ORCAWALE 2008: Weekly Report

Report Dates: 31 August – 6 September 2008 Chief Scientist: *Jay Barlow* Leg 2 Cruise Leader: *Jeremy Rusin*

Weekly Science Summary
Jeremy Rusin

BREAKING NEWS – Acoustician, Tina Yack, a cribbage neophyte, won the ORCAWALE Leg 1-2 Cribbage Tournament. Congratulations Tina! The oversized gift certificate to the ship's store is in the mail!!!

If you've been following the ongoing trials and tribulations of ORCAWALE 2008 you will remember in our last weekly installment we noted the fair weather and seas during the first week of Leg 2. Cruise Leader Lesson #17: don't comment the wonderful weather! Having played baseball, I am fully aware of the consequences associated with commenting on a potential no-hitter. Like the weather out here, everyone recognizes it, but that is enough; the appreciation of these phenomena should remain unspoken. In baseball, this type of gaffe inevitably leads to the next batter getting a hit, and with the crack of a bat and the blink of an eye a rare and special event is over.

Like in baseball, when things are going your way at sea, you look for little superstitions to continue so as not to break your streak of good luck – not speaking of it, not shaving, wearing your lucky hat, not changing your socks, and the list goes on. So, when the weather turns more favorable again you can bet I'm going to be keeping some important things the same. That is, until the very things that had been bringing good luck eventually are faulted for brining us bad luck. It's a vicious, but inevitable cycle.

The weather during much of the past week has been challenging, mostly as a result of high wind and swell. However, our team persevered, surveying and conducting other sampling in some pretty uncomfortable conditions. The dedication and tenacity of this group is evident in their commitment to staying on watch on the flying bridge under these conditions and their enthusiasm for sampling whenever it is permitted. In some cases, scientists have been known to wake up at 3:00 am to check to see if the winds have come down into a workable range. It's truly a pleasure to work with such devoted scientists.

To avoid an extended period of unworkable conditions, we temporarily abandoned tracklines off southern Oregon and northern California and transited to work two days off the placid Central

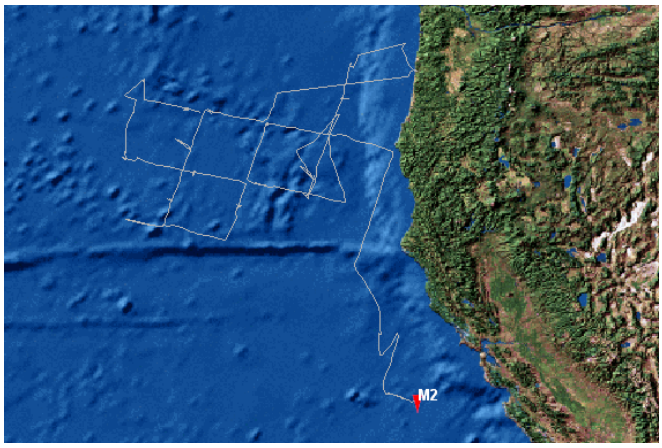

Figure 1ORCAWALE-08 Transect lines to date show near completion of surveys off Oregon before transiting to Central California (note rooster tails behind ship, M2).

California coast at the southern boundary of this leg's scheduled transect lines. This "cut and run" strategy, while sometimes frowned upon, was successful in providing good working conditions and welcome progress toward eventually completing our survey grid.

Although we endured unfavorable conditions much of the week, we found ways to stay productive and busy, and we were rewarded with a number of marine mammal and sea bird sightings, 38 biopsy samples, 59 acoustic encounters, 46 landed jumbo squid, and other accomplishments outlined below.

A Cruise Leader's work is never done

Marine Mammal Effort Summary.

Date	Start time Stop time	Start location Stop location	Distance surveyed (nm)	Average Beaufort
083108	1002 1846	N43:03.47W126:08.15 N41:40.80W126:34.33	112.7	5.5
090108	0703 1154	N41:39.88W126:37.77 N41:28.03W125:46.07	40.5	5.1
090208	0703 1545	N43:04.56W126:06.80 N42:42.27W124:35.91	62.1	4.9
090308	0913 1200	N39:54.25W125:32.20 N39:30.22W125:16.24	25.6	6.2
090408	0707 1940	N38:12.00W124:29.20 N36:45.49W124:23.14	99.3	4.0
090508	0701 1736	N36:44.11W124:22.40 N36:31.26W123:23.71	49.3	3.1
090608	0657 1857	N38:14.65W124:28.45 N39:34.57W124:00.09	79.5	3.0

Marine Mammal Sighting Summary.

