Other biological threats

The infectious salmon anaemia virus (ISAV)

The recent SARS-CoV-2 outbreak in humans has made us very aware of the potential health risk posed by viruses. Viruses are also a risk in aquatic environments. ISAV is the causative agent of infectious salmon anaemia (ISA),[9] an important disease of salmon that was first reported in Norway in 1984 and has subsequently been noted in Canada, the USA, the Faroe Islands, Ireland, and Scotland. While fish species other than Atlantic salmon are susceptible to infection with ISAV, only Atlantic salmon develop ISA disease following infection with ISAV.

As with some other infectious diseases of fish, ISAV-infected fish may not necessarily exhibit clinical signs, but the onset of disease may be precipitated by adverse environmental conditions or water quality. Stress factors such as rising or falling temperatures may play an important role in generating disease, with ISA outbreaks tending to occur during the spring (when water temperatures are rising) or in the autumn (when water temperatures fall).

ISAV-impacted fish may develop symptoms such as pale gills, raised scales, pinpoint areas of bleeding, a bloated abdomen, or bulging eyes, and may swim close to the water surface.

Bacteria

As on land, bacteria are ubiquitous in marine waters and some species carry disease. Bacterial kidney disease (BKD), caused by Renibacterium salmoninarum, is a chronic disease of Atlantic salmon that is most often fatal.[5] It is one of the most important diseases of farmed salmon. Outbreaks can occur throughout the year, but generally accompany rising water temperatures in the spring. Other infected fish seem lethargic and darkened and may exhibit coelomic distension, pale gills (anaemia), vent haemorrhages and protruding eyes (exophthalmia).

Amoebic Gill Disease

Protozoa are a group of single-celled microscopic organisms. One species of protist*, the amoeba Neoparamoeba perurans can cause Amoebic Gill Disease (AGD) in fish.[1] The parasite infects gills of fish and causes a proliferative response within the gill epithelium. In healthy gills this epithelium layer is thin, allowing efficient exchange of gases, acids, ammonia, ions and water. Clinical signs include increased mucus on the gills with white multifocal patches of swollen tissue. Fish may swim close to the surface and breathe rapidly.

N. perurans are free-living, facultative ectoparasites able to quickly replicate asexually. Their biology, life cycle, natural distribution, and reservoirs outside of fish farms remain largely unknown. The disease is thought to have existed in Tasmania for over 30 years but the first cases in Scotland were not until 2011. Fish suffering from AGD have shown clinical signs of inanition, respiratory distress, and lethargy.

***Protist**: a single-celled organism of the Protista genus..

Harmful algal blooms

Harmful algal blooms (HABs) are a threat to fish health in coastal waters. While some species may produce toxins, it is often their elevated density that is a problem as night-time respiration of the algal cells can result in a decrease in the oxygen concentration in the water, impacting fish health.

Some phytoplankton species (microscopic marine algae) have silicon spines that could get trapped in fish gills causing significant injury.[11]

We'll further explore the topic of algal blooms and aquaculture in the next step.

Jellyfish

Other planktonic organisms such as jellyfish (including various types of gelatinous zooplankton including scyphozoa, siphonophores and hydrozoan) can impact fish health. Jellyfish tentacles contain venomous stinging cells or nematocysts which are used to immobilise planktonic and nektonic prey. Damage to fish is often caused by small jellyfish that can pass through cage meshes, or by tentacles of larger species breaking off and entering the cages.

The major impacts of jellyfish blooms are in terms of damage to the fish gills. Impacts of jellyfish can be significant, for example blooms of Pelagica noctiluca (sometimes called mauve stingers) [Fig 3] that killed 300,000 and 100,000 salmon in Scotland in 2014[2] and in Northern Irish waters in 2007, respectively.[8]

