$\label{eq:spectrum} Appendix \ S1-A \ Summary \ of \ Intraguild \ Predation \ Models$

Table S1.1. A summary of IGP model regarding the IG-prey's competitive superiority and its response to enrichment when all species coexist. Footnotes summarize the mechanism responsible for predictions countering those described in the introduction of the main text.

Modeled process	IG-prey must be superior competitor	IG-prey's response to enrichment	Source
Basic IGP module	Yes	Decrease	А
IG-prey refuges due to:			
Type III functional responses	Yes	Decrease	В
Predation-free time periods	Yes	Decrease	С
Anti-predator behavior	Yes	Decrease	D
Predator-specific differences in:			
Prey quality	Yes	Decrease	Е
Diet requirements	Yes	Decrease	F
Mortality rates	Yes	Decrease	G
Immigration	Yes	Decrease	Н
Alternative prey	Yes^1 or No^2	Increase ² or decrease	Ι
Type II functional responses	Yes	Increase ³ or decrease	J
Age-structure and life-history omnivory	Yes	Increase ⁴ , decrease or constant ⁵	Κ
Spatial structure	Yes	Increase ⁶ , decrease ⁷ or constant ⁷	L
Cannibalism	Yes or No ⁸	Increase or decrease ⁸	М
Consumer-dependent functional responses	Yes	Increase ⁹	Ν
Adaptive foraging	Yes	Increase ¹⁰ or decrease	0

- ¹ The IG-prey must be the overall superior competitor across all shared and unshared prey, but may be inferior on the shared prey alone (Daugherty *et al.* 2007).
- ² The need for competitive superiority is precluded by the IG-prey having an allochthonous input exclusive to it (Faria & Costa 2010).
- ³ Provided that the IG-prey exhibits a functional response that is sufficiently more linear than the omnivore's to affect non-equilibrium limit cycles (Abrams & Fung 2010). Coexistence is thereby feasible through a mechanism analogous to that described by Armstrong and McGehee (1976).
- ⁴ Provided density-dependence in the omnivore feeding or growth rates is sufficiently strong to affect limit cycles or chaotic population dynamics (Abrams 2011).
- ⁵ Provided only juvenile omnivores consume the shared resource, only adult omnivores consume IG-prey, and that the IG-prey an essential resource for omnivore adults (Hin *et al.* 2011).
- ⁶ The IG-prey's response is dependent upon the relative between-patch dispersal rate of the omnivore relative to the IG-prey's dispersal rate (Amarasekare 2007a).
- ⁷ Spatial heterogeneity in resource productivity may affect no IG-prey response (Okuyama 2008).
- ⁸ An increase in the IG-prey's abundance requires rates of cannibalism in the omnivore be greater than its rate of feeding on the IG-prey and that the omnivore is the superior competitor (Rudolf 2007).
- ⁹ Affected by decreases in the omnivore's feeding rate on the IG-prey due to conspecific interference (Hart 2002).
- ¹⁰ Provided the omnivore exhibits an evolutionary-scale tradeoff between feeding on the shared prey versus the IG-prey (see also Abrams & Fung 2010; Křivan & Diehl 2005).

SOURCES

- (*A*) Borer *et al.* 2007; Borer *et al.* 2003; Diehl & Feißel 2000; Gard 1982; Holt & Polis 1997; Polis & Holt 1992; Polis *et al.* 1989; Takimoto *et al.* 2007;
- (B) Faria & Costa 2009; Gismervik & Andersen 1997; HilleRisLambers et al. 2006;
- (C) Amarasekare 2007b, 2008;
- (D) Kimbrell et al. 2007; Nakazawa et al. 2010; Urbani & Ramos-Jiliberto 2010;
- (E) Aunapuu et al. 2010; Borer 2006; Diehl 2003;
- (F) HilleRisLambers et al. 2006;
- (*G*) Briggs & Borer 2005; Daugherty *et al.* 2007; Hatcher *et al.* 2008; Holt & Huxel 2007; Holt & Polis 1997; Namba *et al.* 2008; Rudolf 2007;
- (H) Briggs & Borer 2005; Velazquez et al. 2005; Verdy & Amarasekare 2010;
- (1) Briggs & Borer 2005; Daugherty *et al.* 2007; Faria & Costa 2010; Gard 1982; Heithaus 2001; Holt & Huxel 2007; Holt & Polis 1997; Kimbrell *et al.* 2007; Kondoh 2008; Mylius *et al.* 2001;
- (J) Abrams & Fung 2010; Diehl & Feißel 2000; Faria & Costa 2009; Hart 2002; Holt & Polis 1997; Kuijper *et al.* 2003; Mylius *et al.* 2001; Revilla 2002; van de Wolfshaar *et al.* 2006; Verdy & Amarasekare 2010;
- (*K*) Abrams 2011; Amarasekare 2007b, 2008; Borer 2006; Holt & Polis 1997; Mylius *et al.* 2001; Pimm & Rice 1987; Rudolf 2007; van de Wolfshaar *et al.* 2006;
- (*L*) Amarasekare 2006, 2007a; Okuyama 2008; Snyder *et al.* 2005; Su *et al.* 2008; Takimoto *et al.* 2012;
- (*M*) Amarasekare 2007b, 2008; Hart 2002; Rudolf 2007;
- (*N*) Hart 2002;
- (*O*) Abrams & Fung 2010; Holt & Polis 1997; Křivan 2000; Křivan & Diehl 2005; Křivan & Schmitz 2003; Lalonde *et al.* 1999; Matsuda *et al.* 1986.

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APPENDIX S2 – DETAILS OF STUDY SYSTEM, SITES AND METHODS

Study system

Haustrum haustorium (Gmelin, 1979) may grow to 80 mm shell length (Tan 2003), but rarely exceeds 55 mm (Novak 2008). Its diet typically consists of limpets, chitons, and snails, but is also known to include acorn barnacles, mussels, and other whelk species, particularly *H. scobina* (R.T. Paine, unpubl. data; Luckens 1975; McKoy 1969; Morton & Miller 1968; Ottaway 1977; Patrick 2001; Walsby 1977). *H. scobina* (Quoy and Gaimard, 1833) may grow to 35 mm shell length on the North Island (Tan 2003), but is typically no larger than 25 mm on the South Island (Novak 2008). It is a relative specialist whose diet is known to consist primarily of mussels and acorn barnacles (and oysters on the North Island), but may also includes limpets, snails, and tubeworms (Clark 1957; Fearon 1962; Gardner 1978; Luckens 1975; McKillup 1982; Menge *et al.* 1999; Morton & Miller 1968). With handling times – the time needed to drill and ingest a prey item – varying on the order of hours to days, muricids, like the two *Haustrum* species, exhibit classically saturating functional responses(Katz 1985; Moran 1985; Murdoch 1969; Novak 2008).

Little is known about the two *Haustrum*'s predators. The only reported predation on either species comes from Paine (1971) who observed a single individual of the seastar *Stichaster australis* feeding on an *H. scobina*. Other seastars (but see Town 1979; Town 1980), fishes (particularly labrids, Denny & Schiel 2001), crabs (particularly Cancer novaezelandiae, Creswell & Marsden 1990), oystercatchers (Baker 1974), and gulls probably also consume whelks as they do on other rocky shores around the world (e.g., Wootton 1997).

Both *Haustrum* species lay benthic egg masses that hatch to locally dispersing crawl-away larvae (Graham 1941; Pilkington 1974), but *H. haustorium*'s eggs are larger than *H. scobina*'s (~ 4.5 x 4.5 mm vs. 3 x 3 mm, respectively, Graham 1941; Tan 2003). *H. haustorium* individuals appear to become reproductively mature at 24-30 mm, while individuals of *H. scobina* do so at 9-12 mm (*unpubl. data* from dissections and of the minimum size of individuals observed in breeding aggregations). The two whelks' prey species exhibit diverse larval dispersal modes, with some species having direct-developing crawl-away larvae, and others (e.g., mussels and barnacles) having lecithotrophic or planktotrophic larvae that can disperse long distances in the water column before recruiting to the shore (Graham 1941; Pilkington 1974). While no information exists on the number of eggs laid per female, the hatchling size of *H. haustorium* is larger than that of *H. scobina*. Thus, *H. haustorium* is likely to require more units of resource to produce hatchlings than is *H. scobina*, making bottom-up prey impact estimates conservative regarding the IGP predictions of competitive superiority being tested.

