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Abundance and diversity of fish on mussel farms in New Zealand

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Abstract

Fish are often attracted to floating structures, particularly as juveniles, and in many parts of the world longline mussel farms provide complex, three-dimensional floating structures in coastal waters. There have been few quantitative studies of the assemblages of fish living on and around mussel farms. We sampled fish on mussel farms at three sites in the north of the South Island of New Zealand over a year to characterise the assemblages present and their variability. Predictions of the species likely to be present were made on the basis of their occurrence in the general area, habitat preferences, and occurrence around floating structures in previous studies. The farms differed in their degree of exposure, distance from shore and degree of riverine and oceanic influence. Fish were sampled by underwater visual census, and a remote-operated vehicle, and destructively sampled using an anaesthetic. Abundances of fish on the mussel lines were small (median values up to 1.25 fish m^{-1} of line) and were dominated by small, demersal species characteristic of rocky reefs in the area, notably triplefins (*Forsterygion lapillum* and *Grahamina gymnota*, Family Tripterygiidae) and the wrasse *Notolabrus celidotus*. The abundances and species of fish present differed among sites and among sampling methods (but the small and inconsistent numbers of fish recorded precluded formal statistical testing of differences). Few large, commercially or recreationally important species (demersal or pelagic) were recorded. Triplefins may recruit to the lines at settlement from planktonic larvae and spend their entire lives there. *N. celidotus*, in contrast, may recruit to stands of macroalgae on nearby rocky reefs and move to farms later. Direct recruitment of *N. celidotus* may be limited by the low abundances of macroalgae on the mussel lines.

Keywords: Mussel farm; Longline; Fish; Habitat; New Zealand

1. Introduction

In many parts of the world, including New Zealand, longline mussel farms provide extensive, three-dimensional structures with complex substrata of ropes and mussel stock, often located in nearshore, relatively sheltered environments. Many types of

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coastal fish associate with floating structures, including drift algae, gelatinous zooplankton and flotsam (Kingsford and Choat, 1985; Kingsford, 1992, 1993), and there is "good evidence of association with structures in the pelagic environment" for 16 families (Kingsford, 1993). Angel and Ojeda (2001) found that the trophic structure of fish assemblages was more complex in complex habitats, including floating structures in the form of kelp beds, than in structurally simple ones. Thus, mussel farms may act as fish aggregation devices (FADs), which are known to attract pelagic fishes in tropical and temperate waters (e.g., Fréon and Dagorn, 2000; Dempster and Kingsford, 2003) or provide substrata for direct recruitment of fishes and be colonised by demersal species.

Longline mussel farms are often used as fishing sites by recreational anglers and anecdotal evidence suggests that they are considered good places to catch fish. This has been used as a mitigating argument in disputes over occupation of space by mussel farms in the coastal zone, but the evidence that recreationally or commercially important fish are more abundant around farms, whether associated with the floating structure or the seabed, has not often been tested. Carbines (1993) studied the distribution of the labrid *Notolabrus celidotus* (spotty), a species of no commercial or recreational importance, around mussel farms in the Marlborough Sounds, New Zealand. He found large numbers of individuals around the anchor blocks mooring the mussel lines to the seabed, and on the bed beneath the lines, but relatively few on the lines themselves. New recruits were predominantly found among macroalgae on nearby shallow reefs, and Carbines concluded that they later migrated in small numbers to mussel farms, rather than recruiting directly. This species is not targeted recreationally or commercially. There is also anecdotal evidence of fish feeding on mussel spat on farms in the Marlborough Sounds, the main culprits being spotties, but also leatherjackets (*Parika scaber*) and snapper (*Pagrus*

Table 1
Species of fish identified as being potential colonisers of longline mussel farms in the Marlborough Sounds and Golden Bay

Species	Common name	Family	Reason[a]
Pelagic			
Aldrichetta forsteri[b]	Yellow-eyed mullet	Mugilidae[b]	Locally common, recorded in association with drift algae
Arripis trutta[b]	Kahawai	Arripidae[b]	Locally common, recorded in association with drift algae
Engraulis australis[b]	Anchovy	Engraulididae	Locally common, recorded in association with drift algae
Hyporhamphus ihi[b]	Garfish	Hemiramphidae	Locally common
Sardinops neopilchardus[b]	Pilchard	Clupeidae	Locally common, recorded in association with drift algae
Seriola lalandi	Kingfish	Carangidae[b]	Locally common, family recorded in association with drift algae
Thyristes atun	Barracouta	Gempylidae	Locally common
Trachurus novaezelandiae[b]	Jack mackerel	Carangidae[b]	Locally common, genus recorded in association with drift algae
Zeus faber	John Dory	Zeidae	Locally common on reefs
Demersal			
Forsterygion spp.[b]	Triplefin	Tripterygiidae	Locally common on reefs, recorded in association with drift algae and complex topography
Grahamina spp.	Triplefin	Tripterygiidae[b]	Locally common on reefs, often associated with sessile invertebrates
Hippocampus abdominalis[b]	Seahorse	Syngnathidae[b]	
Notolabrus celidotus[b]	Spotty	Labridae	Locally common, recorded in association with benthic and drift algae and complex topography
Pagrus auratus[b]	Snapper	Sparidae	Locally common, recorded in association with drift algae
Parika scaber[b]	Leatherjacket	Monacanthidae[b]	Locally common on reefs, recorded in association with drift algae and sessile invertebrates
Ruanoho spp.[b]	Triplefin	Tripterygiidae[b]	Locally common on reefs, recorded in association with drift algae
Solegnathus spinosissimus	Spiny sea dragon	Syngnathidae[b]	Locally present, associated with macroalgae
Stigmatopora spp.[b]	Pipefish	Syngnathidae[b]	Locally common, associated with macroalgae

[a] Information derived from Kingsford and Choat (1985), Jones (1988), Kingsford (1993), Davidson (2001), Francis (2001) and personal observations.

[b] Family, genus or species reported in association with floating objects (Kingsford and Choat, 1985; Kingsford, 1992, 1993).