

Experimental evaluation and
feasibility study of check valve
type wave-driven upwelling pump

AB16029

押鴨 慧

Background

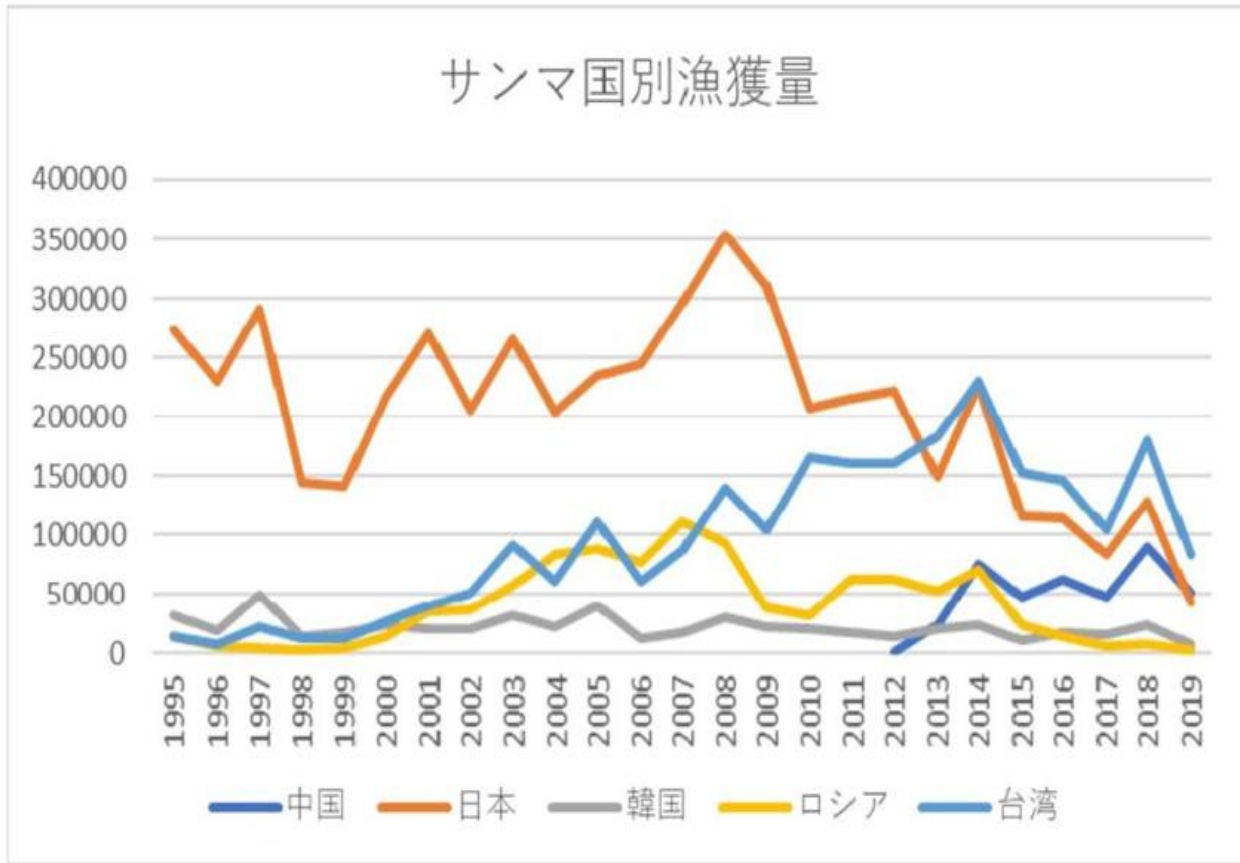