Study sites

Menge and colleagues (Menge *et al.* 1999; Menge *et al.* 2003; Menge *et al.* 2002; Rilov *et al.* 2008) have demonstrated that mussels and barnacles – the primary prey shared by *Haustrum* whelks – exhibit marked regional differences both in recruitment and growth around the South Island of New Zealand. Recruitment rates (recruits per collector per month, RCM) are highest along the northwest coast (~900-1100 mussel RCM, ~2000 – 6000 barnacle RCM), are much lower along the southwest coast (~125 mussel RCM, ~50 barnacle RCM), and are even lower along the east coast, particularly in the northeast (~10 mussel RCM, ~50 barnacle RCM). Individual mussel and barnacle growth rates (as judged by RNA:DNA ratios or the growth of recruited individuals, respectively) are more than twice as high along the northwest coast as they

are on the east coast (Menge *et al.* 1999; Menge *et al.* 2003). Macroalgae remain at low abundance in both the mid and high midlittoral zones of exposed sites throughout the South Island, becoming dominant only in the lower midlittoral zone (Menge *et al.* 2003).

Menge and colleagues have attributed the gradient of mussel and barnacle growth and recruitment rates to the nearshore oceanographic conditions surrounding the South Island. Situated in the path of the eastward flowing Tasman Current, the South Island's west coast causes the current to bifurcate into two water masses (Fig. S2.1). Wind events and the northward flowing Westland Current cause upwelling along the northwest coast, intermittently bringing deep, nutrient rich water to the surface (Stanton 1976; Stanton & Moore 1992; Vincent et al. 1991). This upwelling spurs shallow water primary production (Bradford & Chang 1987; Bradford & Roberts 1978; Chang & Bradford 1985; Chang et al. 1995; Murphy et al. 2001). The position and strength with which the Tasman Current intersects the South Island appears variable (Stanton & Moore 1992; Uddstrom & Oien 1999; Vincent et al. 1991). This suggests that less consistent upwelling and downwelling conditions typify the southwest coast, as the southward flowing tongue of the Tasman Current curls around the southern end of the South Island. The nearshore northeast coast, on the other hand, appears to observe little to no current-driven upwelling (Vincent et al. 1991). While wind-driven upwelling events do occur (Chiswell & Schiel 2001; Heath 1972), and upwelling caused in the nearby Kaikoura Canyon supports a productive pelagic system (Murphy et al. 2001), these do not appear to translate to onshore productivity in mussels and barnacles (Menge et al. 1999; Menge et al. 2003; Menge et al. 2002; Rilov et al. 2008; Seaward 2006).

Six study sites were chosen around New Zealand's South Island to represent the regional productivity gradient in barnacle and mussel growth and recruitment rates. Two low productivity east coast sites, Paia Point (PP) and Rakautara (Rk), respectively located 14 km south and 20 km north of the Kaikoura Peninsula; two mid productivity southwest coast sites, Jackson Head (JH) and Okahu Point (OP), located on the westward side of Jackson Head; and two high productivity northwest coast sites, Tauranga Head (TH) and Cape Foulwind (CF), located to the west of Westport. PP is located 2 km south of Menge et al.'s (2003) northeast coast site; JH is the same as their southwest site; and TH is located 29 km north of their northernmost west coast site.

Site name	Abbreviation	Coast	Location
Tauranga Head	TH	Northwest	41°46′26″ S, 171°27′20″ E
Cape Foulwind	CF	Northwest	41°45′09″ S, 171°27′31″ E
Okahu Point	OP	Southwest	43°57′55″ S, 168°36′16″ E
Jackson Head	JH	Southwest	43°57′53″ S, 168°36′23″ E
Paia Point	PP	East	42°28′24″ S, 173°32′12″ E
Rakautara	Rk	East	42°15′38″ S, 173°48′43″ E

Table S2.1.	Locations	of stud	ly sites
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Figure S2.1. Map of New Zealand's South Island and nearshore oceanography (after Heath 1985) indicating regional locations of study sites and associated productivity levels as reflected by mussel and barnacle growth and recruitment rates.

All localities are generally similar in character to those used by Menge et al. (2003). The study areas chosen within JH, TH and CF, however, are more protected than Menge et al.'s since my focal areas were situated behind seaward rock outcrops rather than being fully exposed to incoming waves. This was done in order to maintain consistent exposure across all study sites. The intertidal substrate of PP and Rk consists of greywacke bedrock extending through the shallow subtidal. The substrate of JH and OP consists of areas of sandstone and sandstone with beach conglomerates, and turns to sandstone outcrops surrounded by beach sand in the shallow subtidal. The substrate of TH and CF consists of gneiss bedrock that also turns to loose sand in the shallow subtidal. JH and TH are adjacent to sandy beaches and often showed evidence of scouring in the low intertidal. TH, CF and Rk are located within 14 km of the mouth of rivers. These sites likely experienced periodically reduced salinities as a result of river discharge (Bradford 1983; Stanton & Moore 1992). Field temperatures were monitored using Stowaway® TidbiTTM temperature loggers (Onset Computer, Pocasset, MA) positioned in the lower midlittoral zone of each site to record temperatures at ¹/₂ hr intervals.

Method Details

Consumer diets – Surveys were performed in both mid- and high tide zones and were not repeated in the same area for at least four high tides. Preliminary surveys repeated more frequently suggested that four high-tides was ample time for whelks to commence normal feeding activity between surveys. Whelk and prey sizes were measured to ± 1 mm. In total I performed between 29-59 *H. haustorium* surveys and between 20-34 *H. scobina* surveys at each site. Site-specific species accumulation curves suggest that enough surveys were to ensure the accuracy of the observational method in estimating species-specific per capita attack rates (Fig. S2.2, Novak & Wootton 2008). Neither species was ever observed scavenging.

PP	Rk	OP	JH	TH	CF			
-	-	-	-	7/1/04	7/1/04			
6/3-8/20/05	7/27-8/22/05	-	-	5/24-7/22/05	7/21-7/23/05			
2/7-2/15/06	2/4-2/20/06	2/25-3/4/06	2/27-3/4/06	1/29-2/2/06	1/30-2/3/06			
6/17-6/26/06	6/11-6/27/06	7/12-7/17/06	7/10-7/16/06	5/27-5/31/06	5/24-5/29/06			
1/29-2/26/07	1/30-2/27/07	2/16-2/21/07	2/15-2/22/07	2/6/07	2/1-2/23/07			
7/4 7/12/07	7/2 7/0/07	6/12 6/14/07	6/11 6/16/07	5/15/07	5/14 &			
//4-//13/0/	//3-//9/07	0/12-0/14/0/	0/11-0/10/0/	3/13/07	718/07			

Table S2.2. Time periods during which systematic feeding surveys were conducted.



Figure S2.2. Species accumulation curves for the prey observed in the diet of (a) the omnivore, *Haustrum haustorium*, and (b) the IG-prey, *H. scobina*, (\pm SD), as a function of the shared prey's productivity. Curves are constructed using feeding surveys as the unit of sampling (Gotelli & Colwell 2001). Site symbols: PP, JH, CF (\circ); Rk, OP, TH (\Box).

