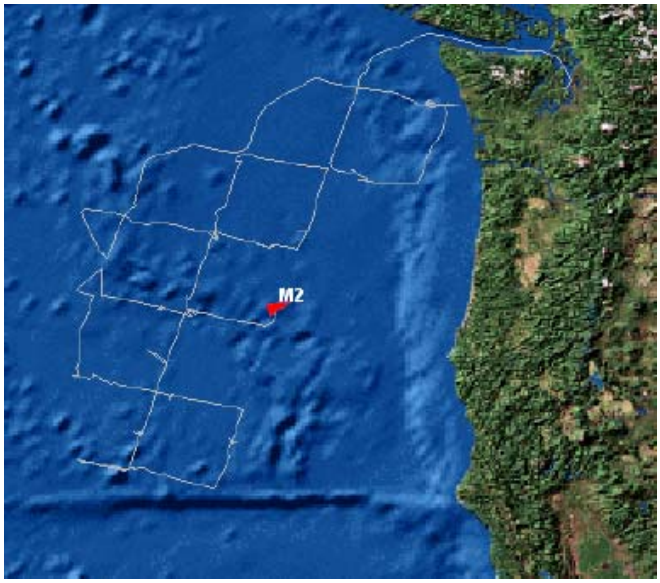
ORCAWALE 2008: Weekly Report

Report Dates: 10-16 August 2008 Chief Scientist: *Jay Barlow* Leg 1 Cruise Leader: *Jay Barlow*

Weekly Science Summary
Jay Barlow

We've had a big week with the big whales. We saw very little else this week other than large whales … blue whales, fin whales, sei whales, and sperm whales. These mammoths of the sea have appetites as large as their mouths (which are a third the length of their bodies). Recently, it has been estimated that baleen whales in our backyard (the California Current) eat about 2 billion pounds of food each year. That's about ten times the combined weight of all the whales. Most of that enormous consumption is krill, which our oceanographers have been collecting nightly in their nets. In contrast to the whales, however, oceanographers take only about a quart jar per day, and I've never seen them eat it.



ORCAWALE-08 Transect lines completed to date cover most areas far offshore of Washington and Oregon.

A large part of the reason for our survey is to determine how the whale populations are doing. Humans decimated the whales throughout the world, but what few people now realize is that California was a whaling state until the mid-1960s. Shore based whalers from the San Francisco Bay area were taking the few remaining whales the California Current. Whaling for most species stopped in the 1960s, but pelagic whaling for fin and sperm whales in our waters continued until the 1970s. It is easy to blame other nations for their irresponsible whaling, but until recently, the U.S. was one of the most active whaling nations on earth and shoulders a large share of the responsibility for their demise. Well, how are they doing now?

A "friendly" fin whale comes to the bow for its annual skin biopsy by Allan Ligon, one of our biopsy specialists.

One of the exciting parts of our science is that we are witnessing the return of large whales. In fact, the oceans up here (off Oregon) are thick with them. Humpback and blue whales have increased to about 2,000 in the California Current, and a recent study (SPLASH) has found that there are approximately 20,000 humpbacks in the entire North Pacific. When I was a kid, I never thought I'd see the recovery of whales in my lifetime. Undoubtedly, whales have not traveled the full road to recovery, and some, like the North Pacific right whale, remain critically endangered. Nonetheless, it is great when we can see a reversal of the damage our species has wrought on our world's wildlife.

Marine Mammal Effort Summary.

Date	Start time Stop time	Start location Stop location	Distance surveyed (nm)	Average Beaufort
081008	0650 1826	N43:59.81 W130:59.43 N42:39.59 W131:00.03	72.9	4.6
081108	0656 2038	N42:29.62 W130:59.01 N42:11.02 W129:23.30	67.8	2.0
081208	0658 2021	N42:10.59 W129:23.87 N41:22.82 W128:18.57	86.3	3.0
081308	0648 2027	N41:21.98 W128:19.11 N40:53.01 W129:49.38	78.4	4.4
081408	0711 1830	N41:02.42 W130:58.06 N41:28.95 W129:54.85	69.5	4.4
081508	0705 1555	N41:29.79 W129:54.22 N42:43.37 W129:28.12	57.2	5.0
081608	1211 1815	N43:05.62 W129:19.78 N43:38.03 W128:56.15	37.0	5.0

Marine Mammal Sighting Summary.

