Supporting Information

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SI Text

Methods Assessing Potential Confounding Factors. Enclosing fishes inside cages and constraining their feeding choices potentially could have altered their normal diet selection. Thus, we compared feeding on macroalgae by caged fishes (Table 1) vs. free-ranging fishes. To determine how free-ranging herbivorous fishes fed on the macroalgae that were used in feeding assays inside the enclosures, we placed portions of the *Dictyota menstrualis*, *Lobophora variegata*, *Halimeda tuna*, *Sargassum fillipendula*, *Kallymenia westii*, *Haloplegma duperryi*, and *Codium taylori* on the open reef and videotaped fish feeding. Portions of each species were entwined into three-stranded polypropylene ropes (one species per rope) and placed in front of video cameras on natural portions of the reef. In one corner of a 0.25 m^2 area of reef, four ropes of a single macroalgal species were affixed to the reef with small nails to prevent fishes from displacing the ropes during feeding. This process was repeated three times so that four species of macroalgae could be included in a 0.25 m^2 area of reef. These areas were then videotaped using a super hi-8 video camera that was mounted on a tripod. Each replicate (n = 3) was taped for 1.25–2 h. The videotapes subsequently were scored as to which species of fish visited the 0.25 m^2 area and how many bites each fish took from each macroalgal species per visit.

If caged fish weighed more or less per unit length than free-roaming fish, it would suggest that caging altered their food intake, potentially biasing our results. Additionally, if the enclosed fishes differed significantly in mass, then identity effects could be confounded by herbivore mass rather than identity. We determined weight:length ratios for caged redband parrotfish and ocean surgeonfish at the end of year 1 by measuring the standard length and wet mass of each fish. These data were compared with the ratios for free-ranging fishes using t tests. Hurricane Dennis prevented evaluation of weight:length ratio of enclosed fishes at the end of the year 2 experiment, so we measured the weight of free-ranging redband and princess parrotfish in the size class we used to determine if treatments were potentially confounded by biomass.

Differences in intra- vs. interspecific interactions between the enclosed fishes could also have biased our results. To determine whether conspecifics were feeding more or less in single-species vs. mixed-species treatments, we measured bite rates of enclosed fishes. We monitored feeding rates by hovering 3–4 m above each replicate and counting the bites each fish took during 10 min. The counts were performed simultaneously for each block of treatments in June 2004 for year 1 and May 2005 for year 2. t tests compared the bite rates of individuals in the single- and mixed-species treatments. To determine whether caging altered the feeding rate of enclosed fishes, we compared bites rates of enclosed and free-ranging fishes. We quantified bite rates for free-ranging fish by haphazardly selecting an adult of the target species and following that fish for five minutes (after a 3 min period allowing the fish to acclimate to the diver), counting the number of bites taken from the benthos.

We also compared bite rates on natural areas of Conch Reef to determine how bite rates within our treatments compared to natural rates. We delineated ≈4 m^2 areas on the benthos, using benthic characteristics such as coral heads or sponges, visually similar in rugosity and benthic community structure to areas enclosed within cages. Then, a diver hovered 3–4 m above the area for 5 min allowing fishes to acclimate to the diver's presence. After the acclimation period, the diver counted bites by adult herbivorous fishes within the demarcated area over a 10 min span. This process was repeated for $n = 16 \times 4$ m^2 areas. All counts were made between 1,100 and 1,500 h. Bite rates within each treatment were determined as described above.

