The effects of liner length and sinking weight on the hydrodynamic performance of Antractic krill beam trawl

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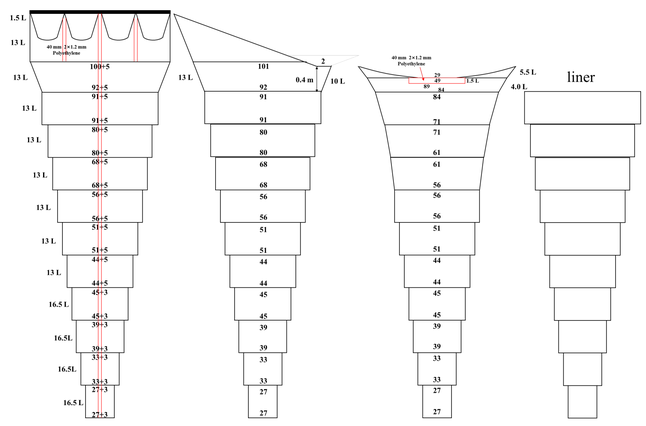
Background

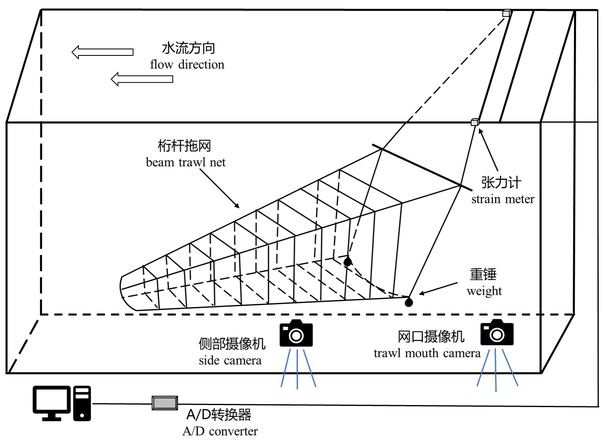
- The Antarctic krill is considered the largest protein resource on Earth and plays a crucial role in the marine ecosystem.
- The introduction of the small mesh liners in both the main body and the codend of large pelagic beam trawls is crucial to reduce the probability of krill escape through the meshes and increase the retention rate. Indeed, having an optimal small mesh liners proportion is vital for sustainable krill harvesting. However, the research on standardized guidelines for determining the appropriate proportion of liner net remains limited.
- This study designed three 1/15th scale beam trawl models with different small mesh liner length proportion from the standard beam trawl commonly used in Antarctic krill trawl fisheries by the fishing vessel “Shenlan” and tested in a flume tank under different flow velocity and sinking force weight. The purpose of this study is to examine the effect of the liner length proportion and sinking weight on the hydrodynamic forces, energy consumption coefficient, and geometrical shape of the beam trawl model.

Materials and methods

A. 1/15th scale beam trawl model



B. Experimental process in the flume tank



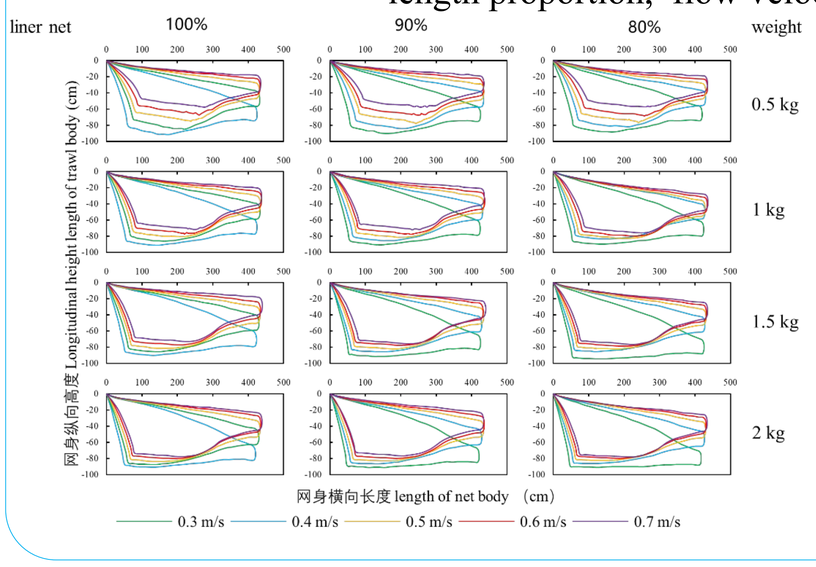
C. Side views of the beam trawl net in the flume tank

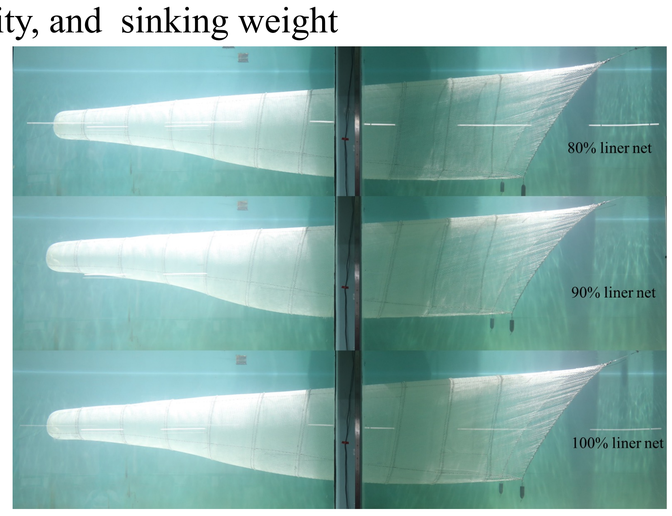
D. The range of variables for model test

liner net	sinker weight	flow velocity
100%	0.5 kg	0.3 m/s
90%	1 kg	0.4 m/s
80%	1.5 kg	0.5 m/s
☐	2 kg	0.6 m/s
☐		0.7 m/s
☐		

