Hydrodynamic performance analysis of model nets of the Antarctic Krill beam trawl with different liner net ratios in flume tank experiments

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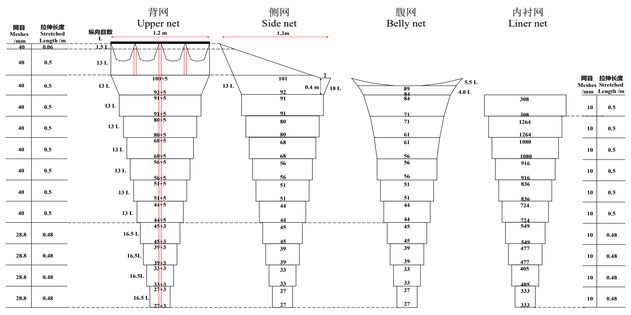
Background

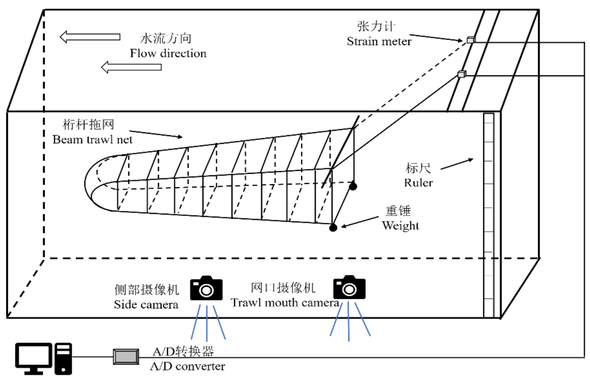
- Antarctic krill is regarded as the largest protein resource on Earth and plays a vital role in the marine ecosystem.
- The assembly of liner nets is crucial for the successful capture of Antarctic krill in beam trawl operations, with an optimal liner net proportion being essential for sustainable krill harvesting. However, current research on standardized guidelines for determining appropriate liner net proportions remains limited.
- This study investigates the beam trawl used by the specialized Antarctic krill fishing and processing vessel "Deep Blue“ and tested in a flume tank, focusing on the effects of liner net proportion and sinker weight distribution on the overall shape, drag, energy consumption coefficient, and stability of the beam trawl model.

