

Salmonid Pigmentation Guide

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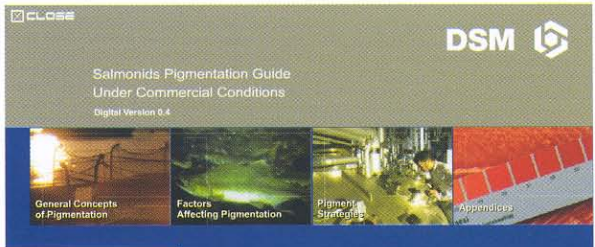


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Salmonid Pigmentation Guide

The pigmentation of salmon and trout is a natural phenomenon that is part of the natural life cycle of these species.



GENERAL CONCEPTS OF PIGMENTATION

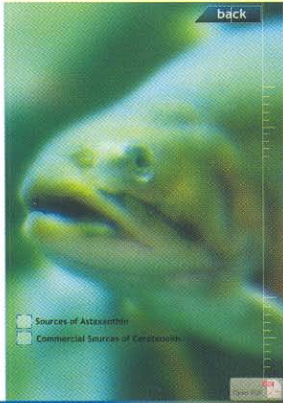
CAROTENOIDS AND COLOUR IN SALMONIDS

Colours play an important role in the natural biological cycle of many species including fish. Colour is used as a protective camouflage against predators, and is important for sexual behaviour and identification. In nature, colours are derived from natural compounds such as chlorophyll, porphyrins, and carotenoids.

Carotenoids are a group of organic pigment that naturally occur and that are responsible for the beautiful red, orange and yellow colours in the skin, flesh, and exoskeleton of aquatic animals. The word pigment originates from the Latin word pigmentum, which refers to painting materials and cosmetics, and implies a notion of colour (Eshkol et al., 1968). In biology any substance which can impart colour to the tissues or cells of animals or plants can be called a pigment. The name of this group of pigments comes from the carrot (*Daucus carota* L.) whose yellow-orange pigment -carotene was isolated by Wackenroder in a crystalline form as long ago as 1831.

Carotenoids are widespread in plants and animals and over 600 have been characterized to date. They are responsible for the colours of many fruits (i.e. tomatoes, paprika, chillies and citrus fruits), vegetables (carrots, corn), flowers (tulip lily, rose hips, tagetes), many birds (flamingo, ibis, oriole, canary) insects (ladybird, Colorado

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- Carotenoids and Colour in Salmonids
- Nutritional Functions of Carotenoids



FACTORS AFFECTING PIGMENTATION

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FEED FACTORS

Pigment Type and Level

An inverse relationship exists between dietary astaxanthin dose and deposition rate in the flesh of salmonids (Eshkol DSM, personal communication, 1984) (Figure 21). Björnseng et al. (1995) fed rainbow trout with increasing levels of astaxanthin and canthaxanthin (25, 50, 100 ppm) over 16 weeks. It was observed that the pigment concentration in the muscle directly increased with increasing dietary dose. In addition, it was observed that with increasing dietary carotenoid dose, pigment retention rate reduced. Essentially, with higher dietary carotenoid doses, the total flesh pigment concentration increased, but at lower retention rates.

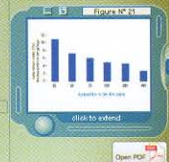
The reason for the inverse relationship between dietary dose and final concentration in the muscle is not completely clear and could be due to the following:

- A lower intestinal absorption rate
- A limit in the capacity of lipoprotein transport
- A limit in the capacity for pigment to bind to the muscle (actinomyosin)
- An increase in the astaxanthin deposition in tissues other than muscle
- An increase in carotenoid catabolism

Figure 21: Effect of dietary astaxanthin dose on the retention rate in rainbow trout flesh astaxanthin retention rate (%)

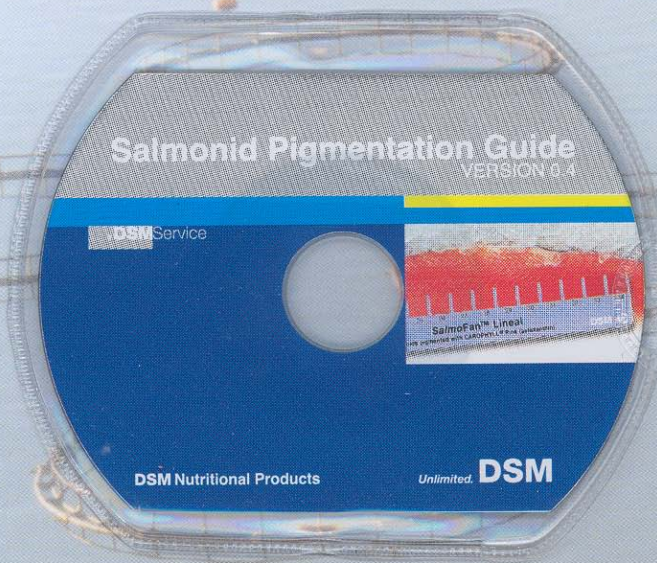
- Animal (physiological) Factors
- Feed Factors
- Environmental Factors

- Lipid Content
- Lipid Type
- Feed Manufacturing
- Feed Water
- Pigment Type and Level
- Feeding Period



During the development of salmon and trout farming, many issues have been solved to enable the continued success of the industry. Constant change in raw materials and market requirements means that development of new technologies and refinement of existing knowledge is paramount. DSM Nutritional Products is a knowledge based company with a proven track record in animal nutrition and has been a key supplier to the

intensive aquaculture industry for many years. DSM Nutritional Products was the first company to develop and manufacture astaxanthin which is sold under the brand name CAROPHYLL® Pink. The commercial synthesis of the astaxanthin molecule in the late 1980's was an important step in the development of a viable global salmonid industry now producing more than one million tonnes of fish.



CAROPHYLL® Pink has been used by the global salmon and trout industry since 1985 and has a clear proven track record. With the developments in diet formulations, increased biological performance of fish and variations in market requirements for flesh colour, there remains a strong focus on the economic

use of astaxanthin. To fully optimise carotenoid use for the pigmentation of salmonid flesh, understanding the pigmentation process and the many biotic and abiotic factors that have an influence is vital. This guide provides information on the pigmentation of salmon and trout with astaxanthin.

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