

Report on LSIESP gray whale passive acoustics program, Winter 2012

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Over the past five years the Laguna San Ignacio Ecosystem Science Project (LSIESP) has both directly and indirectly supported the collection of underwater acoustic data at the lagoon, performed by the Scripps Institution of Oceanography (SIO) and the Autonomous University of Southern Baja California (UABCS), continuing pioneering work on the subject, initially conducted by Marilyn Dahlheim in the 1980's. The fieldwork effort in 2012 was a smaller-scale affair than in previous years, in part due to hip injury by the principal investigator, Aaron Thode (SIO), that prevented him from traveling to Baja this year. Fortunately, many "veterans" from previous years generously volunteered their time to deploy and recover acoustic gear from the lagoon, and they will be recognized throughout this report. The program now has collected five seasons of acoustic data, and published its first peer-reviewed scientific publication on the research (Ponce et al., 2012). The primary goal of the effort is to determine whether passive acoustic monitoring (PAM) can supplement traditional methods in estimating population density (i.e. the number of animals present) in the lagoon. As discussed below, the research also provides some general insights into the general concept of PAM:

Equipment

The primary goal of the acoustic monitoring component of the LSIESP effort is to deploy bottom-mounted acoustic recorders on the ocean floor for at least four weeks during February/March, in an attempt to capture the peak of the breeding and calving season of western Pacific gray whales. One recorder is always placed just offshore of Punta Piedra, a local landmark that was also the location where Dahlheim deployed her hydrophone a couple of decades earlier (Dahlheim, 1987). The custom-built recorders (Figure 1) sample acoustic data at 6.25 kHz (and thus can record sounds up to 3 kHz in frequency), collect

continuous data for three days to a flash memory, and then spend two hours transferring the data to an internal hard drive. The D-cell battery pack is sufficient for powering the devices for up to 3-4 weeks. The devices are attached to 100 m of 3/8" polypro line, which has two anchors attached to both ends, and 18 one-ounce weights distributed throughout the line. The devices are deployed from a panga such that the line lies in a straight line on the ocean floor, and are recovered by grappling the line. This system removes the need for any floating recovery gear in the water, and thus avoids the possibility of whale entanglement. Temperature sensors (HOBO "Tidbits") are also attached to the rope.

Deployment

With the kind permission of Celia Condit (Searcher Sportfishing) four autonomous recorders were loaded into the F/V Searcher in San Diego on Feb. 7 and arrived into the lagoon three days later, on February 10. Simultaneously, Melania Guerra (Cornell University) and Eddie Kisfaludy (Oceans Aloft, Inc.) flew to the lagoon, where local personnel from Kuyamita ("Pedrito") loaned four anchors for the deployments. On Feb. 11 the UABCS panga, driven by Sergio Martinez generously assisted in the deployment of two recorders at the Punta Piedra site (26°, 47.653 N, 113°, 14.703 W) on a single 100 m line during the high tide mark (about 30 m). A second recorder was deployed at 26° 46.856 N, 113° 15.443 W in 67 foot deep water. Originally, some thought was given to deploying the second site just outside the lagoon mouth, but was judged too risky.

An attempt to deploy a wind/weather station was unsuccessful due to software issues. Melania and Eddie returned to San Diego on Feb. 14, 2012. The complete deployment report is attached to the end of this document.



Figure 1. Autonomous acoustic recorder (with hydrophone) attached to deployment line

In previous years the program has also conducted bioacoustic tagging on animals; however, in 2012 no tagging was conducted.

Recovery

On March 13, Sheyna Wisdom (Fairweather Inc.), Shane Walker (SIO), and Kerri Seger (SIO) departed by bus from San Diego, arriving in the town of San Ignacio around 6 AM the following morning. Kuyima then arranged for a van transport down to the lagoon. Remarkably, that same afternoon the group went out with UABCS and retrieved the Punta Piedra deployment on the first try, but failed to recover the second location with little success. The following afternoon (March 15) the group tried again with a Kuyima panga (Manuel “Chavalo”, driver), and recovered the second deployment on the first try, snagging the recovery line seconds after dropping the grappling hook (the underwater equivalent of scoring a hole in one in golf!). The instruments were cleaned, the anchors were returned to their owner, and the group returned to San Ignacio via Kuyima van and ABC bus to San Diego on March 18.

