

***Idotea wosnesenskii* Polymorphism and
Substrate Color**

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Introduction

Idotea wosnesenskii is a species of isopod (a marine crustacean) that is found in the Pacific Northwest that has chromatophores and polymorphism, which is the variation of color in different individuals of the same species regardless of sex (Jormalainen 1996). To change their color, isopods use their chromatophore cells to concentrate the pigment in their chromatophores in order to shift their color, possibly if placed on a different colored substrate. Once transferred onto the different color of algae or grass, they then change their color to match their new habitat.

This particular species lives in the intertidal, docks, and sometimes water as deep as 16 meters. The substrates it prefers are varied and can include: eelgrass, different colors of kelp, different colors of algae, in mussel beds, under rocks, and within seaweed. Their diet is vegetation generally and can include algae and some types of kelp (Sept 1999; Kozloff 1993). *Idotea wosnesenskii* has several different natural color variations including: brown, olive green, nearly black, and sometimes even a pink shade if they are found on coralline algae. Their color is generally uniform and the dark olive green is the most prominent color to find them in the field. Many different species of the genus *Idotea* are able to make this shift in their color.

The question this study was interested in was whether or not isopod *Idotea wosnesenskii* coloration was dependent on substrate color. Our hypothesis is that color of *Idotea wosnesenskii* does depend on the color of the substrate they live on.

Methods

Field Observations

For this experiment, we went into the field and recorded the numbers of *Idotea wosnesenskii* that were on both a species of brown and green seaweed located on the sides of docks at the local fishing marina on the southern Oregon coast. We wrote down for each color of vegetation, the color and number of isopods located there in order to get an idea of what colors isopods in the local area preferred for their substrate. We then collected 25 individuals of *Idotea wosnesenskii* from both the marina docks and from a surf grass bed from the rocky shore of the coast several miles away from the dock location both done in the evening.

Color Changing Experiment

For the first experiment, we set up two containers in the lab with running seawater containing one color each of seaweed; brown and green. We then added 13 green isopods in with the green seaweed and 10 brown isopods in with the brown seaweed from those collected in the sampling. After 1 day passed, we switched the color of seaweed into each container so the isopods were the opposite color from the substrate. We then made observations 7 days later as to what color the isopods were in each container to see if any changed their color due to the different substrate.

Substrate Color Preference Experiment

For the second experiment we took 25 individuals from the collection sampling (10 green isopods, 10 brown isopods, and 5 tan isopods) and added them to a larger container set up in the lab with running seawater. In this container, both colors of seaweed were added along with the isopods so all isopods had access to both colors of seaweed. After 7 days, the number and color of the isopods that were found on each color of seaweed were recorded to determine if there was a preference for isopod color vs. substrate color.

Results

Distribution

Our result revealed non-random distributions of isopod, *Idotea wosnesenskii* (Fig.1). All three different colored isopods (green, tan, and brown) were found in both red and green seaweeds. 81 isopods were found on red seaweeds: 5 greens (6%), 10 tans (12%), and 66 browns (82%). There were a total of 90 isopods attaching to green seaweeds: 62 greens (69%), 14 tans (15%), and 66 browns (16%).

Color modification

4 of 10 originally brown-colored isopods (*I. wosnesenskii*) remained brown 7 days after they had been placed in a container with green seaweeds; 6 changed their color to tan (Table 1). In a container with brown seaweeds, only one of 13 originally green-colored isopods changed itself to brown, and the rest of the isopods were tan or green (10 greens and 2 tans).

Habitat Preference

3 green-, 3 brown-, and 2 tanned-colored isopods were found on the brown seaweeds, while 1 green- and 3 tanned-colored isopods were attaching to the green seaweeds (Table 2). During the experiment, 13 isopods died for unknown reasons, and they were removed from the container. Also, a few molts were found during the experiment. Therefore, the proportion of green-colored isopods slightly increased.

Discussion

For the observations made in the field as we expected, an overwhelming majority of the isopods were found on a substrate that matched their color for both brown and green seaweed as seen in Figure 1. We think this happens for camouflage reasons against predators. As in the experiment done by Merilaita and Jormalainen, isopods rely on substrates for protection from predators since searching predators use sight primarily for hunting. For isopods to avoid predation, visual resemblance on their substrates is important (Jormalainen 1996).

