LAGUNA SAN IGNACIO ECOSYSTEM SCIENCE PROGRAM

ACOUSTIC RESEARCH – WINTER 2016 REPORT

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Laguna San Ignacio (Photo: Ludovic Tenorio-Hallé)

INTRODUCTION

Since 2005, scientists from Scripps Institution of Oceanography (SIO) have collaborated with members of the Universidad Autónoma de Baja California Sur (UABCS) to collect acoustic data using autonomous bottom-mounted recorders, during gray whale (Eschrichtius robustus) breeding season in Laguna San Ignacio, Mexico. The overall objectives of this long-term passive acoustic monitoring study are:

- To demonstrate the potential of autonomous instruments and novel techniques such as tracking vocalizing gray whales and monitoring population trends using sound measurements alone.
- Monitor trends in the lagoon's dynamic acoustic environment.
- Study the vocal repertoire and behavior of gray whales in their breeding grounds.

Each season new ideas are tested. The objective this year was to deploy two lines equipped with two acoustic records each in order to test whether gray whale sounds could be tracked in 2D over a small region (a 300 m radius circle).

This report summarizes the methods, experimental setup and deployment/recovery of the instruments for the 2016 winter season.

TEAM

Aaron Thode	Research Scientist	SIO
Kerri Seger	PhD student	SIO
Ludovic Tenorio-Hallé	PhD student	SIO

TIMELINE

The acoustics team performed two trips to Laguna San Ignacio during the 2016 winter season: the first to deploy the acoustic recorders, which were left recording and were then recovered in a second trip the following month.

Ludovic and Kerri arrived at the lagoon on February 22nd with the gear, followed by Aaron who arrived the next day. These two days were spent preparing for the deployment of the instruments, configuring the recorders and arranging using the UABCS' boat. On February 24th the weather was good enough for the acoustics team to head out with UABCS PhD student and boat driver Carlos López to deploy four acoustic recorders. After a successful deployment of the instruments, all three members of the team left the lagoon the following day.

The second trip took place at the end of March. Aaron and Ludovic arrived at the lagoon on the 25th and 26th respectively. On the 27th, both members of the team

headed out to the deployment zone with Carlos to attempt recovering the instruments using the grappling hook method. However, this attempt was not successful. Aaron had to leave the lagoon the following day, leaving Ludovic in charge of hiring divers to assist with the recovery of the gear. After making the necessary arrangements with eco-tourism camp Kuyimá, Ludovic, accompanied by local boat driver 'Tito' and diver 'Tico', was able to recover three out of the four recorders between the 29th and the 30th. After packing the recovered instruments, Ludovic left the lagoon with the gear and made it back to San Diego on the 31st. He then spent the next few days at Scripps Institution of Oceanography unpacking and downloading the data.

INSTRUMENTS

Autonomous acoustic recorders

These custom-built autonomous acoustic recorders, commonly referred to as Gen1 recorders (Figure 1), sample at 6.25 kHz. This implies they can record sounds up to 3kHz, which includes most sounds of interest in the lagoon (gray whales, boats, etc.) but not dolphin vocalizations that are usually higher frequency. The recorders collect continuous data for three days to a flash memory, and then spend two hours transferring the data to an internal hard drive. These instruments require no maintenance while deployed and can record data for about over a month, until the battery dies.

Figure 1 – Autonomous acoustic recorder or Gen1 recorder.

SUDARs

SoundTrap recorders (OceanInstruments, New Zealand) are commercial small autonomous recorders that can sample at 96 kHz for up to 10 days continuously. This implies they can record up to 48 kHz, which allows them to record higher frequency sounds that the Gen1 recorders like dolphin vocalizations.

Figure 2 – SUDAR.

Auxiliary data instruments

In addition to recording sound, it can also be useful to record auxiliary data such as depth and inclination of the recorders and the water temperature. These data are logged using HOBOware loggers (Figure 3), which are small and easily configurable to the desired sampling frequency.

Figure 3 – HOBOware data loggers (a) Water level logger (b) Tidbit temperature logger (c) Inclinometer.

METHODOLOGY

Lines

The setup used during the 2016 season is similar to those used in previous years. The instruments are secured to line, which is approximately 100 meters long and is weighed down at each extremity by anchors (Figures 4 and 5). This way, the deployment remains at the bottom to avoid any chance of whale entanglement. The two lines were equipped with two Gen1 recorders and two SUDARs respectively. Note that acoustic pingers were also attached onto the SUDAR deployment. These small instruments produce high frequency pings that are used to time synchronize the instruments.

