ORCAWALE 2008: Weekly Report

Report Dates: 21 – 27 September 2008 Chief Scientist: *Jay Barlow* Leg 3 Cruise Leader: *Jim Carretta*

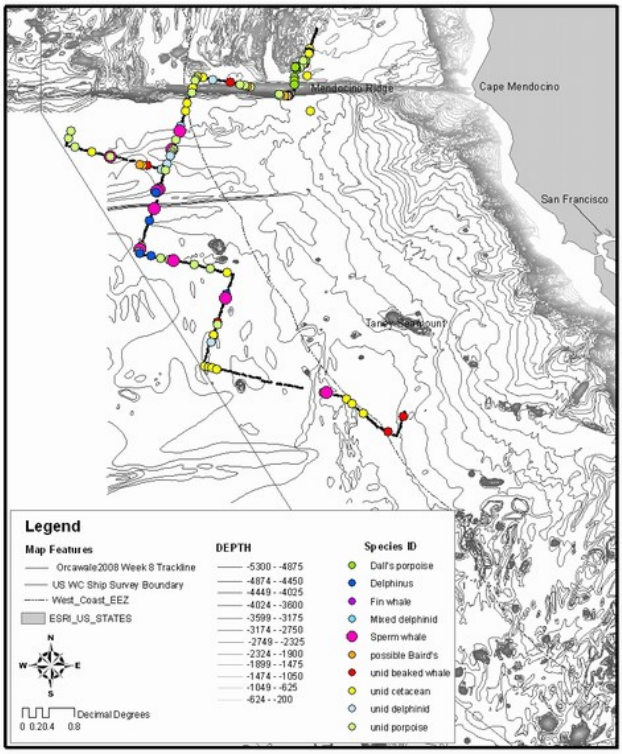
Weekly Science Summary
Jim Carretta

This week has been spent surveying far offshore waters between the latitudes of Point Arena and Big Sur. Out here, we begin to escape some of the dominating influence of the California current. Water temperatures increase, productivity decreases, and striped dolphin begin to appear on our sighting menu. Numerous large groups of short-beaked common dolphin (*Delphinus delphis*) have been sighted this week, with smaller numbers of striped dolphin (*Stenella coeruleoalba*) mixed in. Often, it is only a few striped dolphin individuals that may be seen among the hundreds of common dolphins. Marine mammal observers have to be on their toes to find these few "streakers," as they are called out here. Although short-beaked common and striped dolphin do not share the same genus, genetic work on the systematics of the family *Delphinidae* published by Leduc *et al*. in 1999 suggests that these two species are more closely related than striped dolphin are to other members of the genus *Stenella*. Photographs of each reveal the many similarities in morphology (see photo-ID report).

Today, we found an abandoned raft, still inflated, upside down, floating approximately 150 nm west of Point Sur. As the deck crew brought it on board, we all stared, silently hoping that it had dislodged from a larger vessel and doesn't imply some soul lost at sea. The raft had identification numbers on it and the officers from our NOAA ship *McArthur II* have already reported the information to the Coast Guard.

The cribbage tournament has taken on a sense of urgency, with the CO Greg Hubner steamrolling most opponents, we scientists wonder if we even have a chance. Stay tuned.

ORCAWALE Week 8: Acoustic Encounters



NOAA Ship McArthur II tracklines and acoustic detections: 21-27 September.

Marine Mammal Effort Summary.

Date	Time start Time end	Start Location End location	Distance surveyed (nm)	Average Beaufort
092108	0716 1751	N41:16.89 W126:45.62 N40:15.11 W127:15.07	60.0	1.7
092208	0728 1920	N40:23.64 W127:48.60 N39:27.79 W128:57.48	79.5	5.0
092308	0727 1920	N39:24.44 W128:59.05 N39:44.75 W130:31.33	84.9	3.2
092408	0729 1916	N39:08.10 W129:04.64 N37:47.71 W129:20.43	77.3	4.5
092508	0729 1905	N37:47.20 W129:17.48 N36:38.54 W128:19.07	95.6	4.8
092608	0746 1903	N36:35.38 W128:20.46 N35:45.91 W126:58.67	90.9	4.7
092708	0727 1900	N35:42.17 W126:41.95 N35:25.50 W125:24.01	84.2	4.8

Marine Mammal Sighting Summary.