Fig. 1 Catch of pacific saury

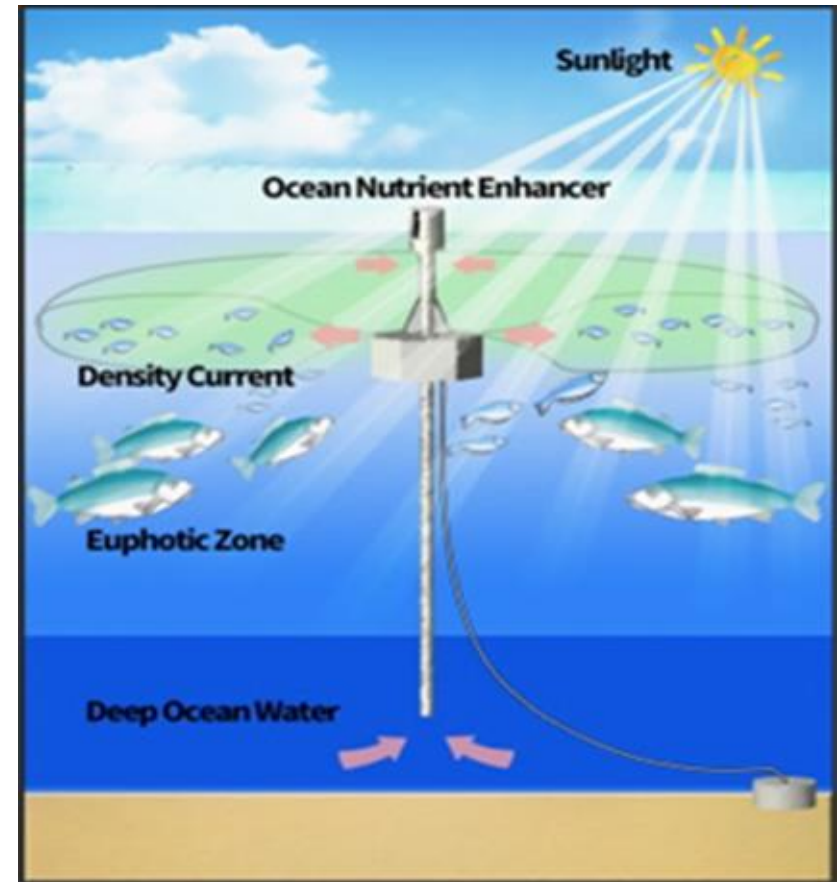


Fig. 2 Upwelling system

Upwelling

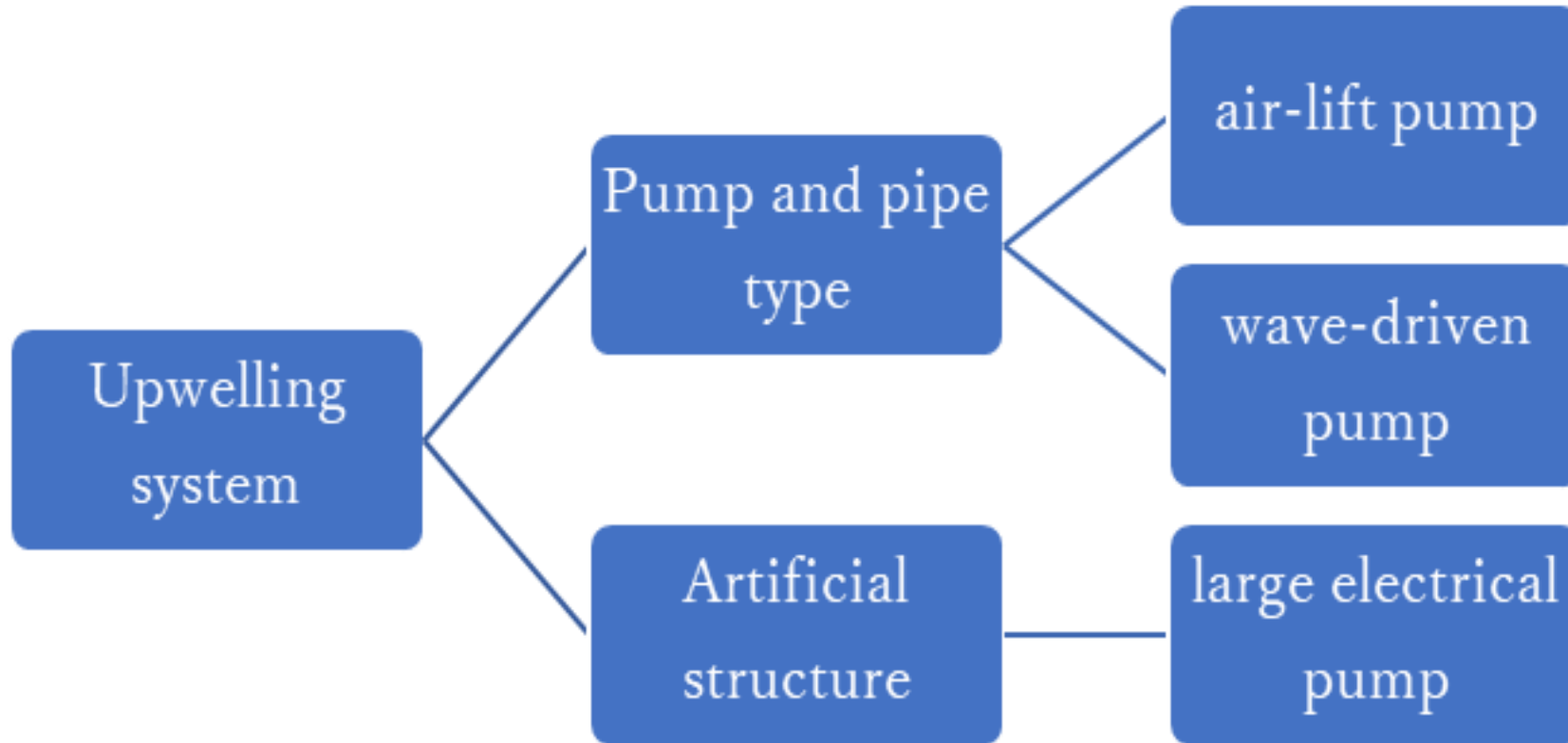