Code	Species	Common name	No. sightings
017	*Delphinus delphis*	Long-beaked common dolphin	11
022	*Lagenorhynchus obliquidens*	Pacific white-sided dolphin	5
027	*Lissodelphis borealis*	Northern right whale dolphin	2
036	*Globicephala macrorhynchus*	Pilot whale	1
037	*Orcinus orca*	Killer whale	1
044	*Phocoenoides dalli*	Dall's porpoise	8
063	*Berardius bairdii*	Baird's beaked whale	2
074	*Balaenoptera physalus*	Blue whale	3
076	*Megaptera novaeangliae*	Humpback whale	2
079	Unid. large whale	Unidentified large whale	2
CU	*Callorhinus ursinus*	Northern fur seal	1
MA	*Mirounga angustirostris*	Northern elephant seal	4
		Total	**42**

Cetacean Biopsy Report

Suzanne Yin, Allan Ligon, and Mark Deakos

Species	Common name	No. weekly samples	No. weekly takes	Total samples	Total takes
Balaenoptera physalus	Fin whale	2	3	14	20
Berardius bairdii	Baird's beaked whale	0	0	1	1
Delphinus delphis	Short-beaked common dolphin	22	55	22	55
Globicephala macrorhynchus	Short-finned pilot whale	4	5	4	5
Lagenorhynchus obliquidens	Pacific white-sided dolphin	10	15	25	49
Lissodelphis borealis	Northern right whale dolphin	0	0	10	23
Orcinus orca	Killer whale (non-SRKW)	0	0	2	9
Weekly Total		**38**	**78**	**78**	**162**

Photo Report
Jim Cotton and Chris Cutler

Our attempts to outwit 'Mother Nature' by avoiding her climatic wrath paid off with cetacean dividends. Our motor-vessel verily sailed for a time with Beaufort 7 winds buffeting us from astern, pushing us southward from the OR-CA (Oregon-California) frontier to calmer seas off the central CA coast. We began the week with Pacific white-sided dolphins and got to witness, among other things, dolphins sideways, upright, melanistic, and leucistic (fig. 1).

Figure 1. Pacific white-sided dolphins.

As we traveled further south, we seemed to have crossed into a different biogeographic realm, one in which the animals were more diminutive (if we're to trust the vernacular). We encountered our first pilot whales ('short-finned') and common dolphins ('short-beaked') of the cruise. The large, tight school of pilot whales was spectacular to see, replete as it was with hugely sexually dimorphic, massive-finned, and heavily-scarred males (fig. 2), as well as multiple mothers with calves (fig. 3) and other animals of varying ages all swimming and diving rather synchronously.

Figure 2. Male Pilot whales.

While we are still scrutinizing our photos for subtle differences between individual animals, thus far we have identified 39 different 'pilots.'

Figure 3. Pilot whale calf.

We entered a 'hotspot' for common dolphins (*Delphinus*); small, fast-swimming, and inquisitive creatures, many of whom rushed to meet the ship, rocketing through the water to match our 10 kts.

Clusters of animals vying for a chance to ride the bow's pressure wave unwittingly made tissue donations to science as several samples were expertly extracted by the biopsy team while the paparazzo stalked dolphins flanking the ship (fig 4).

Figure 4. Common dolphin in flight.

Of nine such schools in one day two were with fin whales. While challenging weather had forced us to keep the 'high-density filters', (a.k.a. lens caps) on the cameras much of the week, we managed to eek out some good conditions and process new digital identity cards for 102 different animals. Our week ended Saturday night close to the Mendocino County coast with a triad of transient orca (see fig. 5), perhaps out for a for family picnic (and possible appetizer in the form of California sea lion swimming nearby).

Figure 5. Male transient killer whale.

	Weekly Totals		Cruise Totals	
Common Name	**Sightings Photographed**	**Individual IDs**	**Sightings Photographed**	**Individual IDs**
Pacific white-sided dolphin	2	20	10	52
Northern right whale dolphin	2	1	8	6
Short-beaked common dolphin	7	33	7	33
Sperm whale	0	0	2	2
Baird's beaked whale	1	6	3	12
Sei whale	0	0	3	9
Fin whale	2	6	22	45
Blue whale	0	0	9	12
Humpback whale	0	0	12	16
Killer whale	1	3	3	37
Goose beaked whale	0	0	1	1
Pilot whale	1	39	1	39
Total	**16**	**102**	**57**	**233**