Code	Species	Total sightings
013	*Stenella coeruleoalba*	6
017	*Delphinus delphis*	9
044	*Phocoenoides dalli*	13
046	*Physeter macrocephalus*	3
049	*Ziphiid whale*	2
070	*Balaenoptera* sp.	1
074	*Balaenoptera physalus*	5
075	*Balaenoptera musculus*	2
078	Unid. small whale	1
079	Unid. large whale	1
177	Unid. small delphinid	2
CU	*Callorhinus ursinus*	3
MA	*Mirounga angustirostris*	3
Total		**51**

Cetacean Biopsy Report

Suzanne Yin, Allan Ligon, and Rich Pagen

Species	Common Name	No of Weekly Samples	No of Weekly Takes	Total Samples	Total Takes
Balaenoptera physalus	Fin whale	0	1	14	21
Berardius bairdii	Baird's beaked whale	0	0	1	1
Delphinus delphis	Short-beaked common dolphin	21	57	43	112
Globicephala macrorhynchus	Short-finned pilot whale	0	0	4	5

Species	Common Name	No of Weekly Samples	No of Weekly Takes	Total Samples	Total Takes
Lagenorhynchus obliquidens	Pacific white-sided dolphin	0	0	25	49
Lissodelphis borealis	Northern right whale dolphin	0	0	10	23
Orcinus orca	Killer whale	0	0	2	9
Grand Total		**21**	**58**	**99**	**220**

Photo Report
Jim Cotton and Chris Cutler

We have seen many groups of short-beaked common dolphin this week, often mixed with a few striped dolphin. Some of the short-beaked common dolphin are quite melanistic, which makes them look almost like striped dolphin at times. Since a picture is worth a thousand words, both are shown below. We also got a nice look at a blue whale, which was kind enough to throw its flukes into the air for a photo opportunity.

Photography summary table.

Common Name	Weekly Totals		Cruise Totals	
	Sightings Photographed	Individual IDs	Sightings Photographed	Individual IDs
Pacific white-sided dolphin	0	0	10	52
Northern right whale dolphin	0	0	8	6
Short beaked common dolphin	6	37	14	87
Striped dolphin	1	0	2	0
Dall's Porpoise	0	0	1	0
Sperm Whale	1	0	1	2
Baird's beaked whale	0	0	3	12
Sei whale	0	0	3	9
Fin whale	4	7	26	52
Blue whale	2	3	12	17
Humpback whale	0	0	12	16
Killer whale	0	0	3	37
Cuvier's beaked whale	0	0	1	1
Pilot whale	0	0	1	39
Total	14	47	106	339

Seabirds

Michael Force and Sophie Webb

It was an exciting week replete with incredible sightings and several new species for ORCAWALE 2008. A state of euphoria was delivered by the wind on a three and a half metre wingspan—a Wandering ("Antipodean") Albatross! Its unexpected arrival created such a frenzy of excitement that even the marine mammal survey effort ground to a halt. For several minutes that afternoon, the flying bridge was completely devoid of marine mammal observers. Instead, there were 12 or 13 birders, all trying to get a look at the world's largest flying bird, its immense size in apparent defiance of the laws of aerodynamics. Seeing one of these magnificent birds in the Northern Hemisphere is remarkable in itself, but is even more astounding when one considers that this is the exact same bird seen 13 days previously, 30nm southwest of Newport, Oregon. At the time of its cameo appearance off the starboard side, we were about 249nm west-southwest of Point Arena, California. Wandering Albatrosses are well known for their affinity for ships, often following a vessel for days on end. Clearly, this bird found us, not the other way around. For additional photos of the bird taken off Oregon visit: http://www.pbase.com/gregbirder/20080913.

A quick look at the numbers this week leads one to the incorrect conclusion that we had a mediocre week. This is only partly true. Our daily total of nine species was one of the lowest of the entire cruise, almost as low as those nearly birdless weeks off Washington and Oregon during Leg 1.

Low diversity and abundance are the expected norm while surveying far beyond the influence of the California Current. With that in mind, finding 24 species (only two less than the cruise average) was somewhat surprising considering the interminable hours of survey effort this week with hardly a single bird in sight. Compare this with the weekly average of 13 species for the aforementioned weeks of Leg 1. Seabirds new for the cruise such as Mottled Petrel and Red-tailed Tropicbird, and lost migrants such as Double-crested Cormorant, Lapland Longspur and Osprey, ran up our weekly score. In addition, several Hawaiian Petrels were seen and on a couple of days Cook's Petrel was the commonest seabird.