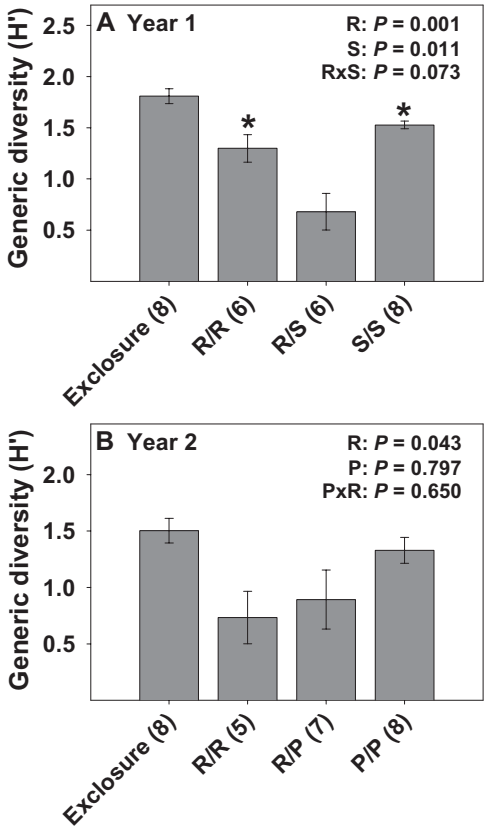

Fig. S1. Generic diversity of upright macroalgae at the end of each experiment for (*A*) year 1 and (*B*) year 2 (mean ± SE) as calculated with the Shannon–Wiener index (H′). *P* values are from two-factor ANOVA. Asterisk notes difference from mixed-species treatment as evaluated with resampling statistics at $P = 0.025$. P = princess parrotfish, R = redband parrotfish, S = ocean surgeonfish. *n* for each treatment is designated in brackets next to each treatment label on the *x* axis.