Seabirds

Michael Force and Sophie Webb

Our ornithological travels through the study area this week were rewarding in both species diversity and overall abundance. Again, as in previous weeks, transect lines that traversed the continental shelf or its margins provided a wealth of species - 32 in fact - our second highest of ORCAWALE 2008. This nearshore offshore dichotomy is impossible to miss and is present regardless of our latitudinal position - further evidence of the importance of the California Current to migratory and resident seabirds. In addition, our daily average of 13 species is one of the highest we've ever recorded, coming in a close second to the 15 seen during our first week of the cruise. Another recurring theme is the low percentage of Procellariiformes represented in this total. This avian order includes what many consider to be "true seabirds" - albatrosses, shearwaters, petrels, storm-petrels and diving-petrels - yet comprised only 17% of the total species we saw; the others

(with a couple of exceptions) were Charadriiformes (shorebirds, alcids, gulls, terns and jaegers).

Figure 1. Juvenile Surfbird, Photo: Sophie Webb.

And what about all those "seagulls" we see while surveying near shore? Take a quick perusal through any bird book and you will be hard-pressed to find a single "seagull" listed anywhere. All those "seagulls" crowding around your beach towel, getting fat on soggy French fries from the local deep fryer, aren't really "seagulls" at all. They could just as easily be called "beachgulls" or "Jack-in-the-Box-gulls," but seagull is far less cumbersome and has become part of the popular lexicon. The vast majority of gulls are closely associated with terrestrial environments (fast food outlets, garbage dumps); very few species are truly pelagic. One of the exceptions is Sabine's gull, named after the famous early eighteenth century English polymath, Sir Edward Sabine, known for his work on the Earth's magnetic field. The Sabine's Gull, with a global population estimated to be around 330,000–700,000 individuals, has a circumpolar breeding distribution, nesting in loose colonies on lakes and coastal tundra throughout North America and Eurasia, migrating southward to wintering quarters in the cold and productive waters of the Humboldt Current and Benguela Current off western South America and southwestern Africa, respectively. Of the roughly 55 species of gulls in the world, Sabine's is certainly one of the most stunning (see fig. 2). Unfortunately, sightings from shore outside of the breeding season are rare, thus depriving land based observers the opportunity to experience this beautiful gull first hand. The remoteness of its Arctic nesting grounds and its highly pelagic nature in the non-breeding season (yes indeed, a true "seagull") has a lot to do with its perceived scarcity. When feeding, it favors small marine organisms such as fish and a wide variety of zooplankton, eschewing the cholesterol-laden food of its congeners.

Figure 2. Adult Sabine's gulls, Photo: Sophie Webb.

As fall migration gets into full swing, lost landbirds, wayward wanderers and other displaced oddballs begin to show up with increasing frequency. Out of place in a watery realm this week was a Band-tailed Pigeon and a Brown-headed Cowbird. Black Turnstone, Surfbird and Western Sandpiper, birds associated with coastal margins, were also seen this week. Horned Puffin is relatively rare south of Alaska at this time of year, so one seen about 10nm west of Orford Reef, Oregon, was noteworthy.

Acoustics Squeakly Report

Tina Yack

While inclement weather conditions have halted visual observations much of the week, acoustics has persevered. As such, it has been another busy week here in the trough, and I have run out of the magic beans (chocolate covered espresso beans), so I find myself rather exhausted at the close of this hectic week. There have been twice as many detections this week as in previous weeks; the hydrophone array has been grounded only once due to high sea states.

This week there were approximately 105hrs of recording effort and 72hrs of monitoring effort (Table 1). There was a total of 59 acoustic encounters, of which 23 corresponded to visual sightings. The highlights of this week's acoustic adventures include Baird's beaked whales (2), a pilot whale and northern right whale dolphin encounter, fin whales, many short-beaked common dolphins, sperm whales (4), transient orcas (1), many short-beaked common dolphins (8), and several porpoise encounters (16).

Why so many porpoise detections this week, you may wonder. Well, during the hydrophone array's day off and during a transit while the array was out, I had the opportunity to modify and test the automated porpoise detection parameters. Prior to this I have been able to detect porpoise only within 200 m of the array. The automatic detector changes now enable detection within three times this range! Figures 1 and 2 below illustrate porpoise echolocation and automated porpoise detection, respectively.

In other acoustics news, the ever elusive beaked whales continue to frustrate both the acoustics and visual teams. Of the two joint visual/acoustic Baird's beaked whale detections this week, we were able to obtain one resight. However, we were able to successfully circle around acoustic detections, obtain reliable bearings, and acquire recordings. With each joint beaked whale encounter, we increase our knowledge of these mysterious creatures and come a bit closer to successful localization. Meanwhile, I like to think of myself cast in the role Nancy Drew in "*The Mystery of the Beaked Whale*." Stay tuned next week to see how this mystery unravels.

