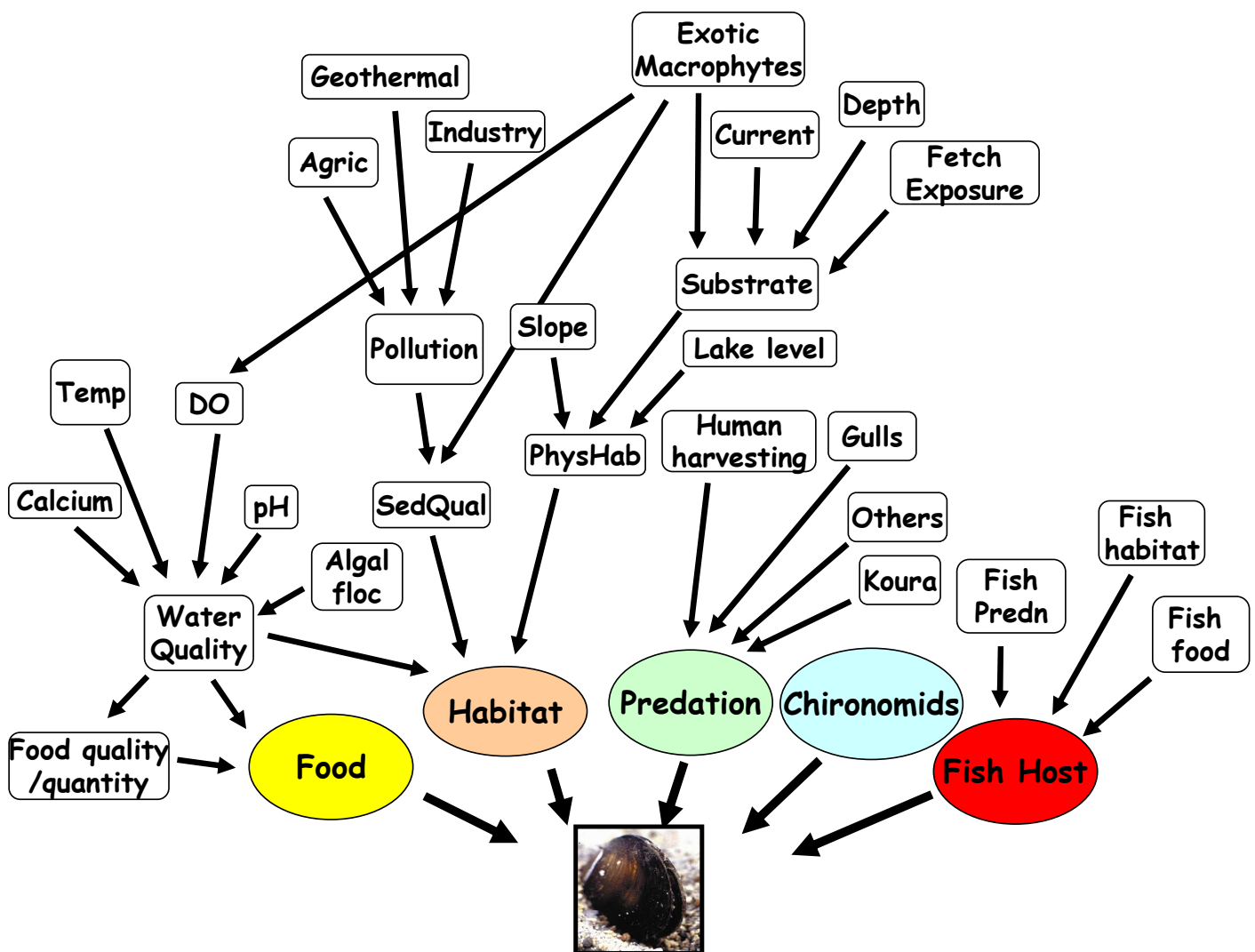


Kakahi Conceptual Model

Dave Roper, Ngaire Phillips and Chris Hickey

The figure below describes the current understanding of factors influencing the distribution and abundance of kakahi in the Te Arawa lakes. The model defines five key factors (food, habitat, predation, chironomids and fish host) which collectively contribute to the quality and quantity of kakahi in the lakes. Each of these key factors can be described by a range of variables (white boxes). The arrows describe the relationships between variables. A description of each of these variables is listed in the table below. This model can be used to identify possible management priorities, as well as test hypotheses and provide research ideas.

For a more detailed description of factors influencing koura in the Te Arawa lakes refer to Phillips N; Parkyn S; Kusabs I; Roper D (2007) Taonga and mahinga kai species of the Te Arawa lakes - kakahi. (https://www.niwascience.co.nz/maori/research/te_arawa_lakes/kakahi)



Variable name	Variable description
Agric	Agricultural activities may result in elevated nutrient levels in lakes, affecting lake productivity and hence food availability for kākahi
Calcium	Calcium is important for shell growth
Current	Inflow currents may also be a factor in lakes as juveniles have been linked to stream mouths
Depth	Is related to wave action and fetch exposure
DO	Adequate dissolved oxygen is crucial for survival and kākahi are generally absent below the thermocline
Exotic Macrophytes	Kākahi are often absent inshore of macrophyte beds, even when the sediment appears to be suitable. They are generally found in low numbers or are absent from within weedbeds, especially if the sediment is muddy
Fetch Exposure	Wave action may erode shells and influence the settlement and subsequent survival of juveniles
Fish Host	The presence of a suitable host fish is an important factor for completion of the life cycle
Fish habitat, Fish food, Fish Predn	Habitat and food availability and the effects of predation on the fish host population will influence the availability of fish hosts
Food	Kākahi are filter feeders and factors influencing water quality can impact on both the quality and quantity of food available
Geothermal	Natural geothermal activity is associated with elevated levels of some heavy metals
Gulls	Gulls are known to prey on kākahi
Habitat	Habitat is a function of water and sediment quality and physical characteristics such as slope and depth
Human harvesting	Kākahi are occasionally harvested for consumption and were used for a variety of purposes by Māori
Industry	Industrial activities can result in elevated contaminant levels, particularly in stormwater. Kākahi are efficient accumulators of contaminants.
Kōura	Kōura are known to prey on kākahi
Lake level	Fluctuations in lake level could leave shoreline populations stranded
Others	Fish and birds may also prey on kākahi
Chironomids	The Chironomid (fly) <i>Xenochironomus canterburyensis</i> spends most of the larval stage of its life cycle within kākahi and may cause internal shell deformities
pH	Acidic waters are likely to affect shell quality
PhysHab	Physical habitat, which is determined by slope, substrate type (and associated features) and macrophytes
Pollution	Includes agriculture, geothermal and industrial
Predation	Includes gulls, kōura, human and others
SedQual	Sediment quality – kākahi prefer coarser substrates
Slope	Affects sediment quality
Substrate	Particle size and cohesion are both important. Higher densities of adults are generally associated with coarser particle sizes.
Temp	Temperature may affect spawning and growth
Water quality	Includes temperature, pH, dissolved oxygen and calcium