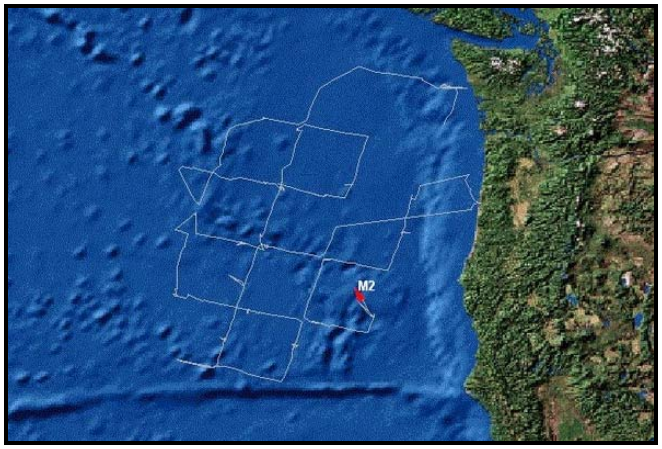
ORCAWALE 2008: Weekly Report

Report Dates: 17-30 August 2008 Chief Scientist: *Jay Barlow* Leg 2 Cruise Leader: *Jeremy Rusin*

Weekly Science Summary
Jeremy Rusin

Leg 1 of ORCAWALE ended on 19 August with some excitement, as storm predictions forced us into Newport, OR, a day earlier than our scheduled arrival. During our in port, we said goodbye to first leg Cruise Leader Jay Barlow and scientists Misty Blakely, Jared Cox, Jim Gilpatrick and Heather Judkins. During our in port, we also learned that *McArthur II* Survey Technician, Lacey O'Neal, would not be able to sail with us on Leg 2. Lacey's absence is an enormous loss both from a personal and professional perspective, and he would not easily be replaced. Lacey, we are thinking of you and wishing you a rapid recovery.

After becoming briefly acquainted with the people and establishments of Newport, we found ourselves rejuvenated and ready to embark on Leg 2 of our survey. We also welcomed incoming scientists Mark Deakos, Karla Garcia, Ioana Ionescu and Iliana Ruiz-Cooley. On 24 August we departed port to resume our work off the more inshore waters of Oregon and northern California.



ORCAWALE-08 Transect lines completed to date cover most waters off Washington and Oregon.

As was the case in first leg, the weather cooperated during much of the first week of Leg 2, allowing us to survey almost continuously during daytime hours. If you are not already aware of it, one thing becomes obvious the moment you begin surveying – we are completely dependent on the weather out here. In addition, interpretation of the information we collect is dependent on numerous weather conditions and other factors – wind, swell height, fog, cloud cover, time of day, sun position, vessel speed, season, survey effort, etc. Changes in any single factor can significantly affect an observer's ability to detect a marine mammal. Incorporating these factors in the final analysis is complex, but it is as important as the data collection itself in estimating the sizes of the populations we study.

Equally important is providing enough information about these and other uncertainties in communicating research results to user groups. The information we collect may be used by a variety of entities for a number of applications. However, a primary purpose is to inform decisions on how to best manage the California Current Ecosystem, marine mammals that occur there, and human activities that may affect both. A frequent challenge is clearly communicating research results to decision-makers while providing them enough information about uncertainties and caveats to enable interpretation. For that reason, it is important for managers to understand the factors that may contribute to uncertainty in research results. And, it is equally important for scientists to understand applicable laws, such as the Endangered Species Act and Marine Mammal Protection Act, and managers' responsibilities relative to these laws. This overlap between scientists and managers fosters better communication between the two groups, and it helps scientists know the kinds of information that are most useful in management and answer questions about the impacts of different management scenarios on marine mammal populations.

One of the most rewarding aspects of our work is seeing our research incorporated into management efforts to protect threatened and endangered species, or as is the case with some large whales, help to document their recovery. I feel fortunate every time I have the opportunity to see these animals in the wild, and it is gratifying knowing our work on *McArthur II* is contributing to their continued survival in the California Current Ecosystem.

Marine Mammal Effort Summary.

