VIII. Marine Debris

Background

Fishing constitutes one of the most significant threats to marine biodiversity and ecosystem function, as evidenced by a significant body of information on the numerous impacts to populations, community structure, and habitats (Dayton et al. 1995; Roberts 1995; Jennings and Polunin 1996). Besides the more obvious effects on the population structure of targeted species, fishing activities may also reduce the structural complexity of habitats or cause corresponding changes in ecological processes such as competition and predation (Russ 1991; Jones and Syms 1998; Auster and Langton 1999). These patterns are most obvious in areas where explosives, poisons, or other destructive fishing methods are used (Hatcher et al. 1989). However, ecological effects may occur in areas where traps, mobile fishing gear such as trawls, and potentially, even large numbers of recreational fishers operate (Russ 1991; Jennings and Lock 1996).

The Florida Keys have a long history of commercial and recreational fisheries that target a great diversity of fish and invertebrate species using a multitude of gears (Tilmant 1989; Bohnsack et al. 1994). In terms of volume of seafood landed, the Florida Keys is the most important area in the State of Florida in landings, dockside value, and numbers of commercial fishing vessels, especially for highly valued invertebrate fisheries represented by pink shrimp, stone crab, and spiny lobster (Adams 1992). There are also significant, but largely undocumented effects of tens of thousands of recreational fishers, who target hundreds of species using mostly hook-and-line and spear guns (Davis 1977; Bohnsack et al. 1994).

Baseline data on marine debris and the biological impacts to coral reef benthic organisms were collected by our program during 2000, 2001, and 2008 (Chiappone et al. 2002c, 2004, 2005). Earlier surveys consisted of quantitative surveys of debris at 45 sites in the lower Keys from inshore to offshore during 2000, followed by surveys of 63 platform margin sites Keys-wide in 2001. These initial efforts addressed several questions pertaining to marine debris and its impacts to benthic organisms. First, what is the spatial extent and frequency of remnant fishing gear at multiple spatial scales in the Florida Keys? Second, what factors, such as habitat type (depth) or management regime (closed or open to fishing) affect the spatial variability of marine debris occurrence? Third, what are the biological impacts of marine debris, especially from remnant commercial and recreational fishing gear, on reef biota such as hard corals and sponges? As a follow-up to these initial surveys, a major effort was expended during 2008 to document the different debris types, length (where applicable), weight, and impacts to benthic coral reef organisms (e.g. abrasion damage) at 145 sites partitioned by habitat type, regional sector, and management zone from northern Key Largo to SW of Key West. To our knowledge, these data represent

the most comprehensive site-level assessment of marine debris and its corresponding impacts in the Florida Keys. These data demonstrate the ubiquitous and damaging characteristics of marine debris, particularly derelict fishing gear, even within "protected" no-fishing zones in the Sanctuary. In 2010, we were able to incorporate marine debris surveys in our upper Keys sampling design to document the frequency of occurrence and biological impacts of marine debris encountered in the course of belt transect surveys for other benthic variables. Although logistics prevented us from retrieving much of the debris encountered, we were able to continue to build a temporal record of occurrence and impacts to benthic coral reef organisms.

2010 Survey Results

At the 120 upper Florida Keys sites sampled during 2010, four belt transects 15-m x 1-m in dimension were used to quantify the type, transect frequency of occurrence, density, and impacts (debris causing tissue abrasion) of marine debris to benthic coral reef organisms. In contrast to previous years, logistics prevented us from measuring and weighing the debris recovered from the seabed. Figure 8-1 illustrates examples of marine debris encountered. From surveys of 480 belt transects comprising 7,200 m^2 of hard-bottom and coral reef habitat, a total of 218 marine debris items were encountered, representing 28 different items or combinations of items (Table 8-1). Of these 28 different debris types, ten categories (36%) were clearly hook-and-line angling gear, five (18%) were lost lobster/crab trap gear, and the remaining 13 categories (46%) were designated as "other". Other marine debris included a range of metal, cloth, ceramic, and plastic items. Of the 218 total debris items counted, 149 (68%) were hook-and-line gear (monofilament, wire leaders, hooks, lead sinkers, etc.), followed by 43 trap debris items (20%), and other debris (26 items, 12%) (Table 8-1).

The debris items encountered caused abrasion damage (tissue loss) to 118 different coral reef benthic organisms, represented by *Millepora* and scleractinian corals, gorgonians, sponges, and the colonial zoanthid *Palythoa* (Table 8-1). Lost hook-and-line gear caused impacts to 72 different organisms (61%), followed by trap debris (37 impacted organisms, 31%) and other debris (9 impacted organisms, 8%). Similar to previous years, the data indicate that while lost hook-and-line fishing gear was the most prevalent in the habitats surveyed, the impact of lost lobster/crab trap debris was proportionally larger than for hook-and-line and other debris types, especially entangled rope from lost traps. The most frequently impacted organisms from marine debris were gorgonians (44% of the total impacts) and milleporid hydrocorals (26%), followed by scleractinian corals (16%), sponges (12%), and the colonial zoanthid *Palythoa* (2%). The summary below highlight aspects of the two dominant debris types, lost

hook-and-line fishing gear and lobster/crab trap gear, found in the upper Florida Keys study area in terms of the transect frequency of occurrence and mean density of debris items.

Lost Hook-and-line Gear

Hook-and-line gear was the most frequent type of marine debris in the upper Florida Keys during 2010 in terms of the number of sites (58 sites, 48% of all sites) and number of items encountered (149 items, 68% of total) (Table 8-2). Figures 8-2 to 8-4 show the spatial distribution of lost hook-and-line fishing gear density (no. items per 60 m^2) throughout the upper Florida Keys study area. Figures 8-5 and 8-6 illustrate the mean densities of lost hook-and-line debris for each of the habitats sampled. The distribution of hook-and-line debris indicates that it is ubiquitous throughout the study area in the habitats sampled, similar to previous years. Site-level mean (± 1 SE) densities of hook-and-line debris were as high as 15 items per 60 m^2 (Table 8-2). Hook-and-line debris was recovered from 58 out of the 120 sites (48%) and, with the exception of back-reef rubble zones, in all other habitats as follows: mid-channel patch reefs (11 sites, 52%), offshore patch reefs, (8 sites, 47%), shallow (< 6 m) hard-bottom (9 sites, 75%), high-relief spur and groove (13 sites, 54%), and the deeper (6-15 m) fore reef (17 sites, 50%). Differences in the mean transect frequency of occurrence and mean density (no. items per 60 m^2) of lost hook-and-line gear were evident among the habitats sampled. Mid-channel patch reefs (26% ± 7% of transects, 2.19 ± 0.82 items per 60 m^2), shallow (< 6 m) hard-bottom (27% ± 8%, 1.92 ± 0.75 items per 60 m^2), and high-relief spur and groove (24% ± 6%, 1.25 ± 0.35 items per 60 m^2) yielded the greatest transect frequency of occurrence and density of lost hook-and-line fishing gear, followed by offshore patch reefs (19% ± 6%, 1.18 ± 0.54 items per 60 m^2) and deeper (6-15 m) fore-reef habitats (18% ± 4%, 0.88 ± 0.19 items per 60 m^2).

Figures 8-5 and 8-6 provide comparisons of lost hook-and-line gear densities between no-take zones and reference areas for each habitat type sampled. The frequency of occurrence and mean density of lost hook-and-line gear was either similar or greater in FKNMS no-take zones compared to reference areas for mid-channel patch reefs, shallow hard-bottom, and the deeper fore-reef. Particularly noteworthy was the relatively high densities of hook-and-line debris documented at Hen and Chickens SPA, Davis Reef SPA, Conch Reef SPA, and Conch Reef RO (Figures 8-5 and 8-6). In contrast, lost hook-and-line gear frequencies and densities were lower on offshore patch reefs and high-relief spur and groove reefs within no-take zones compared to reference areas; however, debris was still recorded from most of the no-take zones, especially on high-relief spur and groove reefs (Table 8-2). On mid-channel patch reefs, mean ± 1 SE transect frequency of occurrence (75% ± 0%) and density (9.00 ± 6.00 items per 60 m^2) were substantially greater at two sites sampled within Hen and Chickens SPA compared to 19 reference patch reefs (21% ± 6%, 1.47 ± 0.56 items per 60 m^2) sampled from Tavernier Rocks to west of Turtle Shoal

(Table 8-2). On shallow hard-bottom sites, mean transect frequency of occurrence (30% ± 5%) and density (2.00 ± 0.77 items per 60 m^2) among five sites within Davis Reef SPA and Conch Reef SPA were slightly greater than at seven reference sites (25% ± 13% frequency of occurrence, 1.86 ± 1.22 items per 60 m^2) from Crocker Reef to Dixie Shoal. A similar pattern was observed on deeper (6-15 m) fore-reef habitats, where the mean transect frequency of occurrence and density (19% ± 7%, 0.83 ± 0.34 items per 60 m^2) at 12 sites within no-take zones at Davis Reef SPA, Conch Reef SPA and RO, and Carysfort/S. Carysfort SPA was similar to the average from 22 reference sites (17% ± 4%, 0.91 ± 0.23 items per 60 m^2) distributed from Crocker Reef to north of Carysfort Light.

Lost Lobster/Crab Trap Debris

Debris from lost lobster/crab trap fishing gear was the second most abundant debris category encountered in terms of the number of sites (22 sites, 18% of all sites) and items encountered (43 items, 20% of total) (Table 8-2). Figures 8-7 to 8-9 show the spatial distribution of trap debris density (no. items per 60 m^2) throughout the upper Florida Keys study area, while figures 8-10 and 8-11 illustrate mean densities of trap debris for each of the habitats sampled. Trap debris was recorded from all of the habitats sampled: mid-channel patch reefs (5 sites, 33%), offshore patch reefs, (6 sites, 35%), back-reef rubble (1 site, 8%), shallow (< 6 m) hard-bottom (4 sites, 33%), high-relief spur and groove (1 site, 4%), and the deeper (6-15 m) fore reef (5 sites, 15%). Site-level mean (± 1 SE) densities were as high as 5 items per 60 m^2 (Table 8-2). Differences in the mean transect frequency of occurrence and mean density (no. items per 60 m^2) of trap debris were evident among the habitats sampled. Transect frequency of occurrence and mean density were greatest on mid-channel patch reefs (14% ± 6%, 0.76 ± 0.34 items per 60 m^2) and offshore patch reefs (16% ± 6%, 0.71 ± 0.27 items per 60 m^2) compared to other habitats (Table 8-2).