Community structure surveys – Surveys were performed in both the mid- and high tide zones using three haphazardly located 20 m transects per zone with five randomly positioned quadrats (0.25 m², subdivided into 100 5x5 cm subquadrats) per transect. One or two of the transects in each zone was surveyed at night. I counted mobile species and estimated percent cover for sessile species, bare space, and macroalgae. A small subset of exceptionally abundant mobile species (e.g., *Austrolittorine* spp.) was subsampled at some sites, and was not counted in the quadrats of the third transect. Surveys were repeated three times at PP, Rk, TH and CF, and twice at OP and JH, in 2005 and 2006. Densities were therefore estimated using 40-90 quadrats per species.

To account for cross-quadrat variation in bedrock topography I divided each mobile species' quadrat count by the ratio of the minimum distance between opposing quadrat corners ($\sqrt{0.5}$ m) and the average distance between quadrat corners measured by following the topography of the substrate surface with a flexible line. I converted sessile species percent-cover estimates to densities with site- and species-specific cover-count conversion relationships determined for each site using haphazardly placed 0.0025 m² quadrats.

I estimated species-specific biomass using size-frequency distributions obtained by systematically measuring all individuals of a species in additional 0.25 m² quadrats positioned randomly along the shore. For most species this resulted in measurements on \geq 50 individuals per species. Size-measurements for exceptionally abundant species were obtained by subsampling quadrats to increase spatial coverage, while size-measurements for rare species were supplemented by systematic searches of the shore. Barnacle sizes were obtained by measuring randomly chosen individuals from within photographed 5 x 5 cm quadrats positioned at random along the shore. I converted the sizes of all individuals to wet weights (shell and tissue) using allometric relationships determined from individuals collected on both coasts (Appendix C). A species' mean biomass was estimated by multiplying its individuals' mean weight by its mean density assuming independence in these variables. Species whose allometric relationships had not been determined (typically due to their rarity) were assigned regression coefficients of measured species considered most similar on taxonomic and morphological (Table S2.4).

To assess cross-gradient changes in community structure in the framework of IGP theory I assigned prey species into three groups – the core shared prey, the omnivore's alternative prey, and the IG-prey's alternative prey. The core shared prey were defined on the basis of their presence in the two consumers' diets at the two high productivity sites (Table S2.5, Fig. S2.5); the group did not include species shared at mid and low productivity sites. Although only a single Notoacmid limpet species (NR, probably N. parviconoidea, Nakano *et al.* 2009) was observed in the diets of both predators during formal feeding surveys, all Notoacmids were including in the shared prey group because numerous anecdotal observations made outside of the formal feeding surveys supported their inclusion. Anecdotal observations also supported the inclusion of the much rarer *Chamaesipho brunnea* and *Balanus* sp. barnacles and the mussels *Aulacomya atra* and *Perna canaliculus* into the shared prey group.



Figure S2.3. Site-specific accumulation curves for (a) documented prey species only, and (b) all species observed during quadrat-based abundance surveys, excluding the 3rd transects in which not all species were counted. Confidence intervals omitted for clarity.



Figure S2.4. Extrapolated richness of prey species available as a function of shared prey productivity levels (\pm SE), estimated by the abundance coverage estimator method (Chao & Lee 1992; O'Hara 2005) treating species with an incidence < 10 as rare.

Table S2.3. Time periods during which species abundance and size-frequency surveys were conducted at each site.

PP	Rk	OP	JH	TH	CF
5/30-5/31 &	7/25-7/26 &	-	-	5/22-5/25 &	6/23-6/24 &
8/16-8/20/05	8/6/05			7/22/05	7/21-7/23/05
2/5-2/6/06	2/4-2/6/06	2/25-3/2/06	2/27-3/3/06	1/29-2/2/06	1/30-2/3/06
6/16-6/23/06	6/18-6/24/06	7/12-7/17/06	7/11-7/17/06	5/26-5/30/06	5/24-5/29/06

Table S2.4. Unmeasured species to which the allometric regression coefficients of measured species were matched.

Unmeasured Species	Matched to
Atalacmea fragilis	Cellana radians
Austrolittorina antipodum	Austrolittorina cincta
Balanus sp.	Chamaesipho brunnea
Calantica spinosa	Calantica villosa
Chamaesipho columna	Chamaesipho brunnea
Chiton glaucus	Sypharochiton pelliserpentis
Dicathais orbita	Haustrum haustorium
<i>Eatoniella</i> sp.	Austrolittorina cincta
Haustrum lacunosus	Haustrum scobina
Lasaea rubra hinemoa	Xenostrobus pulex
Montfortula chathamensis	Diloma aethiops
Notoacmea daedala	Cellana radians
Plaxiphora obtecta	Plaxiphora caelata
Thoristella chathamensis	Diloma aethiops
Zeacumantus subcarinatus	Austrolittorina cincta
Unidentified	Diloma aethiops

Handling Times – I collected whelks and their prey from Tauranga Head and multiple east coast sites nearer the Edward Percival Field Station, Kaikoura. Prey were maintained in aquaria with flowing sea water (~9-11°C), while whelks were kept in aerated aquaria maintained at ~10, 14, or 18°C – the latitudinal and seasonal range of mean ocean temperatures around the South Island (Uddstrom & Oien 1999). After a \geq 3 day acclimation and \geq 5 day starvation period, individually housed whelks were measured (± 0.1 mm) and provided with 6 or 10 individuals of a given prey species. All prey individuals within a group were of similar size, but whelk and prey size combinations were varied to maximize the range of relative sizes. Each whelk was subsequently checked on an hourly basis and classified as either feeding or not feeding. I measured the prey of all successful predation events (± 0.1 mm) and visually estimated the proportion of unconsumed tissue remaining.

To measure barnacle handling times, I placed one or two whelks into aquaria with independent and continuously flowing filtered sea-water, the temperature of which varied over the course of a field season. Barnacles were introduced to the aquaria on cement tiles to which they had naturally recruited in the field over the course of three years. I then monitored whelk feeding using low-light video cameras under natural day:night lighting conditions supplemented by a red light at night. Barnacle prey were measured under a dissecting microscope (\pm 0.1 mm).

Only feeding events for which handling times had been well-constrained (both the start- and end-time within a $1/10^{\text{th}}$ day total window, or a maximum possible start- to end-time difference of $\leq 80\%$ of the estimated midpoint time; 1119 of 1819 feeding events) and in which $\geq 80\%$ of prey tissue had been consumed (1099 of the 1119 feeding events with only 65 events < 100%) were included in the regression analysis. Prey species whose handling times were not measured in the laboratory were assigned handling time regression coefficients of measured species considered most similar on taxonomic, morphological, and behavioral grounds (Table S2.6).

Per Capita Attack and Feeding Rates – Because I was interested in point estimates of the attack and feeding rates rather than their fine-scale spatial (tide zone) or temporal (seasonal) variation, I calculated these rates at each site by combining all focal predator feeding surveys, averaging expected handling times and prey weights across all feeding observations, and averaging across all species density surveys. Species not observed during quadrat-based abundance sampling were assigned ½ the estimated density of the least abundant species. This applied to 21 of the 202 observed predator-prey interactions. These species contributed less than 1% to each predator's total feeding rate.



Figure S2.5. The comparison of *Haustrum haustorium* and *H. scobina*'s prey-specific feeding rates illustrating the separation and overlap in their diets at the two high-productivity sites. Species considered core shared prey are indicated by black fill. See Table S2.5 for abbreviations.



Figure S2.6. The IG-prey and omnivore's relative competitive advantage for core shared prey as assessed by the log-ratio of their site-specific (a) feeding rates, (b) per capita attack rates, and (c) handling times. Prey abbreviations: Cb - *Chamaesipho brunnea*, Xp - *Xenostrobus pulex*, Cc - *Ch. columna*, Ep - *Epopella plicata*, Mg - *Mytilus galloprovincialis*, Rv - *Risellopsis varia*, NR - *Notoacmea* sp..