Date	Start time End time	Start location End location	Distance Surveyed (nm)	Average Beaufort
081708	0659 2025	N43:36.89 W128:54.30 N44:10.73 W127:20.70	43.4	3.6
081808	0648 1855	N44:11.35 W127:19.91 N44:26.22 W125:32.69	82.6	2.2
081908	0644 0920	N44:21.27 W125:04.72 N44:17.79 W124:38.51	7.9	5.3
082408	1331 1945	N44:40.04 W124:10.68 N45:16.74 W124:18.85	15.6	4.1
082508	0634 1552	N45:41.21 W124:04.93 N45:25.25 W125:18.73	48.1	2.1
082608	0636 1938	N45:24.24 W125:17.19 N43:59.00 W125:48.84	79.8	2.6
082708	0801 2000	N43:43.61 W125:54.67 N43:20.32 W127:28.94	82.2	4.2
082808	0652 1629	N43:20.50 W127:38.79 N41:54.12 W127:52.74	86.5	4.1
082908	1126 1903	N41:48.70 W127:34.99 N41:59.63 W126:30.64	45.7	5.1

Marine Mammal Sighting Summary.

Code	Species	Number of sightings
017	*Delphinus delphis*	1
022	*Lagenorhynchus obliquidens*	10
027	*Lissodelphis borealis*	4
037	*Orcinus orca*	2
040	*Phocoena phocoena*	2
044	*Phocoenoides dalli*	3
061	*Ziphius cavirostris*	1
063	*Berardius bairdii*	1
070	*Balaenoptera* sp.	6
074	*Balaenoptera physalus*	4
075	*Balaenoptera musculus*	1
076	*Megaptera novaeangliae*	8
096	unid. cetacean	1
477	unid. Porpoise	3
CU	*Callorhinus ursinus*	1
MA	*Mirounga angustirostris*	13
Total		**61**

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	2	12	17
Berardius bairdii	Baird's beaked whale	0	0	1	1
Lagenorhynchus obliquidens	Pacific white-sided dolphin	14	38	15	39
Lissodelphis borealis	Northern right whale dolphin	6	9	10	18
Orcinus orca	Killer whale (non-SRKW)	2	9	2	9
Weekly Total		**24**	**58**	**40**	**84**

Photo Report
Jim Cotton and Chris Cutler

Since our last installment, we've photographed eight species of cetacean with a total of 82 individual IDs. An "individual ID" simply means that at least one photograph of a single animal is of high enough quality to visually demonstrate features that will allow an individual to be uniquely identified, (*i.e.*, distinctive body coloration, dorsal fin shape, scarring, saddle patch, etc. – depending on the species in question). We have taken numerous photographs of two of the cetacean species best known for their individually unique markings, humpback and orca whales. Among humpbacks, we have photo-identified nine different animals all from the undersides of their flukes (Fig 1).

The humpback shown in Figure 1 even kept the birders interested by briefly acting more avian than mammalian, and making good on its generic scientific moniker: *Megaptera* or "large winged" (Fig 2).

Figure 2. Humpback taking flight.

Figure 1. The flukes of a humpback whale.

Figure 3. Killer whale cow with calf.

Among other cetacean sighting highlights for the "week" were two different orca, or killer whale, pods in as many days. The larger pod yielded 27 group members for the photo archives, including three young calves (see Fig 3). Based on morphological traits such as the patterns of saddle patches, dorsal fin shapes, (and amount of nicks thereupon), in addition to distinctive acoustical features (see Acoustics Squeakly Report below), the first orca pod was deemed part of a subpopulation known as "offshore" (Fig 4), one of three orca ecotypes in the North Pacific.

Figure 4. Offshore killer whale.

The other group contained seven different animals and we believe they were members of the "transient" ecotype (see Fig 5). Orca researchers divide "killer whales," (technically speaking they are dolphins, the largest members of the family *Delphinidae*), into three ecological types, (resident, transient, & offshore), based on morphological, acoustical, and behavioral-ecological differences between groups. We will compare our photographs to images contained in regional photo-catalogs in the hopes of finding ID matches, learning about the movements of individuals, as well as the social structures of these orca pods.

