

An Experiment towards Characterizing Seahorse Sound in a Laboratory Controlled Environment

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Abstract-There are many reports of sounds produced by Seahorse (*Hippocampus*), however, little is known about the mechanism of sound production. Here, we investigate sound produced by the seahorse during feeding. We attempt to try to understand and analyze sound produced by seahorse in terms of time- frequency components. Employing Daubechies wavelet transform de-noising of the signal is made.

I. INTRODUCTION

The seahorse is a throwback to its equine appearance. They have a head at right angles to its torso and generally swim upright propelled by their dorsal fin. The steering is done using the pectoral fins located on both sides of head. A distinct feature of the seahorse is their presence of a prehensile tail that is generally used analogous to an anchor. The lifespan of seahorse is around 2-3 years. The seahorse is carnivorous, preferring live prey. It feeds on small crustaceans, shrimps and other small invertebrates. Seahorses play important role in maintaining the ecological balance in the waters. Fig 1 shows the seahorse we used. In these work we have recorded click like sound made by seahorse during feeding. The de-noising of the signal is being achieved, and presented the signal into time-frequency component. The mechanism of this sound production has been debated. While initially it was proposed that this sound could be produced by means of cavitations (Gill 1905, and James and Heck 1994) or stridulation (Fish and Mowbray 1970). A recent study has confirmed the latter that that the cause for this is stridulation of supraoccipital ridge of the neurocranium and the grooved anterior margin of the coronet bones that produces this sound by the *Hippocampus* seahorses (Syngnathidae) [1]. Analysis of these clicks has given the frequency distribution of

these clicks from 50 to 4800 Hz with the principal frequency varying from 400 to 800Hz .



Fig 1: Seahorse under investigation for research work

II. Method

In the experimental setup we used Cetacean hydrophone having sensitivity of -185 dB re 1V/ μ Pa with frequency range of 6 Hz to 203 kHz, Advantech PCI-1712L A/D card with 12bit converter (Navelkar, et al, 2005), Glass tank of dimensions 90cm length x 44cm width x 44cm breadth with capacity of 50 liters and PC as samples were collected from the A/D card through a computer using MATLAB. The hydrophone was immersed in the water at a depth of 30 cm from the surface. The hydrophone was connected to the A/D card. The output signal from the hydrophone was digitized using the card, and the digital data was transferred to the PC by the parallel port. We have taken sampling rate as 10 kHz. Readings were taken of the tank without seahorse in it, with seahorse in it during feeding.

III. Analysis:

In this study we are recorded seahorse feeding waveform signals in time (seconds) and voltage (volts). Wavelet transform is superior to Fourier transform because of its ability to specify both location and frequency. De-noising is achieved by wavelet transform using Daubechies wavelet with manual thresholding is performed for 4 levels. Fig 2(a) shows the plot of without seahorse recording. Fig 2(c) shows the plot of feeding seahorse recording and Fig 2(e) shows the plot of de-noised feeding seahorse signal. Then we have plotted the spectrogram of the signal. Spectrogram means time-frequency plot of the signal is shown in Fig 2 (b, d and f). Fig 2(b) shows the spectrogram of without seahorse signal, Fig 2(d) spectrogram of the feeding seahorse signal, and Fig 2(f) shows spectrogram of the de-noised seahorse signal.

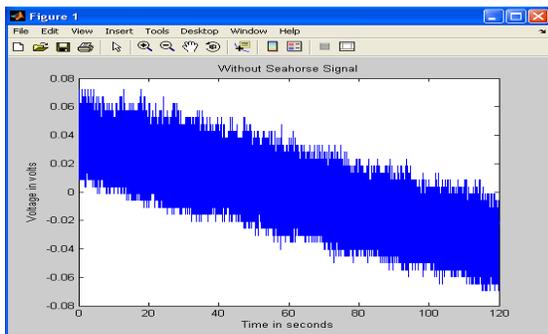


Fig 2(a): Background signal without seahorse.

