

information, I conducted a survey on the presence of amphipod hosts in Irish river systems and lakes in 2015 (Fig. 1.1). While *Echinorhynchus truttae*, *Polymorphus minutus*, and a single *Pomphorhynchus laevis* were found in *G. duebeni*, the most commonly identified parasite I found was *Polymorphus minutus*.

Acanthocephalans in Irish Gammarids

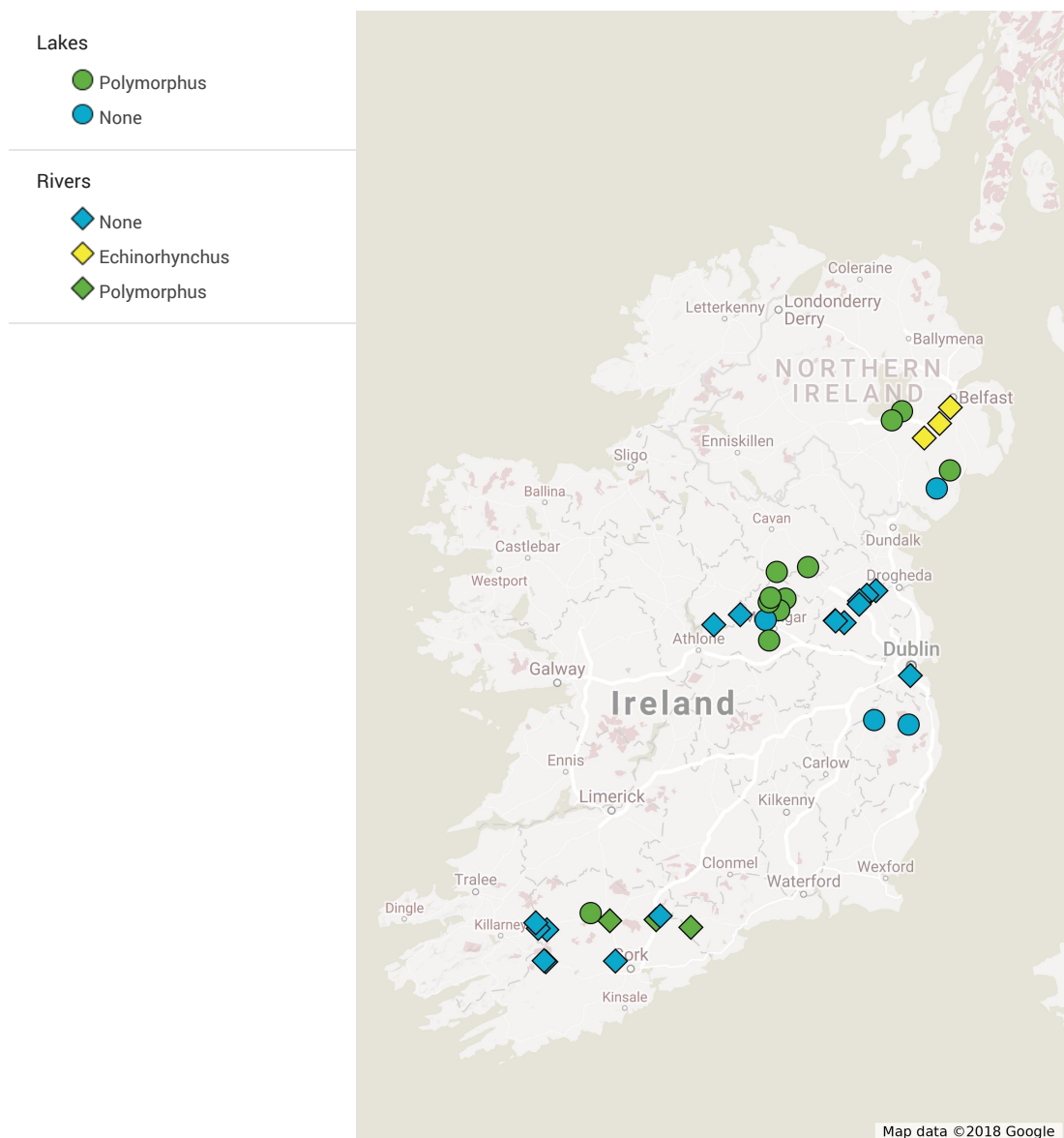


FIGURE 1.1: Dominant acanthocephalan parasites of *Gammarus* spp. across Ireland. Most sites sampled were either dominated by *P. minutus* or had no infected *Gammarus* spp. present.