The data were quickly reviewed for quality check, and were found to have recorded data successfully. Figure 2 shows a spectrogram of some gray whale 'S1' calls and fish sounds recorded at the location off Punta Piedra.

Analysis

The 2012 data have not been analyzed as of yet. However, in April 2012 the LSIESP acoustics program produced its first scientific publication based on 2008 data, entitled "Relationship between visual counts and call detection rates of gray whales (*Eschrichtius robustus*) in Laguna San Ignacio, Mexico", in the Journal of the Acoustical Society of America. The paper reported a good match between visual and acoustic estimates of relative gray whale populations in the lagoon over the course of a month. However, the call detection rate of gray whale sounds was found to grow as the *square* of the number of animals present, a result that has never been observed in previous work on acoustic censusing.

Acknowledgements

The number of people who volunteered their time and effort to make the 2012 data collection possible (despite Thode's injury) is truly heartwarming. Besides Melania, Eddie, Sheyna, Shane, and Kerri, I'd like to thank Celia Condit and the crew of the F/V Searcher, Sergio Martinez, Tabatha Olavarrieta, and Mauricio Rodriguez of UABCS, and "Chavalo", Pedrito and numerous other staff at Kuyamita Ecoturismo. Both Cornell University and Fairweather LLC permitted Melania and Sheyna, respectively, to participate in the fieldwork at no cost to the program. Finally, Steven Swartz (LSIESP) and Jorge Urban (UABCS) have supported the program from its onset, through funding provided by the Ocean Foundation.

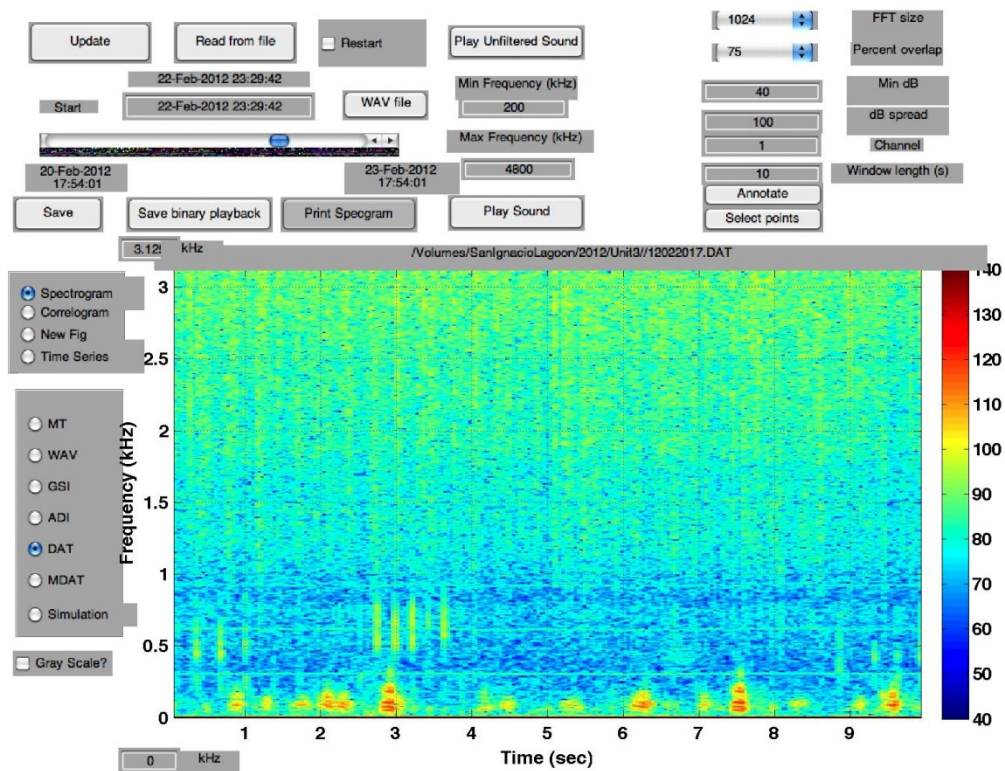


Figure 2: Example of gray whale S1 calls recorded off Punta Piedra in 2012.

