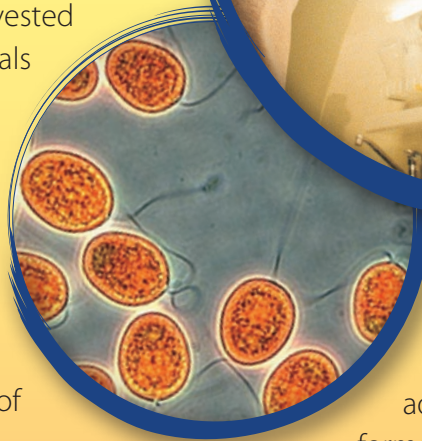


# Dunaliella

## THE RED REVOLUTION

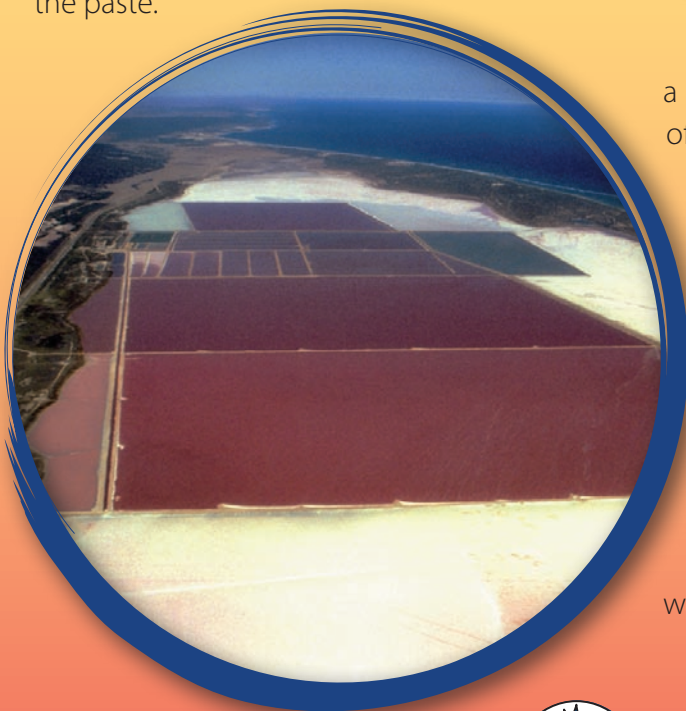
### Introduction

*Dunaliella salina* is a microalgae occurring naturally in a number of locations worldwide. In the marine environment, *D. salina* appears green, however, in conditions of high salinity and light intensity, the microalgae turns red due to the production of protective carotenoids in the cells. The majority of harvested micro-algae are currently being sourced from one of the most pristine environments in the world – a remote coastal salt lagoon in Western Australia. The *D. salina* is harvested without any harmful solvents or chemicals and the carotenoids (the highly-prized anti-oxidant pigments responsible for the red colour) are then extracted for use in pharmaceuticals, cosmetics, nutritional supplements, aquaculture feeds and food colouring. The product contains no pathogens and has very low bacteria levels due to the natural antibacterial qualities of the paste.



### The Algae

Recently, the micro-alga was introduced to the aquaculture industry in two forms, NutraPlus Micro liquid paste and dry powder. The paste is a pure *D. salina* concentrate containing high levels of carotenoids, minerals, vitamins, and fatty acids. The paste is spray dried to create the dry form. The micro-algae has several applications in aquaculture, as a sole food source for filter feeders, a food additive for many fish and crustacean species, as well as a replacement for traditional green micro-algae in 'green water' systems.



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# Dunaliella salina use in Aquaculture

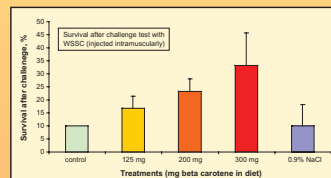
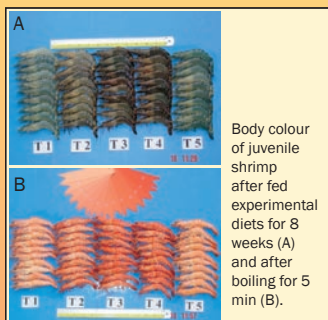
## Feed additive

*Dunaliella salina* paste has a wide range of applications as feedstock:

- As a direct feed for filter feeders such as corals and sponges,
- As an enrichment for live feed organisms such as *Artemia* and rotifers, especially for marine ornamental fish where the colouration is an important consideration,
- As an enrichment in fresh food (mussels, pipis etc.) used for crustacean larvae and broodstock,
- As a natural source of carotenoids in diets for shrimps and finfish (in its powder form).