Figures 8-10 and 8-11 provide comparisons of trap debris densities between no-take zones and reference areas for each habitat sampled. The frequency of occurrence and mean density of lost trap gear was either similar or higher in FKNMS no-take zones compared to reference areas for mid-channel and offshore patch reefs compared to reference areas (Table 8-2). Particularly noteworthy is the relatively high density of trap debris at Hen and Chickens SPA (Table 8-2). On mid-channel patch reefs, mean ± 1 SE transect frequency of occurrence (25% ± 25%) and density (2.50 ± 2.50 items per 60 m^2) were substantially greater at two sites sampled within Hen and Chickens SPA compared to 19 reference patch reefs (13% ± 6%, 0.58 ± 0.29 items per 60 m^2) sampled from Tavernier Rocks to west of Turtle Shoal (Table 8-2). On offshore patch reefs, mean transect frequency of occurrence (13% ± 13%) and density (0.50 ± 0.50 items per 60 m^2) at two sites within Carysfort/S. Carysfort SPA were similar to 15 reference sites (17% ± 7% frequency of occurrence, 0.73 ± 0.30 items per 60 m^2) distributed from Conch Reef to Carysfort Light.

Other Marine Debris

Other debris items encountered in the upper Florida Keys during 2010 are listed in Table 8-1. A total of 26 items represented by 13 types of "other" debris were found, of which glass bottles, plastic bags, and ree-bar stakes combined (13 items) represented 50% of the items. Mean site-level densities of other debris were as high as 3 items per 60 m^2, with mid-channel patch reefs yielding greater densities compared to other habitats (Table 8-3).

Total Marine Debris

The 218 total occurrences of marine debris documented in 480 belt transects (15-m x 1-m in dimension) represents an overall mean density of 1.82 items per m^2. The maximum site-level density was 20 items per m^2 (Table 8-3). One or more debris items were recovered from belt transect surveys at 76 sites (63%), distributed among all of the habitats surveyed. Figures 8-12 to 8-14 show the spatial distribution of total debris density (no. items per 60 m^2) throughout the upper Florida Keys study area, while Figures 8-15 and 8-16 illustrate the mean densities of total debris for each of the habitats sampled. Mid-channel patch reefs (43% ± 8% of transects, 3.33 ± 1.03 items per 60 m^2), shallow (< 6 m) hard-bottom (40% ± 9%, 2.67 ± 0.86 items per 60 m^2), and offshore patch reefs (34% ± 8%, 2.06 ± 0.60 items per 60 m^2) yielded the greatest transect frequency of occurrence and density of marine debris. Figures 8-15 and 8-16 illustrate total marine debris densities between no-take zones and reference areas for each of the habitats sampled. The frequency of occurrence and mean density of total marine debris was either similar or greater in FKNMS no-take zones compared to reference areas for mid-channel patch reefs and the deeper fore-reef, while lower overall values in no-take zones were recorded for other habitats.

Discussion

Methods of fishing that cause habitat modification or damage to benthic organisms represent serious consequences of fishing (Russ 1991; Benaka 1999). Although there is increasing recognition of the consequences to benthic habitats from the use of mobile fishing gear (Watling and Norse 1998; Auster and Langton 1999) and other destructive fishing practices (Saila et al. 1993; Jennings and Polunin 1996), only a handful of studies in the Florida Keys have quantified the spatial extent of marine debris, as well as the biological impacts to organisms and habitats (Chiappone et al. 2002c, 2004, 2005). Recent investigations of lobster trap movement (e.g. T. Matthews et al. at FWRI) indicate the potential for extensive movement of deployed gear, especially during storms. Similar to debris surveys completed by our program in 2000, 2001, and 2008, the results from 2010 indicate the persistence of marine debris, especially lost fishing gear, even within Sanctuary no-fishing zones.

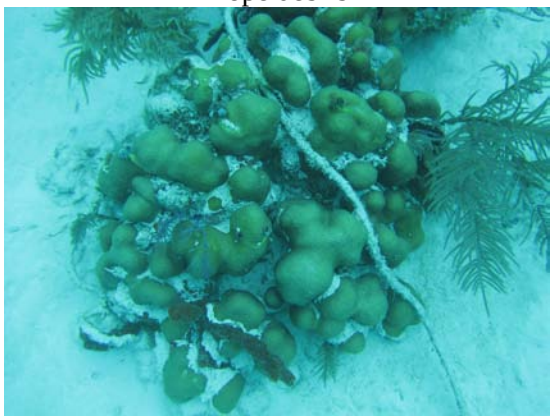
Interpretation of the biological impact data is complicated by several factors. Both the debris density and the distribution of sessile invertebrates sampled in this study are related to habitat type, and secondarily by management type. Future efforts need to consider the scaling of debris occurrence with impacts relative to these two factors. For example, it is probable that a coral-dominated reef with a given amount of hook-and-line gear will not be affected in the same way as a gorgonian-sponge dominated reef with the same density of gear. Estimates of the proportion of different taxa impacted by debris relative to total abundance estimates are also useful for placing the debris impact assessment into context. In addition, the long-term impacts to biota and the degree of recovery are unknown. For example, we continue to document instances where debris is overgrown by invertebrates, and it seems plausible that some debris will be incorporated into the habitat matrix. We also recognize that the future biological assessments would be more useful if data on the severity of each impact (e.g. amount of tissue damage) relative to the size of the organism were collected. We suggest that future debris surveys in the Florida Keys should compare debris densities between no-fishing zones and reference areas, as well as the impacts to sessile biota and whether fishing gear is relatively recent or biologically fouled. The site-level data presented in this report clearly indicate areas in the Florida Keys, including reefs heavily visited by divers and snorkelers, where public debris collection efforts such as "reef sweeps" should be focused.

Considering the intensive fishing effort and the significant increases in registered recreational boats and angler days in the Florida Keys (Bohnsack et al. 1994), patterns in the distribution and frequency of marine debris recorded during this study, especially derelict fishing gear, are not surprising. Marine debris documented in 2010, most of which was derelict fishing gear, was more or less proportional to the sampling effort, similar to previous surveys in 2000 (Chiappone et al. 2002c), 2001 (Chiappone et al. 2004), and 2008 (http://people.uncw.edu/millers). We generally found either similar or greater amounts of debris, especially lost fishing gear, in no-fishing zones compared to reference areas open to fishing for many of the habitats sampled. Non-compliance certainly occurs in Sanctuary no-fishing zones and it is common to find "fresh" (un-fouled) hook-and-line gear in the no-take zones. The no-take zones may attract fishers to fish illegally or to fish close to the zone boundaries, otherwise known as "fishing the line". Storms also re-distribute debris from areas where it is initially lost into adjacent areas, including coral reefs, suggesting the need for either less mobile gear types or for buffer areas to protect neighboring areas from physical damage.

Figure 8-1. Examples of marine debris encountered in the upper Florida Keys National Marine Sanctuary during June-August 2010.

Monofilament

Rope debris



Rope debris

Rope debris

Trap

Grating

Figure 8-2. Densities (no. items per 60 m^2) of lost hook-and-line fishing gear in the upper Florida Keys National Marine Sanctuary from the southern BNP boundary to Carysfort/S. Carysfort SPA surveyed during June-August 2010.

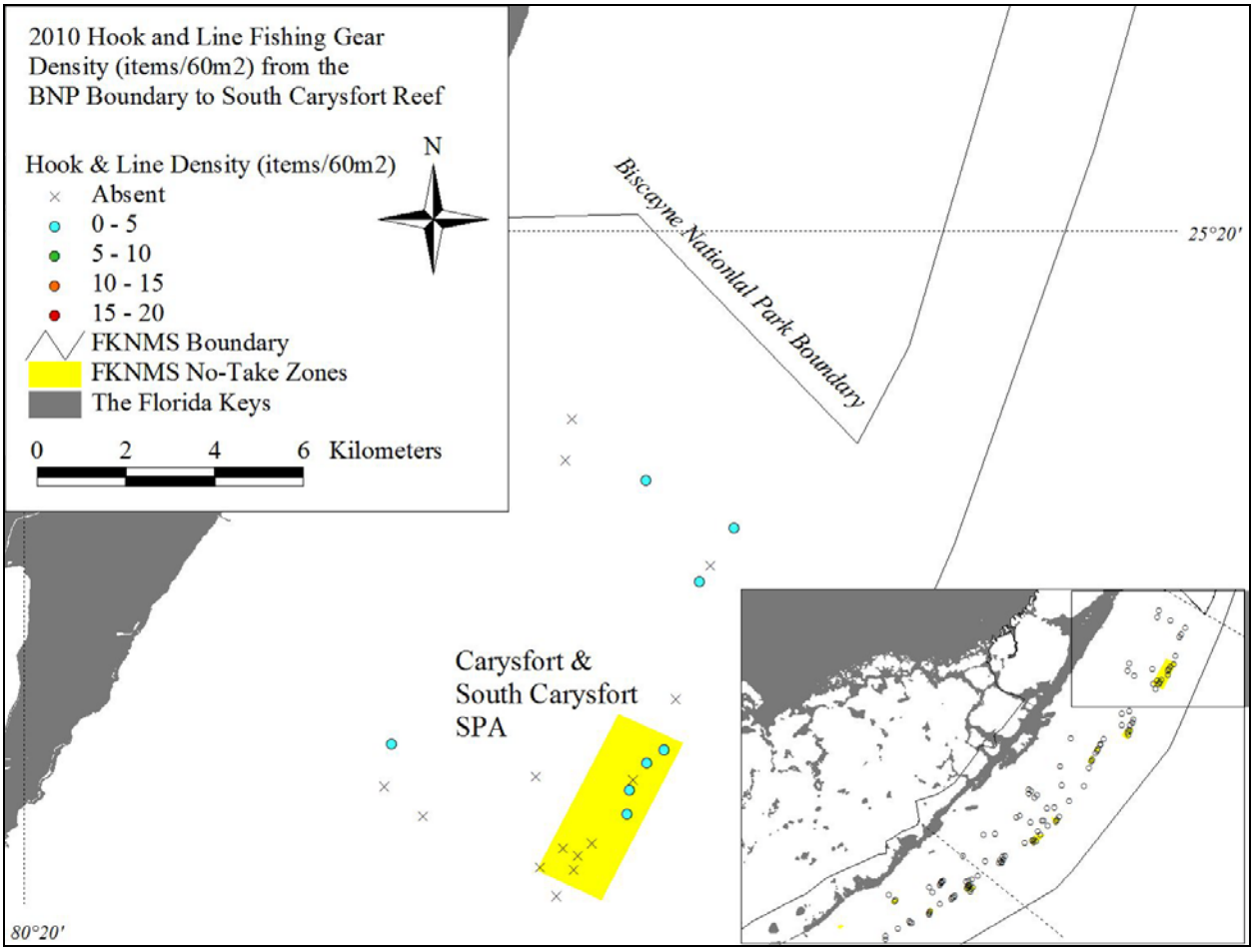


Figure 8-3. Densities (no. items per 60 m^2) of lost hook-and-line fishing gear in the upper Florida Keys National Marine Sanctuary from Elbow Reef to Pickles Reef (bottom) surveyed during June-August 2010.