Table 1. Rainbow Click recording effort (sample rate: 480 kHz: hydrophones 4 and 5).

Date	Average Beaufort	Recording Start	Recording End	Recording Time	Monitoring Effort	Acoustic Encounters
8/31/2008	5.4	6:57	20:02	13:05:00	8:00	4
9/1/2008	6.4	6:50	18:21	11:31:00	10:00	9
9/2/2008	5.2	6:55	17:30	10:35:00	7:00	9
9/3/2008	6.2	9:10	11:16	2:06:00	1:30	1
9/4/2008	4.0	7:00	19:47	12:47:00	9:00	13
9/5/2008	3.1	7:07	17:40	10:33:00	8:30	17
9/6/2008	3.0	6:56	20:20	13:24:00	9:24	6
Total				**74:01:00**	**53:24:00**	**59**

Table 2. Acoustic Encounters

Species ID	Number of Acoustic Encounters
Baird's beaked whale	2
Common dolphin	8
Dall's porpoise	4
Fin whale & common dolphin	2
Pacific white-sided dolphin	1
Pacific white-sided dolphin & Dall's porpoise	1
Pacific white-sided dolphin & northern right whale dolphin	1
Pilot whale & northern right whale dolphins	1

Species ID	Number of Acoustic Encounters
Sperm whale	4
Transient Orca	1
unid beaked whale	3
unid cetacean	10
unid delphinid	9
unid porpoise	12
Total	**59**

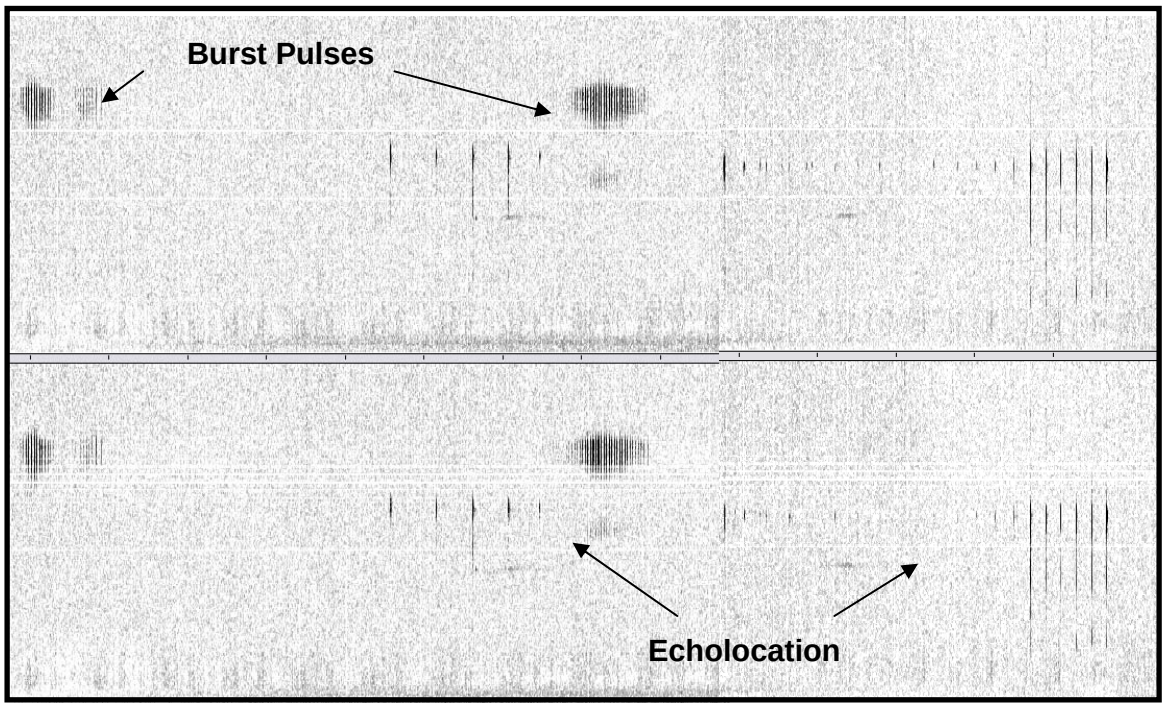

Figure 1. Acoustic Encounter of Dall's porpoise on 04 September 2008.

