Measurement of swimming behavior of alfonsino *Beryx splendens* in experimental tank using micro-data logger

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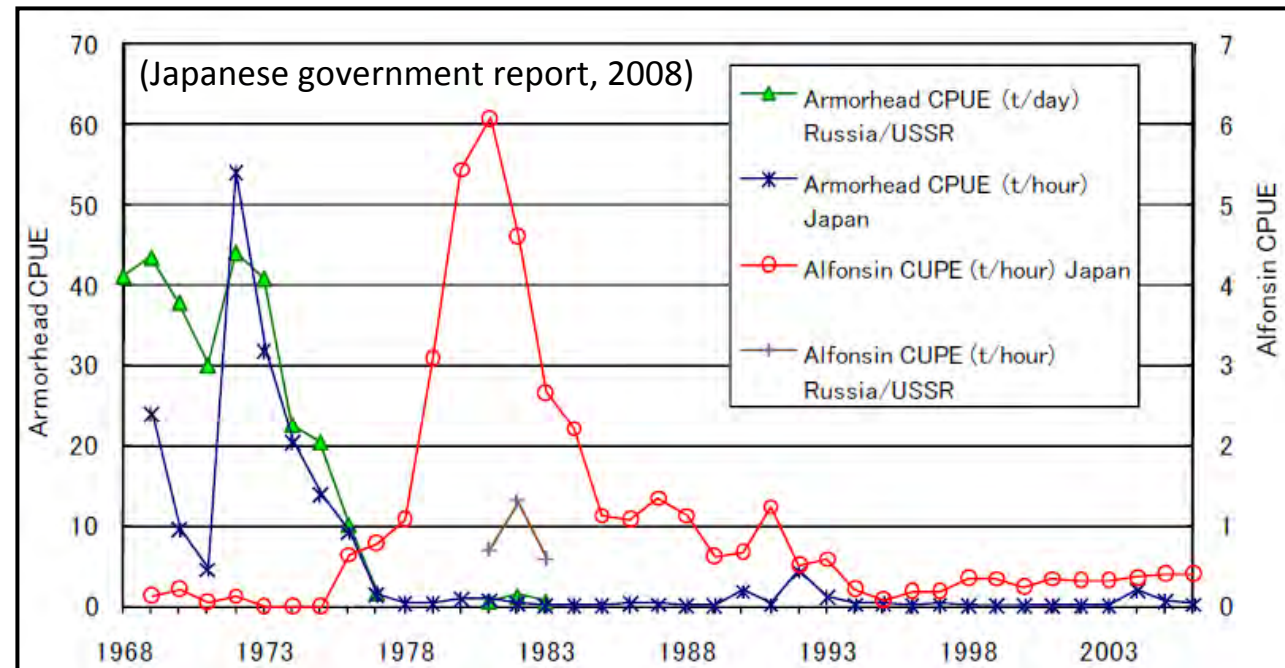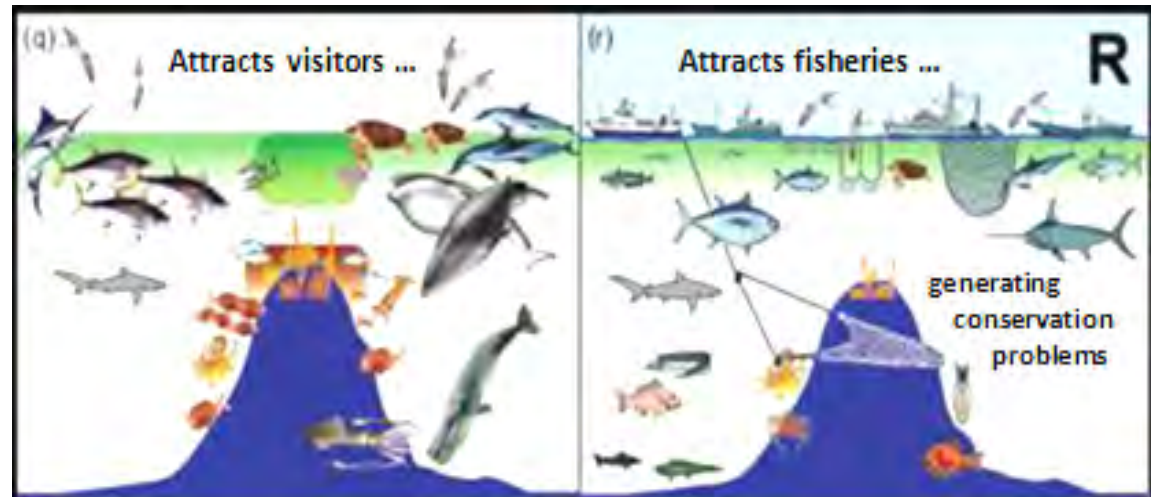
Seamounts ecosystem

- unique ecosystems
- high levels of endemism
- hotspots of marine life
- high diversity but fragile

Seamounts fisheries

- depletion of stocks
- overfishing
- habitat degradation
- location outside EEZ
- poor management

(q) Attracts visitors ...

