 month-long project. Having sailed from San Francisco on November 6, re-provisioned, re-fueled, and (temporarily) refreshed, we are now in the far southwest reaches of the study area, some 750 km to the west by southwest of San Diego. In November, it is steely gray out here – in both sea and sky – and often storm-tossed. Of the past 9 days at sea, 5 have brought winds of 20+ knots and 4 unworkable conditions for marine mammal visual and acoustic survey (although very little keeps the bird scientists, the oceanographers, and the mid-water trawl researchers down). For many days, the wind screams around the ship, a challenge to communication, thermoregulation, and concentration, for anyone working outside. It is particularly striking during these conditions, even to those of us who have sailed out here for years, that so many kinds of animals are completely at home in this wildest of worlds. A *Cyclothone* (the most abundant vertebrate on the planet, Pete Davison tells me, and the stuff of "Aliens" if it were any larger than its tiny inch at most) pulled from hundreds of meters below us by the Issacs-Kidd midwater trawl is a good example but for me the point is brought home one night during a casual back deck weather check. There, sitting outside the door, is a sparrow-sized Leach's Storm Petrel – perhaps the most abundant seabird out here. Although its ancestors were purely terrestrial, this species is now so well adapted to the ocean that it is unable to walk on land and this bird has blundered onto our ship, blinded by the unfamiliar light and now, unable to take off on its own. On the bow and in the black darkness and cold (for me), it takes a minute, maybe two, before it spreads its wings and leaves my open hand, once more in its element, and below a dolphin exhales, then takes a deep breath before it submerges into the water swimming around our bow.

Our progress in the California Current this leg. The ship's location on 15 November is indicated by the red dot. The confused-looking tracks in the center are the result of our search for better weather.

<u>Of note:</u> Survey Technician Lacey O'Neal is back after a lengthy and noticeable absence (nice to have you with us again Lacey). Pete Davison returns for one more leg of research on his Ph.D. and Shannon

Rankin replaces Tina Yak as the lead acoustician (Shannon has spent so much time on the *McArthur II* that it is her second home). New scientists making their ORCAWALE debut include Lilian Carswell (although a veteran of PRD cruises past) and Nicky Beaulieu (a multi-year intern with the molecular genetics lab on land getting her feet wet in the field for the first time).

Marine Mammal Effort Summary.

Date	Start time Stop time	Start location Stop location		Distance surveyed (nm)	Average Beaufort
6 Nov	1327	37 39.11 N	122 43.43 W	24.4	3.3
	1653	37 12.08 N	123 02.81 W		
7 Nov	0824	35 25.29 N	125 23.82 W	78.9	3.9
	1714	35 46.68 N	127 02.01 W		
8 Nov	0847	35 27.86 N	127 02.37 W	72.6	4.6
	1715	34 15.33 N	126 59.78 W		
9 Nov	0739	33 57.17 N	125 51.77 W	0.8	6.0
	0743	33 56.36 N	125 51.74 W		
10 Nov	0651	32 59.20 N	124 33.40 W	84.7	4.7
	1700	31 29.40 N	125 02.54 W		
11 Nov	0650	32 16.38 N	124 48.64 W	88.3	5.2
	1635	32 46.96 N	126 12.62 W		
12 Nov	0703	33 58.52 N	125 52.00 W	71.7	5.3
	1706	32 39.43 N	126 19.56 W		
13 Nov	1040	31 40.95 N	124 49.99 W	36.6	5.5
	1440	31 08.13 N	124 25.65 W		
14 Nov	0652	30 37.52 N	124 07.41 W	44.3	5.1
	1705	31 46.00 N	123 17.75 W		
15 Nov	0648	31 55.05 N	123 15.56 W	23.0	2.0
	1705	32 16.54 N	124 48.39 W		

Marine Mammal Sighting Summary.