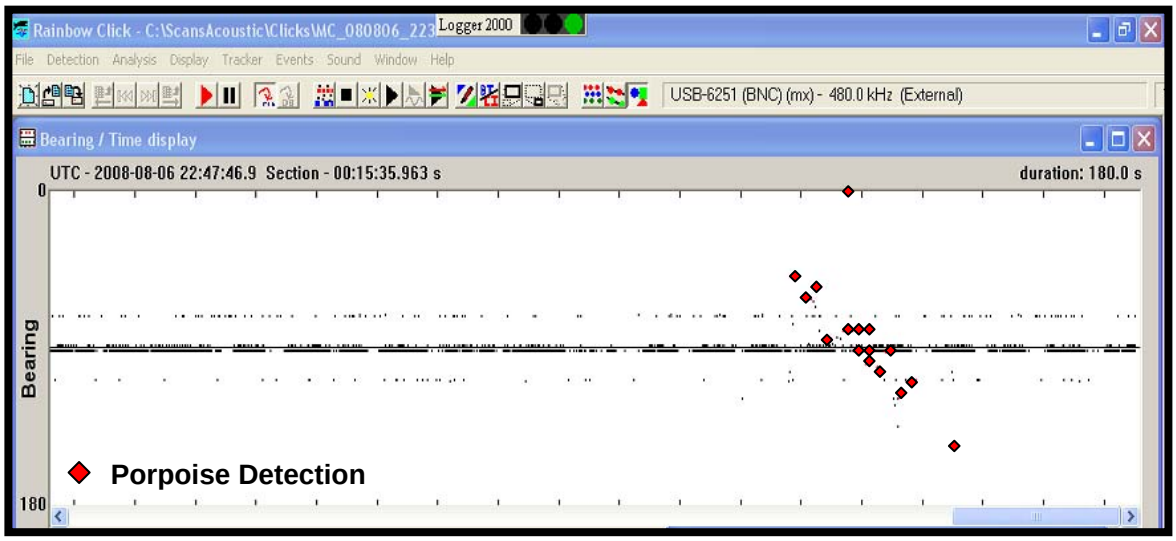

Figure 2. Rainbow Click automated porpoise detection.

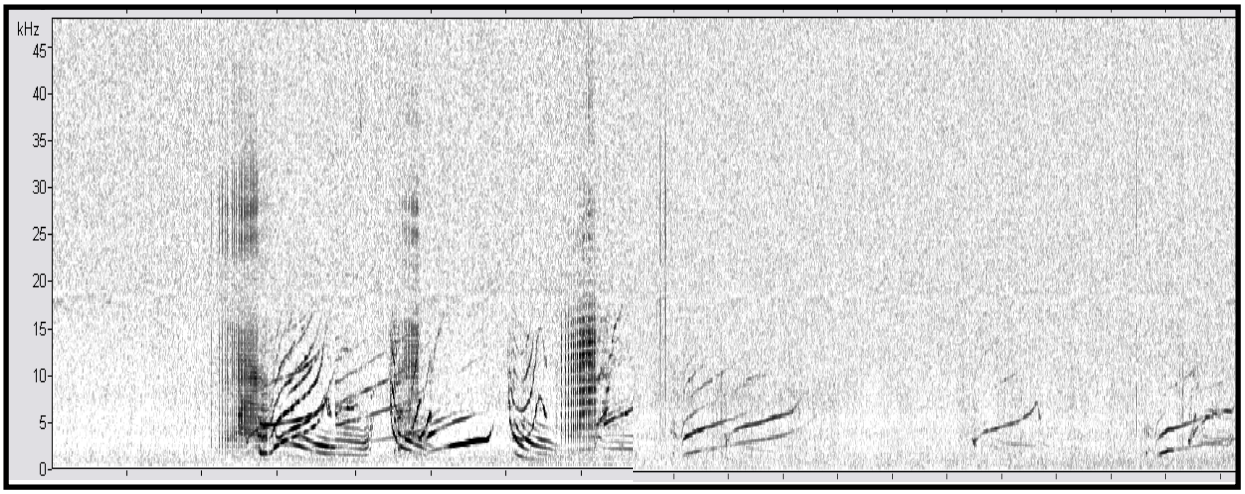

Figure 3. Acoustic encounter of pilot whales on 04 September 2008.

Squid Jigging Efforts: P.I. *Iliana Ruiz-Cooley*
With assistance from Karla Garcia, Dave Lapointe, Chris Cutler, Alan Ligon, Jim Kintzele and Art Mercado

Our week began with a very exciting night on Sunday, August 31st. Jim caught our first squid in the first 10 minutes of jigging at depths deeper than 150m. As soon as we brought this first one aboard, the other jiggers caught more squid in a matter of seconds. Interestingly, later, we couldn't lower our luminescent jigs to waters deeper than 50m because many squid were 'biting' near the sea surface. At one point 30 to 40 squid were observed at the surface forming a semicircle adjacent the starboard side of the fantail. It seems that they were just waiting for something: a fake prey? A jig?