P. minutus is an acanthocephalan parasite that cycles through *Gammarus* spp. as an intermediate host and utilizes water fowl as a final definitive host where

the adults are able to reach reproductive maturity (Fig. 1.2). Like many acanthocephalans, *P. minutus* cystacanths have been shown to alter the behaviour of their amphipod hosts to increase the chance of parasite transmission to the definitive host (Jacquin et al., 2014; Labaude et al., 2017).

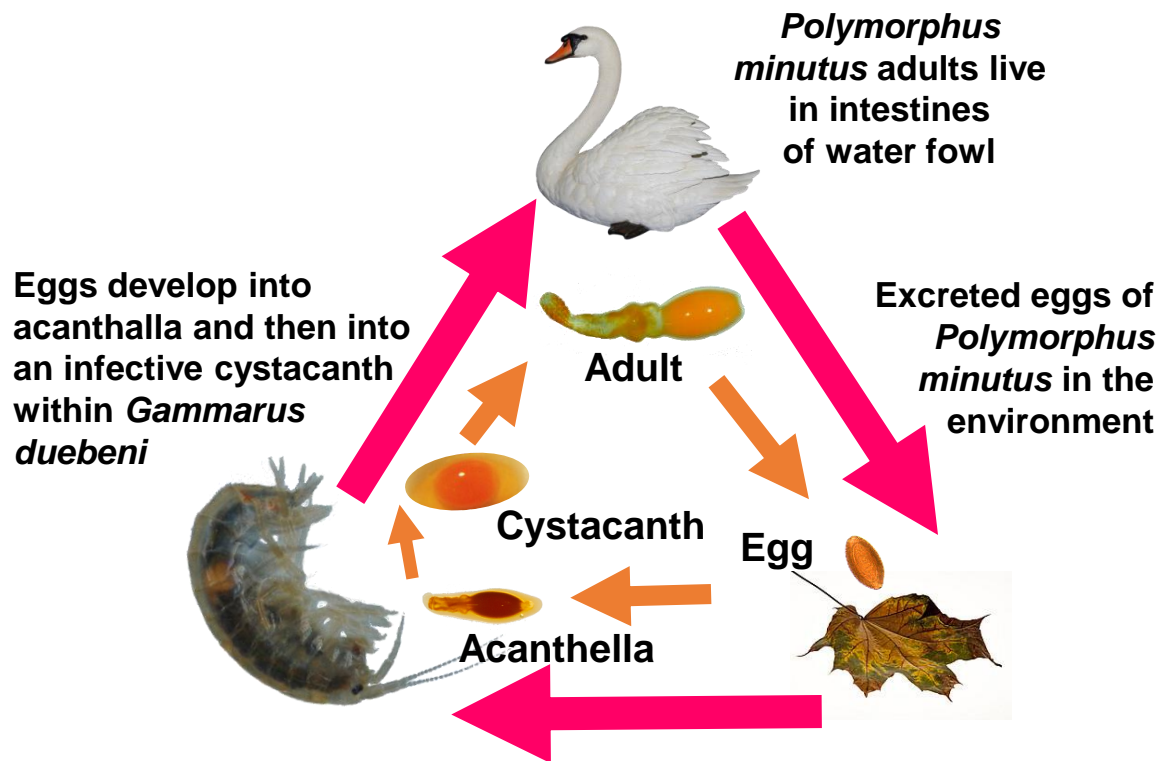


FIGURE 1.2: Life cycle of *Polymorphus minutus* in Ireland. The parasite has one intermediate host, *Gammarus duebeni*, and a definitive bird host, typically ducks or swans.