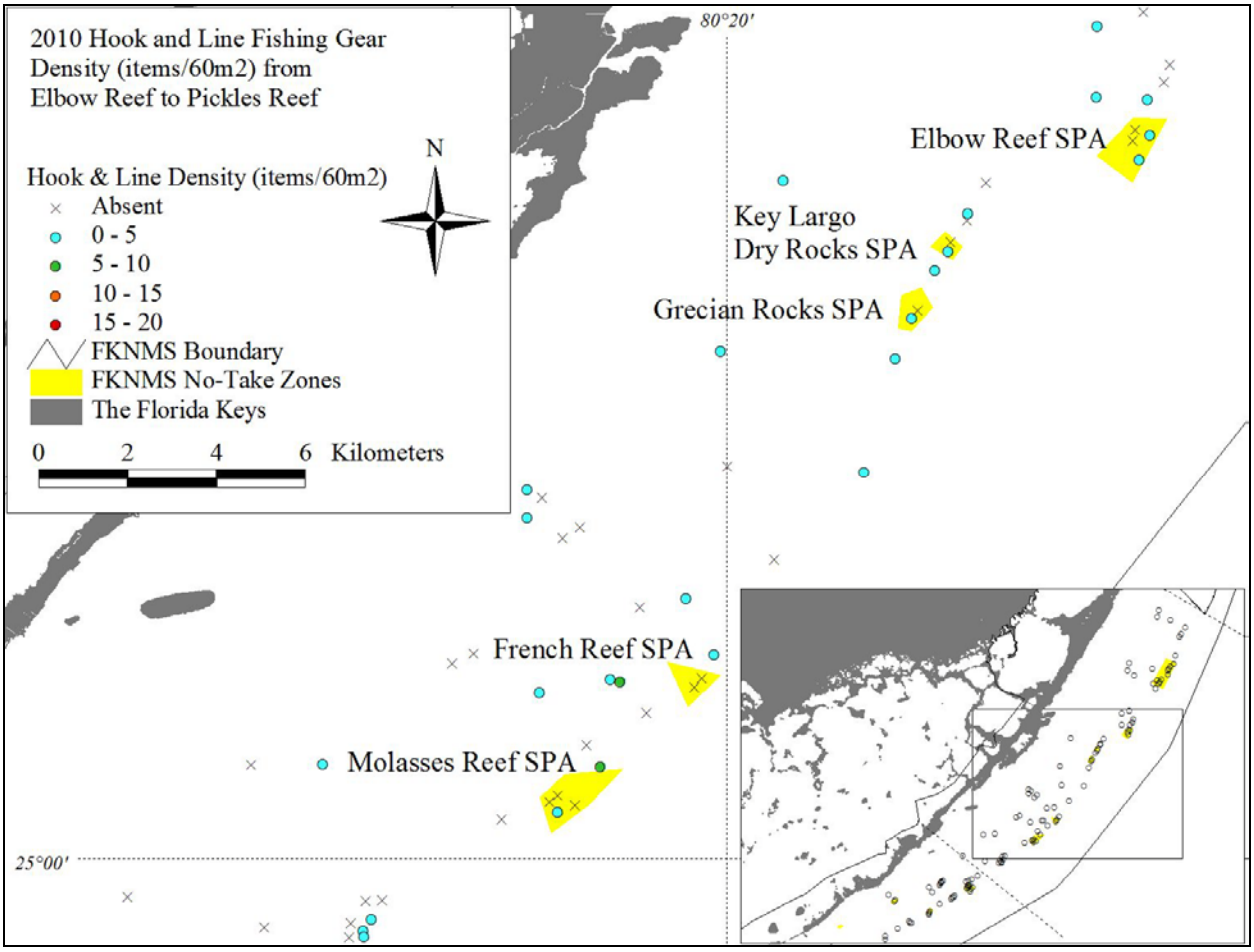


Figure 8-4. Densities (no. items per 60 m^2) of lost hook-and-line fishing gear in the upper Florida Keys National Marine Sanctuary from Conch Reef SPA to Crocker Reef surveyed during June-August 2010.

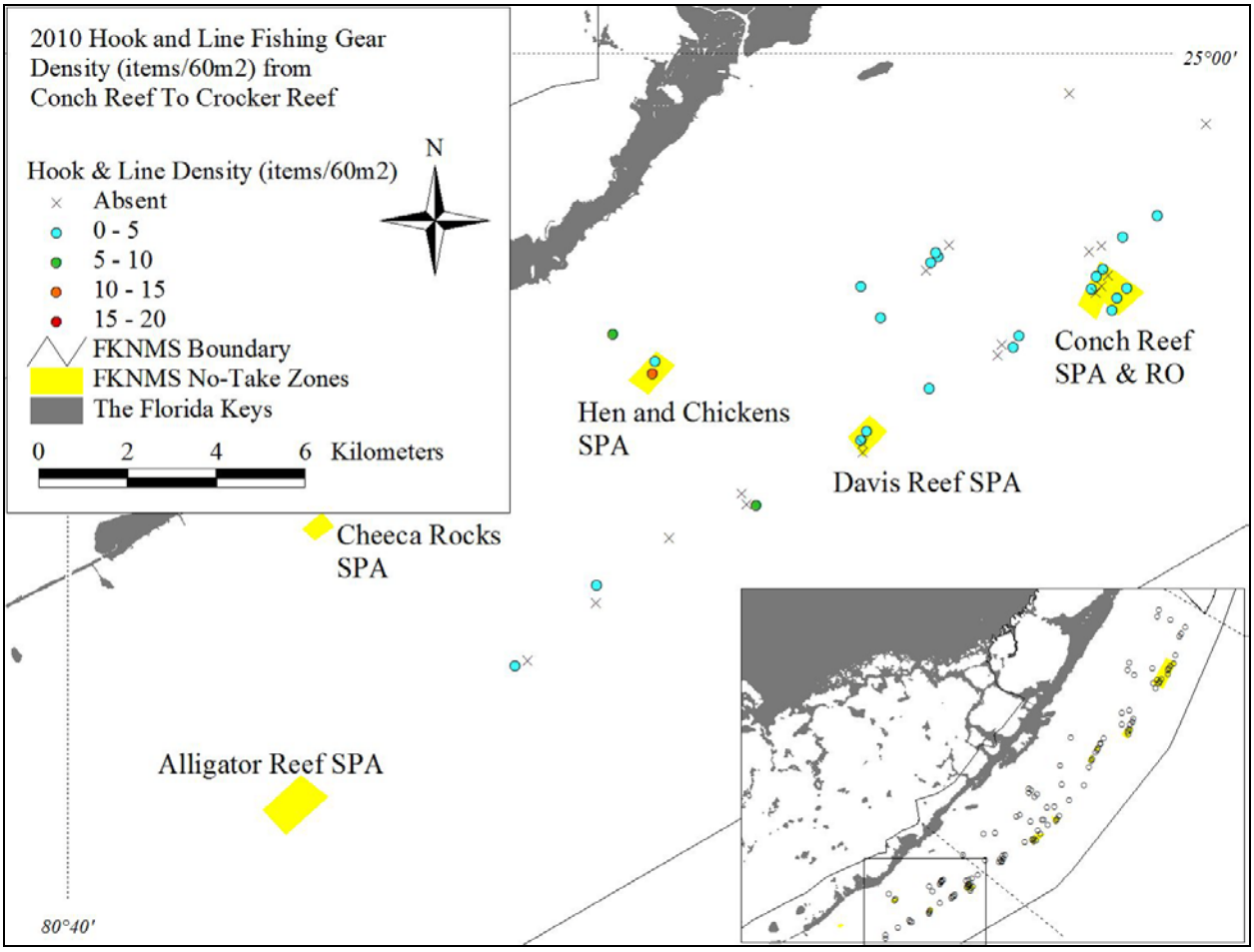


Figure 8-5. Mean (+ 1 SE) densities (no. items per 60 m^2) of lost hook-and-line fishing gear on inshore and mid-channel patch reefs (top), offshore patch reefs (middle), and back reef rubble habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