ID	Species	<u>Ab</u> b.	Taxon group	IGP group
1	Haustrum haustorium	Hh	Whelk	Omnivore
2	Haustrum scobina	Hs	Whelk	IG-prey
3	Balanus sp.	-	Acorn barnacle	Shared (core)
4	Chamaesipho brunnea	Cb	Acorn barnacle	Shared (core)
5	Chamaesipho columna	Cc	Acorn barnacle	Shared (core)
6	Epopella plicata	Ep	Acorn barnacle	Shared (core)
7	Calantica spinosa	-	Gooseneck	Shared
8	Calantica villosa	-	Gooseneck	Shared
9	Lasaea rubra hinemoa	-	Veneroid	Shared
10	Aulacomva atra maoriana	Am	Mussel	Shared (core)
11	Mytilus galloprovincialis	Mg	Mussel	Shared (core)
12	Xenostrobus pulex	Xp	Mussel	Shared (core)
13	Acanthochitona zelandica	P -	Chiton	Omnivore's
14	Chiton glaucus	-	Chiton	Shared
15	Onithochiton neglectus	-	Chiton	Omnivore's
16	Plaxinhora caelata	P1	Chiton	Omnivore's
17	Plaxiphora obtecta	-	Chiton	Omnivore's
1,	Synharochiton		eniton	
18	nellisernentis	Sp	Chiton	Omnivore's
19	Cellana denticulata	-	Patellid limpet	Shared
20	Cellana ornata	Co	Patellid limpet	Omnivore's
21	Cellana radians	Cr	Patellid limpet	Omnivore's
$\frac{21}{22}$	Atalacmea fragilis	-	Acmid limpet	Omnivore's
22	Notoacmaa sp. 2spokes	N2	Acmid limpet	Shared (core)
$\frac{23}{24}$	Notoacmea sp. 2spokes	NR	Acmid limpet	Shared (core)
25	Notoacmea sp. Net	NN	Acmid limpet	Shared (core)
23	Notoacmaa sp.	1111	Acmid limpet	Shared (core)
26	Padialspokes	NR	Actilità intipet	Shared (core)
27	Notoacmaa daadala		Acmid limnet	Shared (core)
27	Patalloida corticata	- Dt	Acmid limpet	Omnivore's
20	Notogemag spp	NII	Acmid limpet	Shared (core)
29	Montfortula chathamansis	NU	Fissurelid limnet	Omnivore's
21	Sinhonawia australia	- So	Pulmonata limnat	Omnivore's
27	Trimuseulus conieus	Sa	Pulmonate limpet	Omnivore's
32 22	Austrolittoring antipodum	-	Funitonate minpet	IC prov's
21	Austrolittoring singta	na Ao	Shall	IG prov's
24 25	Austronnorina cincia	AU Ct	Shall	Omnivers's
33 26	Diloma acthions	Ci De	Shall	Omnivore's
20 27	Diloma arida	De	Shall	Omnivore's
2/ 20	Diloma di angli sul str	Da Dh	Shall	Omnivore's
20 20	Diloma vigoriu z	Du Du	Shall	Omnivore's
39 40	Estavialla an	DII	Shall	Omnivore s
40	<i>Eatonietta</i> sp.	-	Shall	Omnivore s
41	Margarella spp.	- D.,	Snall	Omnivore's
42	KISEHOPSIS VARIA	KV	Snall	Snared (core)
45	<i>i noristella chathamensis</i>	- T-	Shall	Omnivore's
44	Turbo smaragdus	15	Snail	Omnivore's
45	<i>Leacumantus subcarinatus</i>	-	Snall	Omnivore's
46	Unidentified	-		
47	Buccinulum spp.	-	Whelk	Omnivore's
48	Haustrum lacunosus	-	Whelk	Omnivore's
49	Paratrophon patens	Рр	Whelk	Omnivore's

Table S2.5. Species identification codes, main text abbreviations, and IGP group in which species occurred when assessing cross-gradient changes in community and network structure (see also Fig. S2.5).



Figure S2.7. Site-specific temporal variation in the densities (m^{-2}) of the omnivore (*Haustrum haustorium*), the IG-prey (*H. scobina*), and their dominant shared prey: the barnacle *Chamaesipho columna* and the mussel *Xenostrobus pulex*.

Unmeasured Matched to			Matched to
Predator	Prey	Predator	Prey
H. haustorium	Atalacmea fragilis	H. haustorium	Cellana radians
H. haustorium	Austrolittorina antipodum	H. haustorium	Austrolittorina cincta
H. haustorium	Buccinulum sp.	H. haustorium	H. scobina
H. haustorium	Calantica spinosa	H. scobina	Xenostrobus pulex
H. haustorium	Diloma arida	H. haustorium	Diloma aethiops
H. haustorium	Diloma bicanaliculata	H. haustorium	Diloma aethiops
H. haustorium	Diloma nigerrima	H. haustorium	Diloma aethiops
H. haustorium	<i>Eatoniella</i> sp.	H. haustorium	Austrolittorina cincta
H. haustorium	Epopella plicata	H. scobina	Epopella plicata
H. haustorium	H. haustorium	H. haustorium	H. scobina
H. haustorium	H. lacunosus	H. haustorium	H. scobina
H. haustorium	Lasaea rubra hinemoa	H. scobina	Lasaea rubra hinemoa
H. haustorium	<i>Margarella</i> sp.	H. haustorium	Diloma aethiops
H. haustorium	Montfortula chathamensis	H. haustorium	Cellana ornata
H. haustorium	Mytilus galloprovincialis	H. scobina	Mytilus galloprovincialis
H. haustorium	Notoacmea daedala	H. haustorium	Cellana radians
H. haustorium	Paratrophon patens	H. haustorium	H. scobina
H. haustorium	Plaxiphora obtecta	H. haustorium	Plaxiphora caelata
H. haustorium	Thoristella chathamensis	H. haustorium	Diloma aethiops
H. haustorium	Trimusculus conicus	H. haustorium	Cellana ornata
H. haustorium	Zeacumantus subcarinatus	H. haustorium	Austrolittorina cincta
H. scobina	Aulacomya atra maoriana	H. scobina	Mytilus galloprovincialis
H. scobina	Austrolittorina antipodum	H. scobina	Austrolittorina cincta
H. scobina	<i>Balanus</i> sp.	H. scobina	Chamaesipho spp.
H. scobina	Calantica spinosa	H. scobina	Xenostrobus pulex
H. scobina	Calantica villosa	H. scobina	Xenostrobus pulex
H. scobina	Cellana denticulata	H. haustorium	Cellana denticulata
H. scobina	Chamaesipho brunnea	H. scobina	Chamaesipho spp.
H. scobina	Chamaesipho columna	H. scobina	Chamaesipho spp.
H. scobina	Chiton glaucus	H. haustorium	Onithochiton neglectus
H. scobina	Siphonaria australis	H. haustorium	Siphonaria australis

Table S2.6. Unmeasured predator-prey combinations to which the handling time regression coefficients of measured predator-prey combinations were matched.

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APPENDIX S3 – SUMMARY DATA

This appendix includes:

- A summary of the frequency by which prey species were observed in the diets of *Haustrum haustorium* and *H. scobina* whelks at each of the six focal study sites, summed across all systematic feeding surveys (Tables C.1 and C.2),
- Weighted regression coefficients relating handling times to the size of whelk predators, the size of their prey, and temperature, which I obtained using the laboratory experiments (Table S3.3),
- Allometric regression coefficients relating estimates of individual body size (shell length) to a species' whole-, shell-, and tissue-weight, which I used to infer each species' weight and biomass (Table S3.4),
- 4) Site-specific regression coefficients relating a species' percent cover abundance to an estimate of its density (Table S3.5),
- 5) Location information of the focal and additional study sites from which whelks and prey were collected for laboratory-based handling time experiments and for determining species-specific allometric relationships (Table S3.6),
- 6) Mean monthly temperatures measured using temperature loggers placed in the low shore zone of each focal site used to obtain field-based estimates of handling times for all individual feeding observations (Table S3.7)