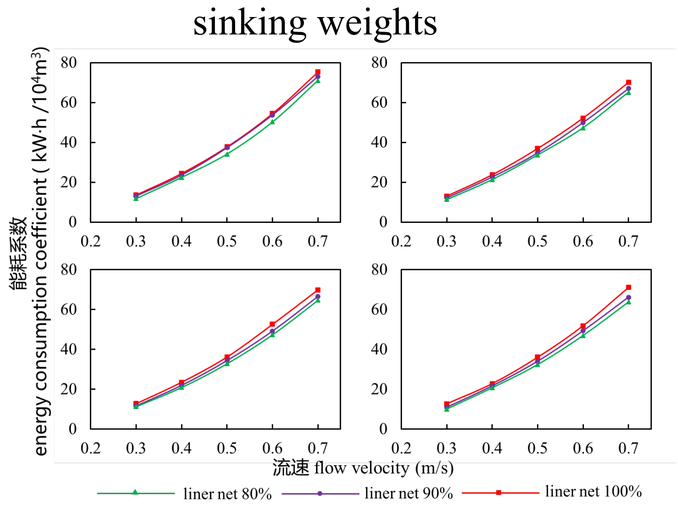
Result

A. Geometrical profile of the beam trawl model obtained from video cameras in relation with liner length proportion, flow velocity, and sinking weight

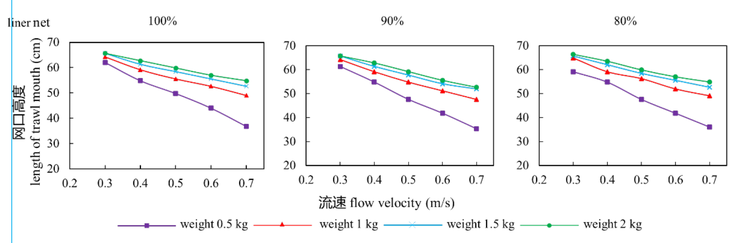




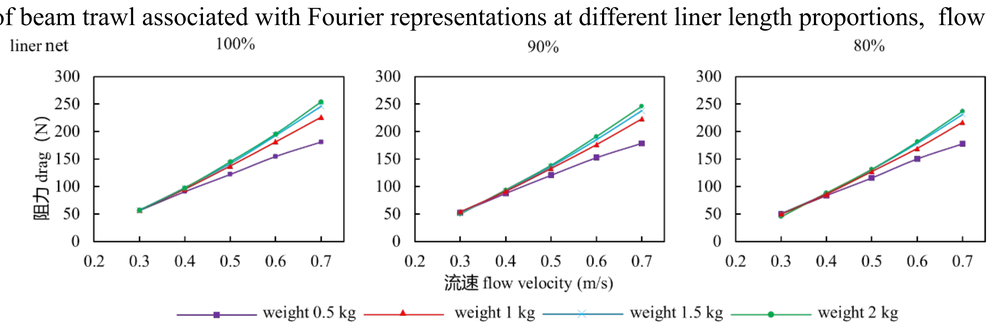
B. Coefficient of energy consumption of the beam trawl in relation with different flow velocities, liner length proportions, and sinking weights

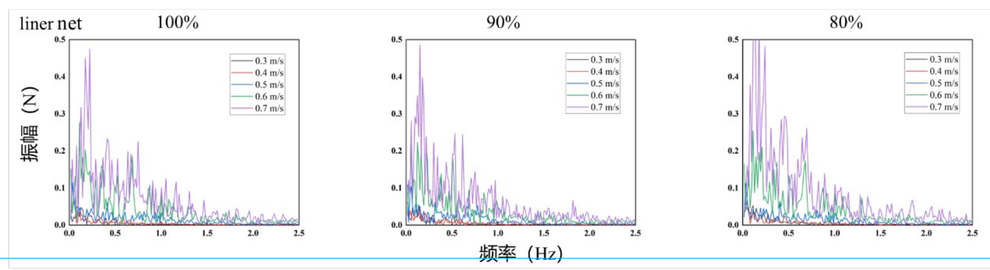


C. The net mouth height of beam trawl with different liner length proportions, flow velocities , sinking weights



D. The drag forces of beam trawl associated with Fourier representations at different liner length proportions, flow velocities and sinking weights





Conclusions

- Reducing liner length proportion leads to a decrease in both the drag and energy consumption coefficients of the model trawl. Additionally, the amplitude of drag decreases, while the net mouth height remains relatively stable. Specifically, a 20% reduction in liner length proportion results in approximately a 21% decrease in drag and an 11.5% decrease in the energy consumption coefficient under the same conditions.
- The sinking weight showed a positive correlation with trawl drag and energy consumption coefficient but a negative correlation with net mouth height and drag amplitude.
- It can be concluded that trawls with 80% liner proportion have very good performance in terms of hydrodynamic drag and mouth opening.