

# Cryptic coloration and mirrored sides as camouflage strategies in near-surface pelagic habitats: Implications for foraging and predator avoidance

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ABSTRACT: Mirrored and colored surfaces are common adaptations for crypsis in pelagic habitats. Although highly successful when optimized for a particular situation, either may become less successful if it is then viewed in a different situation. In this study we examine the relative robustness of these two strategies by determining how visible an organism becomes when viewed under optical conditions different from those under which the camouflage is optimal. Underwater radiance distributions were calculated using inherent optical properties measured in coastal waters 80 km off the coast of New Hampshire. These radiance distributions were then used to calculate optimally cryptic diffuse and specular reflectance spectra as a function of depth, solar elevation, viewing angle, and azimuth. Then the visibilities of organisms cryptic in one situation viewed in a different situation were calculated, using the Atlantic Cod, *Gadus morhua*, as the viewer. In contrast to benthic organisms, pelagic organisms cryptic under one set of optical conditions were quite visible under a different set, particularly when viewed from a different azimuth. The crypsis afforded by mirrored surfaces was generally more robust than that resulting from colored surfaces. However, because mirrored surfaces could never be perfectly cryptic when viewed in the azimuth of the sun, neither strategy clearly outperformed the other. In general, crypsis by colored or mirrored surfaces was not robust in nearsurface water, which may help explain both the predominance of transparent species in near-surface pelagic habitats and the vertical migration of many colored and mirrored species. The results also show that three common foraging strategies[]circling, crepuscular activity, and driving prey toward the surface[]all increase the visibility of cryptically colored or mirrored prey.