Code	Species	Common name	No. sightings
013	*Stenella coeruleoalba*	Striped dolphin	1
017	*Delphinus delphis*	Short-beaked common dolphin	15
021	*Grampus griseus*	Risso's dolphin	1
046	*Physeter macrocephalus*	Sperm whale	2
061	*Ziphius cavirostris*	Cuvier's beaked whale	1
070	*Balaeonoptera sp.*	Unidentified rorqual	2
071	*Balaenoptera acutorostrata*	Minke whale	1
075	*Balaenoptera musculus*	Blue whale	2
076	*Megaptera novaeahngliae*	Humpback whale	3
177		Unidentified small delphinid	1
		TOTAL	**29**

Cetacean Biopsy Report
Suzanne Yin, Allan Ligon, and Rich Pagen

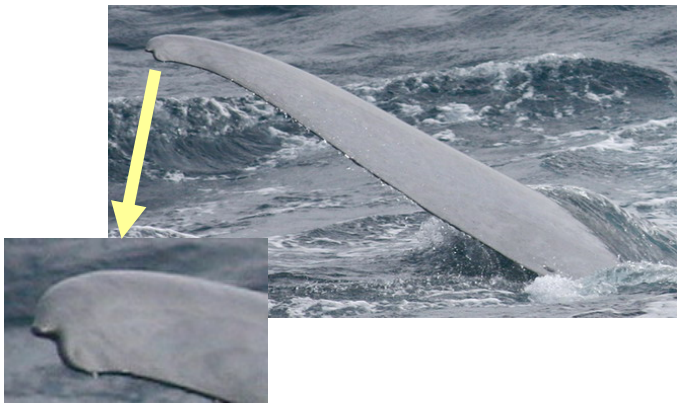
Species	Common name	No. weekly samples	No. weekly takes	Total samples	Total takes
Balaenoptera physalus	Fin whale	0	0	25	37
Berardius bairdii	Baird's beaked whale	0	0	1	1
Delphinus capensis	Long-beaked common dolphin	0	0	19	37
Delphinus delphis	Short-beaked common dolphin	10	24	125	313
Delphinus sp.	Unidentified common dolphin	0	0	3	4
Globicephala macrorhynchus	Short-finned pilot whale	0	0	4	5
Lagenorhynchus obliquidens	Pacific white-sided dolphin	0	0	25	49
Lissodelphis borealis	Northern right whale dolphin	0	0	12	25
Orcinus orca	Killer whale	0	0	2	9
Grand Total		**10**	**24**	**216**	**480**

Photo Report
Jim Cotton and Chris Cutler

A single blue whale ID, along with 20 short-beaked common dolphin IDs, were collected photographically. The lone blue whale had a peculiar dorsal fin: it appeared normal from the right side yet the fin was significantly canted to the side when viewed from the left, as if it had been bent-over congenitally.

This blue whale never showed us its flukes in their entirety, yet it did give us a glimpse. The notch at the far left corner of the fluke (below), combined with the dorsal fin photos, should allow us to identify this individual and hopefully shed some light on its movements.

Blue whale right and left sides.



Left fluke-tip notch – a distinctive feature of this individual.

Blue whale blowholes!

Photography Summary.

Common Name	Weekly Totals		Cruise Totals	
	Sightings Photographed	Individual IDs	Sightings Photographed	Individual IDs
Pacific white-sided dolphin	0	0	14	69
Northern right whale dolphin	0	0	9	6
Short-beaked common dolphin	4	19	54	230
Long-beaked common dolphin	0	0	8	43
Bottlenose dolphin	0	0	1	1
Striped dolphin	0	0	4	4
Dall's Porpoise	0	0	1	0
Risso's Dolphin	0	0	2	21
Sperm Whale	0	0	1	2
Baird's beaked whale	0	0	3	12
Sei whale	0	0	3	9
Fin whale	0	0	41	83
Blue whale	1	1	19	28
Humpback whale	0	0	16	21
Killer whale	0	0	4	37
Cuvier's beaked whale	0	0	1	1
Pilot whale	0	0	1	39
Total	**5**	**20**	**286**	**639**