(r) Attracts fisheries ... R

generating conservation problems

(Japanese government report, 2008)

Armorhead CPUE (t/day) Russia/USSR
Armorhead CPUE (t/hour) Japan
Alfonsin CUPE (t/hour) Japan
Alfonsin CUPE (t/hour) Russia/USSR

- **Vulnerability of seamount fishes**

  life history and **ecological characteristics**
  late maturity, slow growth, low
  fecundity, long life span

- **Alfonsino** *Beryx splendens*

  - Important commercial fish
  - Cosmopolitan
  - Distribution around seamounts
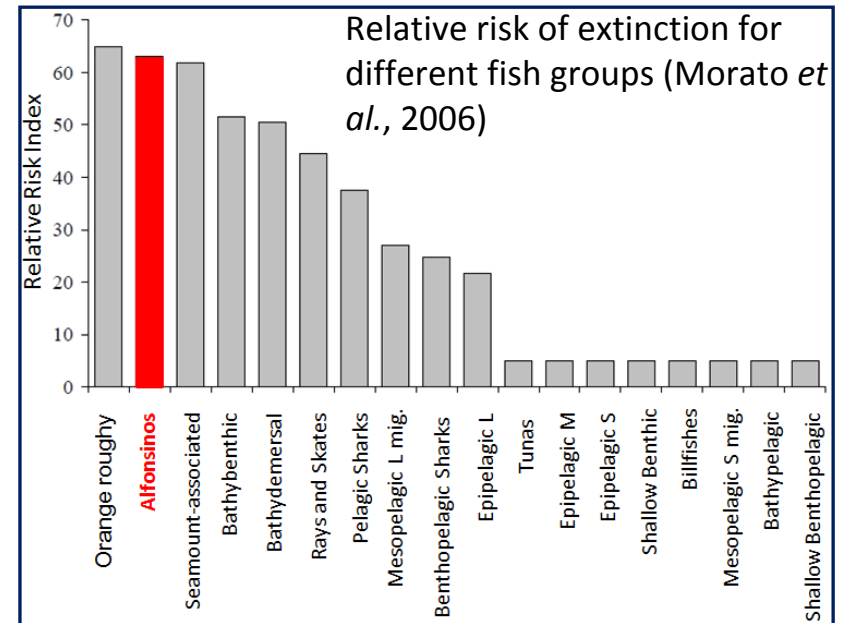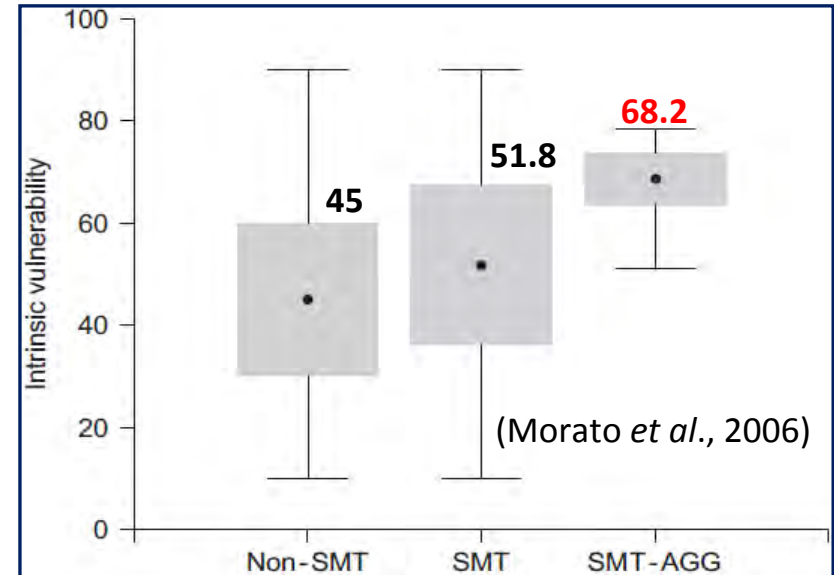 - Depth range from 200 to 600 m

  - **Vulnerability of alfonsino**

  Social aggregation leads to increased
  catchability, hyperstability of catch
  rates and disruption of spawning

**Therefore understanding and monitoring
of their behavior should be a priority**

(Morato *et al.*, 2006)

Relative risk of extinction for
different fish groups (Morato *et al.*, 2006)

Monitoring methods

Bio-logging science

Bio-logging has measured behavior, movements, physiology and environments of large marine animals. Archival tags, Satellite tags, Camera data-logger, Acceleration data-logger

■ Downsizing

Introducing bio-logging to small fish

Acceleration data-logger reveals their behaviour

For example, Tanoue *et al.* (submitted) developed a new method to obtain body tilt angle of threeline grunt.