We want to thank all scientists and crew who assisted with the nightly task of rescuing Leach's Storm-Petrels stranded on deck and in the ship's coffer dams. Fortunately, mitigation measures are currently being implemented.

Acoustics Squeakly Report

Tina Yack and Aly Fleming

Acoustics continues to be squeaky and busy as we approach the mid-point of ORCAWALE 2008. This week I am happy to report that we have been blessed with sunny skies and calm seas for at least part of the week. Our travels have taken us to the western edge of the study area over the Mendocino Ridge and back south past San Francisco providing many acoustical encounters along the way (Figure 1). This has resulted in 77 hours of acoustic recording effort and 68 hours of monitoring effort (Table 1). During this time, there were 103 acoustic encounters, approximately 25% of which matched visual sightings (Table 2). There were two joint visual/acoustic unidentified beaked whale encounters, two fin whale encounters, nine Dall's porpoise encounters, four short beaked common dolphin encounters, and three mixed dolphin schools. But, the stars of the show this week were sperm whales, with a total of ten acoustic encounters.

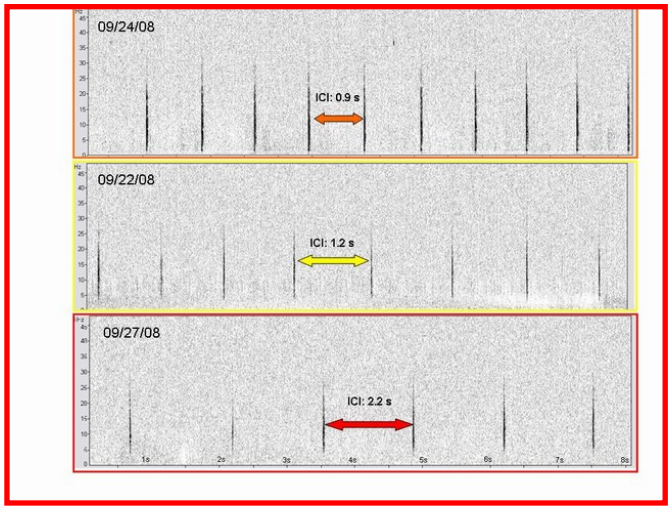


Figure 2. Spectrogram of three different acoustic sperm whale encounters (FFT size: 512).

Sperm whales vocalize approximately 66% of every hour, therefore they are more likely to be detected acoustically versus visually. This was evident this week, with approximately 60% of acoustic only sperm whale encounters, 90% of which were *first* detected acoustically. Sperm whales are perhaps one of the most easily recognized marine mammals. The Sperm whales' large boxy head, thin lower jaw and off-center blow hole make it easy to identify at the ocean's surface. Interestingly, they are also highly recognizable *acoustically* with relatively low frequency (0.1-30kHz) echolocation clicks that are usually repeated regularly for the majority of an animal's dive. It is thought that these click sequences, called codas, are used for both foraging and communication. Sperm whales are social odontocetes and it is thought that each individual may have its own unique coda enabling coordination of group behavior. These codas can vary in their frequency as well as their interclick interval ((ICI) the time between each click). An example from our acoustic encounters this week is shown in Figure 2. It is thought that the speed and frequency of the clicks may convey information about the sender, including animal size, sex and reproductive status. Luckily for us whale eavesdroppers, these signatory vocalizations allow us to acoustically estimate the number of individual animals in an area, something often difficult to do with just visual observations alone. Additionally, their clicks are also at a low enough frequency that we are able to hear them in real-time on the hydrophones making them just plain fun!

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

Date	Average Beaufort	Average Visibility Range (nm)	Recording Start	Recording End	Recording Time	Monitoring Effort	Acoustic Encounters
09/21/08	1.7	6.5	7:10	19:52	12:42	12:00	29
09/22/08	5.0	6.5	7:10	20:19	13:09	12:00	19
09/23/08	3.1	6.9	7:34	19:22	11:48	10:00	15
09/24/08	4.5	5.6	7:25	19:15	11:50	9:00	16
09/25/08	4.8	6.9	7:30	19:07	11:37	9:00	12
09/26/08	4.7	7.0	7:48	12:02	4:14	3:30	7
09/27/08	4.8	6.4	7:30	19:00	11:30	9:30	8
Total					**76:50:00**	**65:00:00**	**106**

Table 2. Acoustic Encounters

Species ID	No. Acoustic Encounters
Short-beaked common dolphin	4
Dall's porpoise	9
Fin whale	2
Sperm whale	10
Unid small delphinid	1
Mixed delphinid	3
Unid beaked whale	7
Unid cetacean	22
Unid delphinid	5
Unid porpoise	36
Possible Baird's beaked whale	4
Total	**103**

Oceanography
Ryan Driscoll, Shannon Lyday, Jim Carretta

The Squeakly team (acoustics) isn't the only one using acoustics. The real music is here in Oceanography. This week we will touch upon the basics of echosounders, an increasingly important tool in the world of biological oceanography.