Code	Species	Common name	No. sightings
046	*Physeter macrocephalus*	Sperm whale	1
051	*Mesoplodon* sp.	Mesoplodon sp.	1
061	*Ziphius cavirostris*	Cuvier's beaked whale	2
070	*Balaenoptera* sp.	Baleen whale	4
073	*Balaenoptera borealis*	Sei whale	2
074	*Balaenoptera physalus*	Fin whale	6
075	*Balaenoptera musculus*	Blue whale	3
MA	*Mirounga angustirostris*	Northern elephant seal	10
		Total	**29**

Cetacean Biopsy Report

Suzanne Yin and Allan Ligon

Species	Common name	No. weekly samples	No. weekly takes	Total samples	Total takes
Balaenoptera physalus	Fin whale	2	6	10	15
Berardius bairdii	Baird's beaked whale	0	0	1	1
Lagenorhynchus obliquidens	Pacific white-sided dolphin	0	0	1	1
Lissodelphis borealis	Northern right whale dolphin	0	0	4	9
Weekly Total		**2**	**6**	**16**	**26**

Photo Report
Jim Cotton and Chris Cutler

Photographs of whales can often be used to identify individuals, and these photo-IDs are used to study migration, abundance, and many other aspects of whale ecology. Of our 30 "Photo-ID'd" whales this week, more than half came from one species (fin whale) while the rest were from three other species (blue, sei, and sperm whales). We also took a few photos of the northern right-whale dolphins we encountered, notable for their complete lack of any dorsal fin.

Sei whales (pronounced "say"), on the other hand, possess massive sweptback and sickle-shaped dorsal fins reaching up to two feet in height. The name sei is Norwegian for Pollock, a fish that historically showed up off the coast of that Scandinavian land around the same time as the whales. We saw two mixed groups of fin and sei whales this week, and each had different dorsal fin characteristics. Two sei whales in one group (photos on right) possessed unique scars or notches in their dorsal fins that could be used to identify them at a later date. The five sei whales in the other group, however, lacked dorsal fin scars altogether and yet they each had something not seen in the first group (photos on page 4). Each whale's dorsal fin had what looked like a glossy black, shellac-like patina of keratinized epidermis in varying degrees of exfoliation.

We were left with many questions. Why did one group of sei whales show this strange fin condition and the other not? How long does the condition persist? Can such patterns be used to identify individuals over seasons or years? All of the sei whales we have seen as well bear numerous cookie-cutter shark scars (see photos) acquired during seasonal ('winter') residence on lower latitude and warmer water calving 'grounds'.

Fin whales are one of the few species on the planet that have consistently asymmetrical color patters. Our photographs (see page 4) show the bi-colored lower jaw – black on the port side, white to starboard. The white has been speculated to be useful to the whale whilst feeding, perhaps by startling and disorienting schooling prey such as krill.

The week ended in patchy dense fog as we tried to keep track of a pair of fin whales. Skillfully maneuvering the ship, the officers and crew of the watch brought us close to the whales. The whales were seemingly unconcerned about our presence, and our sharp-shooters obtained biopsies while the photographers obtained matching photos of each whale.

Sei whales showing distinctive markings on their dorsal fins.

Sei whales showing unusual dark pigmentation patterns on their dorsal fins and white oval scars from cookie-cutter shark bites.

Fin whales heads show asymmetrical black and white jaws.

Photography summary table.

	Weekly Totals		Cruise Totals	
Common Name	**Sightings Photographed**	**Individual IDs**	**Sightings Photographed**	**Individual IDs**
Pacific white-sided dolphin	0	0	1	1
Northern right whale dolphin	1	0	4	4
Sperm whale	1	1	2	2
Baird's beaked whale	0	0	1	6
Sei whale	2	8	3	9
Fin whale	7	18	18	37
Blue whale	3	3	8	10
Humpback whale	0	0	5	7
Total	**14**	**30**	**42**	**76**

Seabirds

Michael Force and Sophie Webb

We had high expectations for the unexpected this week, considering that we were far offshore and thought that maybe, just maybe, there could be something new and unforeseen out here. After all,

land-based seabirders, constrained as they are by the limited reach of commercial sport fishing charter boats, continually dream of exploring beyond the shelf break and into the "Final Frontier". Never mind. Don't bother. The open ocean over deep pelagic waters is pretty empty and depauperate for seabirds, at least at this time of year. At the end of each day we considered ourselves lucky if we ended up with our daily average of seven species. Thirteen, the total number of species we saw this week, is five species fewer than the previous week.