Micro Data Logger
Camera/ Speed / Acceleration

Alfonsino's behaviour

Objectives

I. Investigate the possibility to attach the data-logger to alfonsino

  - How to attach the acceleration data-logger to alfonsino

    - Whether data-logger attachment influences fish behavior

II. Study the behavior of alfonsino

  - comparison between visual observations and data-logger records of swimming behavior

  - measurement of fin beat frequency (pectoral and caudal)

    - measurement of the distribution of body tilt angle

    - comparison of behavior between day and night

Materials & Methods 1

Acceleration data-logger

D2GT (Little Leonardo Co. Ltd, Tokyo)

depth (D),
2-axis accelerations (G),
water temperature (T)

45-mm

12-mm

10 g in air

Sampling rate:
1 s (depth), 1/16 s (acceleration)

Fish size:
1) 23.5 cm FL, 307.9 g   2) 24.5 cm FL, 371.05 g

Fishing gear: hook and line

Transportation: large container

Experimental Tank:
Length: 120cm, Width: 80cm, Depth: 100cm

Captivity condition: 13 °C, dark

Attachment method

Acceleration data-logger D2GT in
neutral buoyancy attached to alfonsino
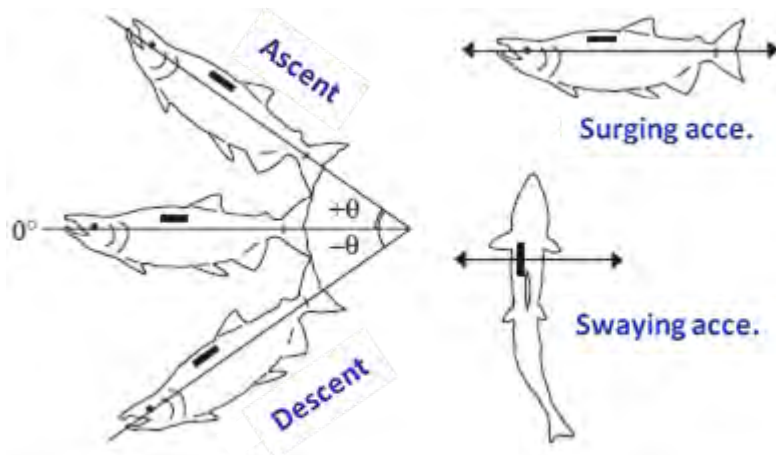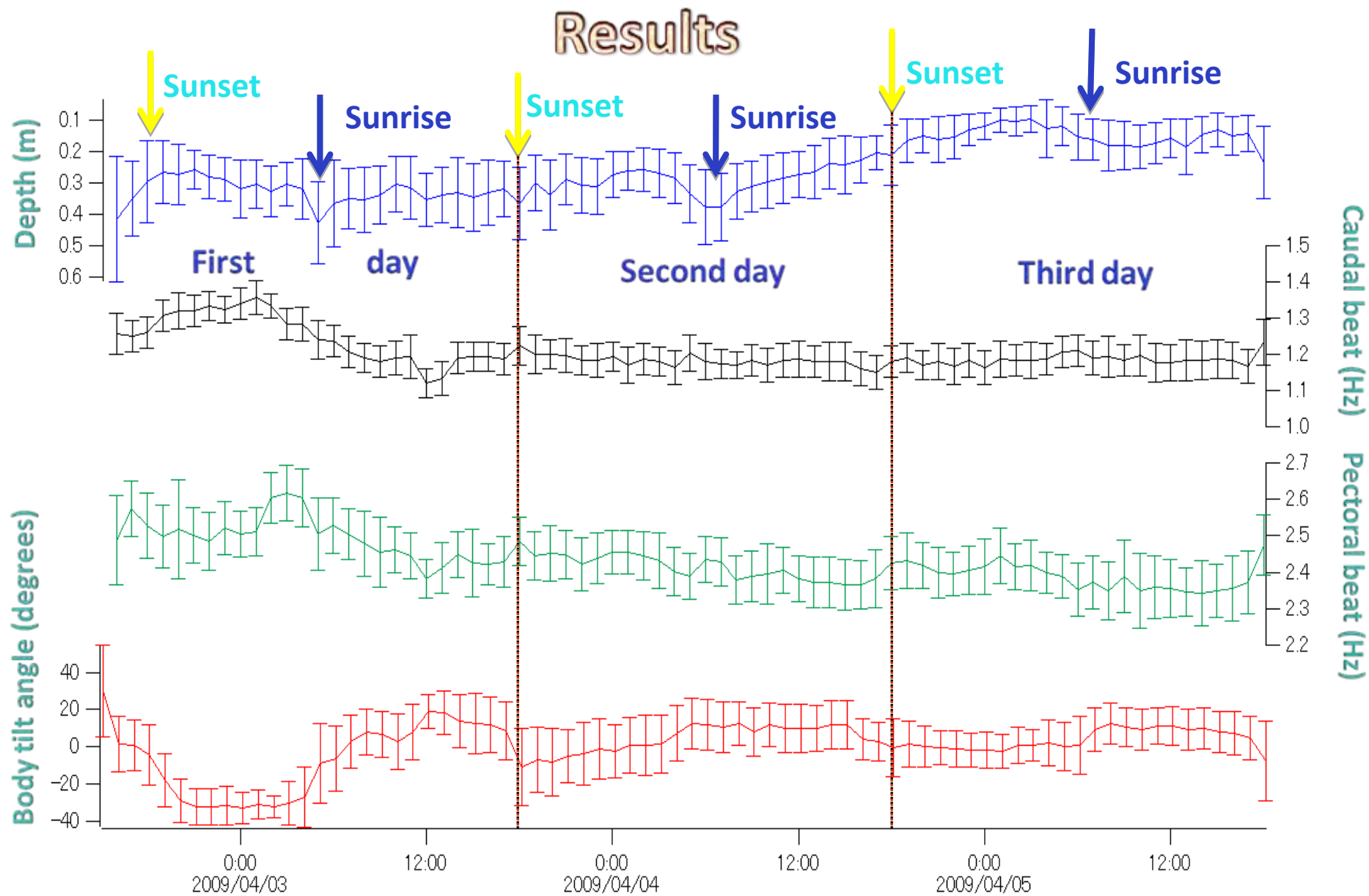
Materials & Methods 2