Seabirds

Michael Force and Sophie Webb

No need to keep our faithful readers in suspense any longer than necessary. With that in mind, we will lead off our report with the highlight bird of the week—European Starling—three of them! Yes, one might say it was a fairly slow week. Often disparagingly referred to as the "flying rat" for their ubiquitousness and successful adaptation to human created environments and the resultant easy access to garbage and fast food outlets, their appearance at sea was unexpected. Due to a variety of reasons, we have never before seen them out here. One of our colleagues on shore, Peter Pyle, regaled us of stories where large flocks are seen at this time of year flying out to the Farallon Islands, off San Francisco, and returning to the mainland in the evening. It doesn't seem too preposterous to assume that a few become lost and wander the watery void of the eastern Pacific Ocean in search of the nearest dumpster.

In terms of diversity and abundance, this was our slowest week of the entire cruise. Our daily average of seven species is a tie for last place set in mid-August off Oregon, and some days we were hard-pressed to find even 30 birds. Nevertheless, our weekly total of 25 species hides some gems such as Mottled and Cook's Petrels and a single Laysan Albatross. Once we sailed westward away from the California Current, we found Mottled Petrels every day; on 14 November it was the commonest bird. Almost all of them were heading south or south by southwest to their nesting islands around New Zealand from their wintering quarters in the Gulf of Alaska. Interesting was the appearance of migrating Brant, a medium-sized Arctic-nesting goose. In just a couple of hours on 8 November, about 250 NM west of the Big Sur coast, we saw six flocks, totaling 265 birds, all heading southeasterly, presumably to their wintering quarters on the Pacific coast of Baja California. The Alaskan population is known to migrate across the Gulf of Alaska, but these birds were thought to be slightly farther west then expected. One species definitely not expected was a Chipping Sparrow that appeared out of nowhere and briefly landed on the arm of the startled on-duty seabird observer.

A view of what we saw this week. Photo: Sophie Webb.

Acoustics Squeakly Report

Shannon Rankin and Nicky Beaulieu

For a change of pace, I would like to introduce the reader to some of the most common sounds we encounter at sea - noise. Noise comes in all shapes and sizes, and one could argue that recognizing noise sources is as important as recognizing biological sounds. It is no surprise that the most common noise we encounter is the noise produced by the ship, and it is the simplest check that we have to make sure our equipment is functioning correctly. In addition, we are constantly inundated with wave noise, echosounders. electrical noise-- the list is never-ending.

There is a wide variety of echosounding equipment on board the *McArthur II*. The audible 12 kHz depth sounder is used by the bridge to determine bottom depth, while the 38 kHz 'pinger' is used by the oceanographers as a fishfinder. The reflected sound from these pingers provides information about the reflecting object-- be it the seafloor or the fish of the deep-scattering layer. Our automated detection programs dutifully identify them as "Unidentified Species".