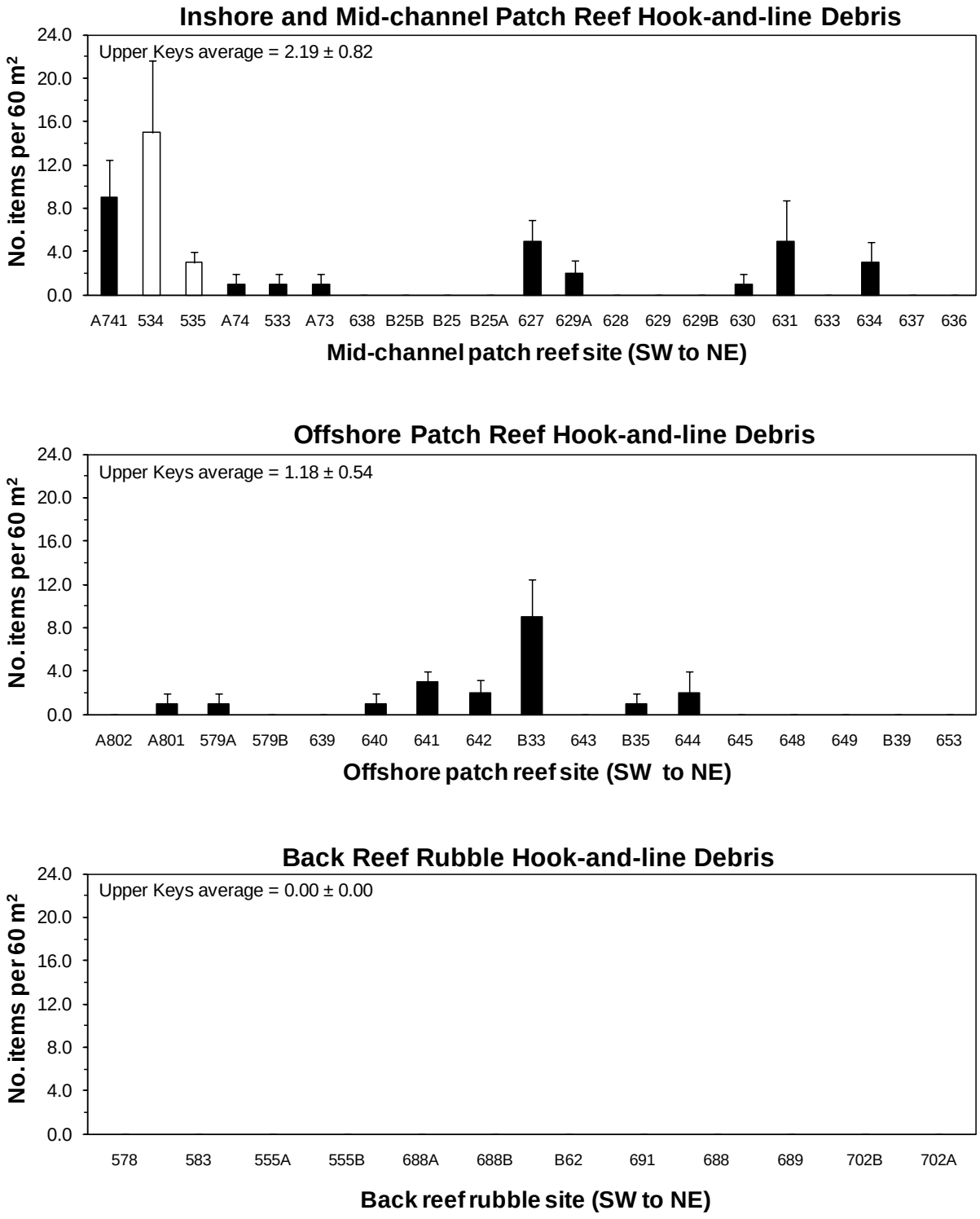


Figure 8-6. Mean (+ 1 SE) densities (no. items per 60 m^2) of lost hook-and-line fishing gear on shallow (< 6 m) hard-bottom (top), high-relief spur and groove reefs (middle) and deeper (6-15 m) fore reef habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

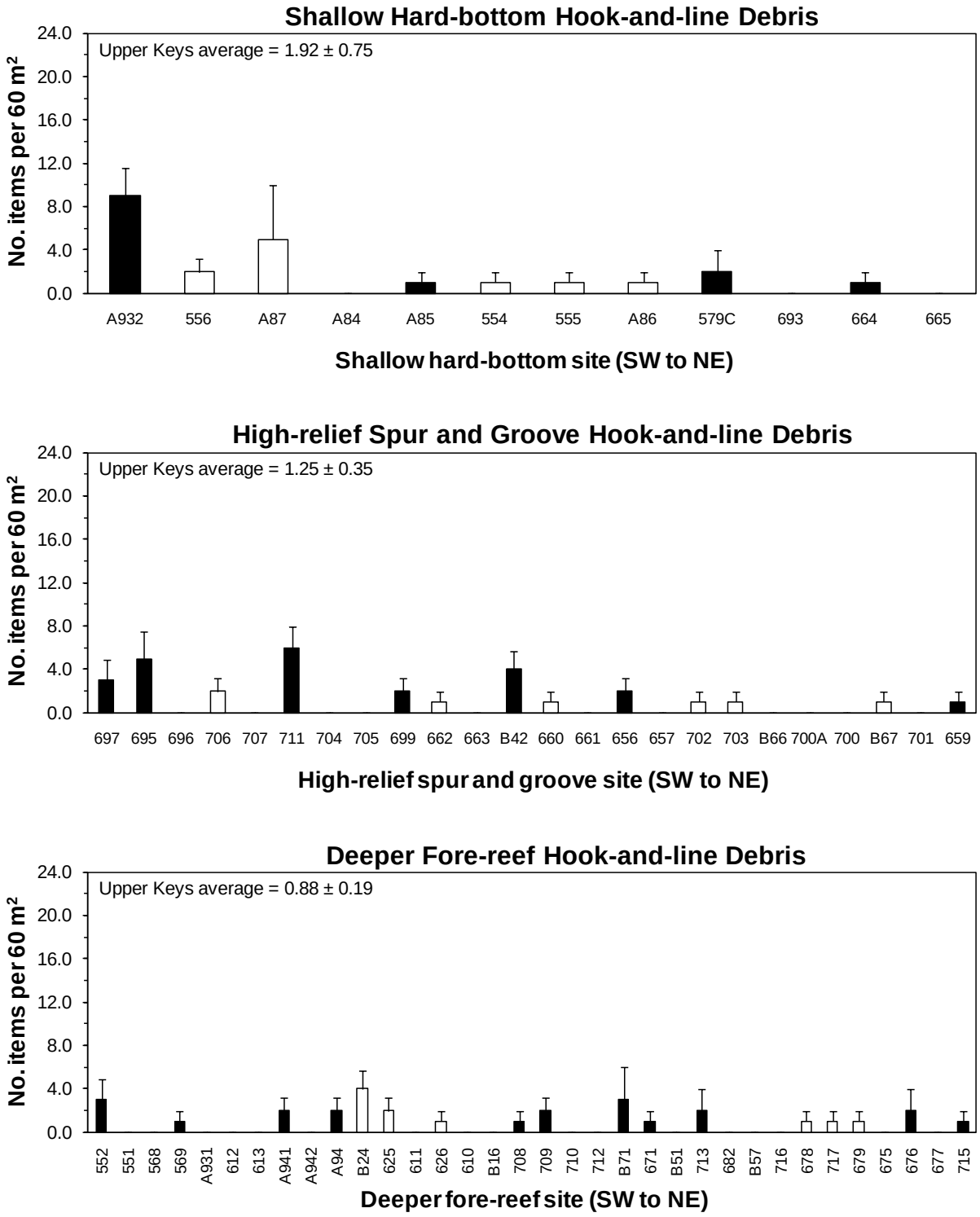


Figure 8-7. Densities (no. items per 60 m^2) of lost lobster trap fishing gear in the upper Florida Keys National Marine Sanctuary from the southern BNP boundary to Carysfort/S. Carysfort SPA surveyed during June-August 2010.

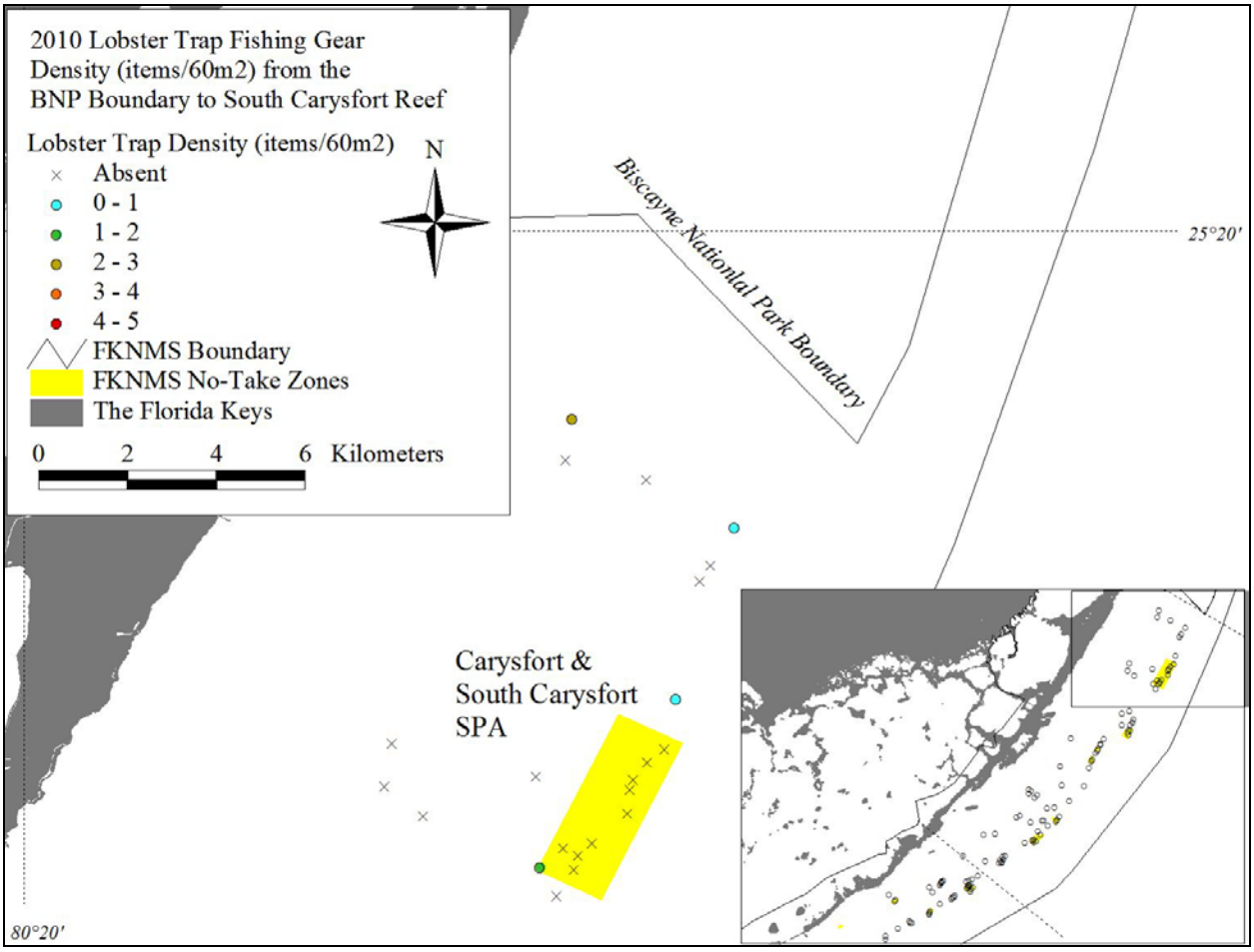


Figure 8-8. Densities (no. items per 60 m^2) of lost lobster trap fishing gear in the upper Florida Keys National Marine Sanctuary from Elbow Reef to Pickles Reef (bottom) surveyed during June-August 2010.