Species	PP	Rk	OP	JH	TH	CF
Acanthochitona zelandica	2	2	-	-	-	-
Atalacmea fragilis	1	-	-	-	-	-
Austrolittorina antipodum	2	1	-	-	-	-
Austrolittorina cincta	6	2	-	-	-	-
Buccinulum sp.	_	-	-	1	-	-
Calantica spinosa	-	1	-	_	_	-
Cantharidella tesselata	4	-	2	_	13	5
Cellana denticulata	23	11	-	_	-	-
Cellana ornata	17	36	76	117	4	31
Cellana radians	3	4	70 4	2	1	2
Chamaesinho brunnea	10			-	-	-
Chamaesipho columna	179	37	5	3	113	16
Diloma aethions	177	3	6	5	2	10
Diloma arida	-	5	2	5	2	-
Diloma bicanaliculata	-	-	2 1	-	2 1	- 3
Diloma vicanaliculata	-	-	4	-	4 2	5
Diloma nigerrima Estopialla an	1	-	1	-	2	1
Euronella plicata	9	-	-	-	-	-
Epopella plicala	5	1	-	1	2	2
Haustrum naustorium	/	1	-	-	-	-
Haustrum lacunosus	1	1	-	-	-	-
Haustrum scobina	4	4	/	/	146	60
Lasaea rubra hinemoa	3	-	-	-	-	-
Margarella sp.	-	-	-	I	/	2
Montfortula chathamensis	l	-	-	-	-	-
Mytilus galloprovincialis	3	-	-	1	1	2
Notoacmea sp. 2spokes	-	-	-	-	1	-
<i>Notoacmea</i> sp. Black	-	-	-	-	3	1
Notoacmea sp. Net	-	-	-	-	1	-
Notoacmea sp. Radialspokes	3	2	-	-	20	-
<i>Notoacmea</i> sp.	-	1	-	-	1	-
Notoacmea daedala	-	1	1	1	-	-
Onithochiton neglectus neglectus	3	4	-	-	-	-
Paratrophon patens	-	-	-	-	8	9
Patelloida corticata	35	105	134	94	70	24
Plaxiphora caelata	5	1	4	6	65	15
Plaxiphora obtecta	1	-	1	2	1	2
Risellopsis varia	80	13	3	1	4	-
Siphonaria australis	64	43	15	11	67	14
Sypharochiton pelliserpentis	2	7	2	-	10	-
Thoristella chathamensis	1	-	-	-	-	-
Trimusculus conicus	-	-	1	-	-	8
Turbo smaragdus	1	5	11	11	1	1
Xenostrobus pulex	4	-	3	1	51	10
Zeacumantus subcarinatus	2	2	-	-	-	-
Unidentified	2	3	1	-	7	-
Feeding	488	291	283	265	607	208
Not Feeding	4356	3532	2694	2892	3785	1627

Table S3.1. Frequency by which prey were observed in the diet of *Haustrum haustorium*.

Species	PP	Rk	OP	JH	TH	CF
Aulacomya atra maoriana	4	1	3	1	-	-
Austrolittorina antipodum	74	48	17	11	4	-
Austrolittorina cincta	59	107	23	24	3	3
Balanus sp.	1	-	-	-	-	-
Calantica spinosa	5	-	-	-	-	-
Calantica villosa	-	2	-	-	-	-
Cellana denticulata	-	1	-	-	-	-
Chamaesipho brunnea	326	194	-	-	-	1
Chamaesipho columna	300	48	193	377	321	394
Chiton glaucus	1	-	-	-	-	-
Epopella plicata	15	12	4	2	5	13
Lasaea rubra hinemoa	17	1	-	2	-	-
Mytilus galloprovincialis	3	2	7	-	5	5
Notoacmea sp. 2spokes	-	-	-	4	-	-
Notoacmea sp. Net	-	-	1	1	-	-
Notoacmea sp. Radialspokes	2	3	5	15	1	-
Risellopsis varia	12	4	4	2	2	2
Siphonaria australis	-	9	-	2	-	-
Xenostrobus pulex	17	7	199	191	213	191
Feeding	836	439	456	632	554	609
Not Feeding	3775	1308	1773	2273	2116	2522

Table S3.2. Frequency by which prey were observed in the diet of *Haustrum scobina*.

Table S3.3. Weighted multiple regression coefficients relating handling time (days) to whelk β_1 and prey size β_2 (mm) and temperature β_3 (°C). Log-transformed mean handling times and standard deviations (σ) are given for combinations with n < 5 observations. Collection sites: ¹ES, ²LR, ³PP, ⁴TH, ⁵IT, ⁶Rk, ⁷ST, ⁸CF. (See Table B.1 for site abbreviations.)

Predator	Prey	β_1	β_2	β_3	β_4	σ	n	r^2	р
Haustrum	Acanthochitona	2.560	-	-	-	0.870	2	-	-
haustorium ¹	zelandica ^{1,2}								
Haustrum	Austrolittorina	8.311	-	1.357	-	1.155	68	0.54	< 0.001
haustorium ¹	cincta ^{1,3}		1.784		1.143				
Haustrum	Cantharidella	13.241	-	1.056	-	1.559	34	0.58	< 0.001
haustorium ¹	tesselata ⁴		2.189		1.979				
Haustrum	Cellana denticulata ^{1,2}	9.496	-	2.532	-	1.453	45	0.72	< 0.001
haustorium ¹			3.456		0.888				
Haustrum	Cellana ornata ^{1,2,3}	8.002	-	1.756	-	1.537	93	0.53	< 0.001
haustorium ¹			1.560		1.689				
Haustrum	<i>Cellana radians</i> ^{1,2,3}	5.123	-	2.364	-	1.103	41	0.80	< 0.001
haustorium ¹			1.518		1.642				
Haustrum	Chamaesipho spp ⁵	3.629	0.175	-	-	5.857	40	0.01	0.918
haustorium ³				0.201	0.404				
Haustrum	Diloma aethiops ¹	9.600	-	2.344	-	1.280	69	0.72	< 0.001
haustorium ¹			2.458		1.506				
Haustrum	Haustrum scobina ⁴	8.225	-	1.405	-	0.799	77	0.44	< 0.001
haustorium ¹			1.321		1.381				
Haustrum	<i>Notoacmea</i> spp. ^{1,2,3,4,6}	9.136	-	1.269	-	2.076	73	0.49	< 0.001
haustorium ¹			1.927		1.535				
Haustrum	Onithochiton	10.829	-	1.576	-	0.947	47	0.81	< 0.001
haustorium ¹	neglectus neglectus ⁷		2.583		1.109				
Haustrum	Patelloida	8.963	-	1.866	-	2.144	66	0.38	< 0.001
haustorium ¹	corticata ^{1,2,3}		3.156		0.235				
Haustrum	Plaxiphora caelata ⁴	5.895	-	1.961	0.071	1.507	25	0.42	0.009
haustorium ¹			2.283						
Haustrum	Risellopsis varia ^{1,2,3}	3.949	-	0.825	-	1.143	78	0.09	0.085
haustorium ¹			0.268		0.456				
Haustrum	Siphonaria	6.362	-	2.687	-	1.913	54	0.68	< 0.001
haustorium ^{1,3}	australis ^{1,2,5}		1.596		1.860				
Haustrum	Sypharochiton	4.410	0.132	0.257	-	1.128	32	0.13	0.248
haustorium ¹	pelliserpentis ^{1,2,3}				0.700				
Haustrum	<i>Turbo smaragdus</i> ^{1,2}	3.341	0.538	0.670	-	1.350	43	0.15	0.084
haustorium ¹					0.954				
Haustrum	Xenostrobus pulex ⁴	3.579	-	-	-	0.177	4	-	-
haustorium ⁴									

Predator	Prey	β_1	β_2	β3	β_4	σ	n	r^2	р
Haustrum scobina ³ *	Austrolittorina cincta ³	5.135	-0.423	0.859	-0.850	0.853	37	0.48	< 0.001
Haustrum scobina ³ *	<i>Chamaesipho</i> spp. ⁵	8.667	-0.755	1.110	-1.759	2.768	37	0.69	< 0.001
Haustrum scobina ³ *	Epopella plicata ⁵	3.186	-	-	-	-	1	-	-
Haustrum scobina ³	Lasaea rubra hinemoa ³	1.643	-	-	-	-	1	-	-
Haustrum scobina ³ *	Mytilus galloprovincialis ⁴	2.657	-0.539	0.955	0.079	0.421	17	0.67	0.002
Haustrum scobina ³ *	<i>Notoacmea</i> spp. ^{3,6}	1.294	-1.228	2.925	-0.162	0.967	30	0.39	0.004
Haustrum scobina ³ *	Risellopsis varia ^{2,3,6}	1.791	0.113	0.428	0.068	1.319	40	0.07	0.428
Haustrum scobina ⁸ *	Xenostrobus pulex ⁴	6.351	-1.106	1.326	-1.152	0.680	45	0.70	< 0.001

 Table S3.3 continued.

