

Spectral Sensitivity of Cleanerfish

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The study was carried out at the Norwegian Institute of Marine Research's Austevoll Research Station (60.08°N, 5.26°E)

Background

Several species of wrasse (*Labridae*) and Lumpfish (*Cyclopterus lumpus*) are used in Norwegian salmon aquaculture as cleanerfish to combat salmon lice (*L. salmonis*). All species used as cleanerfish are diurnal and are visual predators. This makes them particularly effective during the long, high-latitude summer days, but less so during the dark winter months.

This project explores whether the use of artificial light can increase cleanerfish activity in salmon pens during periods of shorter daylight.

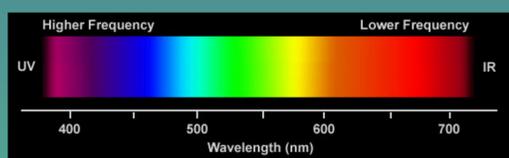


Sea temperature at 5 m (red) lags behind changes in day length (green) at 60°N.

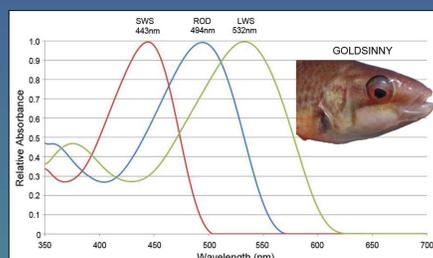
What wavelengths can cleanerfish detect?



Microspectrophotometry was used to obtain the spectral absorption profiles of the photoreceptors (rods and cones) in the eyes of these fishes.

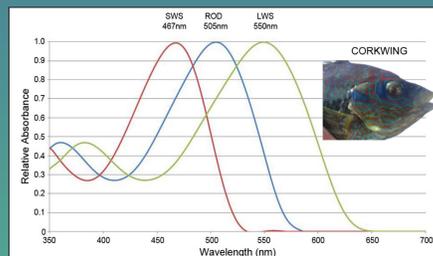


Goldsinny wrasse

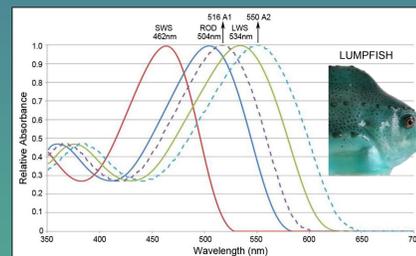


All cleanerfish species possess three photoreceptors: a long-wave sensitive (LWS) cone class in the green part of the spectrum, a short-wave sensitive (SWS) cone class in the blue spectrum, and rods between with a peak sensitivity in the blue-green (~500 nm).

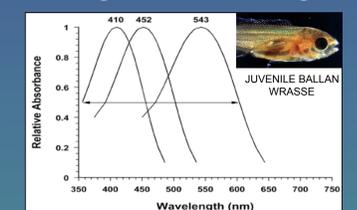
Corkwing wrasse



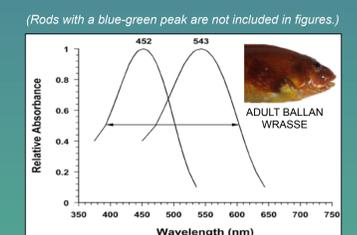
Lumpfish



Ballan wrasse: Ontogenetic changes



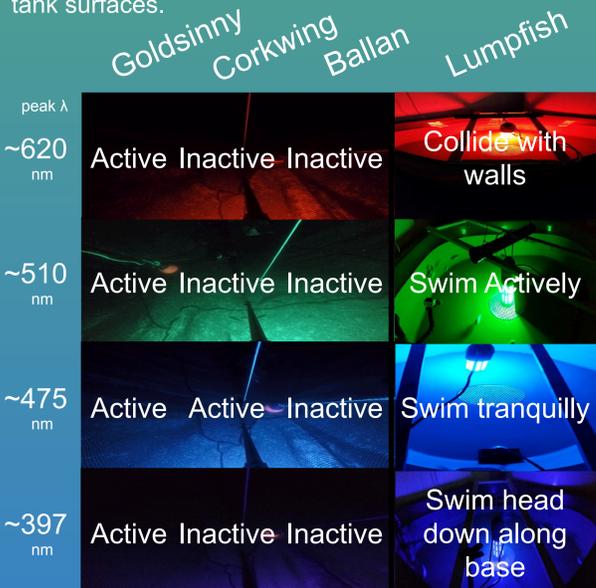
In Ballan wrasse, a third, violet cone class is lost after the juvenile stages.



How does artificial light affect behavior?

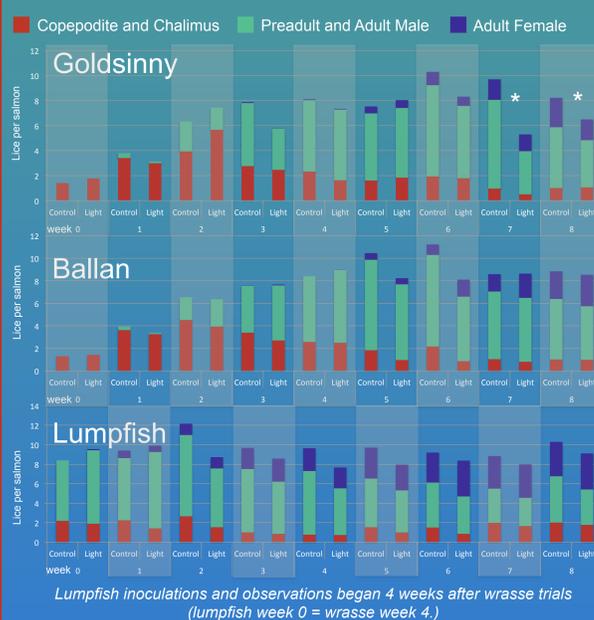
Swimming Activity

Swimming behavior was observed for wrasse in 2x2 m net pens in light at different wavelengths. Each pen included a shelter. Fish were considered inactive if they did not leave the shelter. Lumpfish were tested in a 1.5x1.5 m tank. Inactive lumpfish remained attached to tank surfaces.



Cleanerfish Efficiency

The effect of additional blue light after dusk on cleaning behavior was observed in three species. Eighteen 125 m³ net pens were stocked with salmon. Two treatments (natural light only and additional blue light) were stocked with separate cleanerfish species in triplicate pens. Ten salmon from each pen were randomly selected and examined for lice weekly from December 2015 to February 2016. A significant reduction (*) in lice was observed in weeks 7 and 8 with goldsinny wrasse in the light treatment.



Stomach Contents

After eight weeks of observing cleanerfish efficiency, 10 cleanerfish from each net were randomly selected for examination of stomach contents.



treatment	Salmon Lice		Food Pellets		Jellyfish		Other		Empty	
	Control	Light	Control	Light	Control	Light	Control	Light	Control	Light
Goldsinny	13	3	20	35	0	0	57	52	27	26
Ballan	3	3	0	0	0	0	20	17	77	80
Lumpfish	3	0	77	80	10	0	60	27	0	3

Stomach contents as a percentage (%) of total fish in each treatment (n=181).

Conclusions

- Cleanerfish species have photoreceptors clustered at similar wavelengths (blue and green cones.)
- Though cleanerfish species may perceive light similarly, their behavioral responses vary.
- Goldsinny demonstrated a small increase in delousing efficiency under artificial blue light.

The delousing efficiency trials will be repeated in the late fall of 2016 with goldsinny and corkwing wrasse.



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