Materials and methods

A. Model net



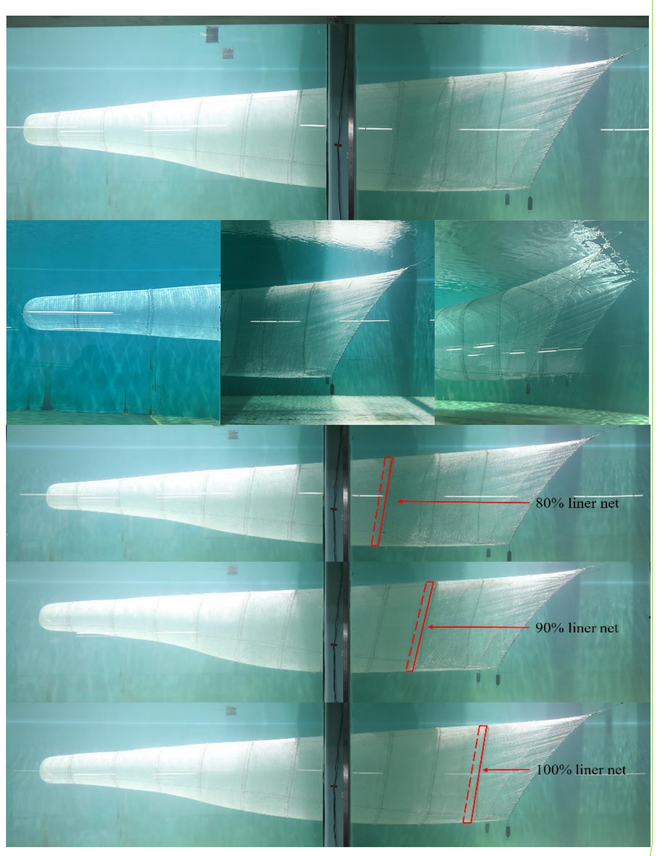
B. Flume tank and equipment



C. Parameter setting

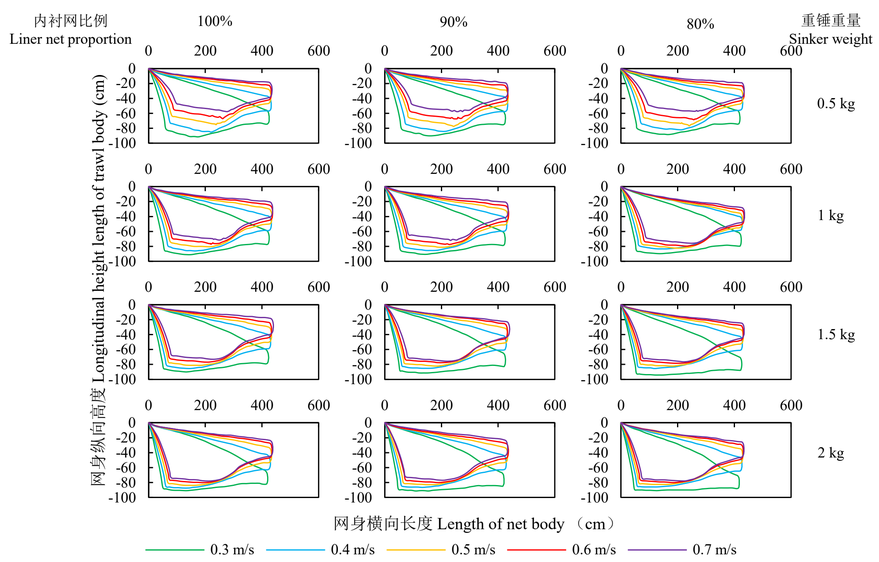
liner net	sinker weight	flow velocity
100%	0.5 kg	0.3 m/s
90%	1 kg	0.4 m/s
80%	1.5 kg	0.5 m/s
	2 kg	0.6 m/s
		0.7 m/s

