Does polarized / non-polarized illumination, and wet / dry skin change the perceived surface color of fish?

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INTRODUCTION

Skin color of fish is affected by age, handling, nutrition, and illumination. There is also a perception that wet or dry conditions may affect skin color. Since color is an important visual quality attribute of fish, it is important to determine if illumination and wet / dry conditions affect skin color.

OBJECTIVE

Our objective was to store fish on ice, and measure the average skin color under polarized / non polarized conditions. Fish were also patted dry with a paper towel (dry skin), and dipped in water for 30 sec before taking pictures.

MATERIALS AND METHODS

Fish and storage

Yellowbelly flounder (*Rhombosolea leporina*) was obtained while fresh from a local market in Auckland, New Zealand, and stored on ice for one week. Every day, the fish were first patted dry with a paper towel to make sure there was no surface water. Then they were placed in a light box with polarized lighting. A Nikon D300 digital camera, with a circular polarizing filter was used to obtain the images. Both polarized (P) and non-polarized (NP) pictures were taken. Then, the fish were dipped in water for 30 sec and the process was repeated (Figure 1).

Image acquisition and analysis

The LensEye software (Engineering & Cyber Solutions, Gainesville, FL) was used to analyze each image. The average colors (L*, a*, b*) of the images were calculated. Also, LensEye subtracted the color of each pixel from the polarized and non-polarized images as ΔE values (Figure 2).

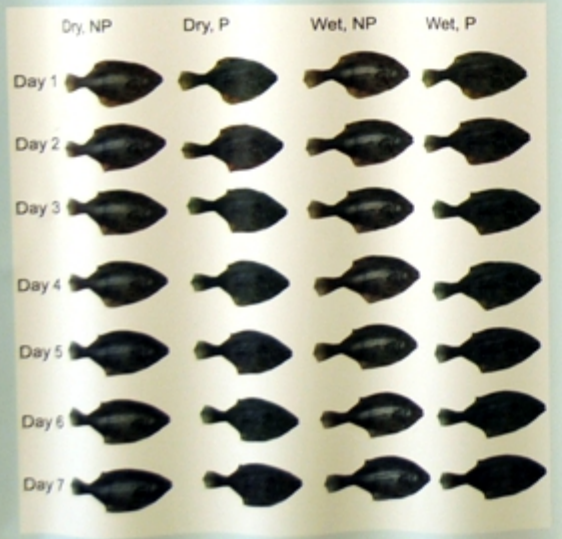


Figure 1. Images of the Yellowbelly flounder over time, under different lighting conditions.

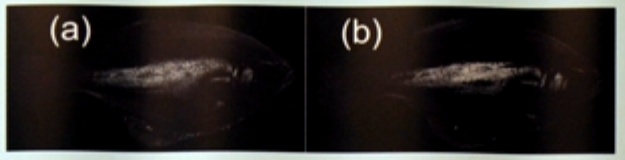


Figure 2. ΔE between polarized and non-polarized images. (a) dry fish, (b) wet fish.

RESULTS

The average L*, a* and b* values of the fish shown in Figure 1 are plotted against time in Figure 3. The a* values of images taken by non-polarized lighting were higher than those of polarized lighting. However, the a* values were not affected by wet or dry conditions. The same also applied to the average L* values: although there was a large difference between polarized and non-polarized values, there was no difference, for a given state of polarization, between wet and dry L* values.

The b* values of the polarized images were always lower than that of non-polarized images. Again, there was little difference between wet and dry b* values for a given state of polarization.

DISCUSSION

Accurate quantification of the color of foods in general, and aquatic foods such as fish in particular requires that the reflection from shiny / wet surfaces is considered. It is recommended that polarized lighting be used to take images of fish for analysis of color. However, whether the surface of the fish is wet or dry affects the color very little, as long as polarized lighting is used.

CONCLUSION

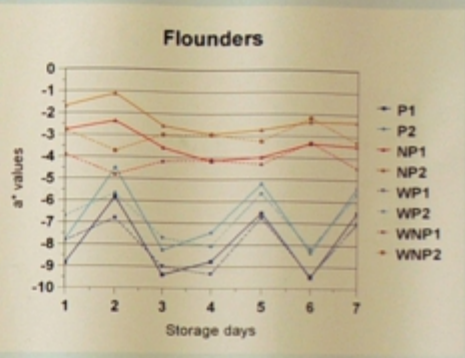
It is important to use polarized light to obtain the true color of shiny surfaces such as the skin of fish, whether the surface is wet or dry. Under polarized light, wet or dry conditions affect the color insignificantly.

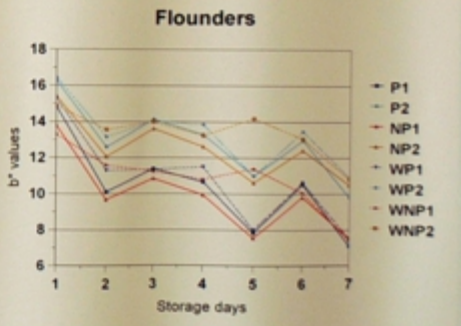
The "degree of reflection" can be found by taking the ΔE difference of the colors between polarized and non-polarized images.

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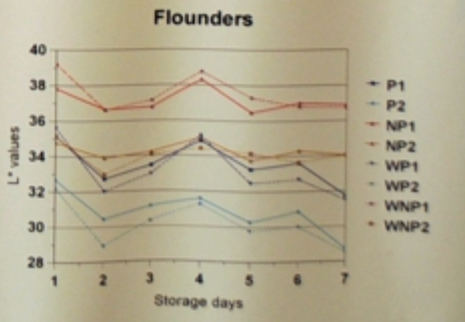


Figure 3. The average L*, a* and b* values of fish under different lighting conditions.