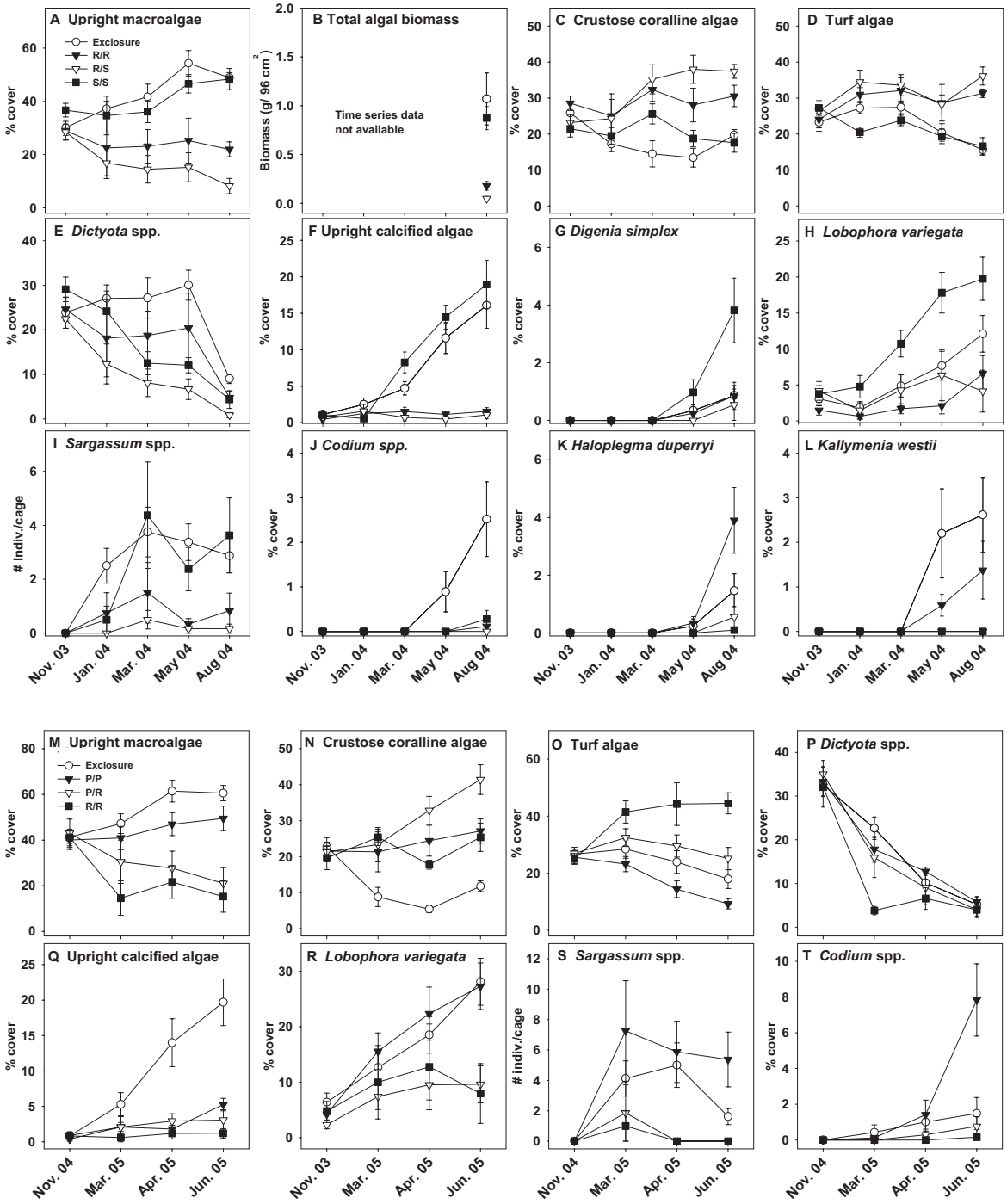

Fig. S2. Year 1% cover, biomass, or density for (*A*) total upright macroalgae, (*B*) total algal biomass and (C-L) macroalgal species or groups (mean ± SE). R = redband parrotfish, S = ocean surgeonfish. Year 2% cover or density for (M) total upright macroalgae and (N-T) macroalgal species or groups (mean ± SE). P = princess parrotfish, R = redband parrotfish. Note different scales for Y-axes.

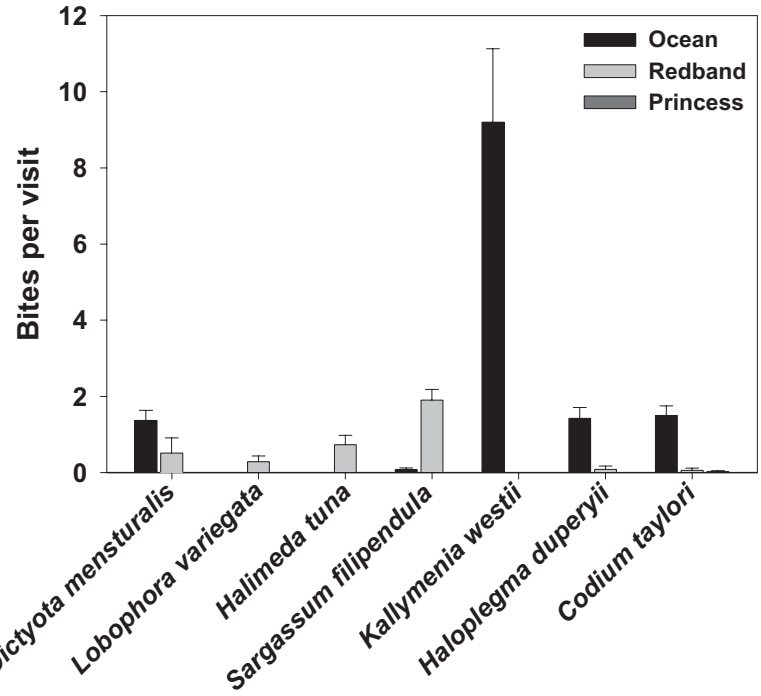

Fig. S3. Bites per visit (mean ± SE) for free-ranging ocean surgeonfish, redband parrotfish, and princess parrotfish on seven species of macroalgae from videotaped feeding assays on open areas of reef.