The Humboldt Squid *(Dosidicus gigas)* is a voracious predator. During fishing operations, people commonly observe them attacking and eating their own kind. That night we brought in some squid with holes in their mantles; evidence of a recent attack by other squid. By analyzing jumbo squid stomach contents, scientists have found fresh remains and hard structures of other jumbo squid, suggesting cannibalism. However, the percentage of such remains is low in their diet; such analyses represent a snapshot of the most recent feeding events (~ four hours). Thus, we don't know if cannibalism is a natural behavior or if fishery operations (e.g. the use of bright lights, jigs, nets) promote and facilitate it. Until scientists observe or record evidence about this behavior in its natural environment, this question remains a mystery.

Figure 1. Jumbo squid, *Dosidicus gigas*, brought to the sea surface after jigging at 50 meters with a medium size jig.

That Sunday night, in the final minutes of our efforts, three medium-sized sharks (presumably blue sharks) attacked three different jumbo squid

while we were recovering the squid. Those attacks precluded us from collecting data and biological samples from these squid. Approximately one third of the mantle of one squid and half of the head of another were missing due to the shark's attack. Nonetheless, we were very excited and fortunate to observe this interaction and predatory behavior. Overall, we were only able to jig for three nights during this week. We caught 14 to 17 specimens per night, for a total of 46 squid. Squid sizes ranged between 55 to 74.8 cm mantle lengths (ML) even though we used different jig sizes (small, medium, large and extra large). So far, the largest and heaviest squid, caught by marine mammal observer Chris Cutler (sorry Jim), was a female that measured 74.8 cm ML and weighed 32 lbs.

I thank Karla, Dave, Chris, Alan, Jim, and Art for their support in collecting and dissecting specimens. I feel fortunate to count on such a great team with a positive attitude. Thanks to them, the jigging effort has been a safe and successful operation.

Figure 2. Jumbo squid being recovered with a gaff and fishing pole.

Oceanography
Ryan Driscoll

The starring role in this week's story is weather. It stole scene after scene, changing everything from our sampling schedule to the water we sampled. It drove us south into the waters off San Francisco and tricked us back north by playing it cool. This week we will break from our series on ORCAWALE's sampling program to get outside and take advantage of the (bad) weather.

The winds that have dogged us this past week are the winds of change for the coastal ecosystem. Winds provide the mechanism to deliver nutrients and transport larvae in process called upwelling. This occurs when wind pushes the warmer surface waters out to sea and deep, cold, nutrient rich waters slide up on the shelf to the surface to replace it (Fig. 1, panels 1-3). When the wind changes, the warm surface waters move back to the coast and the colder water recedes. Nutrients cause blooms in phytoplankton which feed the base of the food chain. During one transect this week we saw a

striking example of upwelling. As the ship neared Cape Blanco off the Oregon coast the surface temperature dropped nearly 2º every 20nm from 15 to 9° C as we passed from the old near shore water to the new cold deep water that had taken its place.