Figure 5 Transient killer whales.

We also shot several Baird's and one Cuvier's (or goose-beaked) beaked whales, two fin and two blue whales, the underside of one right-whale dolphin, and at least 27 distinctive Pacific white-sided dolphins (Fig 6).

Figure 6. Pacific white-sided dolphin.

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	Weekly Totals		Cruise Totals	
Common Name	**Sightings Photographed**	**Individual IDs**	**Sightings Photographed**	**Individual IDs**
Pacific white-sided dolphin	7	27	8	28
Northern right whale dolphin	2	1	6	5
Sperm whale	0	0	2	2
Baird's beaked whale	1	6	2	12
Sei whale	0	0	3	9
Fin whale	2	2	20	39

Common Name	Weekly Totals Sightings Photographed	Weekly Totals Individual IDs	Cruise Totals Sightings Photographed	Cruise Totals Individual IDs
Blue whale	1	2	9	12
Humpback whale	7	9	12	16
Killer whale	2	34	2	34
Cuvier's beaked whale	1	1	1	1
Total	**23**	**82**	**65**	**158**

Seabirds

Michael Force and Sophie Webb

That famous TV gumshoe of "Dragnet" fame, Sergeant Joe Friday, implored, "All we want are the facts, Ma'am." Of course, we handed over what we knew. But in our case, the facts misled the jury into believing we were overwhelmed with seabirds every day of this extended reporting period. Understandably though, just looking at the numbers, one can be forgiven for arriving at this erroneous conclusion.

It takes only a couple of days surveying the neritic waters of the continental shelf to boost our totals into the stratosphere. The rich upwelled coastal zone is a gold mine for feeding seabirds, particularly Pink-footed and Sooty Shearwaters, Common Murres, and various species of gulls. This "week," actually 10 days, we found 34 species of seabirds (our most ever), including a single day record count of 22 species. If hard-nosed Sergeant Joe Friday requires further proof of our whereabouts, we present Exhibit B: 70% of the species seen that day were members of the avian order Charadriiformes—gulls, terns, jaegers and alcids—species commonly associated with coastal neritic habitats.

Once we reached the western edge of the continental shelf and continued westward into the deep pelagic waters beyond, diversity and abundance hit rock button. Here the sparse avifauna is dominated by migrating seabirds such as Arctic Terns, Long-tailed Jaegers and scattered Leach's Storm-Petrels and Red Phalaropes. Finding eight species during a day's honest work is considered exceptional during explorations of the study area's nether regions, where, truth be told, we spent a good portion of this reporting period.

Long-tailed Jaeger. Photo by Sophie Webb

As always though, there were exciting highlights: a Laysan Albatross; a single Hawaiian Petrel only 130 nm west of Newport, Oregon; and several Xantus's Murrelets. It was possible to determine the subspecies of two of the Xantus's Murrelets, being of the expected southern subspecies *Synthliboramphus hypoleucus hypoleucus.*

Acoustics Squeakly Report
Tina Yack

This weekly report data is punctuated by a trip to shore, where many rare species of ale were sighted at the Rogue Brewery, and there was an acoustic encounter of a late 80's flashback on karaoke night. Back at sea we have had some interesting encounters as well, including both offshore and transient killer whales. During the 10 days of at sea monitoring covered in this report the array was deployed for approximately 105 hours, with 72 hours of monitoring effort (Table 1). During this time there were 34 acoustic encounters, of which 16 were associated with a visual sighting (Table 2). The most noteworthy of these encounters were: Cuvier's beaked whales, Baird's beaked whales, two killer whale encounters, two humpback whale encounters, and five Pacific white-sided dolphin encounters.