Fig. 3 Classification of upwelling systems

Air-lift pump

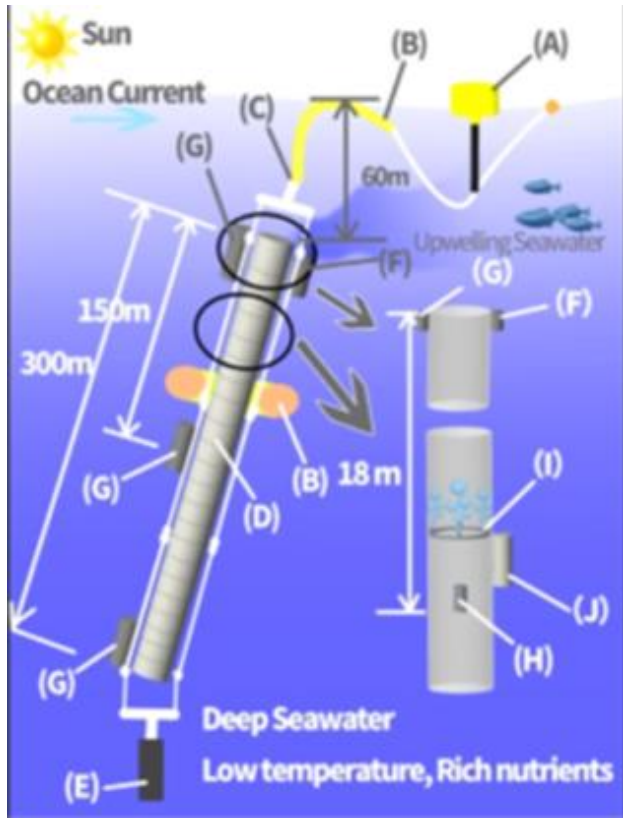
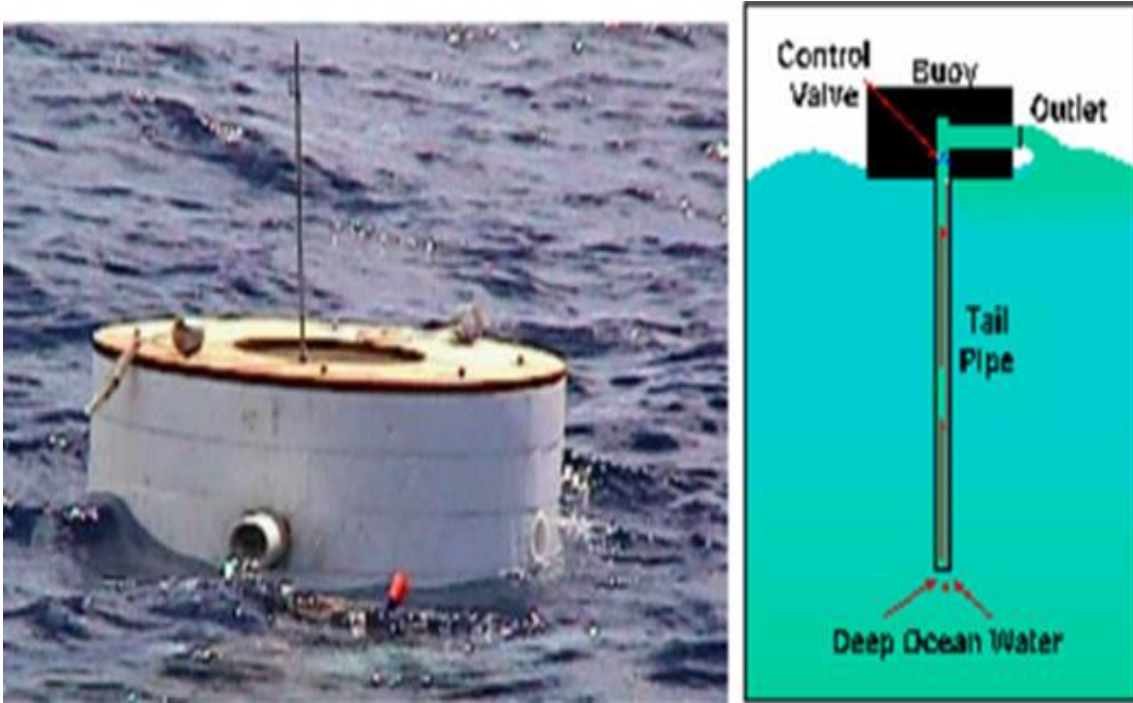