Laguna San Ignacio 2012

Acoustics Team

Deployment Report

Melania Guerra
February, 15th 2012

February 10th, 2012

8am: Depart Montgomery Field (San Diego) with Eddie, Mindy, Janice on Eddie's plane.

1 pm: Arrive into LSI. Get picked up by Kuyima van.

Equipment is already in the lab. Arrived via F/V Searcher from San Diego
Was loaded in Shelter Island (San Diego) on February 7th.

- Inventory of equipment:
 - 4 x autonomous instruments: Units #1, #2, #3, #7. All programed to sample at 6250Hz. Comm cable and Windows laptop.
 - Plan is to deploy 2 arrays:
 - @Pt. Piedra – 2 elements at 10m spacing (Units #1 and #2)
 - 1 element (Unit #3) array at another location.
 - Locations:
 - across of PP array?
 - outside of mouth?
 - get advice from Steve S about location of second array.
 - Leave one unit in campsite for possible deployment in Cabo by Jorge Urban's group.
 - 2 x acoustic releases (AR):
 - S/N: 31466 & 31467 + deckbox and cabled source
 - Acoustic release S/N 31467 is NOT responding (out of battery?)
 - Decision: deploy 2-element at Pt. Piedra without an AR, because it's a known location, tested in the past, where all instruments have been recovered.
 - Especially if new deployment is at entrance of the lagoon, we don't know the tides and currents and we will/may have to rely on AR for recovery.
 - 4 x HOBO tidbit temperature sensors + connector base
 - S/N: 2225088, 2225091, 2225093, 2225094

- All working and responding through HOBO software/Keyspan
 - Will attach 3 close to each of the recorder's hydrophones.
- 1 x HOBO wind/temperature weather station + comm cable.
 - Keyspan is acting up. Tried multiple Keyspans. (Same Keyspans do respond when using with Tidbits and with GPS.) Switched batteries in station. Restarted computer. Station is not responding. Not able to program it and deploy.
 - 6 x 100 ft polypro, hollow-braid line.
 - 3/8 in
 - Will use 18 x 1 ounce lead weights to sink line.
 - Each array will use 300 ft of line.
 - 4 x Grapple-hook type anchors from boat drivers.
 - Lent to us by a friend of Toto's (=works at the customer's desk in Kuyimita palapa).

February 11th, 2012

TO DO:

Programming autonomous instruments + Building array lines

See table of programming and schematic of array lines annexed at the end.

Tidbit programming (*):

- S/N: 2225088 - 25 in from hydrophone of Unit 1 @ PP array.
- Name: LSI_PuntaPiedra1_02112012
- 1 sample every 2 minutes – lasts 60 days.
- Start at 10:13am (SD time) *
- Light, check!
- S/N: 2225091 with Unit 2 @ PP array.
- Name: LSI_PuntaPiedra2_02112012
- 1 sample every 2 minutes – lasts 60 days.
- Start at 10:16am (SD time) *
- Light, check!
- S/N: 2225093 – 51 in from hydrophone of Unit 3 @ PP array.
- Name: LSI_MouthEntrance_02112012
- 1 sample every 2 minutes – lasts 60 days.
- Start at 10:23am (SD time) *
- Light, check!

(*) All Tidbits are 1 hour behind local Baja time, programmed at San Diego time because not admin to SIO laptop.

DEPLOYMENT:

With UABCS panga.

Team: Tabatha, Mauricio, Sergio (driver), Mindy, Eddie, Melania

Following GPS waypoints from 2010 deployments.

Very strong tides at 2pm. High tide was a noon, now going down.