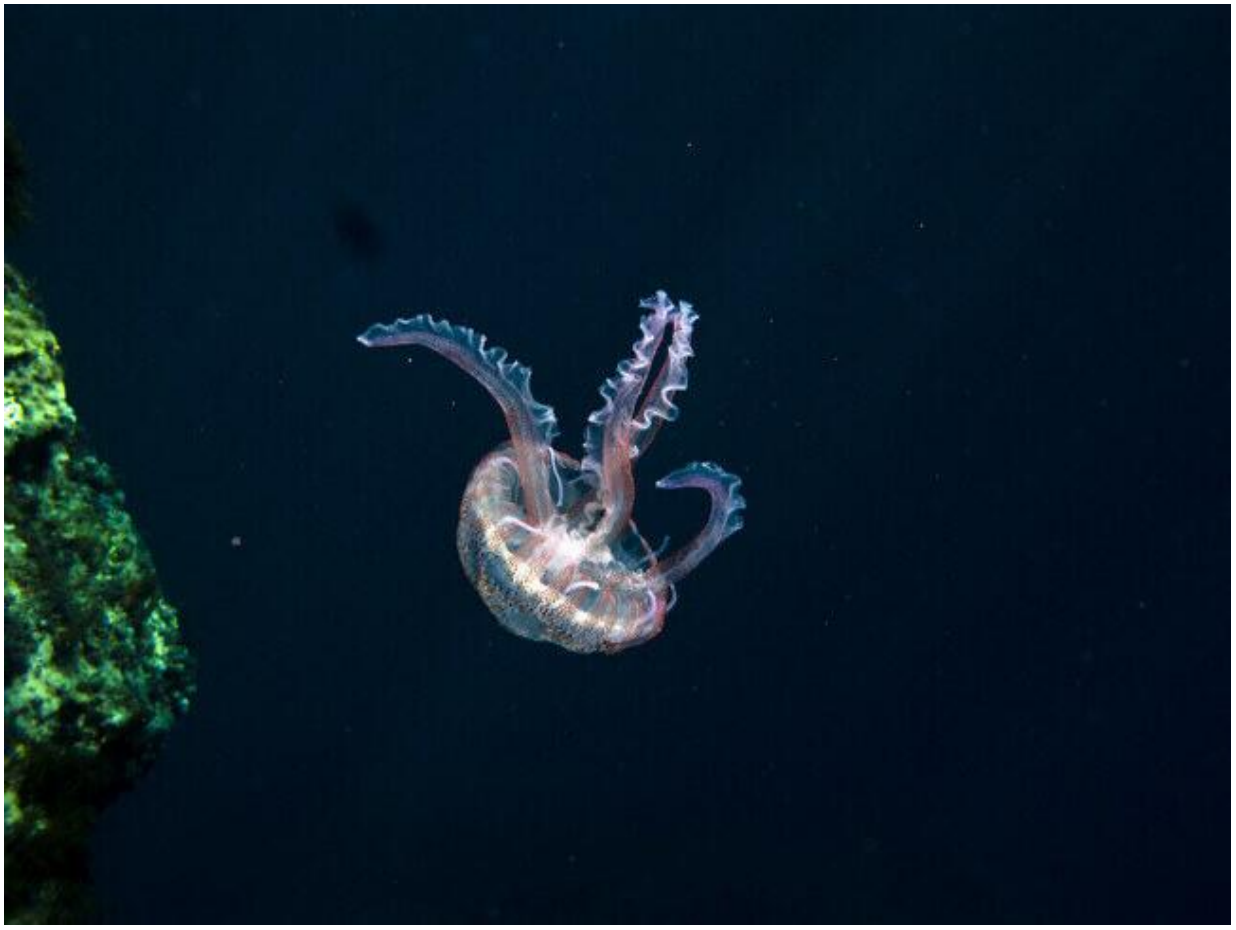

Figure 3: Mauve stingers

Complex gill disease

The term complex gill disease (CGD) describes a range of clinical gill diseases of Atlantic salmon.[7] CGD typically occurs from late summer to early winter. Several agents have been associated with CGD, perhaps acting in combination. Some of these are viral in nature including Atlantic salmon paramyxovirus and salmon gill poxvirus (SGPV).

Other potentially causative agents include Desmozoon lepeophtherii a microsporidian (fungal) parasite. D. lepeophtherii infects several salmon cell types including gill and skin epithelial cells, blood vessel endothelial cells, polymorphonuclear leucocytes, and macrophage-like cells. Harmful phytoplankton blooms (HABs) can precede CGD outbreaks, presumably as their physical damage or irritation to the gills makes them more susceptible to subsequent infection.

It may look like farmed fish have a hard life, but diseases are a fact of life for any sort of farming. Available data suggest that about 1.3% of farmed salmon die each month giving an annual survival rate of 85.5%[12]

A ~ 15% mortality per year, may sound quite high, but is actually thought to be lower than the mortality rate that wild salmon experience at sea.[4]