

# The characteristics of underwater noise and the temporal and spatial distribution of the porpoises in the lower reaches of Yangtze River

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## Field work

This project has been carried out in the lower reaches of Yangtze River, from Nanjing to Zhangjiagang. I divided this water into four parts and chose 20 wharf boats as the recording points. The recording has been ongoing for 10 months in the 20 wharf boats.

## Lab work

Two types of sound signals are obtained from the monitor work: high frequency signals from the porpoises and the underwater noise. Utilizing MATLAB (Math Works, Natick, MA, USA) and particular scripts, the high frequency clicks signals of porpoises were picked up. After a series of statistical analysis, the animals' presence density, duration time, presence frequency, diel rhythm have been determined. Also we analyzed the acoustic parameters of underwater noise, such as sound frequency components, Root-mean-square sound pressure levels (SPL, dB re 1 $\mu$ Pa), one-third octave sound pressure levels (1/3 octave SPLs) and so on. Now we are investigating the relationships between porpoises' signals and noise. I am preparing a paper about a part of this research. The abstract is as following.

### Abstract

Up to now, the research on how the underwater noise influences the critically endangered Yangtze finless porpoise (YFP, *Neophocaena asiaeorientalis asiaeorientalis*) in the lower reaches of the Yangtze River is extremely limited and indispensable for its conservation. One of the most important way to protect the endangered species is the establishment of nature reserves. In order to evaluate the particular function of the porpoise's reserves in the "golden waterway" in China, we chose three points from a dozen of passive acoustic monitoring points in this area, one is within the porpoises' reserve which has no ship traffic, and the other two are in the lower reaches and upper reaches of the porpoise's reserve. The parameters of the porpoise's high-frequency clicks signals and the underwater noise were computing and analyzed through a series of statistical methods. Finally, we acquired some results as follows.

Firstly, the 24 h of the day were divided into five diel phases: night1, morning, day, evening and night2. On one hand, the diel rhythm differences among three points were tested. The number of click trains at every phrase in porpoises reserve is significantly higher than those in other points. While the buzzes at night1, evening and night2 in reserve are significantly more than those in other points. It is obvious that the porpoises reserve performs a critical function in creating good habitat for their echolocation behavior, especially for their predatory activity at evening and night. On the other hand, the variances at different times were compared respectively in every point. In porpoise's reserve, the click trains appeared significantly more at morning, day and evening than night1 and night2, but predation occurred more at night1 than it at other times. At the other points, the click trains and buzzes in day are significantly more than those at other times. Although the porpoises' echolocation behavior in different points have their own diel rhythm, the duration of the concentration of the echolocation behavior in reserve appears longer than those in other points. It is supposed that the porpoises' reserve is a preferable habitat for porpoises to live and prey.

Then, the relationship between the porpoises' echolocation behavior and the underwater noise was verified by nonparametric statistics and correlation analysis. The number of click trains, acoustic encounters and buzzes

(which were treated as predation behavior) in the porpoises' reserve are significantly higher than those in the other two points. However, the root-mean-square sound pressure level ( $SPL_{rms}$ ) in the porpoises reserve is not the lowest one in three points and the variance of peak sound pressure level ( $SPL_{p-p}$ ) is the lowest one of them. Detailed statistical analyses shows that the number of click trains, acoustic encounters and their duration are significantly related to the variance of  $SPL_{p-p}$ . This indicates that the appearance of porpoises and the duration of their stay are affected more by the fluctuation of peak level of the noise. Additionally, there is a significant negative correlation between the number of buzzes and the variance of  $SPL_{p-p}$ . It is claimed that sound environment with drastic undulation of peak level is disadvantageous for the porpoises' predation. It seems that one of the critical functions of the reserve for the porpoises is reducing the noise fluctuates.

### **Next steps**

Discover the relations between the ship density and the porpoises' distribution;

Discuss strategies the species use to adapt to the busy shipping and complex noise in the river;

Conclude practical and effective suggestions for Yangtze finless porpoises' protection.