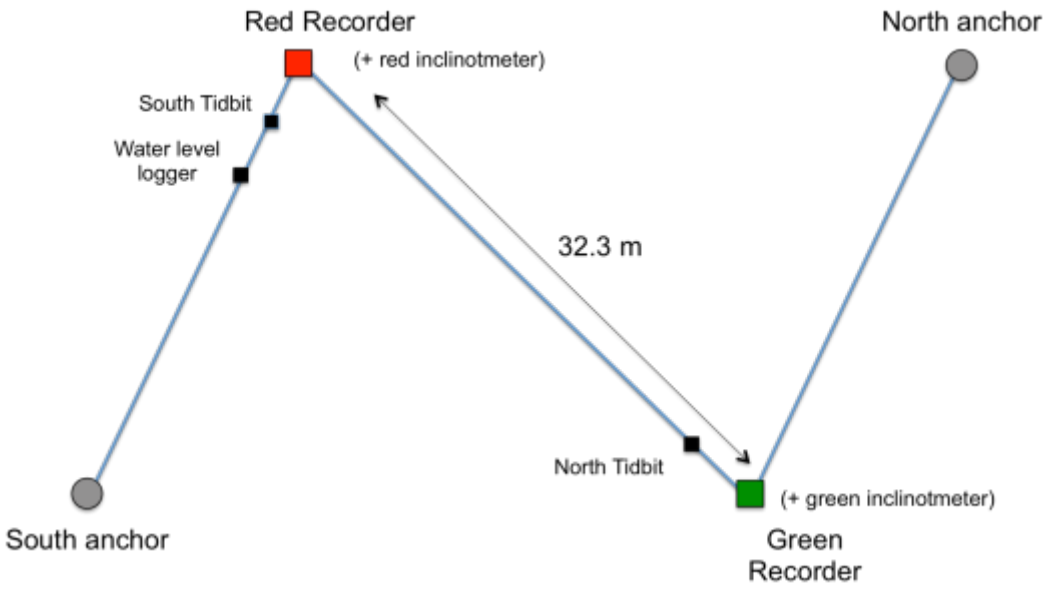

Figure 4 – Autonomous acoustic recorder deployment diagram.

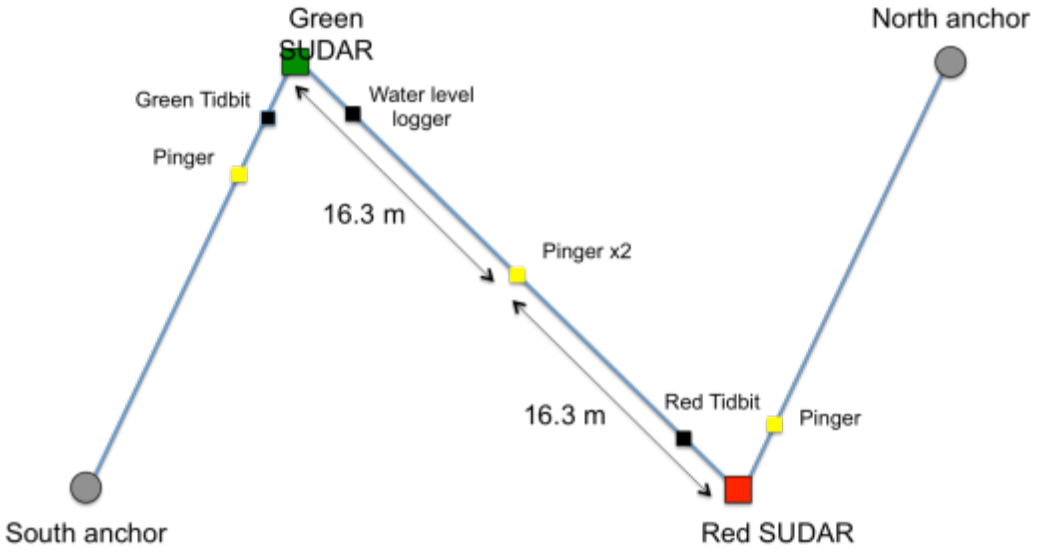

Figure 5 – SUDAR deployment diagram.

Deployment

The deployment site chosen for 2016 is close to Punta Piedra where instruments are usually deployed every year. This location, which is just next to the whale-watching zone, was initially chosen because of the high density of whales present throughout the breeding season. It is also where the first acoustic recordings in the lagoon where made in the 1980s (Dahlheim, 1987).

Figure 6 shows a schematic representation of the full experimental setup. Table 1 gives the exact coordinates of where the two anchors for each line. The depth where each line was deployed varied between 8 to 10 meters.