Data Analysis

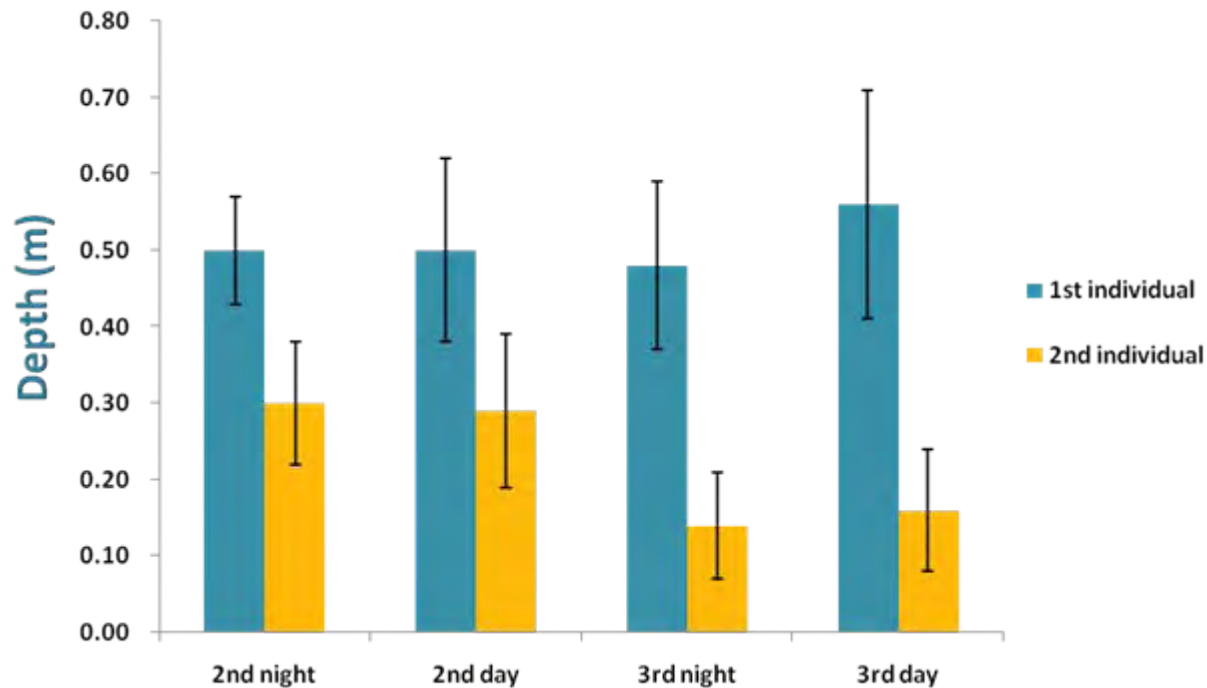Observation with video camera → Identification of pectoral & caudal beat from swaying acceleration → Identification of body angle from surging acceleration → Time series data; day and night

Ascent

$0°$ $+\theta$ $-\theta$

Descent

Surging acce.

