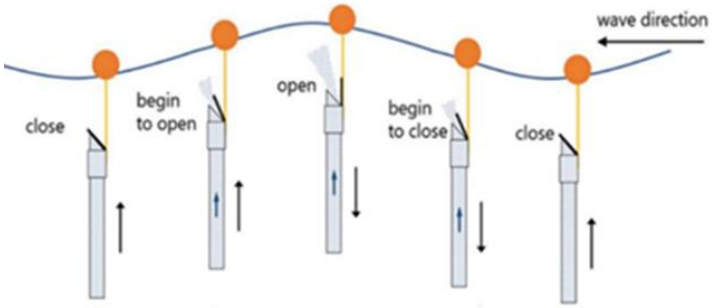
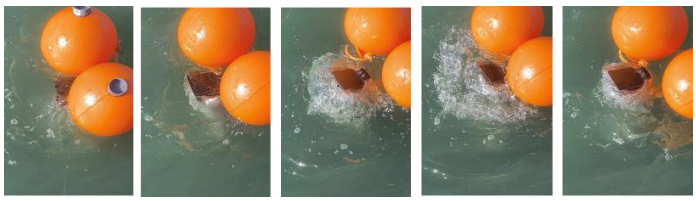
Wave-Actuated Upwelling Pump

A Zero-Energy Approach to Coastal SST Cooling and Marine Heatwave Adaptation

How it Works

① **Waves move the float**
② **Check valves pump water upward**
③ **Healthy Cooling Water Layer (~5 m)**
④ **Surface cooling + ecosystem protection**





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HCWL Research
      ↓
Selective Upwelling
      ↓
Wave-Actuated Pump
      ↓
Marine Heatwave Mitigation
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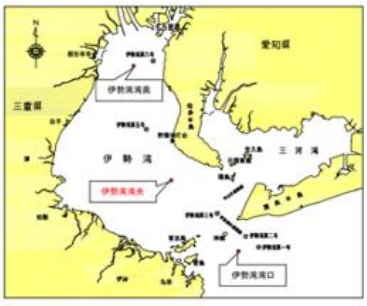
HCWL: Healthy Cooling Water Layer

A shallow subsurface layer that can cool the surface while maintaining ecosystem safety.

Why 5 m?

✓ Cooling effect
✓ Dissolved oxygen
✓ Biological productivity
✓ Ecosystem safety




伊勢湾湾央（伊勢湾第四号灯標）

Figure 1. Physical Environment
Temperature, DO and Salinity

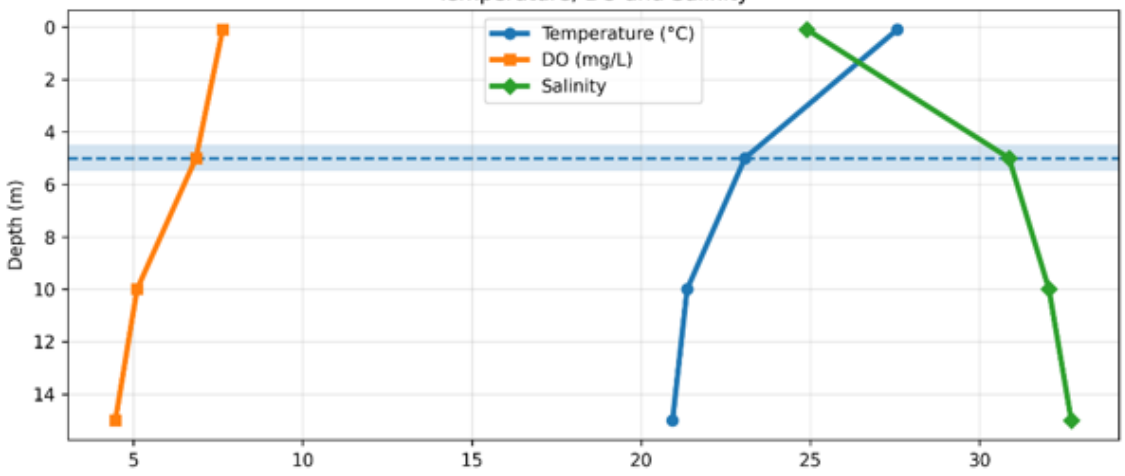
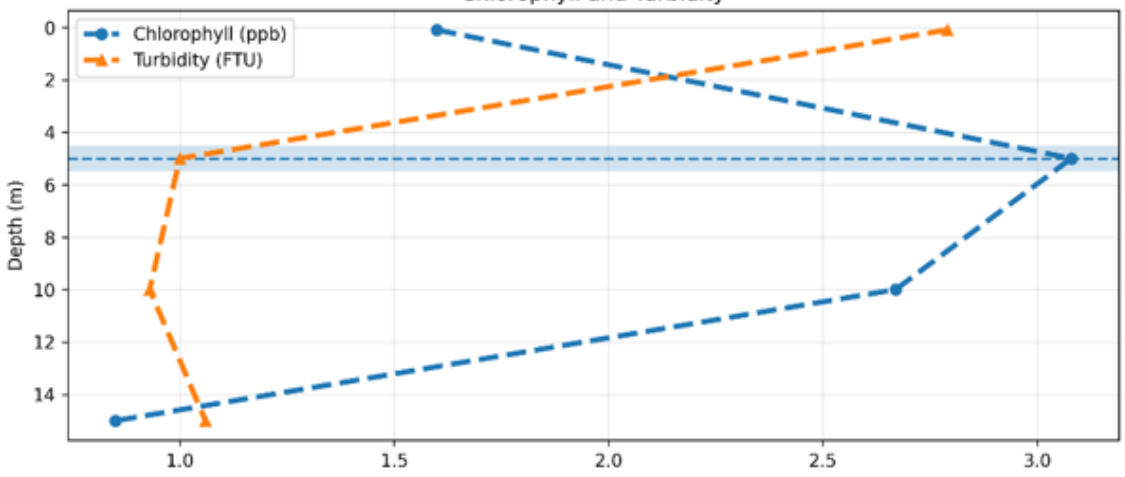


Figure 2. Biological Environment
Chlorophyll and Turbidity



5 m layer: -4.5°C cooling, DO=6.85 mg/L, Peak Chlorophyll=3.08 ppb, Low Turbidity=1.00 FTU, Stable Salinity=30.87

Upwelling Pump

ESCOT Website

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