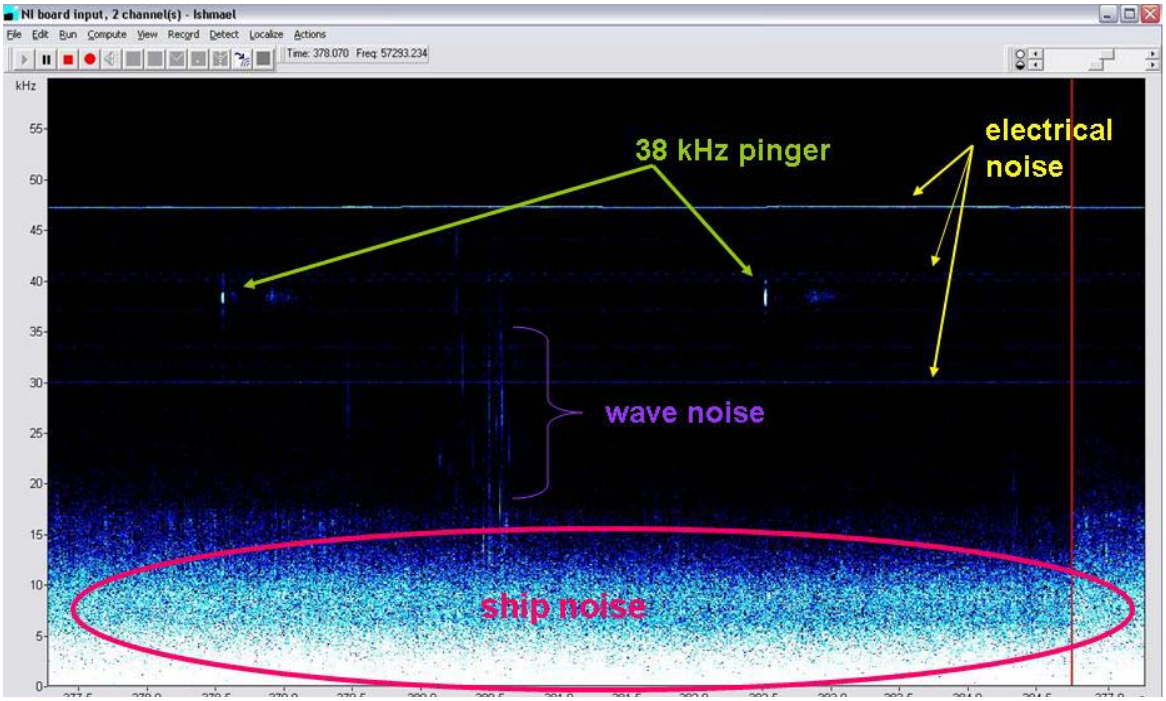
We are also continually 'hearing' clues about our environment. Increasing sea state increases the wave noise, and the rain can create so much noise that we are unable to hear even the *McArthur*! Noise increases dramatically in shallow waters, as the sounds of the ship are reflected from the bottom. We can always detect the presence of a submarine canyon-- the sounds bounce off the canyon walls and sounds are warped and twisted (imagine a metallic dolphin whistle).

Possibly the most frustrating of noise is the myriad of electrical noise that inundates our system. The fluorescent lights, ships' power, USB converters-- all of these devices produce noise that may appear as tonal or pulsed sounds at a particular frequency. The first days of this leg included a battle with electronics to find the culprit of a 163 kHz pulsed sound that masqueraded as porpoise echolocation.

Invariably, if you tow something behind a ship, it is bound to get caught up on something on occasion. These 'stowaways' also produce noise that can be heard on the hydrophones. The familiar 'whooshing' sound of the copper wire from an XBT brushing against the array is music to my ears (although the oceanographers have different opinions on this matter). Biopsy string, as we recently learned, produces a whistling sound not unlike wind through the rigging.

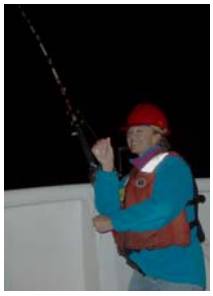
Despite all the buzzing and pinging and grinding in our ears-- there are those rare days where all is silent. It is peaceful, relaxing, and almost too good to be true. Unfortunately, this peace never lasts long, and eventually you are caught and must plug in the hydrophones (thanks, Hermie!).

In addition to these sounds, we heard three sperm whales, 10 common dolphins, 1 mixed common and striped dolphin school, 27 unidentified cetaceans (clickers), and 22 unidentified dolphins (whistlers).



Squid Jigging Efforts

Jim Cotton, with help from Sophie Webb, Rich Pagen, Allan Ligon, Suzanne Yin, Chris Cutler, and Nicky Beaulieu



A Cruise Leader's job is never done.