Swaying acce.
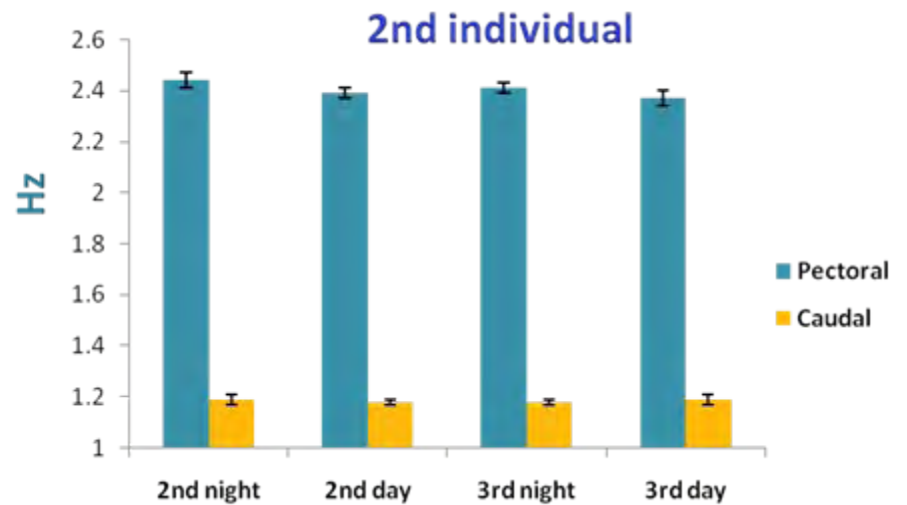
Data-logger
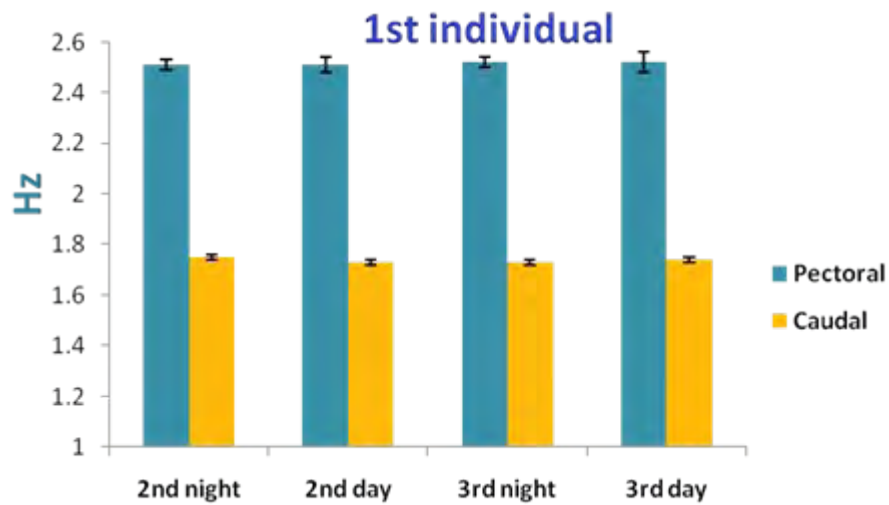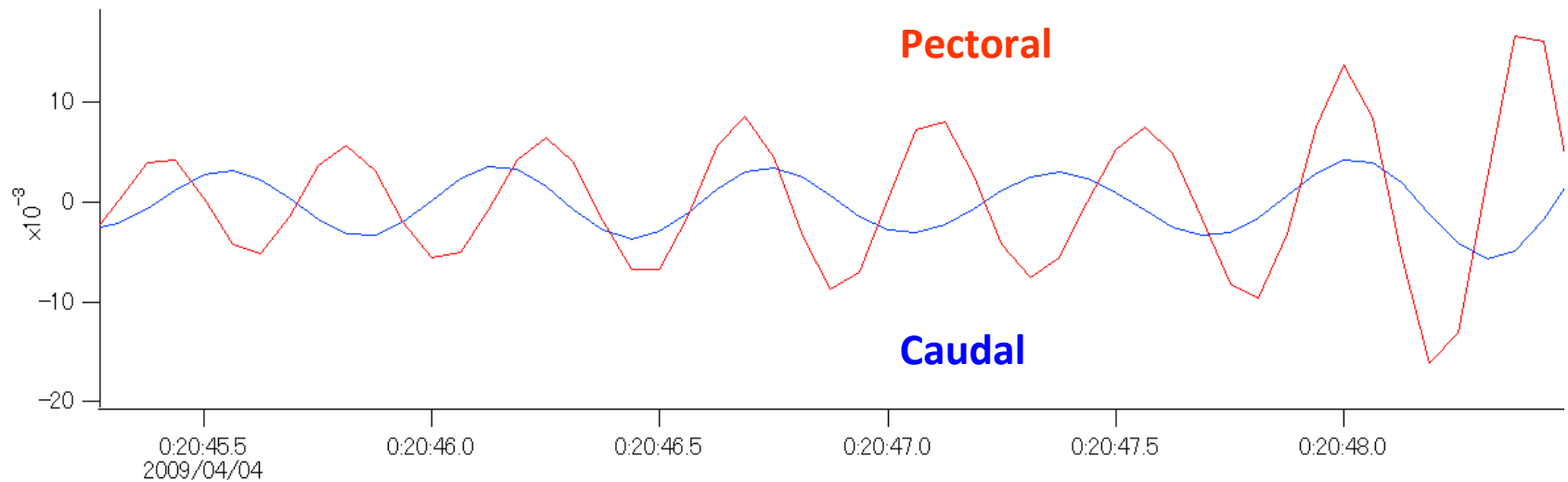