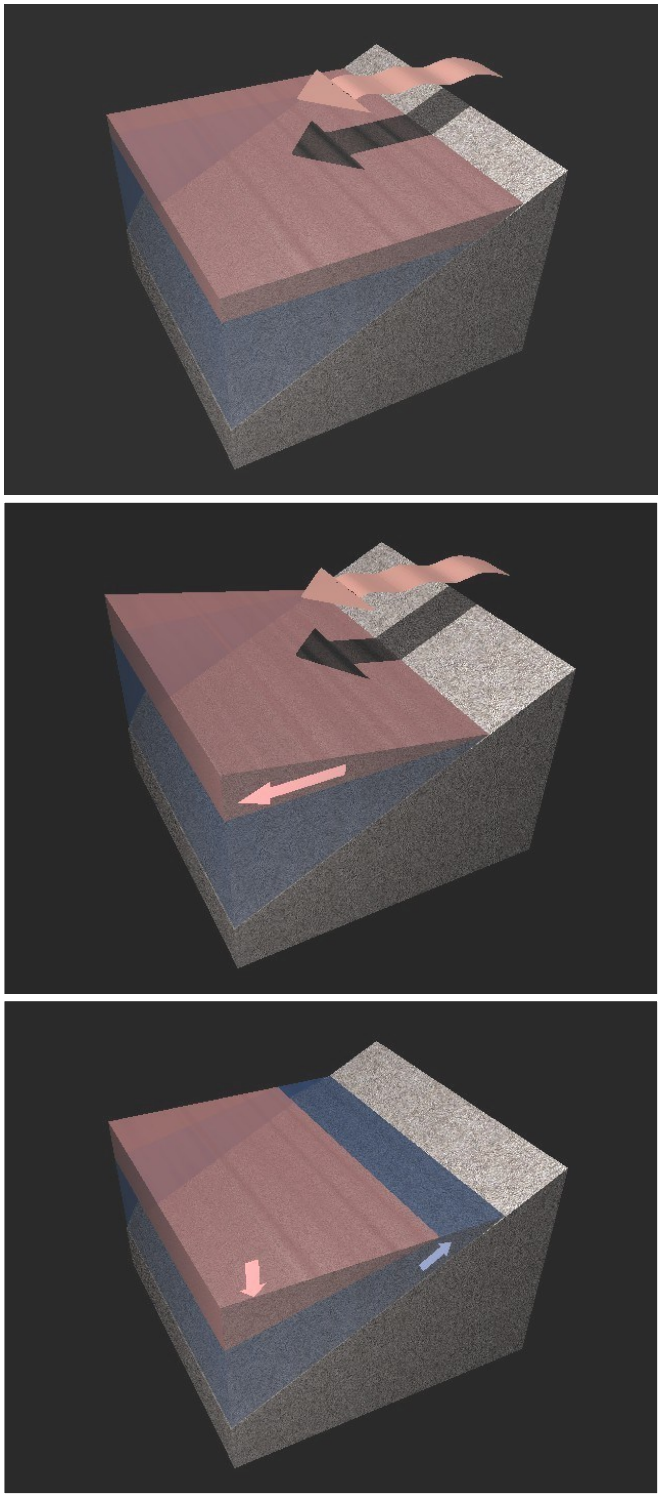

Figure 1. Upwelling.

Some organisms coordinate their reproductive cycles with one of these upwelling events. Larvae are hopefully pushed offshore where they mature and later transported back to the coast to settle. Good examples of this are barnacles (Cirripedia) and mussels (Mytilidae), both of which under go multiple stages before returning to settle. During this planktonic stage of their life they join the Meroplankton, organisms that spend only part of their life floating with the currents.

The friction of wind on surface water starts as innocently as small ripples, mere ruffles on the surface. But as the wind builds, those ripples turn to wavelets, then waves, then waves crested with whitecaps foaming the ocean. These cresting waves which we have seen so much of this past week force the surface water to start mixing with what is below. This increases a part of the ocean called the mixed layer (Fig. 2), a homogenous zone of water near the surface below which starts the Thermocline. Phytoplankton growth is maximized near the bottom of the mixed layer at the boundary of ideal temperature and maximum light. .

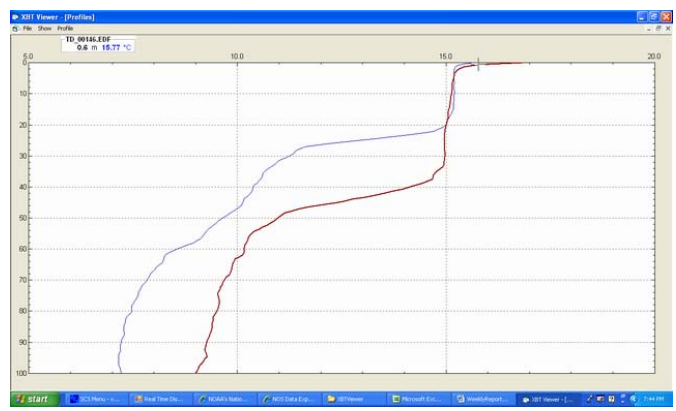

Figure 2. A mixed layer at 20m during a calm day first leg and a deeper one at 30m during a stormy day.

Barnacle nauplius .

Oceanography, by the numbers.

Day	CTD	XBT	Surface chlorophylls	Bongo Tows	HAB
8/31/2008	1	5	5	1	24
9/1/2008	0	2	2	0	12
9/2/2008	1	3	3	0	18
9/3/2008	0	1	1	0	6
9/4/2008	1	4	4	1	24
9/5/2008	1	2	2	0	12
9/6/2008	1	3	3	1	18
Total	5	20	20	3	112

Midwater Trawling Weekly Report

IKMT Leader: Pete Davison; IKMT Assistants: Karla Garcia and Ioana Ionescu

This week was a difficult one for midwater trawling. Trawling was canceled five out of seven nights due to night transits and direct or indirect effects of the weather. We have completed 67 Isaacs-Kidd Midwater Trawl (IKMT) tows to date, comprised of twenty-six nightly pairs (150 and 500 m), two supplemental night tow (60 and, 350 m), and thirteen daylight tows-of-opportunity.