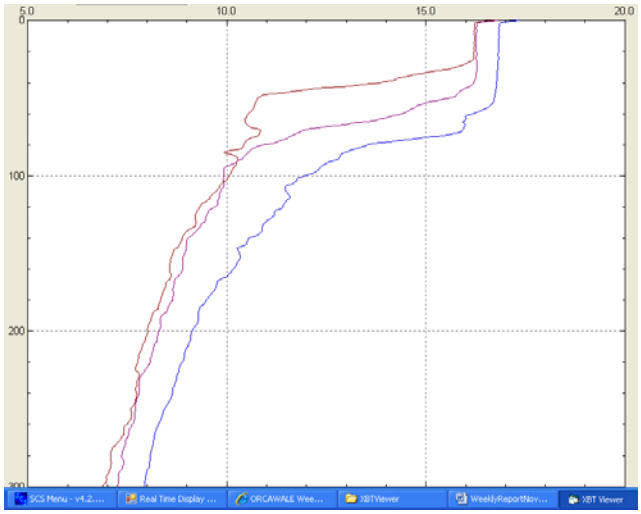
DATE	POSITION		SQUID WEIGHT (lbs)
11/07/2008	35:46N	126:56W	none caught
11/08/2008	34:15N	127:00W	none caught
11/09/2008	32:52N	125:07W	none caught
11/10/2008	31:29N	125:04W	none caught
11/11/2008	32:52N	126:11W	none caught
11/12/2008	32:36N	126:08W	none caught
11/13/2008	30:51N	124:13W	none caught
11/14/2008	31:54N	123:14W	none caught
11/15/2008	32:17N	124:49W	none caught!

Oceanography

Ryan Driscoll and Justin Garver

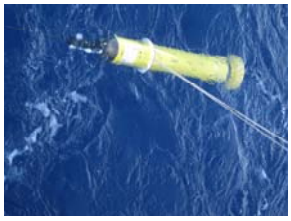
During the first week of leg 5, team Oceo has completed the final two XBT Paloozas of the 2008 ORCAWALE cruise. We dropped 18 XBTs during two exciting days. With the temperature profiles that the XBTs provide, we are able to get a detailed look at various layers occurring within the water column. One aspect of the profile that is particularly interesting to watch is the changes that occur with the thermocline depth.

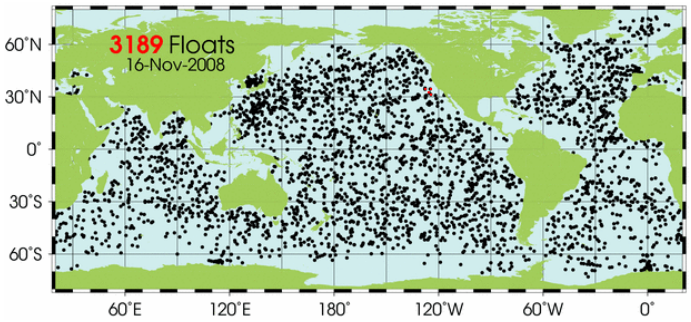
The thermocline is a thin layer within the water column where temperature changes rapidly with depth. The thermocline separates the upper region called the mixed layer from the lower region which is calmer deep water. There are three primary factors that affect the mixed layer. These are wind, surface waves or swells, as well as heating and cooling of the sea surface leading to evaporation or freezing. All of these factors contribute to adjusting the thermocline to various depths. The temperature profiles of the water column can vary dramatically within a very small area. This is well illustrated by the three temperature profiles pictured below.