* Coefficients reproduced from Novak (2010).



Figure S3.1. Shell length measures used in Table S3.4.

Spagios	Total wet weight			Dry shel	Dry shell weight			Dry tissue weight		
Species	i	е	n	i	е	n	i	е	n	
Acanthochitona zelandica	8.877 x 10 ⁻⁵	3.117	45	5.375 x 10 ⁻⁵	2.889	44	1.168 x 10 ⁻⁵	2.808	37	
Amourichiton sp.	5.293 x 10 ⁻⁴	2.517	4	-	-	-	-	-	-	
Aulacomya atra maoriana	8.661 x 10 ⁻⁵	3.029	44	9.118 x 10 ⁻⁵	2.876	30	1.146 x 10 ⁻⁵	2.823	16	
Austrolittorina antipodum	5.725 x 10 ⁻⁴	2.561	154	4.308 x 10 ⁻³	1.416	36	-	-	-	
Austrolittorina cincta	1.191 x 10 ⁻⁴	3.265	138	9.817 x 10 ⁻⁵	3.194	94	9.041 x 10 ⁻⁵	2.261	69	
Benhamina obliquata	1.573 x 10 ⁻⁴	2.963	29	9.673 x 10 ⁻⁵	2.799	20	1.558 x 10 ⁻⁵	3.031	20	
Buccinulum sp.	8.618 x 10 ⁻⁵	3.057	11	6.506 x 10 ⁻⁵	3.020	11	4.223 x 10 ⁻⁶	3.196	11	
Calantica villosa ¹	6.218 x 10 ⁻⁴	3.325	47	5.621 x 10 ⁻⁴	2.916	47	3.188 x 10 ⁻⁵	3.491	45	
Cantharidella tesselata	1.364 x 10 ⁻³	2.549	113	$1.061 \ge 10^{-3}$	2.442	49	1.495 x 10 ⁻⁴	2.466	15	
Cellana denticulata	3.277 x 10 ⁻⁵	3.353	46	1.446 x 10 ⁻⁵	3.422	36	4.541 x 10 ⁻⁶	3.217	26	
Cellana flava	4.080 x 10 ⁻⁵	3.377	6	5.087 x 10 ⁻⁵	3.169	6	2.339 x 10 ⁻⁵	2.621	6	
Cellana ornata	4.788 x 10 ⁻⁵	3.346	64	2.491 x 10 ⁻⁵	3.352	49	9.041 x 10 ⁻⁶	3.137	34	
Cellana radians	3.976 x 10 ⁻⁵	3.230	62	1.650 x 10 ⁻⁵	3.300	47	6.600 x 10 ⁻⁶	3.080	32	
Chamaesipho brunnea ²	2.349 x 10 ⁻³	2.776	102	9.040 x 10 ⁻⁵	4.315	85	8.041 x 10 ⁻⁴	1.449	29	
Cominella maculosa	1.416 x 10 ⁻⁴	3.007	64	8.544 x 10 ⁻⁵	3.027	46	1.005 x 10 ⁻⁵	3.093	33	
Diloma aethiops	8.871 x 10 ⁻⁴	2.807	108	4.415 x 10 ⁻⁴	2.910	76	1.063 x 10 ⁻⁴	2.519	36	
Diloma arida	4.980 x 10 ⁻³	2.136	27	4.238 x 10 ⁻³	2.048	17	4.225 x 10 ⁻³	1.147	7	
Diloma bicanaliculata	2.133 x 10 ⁻³	2.442	41	1.282 x 10 ⁻³	2.498	31	1.089 x 10 ⁻⁴	2.554	19	
Diloma nigerrima	2.648 x 10 ⁻³	2.394	36	2.344 x 10 ⁻³	2.283	30	8.872 x 10 ⁻⁵	2.758	24	
Epopella plicata ²	6.612 x 10 ⁻³	2.383	46	4.327 x 10 ⁻³	2.461	37	3.766 x 10 ⁻⁴	2.355	21	
Haustrum haustorium	1.616 x 10 ⁻⁴	2.954	343	1.499 x 10 ⁻⁴	2.870	141	1.988 x 10 ⁻⁶	3.466	60	
Haustrum scobina	1.214 x 10 ⁻⁴	3.210	252	6.105 x 10 ⁻⁵	3.279	108	5.909 x 10 ⁻⁶	3.417	37	

Table S3.4. Allometric regression coefficients and sample sizes (*n*) relating total length (*L*) to total wet weight, dry shell weight, and dry tissue weight (*W*, in grams), corresponding to $W = i L^e$.

¹ Tergum length. Weight includes cirri. ² Aperture length. Weight includes cirri.

Table S3.4 continued.

Spagios	Total wet weight			Dry shell weight			Dry tissue weight		
Species	i	е	n	i	е	n	i	е	n
<i>Margarella</i> sp.	2.002 x 10 ⁻³	2.338	8	6.195 x 10 ⁻⁴	2.819	8	3.709 x 10 ⁻⁴	1.992	8
Montfortula chathamensis	1.932 x 10 ⁻⁴	3.009	5	8.050 x 10 ⁻⁵	3.056	5	4.429 x 10 ⁻⁴	1.633	5
Mytilus galloprovincialis	1.648 x 10 ⁻⁴	2.809	98	1.104 x 10 ⁻⁴	2.801	67	6.803 x 10 ⁻⁶	2.806	47
Notoacmea spp.	2.156 x 10 ⁻⁵	3.973	39	3.567 x 10 ⁻⁵	3.475	37	1.419 x 10 ⁻⁵	3.026	32
Notoacmea pileopsis	2.723 x 10 ⁻³	1.860	16	5.504 x 10 ⁻⁵	3.072	5	4.765 x 10 ⁻³	0.777	4
Onchidella nigricans	4.857 x 10 ⁻⁴	2.453	13	-	-	-	8.614 x 10 ⁻⁵	2.637	13
Onithochiton neglectus neglectus	1.951 x 10 ⁻⁴	2.726	40	2.973 x 10 ⁻⁴	2.218	40	2.915 x 10 ⁻⁵	2.385	37
Paratrophon patens	6.256 x 10 ⁻⁵	3.407	28	3.089 x 10 ⁻⁵	3.550	22	5.897 x 10 ⁻⁶	3.272	18
Patelloida corticata	5.579 x 10 ⁻⁵	3.283	112	4.708 x 10 ⁻⁵	3.160	78	4.542 x 10 ⁻⁶	3.267	45
Perna canaliculus	1.728 x 10 ⁻⁴	2.765	73	9.812 x 10 ⁻⁵	2.814	61	1.242 x 10 ⁻⁵	2.635	59
Plaxiphora caelata	4.737 x 10 ⁻⁵	3.239	27	8.785 x 10 ⁻⁵	2.633	20	2.571 x 10 ⁻⁵	2.334	13
Risellopsis varia ³	3.427 x 10 ⁻⁴	2.782	109	2.201 x 10 ⁻⁴	2.772	40	3.254 x 10 ⁻⁵	2.759	33
Siphonaria australis	1.533 x 10 ⁻⁴	2.792	85	9.705 x 10 ⁻⁵	2.732	85	8.363 x 10 ⁻⁶	3.036	52
Sypharochiton pelliserpentis	3.660 x 10 ⁻⁵	3.294	55	2.607 x 10 ⁻⁵	3.169	37	7.024 x 10 ⁻⁶	2.896	22
Trimusculus conicus	6.721 x 10 ⁻⁵	3.246	38	4.340 x 10 ⁻⁵	3.175	38	1.035 x 10 ⁻⁵	3.094	37
Turbo smaragdus	1.192 x 10 ⁻³	2.717	103	1.154 x 10 ⁻³	2.554	63	5.444 x 10 ⁻⁵	2.912	26
Xenostrobus pulex	1.188 x 10 ⁻⁴	2.855	98	1.032 x 10 ⁻⁴	2.766	73	1.636 x 10 ⁻⁵	2.454	59
Zeacumantus subcarinatus	3.948 x 10 ⁻⁴	2.385	147	1.895 x 10 ⁻²	0.454	4	5.126 x 10 ⁻⁵	1.834	29