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Results
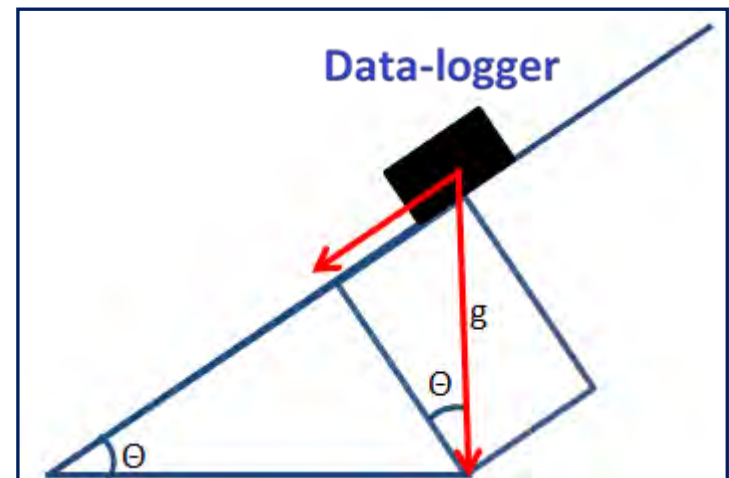
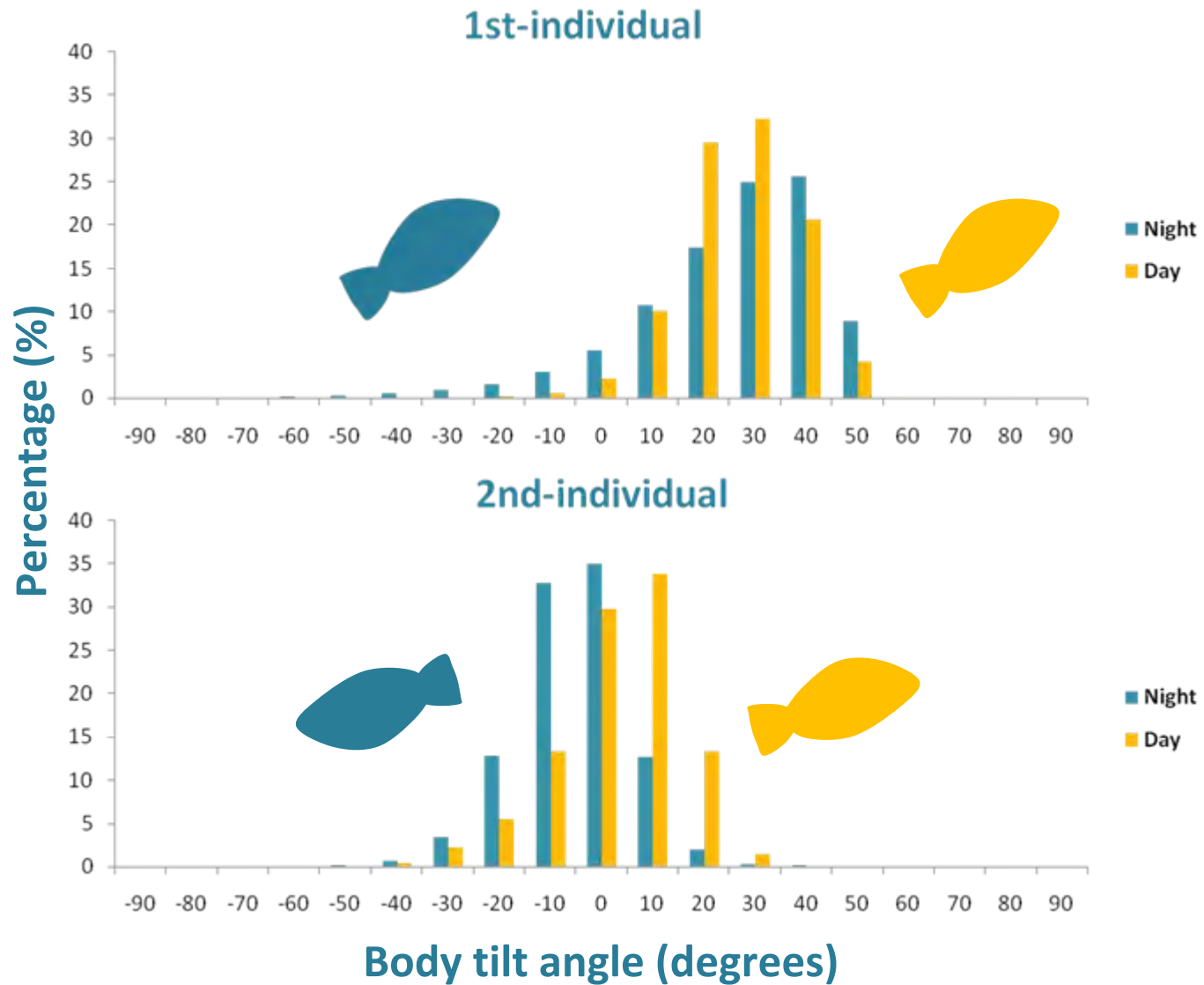1 hour average time series data of one of the individuals