For the color changing experiment, we found that the isopods were generally the same color after 7 days as they were when we added them into the containers for both brown and green seaweed. However, since several changed to the tan color perhaps some kind of a color shift did take place for some individuals. It did not appear that a clear color change took place overall for the isopods. Since the tan color in between green and brown is difficult to distinguish sometimes from the green or brown color, it could have been observer error and perhaps they were closer to the tan color in the beginning when placed in the container. Especially since none changed from brown to green or vice versa, there does not seem to be a conclusive color shift. The results could have been altered slightly since the brown seaweed was thicker and stronger than the green seaweed in the other container as well.

For the substrate color preference experiment, the results did not seem conclusive for a preference in substrate color that matched the isopod's color. For the individuals observed on both colors of seaweed, color preference for substrate that matched the color of their bodies did not occur. These results did not follow our hypothesis, but the small sample size lead to inconclusive results. The difference between a controlled environment, as in our lab vs. the

natural environment in the field should also be considered. Since our lab had many unnatural conditions, the results could have been different than we hypothesized and different from what we observed in the field. For example, the container holding the isopods and the 2 colors of seaweed was very small, and both colors of seaweed were touching each other, making there less of a difference between substrates than would occur in the field.

Since our hypothesis was that isopod color does depend on substrate color, the results from our field observations support it even though the lab experiments did not necessarily support it. Again, this was perhaps due to small sample size or unnatural conditions in the lab.

If we were to conduct this experiment in the future, we would have a much larger sample size of isopods. We would also make multiple observations at different times of the day to see where the isopods were located in the lab setup instead of doing one observation at the end of the study. Having a larger and more natural container would also be implemented perhaps with more vegetation or bottom composition as well as possibly extending the duration of the experiment.

Table 1. Distribution of colors of isopods (*I. wosnesenskii*) after 4-day experimental period.

	Green isopod	Tanned isopod	Brown isopod
Green seaweeds/Brown isopods	0	6	4
Brown seaweeds/Green isopods	10	2	1

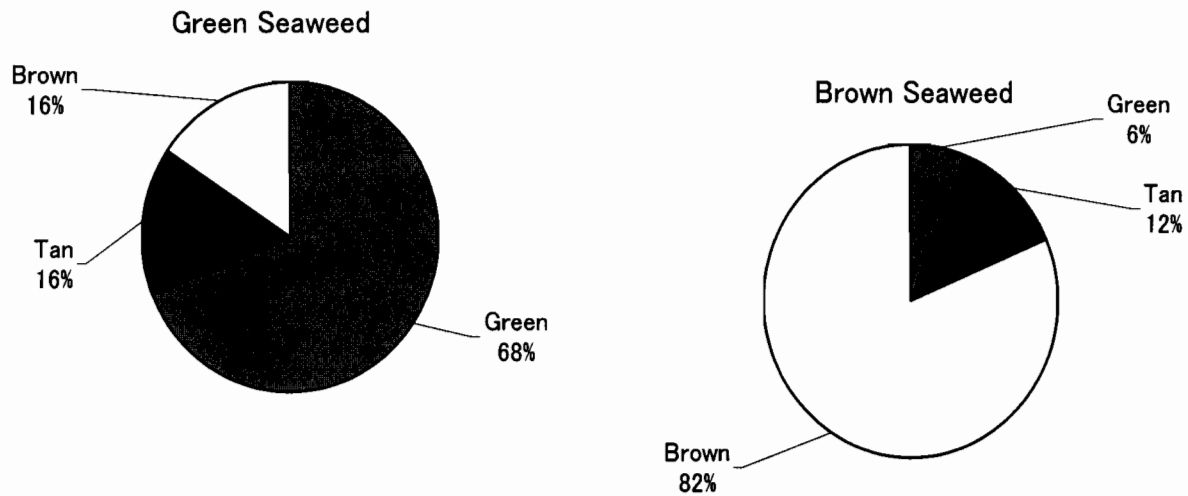


Figure 1. Distribution of colors of isopods on different colored seaweeds. Sample sizes were 81 for brown seaweed and 90 for green seaweed.