In an environment where vision is limited, transmission of acoustic signals is the most efficient means of foraging, navigation, and information transfer available to marine mammals. Delphinid vocalizations are typically classified into three categories: whistles, echolocation clicks, and burst pulse signals. Whistles are frequency modulated, continuous, narrow band signals. They are often pure tonal signals that vary in frequency over time, but sometimes harmonics of this fundamental frequency are also present. Whistles, believed to function as social signals, may range in duration from fractions of a second to several seconds and typically range in fundamental frequency from 2 to 30 kHz. Echolocation clicks are impulsive, broadband signals that typically vary in peak frequency between 10 and over 100 kHz. These signals are used for navigation and in object discrimination. Burst pulse signals are composed of short-interval broadband click trains, resulting in a signal that may appear tonal due to the high repetition rate of the clicks. Burst pulse sounds may be used as social signals as well as in echolocation tasks. These categories are not mutually exclusive, as transition from increasing click rates to click bursts to purely tonal signals often occurs during acoustic encounters. The killer whale vocal repertoire contains all three categories of vocalizations, all of which were recorded during one of our acoustic encounters last week (Figure 1).

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**
8/17/2008	3.6	06:35	20:50	14:15:00	8:00	4
8/18/2008	2.2	06:50	20:18	13:28:00	11:00	6
8/19/2008	4.7	06:35	12:10	05:35:00	4:00	3
8/24/2008	4.3	13:29	19:49	06:20:00	5:00	3
8/25/2008	2.2	06:30	20:10	13:40:00	12:00	4
8/26/2008	2.6	06:25	20:30	14:05:00	7:30	4
8/27/2008	4.3	06:40	20:11	13:31:00	8:30	5
8/28/2008	4.2	06:41	18:50	12:09:00	7:00	2
8/29/2008	5.1	06:53	19:15	12:22:00	9:00	3
8/30/2008	OFF	OFF	OFF	OFF	OFF	OFF
Total				105:25:00	72:00:00	34

Table 2. Acoustic detections.

Date/Time	AC #	Acoustic ID	Latitude	Longitude	Visual Sighting	Visual ID
8/17/2008 16:20	75	unid beaked whale	43.7206N	127.5076W	95	Cuvier's beaked whale
8/17/2008 17:46	76	unid beaked whale	43.7537N	122.4807W	NA	NA
8/17/2008 18:20	77	unid beaked whale	43.8512N	127.4509W	NA	NA
8/17/2008 19:23	78	unid beaked whale	44.0101N	127.3942W	NA	NA
8/18/2008 8:07	79	unid beaked whale	44.4265N	127.2366W	96	Baird's beaked whale
8/18/2008 11:08	80	unid beaked whale	44.7342N	127.1471W	NA	NA
8/18/2008 13:21	81	unid beaked whale	44.7063N	126.7894W	NA	NA
8/18/2008 14:05	82	unid whale	44.7063N	126.7894W	97	Fin whale
8/18/2008 18:18	83	unid cetacean	44.4639N	125.5600W	101	Pacific white sided dolphins
8/18/2008 18:55	84	unid cetacean	44.4379N	125.5405W	102	Mixed species
8/19/2008 7:30	85	Sperm whale	44.3217N	124.5088W	NA	NA
8/19/2008 8:26	86	unid cetacean	44.3043N	124.7081W	NA	NA
8/19/2008 9:40	87	unid whale	44.2963N	124.6416W	104	Humpback whale
8/24/2008 13:34	88	unid cetacean	44.6708N	184.1787W	NA	NA
8/24/2008 14:56	89	unid cetacean	44.8732N	124.2797W	106	Humpback whale
8/24/2008 15:46	90	unid balaenoptera	44.9308N	124.2811W	108	Balaenoptera sp.
8/25/2008 11:28	91	unid cetacean	45.6944N	124.8310W	121	Pacific white sided dolphins
8/25/2008 12:57	92	unid cetacean	45.6721N	125.0480W	122	Mixed species
8/25/2008 16:33	93	unid cetacean	45.3073N	125.3017W	125	Offshore Killer Whales
8/25/2008 18:14	94	unid cetacean	45.1798N	125.3835W	126	Mixed species
8/26/2008 6:31	95	unid cetacean	45.4199N	125.2823W	NA	NA
8/26/2008 6:51	96	unid cetacean	45.3602N	125.3037W	127	Mixed species
8/26/2008 13:29	97	unid cetacean	44.7909N	125.6476W	120	Transient Killer Whales
8/26/2008 19:24	98	unid beaked whale	44.8234N	125.8019W	NA	NA
8/27/2008 7:46	99	unid cetacean	43.7554N	125.9003W	NA	NA
8/27/2008 9:13	100	unid cetacean	43.5453N	125.9837W	139	Pacific white sided dolphins
8/27/2008 11:29	101	unid cetacean	43.3048N	126.0868W	NA	NA
8/27/2008 16:15	102	unid cetacean	43.2289N	126.9054W	142	Pacific white sided dolphins
8/27/2008 16:56	103	unid cetacean	43.2435N	126.9527W	143	Pacific white sided dolphins
8/28/2008 9:52	104	unid cetacean	42.8596N	127.8077W	NA	NA
8/28/2009 10:09	105	unid cetacean	42.7955N	127.8315W	NA	NA
8/29/2008 8:21	106	unid beaked whale	41.8698N	127.7128W	NA	NA
8/29/2008 10:29	107	unid beaked whale	41.8413N	127.6287W	NA	NA
8/29/2008 18:46	108	unid beaked whale	41.9412N	126.5351W	NA	NA