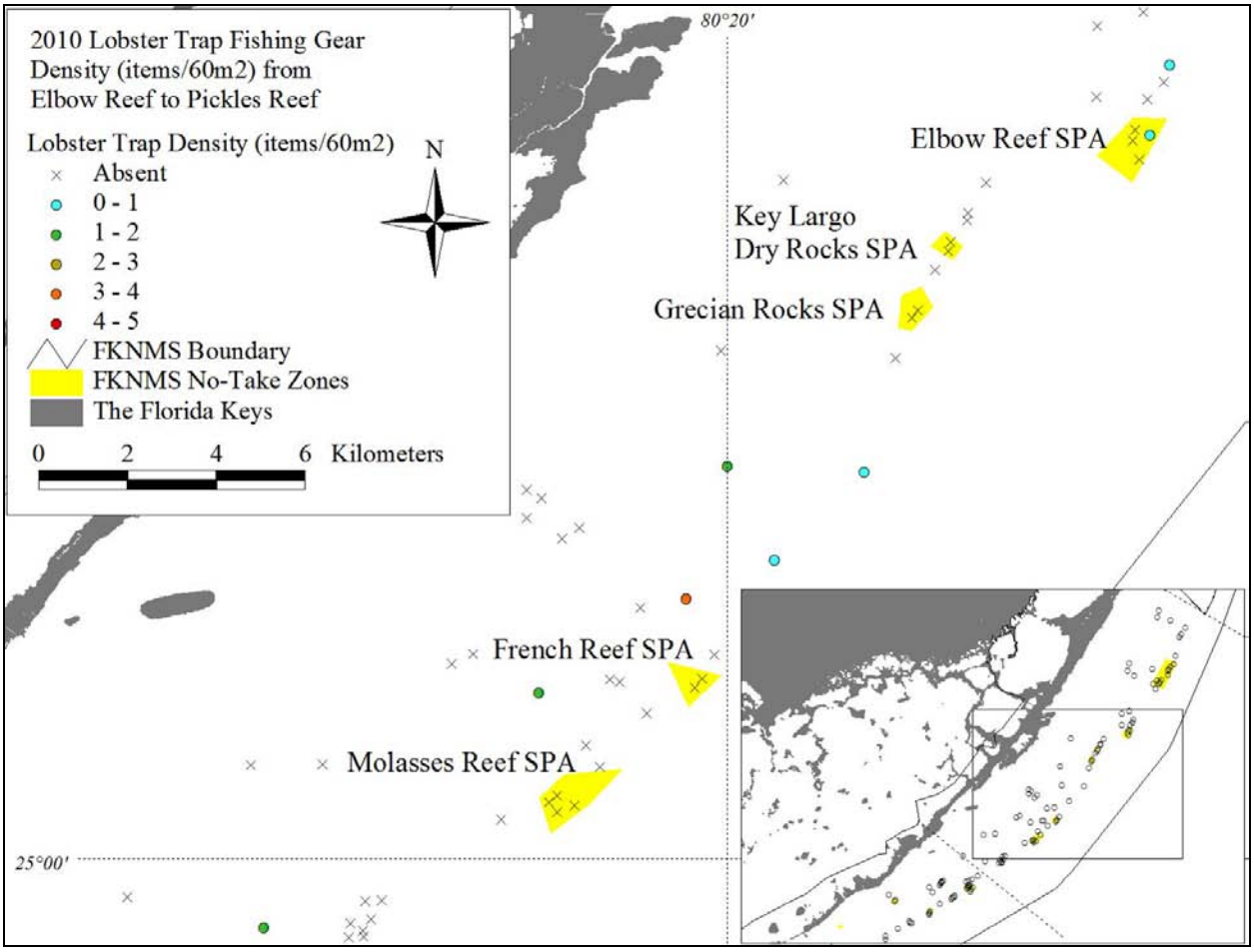


Figure 8-9. Densities (no. items per 60 m^2) of lost lobster trap fishing gear in the upper Florida Keys National Marine Sanctuary from Conch Reef SPA to Crocker Reef surveyed during June-August 2010.

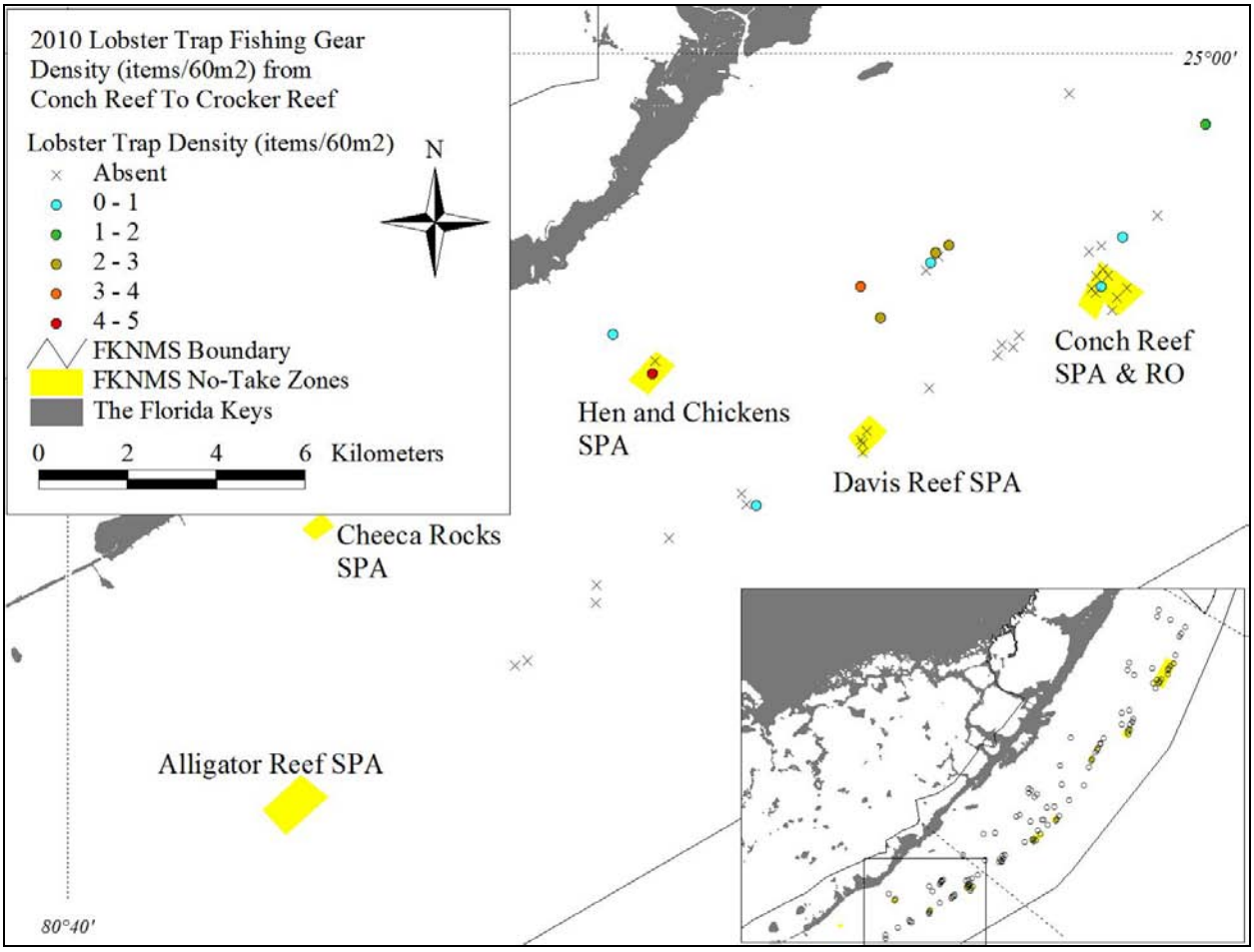


Figure 8-10. Mean (+ 1 SE) densities (no. items per 60 m^2) of lost lobster trap fishing gear on inshore and mid-channel patch reefs (top), offshore patch reefs (middle), and back reef rubble habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