Table 2. Habitat preference of isopod *I. wosnesenskii*.

	On green seaweed	On brown seaweed
Green	0	3
Tan	6	2
Brown	4	3
Total	10	8

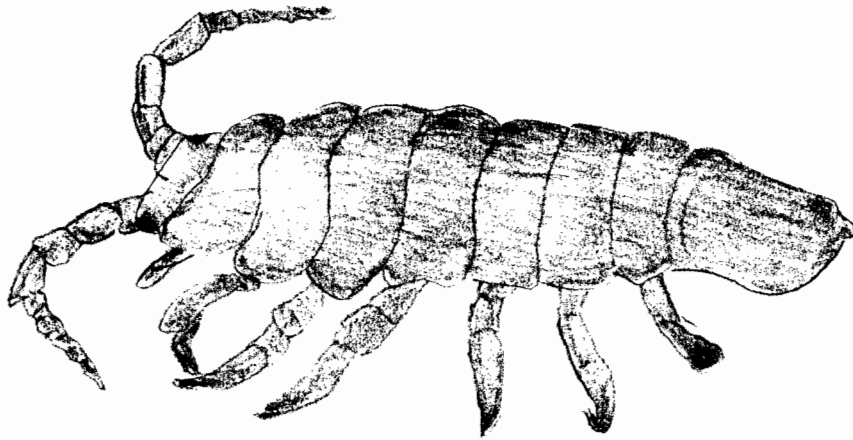
Works Cited

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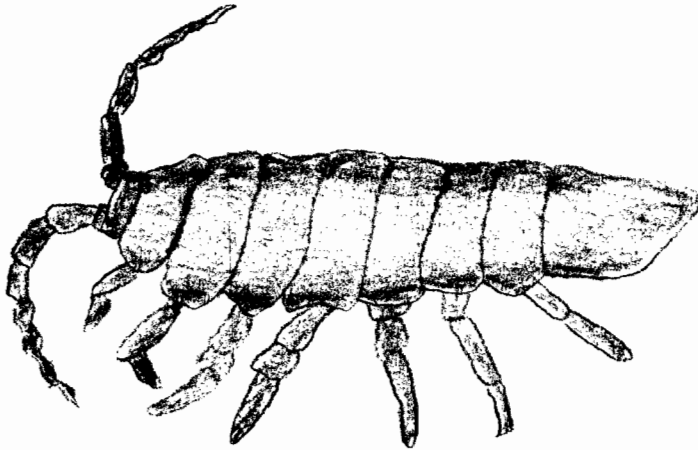
Jormalainen, Veijo and Merilaita, Sami. 1996. Evolution of sex differences in microhabitat choice and colour polymorphism in *Idotea baltica*. *Animal Behavior*, 54, 769.

Sept, J. Duane. The Beachcomber's Guide to Seashore Life in the Pacific Northwest. Harbour Publishing, 1999. pp. 108.

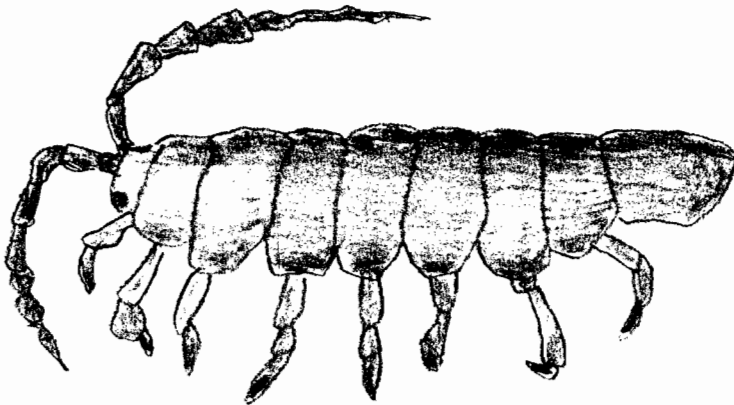
Idotea wosnesenskii



Green



Tan



Brown

Magnification = 3.2 x actual size.