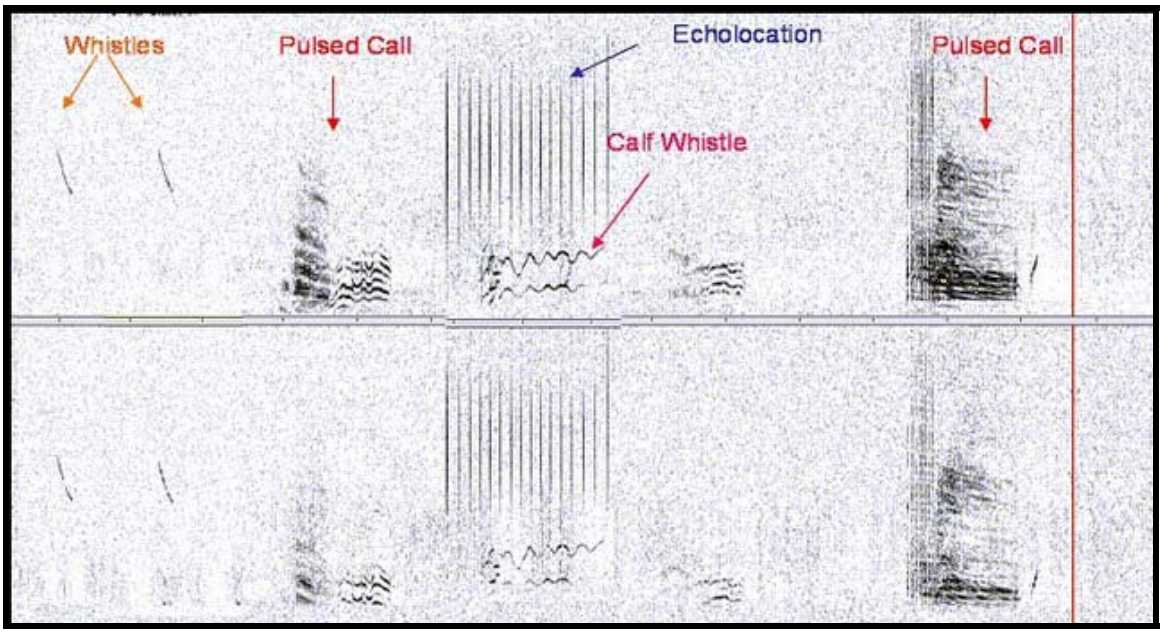

Figure 1. Spectrogram of acoustic killer whale detection (1024 FFT; Hann). Two mid frequency channels are sampled at 96 kHz on 8/25/08 between 17:00 and 17:30. This image was created for display using calls clipped from various time periods within the recordings as such, both time and frequency are not displayed at scale.