A number of studies have established that *P. minutus* manipulates the behaviour of *Gammarus* (Kaldonski et al., 2008; Perrot-Minnot et al., 2016). *P. minutus* reduces the fecundity of amphipods (Dezfuli and Giari, 1999), increases movement upwards in the water column (Perrot-Minnot et al., 2016), and reduces host activity levels (Jacquin et al., 2014). The manipulative activity of *P. minutus* is sensitive to environmental factors (Perrot-Minnot et al., 2016), with the oxygenation of the environment influencing the parasite's ability to alter behaviour. The ability of the parasite to alter behaviour also depends on the life-stage of the parasite, as the cystacanth stage changes behaviour but the acanthella stage of the parasite does not (Bailly et al., 2017). Few studies have addressed the crucial interaction between parasitic infection and temperature in controlling the behaviour of gammarid amphipods, especially across broad temperature ranges similar to those experienced seasonally in temperate ecosystems and those expanded temperature ranges that are predicted under

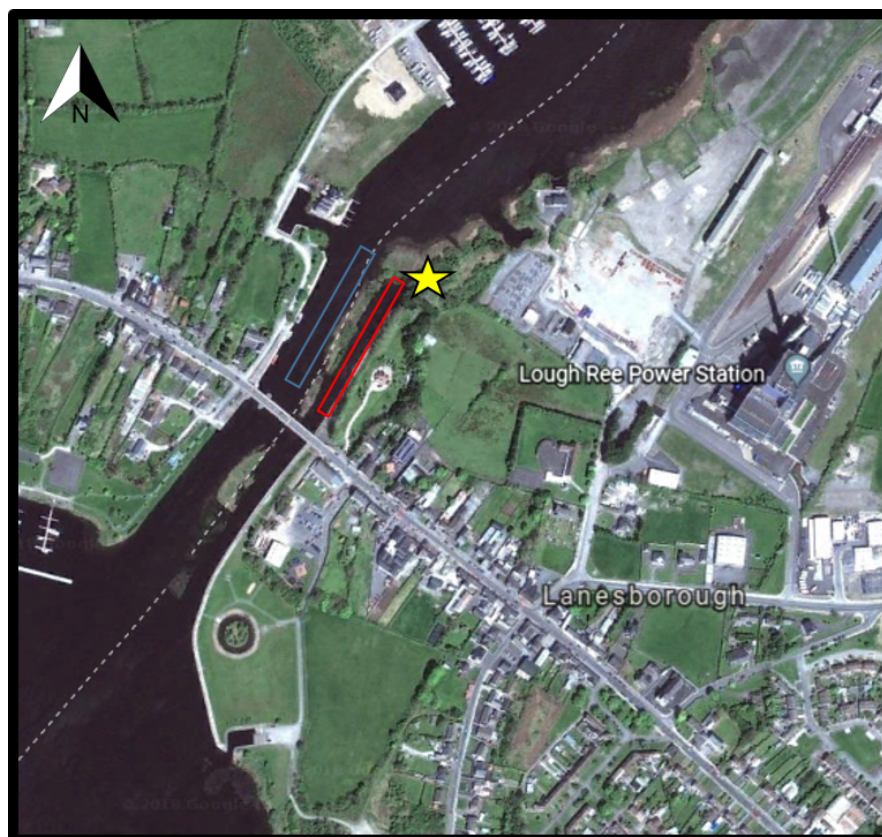


FIGURE 5.1: The location of the warmed (red) and ambient (blue) reaches used in my experiments. The Lough Ree power station thermal discharge is indicated with a yellow star.