Fig. 4 Experimental equipment of air-lift pump system

N.K. Liang, H.K. Peng
A study of air-lift artificial upwelling
Ocean Eng, 32 (2005), pp. 731-745

In this experiment, when air was injected into a pipe with a length of 300 m and a diameter of 0.3 m below the sea level, a flow rate of about $0.0005 \text{ m}^3 / \text{s}$ was obtained.

Wave-driven pump



- In this experiment, when a buoy with a diameter of 4.0 m, a flow control valve, and a wave-powered device with a diameter of 1.2 m and a length of 300 m were submerged on the south coast of Hawaii, an upwelling flow rate of about $2.41 \text{ m}^3 / \text{s}$ was obtained.

Fig. 5 Experimental equipment of wave-driven upwelling pump

Large electrical pump

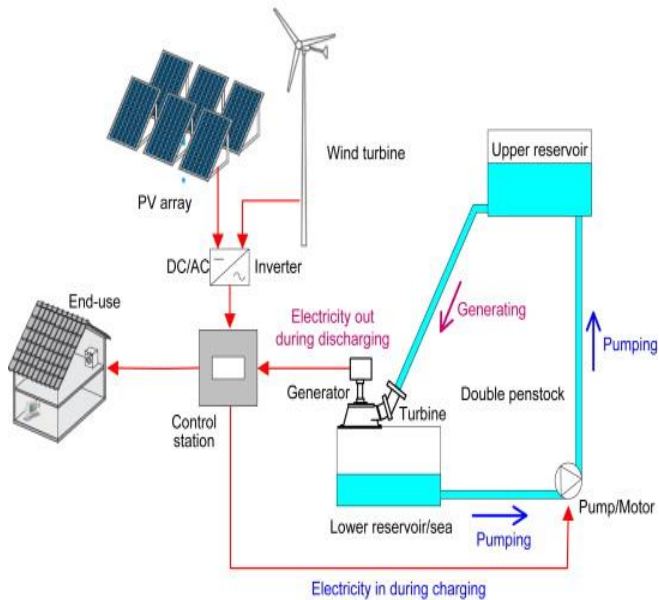


Fig. 6 Large-scale upwelling system



Fig. 7 Photo of OTEC in operation

- In this experiment, it is said that the upwelling flow rate of "Takumi" ocean thermal energy conversion, which is equipped with a pipe with a diameter of 1 m and a length of 200 m, was about $1.2 \text{ m}^3 / \text{s}$.

