# Sonobouys

Sonobouys are disposable hydrophone units surplused by the Navy, and we manage to scrounge up a few to be used in certain situations. The beneficial aspect of the sononbouys is that since they are disposable, we can deploy them near a sighting and then leave the area, so that the recordings are less likely to be masked by ship noise. This is especially important with lower frequency vocalizations, such as those from baleen whales. They are also free, that's a good thing. However, the surplused bouys are usually past their prime, and there is a high failure rate with the sonobouys, usually due to dead batteries (which are housed within the sonobouy unit).

The sonobouy itself consists of a housing (metal), often within a plastic case. Within this housing is a battery, the hydrophone, a float, and an antennae (and some cables). When you prep the hydrophone, you want to take it out of the plastic case and cut off any excess garbage (we want to minimize what we dispose of in the ocean, especially plastics). We then need to set the hydrophone for the proper transmitting frequency and depth. The low frequency hydrophones (53s) have a set transmitting frequency, which is labeled on the outside of the bouy. The choice of frequencies for the high frequency sonobouys (57s) are shown in the inside cover of the sonobouy log (also in the manila envelope in the sonobouy receiver lid). Each channel corresponds to a certain frequency.

The frequency, in this case, is the transmitting frequency. When the sonobouy is deployed, the float pops up with an antennae. The antennae transmits the signals obtained by the hydrophone (which sinks to a specified depth upon deployment). These transmitted signals are received by the ships antennae and transferred to the plot room by a cable. When choosing a transmitting frequency, there are several factors to take into consideration. First, there are many channels that cannot be used in the EEZ (within two hundred miles) of any country. Chances are that if you are in the EEZ you cannot toss a high frequency sonobouy on a sighting. The Mac's antenna's are a little better at receiving frequencies between 144-148 kHz (which correspond to channels 54-63). We would therefore receive signals from these channels for a longer duration than we might receive from other channels. Another factor to take into consideration is if other bouys were tossed nearby . You want to make sure that you receive from a "clean" frequency, with minimal interference. Therefore, if you will be using two sonobouys in a sighting, or on sightings near each other (w/in 10 nm or so), then you will want to choose transmitting frequencies that differ by at least 2 channels.

After you choose a frequency, set the sonobouy to that frequency by pushing the buttons until that number is set. You will also want to choose the depth of deployment, and that will depend primarily on sea state. Ideally, you would like the sonobouy as near the source (whale/dolphins) as possible, and this is usually the surface waters. If it is a deep diving animal, you may want to set it deeper. However, if the sea state is poor, then noise from breaking waves could interfere with our recordings, so to minimize this noise you might want to set it at a deeper depth, farther from the wave action.

In the lab, make sure the receivers are on, and set to the appropriate channels. Make sure the DAT is set up to record (make sure you see the word WRITE on the display, this means it is writing-recording- to the tape).

Take a radio with you to the fantail to toss the sonobouy, and ask the flying bridge to inform you of a good time to toss the bouy. Then ask the bridge for permission to toss the bouy. Toss in the bouy and ask the flying bridge to make a note in WinCruz. Watch the sonobouy until the antennae pops up, then return to the Plotroom. If there is a good signal, let the flying bridge know and monitor the sonobouy. If there is no signal and you suspect that it was a bad sonobouy, prepare to toss another sonobouy (and let the flying bridge and bridge know your intentions).

Once you have a good signal, make a red dot on Whaltrak noting where the sonobouy was deployed, and comments regarding the sonobouy and sighting. You should continue recording until the receivers are no longer receiving a decent signal. At intervals, write down in the log how many bars each channel are consistently receiving. Be sure and fill out the information (including the lat/long) in the front of the sonobouy green book.

## DIFAR Sonbouys

The Difar sonobouys are low frequency sonobouys that emit two high frequency signals used to locate a bearing (in relation to a magnetic compass) of signals detected by the sonobouy. These two signals are at 7 kHz and 15kHz. There are several steps that must be taken in order to obtain this information.

First, the signal is examined in SpectraPlus RTS until the signal is found. You can then copy/paste the signal (use the arrow key to give the cursor selection capabilities, then select the signal, with about 1.5-2.0 seconds lead time, then go to edit: copy, then open another SpectraPlus window and edit:paste function). You can then hit the “run” button to run this spectrogram clip. Now you must export this (file: export) and save it as a binary 16-bit file. Keep this spectrograph open on the desktop.

You now need to save the file as “data.16” in the difar folder. This data.16 file is a file used by the difar program for 16-bit binary files. Once you are all done, you will need to re-save this file under its own name so you can use the name “data.16” to analyze future files.

Once this is saved, open the Run.bat program in the difar folder (where you saved the data.16 file) . You use this program to check the difar signal, and to make sure that it was able to ‘lock on’ to signals in this sound segment. It usually takes about 1.5 seconds for the signal to lock on (that is why you need the 1.5 second lead time in selecting the signal). check the time to make sure all is well.

Now, you must determine the time segment to analyze through the Matlab program “difar”. Use the crosshairs on the cursor in SpectraPlus to determine the start/end time of

the signal. Basically, you need a start time (say, 2.2 seconds into the clip), and the length of the signal you want to examine (say, 1.5 seconds long).

Go into the Matlab Edit/Debugger (c:\difar.df.m??) and change the start time and the length of the clip you want to analyze with the difar. In this example your start time would be 2.2 sec (into the clip), and the length would be 1.5 seconds (length of the vocalization). Once these times are changed, save this setting.

Now, go into Matlab and enter "df" to run the difar program developed in matlab. If you are not in the correct directory, type cd.. to go up a directory, then type cd.. to go up one more directory, then you can type in "df" to run difar. Then hit "enter". In a minute or so, the visual display will show a colorband display with frequency on the y-axis and bearing on the x-axis. You now must look to the frequency range of the signal you were examining, and find a "cluster" of points at that frequency. This cluster should be associated with the signal selected. You might find a wide band of "noise" at a particular angle, with the noise going across a wide range of frequencies. Chances are that this is the ship noise, and therefore this angle would give you the bearing of the ship (according to a magnetic compass).

If two difar bouys are deployed, it is possible to determine the absolute location of an animal(s) vocalizing, and to determine their direction of travel, etc. Even with one difar sonobouy, you can separate the signals from more than one animal if they have different bearings relative to the deployed sonobouy.