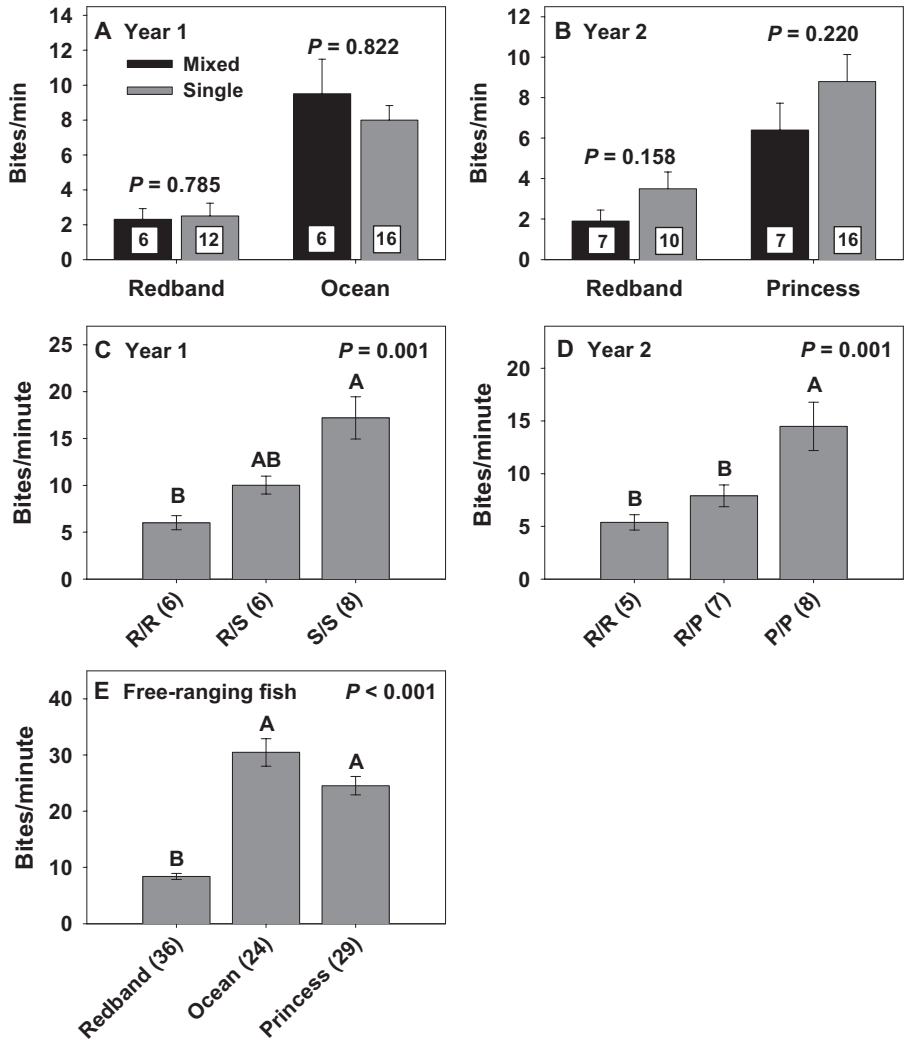

Fig. S4. Comparisons of bite rates (mean ± SE) between fishes in mixed- vs. single-species cages from (*A*) year 1 and (*B*) year 2. *P* values are from *t* tests testing for differences between fishes in mixed- vs. single-species cages. *Inset* boxes give sample size for each bar. *C* and *D* give bite rates for fishes inside of the treatments. Bite rates inside treatments for year 1 and 2 (*C* and *D*, respectively) denote the combined rate for both fishes inside each treatment type. Bite rates for free-ranging fishes (*E*) of each test species were acquired at the same time period as for that fish species in the cages. P = princess parrotfish, R = redband parrotfish, S = ocean surgeonfish. *n* for each treatment is designated in brackets next to each treatment label on the *x* axis. *P* values are from one-way ANOVA. Letters designate significant groupings according to Tukey's multiple comparison test.