check valve type wave-driven upwelling pump



Fig. 8 Upwelling pump

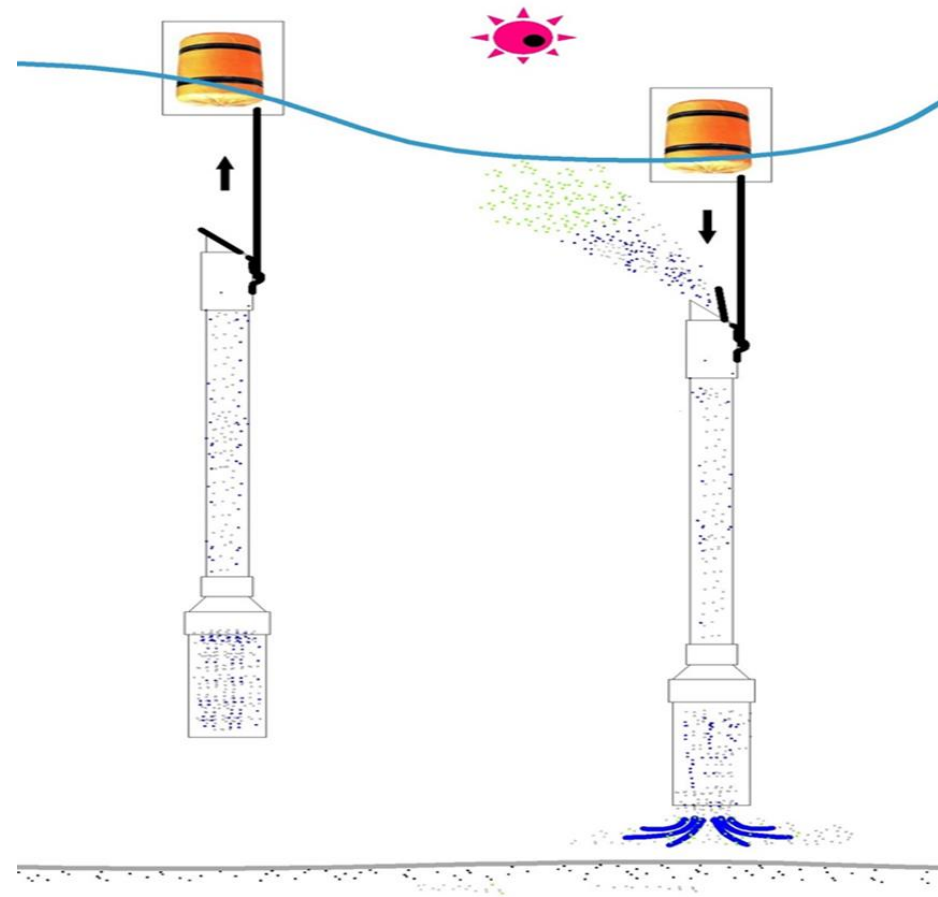


Fig. 9 principle of wave pump

Experimental setup



Fig. 10 Acrylic pipes and saucer