Squid Jigging Efforts

Iliana Ruiz-Cooley and Karla Garcia
with assistance from
Jim Cotton, Dave Lapointe and Jim Kintzele and other McArthur II crew

On the last week of the first leg, Heather Judkins and the rest of the jigging team caught twelve jumbo squid within the last fifteen minutes of effort! Everybody was excited about this catch. Heather processed the samples for about five hours, not finishing dissections until 4:00 am. Catching, dissecting, measuring and weighing jumbo squid is not an easy task, and it's even more onerous if the squid are large specimens. We thank Heather for her enthusiasm, dedication and effort on the squid project, and we hope she can join us on another survey.

Our squid team for the second leg, also known as 'Equipo Calamar', includes Karla and Iliana as the main jiggers and Dave Lapointe as gaffer. On the first night while in shallow waters (170m) we practiced jigging and standardized our jigging effort. After this first night, we were pleasantly surprised by the days that followed. On August 25th, as soon as we dropped our first jig, and even before reaching the desirable depth, I (Iliana) caught the first squid. I had forgotten the feeling of catching a squid so much that I didn't believe I had one until we brought it to the surface. Our night ended having caught four jumbo squid of 56-66 cm mantle length (ML). The heaviest was approximately 8kg, caught by first-time jigger Karla.

In Oregon and Washington waters, the jumbo squid, *Dosidicus gigas*, was once uncommon. However, since 2003, this mesopelagic squid species has remained abundant in OR-WA and Canada, and it seems to be associated with a decline in fish stocks of commercial importance (*e.g.*, Pacific hake). To understand the role of jumbo squid in the California Current (CC), we are collaborating with a group of scientists to sample specimens for the next three months. As a result of this work, we hope to better understand this species' role in CC food webs.

On August 26 and 27, we caught more jumbo squid. The heaviest squid was a female of 8.5kg and 63.3cm ML. We have enjoyed the jigging effort every night along with the company and cheerful attitudes of our skilled gaffer Dave and other jiggers: Jim Kintzele, Orcino Tan, Peter Stoeckle, and Art Mercado. After jigging, Karla and I felt soreness in our muscles for several days. To gain strength we decided eat more and work out. So far, we have succeeded in just eating more.

From August 28 to 30 we were unable to jig because of weather and rough sea conditions. This week, when conditions are favorable, we will try our new downrigger and hope to land an extra-large squid.

Figure 1 Jumbo squid, *Dosidicus gigas*, caught off Oregon.

Oceanography
Ryan Driscoll

We sailed this leg without the wisdom and company of the ship's ST, Lacey, for whom we wish a speedy recovery. Oceanography has rallied from the loss with the help of Jim Kintzele, Jeremy Rusin, Karla Garcia, and the support of the rest of the crew. Though we are short in numbers we don't plan on missing a beat as science must go on! So with that in mind let's look at the ubiquitous XBT and the even more ubiquitous Salp.

The Expendable Bathythermograph (XBT) is a one-time probe that gives a profile of temperature versus depth in the water column to 760m. The small streamlined device was designed in the 1960's to aid in Anti-Submarine warfare. It functions by allowing ships to locate the thermocline, a sharp temperature boundary in which submarines hide from sonar. Over 5 million XBTs have been manufactured by Lockheed-Martin and are used by navies and researchers all over the world.

The device consists of two parts: a probe with a small thermistor giving temperature that falls at a predetermined rate giving depth, and a launcher. The probe and launcher both have spools of thin copper wire connecting the two, which pay out with descent and ship speed respectively. The value of an XBT is that it can be deployed at speeds up to 20kts, allowing us to cover large areas without gaps in our data. It can even be

deployed by an oceanographer in inclement weather when everyone else is inside getting warm with hot cocoa.

Photo 1: XBT shown out of its case.