Nevertheless, we recorded valuable data on the abundance and distribution of seabirds in an area rarely visited. Red Phalarope (known as Gray Phalarope in English speaking countries overseas) was the commonest species, being seen every day, often in impressive concentrations. This petite ocean-going member of the sandpiper family, hardly larger than the familiar Killdeer, nests along the edges of lakes and marshy pools on Arctic tundra around the world and winters primarily off western South America and western Africa. Unlike other sandpipers, its feet are modified for a life on the ocean—the toes are webbed and lobed—an adaptation for swimming. These unique characteristics are shared by the other phalarope species (Red-necked, and Wilson's), but reach a high degree of development on Red Phalarope, the most pelagic of the three.

Laysan Albatross, Hawaiian Petrel and a Sabine's Gull, the latter unusually far from the shelf break, stand out on the list of birds seen this week. A single juvenile Brown-headed Cowbird, likely puzzled by the complete lack of livestock paddocks, briefly visited the ship.

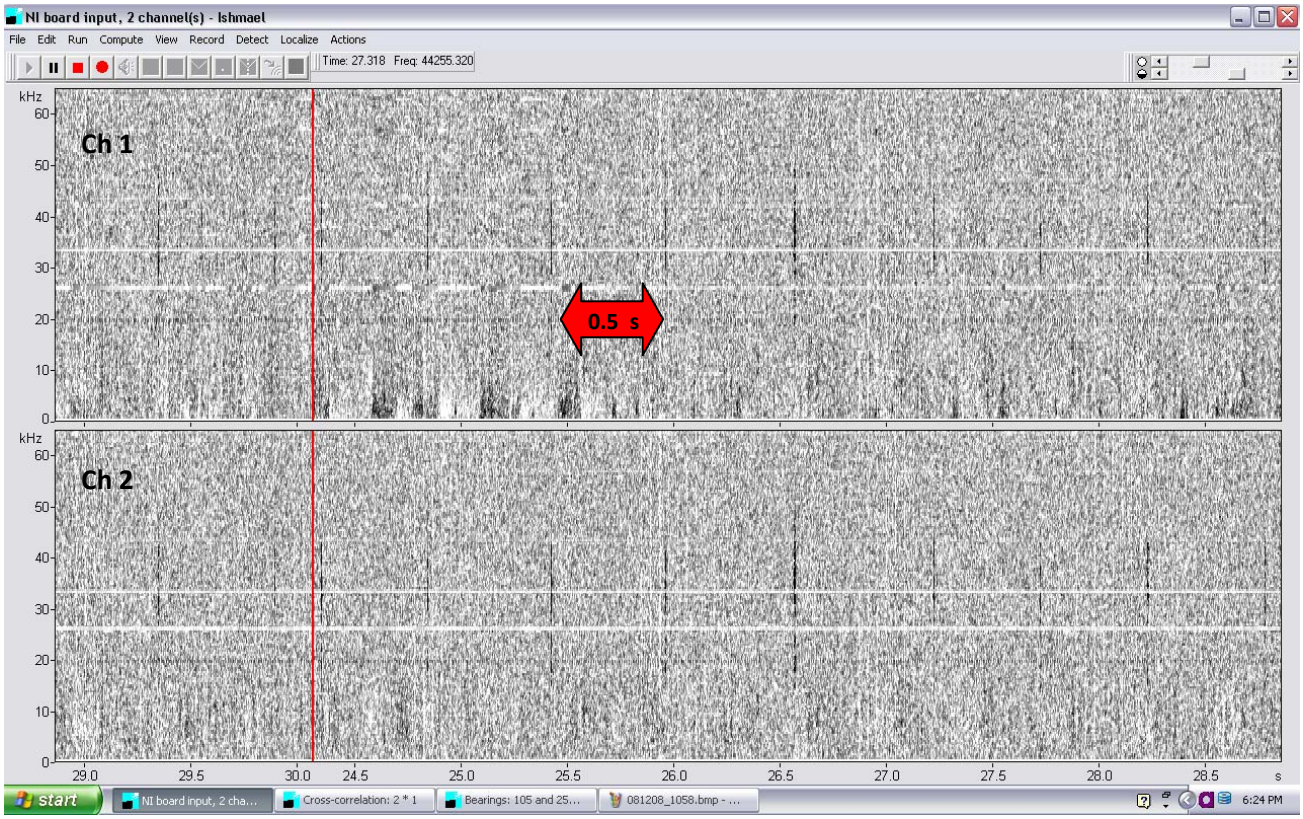
Secretary bird (*Sagittarius serpentarius*) - one of many species NOT seen this week.