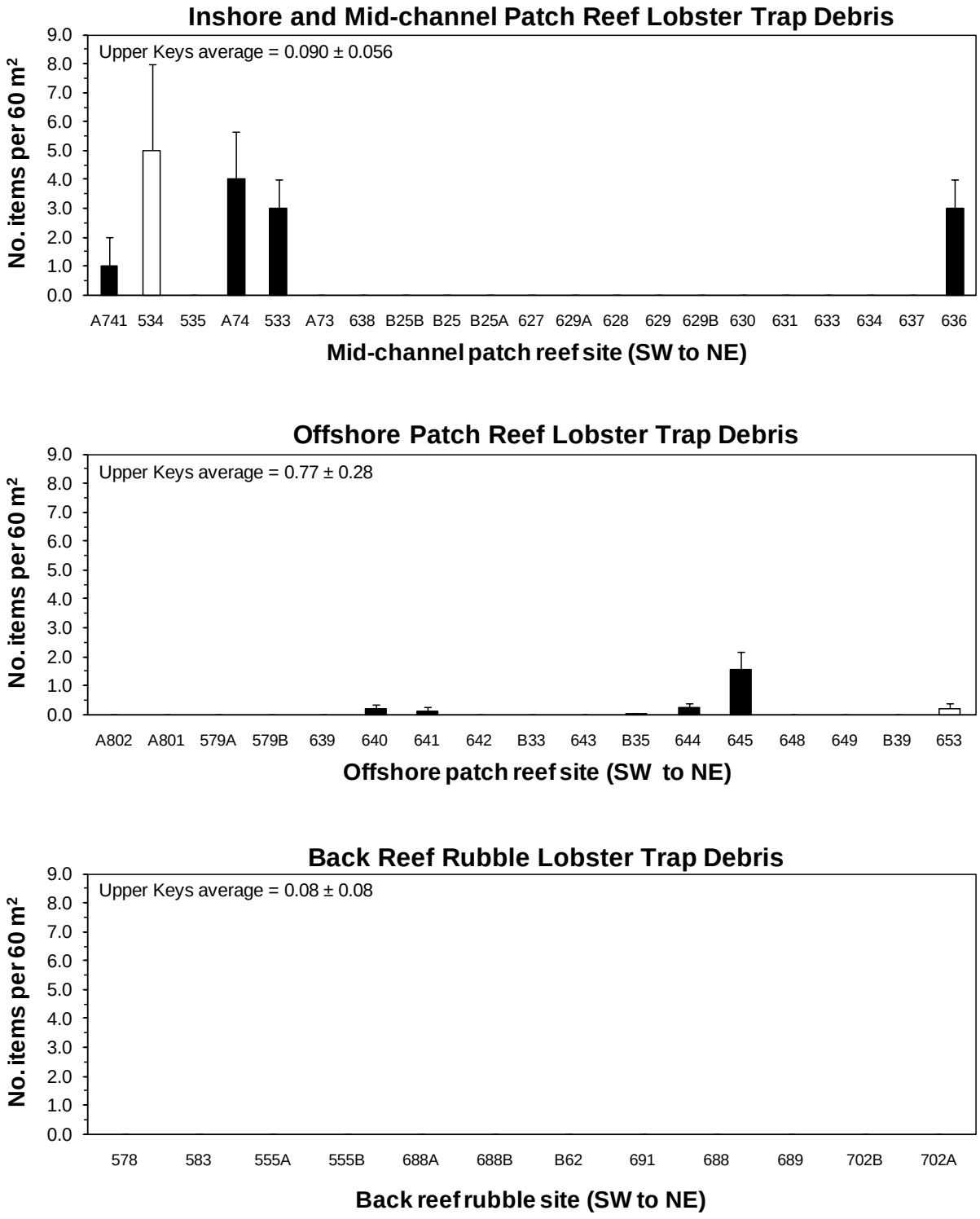


Figure 8-11. Mean (+ 1 SE) densities (no. items per 60 m^2) of lost lobster trap fishing gear on shallow (< 6 m) hard-bottom (top), high-relief spur and groove reefs (middle) and deeper (6-15 m) fore reef habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

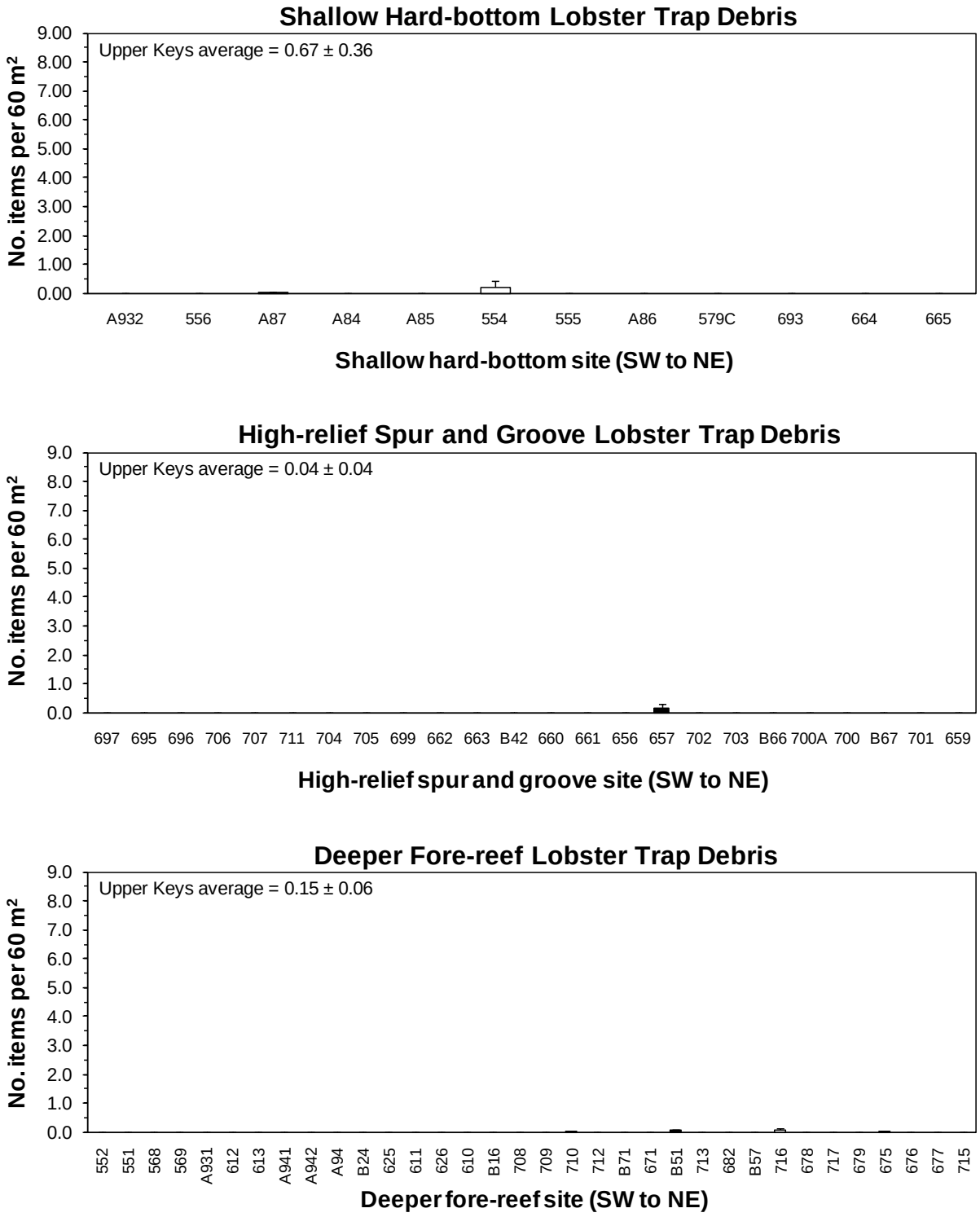


Figure 8-12. Densities (no. items per 60 m^2) of all marine debris categories in the upper Florida Keys National Marine Sanctuary from the southern BNP boundary to Carysfort/S. Carysfort SPA surveyed during June-August 2010.

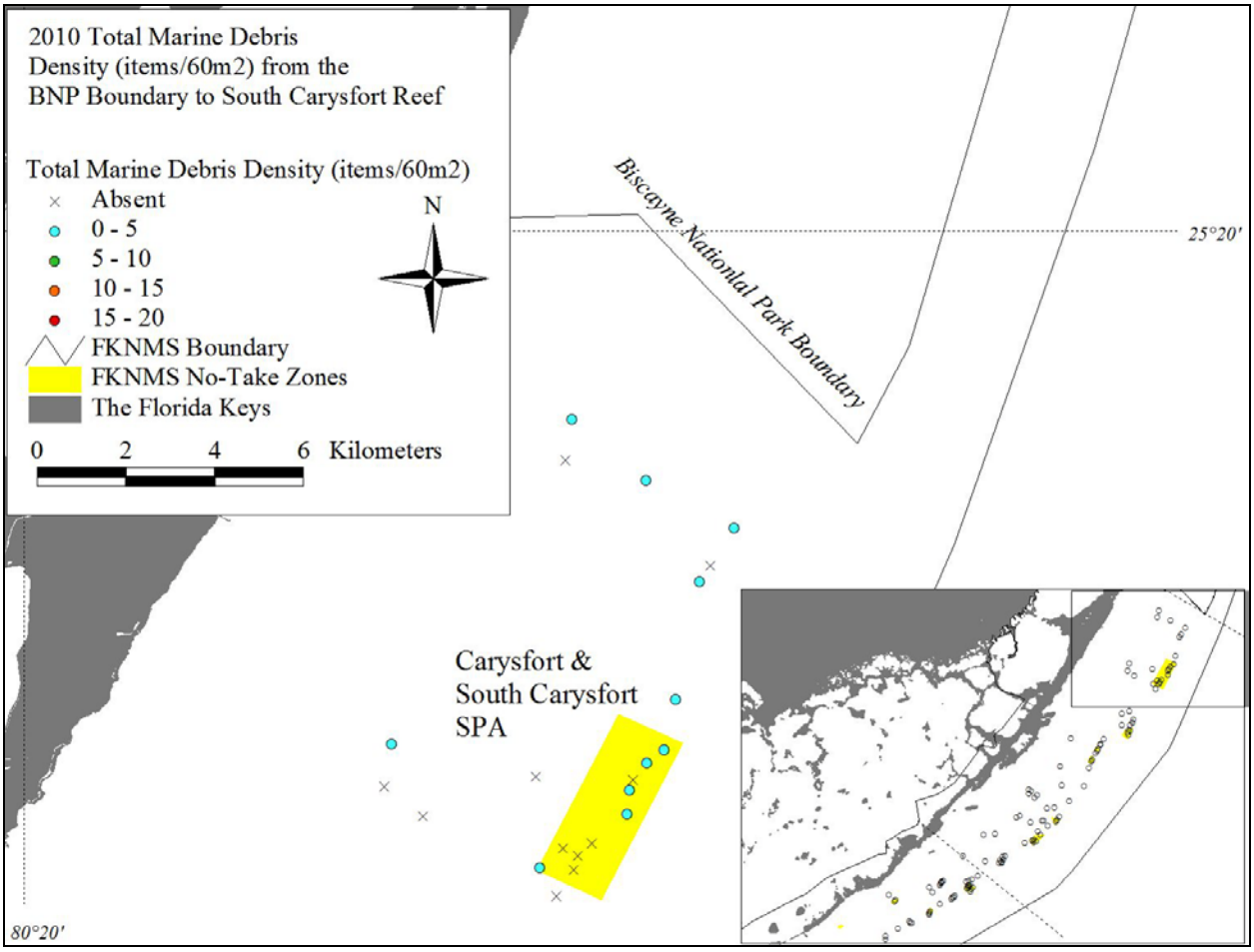


Figure 8-13. Densities (no. items per 60 m^2) of all marine debris categories in the upper Florida Keys National Marine Sanctuary from Elbow Reef to Pickles Reef (bottom) surveyed during June-August 2010.