Deploying PP 2-element array first:

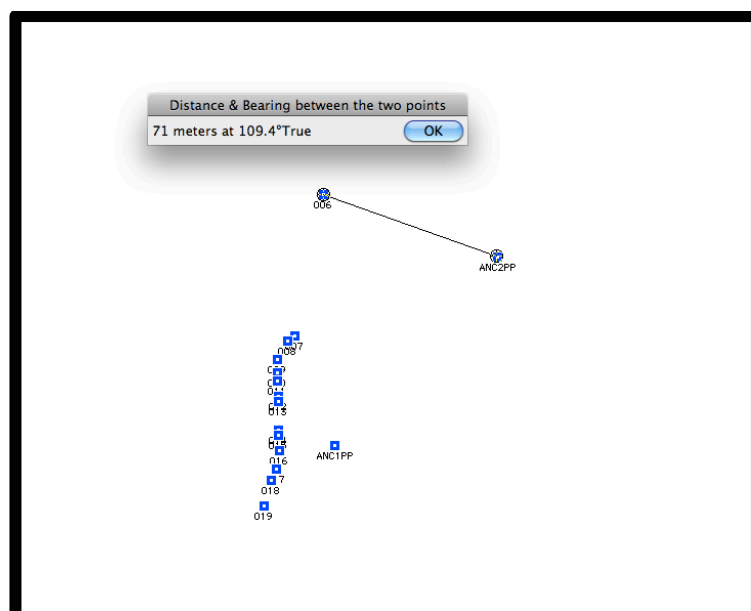
Depths tested around 2010 waypoints: 48 ft, 40 ft, 35.8 ft, 35 ft.

Attempted one deployment (until everything underwater except for last anchor) but Eddie “didn’t think the array felt right”, so we recovered and redeployed.

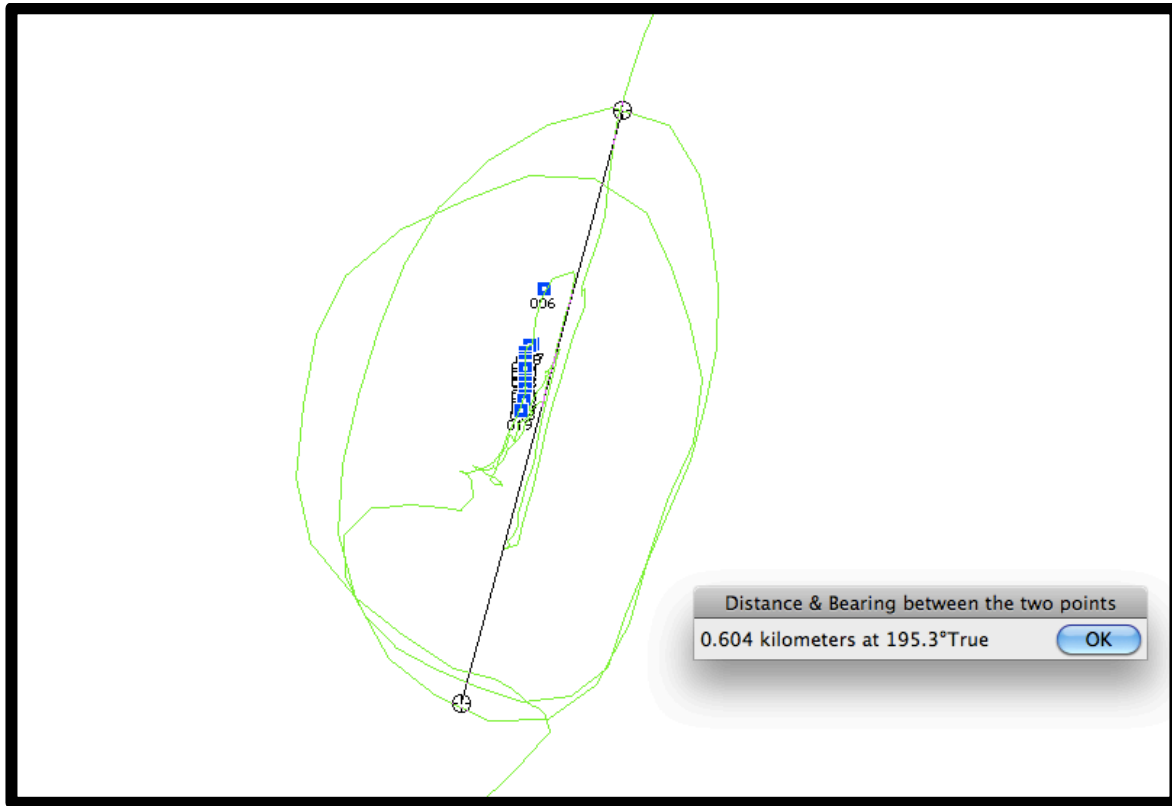
Waypoint	Deployed	Depth (ft)
006	Anchor 1	46
008	Instrument	35
018	Anchor 2	34