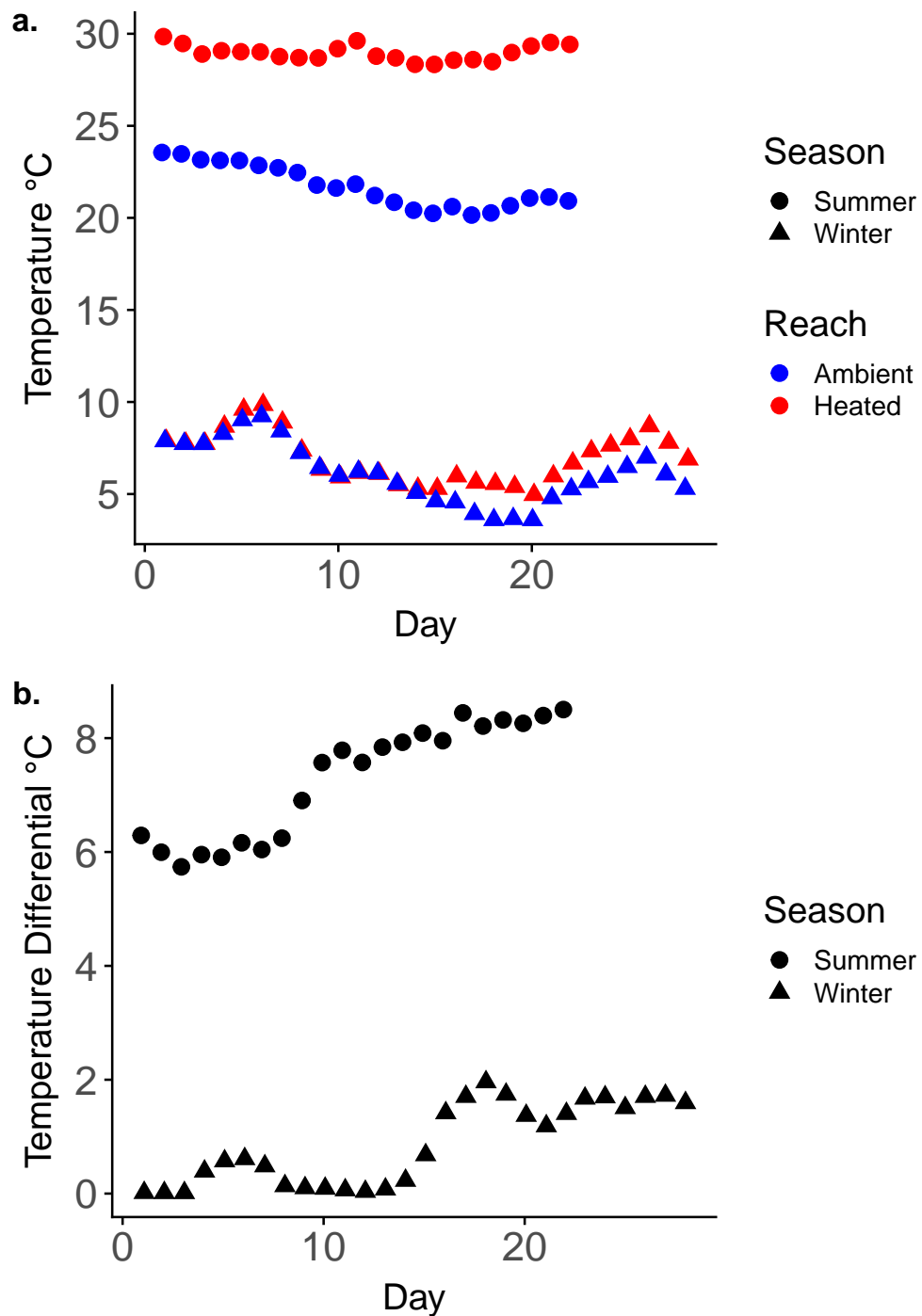


FIGURE 5.2: Temperature (a) and temperature differential (b) of warmed and ambient reaches during the two experimental runs. Day refers to day number within the experimental run.