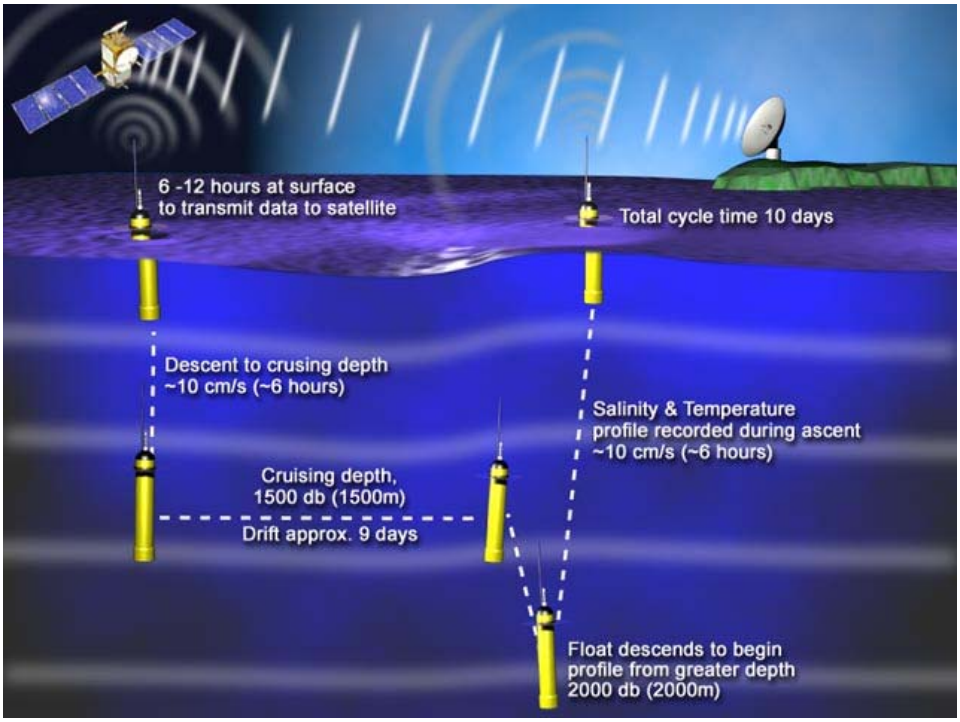
This week we launched the last of our two ARGO floats. So, we'll take a look at these amazing instruments and the larger program they are tied to. In recent years, remote sampling technology has allowed researchers to measure various parameters from vast swaths of the planet providing an unprecedented level of coverage. We can now obtain temperature, sea surface chlorophyll, wave heights and more from almost anywhere on the planet. One of these satellites called Jason-1 which will be replaced by Jason-2, launched in June of this year, measures the relative height of the oceans surface. Positioning stations around the globe find out exactly where the satellite is and microwaves record the distance between it and the ocean's surface relative to the seafloor every 10 days. This gives us what is called Ocean Surface Topography, that is the shape of the ocean which is actually NOT a sphere nor is it an ellipse. One main factor accounting for the ocean's varying height is that it is a massive sink for solar energy. As water warms it swells giving areas of high and low heights much like high and low pressure systems one sees in weather reports. This heat is transported throughout the oceans as currents flowing from areas of high to low "pressure." However Jason-1 can not tell us what goes on beneath the surface. That is a job for his ARGOnauts.

As you may have guessed by now, the ARGO program is named for Jason and the Argonauts who sailed aboard the Argo in search of the Golden Fleece. We are searching for density layers in the ocean. Not as glamorous as Jason's quest but in many respects, far more ambitious and daunting a task. ARGO floats compliment the JASON satellite by continually moving up and down the water column measuring temperature and salinity while drifting with the ocean's currents. We can now know the high and low "pressure" systems in the oceans from JASON then use the ARGOs to find out what density layers comprise those areas and map their drift. The ARGO floats are deployed worldwide with the goal of one float every three degrees. The program reached its goal of 3,000 floats last year. 23 countries participate in the ARGO program and the US is responsible for about 50% of the total deployments. I think even Jason would be impressed.





The floats work by using small changes in their buoyancy to slowly rise and fall through the water column. A small piston powered by a stack of D-cell batteries pushes about 1 cup of oil in to a small bladder on the bottom of the float. Because oil is more buoyant than water, the ARGO begins to float upward. The change is so slight that the entire 60lb unit is calibrated to 4 grams and the trip takes the better part of a day! When it reaches the surface an air pump fills another bladder just enough to keep the antennae out of the water where it can transmit its location and data home. An Argo float is designed to continuously sink to 2000meters and back for 5 years. For more information check out http://floats.pmel.noaa.gov.