Echosounders work on the basic principle of talking into the water and listening to what echoes back. We just use sophisticated transducers to do our talking, transceivers to listen and software to clean and magnify the noise. A simple version, for example, is the depth sounder, which emits a signal and bounces it off the sea floor telling us how deep the water is. What we want to know is what is in between and how much of it is there. We can use tows to tell us the composition of different species and a very general idea of where they are but it is a drop in the bucket. A Bongo might filter a volume of water about the size of a medium swimming pool, not a whole lot with respect to the Pacific Ocean.

On ORCAWALE we run our echo-sounder (SIMRAD EK-60) around the clock, covering an area of the ocean unobtainable with nets. In essence it is like a very detailed fish finder. However, in order to find something as small as krill, we need to know a bit about frequencies. We have three transducers each set to a different frequency, 38, 120 and 200 kHz and three transceivers, one for each transducer. Each frequency responds uniquely to different sizes and densities. Smaller organisms, even copepods, will reflect the short wavelengths of 200 kHz which penetrate down to about 250m. Lower frequencies, like our 38 kHz, detect larger less dense organisms like fish and travel farther through the water. We can determine a size and acoustical signature for an organism or group of organisms by seeing how each frequency reflects off of it. Then using computer software we can find out how many times our echo sounder came back with that arrangement of signals. After a cruise, all the data are processed to tell us where and how much was in the water and to a certain extent, what.

State of the Ocean: We have spent the past week far out on the western edge of the grid exploring the deep blue of offshore waters. The phytoplankton greens and browns of the productive shelf waters are long gone. Warm days and sustained seas have created a deep mix layer, also contributing to lower productivity.

Oceanographic data summary.

Day	CTD	XBT	Surface chlorophylls	Bongo Tows	HAB
09/21/2008	1	3	3	1	25
09/22/2008	1	4	4	1	25
09/23/2008	1	4	4	1	31
09/24/2008	1	4	4	1	31
09/25/2008	1	4	4	1	31
09/26/2008	1	4	4	1	31
09/27/2008	1	5	4	1	31
Weekly Totals	**44**	**204**	**185**	**40**	**1133**