Since the IKMT team didn't actually do much towing this week, I thought I describe what we are trying to do with all of these fish and invertebrates that we catch in the IKMT. My primary goal is to measure the biomass (wet weight per square meter) of vertically migrating fish across the California Current, and how it relates to bottom depth and primary productivity. We are measuring the number of fish present using two complementary methods, the IKMT trawl and a sonar system. A typical value of migratory fish biomass in the California Current is 4 g/m^2. This is roughly equivalent to one fish with a volume of 4 cubic centimeters for every square meter of water surface.

Vertically migrating fish are defined as being present in the top 150m of the water column at night, and absent during the day. Many small oceanic fish species descend during the day to deeper, darker water to avoid visual predators such as birds or tuna. The food of these fish is more concentrated near the ocean surface, so they must return to the epipelagic at night in order to feed. The fish eat zooplankton, which in turn eat phytoplankton, and the phytoplankton concentration is measurable from satellites. If a relationship between the fish biomass and phytoplankton concentration can be made, it will be possible to predict the biomass of fish without expensive and time consuming cruises designed for that purpose. It is necessary to establish the biomass of these fish in order to assess their role in the ecosystem.

I am interested in the contribution of diel vertical migration to the global carbon cycle. The daily movements of these fish serve to move carbon (in the form of food) from the surface water to deep water, where it is released through the processes of defecation, respired CO_2, and mortality. Zooplankton such as krill also migrate vertically, and contribute to the flux of carbon. This flux by living animals is known as "direct transport." Direct transport is an important component of the "biological pump," the overall export of biogenic carbon to the deep-sea. The carbon that is transported to deep water may remain isolated from the atmosphere for decades to centuries, so the biological pump is an important process to quantify for the study of global warming. Photographs of some interesting animals captured in the IKMT this week are shown below in Figures 1-3.

Figure 1.The vertically migratory myctophid *Diogenichthys atlanticus*. It spends the day about 500m below the water surface, and ascends to the surface at night to feed on zooplankton. This species reaches a maximum length of 25mm.

Figure 2. *Lipolagus ochotensis*, a vertically migratory deep-sea smelt.

Figure 3: A strange-looking crustacean.

Special Dispatch from Visiting Scientist
Ioana Ionescu

Studies of seabirds can provide insight into the ecology of pelagic communities, a concept expounded by many marine ornithologists. Seabirds play an important role in the ecological balance. Some species of seabirds are top-level predators and are therefore important indicators of the general health and stability of the ecosystem. In order to understand better these relationships, data are recorded on the density and distribution of seabirds in tandem with other marine ecosystem variables obtained on ORCAWALE 2008, such as data on the physical and biological oceanography.

The Long-tailed Jaeger (*Stercorarius longicaudus*, also known as Long-tailed Skua) was one of the graceful species seen during the last week. Long-tailed Jaegers are similar to Parasitic Jaegers (another widespread species of jaeger seen this week) but are slimmer, have narrower wings, a more buoyant flight and, in full alternate plumage, very long central tail feathers. Long-tailed Jaegers disperse to pelagic habitats mainly off Atlantic and Pacific coasts of South Africa and South America, respectively.

Arctic Terns (*Sterna paradisaea)* were conspicuous and gregarious, often traveling in flocks of up to 80 birds. The dichotomy between the majestic Long-tailed Jaegers and elegant Arctic Terns was obvious, and the interactions between these two species are of interest. Long-

tailed Jaegers are kleptoparasitic and favor Arctic Terns, taking advantage of their smaller size. As a result, Long-tailed Jaegers tend to be the earliest of the jaegers to begin their southward journey, timed to the departure of Arctic Terns from their tundra nesting grounds.

The ubiquitous California Gull (*Larus californicus)* is common and widespread; yet separating them in immature plumage from the similar Western Gull (*Larus occidentalis)* was an arduous task. However, adult plumage is acquired after four years, greatly simplifying the dilemma. The California Gull is distinctly smaller than the Western Gull. Furthermore, the Western Gull varies from the California Gull in its darker, slate-grey saddle and upperwings, and dusky underwings.

Further studies of seabirds in their natural habitat may reveal new species relationships and as yet not completely understood inter- and intra-specific interactions with their habitat and their prey.