The two individuals kept a distance between each other with the first individual mostly occupied the lower part while the other the upper part of the tank
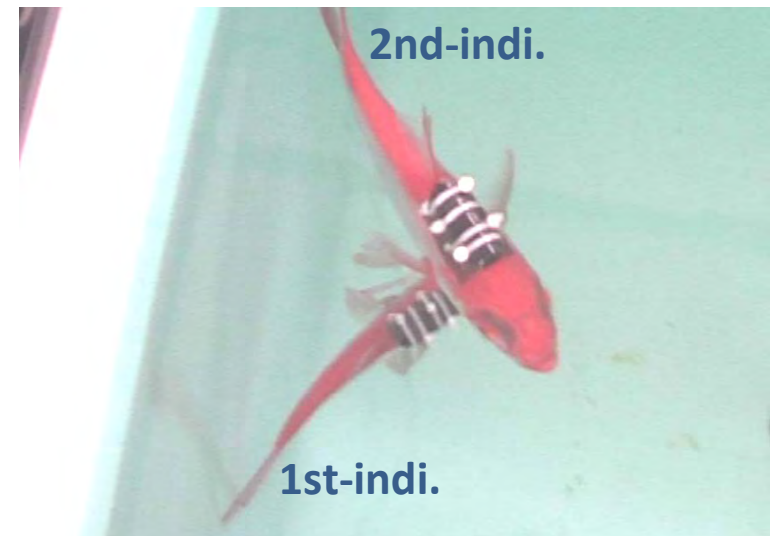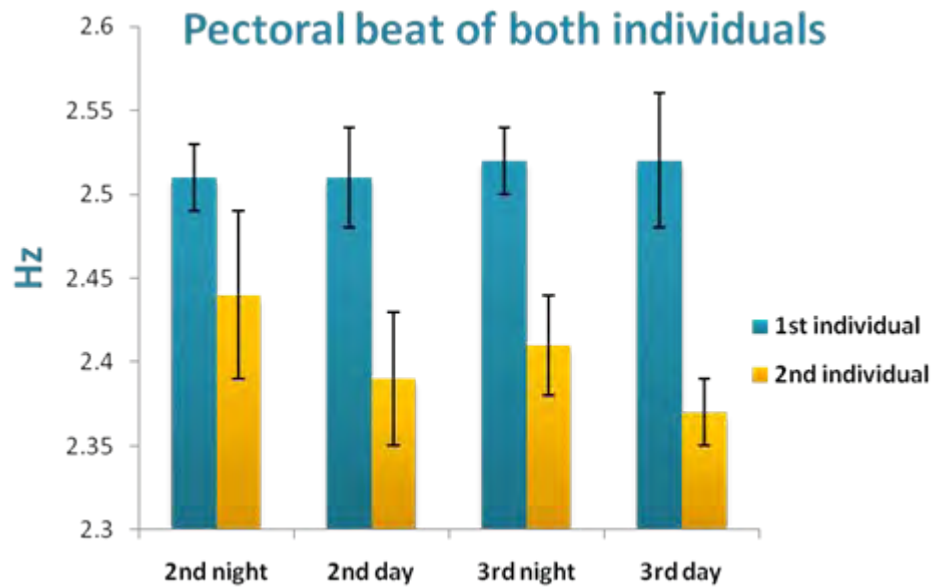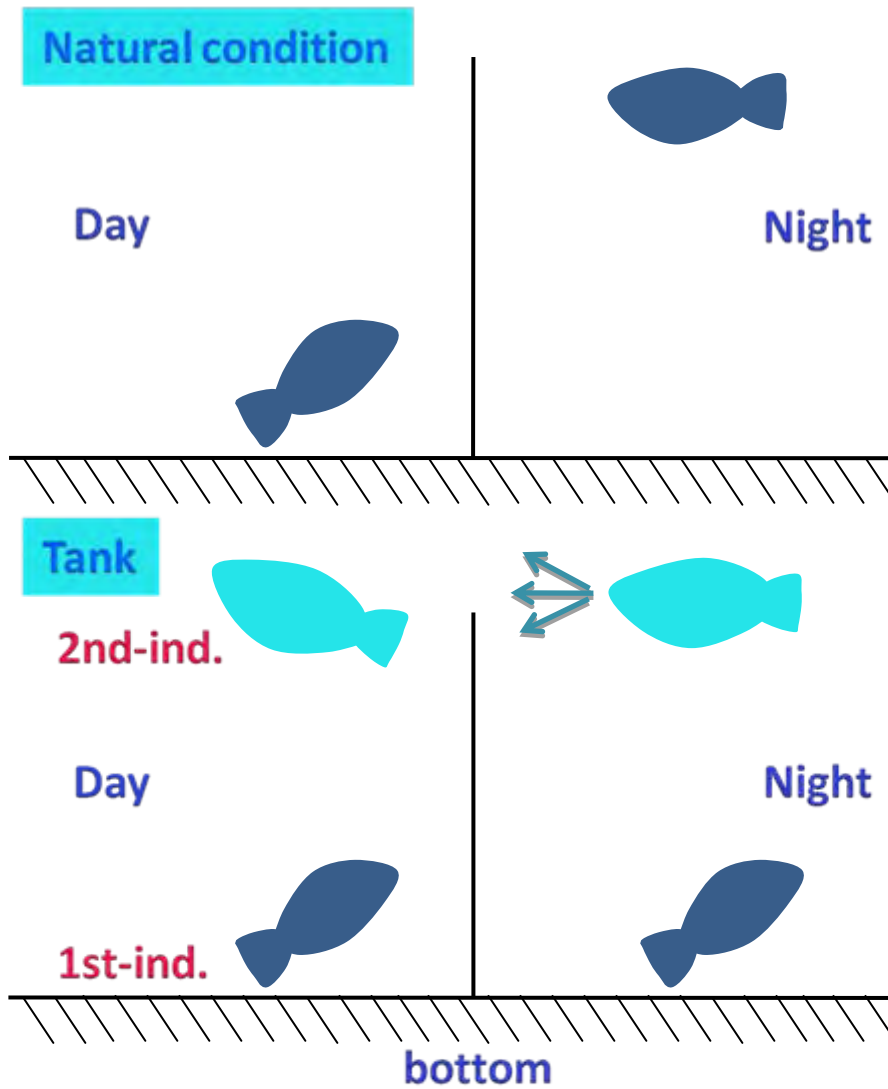
Fin beat frequency