Fig. 11 Motor

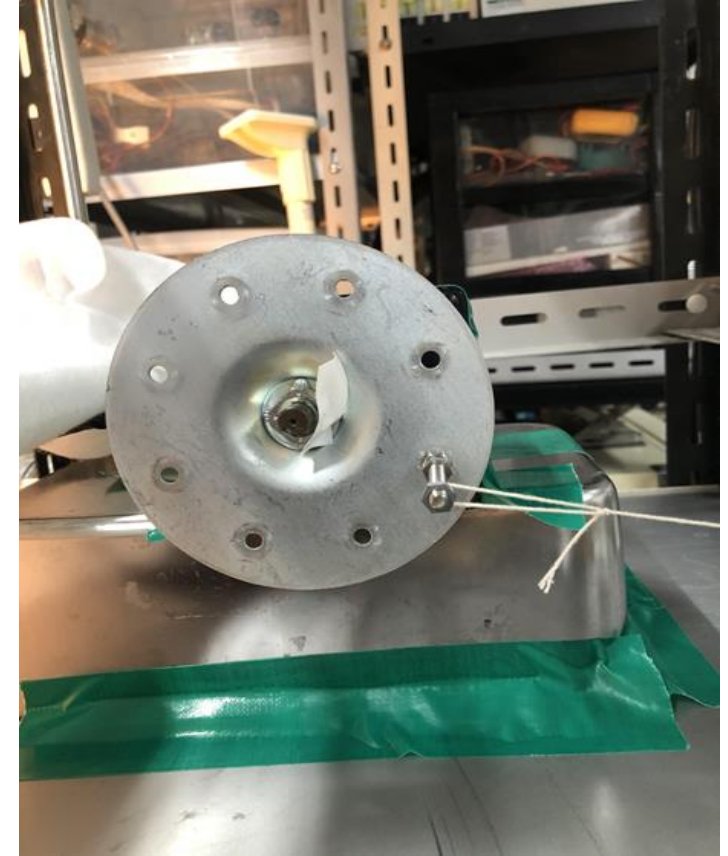


Fig. 12 Cog

Experimental setup



Fig. 13 Experimental equipment



Fig. 14 Experimental photo

Experimental results