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

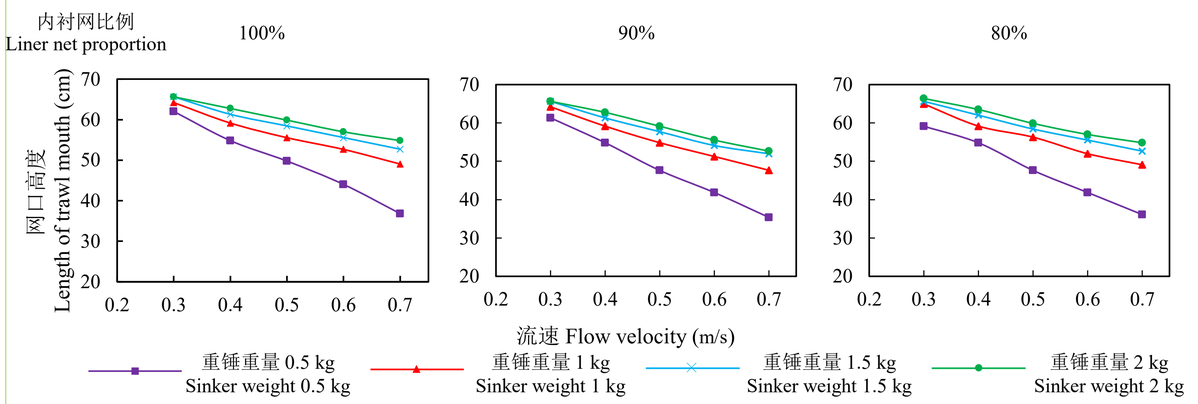


Result

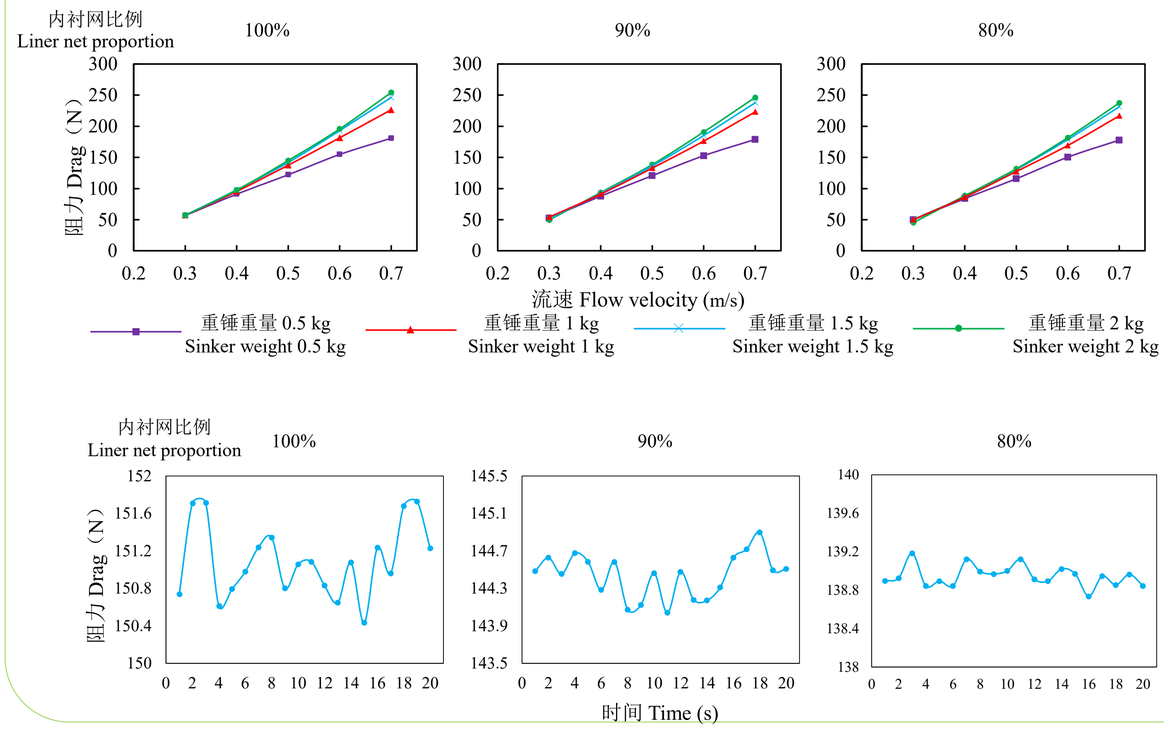
A. Overall shape of beam trawl under different flow velocities



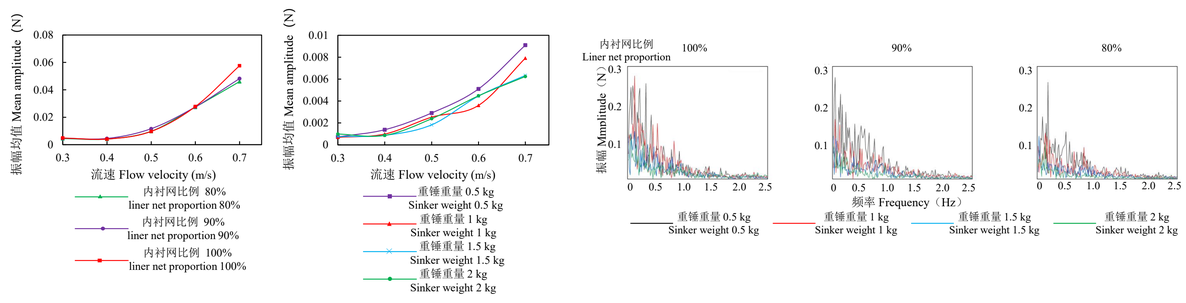
B. Mouth height of beam trawl with different flow velocities and sinker weights



C. Drag of beam trawl with different flow velocities and sinker weights



D. The drag amplitudes of beam trawl with different flow velocities and sinker weights



Conclusions

- A reduction in the liner net proportion led to decreases in drag and energy consumption coefficient, while the net mouth height remained relatively unchanged. Under identical conditions, a 20% reduction in liner net proportion resulted in a 12.02% decrease in drag and a 5.66% reduction in the energy consumption coefficient.
- With increasing flow velocity, the beam trawl model exhibited a reduction in net mouth height, greater overall contraction and increased drag.
- Increased sinker weight was positively correlated with drag, net mouth height, and energy consumption coefficient.
- Reducing the liner net proportion while increasing sinker weight resulted in more stable drag oscillations with reduced amplitude.