Deployment line between Waypoints 006 – 018

Shown in map with respect to anchor points from 2010 deployment (ANC1PP and ANC2PP).



2 circles around PP array: between ~15:09 – 15:17pm.



Deploying one element array:

Waypoint	Deployed	Depth (ft)
020	Test site	67
021	Anchor 1	66
022	Instrument	71
025	Acoustic Release	82
027	Anchor 2	75

No circles around array needed, because only one element.

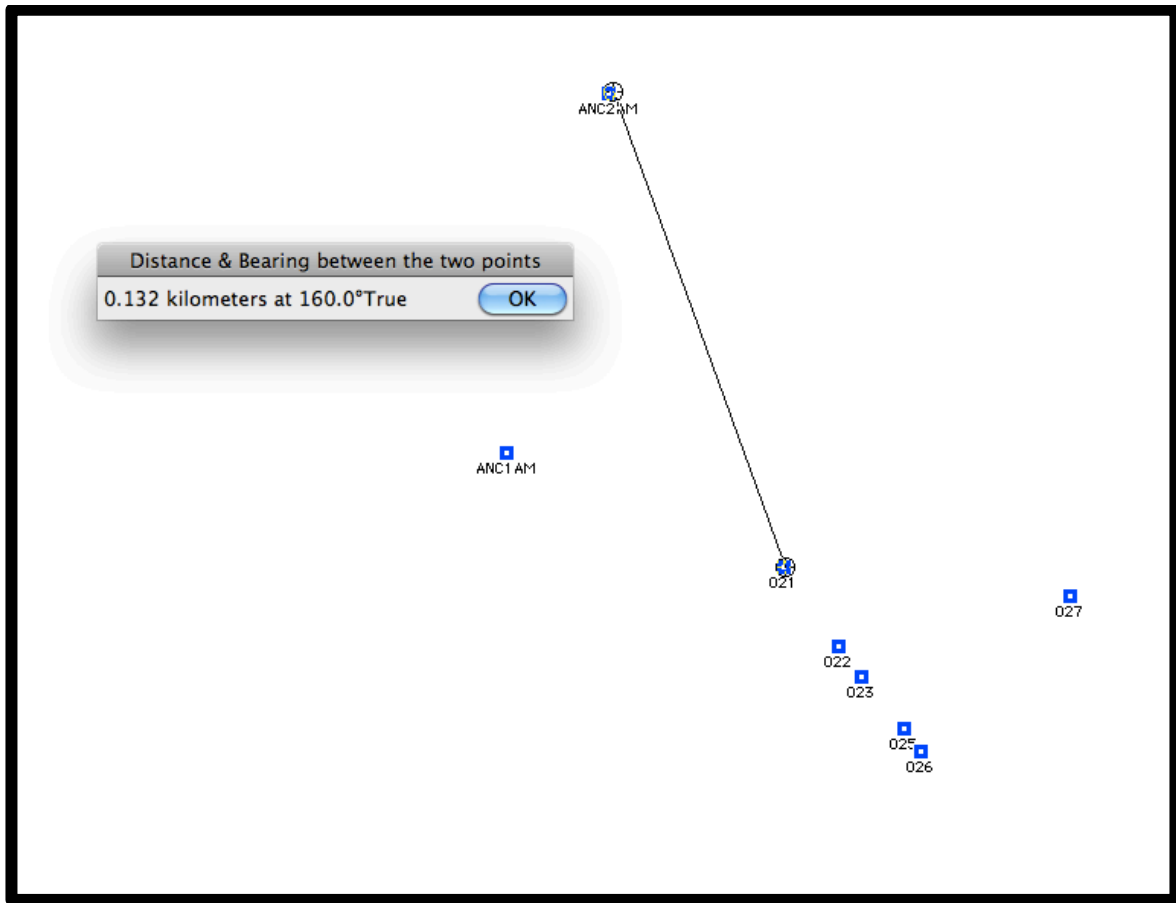
Pining/testing of acoustic release:

@ Waypoint 029 – acoustic range = 240m vs. GPS range = 255m

@ Waypoint 030 – acoustic range = 258m vs. GPS range = 269m

Pinger disabled.

Shown in map with respect to site of 2010 anchor deployment (ANC1AM and ANC2AM).



February 13th, 2012

STORAGE @ Kuyima → To be returned to San Diego upon recovery!

Boxes stored in the storage tent of the research team.

- 1) 2 x long, black Pelican cases for acoustic instruments (=coffin boxes). With one instruments inside and extra hydrophone.
- 2) 1 x gray, black-lid Rubbermaid box labeled "General Hardware". Includes inside the black Pelican computer case with Windows laptop, with cables for communicating with instruments.
- 3) 1 x weather station in cardboard box.
- 4) 1 x yellow deckbox for acoustic release.
- 5) 1 x cardboard box with cabled source for acoustic release
- 6) 1 x black + red-rim toolbox
- 7) 1 x orange/gray REI tent.

Return to San Diego on February 14th, 2012

LESSONS LEARNED:

- Need to have admin privileges to computer when traveling on field work. This way I could have set the right date/time on computer clock to have tidbits synched to local time and I would have been able to download Keyspan drivers (next door at Baja Expeditions) to attempt to communicate with weather station.
- Acoustic release S/N 31467 is back at Rob's lab. I would recommend purchasing a new battery ASAP.
- I will try to communicate with Mexican researchers down at the lagoon, to have one hydrophone sent up to San Diego, to loan Lauren at USEA /Sitka.

EXTRAS:

- Jose Luis (Pepe Lucho) contact/cell number at Pt. Piedra: 615 104 3331
- Baja Expeditions/Antonio's campsite has now wireless Internet.
- Searcher info: <http://www.bajawhale.com/>

Potential Searcher schedule that works for recovery between Mar 23-Apr 3rd. Would mean loading gear on to the boat on Mar 25-26th.

- For/after recovery:
 - Must bring down the grapple hook from SIO/Pt Loma or borrow another one from the boat drivers. In the past, what has worked best in order to recover, is using a combination of both anchors, towed in a series.
 - Good idea to bring extra rope, though ~200ft of nylon/polypro are stored there.
 - Do not forget to return 4 anchors back to Toto (Kuyima). It would be nice to present something in return. The owner of the anchors is a fisherman, so a handheld GPS may be appropriate.
 - The 6 lead weights used to sink the instruments belong to the SIO dive locker (see Rich Walsh). Please return.
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ANNEX

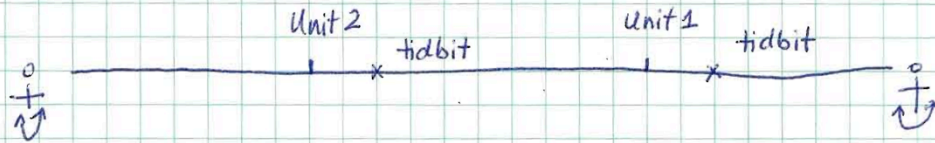
Programming autonomous instruments:

	Unit 1	Unit 2	Unit 3
Battery connected	✓ main aux ✓	✓ main aux ✓	✓ main aux ✓
Comm cable plugged	✓ dummy ✓	✓ dummy ✓	✓ dummy ✓
Clock to GPS	✓ @ 9:35 am	✓ @ 10:12 am	✓ @ 10:33:30
Format	flash free: 41 ✓ hard drive: 134 ✓	flash: 41 ✓ hard: 134	flash: 41 ✓ hard: 134
Hydrophone	303050 test ✓	303052 test ✓	303055 ✓
Battery (V)	12.67V ✓	12.56V ✓	12.56V
O-ring	inside ✓ outside ✓	inside ✓ outside ✓	inside ✓ outside ✓
Delay time	0:0:0	0:0:0	0:0:0
Run time	72:00:00	72:00:00	72:00:00
Sleep time	0:0:0	0:0:0	0:0:0
Low battery	7.0V	7.0V	7.0V
Activated / start	09:47:10	10:19:35	10:42:15
Light LED	✓	✓	✓
Array?	PP	PP	Mouth / Entrance
Fs (Hz)	6250 Hz	6250 Hz	6250 Hz
Read and Understood By			
C:/empty ✓			
D:/empty ✓			
Reset			

Schematic of deployments:

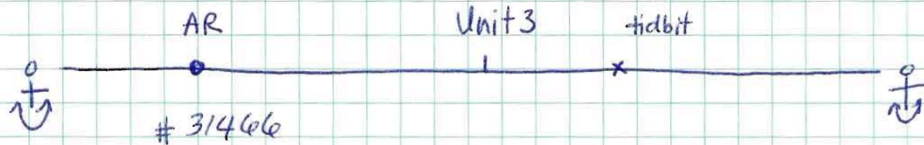
Schematic of arrays:

PP: → no acoustic release "



exact separation btwn Unit 1 to Unit 2: 34 ft + 2 in
tidbits from hydrophone

M/E → instrument @ very center of 300 ft line



Continued on Page

Read and Understood By

Signed

Date

Signed

Date

Coordinates of 2012 waypoints (both deployments)

Name	Comment ▲	Latitude	Longitude
006	11-FEB-12 15:04	26°47.653'	-113°14.703'
007	11-FEB-12 15:05	26°47.624'	-113°14.710'
008	11-FEB-12 15:05	26°47.623'	-113°14.712'
009	11-FEB-12 15:05	26°47.619'	-113°14.714'
010	11-FEB-12 15:05	26°47.616'	-113°14.714'
011	11-FEB-12 15:05	26°47.614'	-113°14.714'
012	11-FEB-12 15:05	26°47.611'	-113°14.714'
013	11-FEB-12 15:05	26°47.610'	-113°14.714'
014	11-FEB-12 15:05	26°47.604'	-113°14.714'
015	11-FEB-12 15:05	26°47.603'	-113°14.714'
016	11-FEB-12 15:05	26°47.600'	-113°14.714'
017	11-FEB-12 15:05	26°47.596'	-113°14.714'
018	11-FEB-12 15:05	26°47.594'	-113°14.716'
019	11-FEB-12 15:06	26°47.588'	-113°14.717'
020	11-FEB-12 15:29	26°46.856'	-113°15.443'
021	11-FEB-12 15:33	26°46.812'	-113°15.394'
022	11-FEB-12 15:33	26°46.801'	-113°15.385'
023	11-FEB-12 15:34	26°46.796'	-113°15.382'
024	11-FEB-12 15:34	26°46.827'	-113°15.421'
025	11-FEB-12 15:34	26°46.789'	-113°15.375'
026	11-FEB-12 15:34	26°46.786'	-113°15.372'
027	11-FEB-12 15:35	26°46.808'	-113°15.349'
028	11-FEB-12 15:40	26°46.727'	-113°15.272'
029	11-FEB-12 15:41	26°46.700'	-113°15.258'
030	11-FEB-12 15:41	26°46.694'	-113°15.253'