³ Shell width

Table S3.5. The mean site-specific number of individuals contained in 1% of the area of a 0.25 m² quadrat as estimated by linear least squares regression ($y = 0 + \beta x$) between the number and percent-cover of individuals occupying randomly placed 0.0025 m² quadrats.

Species	Site	Count	SE	t-value	n	р
Aulacomya atra maoriana	Cape Foulwind	15.91	1.88	8.45	15	< 0.001
Aulacomya atra maoriana	Okahu Point	25.74	3.24	7.94	15	< 0.001
Aulacomya atra maoriana	Paia Point	27.10	1.79	15.16	15	< 0.001
Aulacomya atra maoriana	Rakautara	19.98	1.72	11.59	15	< 0.001
Aulacomya atra maoriana	Tauranga Head	7.74	0.88	8.79	15	< 0.001
Calantica spp	Cape Foulwind	10.41	0.92	11.37	15	< 0.001
Calantica spp	Jackson Head	7.37	1.07	6.92	15	< 0.001
Calantica spp	Okahu Point	9.58	0.44	21.69	15	< 0.001
Calantica spp	Paia Point	6.40	0.73	8.79	15	< 0.001
Calantica spp	Rakautara	8.58	0.53	16.16	15	< 0.001
Calantica spp	Tauranga Head	13.07	1.43	9.12	15	< 0.001
Chamaesipho brunnea	Paia Point	120.14	12.53	9.59	30	< 0.001
Chamaesipho brunnea	Rakautara	124.86	9.90	12.61	30	< 0.001
Chamaesipho columna	Cape Foulwind	313.97	8.82	35.61	40	< 0.001
Chamaesipho columna	Jackson Head	400.34	17.44	22.96	30	< 0.001
Chamaesipho columna	Okahu Point	375.08	8.53	43.98	30	< 0.001
Chamaesipho columna	Paia Point	348.31	15.33	22.71	30	< 0.001
Chamaesipho columna	Rakautara	322.85	22.22	14.53	30	< 0.001
Chamaesipho columna	Tauranga Head	418.50	19.72	21.22	40	< 0.001
Epopella plicata	Cape Foulwind	63.26	2.79	22.64	30	< 0.001
Epopella plicata	Jackson Head	51.04	4.59	11.13	30	< 0.001
Epopella plicata	Okahu Point	41.05	3.00	13.68	30	< 0.001
Epopella plicata	Paia Point	41.07	2.21	18.59	30	< 0.001
Epopella plicata	Rakautara	29.47	2.21	13.31	30	< 0.001
Epopella plicata	Tauranga Head	68.38	3.07	22.25	30	< 0.001
Lasaea rubra hinemoa	Paia Point	709.62	50.13	14.16	5	< 0.001
Mytilus galloprovincialis	Cape Foulwind	8.58	0.68	12.63	30	< 0.001
Mytilus galloprovincialis	Jackson Head	20.02	3.44	5.81	15	< 0.001
Mytilus galloprovincialis	Okahu Point	15.80	2.77	5.70	15	< 0.001
Mytilus galloprovincialis	Paia Point	11.57	1.93	6.01	15	< 0.001
Mytilus galloprovincialis	Rakautara	10.33	0.88	11.73	15	< 0.001
Mytilus galloprovincialis	Tauranga Head	9.06	0.48	18.94	30	< 0.001
Xenostrobus pulex	Cape Foulwind	66.15	3.12	21.19	49	< 0.001
Xenostrobus pulex	Jackson Head	100.93	8.94	11.28	30	< 0.001
Xenostrobus pulex	Okahu Point	145.55	16.37	8.89	30	< 0.001
Xenostrobus pulex	Paia Point	247.15	26.44	9.35	30	< 0.001
Xenostrobus pulex	Rakautara	171.57	13.78	12.45	30	< 0.001
Xenostrobus pulex	Tauranga Head	78.81	3.61	21.85	50	< 0.001

S3-9

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Site name	Abbreviation	Coast	Location
EPFS [*] Rocks	ER	East	42°24′55″ S, 173°41′50″ E
Lighthouse Reef	LR	East	42°25′26″ S, 173°43′01″ E
Intertunnel	IT	East	42°27′07″ S, 173°34′08″ E
EPFS [*] sea-table	ST	East	Open to natural recruitment
+ D 1 1 D	· 15:110	•	

Table S3.6. Locations of additional collection sites for handling time experiments and allometric relationships.

*Edward Percival Field Station

Table S3.7. Monthly mean site-specific temperatures (°C, air and water combined) with one standard deviation given in parentheses.

Month	Site							
WIUIII	PP	Rk	OP	JH	ТН	CF		
2005/07	-	-	-	-	12.2 (0.4)	12.2 (0.3)		
2005/08	12.7 (4.9)	13.8 (4.7)	-	-	12.1 (0.8)	12.2 (0.7)		
2005/09	10.5 (0.9)	10.7 (0.5)	-	-	13.0 (1.1)	12.9 (0.9)		
2005/10	12.0 (2.3)	11.9 (1.6)	-	-	13.9 (1.7)	13.7 (1.8)		
2005/11	14.5 (2.1)	14.3 (1.1)	-	-	14.9 (1.6)	14.4 (1.5)		
2005/12	15.6 (2.6)	15.5 (1.2)	-	-	17.2 (1.5)	16.9 (1.9)		
2006/01	16.4 (2.1)	16.2 (1.0)	-	-	15.3 (1.4)	14.8 (1.7)		
2006/02	16.3 (1.6)	16.5 (0.9)	13.1 (1.4)	16.4 (2.4)	16.2 (1.3)	15.7 (1.5)		
2006/03	15.1 (1.2)	15.4 (0.9)	13.9 (1.6)	12.3 (2.1)	15.0 (1.0)	14.8 (1.1)		
2006/04	14.2 (1.0)	14.9 (0.7)	15.4 (0.8)	13.7 (0.6)	16.1 (0.9)	16.1 (0.8)		
2006/05	12.4 (0.9)	12.8 (1.0)	14.5 (1.3)	12.9 (0.9)	14.9 (0.9)	15.0 (0.9)		
2006/06	10.2 (1.5)	10.7 (1.4)	13.0 (1.4)	11.4 (1.0)	13.0 (1.3)	13.5 (1.3)		
2006/07	9.2 (0.8)	9.5 (0.4)	12.1 (1.3)	10.4 (1.0)	12.0 (0.7)	12.2 (0.7)		
2006/08	8.9 (1.0)	9.2 (0.7)	11.7 (1.4)	10.1 (0.9)	11.9 (0.9)	12.0(1)		
2006/09	10.2 (1.7)	10.4 (1.0)	12.1 (0.9)	10.4 (0.8)	12.6 (0.7)	12.5 (0.7)		
2006/10	11.4 (1.9)	11.6 (0.8)	12.4 (1.2)	10.7 (0.9)	12.8 (0.9)	12.7 (0.9)		
2006/11	13.2 (1.7)	13.3 (1.2)	12.5 (1.3)	10.6 (1.2)	13.9 (1.3)	13.6 (1.7)		
2006/12	14.1 (1.9)	14.1 (1.3)	13.2 (1.3)	11.2 (1.0)	13.9 (1.4)	13.6 (1.7)		
2007/01	15.5 (2.3)	15.4 (1.3)	15.8 (1.4)	13.8 (1.2)	16.3 (1.5)	15.8 (1.7)		
2007/02	16.2 (2.4)	16.1 (1.5)	14.6 (2.0)	14.3 (2.0)	17.1 (1.5)	16.5 (1.8)		
2007/03	16.2 (2.3)	16.4 (1.4)	12.5 (1.7)	14.9 (1.7)	15.7 (1.8)	15.4 (2.2)		
2007/04	14.2 (1.5)	14.3 (1.1)	11.0 (1.4)	13.4 (1.4)	14.1 (1.0)	13.9 (1.1)		
2007/05	12.3 (1.0)	12.8 (0.6)	10.9 (0.9)	13.5 (1.0)	14.0 (0.6)	13.7 (0.6)		
2007/06	10.4 (1.0)	10.7 (0.9)	9.7 (1.3)	12.3 (1.6)	11.7 (1.4)	11.6 (1.4)		
2007/07	9.4 (1.5)	9.6 (1.4)	-	-	10.5 (1.4)	10.2 (1.7)		