This week, by the numbers.

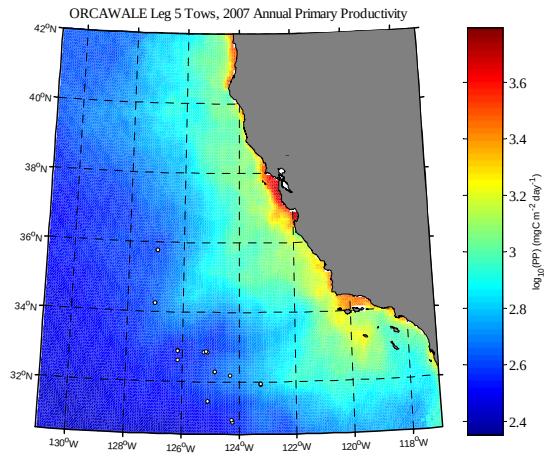
Day	CTD	XBT	Surface chlorophylls	Bongo Tows	HAB
11/06/2008	0	0	0	0	0
11/07/2008	0	3	3	0	18
11/08/2008	2	4	4	1	31
11/09/2008	1	1	1	1	6
11/10/2008	0	4	4	0	24
11/11/2008	1	9	4	1	31
11/12/2008	1	9	3	1	25
11/13/2008	1	1	0	1	0
11/14/2008	1	3	3	1	19
11/15/2008	1	3	3	1	25
Weekly Total	**8**	**37**	**25**	**7**	**179**
Grand Total	**82**	**334**	**294**	**71**	**1873**

Midwater Trawling Weekly Report

IKMT Leader: Pete Davison; IKMT Assistant: Lilian Carswell, Allan Ligon, James Cotton

This week marks the beginning of the last leg of the cruise. I would like to welcome the new IKMT assistant Lilian Carswell, who has quickly become indispensable. We have performed 20 Isaacs-Kidd Midwater Trawl (IKMT) tows this week, and 175 to date.

The first week of Leg 5 was spent far offshore in oligotrophic (nutrient-poor) water. In the California Current, nutrients are present in greater amounts in the colder surface water close to shore. This water has recently upwelled from the deep by the action of winds blowing south along the coast. These winds also push the warmer, nutrient-depleted surface water offshore to the west. The nutrients in upwelling regions support blooms of phytoplankton. Primary productivity is a measure of the rate of growth of phytoplankton. The phytoplankton is consumed by zooplankton, which is



Annual primary productivity. On the log scale, the difference between 2.6 and 2.9 is a factor of two. The location of our trawls are indicated by the red dots in the deep blue region.

in turn eaten by mesopelagic fish. Changes in the pattern of food availability delineate pelagic habitat changes, and are reflected in the communities of

animals that live there. This past week, we have been catching different species of animals with the IKMT that reflect the new habitat that we are sampling. The amount of available food also determines the quantity of animals that can be supported in the habitat. We have been collecting very small volumes of zooplankton and fish this week that correspond to the low productivity of the habitat we are sampling.

A selection of the animals captured in our IKMT this week, clockwise from upper left: A) Dozens of larval dragonfish (Idiacanthus antrostomus) have been captured in each net tow this week. The stalked eyes have better binocular vision and enable the larval fish to search a greater volume of water for prey than unstalked eyes would. B) A mesopelagic shrimp that we have not seen close to shore. C) This dragonfish, Bathophilus flemingi, has an impressively long chin barbel. The tip is luminescent, and the dragonfish uses it to lure prey closer. D) Spines on the carapace of crustaceans can deter predation by making the animal harder to eat. E) This myctophid (Hygophum proximum) is not commonly found close to shore. F) Halobates sp. is the only oceanic insect. It "walks" on the surface of the water with its hydrophobic legs and lays its eggs on floating debris. G) Melanonus zugmayeri, a pelagic codlet. F) This loosescale (Melamphaes sp.) has small eyes but a well-developed sensory canal and pore system on its head that can detect movement in the water around the fish.