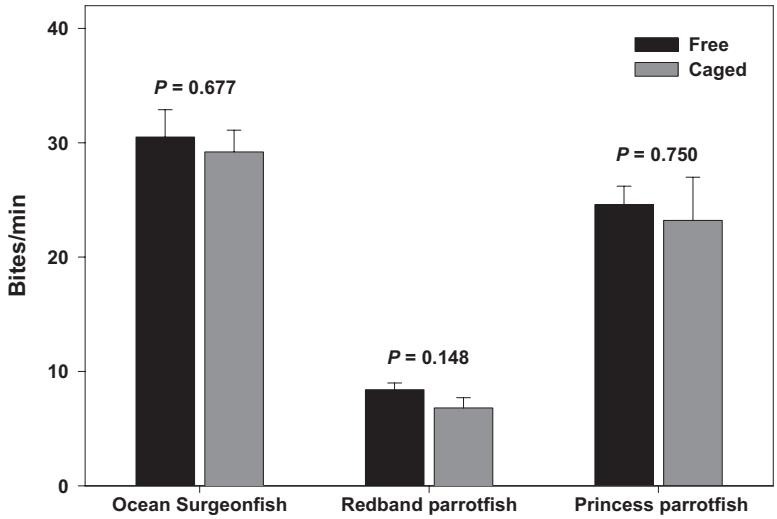

Fig. S5. Total bite rates (mean ± SE) for free vs. caged individuals for each herbivore species used in the study. Bite rates for caged and free-ranging fishes include bites from the benthos and from the cage surface. *P* values are from two-sample *t* tests comparing rates for free vs. caged fishes for each species.

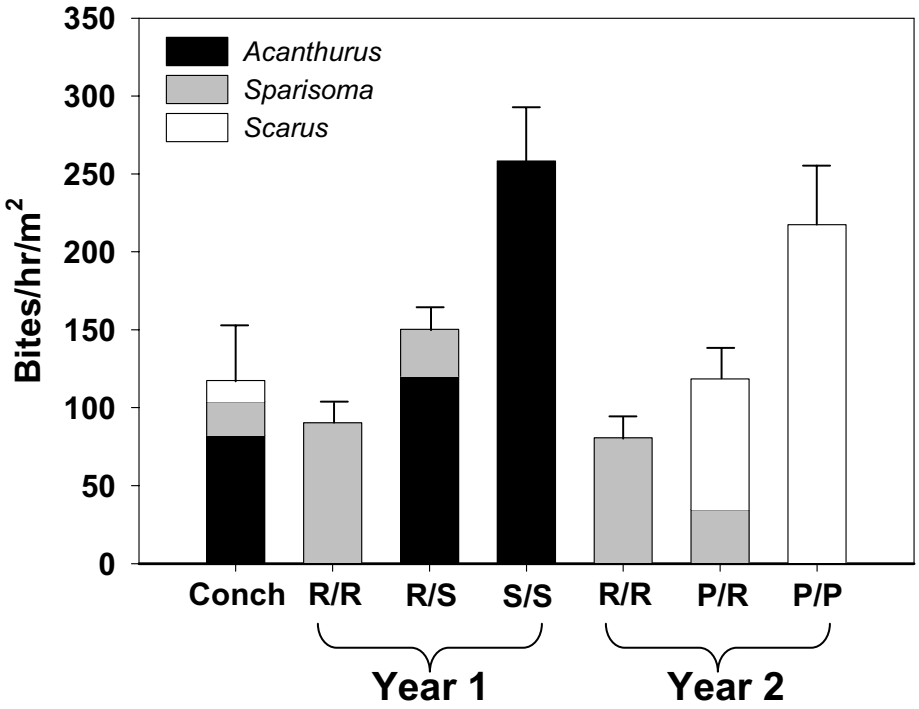

Fig. S6. Grazing rates (bites/hr/m^2) for treatments in both year 1 and year 2 as compared with natural rates on Conch Reef. Error bars are for overall rates only and represent standard error. R = redband parrotfish (*Sparisoma aurofrenatum*), S = Ocean surgeonfish (*Acanthurus bahianus*), P = princess parrotfish (*Scarus taeniopterus*).

