

Phaeohyphomycosis of Saffron Cod and Other Fish Species

I. Causative Agent and Disease

Fungal infections caused by a variety of dark-colored (dematiaceous) fungi define phaeohyphomycosis. Large black, oval, external lesions of the skin and smaller foci on the gills have been reported by subsistence users in saffron cod and other fish species from the Norton Sound area of Alaska since 2005. The lesions are caused by at least 8 different opportunistic ascomycete fungi including: *Alternaria* sp., *Cladosporium herbarum*, *Chaetomium globosum*, *Cadophora luteo-olivacea*, *Penicillium* sp., *Phoma herbarum*, *Pseudophacidium ledi* and *Valsa sordida*. These fungi typically infect the surface of the skin with invasion of the underlying skeletal muscle. Mortality has not been reported but estimated prevalence is 1 in 200 fish. These brown to black pigmented fungi are filamentous and ubiquitous in the soil. They occur as plant pathogens, on paper products, wood, natural fiber textiles, in the air and on plant debris.

II. Host Species

The black external lesions have been confirmed from saffron cod and also photographed in rainbow smelt from Norton Sound including estuarine waters of the Unalakleet, Nome and Snake Rivers.

III. Clinical Signs

Skin lesions caused by these fungi are typically large (1 X 2 cm), black, slightly raised circumscribed plaques that are firm with rugose textured centers. Gill infection results in smaller black foci within the soft tissues of the filaments. Rarely are internal tissues invaded and often there is food in the gut indicating that infected fish are feeding normally.

IV. Transmission

The external nature of the fungal infections suggests that transmission is by ascospores contained in ambient seawater or sediments, possibly increased by rain, flooding and stress that require previous mechanical tissue injury as a portal of entry into the host. However, the actual mode of transmission is unknown. Reports of these black lesions on fish most commonly occur during the late fall and early winter months of October through December.

V. Diagnosis

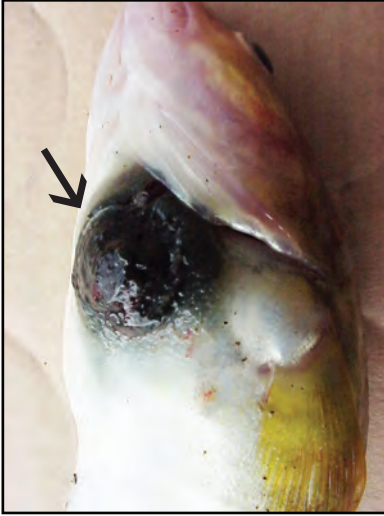
Diagnosis is based on typical clinical signs of shallow, circular, black rugose plaques or foci on the skin and/or gills with hyphae present in wet mounts. This is followed by isolation and characterization of the fungus on artificial media and confirmation of fungal genus and species by PCR.

VI. Prognosis for Host

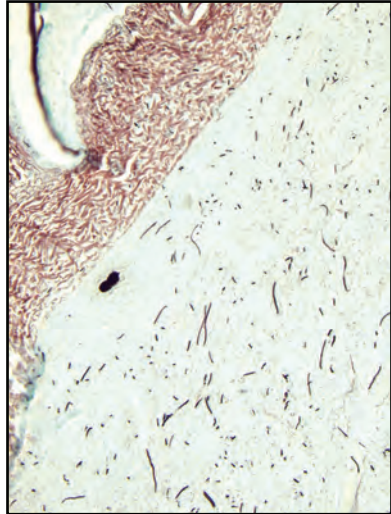
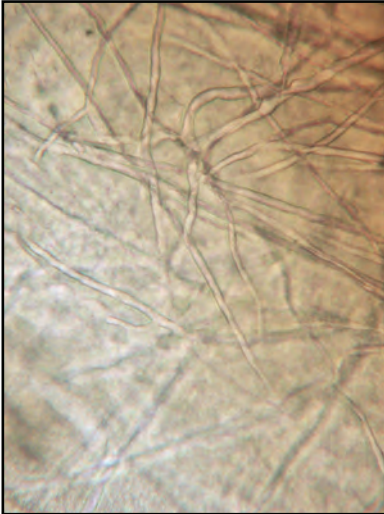
The prognosis for infected fish is unknown but the large skin plaques and/or involvement of the gill tissues suggest a chronic debilitating mycosis that may result in mortality.

VII. Human Health Significance

Several of these fungi are opportunistic human pathogens in immunocompromised hosts. These fungi have caused fatal deep mycoses as well as brain abscess, sinusitis, peritonitis, cutaneous lesions, pneumonia and onychomycosis (nail infections). *Chaetomium globosum* produces mycotoxins such as chaetomin and chaetoglobosin and commonly grows inside homes on water damaged roofs, ceilings, walls and carpets, possibly representing an allergenic threat to human health.



Left: Saffron cod with phaeohyphomycotic fungal lesion (arrow) caught from mouth of the Tununak River near Nightmute, AK (photo: Peter Pitka); **Right:** Similar black skin lesion on rainbow smelt from Bethel, AK (photo: Mary Matthias).



Left: Wet mount of branching fungal hyphae of *Chaetomium globosum* from saffron cod lesion, X 400; **Right:** GMS histological stain of similar skin lesion showing fungal hyphae (stained black) infiltrating the dermal tissues, X 100.