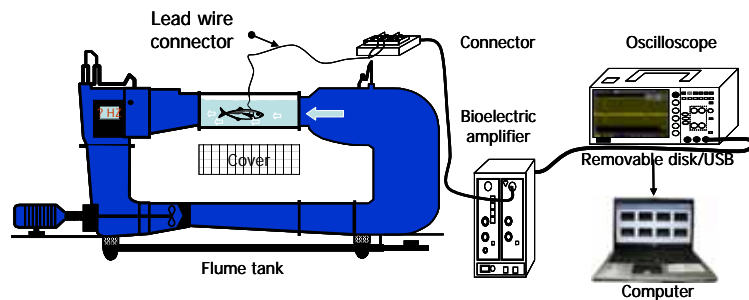


**Swimming performance of the jack mackerel
(*Trachurus japonicus*) with ECG monitoring
(心電図測定によるマアジの遊泳能力解析)**

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[Objective] The heart beat rate of jack mackerel was examined during the swimming exercise in the flume tank, for understanding the swimming performance during the capture process.

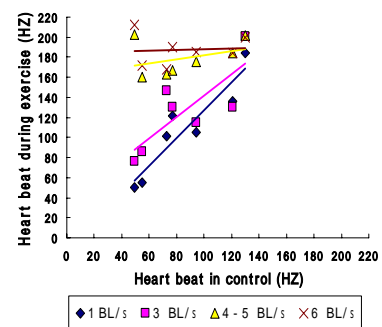
[Methods] The forced swimming in the flume tank was monitored for speed level of 1.3– 6.7 BL/s of jack mackerel (17.5-20 cm FL), firstly for the swimming endurance test, and then for the ECG monitoring to



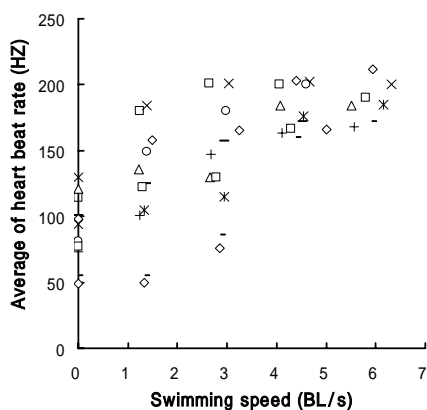
Schematic drawing of the experimental flume tank and equipment for measuring the heart beat

analyse the change of heart beat rate according to the swimming speed by step-up protocol.

[Results] Jack mackerel sustained swimming speeds of 1.3–2.9 BL/s for extended period (120 minutes). However, the swimming endurance was decrease to be 24 minutes while fish was swimming at 4.4 BL/s or faster. For the speed of 6.7 BL/s, no longer than 7 min. The heart beat rate was not so much increased in the speed range of 1.3-2.9 BL/s with the



Relationship of heart beat rate during exercise and control



Relationship of swimming speed and heart beat. Respectively marker is represent an individual

control value of 90 beats/min on average in static water. Higher heart beat rate was monitored for the increased speeds from 2.9 to 4.4 BL/s, and then it was stabilized at 188 beats/min in average, at swimming speed of 4.4 – 6.7 BL/s. The result indicated that the anaerobic muscle activity start to work for the jack mackerel is nearly 4.4 BL/s. Peak heart rate was 4.3 times as much as the control. The recovery time from the peak to the control level for the

fish experienced force swimming exercise was 227 minutes on average.