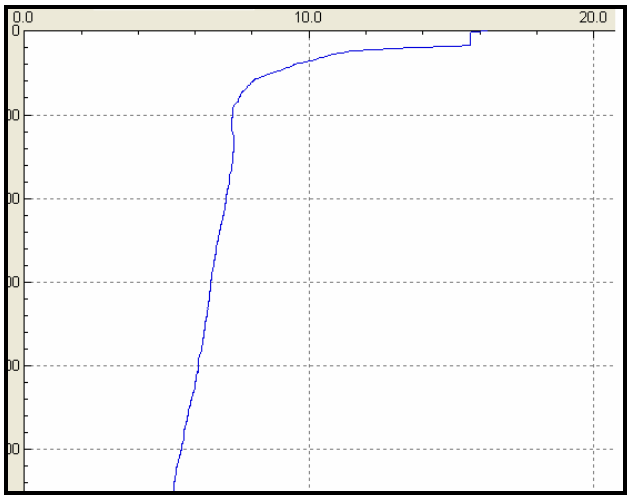

Photo 2: XBT profile: note the sharp drop in temperature at the thermocline in the top 100m.

So easy the Cruise Leader can do it. Here, Jeremy Rusin is seen preparing for a special XBT launch.

In our State of the ocean we will include the last few days of leg 1 as well as this week. The name of the game has been inshore, relatively. Our track lines have carried on and off the shelf break along the central and southern coast of Oregon, a highly productive area. This means lots of phytoplankton in the water and lots of zooplankton feeding on it. Our BONGO net came up filled with near a gallon of the small gelatinous Tunicate, Salps. In one part of their unique life cycle they form long drifting aggregate chains that can be several meters long before they enter their second life phase as a solitary organism. These filter feeders pump water through a body cavity and respond well to phytoplankton rich waters by budding off and growing rapidly. They can multiply so quickly that they can strip the water of phytoplankton and sink won their full stomachs creating slimy mats on the ocean floor.

Oceanography Operations, by the numbers

Date	CTD	XBT	Surface chlorophylls	Bongo tows	HAB
08/17/2008	1	4	4	1	24
08/18/2008	1	5	4	1	24
08/19/2008	0	3	3	0	18
08/24/2008	1	2	2	1	12
08/25/2008	2	4	3	1	18
08/26/2008	1	4	4	1	24
08/27/2008	1	6	5	1	24
08/28/2008	1	3	3	1	18
08/29/2008	1	3	3	0	12
08/30/2008	0	0	0	0	0
Total	**9**	**34**	**31**	**7**	**174**
Grand Total	**29**	**127**	**112**	**25**	**676**

Midwater Trawling Weekly Report

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

This week spanned the end of Leg 1 and the beginning of Leg 2. I would like to welcome the new IKMT assistants for Leg 2, Karla Garcia and Ioana Ionescu. They are learning how much fun it is to stay up all night trawling for fish! We have completed 61 Isaacs-Kidd Midwater Trawl (IKMT) tows to date, comprised of twenty-four nightly pairs (150 and 500m), a shallow night tow (60m), and twelve daylight tows-of-opportunity. Two nights of sampling (8/29 – 8/30/08) have been cancelled due to rough weather this week.

NOAA Ship *McArthur II* has been closer to shore this week than we have been since the first few days of Leg 1. Coastal waters in the California Current have higher primary productivity than offshore waters due to the extra nutrients supplied by upwelling water. This abundance of food supports higher zooplankton and fish populations than are found offshore. Our trawls this week have reflected this, collecting as much as two gallons of krill in a single tow. That is about eight times as much as we typically catch with a similar tow offshore. The abundance of zooplankton food makes near-shore waters a good place for growing fish, and we have been seeing many larval fish in our catches. Larval anchovies have been particularly abundant, and there can be 100's of them in a sample. We separate the larval anchovies from the zooplankton, and preserve them separately in ethyl alcohol. The alcohol is not as acidic as formaldehyde (the "regular" preservative), and it prevents damage to the otoliths of the fish. The otoliths are ear bones that have concentric rings like a tree. These rings are used to study the growth rate of larval fish.

Photographs of some interesting animals captured in the IKMT this week are shown below in Figures 1-3.

Figure 1: A larval anchovy, *Engraulis mordax.* This fish is about 30mm long.

Figure 2: *Nematoscelis difficilis*, a species of krill collected in our trawl. It is about 20mm long.

Figure 3: The head of a black dragonfish, *Idiacanthus antrostomus.* This fish uses the luminescent tip of its chin barbel to lure prey within reach of those impressive teeth.