

ECTOPARASITES OF FISH AND INVERTEBRATES OF THE SALTON SEA

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Parasites of fish and invertebrates are integral parts of aquatic ecosystems. Especially in water bodies with poor environmental conditions they can exert a strong regulatory effect on populations. Environmental stresses can depress host immunity. Fish become more susceptible to infections and these can become more severe, even fatal. Sick and dead fish can become a source of disease for piscivorous birds and can present serious threats to their health.

For many decades, the Salton Sea has been the site of an unprecedented series of die-offs of fish and water birds. These mortality events have been associated with critical combinations of high temperature and salinity, low oxygen tension, and toxic algal blooms. Recently, bacterial and viral pathogens have been documented or suspected as a cause of some of the massive birds and fish kills. Until 1997 nothing was known about parasites and their roles in fish disease at the Salton Sea.

Parasitological monitoring was carried out in 1997-1999. A total of 1,512 fish were examined from 6 locations along the shoreline of the Salton Sea. The young of tilapia, croaker, and longjaw mudsucker were found infected by ectoparasites that is parasites that attach to the external body surfaces. Some permanent and persistent infestations of fish by such parasites were discovered around the perimeter of the Salton Sea at Varner Harbor, Bombay Beach, Red Hill Marina and Salton City. Invertebrates such as pile worms and copepods that represented the major food items for fish were also infected.

We found that fish from the Salton Sea are infected by three species of parasitic protozoans: the dinoflagellate *Amyloodinium ocellatum*, the ciliate *Ambiphrya ameiri*, and the flagellate *Cryptobia branchialis*, and two species of parasitic flatworms, *Gyrodactylus olsoni* and *Gyrodactylus imperialis*. The protozoans range from 7.5 μm to 129 μm in length, the flatworm from 281 μm to 312 μm . These parasites are dangerous and sometimes spread pathogens for fish in aquaculture facilities. In nature, however, infestations by these parasites are usually low. At the Salton Sea, parasitic protozoans infected fish from spring through fall with extremely high intensity. In summer months of 1997-1999, 100% of fish from 6 locations examined were infected by the dinoflagellate *A. ocellatum*. Hundreds of these dangerous and destructive parasites were attached to fish gills. In spring and autumn during 1997-1999, about 100% of fish fry from the same locations along the shoreline were heavily infected by the ciliate *A. ameiri*, which completely covered fish skin, fins and, rarely, gills. In autumn 1997, an outbreak of fish infestation by *C. branchialis* was found at Bombay Beach. Parasites tightly covered the gill surface. Parasitic flatworms *G. olsoni* and *G. imperialis* infected gills longjaw mudsucker and tilapia in different seasons. Their numerous hooks penetrated deeply into epithelial tissue of gills, skin and fins, heavily damaging it.

All these ectoparasites affect fish gills and skin, which are the major respiratory organs for young fish. Both parasitic protozoans and flatworms changed the general structure of fish gills and skin and caused numerous lesions, local erosion, and severe irritation at sites of their attachment to epithelial tissues. These alterations of fish gills and skin may suppress respiratory functions and cause fish suffocation. The numerous sites of epithelial damage also represent portals of entry for bacterial, viral and fungal infections.

The pile worm, *Neanthes succinea*, was heavily infected by peritrich *Epistylis* sp., individuals of which were attached to their body segments and locomotory organs. Another peritrich, *Rhabdostyla vernalis*, was distributed over the body surface of the copepod *Apocyclops dengizicus*. It is suggested that heavily infected invertebrates have decreased locomotor capabilities and become easy prey for predators.

Parasites appear to be an important stressor affecting fish populations in this unique water body. If they are a major cause of juvenile fish mortality, as seems likely, they may play a major role in determining fish population dynamics in the Salton Sea.