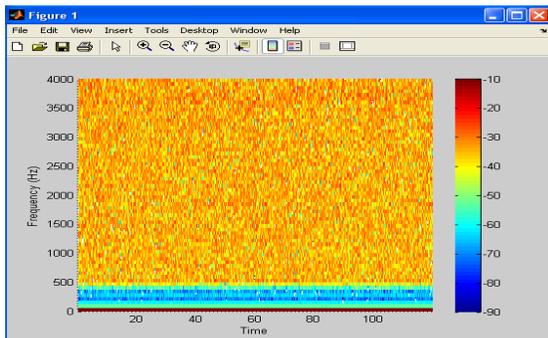


Fig 2(b): Spectrogram of without seahorse signal

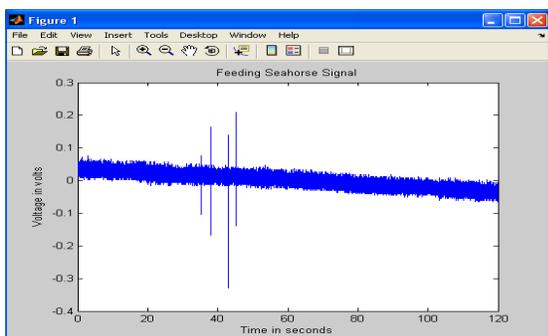


Fig 2(c): Feeding seahorse signal

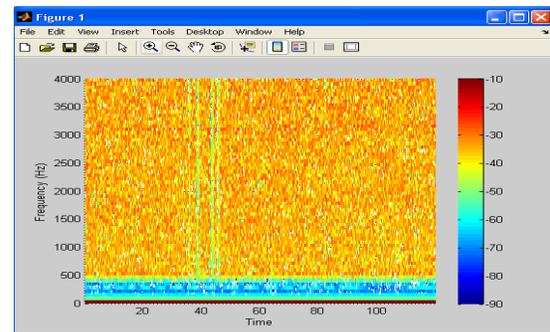


Fig 2(d): Spectrogram of feeding seahorse signal

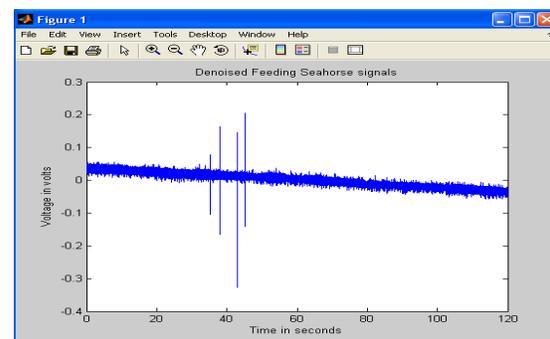


Fig 2(e): De-noised feeding seahorse signal

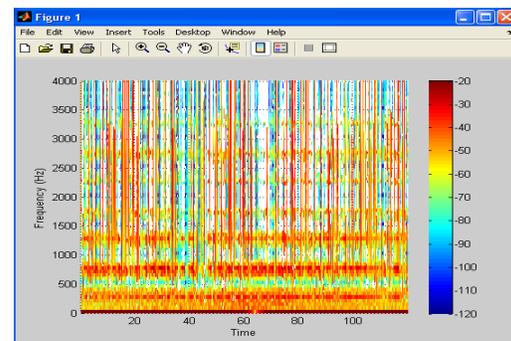


Fig 2(f): Spectrogram de-noised feeding seahorse signal

As we can see that there are 4 peaks. These peaks are the click like sound made by seahorse during feeding. In Fig 3 the enlarged versions of the waveforms are shown. Figures 3(a) shows first click, (b) shows the second click, (c) shows the third click, and (d) shows the fourth click-different waveforms.

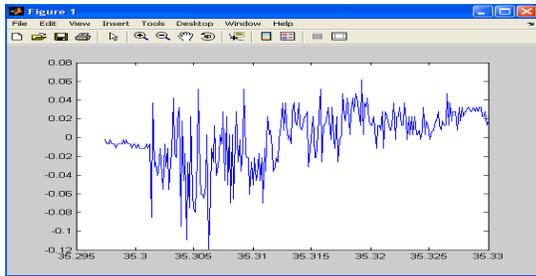


Fig 3(a): First click

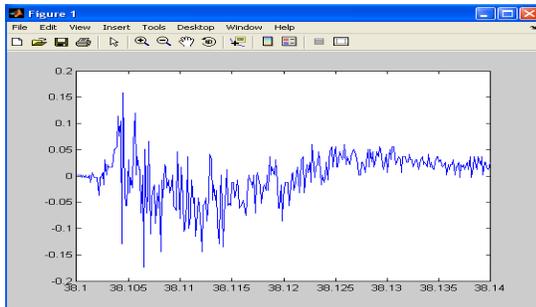


Fig 3(b): Second click

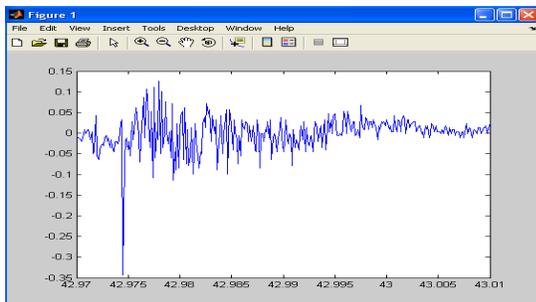


Fig 3(c): Third click

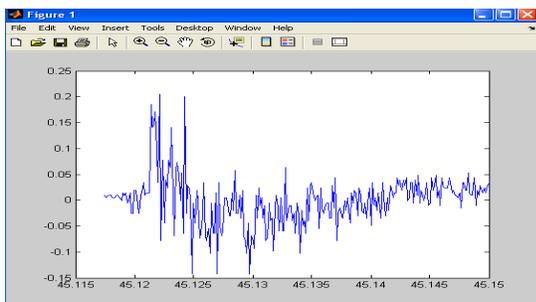


Fig 3(d): Fourth click

attempted. De-noising is achieved by wavelet transform for both the signals. Then we have plotted the spectrogram of feeding seahorse and without seahorse recording. We have found four clicks for feeding recording, and presented all the four clicks. This data helped us in understanding the behavioural pattern of seahorse during feeding.

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References

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Conclusion

In this experiment differences between feeding seahorse recording over without seahorse recording is

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