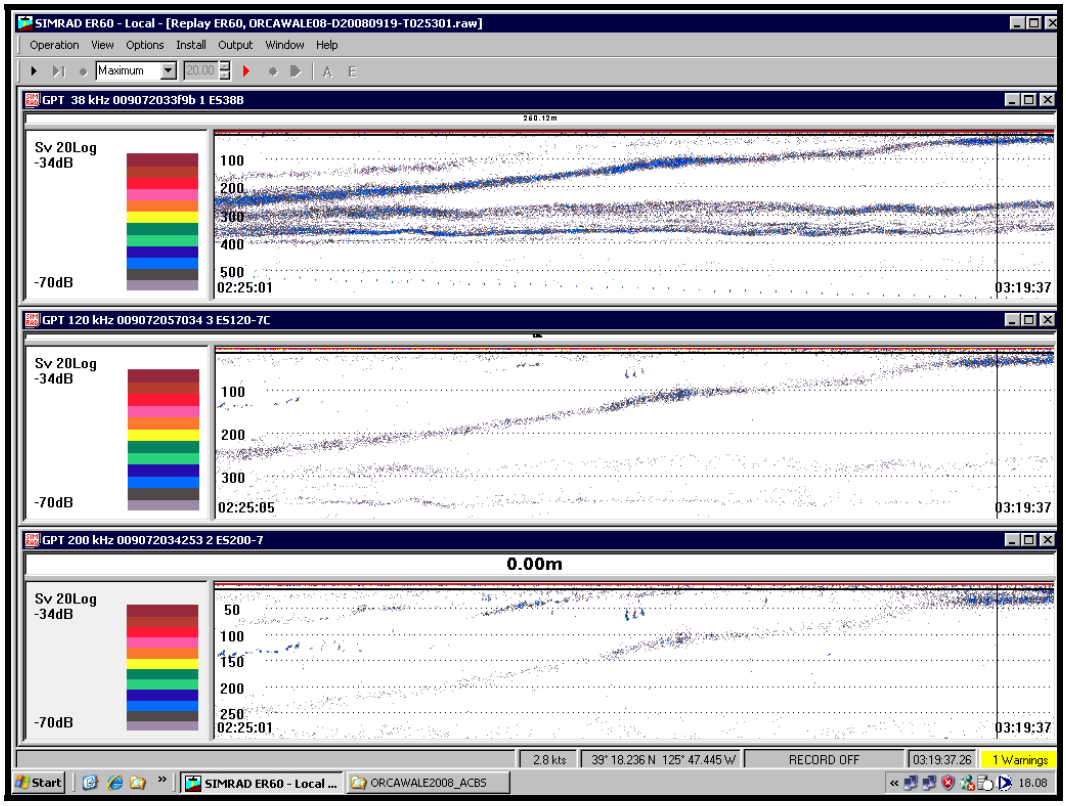


Figure 3. Diel Vertical Migration (DVM) caught by the echo- sounder. Plankton migrating up the water column as dusk settles to night.

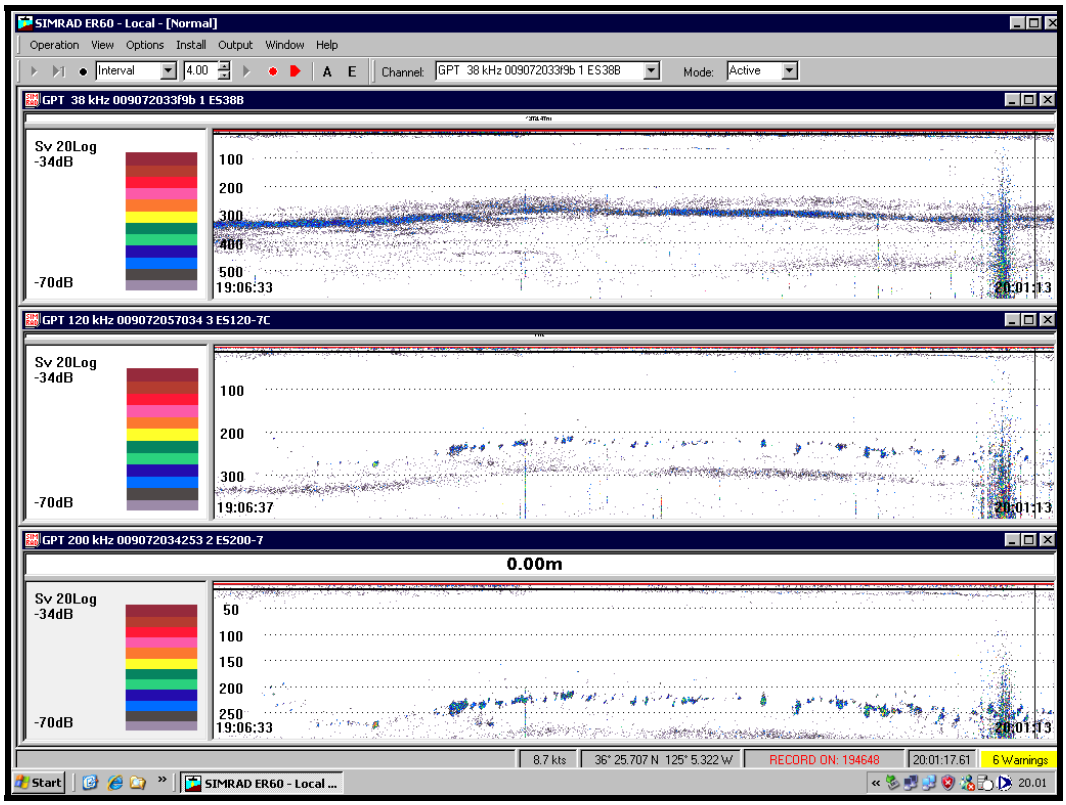


Figure 4. Patches at 200m indicating schools or swarms of plankton, the dense band below the main body of plankton during the day, before DVM. **Midwater Trawling Weekly Report**

