

Acoustic Characteristics of Clione Limacina in the Southern Ocean

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Abstract

In the Southern Ocean, the biomass of *Clione limacina* is relatively large in some sea areas, and the largest biological density was found in the survey reached 300 Ind /m³. The acoustic data were obtained from the scientific fish finder (SIMRAD EK60) on Xuelong polar research vessel during China's 32nd Antarctic expedition. The system operated at a frequency of 38 and 120kHz. The acoustic data obtained from the expedition were processed in the specialized software used by the Institute for Underwater Acoustic Survey and Analysis of Biological Resources (ECHOVIEW 6.1.72, MYRIAX, AUSTRILIA). Biological sampling was carried out by using a "Framed Antarctic Krill Resource Assessment with Double capsule trawl". The sampling net is double capsule structure, the network port is frame type, the size is 4 m×2 m, the net capsule net mesh is 15 mm. It was found that the target intensity of *Clione limacina* in the central Ocean was significantly stronger at 120 kHz, which was 12.97±0.61 dB stronger than 38 kHz in general.

Keywords

Acoustic Characteristics; *Clione Limacina*; Southern Ocean.

1. Introduction

In recent years, the acoustic assessment of fishery resources has been developed as an effective method for the investigation of zooplankton and fish populations. The acoustic characteristics of target species are the key reference for the acoustic assessment and species identification of fishery resources. Through the study of this project, the acoustic characteristics of the Southern Ocean naked sea butterfly *Clione limacina* were studied in terms of the acoustic survey image of biological resources in the Southern Ocean.

In the Southern Ocean, the biomass of *Clione limacina* is relatively large in some sea areas, and the largest biological density was found to reach 300 Ind /m³ in the survey.



Fig 1. *Clione limacina* in the Southern Ocean

The Southern Ocean Naked Sea Butterfly is a pteropod mollusk belonging to the genus *Pteropod* in the family Pteropod. *Clione limacina* live in the Arctic and Southern oceans at depths of more than 350 meters. Because the whole body transparent, also known as "sea angel" "ice sea elf". The body length of the naked sea butterfly is generally less than 40 mm. The spherical part of the front end is its head, which has the function of sensing and hunting. In the middle is the neck, with a triplete gastropod. A pair of transparent "wings" are actually well-developed pteropods that develop from the dorsal sides of the gastropod. Just below the head, near the neck, are ringed ganglia that control the movement of the wings, while the tail acts like a rudder to change the direction of movement. On the upper part of the naked sea butterfly's transparent body, there is a kind of "heart", which is actually its internal mass, mainly performing the tasks of digestion, circulation and reproduction. This visceral mass, which has accumulated a lot of carotenoids from the food chain, turns orange when it reaches sexual maturity.

Southern Ocean *Clione limacina* are carnivorous for most of their life cycle. The naked sea butterfly has two exposed antennae on its head, which can be sensitive to information about the approach of prey. Once it finds prey, it will quickly approach and "launch" six hidden tentacles from its head, similar to octopus-like hunting action, to tightly hug the prey. They usually feed on small zooplankton.

2. Material

The acoustic data were obtained from the scientific fish finder (SIMRAD EK60) aboard the xuelong polar research vessel during China's 32nd Antarctic expedition. The system operated at a frequency of 38 and 120kHz. Unlike before the upgrade, the new system run on WINDOWS 7 system, data collection, storage, full automation, in the process of investigation if the working parameters are not suitable for investigation on the current environment, the system will automatically provide prompt, combined with prompt investigators can be adjusted very quick, effective guarantee the quality level of survey data.

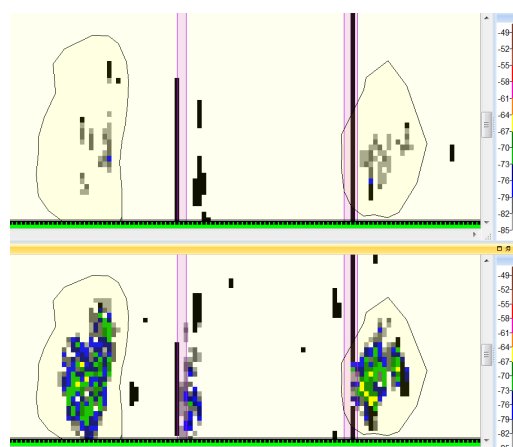


Fig 2. Acoustic images of *Clione limacina* in the Southern Ocean

In terms of survey time and scope, the acoustic survey covered the whole time of the survey, focusing on the seas around the Antarctic Peninsula. The acoustic data obtained from the expedition were processed in the specialized software used by the Institute for Underwater Acoustic Survey and Analysis of Biological Resources (ECHOVIEW 6.1.72, MYRIAX, AUSTRILIA). Biological sampling was carried out using a "Framed Antarctic Krill Resource Assessment with Double capsule trawl". The sampling net is double capsule structure, the network port is frame type, the size is 4 m×2 m, the net capsule net mesh is 15 mm. During the investigation, biological sampling was carried out after the end of the station operation according to the time