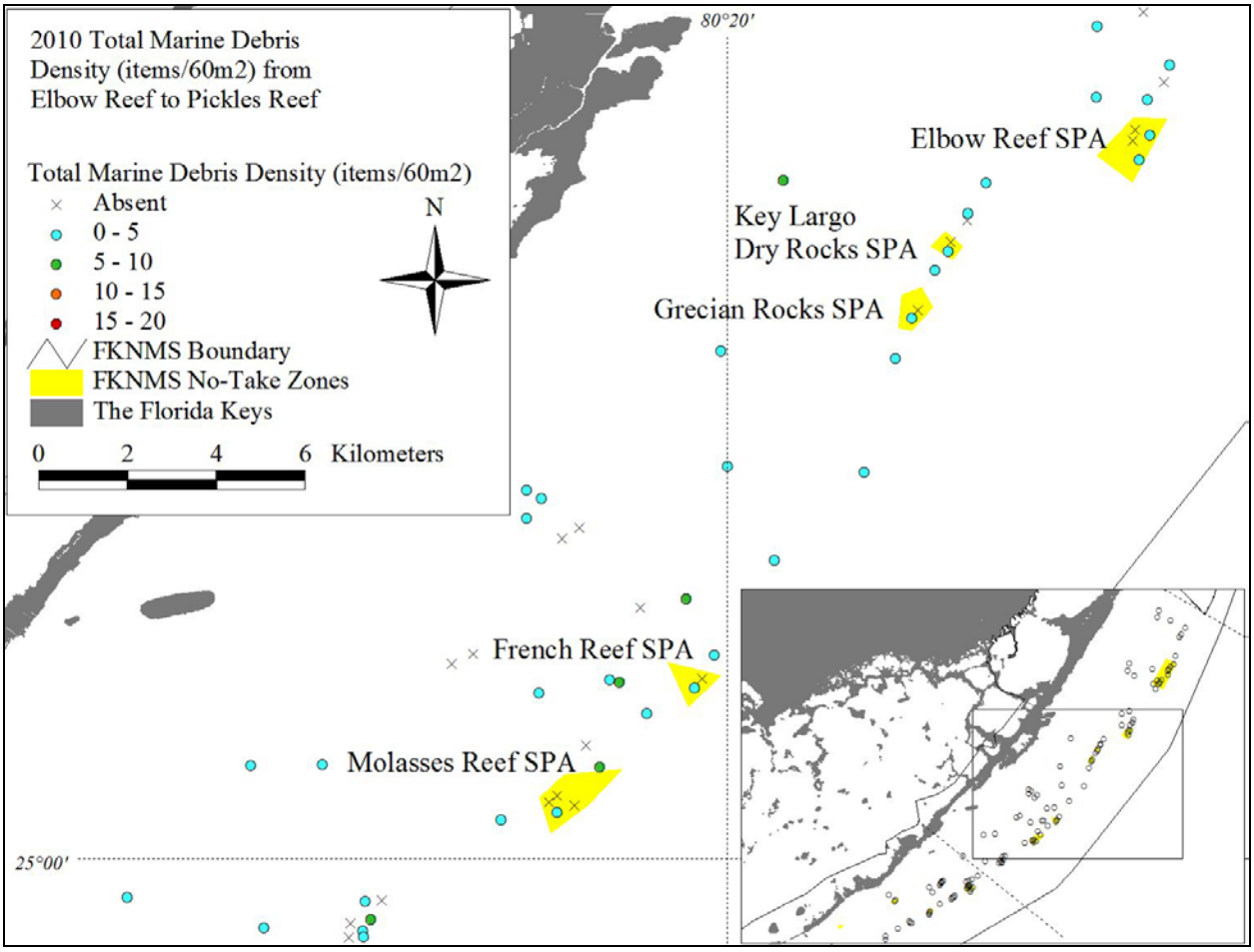


Figure 8-14. Densities (no. items per 60 m^2) of all marine debris categories in the upper Florida Keys National Marine Sanctuary from Conch Reef SPA to Crocker Reef surveyed during June-August 2010.

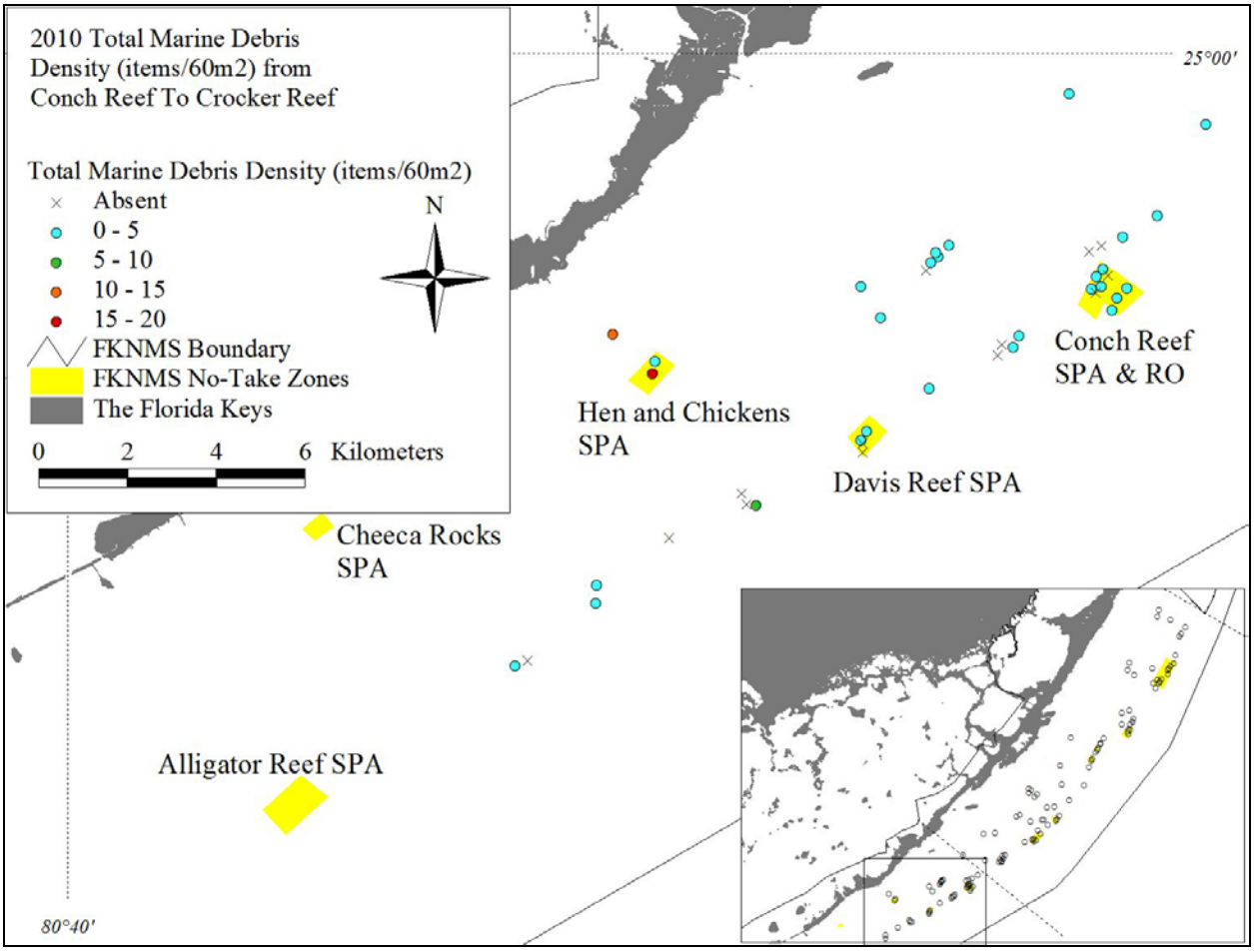


Figure 8-15. Mean (+ 1 SE) densities (no. items per 60 m^2) of all marine debris categories on inshore and mid-channel patch reefs (top), offshore patch reefs (middle), and back reef rubble habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