IKMT

Leader: Andrey Suntsov; IKMT Assistant: Carl Mayhugh

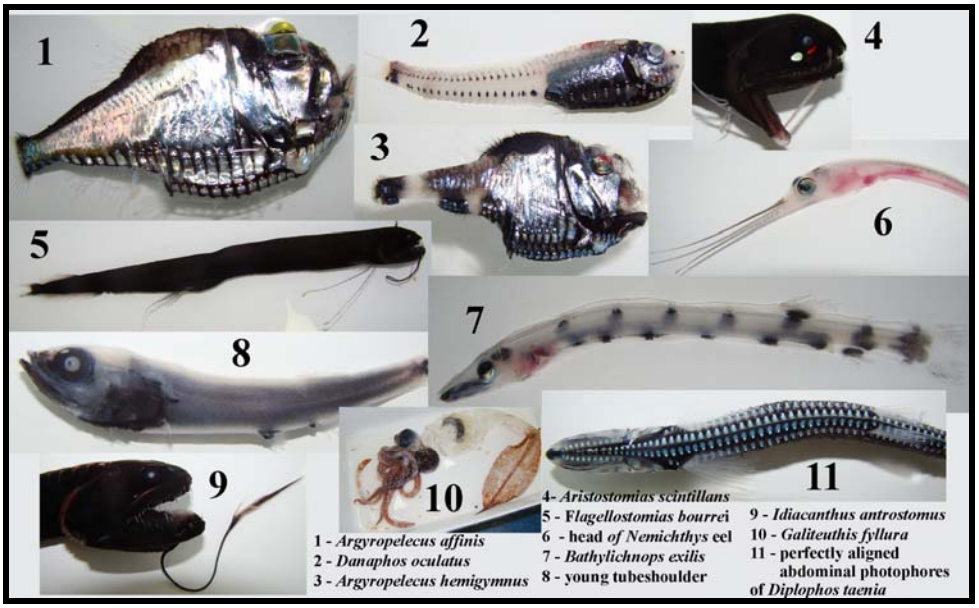
During past week we were working significantly more offshore and also started to move south. We are now working in waters of low productivity, as evidenced by significantly lower volumes of crustacean zooplankton and increase in the number of gelatinous animals such as salps. During this week we did seven successful nightly pairs of midwater trawls (150 and 500 m) and two shallow tows (65m) at night. Our catch still contains significant numbers of common California Current lanternfishes such as *Stenobrachius leucopsarus* and *Diaphis theta*, but their size composition has shifted mostly to very small juveniles and metamorphosing specimens. We practically stopped collecting another common California Current myctophid – *Tarletonbeania crenularis* but the myctophid diversity now includes infrequently collected *Symbolophorus californensis* and *Ceratoscopelus townsendii*, as well as small specimens of *Protomyctophum thompsoni* and *Diogenichthys atlanticus*. We are also getting a higher diversity of predatory fishes in our trawls, including *Idiacanthus antrostomus*, *Flagellostomias bourrei*, *Photonectes albipinnis*, *Bathophylus* sp. Our deeper tows (500m) now regularly bring an assortment of oceanic hatchetfishes, from more generalized elongated *Danaphos oculatus* to canonical bright-silver *Argyropelecus affinis*, with some specimens reaching 80mm in length, as well as smaller, semi-transparent hatchetfish *Argyropelecus hemigymnus*. We also infrequently get curiously looking snipe eels (family Nemichthyidae), with extremely elongated thin jaws that are curved upward, giving the fish its common name.