Acoustics Squeakly Report
Tina Yack

Despite the variable weather conditions this week acoustics has remained busy. However, tracking efforts have been only minimally successful. This week, the array was deployed for approximately 100 hours with 70 hours of monitoring effort. During this time there were 31 acoustic detections, of which 11 were associated with a visual sighting. The most noteworthy of these were four sperm whale detections, three blue whale detections, a mixed fin and sei whale detection, a fin whale detection, a Cuvier's beaked whale detection and a *Mesoplodon* beaked whale detection.

The beaked whale detections have led to some frustrations here in the acoustics department this week. In the last few weeks we have shown that we are able to detect beaked whales using a combination of manual and automated acoustic methods. However, localizing them is another story. Given our current inability to find them and visually determine the species, most of our acoustic beaked whale detections will remain unconfirmed until we are able to analyze the data back at the lab. However, we have obtained many valuable recordings.

Beaked whales are the least known family of all marine mammals and new species are still being described. These animals are notoriously elusive and difficult to study, especially using visual survey methods. They spend a significant amount of time during the day in deep (>800 m) and mid-water (100 – 600 m) dives and are highly vocal only at depths greater than 200m. Blainville's (*Mesoplodon densirostris*) and Cuvier's (*Ziphius cavirostris*) beaked whales both produce long duration (>175µs) clicks with center frequencies between 30 and 40 kHz and typical inter-click intervals between 0.2 and 0.4 seconds. This information suggests that acoustic methods may be the most feasible way to detect and track beaked whales, given the inherent difficulties associated with seeing them. For the time being these elusive creatures of the deep continue to present a challenge for the acoustics team. Stay tuned for more on our efforts to track the beaked whale…



Spectrogram of an Acoustic Beaked Whale Detection. The vertical lines spaced about 0.5 second apart are beaked whale echo-location clicks.

Rainbow Click Recording Effort (Sample Rate: 480 kHz: Hydrophones 3 and 4; *Hydrophones 4 and 5)

Date	Average Beaufort	Recording Start	Recording End	Recording Time	Monitoring Effort	Acoustic Encounters
8/10/2008	4.6	6:25	20:50	14:25:00	11:30	4
8/11/2008	2.1	6:38	21:00	14:22:00	14:00	10
8/12/2008	3.0	6:58	20:44	13:46:00	8:30	4
8/13/2008	4.4	6:31	21:22	14:51:00	12:00	4
*8/14/2008	4.4	6:23	20:40	14:17:00	12:00	5
*8/15/2008	5.1	6:25	20:44	14:19:00	2:00	0
*8/16/2008	5.5	6:34	20:11	13:37:00	9:00	4
Total				**99:37:00**	**69:00:00**	**26**

Acoustic Detections

Date/Time	AC #	Acoustic ID	Latitude	Longitude	Visual Sighting	Visual ID
8/10/2008 8:21	44	Sperm whale	43.8845N	130.7671W	NA	NA
8/10/2008 10:42	45	Sperm whale	43.6588N	130.8213W	NA	NA
8/10/2008 13:37	46	Sperm whale	43.4608N	130.9125W	NA	NA
8/10/2008 18:54	47	Blue whale	42.6535N	131.0327W	72	Blue whale
8/11/2008 7:25	48	unid beaked whale	42.4597N	130.8781W	NA	NA

