Old stuff.

[PAR2] Parasites can influence natural populations and communities in many ways. By definition, parasites must benefit from their host at their expense. Coûts indirects

**[Physiological]** These energetic demands trigger metabolic responses that may induce physiological impairments to the host. For example, (Rohlenová et al., 2011) showed that infection by cestodes stimulates immune response by activating phagocytes cells. Resources allocation is a trade-off between energetic demands of the host. Increasing immune response comes with a lesser energy budget for the other functions such as growth, reproduction and maintenance of vital organs. Parasite load may also induce stress that results in performance alteration such as swimming behavior and escape time (Allan et al., 2020). Other parasites migrate through tissues causing direct physiological damage. For example, eye flukes cause their host cataract that reduces visual acuity hampering predation escape and foraging behaviour (Seppälä et al., 2005; Vivas Muñoz et al., 2019).

Lafferty and Shaw, 2013

**[Behavior & Cognition]** Another way to escape infection is by avoiding infected conspecifics/mates or hot spots of infection (*i.e.* parasite avoidance behaviours)(see (Behringer et al., 2018). For example, [*habitat*] (Karvonen et al., 2004; Poulin & FitzGerald, 1989) [*conspecifics*] (Dugatkin et al., 1994; Ward et al., 2005) [*mates*](Kennedy et al., 1987; Milinski & Bakker, 1990; Rosenqvist & Johansson, 1995)

Parasite manipulation…

Mikheev et al., 2010

Rainbow trout (*Oncorhynchus mykiss)* infected by eye fluke *Diplostimum spathaceum*. Parasite infection increased aggressiveness but infected fish lost contests for a territory against control fish. Parasitized fish pay the cost of aggressiveness without the benefit of acquiring territory.

See Binning et al., 2017

Infection can alter host locomotor performance via impacts on host morphology and physiology.

Neglecting the role of micropredators on performance capacity and behaviour of their hosts can greatly affect our understanding of a species’s ecology.

Behavior manipulation

Predator avoidance but less neophobia to new foods in fish suggest complex modulation of risk-averse behaviour. (Freire et al , 2022)

Lafferty and Shaw, 2013

Infected vertebrate hosts had more strongly altered microhabitat choices than did invertebrate hosts

Host microhabitat choice or host activity

Two types of behaviour : increased contact with predator and/or decreased reaction to predators

Vertebrate hosts were more associated with decreased reations

Mechanims of host manipulation : energetic drain, site of infection, neurmodulation (hormonal and neuronal activity)

**[Dynamics & BEF]**

(Anderson et May, 1979; May et Anderson, 1979; Scott et Dobson, 1989)

Dispersion

Kuris et al., 2008. Total parasite biomass in estuarian system – Important component of matter and energy fluxes.

Anguilla eel species infected by nematode which dammande swim bladder, thus buoyancy and swimming performance (Palstra et al., 2007)

Development of abnormalities

Coral reef fishes infected with Anilocra isopod – less active during the day, smaller territoiriesm low water flow habitats (Meadows and Meadows, 2003; Welicky and Sikkel, 2015).

Mortality resulting directly from parasite infection aanlone can put host population viablility at risk, leading to local population extinction (Jensen & Jensen, 1992; Boots and Sasaki, 2002)

Deacreasing probability that migrating individuals successfully reach their breeding grounds (Moller et al., 2004; Palstra et al., 2007)

Infection can influence spatial distribution /spatial structure of population (Poulin, 1999; Curtis, 2002; Poulin and Latham, 2002; Miura et al 2006) – Increasing migratory connectivity (Mollet and Szep, 2001) – Increasing trophic connectivity of ecosystems (Welicky and Sikkel, 2015)