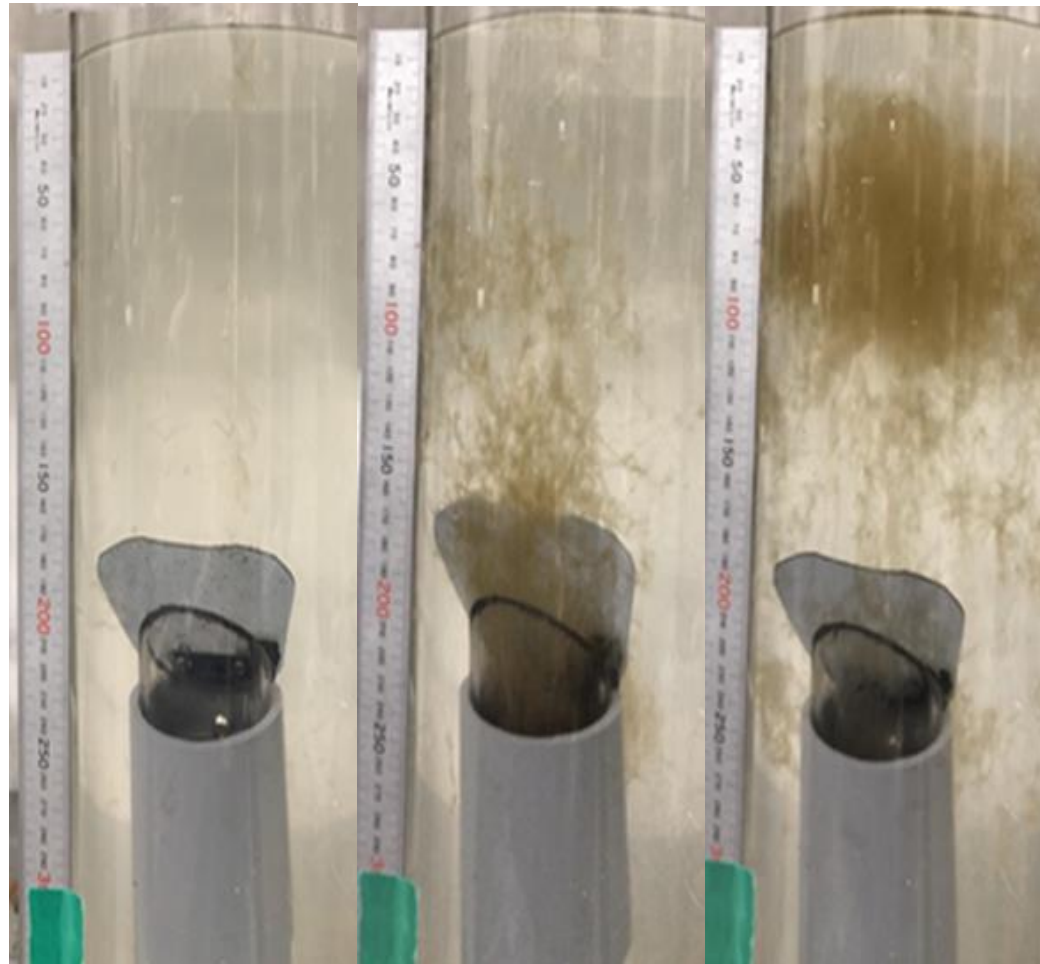


Fig. 15 Experiment with cycle of 5 s

Experimental results

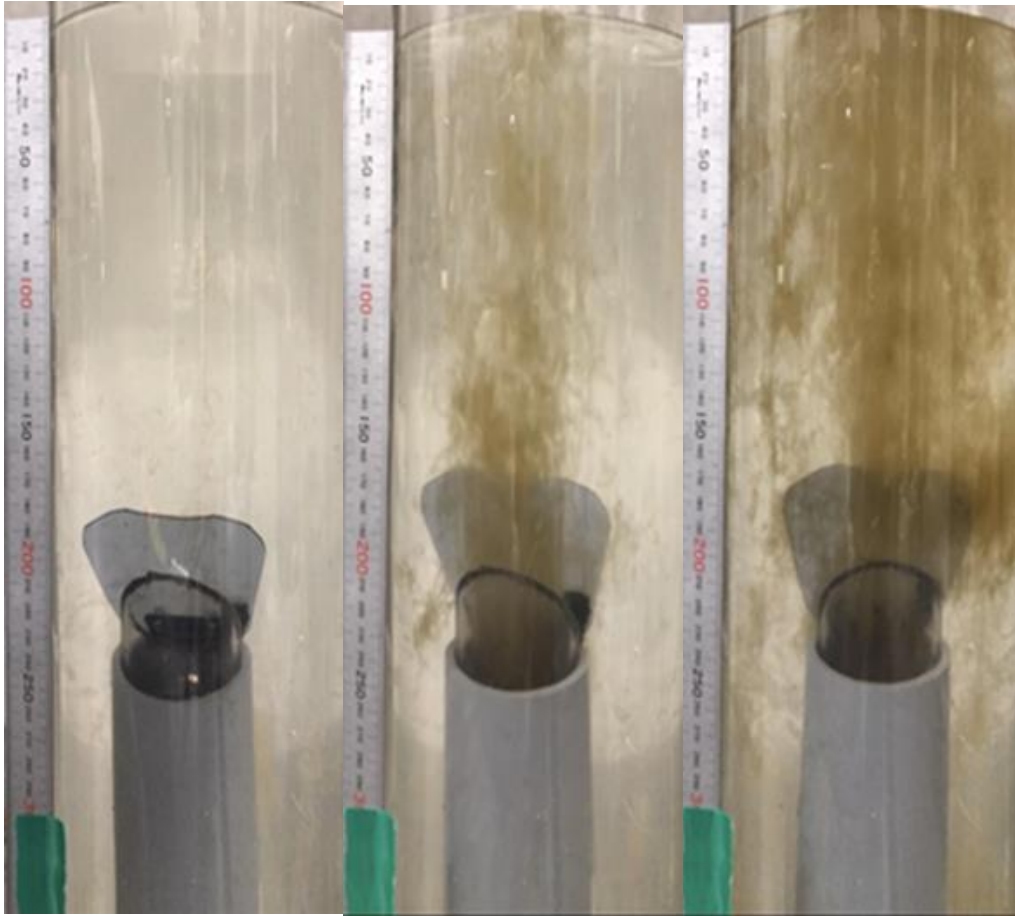


Fig. 16 Experiment with cycle of 2.5 s