Date/Time	AC #	Acoustic ID	Latitude	Longitude	Visual Sighting	Visual ID
8/11/2008 8:12	49	Blue whale	42.4659N	130.7673W	73	Blue whale
8/11/2008 9:32	50	unid cetacean	42.5756N	130.7523W	NA	NA
8/11/2008 9:46	51	unid cetacean	42.5515N	130.7551W	NA	NA
8/11/2008 10:42	52	Sperm whale	42.4112N	130.4557W	74	Sperm whale
8/11/2008 13:18	53	unid beaked whale	42.3969N	130.3996W	NA	NA
8/11/2008 15:45	54	unid beaked whale	42.3423N	130.1499W	76	Ziphius
8/11/2008 17:15	55	unid beaked whale	42.3119N	130.0093W	NA	NA
8/11/2008 18:50	56	unid beaked whale	42.2641N	129.7777W	NA	NA
8/11/2008 19:28	57	unid beaked whale	42.2298N	129.6176W	NA	NA
8/12/2008 7:14	58	unid beaked whale	42.1741N	129.3644W	NA	NA
8/12/2008 7:41	59	unid whale	42.1555N	129.2370W	77	Fin and Sei whales
8/12/2008 10:56	60	unid cetacean	42.1044N	129.0031W	NA	NA
8/12/2008 18:15	61	unid beaked whale	41.5177N	128.2682W	NA	NA
8/13/2008 13:49	62	unid whale	41.1774N	128.3937W	84	Fin and Sei whales
8/13/2008 10:17	63	unid cetacean	40.9440N	128.4220W	NA	NA
8/13/2008 16:13	64	unid cetacean	40.7415N	129.4068W	85	Fin & unid baleen
8/13/2008 20:00	65	unid cetacean	40.8579N	129.7453W	NA	NA
8/14/2008 7:27	66	unid beaked whale	41.0256N	130.9047W	87	Ziphius
8/14/2008 8:23	67	unid cetacean	41.0014N	130.8280W	NA	NA
8/14/2008 12:20	68	unid beaked whale	40.9245N	130.1194W	88	Mesoplodon sp.
8/14/2008 14:16	69	Blue whale	41.0820N	130.0489W	89	Blue whale
8/14/2008 15:49	70	unid beaked whale	41.0982N	130.0480W	NA	NA
8/16/2008 9:30	71	unid cetacean	42.8992N	129.4047W	NA	NA
8/16/2008 9:30	72	unid cetacean	42.8992N	129.4047W	NA	NA
8/16/2008 16:22	73	unid cetacean	43.6890N	129.1097W	NA	NA
8/16/2008 19:06	74	Fin whale	43.6558N	128.9314W	93	Fin whale

Squid Jigging Efforts

Heather Judkins and Jared Cox

with help from Sophie Webb, Jim Gilpatrick, and Allan Ligon

Squid caught: 0

CTDs caught: 1

Bongo nets caught: 1

Engine props caught: 3

Cost of jigs lost: $75.00

Human hours spent jigging: Approximately 70

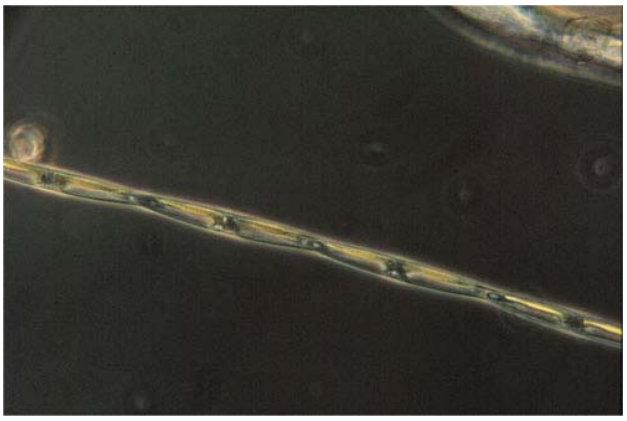
Attempting to catch Humboldts nightly in the middle of the Pacific for 20 days? ***Priceless!***

Oceanography
Ryan Driscoll and Misty Blakely

In our continuing exposé on the inner workings of Oceanography on ORCAWALE 2008, I have asked visiting scientist and PhD candidate at UC Santa Cruz, Misty Blakely, to talk about our special projects studying phytoplankton.

