

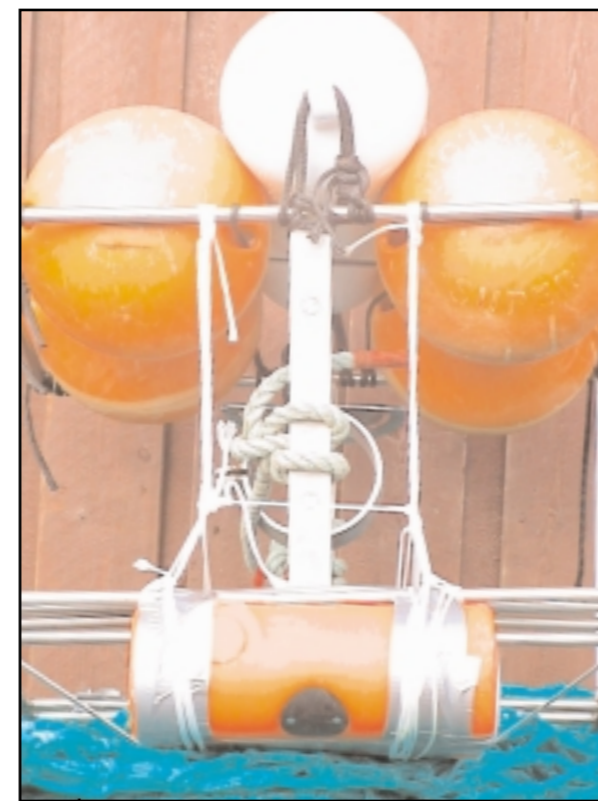
# High velocity towing of live fish

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The efficiency of towing live fish in cages for storage and fattening is restricted by physical resistance, cage construction, strength, machine power, and most important; the species cruising speed. By applying the “wind-sock”-principle on a canvas cylinder (industrial partner Fish Supply AS), the water velocity inside the cylinder can be altered irrespectively of towing speed.

## MATERIALS & METHODS

A traditional 70 feet purse-seiner with a 350 HP engine was used as fishing and towing vessel. The cylinders were made of welded, heavy duty canvas. Sizes varied from 200 m<sup>3</sup> to 700 m<sup>3</sup> with capacities of 30 to 100 tons. The front opening is covered with a small-meshed net panel, the rear end is attached to a seine-net extension with cod-end. Both openings are supplied with concentric foils and the rear end can be regulated. Ratio between diameter and length is 1:8 (e.g. 3,2 meters in diameter, 25 meter long). Two experiments were performed with front opening 8 m<sup>2</sup> and rear end opening 3,1 m<sup>2</sup> and 1,5 m<sup>2</sup>, respectively. Oxygen diffusers were mounted along the bottom of the cylinder to prevent asphyxia during fish transfer. Towing speed, water velocity inside the cylinder, O<sub>2</sub> and fish behaviour were monitored during the experiments.



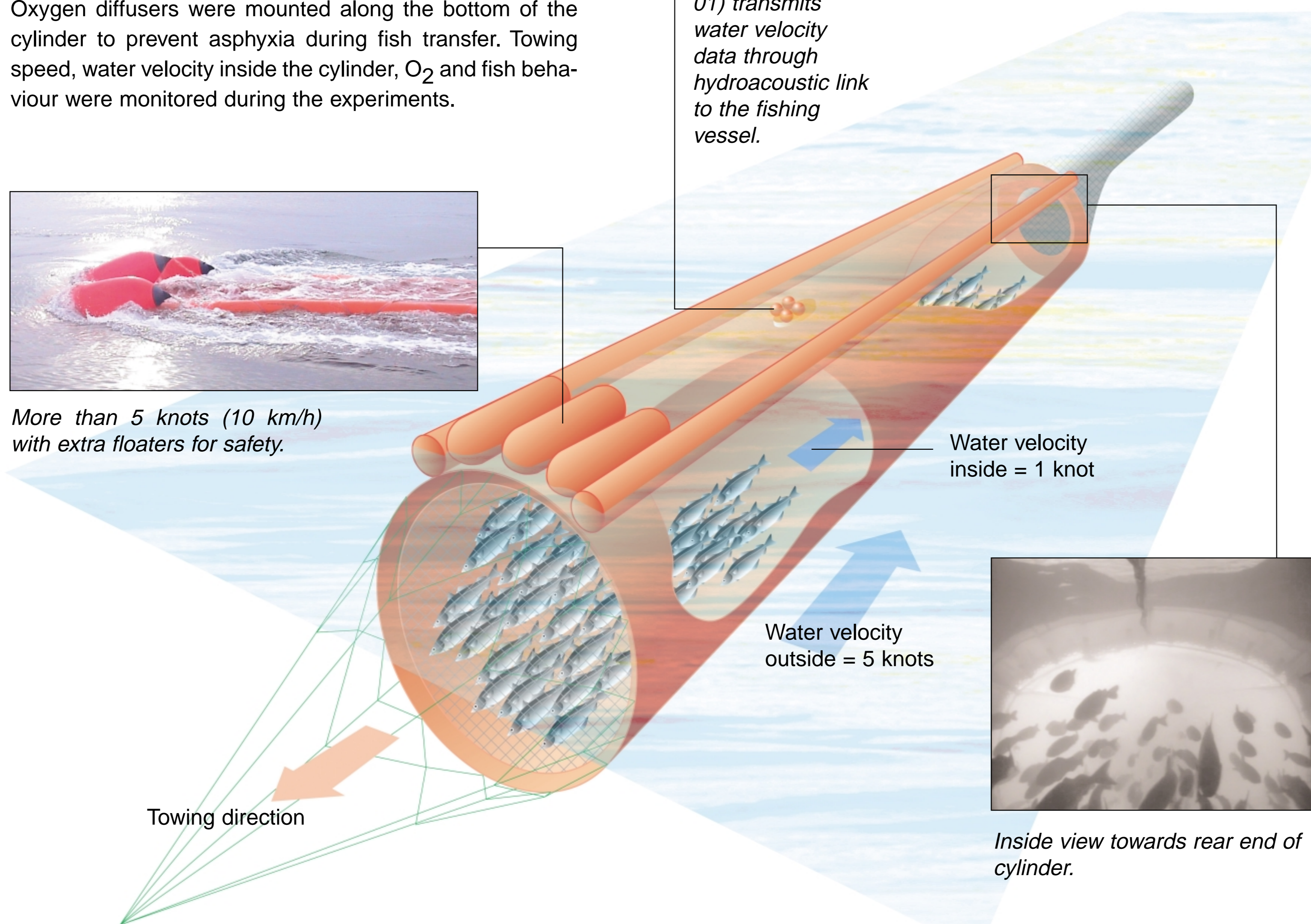
Scanmar grid sensor (HCG GS-01) transmits water velocity data through hydroacoustic link to the fishing vessel.



