Fish Predation on New Zealand's Greenshell™ Mussel Farms

The Greenshell™ industry frequently reports fish predation as a major problem for the industry, but a comprehensive understanding of the relative contribution of fish predation to crop losses throughout the production cycle is still lacking. Evidence of the species responsible, the timing of predation events, and the magnitude of crop losses due to fish predation remain entirely anecdotal. Reports suggest that fish predation can lead to significant losses, possibly even reaching 100%. This is substantiated by instances of torn mussock, stripped spat, and, in more severe cases, lines becoming entangled on the surface. Fish predation is thought to pose a greater threat during the initial production stages, especially to seed and juvenile mussels, which are considered particularly susceptible. Despite its severity, we have only limited knowledge about fish predation's true extent and impact on the Greenshell™ mussel industry. To comprehensively evaluate the influence of fish predation on Greenshell™ farms and to develop successful strategies for minimising its impact within the Greenshell™ mussel industry, additional research is imperative.

Therefore, our research aims to quantify crop losses due to fish predation and determine when they occur throughout the production cycle, identify the species responsible for these losses and document the associated evidence of fish predation on mussel farms. To achieve this, we are conducting a series of fish exclusion experiments in conjunction with underwater camera deployments on Greenshell™ farms throughout the Coromandel region. These experiments will determine exactly when in the production cycle fish predation occurs and the relative impact at each stage, whether size-selective feeding occurs within crops and if exclusion works at preventing the effects of fish predation. Preliminary findings demonstrate the effectiveness of exclusion measures. In situations where fish are not excluded, the impact of fish predation becomes evident, leading to substantial losses of up to 46% over a 63-day period. Underwater cameras have captured Snapper and Parore in feeding frenzies in various farm locations *(Figure 1)*.

(A)

(B)

(C)

(D)

Figure 1: Snapshots from underwater videos showing a) snapper at Esk Point feeding on spat ~20mm b) snapper at Kereta tearing mussock c) parore in Hautapu pulling on biofouling d) parore feeding directly off the dropper line.

Evidence of predation on mussels was observed, including chewed and patchy rope and broken shells. Snapper are clearly the dominant species responsible however, observations of parore preying directly of the lines requires further investigation as to whether they are preying on the mussels themselves or the associated biofouling. Initial results suggest that fish may be selectively targeting the largest mussels within the crop, potentially because they protrude more, however, further investigation is required to confirm this.

Now that we have identified which species are responsible, the subsequent step involves confirming the precise stage of production during which these events occur. This will enable us to begin to develop targeted approaches for limiting fish predation. This ongoing research is primarily being conducted in the Coromandel, where the findings are invaluable for developing effective mitigation strategies. Notably, as water temperatures rise and fish migrate southward, the applicability of these findings will progressively extend to the regions situated at the top of the South Island.

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