	Gen1 recorders		SUDARs	
	Latitude	Longitude	Latitude	Longitude
North anchor	26.79309	-113.24491	26.79087	-113.24636
South anchor	26.79223	-113.24538	26.79001	-113.24689

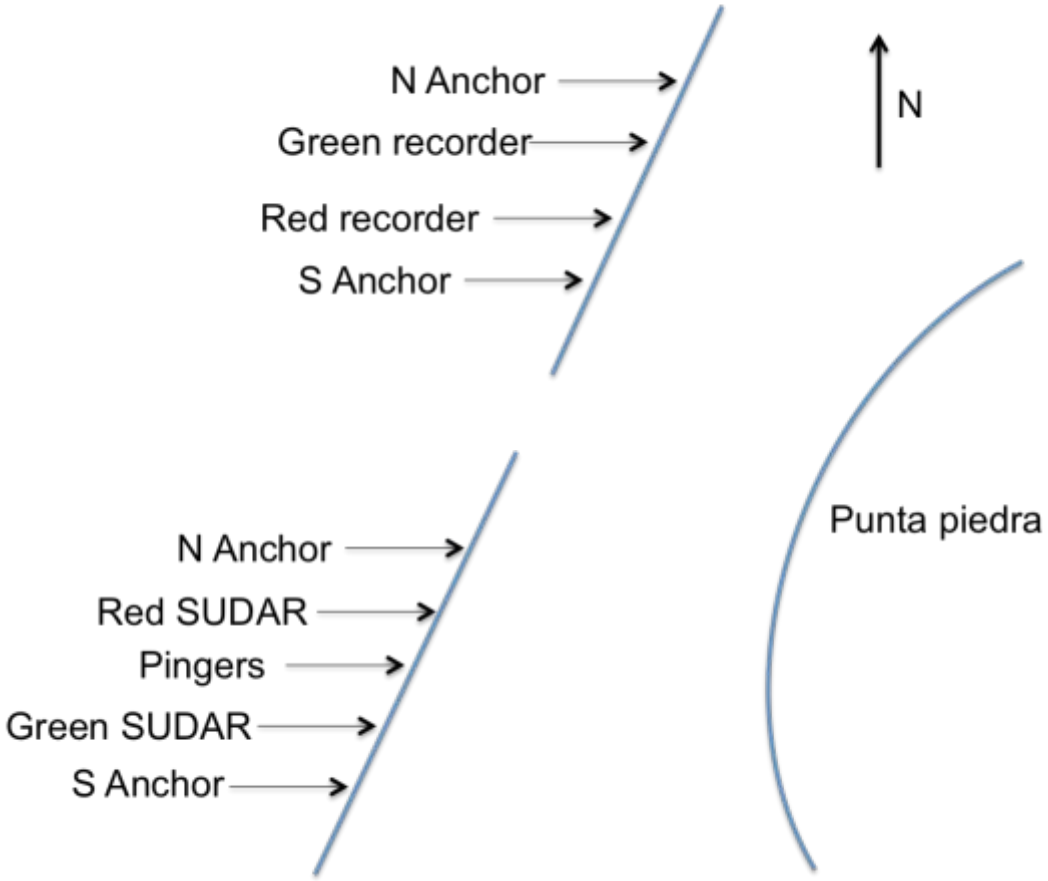

Figure 6 – Schematic diagram of the full experimental setup.

Recovery

The lines and instruments are usually recovered by dredging to bottom of the lagoon with a grappling hook using the recorded coordinates of the deployment. However, because the instruments are left recording during extended periods of time, they sometimes get buried due to high intensity of the current in the lagoon. The grappling hook attempt not being successful, we suspected that the instruments might have gotten too buried for this method to work. It was therefore decided to hire local divers to recover the gear, which is a time consuming but effective method. The first line was successfully recovered with the two Gen1 recorders in one morning. The second line was also recovered in one morning but with only one SUDAR. Unfortunately one of the SUDARs had been ripped off the line due to unknown circumstances. A possibility is that this happened when trying to recover the line using the grappling the previous day. All four anchors were buried so deep that it was too time-consuming for the divers to recover and were therefore left behind.

LOGISTICS & RECOMMENDATIONS FOR NEXT YEAR

- Use polypro rope, which floats underwater, which will avoid it getting too buried and making it easier to recover.
- Make sure instruments are robustly secured to line. Have adapted sized hose clamps for different instruments.
- Order anchors from Tito whom can manufacture them for cheaper than at Scripps.
- Discuss deployment/recovery techniques with locals whom have experience to make recovery easier in future years.

ACKNOWLEGEMENTS

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San Ignacio (Photo: Ludovic Tenorio-Hallé)