As stated in the main text, the coexistence of all 5 species in an IGP module is feasible only when the IG-prey is the overall superior competitor. This superiority is achieved when the difference between the IG-prey's gains from feeding on its alternative prey and its total mortality losses (due to the omnivore, top-predators, and intrinsic mortality) is greater than the difference between the omnivore's gains from feeding (on both its alternative prey and the IG-prey) and its losses due to mortality, relative to their respective gains from feeding on the shared prey. This condition for coexistence may be shown as follows (Diehl & Feißel 2000; and Kondoh 2008 who use a more general notation without assuming a specific form of the two predator's functional responses; see also Polis & Holt 1992):

Let the population dynamics of the IG-prey (P) and the omnivore (O) be described by

$$\frac{dN_P}{dt} = N_P(e_P(f_{SP} + f_{AP}) - \frac{f_{PO}}{w_{PO}N_P}N_O - m_P)$$
(S4.1a)

and

$$\frac{dN_O}{dt} = N_O \left(e_O (f_{SO} + f_{AO} + f_{PO}) - m_P \right),$$
(S4.1b)

where N_j is predator *j*'s density, e_j its conversion rate, m_j its overall density-independent mortality rate, and w_{ij} the weight of the prey *i* individuals it consumes. The f_{ij} terms denote the feeding rate of predator *j* on prey group *i* – either shared prey (*S*) or each predator's alternative prey (*A*). In this study, feeding rates were estimated on the assumption of a multispecies type II functional response,

$$f_{ij} = \frac{w_i c_{ij} N_i}{1 + \sum c_{kj} h_{kj} N_k}$$

where the summation is over all *k* species consumed by the predator. Note that the $\frac{f_{PO}}{w_{PO}N_P}$ term of eqn. S4.1a converts the omnivore's feeding rate on the IG-prey (grams of IG-prey consumed per omnivore per day) to a per capita feeding rate (number of IG-prey consumed per omnivore per day per IG-prey individual in the population). Note that the formulation of the prey group's population dynamics is unnecessary for establishing the conditions of feasible coexistence (Polis & Holt 1992).

If all species in the 5-species IGP module are able to reach a non-trivial steady-state (be it stable or not) such that $dN_P/dt = dN_O/dt = 0$, then

$$e_P(f_{SP} + f_{AP}) = m_P + \frac{f_{PO}}{w_{PO}N_P}N_O$$
 (S4.2a)

and

$$e_O(f_{SO} + f_{AO}) = m_O - e_0 f_{PO}.$$
 (S4.2b)

The need for the IG-prey's overall competitive superiority (including both shared and alternative prey) is most apparent from eqns. S4.2 in the special case where $e_O = e_P$ and $m_O = m_P$ because it follows that $f_{SP} + f_{AP} > f_{SO} + f_{AO}$ (Kondoh 2008; Polis & Holt 1992).

More generally, if all species in the 5-species IGP module are able to reach a non-trivial steady-state equilibrium, then it must be that the solution for the abundance of the shared prey group from eqn. S4.1a is equal to the solution for its equilibrium abundance from eqn. S4.1b,

$$N_{S}^{*} = \frac{f_{AP}}{f_{SP}} - \frac{f_{PO}N_{O}}{e_{P}w_{PO}N_{P}f_{SP}} - \frac{m_{P}}{e_{P}f_{SP}} = \frac{f_{AO}}{f_{SO}} + \frac{f_{PO}}{f_{SO}} - \frac{m_{O}}{e_{O}f_{SO}}.$$
(S4.3)

Eqn. S4.3 reflects a point of competitive equality where the two predators are able to depress the abundance of the shared resource to the same level. The predator with the lower N_S^* is the overall superior competitor (Kondoh 2008). The $\frac{m_j}{e_j f_{Sj}}$ terms are equivalent to the R^* rule of Tilman (1982) for exploitative competition. The additional terms reflect the gains from alternative prey (f_{Aj}) and losses due to predation (f_{PO}) present in the 5-spp. module of intraguild predation. The necessity of the IG-prey's overall superiority for the coexistence of all 5 species follows from the observation that

$$\frac{f_{AP}}{f_{SP}} = \frac{m_P}{e_P f_{SP}} + \frac{f_{PO} N_O}{e_P w_{PO} N_P f_{SP}} > \frac{m_O}{e_O f_{SO}} - \frac{f_{PO}}{f_{SO}} = \frac{f_{AO}}{f_{SO}}$$
(S.4.4)

when $e_O = e_P$ and $m_O = m_P$. Thus, in rearranged form, the equation

$$\frac{f_{AP}}{f_{SP}} - \frac{f_{PO}N_O}{e_Pw_{PO}N_Pf_{SP}} - \frac{m_P}{e_Pf_{SP}} > \frac{f_{AO}}{f_{SO}} + \frac{f_{PO}}{f_{SO}} - \frac{m_O}{e_Of_{SO}},\tag{S4.5}$$

represents the line above which the IG-prey achieves overall competitive superiority, as given in the main text (eqn. 3).

Having obtained site-specific estimates for all but the conversion and mortality rates, I estimated these for the omnivore as follows: First, I used the allometric relationship general to invertebrates (McCoy & Gillooly 2008; 2009 with fixed slope intercepts) to infer annual mortality rates using each omnivore population's mean body mass. These were converted to a daily scale. Values were congruent with those estimated for the ecologically-equivalent *Nucella* spp. whelks of northern hemisphere rocky shores (William Tyburczy, pers. comm., Emlen 1966; Spight 1975). Assuming each omnivore population was at steady state ($dN_0/dt=0$), I then used eqn S4.1b to infer its site-specific conversion rates.

With all but the mortality and conversion rates of the IG-prey now specified, I reformulated eqn. S4.4 with the IG-prey's mortality and conversion rates specified in terms relative to those of omnivore ($m_P = m_O/\mu$ and $e_P = \epsilon \cdot e_O$) such that

$$\epsilon = \frac{f_{SO} \left(\mu f_{PO} N_O + m_O w_{PO} N_P\right)}{\mu \left(e_O \left(f_{A1P} f_{SO} - \left(f_{A2O} + f_{PO}\right) f_{SP}\right) + f_{SP} m_O\right) w_{PO} N_P},\tag{S4.5}$$

to produce the curves of Fig. 3 in the main text. The region above a given curve reflects a parameter space where the IG-prey is the overall superior competitor, while the region below the curve reflects a parameter space where the omnivore has the competitive advantage.

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