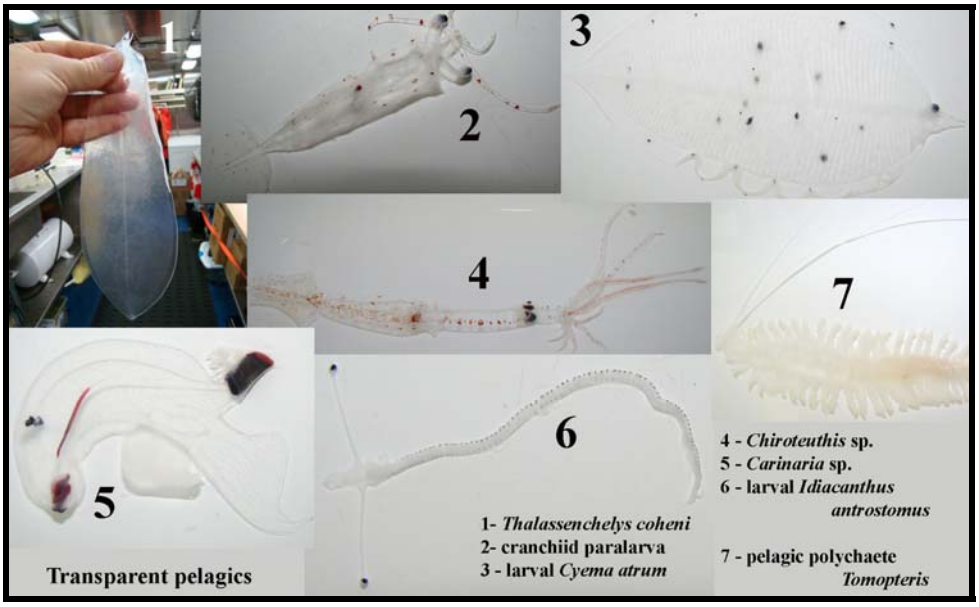
The highlight of this week's sampling was a perfect specimen of a young adult javelin spookfish (*Bathylichnops exilis*). The fish, a member of a highly specialized oceanic family Opisthoproctidae, is a good example of neoteny in the deep-sea, the phenomenon where adults retain many larval or juvenile characters. But the most outstanding feature of this species is the presence of a second eye, with separate lens and cornea, located below the primary upward looking eye, making it a unique four-eyed fish in the mesopelagic zone. The second eye is much smaller, and possibly scans the space below, not covered by the primary eye. Another interesting fish collected was a shining loosejaw (*Aristostomias scintillans*), a member of a small deep-sea group (fam. Malacosteidae) called loosejaws due to lack of floor in the mouth. This family is unique among deep-sea ichthyofauna for evolving red-bioluminescence (extremely rare in nature!). These fishes produce red light and are also able to see it, which gives them significant selective advantage. Most organisms in this environment are being insensitive to red light - they see only short waves (blue light, hence the dominating role of blue bioluminescence!), which gives loosejaws the ability to illuminate prey without being seen. We also collected an excellent specimen of juvenile tubeshoulder (fam. Platytroctidae) – a group of deep-sea fishes unique in its ability to squirt a bioluminescent fluid out of tube located above the pectoral fin, a defense strategy similar to that utilized by some pelagic crustaceans, as well as one species of midwater squid (*Heteroteuthis*).

Large larvae retained by 1.8mm mesh IKMT mesh now include only oceanic representatives, with no larval rockfishes (*Sebastes*) or flatfishes. We commonly collect remarkable larvae of Pacific blackdragonish *Idiacanthus antrostomus*, with eyes born on long stalks (these were initially given their own scientific name *Stylophthalmus paradoxus* – paradoxical stalked-eye, until William Beebe cracked the puzzle by matching larvae with adults during his extensive trawling off Nonsuch Island, Bermuda), larval notosudids (*Scopelosaurus* sp.), whose fast moving adults are never collected by slow midwater IKMT towing, as well as a variety of larval myctophids, paralepidids, melanostomiids, viperfishes, bathylagids and melamphaeids. One trawl brought a very large specimen of rare leptocephalus (eel larva) which was given its own name *Talassenchelys coheni* for the time

being, but whose actual adults remain unknown. Another interesting leptocephalus larva we observed is that of a deep-sea bobtail eel *Cyema atrum*.

More offshore trawling and movement to lower latitudes resulted in change of invertebrate composition of our trawls as well. On one occasion we collected a large specimen of midwater squid *Galiteuthis phyllura* (Fam. Cranchiidae) – a species known to inflate its mantle when threatened with subsequent release of ink into the mantle cavity, transforming itself into a dark ball. Oceanic cephalopods in our trawls also included nearly transparent doratopsis paralarvae of midwater squid *Chiroteuthis* (Fam. Chiroteuthidae) and peculiar glass squid (Fam. Cranchiidae) paralarvae with stalked eyes. Of other transparent pelagics we regularly observe beautiful heteropods (holopelagic mollusks) of the genus *Carinaria*. Clearly, in addition to bioluminescent camouflage, dark or bright red coloration, transparency is a dominant theme in the twilight zone of the open ocean.





Squid Jigging
Jim Cotton, Sophie Webb, Jim Carretta, Suzanne Yin, Chris Cutler, Allan Ligon, Rich Pagen.

It was a slow week for squid. Only four small, six to eight pound squid came aboard. We know the big ones are lurking out there though.