Pectoral

Caudal

2009/04/04

1st individual

2nd individual

Body tilt angle distribution

Discussion 1

Pectoral beat of both individuals

Hz

- 1st individual
- 2nd individual

2nd night   2nd day   3rd night   3rd day

1st-indi.

2nd-indi.

2nd-indi.

1st-indi.

Discussion 2

Natural condition

Day   Night

Tank

2nd-ind.

Day   Night

1st-ind.

bottom

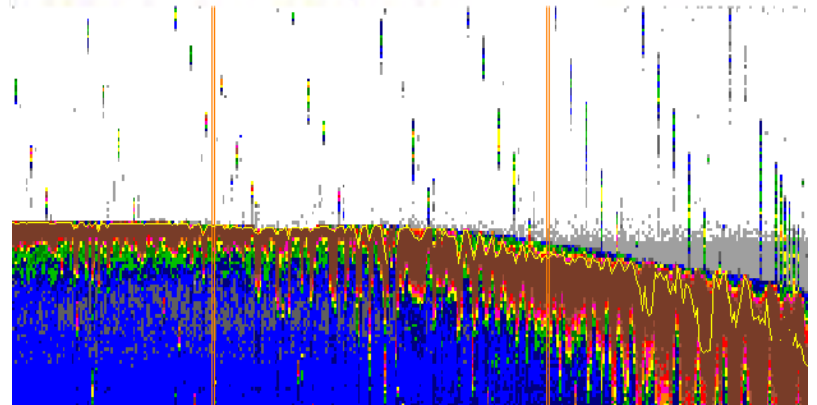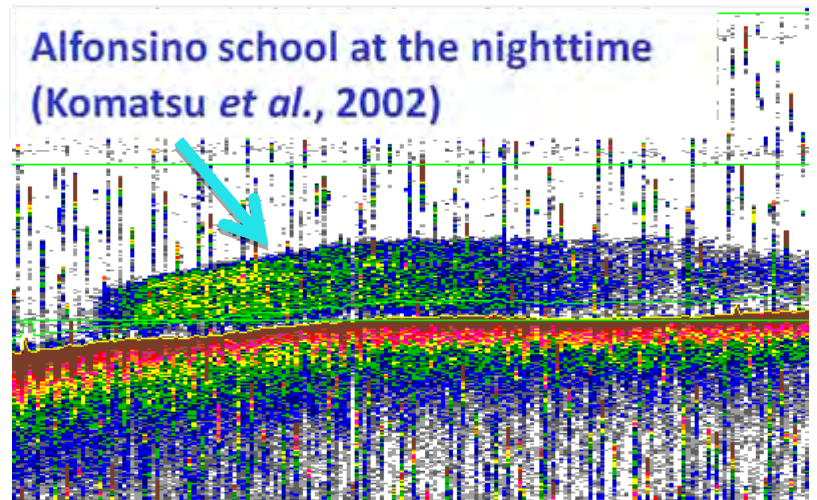**Alfonsino school might be near the bottom in the daytime**

Alfonsino school at the nighttime (Komatsu et al., 2002)

Conclusion

➢ **Acceleration data-logger has proved efficient for measuring the behavior of alfonsino**

- The attachment of the data-logger to alfonsino has no effect on the behavior after the first day of the experiment

- This technique is useful for measurement of fin beat frequencies and body tilt angle

- This is the first experiment that can detect pectoral beat frequency

☆ **We are now preparing to conduct the next experiment in the open ocean based on these results for exploring the mysterious behavior of alfonsino**

Thank you for your attention!