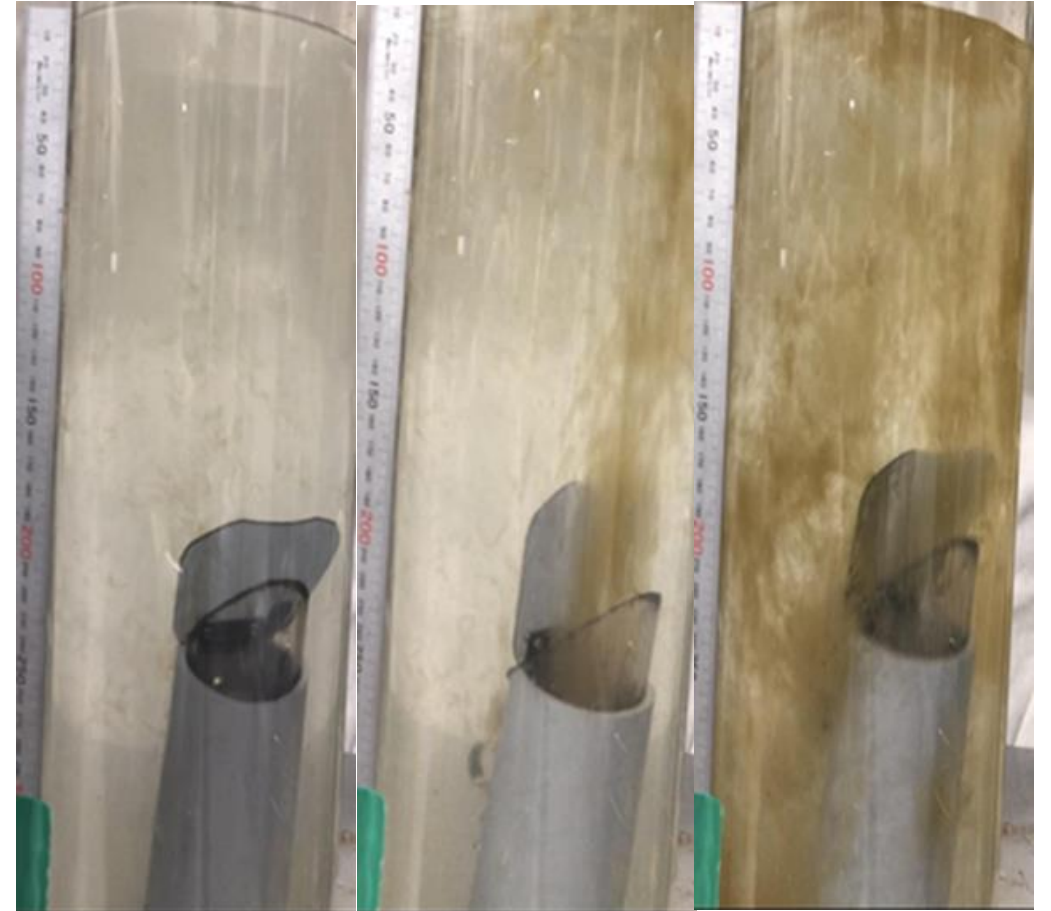
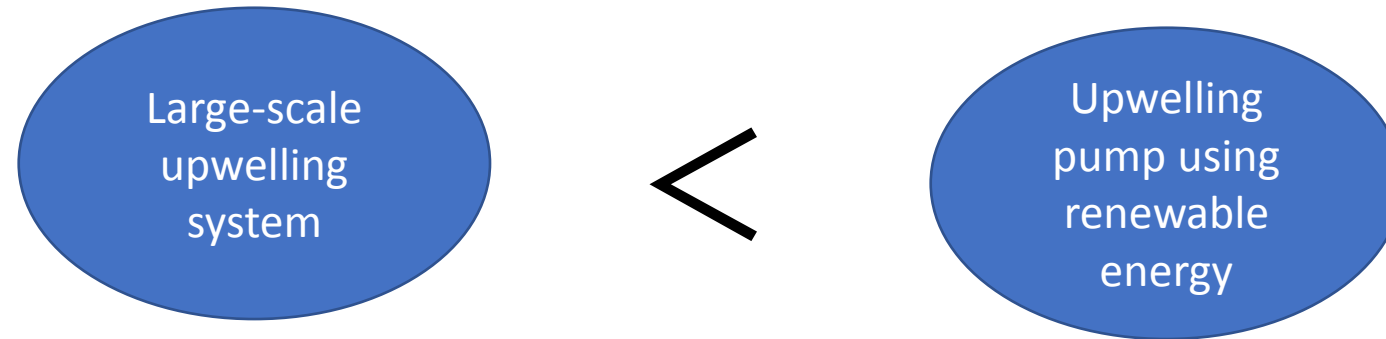


Fig. 17 Experiment with cycle of 1 s

Consideration



Upwelling flow rates were obtained at an amplitude of 100 mm.