Harbor seals (*Phoca vitulina*) discriminate in 3D objects : Effects of Brightness and Shape

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New perspective in mitigating seal-fishery conflicts

Background

- Harbor seals are the only pinnipeds stay in Japan throughout the year and Cape Erimo is the biggest haul-out site
- Fishery damage in the salmon set net has been serious problem
- To mitigate damage, **many efforts have been done but the effect was transitory due to their high learning ability**

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Cape Erimo

Attention has not been paid to their cognitive and learning ability which is the very cause of fishery damages

Objectives

It is the priority to clarify their visual cognitive

Previous study revealed that seals are…
- color-blind (Griebel & Peichl 2003)
- but can discriminate color by using brightness difference (Scholtyseek et al, 2014)
- can discriminate complex shape (Mauck & Dehnhardt 2005)

But actual mechanism of how they discriminate in objects is unknown

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Materials and Methods

Hypothesis
They discriminate objects by using…
1. Shape difference
2. Brightness difference
3. Shape and Brightness difference

1. Training
Objective : train subjects to learn S+ object

- Subjects were trained to choose S+ (dark-gray circle)
- feed them to reinforce when they choose S+

2. Pre-test
Objective : check subjects learned S+ object

Pre-test continued until each individual achieved 80% or better correct choices in 3 successive sessions

3. Test
Objective : find how they discriminate in objects

Shape different probe
Each pair is different in shape and test the ability of seals to discriminate in objects on basis of shape

Brightness different probe
Each pair is different in brightness and test the ability of seals to discriminate in objects on basis of brightness

Shape-Brightness different probe
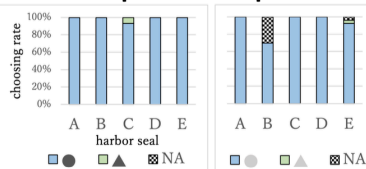Two objects are different in both shape and brightness

- feed and reinforce only when they choose S+ objects
- When they did not make choice within 5 seconds, we count as "NA"
- compare choosing rate of each objects

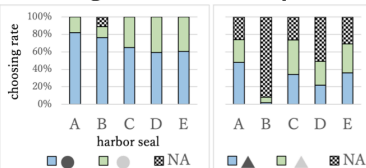| Probe Type	Object pair
Shape different probe	● ▲
	● ▲
Brightness different probe	● ●
	▲ ▲
Shape-Brightness different probe	● ▲

Results
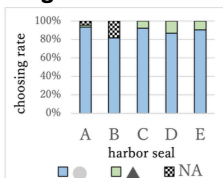
Shape different probe

There is a significant tendency to choose object with the same shape as S+ (circle) regardless of its brightness

Brightness different probe

There was no tendency to choose object with the same brightness as S+ (dark)

Shape-Brightness different probe

They chose object with same shape as S+ (circle) rather than same brightness (dark)

Conclusion

Seals rely more on SHAPE than brightness

Why??

Light is limited and reliability of brightness difference is low under the sea, while shape is not subjected by light and universal

The knowledge can contribute to improve countermeasure for fishery damages.

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