Phytoplankton are small microscopic single-cellular plants that live in the ocean and survive by using light to make energy in a process called photosynthesis. They are responsible for producing 50% of the earth's oxygen in our atmosphere. To determine whether phytoplankton are healthy, one can look at their ability to take up light. One way to do this is the use of an instrument called a fluorometer (see below). The fluorometer floods the phytoplankton with light and measures their ability to photosynthesize, thus giving an estimate of whether the cell is 'healthy.' For the last three weeks ORCAWALE has conducted an intensive spatial study along our track lines to determine the general level of phytoplankton healthiness.

Some phytoplankton can have deleterious effects on humans, fish, shellfish, and marine mammals and are often famously called "Red Tides" although not all red tides are harmful. These phytoplankton can sometimes form dense aggregates, called 'Harmful Algal Blooms' (HABs). One chain-forming diatom (a type of phytoplankton), Pseudo-nitzschia, produces a toxin called Domoic Acid. This is known to cause serious ill effects in humans, birds, and marine mammals, including stranding, permanent brain damage and death. Over the last 10 years, HABs have been increasing along the west coast of the United States. The HAB study during the ORCAWALE cruise is a spatial determination of the level of Domoic Acid in the waters off the coasts of California, Oregon, and Washington where marine



Pseudo-nitzschia - the latest bad-boy superstar of the phytoplankton world.

mammals have been hit particularly hard with Domoic Acid poisoning.

This week's State of the Ocean: We moved offshore this week and with it came more offshore waters. Oceanography almost settled into a routine until our CTD "Rosy" started to act up. Thanks to the diligence of the Ship's ET Jim Kintzele she was outfitted with new cables and was back in the water without missing a night.

"Rosy" goes for a rare daytime swim in the Pacific.

Let's move up in size from nutrients and phytoplankton to the animal kingdom. Everyone knows that Oceanography is the sexiest of the Marine Sciences (trust me on this one). How sexy you might ask? Well, squid for one can't keep their arms off us. The cod end of our BONGO came up on Saturday

with some funny white markings and a black ooze. Our resident squid expert, Heather Judkins, came up with this likely scenario. The white streaks were sperm deposited by an amorous squid that subsequently exuded black ink in embarrassment when he realized his mistake. Male squid have a modified arm to hold spermataphores. The male then uses this arm to deposit sperm on a female, who will then store the sperm for as long as 2 years until needed, or on a cod end of a plankton net, where it will be washed off by a fascinated oceanographer. Special thanks goes out to Heather Judkins and Jared Cox, the unsung members of the oceanography team who help out with our nightly Bongo tows and cephalopod dating scene.

This week, by the numbers:

Day	CTD	XBT	Surface chlorophylls	Bongo tows	HAB	Phytoplankton health
08/10/2008	1	4	4	1	24	16
08/11/2008	1	4	4	1	24	16
08/12/2008	1	4	4	1	31	20
08/13/2008	1	5	4	1	31	20
08/14/2008	1	5	5	1	31	20
08/15/2008	1	4	4	1	30	20
08/16/2008	1	4	4	1	24	16
Total	**7**	**30**	**29**	**7**	**195**	**128**
Grand Total	**19**	**90**	**85**	**18**	**502**	**390**

Midwater Trawling Weekly Report
IKMT Leader: Pete Davison
IKMT Assistants: Heather Judkins and Jared Cox

We have completed 44 Isaacs-Kidd Midwater Trawl (IKMT) tows to date, comprised of seventeen nightly pairs (150 and 500 m) and ten daylight tows-of-opportunity. Poor visibility for the mammal observers on August 15th allowed us to perform our first deep daylight trawl. The tow targeted an acoustic layer at 400m depth, which rose to 250m during the three hours that the net was in the water. The acoustic pinger that we attached to the net allowed us to track the target layer while we were fishing. This deep layer turned out to be primarily composed of vertically migrating myctophids, which we have failed to find in our shallower daylight trawls. Identification of the daylight location of these myctophids will allow us to estimate their biomass using the EK60 sonar system.

Photographs of some interesting animals captured in the IKMT this week are shown below.

The vertically migrating myctophid fish *Tarletonbeania crenularis*. Note the light-emitting photophore organs along its belly. The light emitted by these organs provides counterillumination camouflage from predators that attempt to seek prey from below by silhouetting their target against sunlight.

A second species of vertically migrating myctophid, *Symbolophorus californiensis*

A pearleye (Benthalbella dentata) that has upward looking telescopic eyes that it uses to find prey above it.