Table S1. Timing of replacement of missing fish in treatments for years 1 and 2

Year 1		Date of replacement and fish replaced									
Treat.	Rep.	12/13/03	1/10/04	2/12/04	3/12/04	4/16/04	5/8/04	6/2/04	7/3/04	8/10/04	Time w/full treatment, %
R/R	1	R			R						77.8
R/R	2							R			88.9
R/R	3	R		R (2)	R						66.7
R/R	4		R	R							77.8
R/R	5	R (2)					R				77.8
R/R	6	R (2)	R (2)								77.8
R/S	1	R									88.9
R/S	2				S						88.9
R/S	3	R			S						77.8
R/S	4	R	R					R			66.7
R/S	5	R + S		R		S					66.7
R/S	6							R + S			88.9
S/S	1	S (2)				S		S			66.7
S/S	2						S (2)				88.9
S/S	3		S	S							77.8
S/S	4										100
S/S	5				S						88.9
S/S	6										100
S/S	7					S (2)					88.9
S/S	8			S	S						77.8
Year 2		12/13/04	1/25/05	3/5/05	4/25/04	5/23/05	6/13/05				
R/R	1	R (2)									83.3
R/R	2	R			R						66.7
R/R	3	R (2)	R (2)								66.7
R/R	4	R	R								66.7
R/R	5			R							83.3
R/P	1	R + P	R + P								66.7
R/P	2	R	P								66.7
R/P	3	R									83.3
R/P	4	R + P									83.3
R/P	5	R + P	R + P								66.7
R/P	6	R + P	P								66.7
R/P	7	P	P								66.7
P/P	1	P (2)		P							66.7
P/P	2	P	P (2)								66.7
P/P	3	P									83.3
P/P	4										100
P/P	5	P (2)	P (2)								66.7
P/P	6	P	P								66.7
P/P	7	P (2)									83.3
P/P	8	P (2)		P							66.7

Year 1 treatments initiated November 18, 2003. Year 2 treatments initiated November 17, 2004. Treat. = treatment; Rep = replicate, R = redband parrotfish, S = ocean surgeonfish, P = princess parrotfish.

Table S2. Results of two-factor ANOVAs assessing differences in macroalgal cover before treatments were applied at the beginning of years 1 and 2

Year	*Dictyota* spp.		*Lobophora variegata*		Upright coralline algae		Turf algae		Crustose coralline algae		Upright macroalgae	
Year 1												
Treatment	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Redband	0.98	0.332	0.28	0.604	0.96	0.337	0.01	0.973	0.81	0.378	2.51	0.125
Surgeon	0.26	0.614	2.45	0.131	0.09	0.770	1.96	0.175	3.90	0.060	1.06	0.314
RxS	1.58	0.222	0.86	0.363	0.19	0.664	0.14	0.708	0.04	0.842	1.45	0.240
Year 2												
Treatment	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Redband	0.17	0.679	0.90	0.350	1.30	0.264	0.31	0.581	0.09	0.766	0.36	0.552
Princess	0.20	0.660	3.25	0.082	0.06	0.808	0.36	0.552	0.06	0.803	0.09	0.761
PxR	0.05	0.831	0.96	0.337	0.02	0.893	1.49	0.232	0.07	0.787	0.01	0.991

Table S3. Results of two-factor ANOVA assessing differences in coral colony abundance (individuals/replicate) or coral colony size before treatments were applied at the beginning of year 1

Treatment	df	Seq SS	Adj MS	*F*	*P*
Coral colony abundance					
Redband	1	1.714	1.714	0.37	0.547
Surgeon	1	10.321	10.714	2.33	0.140
RxS	1	0.429	0.429	0.09	0.763
Error	24	110.500	4.604		
Total	27	122.964			
Coral colony size					
Redband	1	0.0052	0.0052	0.07	0.792
Surgeon	1	0.0500	0.0663	0.90	0.353
RxS	1	0.0641	0.0641	0.87	0.361
Error	24	1.7709	0.0738		
Total	27	1.8902			