arrangement. The towing speed was generally controlled at about 3-4 kN, the sampling depth was generally adjusted according to the influence of the scientific fish finder, and the sampling time was generally controlled at more than 20 min. In the process of trawling, we also studied the force of the sampling net by using the display results of the winch pulling force on the research ship. In the course of this study, only 23 *Clione limacina* from the Southern Ocean were found in biological sampling, with body length between 12.0 and 21.5mm.

3. Methods

In this study, the comparative method is mainly used. In the general acoustic survey and assessment of biological resources, the density of target species can be determined if the target intensity is known. Conversely, if the density of the target species can be known independently from biological sampling, the acoustic characteristics of the target species can be learned from acoustic data. This is the comparative method.

This approach has been applied to fish such as herring and mackerel. A specific target population that is easily captured by a sampling net. First, the sampling net traverses the colony in several cross-sections while collecting scientific fish finder acoustic data. At the same time, the size of the colony is plotted to determine the total volume. This can be done using a common scientific fish finder to record the vertical extent of the colony along the transect, while the horizontal dimensions are determined from the distance covered by the boat as it traverses the colony. It is helpful to operate a scanning or multibeam sonar at a shallow Angle so that the horizontal range of the colony can be directly observed. The sonar display will also indicate whether the group is disturbed by these activities. After acoustic measurements are completed, biological sampling captures the entire population. The size of the capture divided by the population volume gives the density needed to calculate the average target intensity.

Independent estimates of populations may be easier to obtain when fish are known to be confined to small areas with limited access. Mulligan and Kieser (1986) applied this comparison to sockeye salmon (*Oncorhynchus nerka*) from Lake Governor, British Columbia. During the summer, fish migrated into the lake for a short period of time, and they were counted when they passed through a weir at a single entrance. Weir number is an accurate estimate of the total population and can be compared with echo integration or echo count data as long as acoustic measurements are available for most populations.

In this study, the temperature depth meter is used to measure the position and height of the network port.

4. Results and Discussion

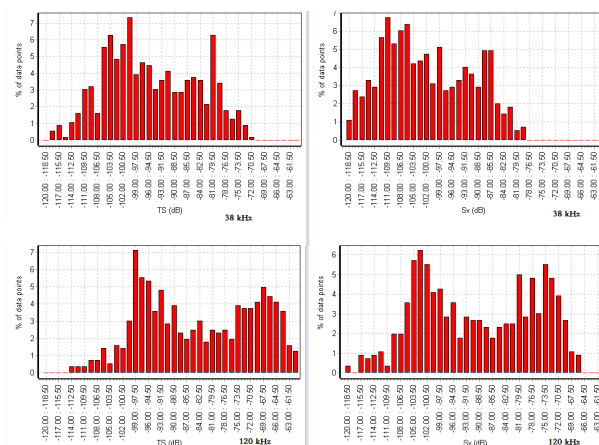


Fig 3. Sv and Ts distribution of *Clione limacina* in the Southern Ocean at two operating frequencies

At 38 kHz operating frequency, the Sv of the Southern Ocean naked Sea butterfly was mostly distributed between -111.0 and -87.5dB, and the Ts was mostly distributed between -105dB and -76.5dB. At 120 kHz operating frequency, the Sv of the Southern Ocean naked Sea butterfly was mostly distributed between -105.0 and -70.5dB, showing an obvious bimodal structure. The first distribution peak appeared at about -74dB, the second distribution peak appeared at about -103.5dB, Ts mostly distributed from -100.5dB to -64.5dB, also showing obvious bimodal structure, the first distribution peak appeared at about -67.5dB, the second distribution peak appeared at about -97.5dB.

Compared with the two operating frequencies, the target intensity of *Clione limacina* in the Central Ocean at 120 kHz was significantly stronger, which was generally 12.97 ± 0.61 dB stronger than that at 38 kHz. This result can be used in species identification by frequency difference method.

DB difference or MVBS difference (dB Difference or MVBS difference) technology is based on the acoustic scattering characteristics of the target, by comparing the difference of echo intensity of different frequency sound waves to identify the species. At present, the technique has been successfully applied to distinguish the echo images of zooplankton and fish, and to identify and classify different species or age structures of fish.

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