Assembling net, floaters and ropes at the jetty.

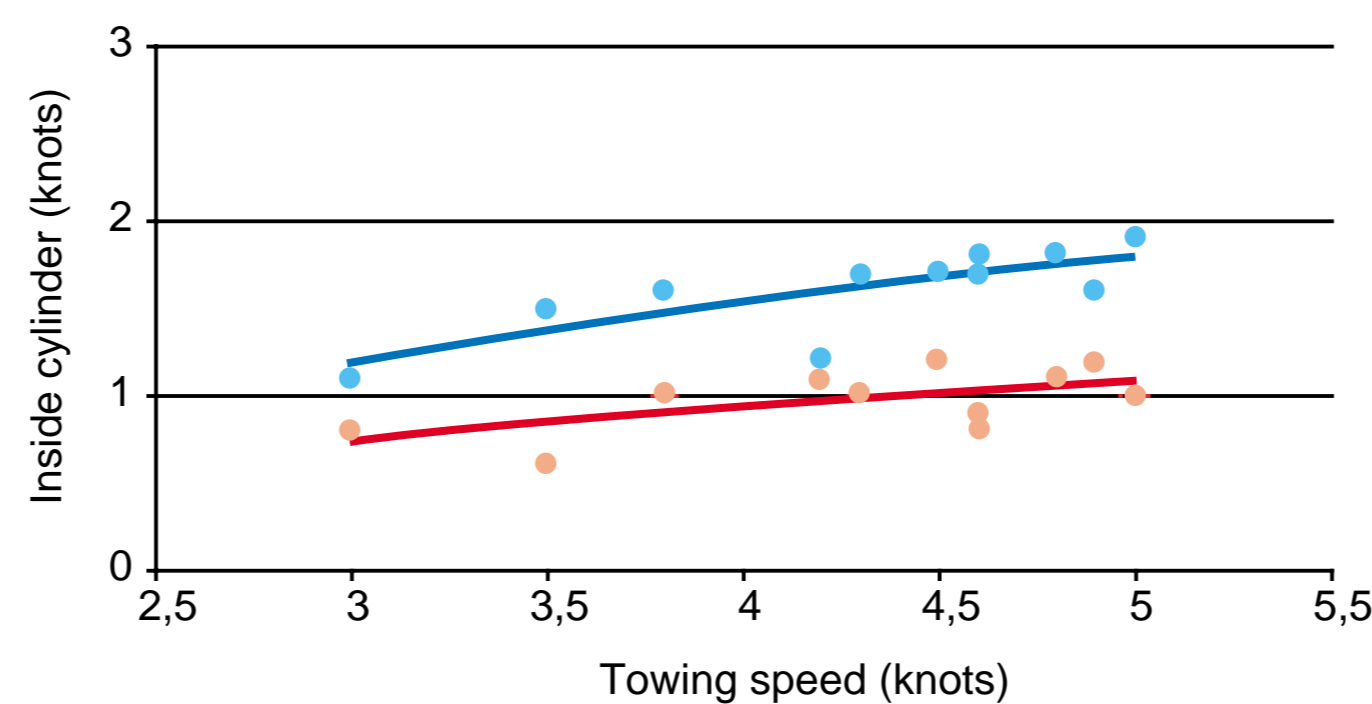


More than 5 knots (10 km/h) with extra floaters for safety.



## RESULTS

The towing cylinder is assembled, set afloat or taken on-board in less than 15 minutes. The cylinder inflates and becomes taut at a towing speed of less than one knot. The purse-seiner was able to tow the cylinder at 5,5 knots. Water velocity inside the cylinder was 20 % of towing velocity (1 knot inside the cylinder when towed at 5 knots). By concentrating the catch in the seine, the fish swim from the seine to the cylinder through the transfer tunnel. Fish density is highest near the front panel and at the bottom of the cylinder.



Relations between towing speed and water velocity inside the cylinder depending on rear opening 1,5 m<sup>2</sup> (→) and 3,1 m<sup>2</sup> (←) respectively.

## CONCLUSION

Towing duration for Norwegian coastal purse-seiners, catching saith (*Pollachius virens*), can now be reduced by 80 %, or from 30 to 6 hours. The towing cylinder represents an efficient, lenient and economic alternative to towing in cages or transport in well boats.

Future experiments seek to evaluate the feasibility for transportation of other pelagic species as herring, mackerel and tuna. For live tuna, the transportation time in the Australian tuna industry can theoretically be reduced from 20 to 4 days, in the Croatian industry from 45 to 9 days.



The towing cylinder is set afloat over the stern. It can be towed and kept open by the coastal seiner's life-boat, and is taken on board through the triplex.