## Feed additive for shrimp

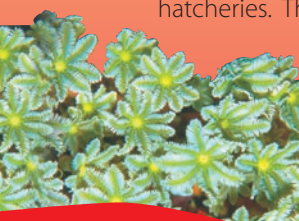
The effect of *Dunaliella salina* dry powder on growth, immune function and disease resistance were determined in black tiger shrimp *Penaeus monodon* (Supamattaya et al. 2005). Shrimp (1-2 g body weight) fed 6.25 –15 g *D. salina* powder · kg<sup>-1</sup> (125 – 300 mg β carotene · kg<sup>-1</sup>) for 8 weeks. All the shrimp groups fed on diet supplemented with *D. salina* showed higher weight gain and survival compared to the control groups. Shrimp fed the 15 g *D. salina* · kg<sup>-1</sup> exhibited higher resistance to white spot syndrome virus infection (WSSV). This group also demonstrated significantly higher stress resistance (low oxygen condition). The colour intensity of boiled shrimp was correlated with the level of *D. salina* in the diet.



Treatment	Dunaliella salina powder, gr kg <sup>-1</sup>	β carotene conc. in diet, mg kg <sup>-1</sup>
T1 (control)	0	0
T2	6.25	125
T3	10	200
T4	15	300
T5, 0.9% NaCl	9 (salt)	0

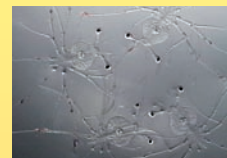
## Filter feeders

The culture of corals and sponges for the marine ornamental market has gained considerable momentum in recent years. The use of *Dunaliella salina* paste as a sole food source or in combination with other feed organisms such as rotifers and *Artemia* is now a standard practice in several public aquaria and hatcheries. The *D. salina* enables the culture of several hard-to-grow species of sponges. The *D. salina* not only supplies essential nutrients, but also enhances the colouration of the marine organisms.



## Feed additive for rock lobster

Several species of rock lobster are, currently, under investigation in Australia (western rock lobster *Panulirus cygnus*, southern *Jasus edwardsii* and tropical *P. ornatus*). The main challenges in closing the life cycle are faced during the larvae or phylosoma stage and specifically relate to their nutrition. Recently, the use of *Dunaliella salina* paste as both a food source and feed additive has dramatically increased the survival of the phylosoma. The *D. salina* paste is incorporated in the phylosoma feed. In the early stages, *Artemia* is reared on *D. salina* paste and then



enriched with a 'tailor-made' enrichment containing high levels of the paste. At the later stages, the phylosoma are given mussels previously fed and enriched with *D. salina* paste.

## Artemia growout food

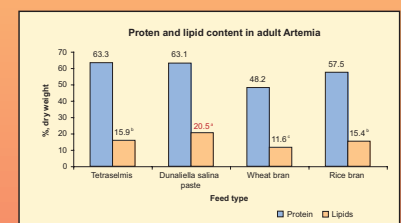
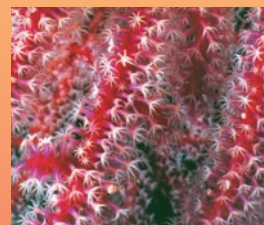
To test the effect of different feeds on the growth and nutritional profile of adult *Artemia*, four feeds were compared; live *Tetraselmis suecica*, *Dunaliella salina* paste, wheat bran and rice bran. The wheat and rice bran were screened to 49 μm. A secchi disk



depth of 20 cm was maintained in each tank. *Artemia* were cultured in 170 L static tanks to 14 dph using the 4 different feeds in 3 replicates.



Heated seawater (28°C, 32 ‰) was used with 60% exchanged daily. *Artemia* fed on the micro-algae (*T. suecica* and *D. salina*) had significantly higher protein levels, while *D. salina* paste significantly improved lipid content.



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