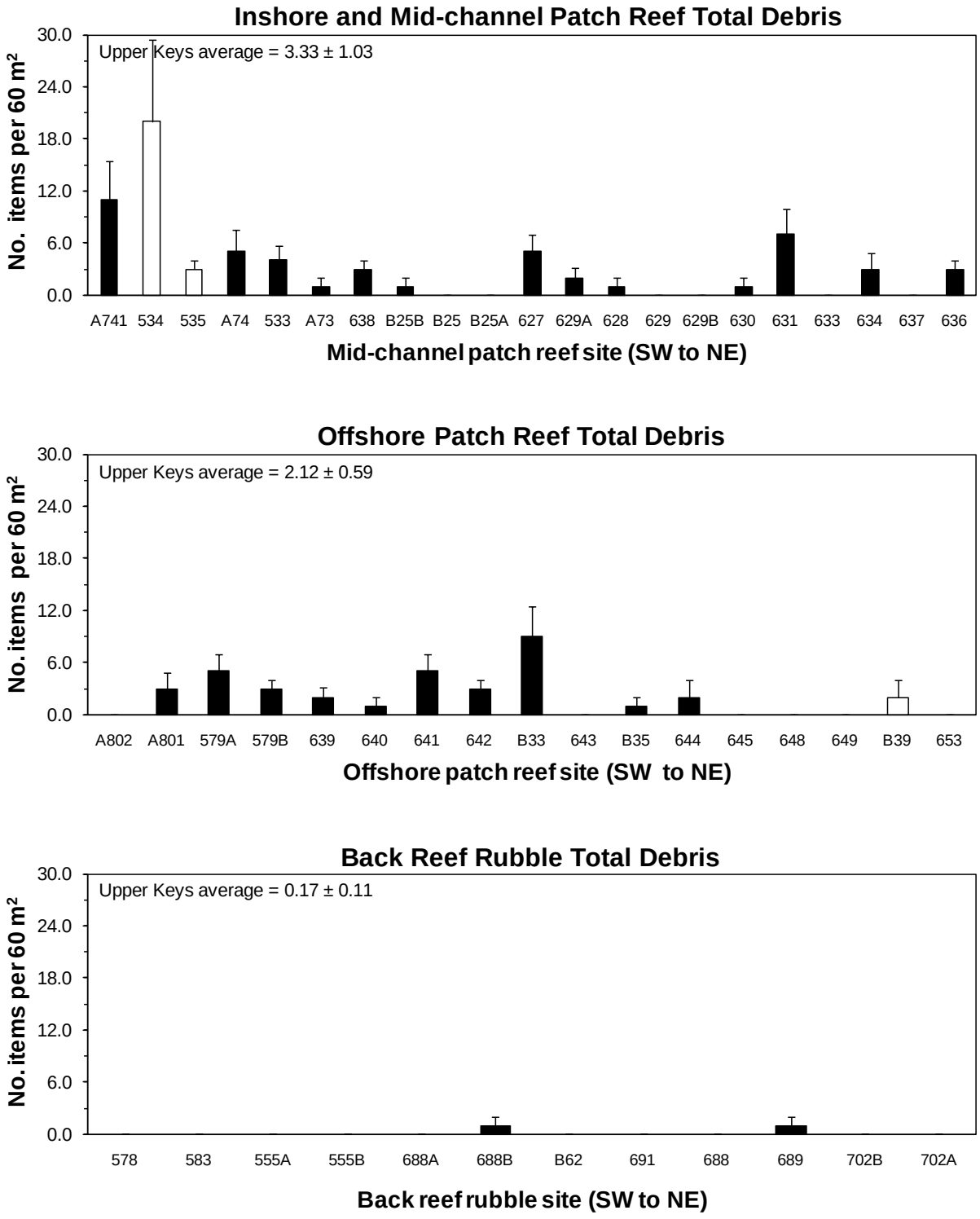


Figure 8-16. Mean (+ 1 SE) densities (no. items per 60 m^2) of all marine debris categories on shallow (< 6 m) hard-bottom (top), high-relief spur and groove reefs (middle) and deeper (6-15 m) fore reef habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

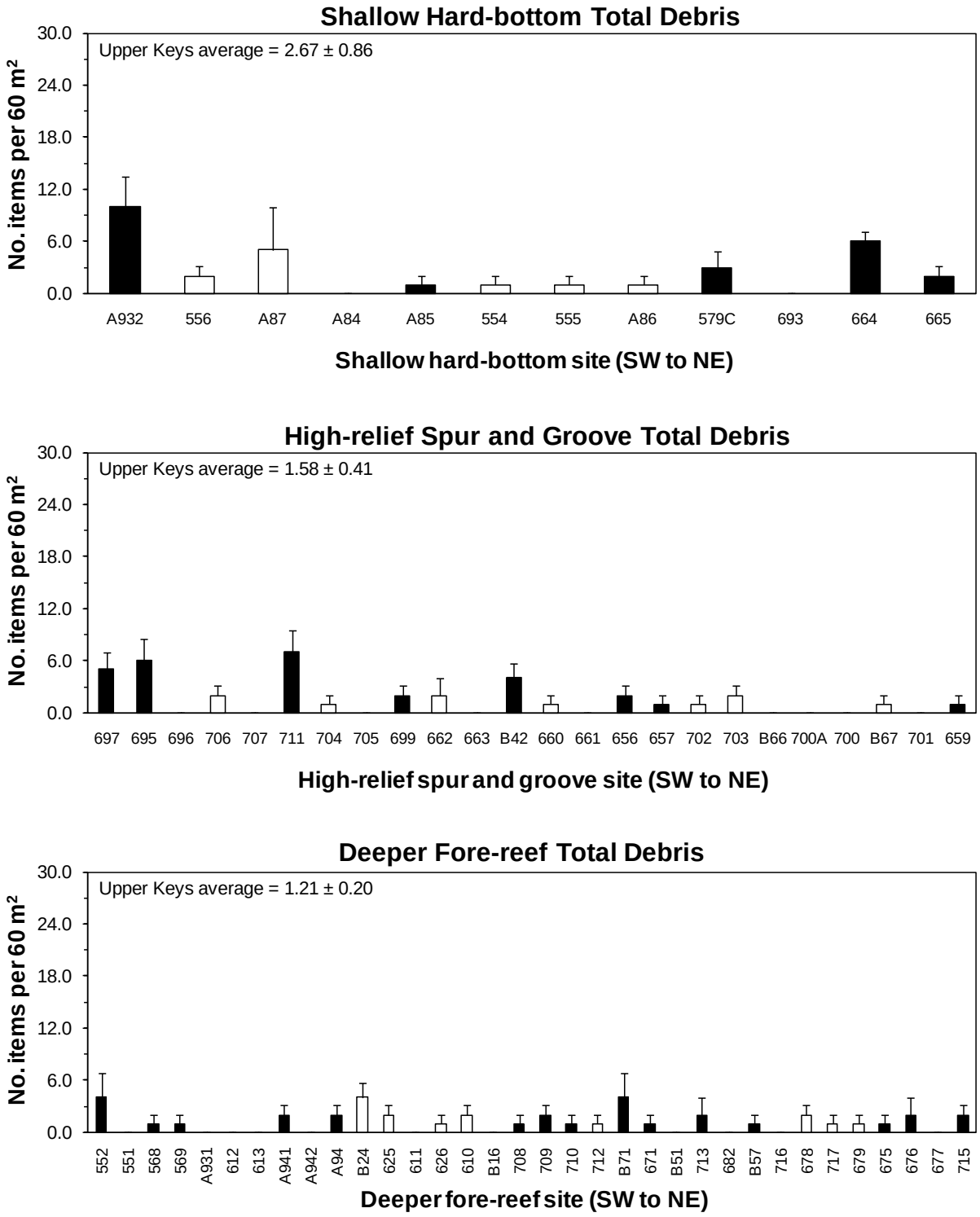


Table 8-1. Number and relative frequency (%) of marine debris items and number and relative frequency (%) of impacts to benthic coral reef organisms in the upper Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 4-m belt transects per site at 120 sites during June-August 2010. Impacted organisms were those exhibiting abrasion stress and tissue damage from debris.

Debris type	**N (%)**	***Millepora***	**Scleractinia**	**Gorgonians**	**Sponges**	***Palythoa***	**Total**
Hook-and-line gear							
Fishing rod	1 (0.5)						
Lead sinker	13 (6.0)						
Monofilament	77 (35.3)	15 (48.4)	2 (10.5)	25 (48.1)	11 (78.6)	1 (50.0)	54 (45.8)
Monofilament + hook	4 (1.8)		2 (10.5)	1 (1.9)			3 (2.5)
Monofilament + leader	3 (1.4)			2 (3.8)			2 (1.7)
Monofilament + sinker	2 (0.9)						
Wire leader	44 (20.2)	5 (16.1)		4 (7.7)	1 (7.1)		10 (8.5)
Wire leader + hook + sinker	1 (0.5)						
Wire leader + lure	1 (0.5)						
Wire leader + sinker	1 (0.5)	1 (3.2)		1 (1.9)		1 (50.0)	3 (2.5)
Total hook-and-line gear	**149 (68.3)**	**21 (67.7)**	**4 (21.1)**	**33 (63.5)**	**12 (85.7)**	**2 (100)**	**72 (61.0)**
Lobster/crab trap gear							
Cement block	4 (1.8)						
Plastic pot opening	4 (1.8)				1 (7.1)		1 (0.8)
Rope	18 (8.3)	3 (9.7)	14 (73.7)	17 (32.7)	1 (7.1)		35 (29.7)
Trap staple	1 (0.5)						
Wood	16 (7.3)		1 (5.3)				
Total trap gear	**43 (19.7)**	**3 (9.7)**	**15 (78.9)**	**17 (32.7)**	**2 (14.3)**	**0 (0)**	**37 (31.4)**
Other debris							
Anchor line + rope	1 (0.5)	2 (6.5)		1 (1.9)			3 (2.5)
Boat rub rail	1 (0.5)						
Cable tie	2 (0.9)						
Glass bottle	5 (2.3)						
Knife	2 (0.9)						
Mesh bag	1 (0.5)	1 (3.2)					1 (0.8)
Mesh rope	2 (0.9)	2 (6.5)					2 (1.7)
Plastic bag	4 (1.8)	2 (6.5)					2 (1.7)
Plastic cord	1 (0.5)						
Ree-bar stake	3 (1.4)						
Rope/string	1 (0.5)						
Skeg	1 (0.5)						
Speargun tubing	1 (0.5)			1			1 (0.8)
Total other debris	**26 (11.9)**	**7 (22.6)**	**0 (0)**	**2 (3.8)**	**0 (0)**	**0 (0)**	**9 (7.6)**
All marine debris	**218 (100)**	**31 (100)**	**19 (100)**	**52 (100)**	**14 (100)**	**2 (100)**	**118 (100)**

Table 8-2. Mean ± 1 SE transect frequencies (%), number of items encountered, and densities (no. items per 60 m^2) of combined lost hook-and-line fishing gear types and lost trap gear in the upper Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 120 sites during June-September 2010. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Hook-and-line debris			Lobster trap debris		
	Frequency	N	No./60 m^2	Frequency	N	No./60 m^2
Inshore and mid-channel patch reefs						
Middle Florida Keys						
A741 – Tavernier Rocks	75 ± 25	9	9.00 ± 3.42	25 ± 25	1	1.00 ± 1.00
534 – Hen and Chickens SPA**	75 ± 25	15	15.00 ± 6.61	50 ± 29	5	5.00 ± 3.00
535 – Hen and Chickens SPA**	75 ± 25	3	3.00 ± 1.00	0 ± 0	0	0
A74 – West of Conch Reef	25 ± 25	1	1.00 ± 1.00	75 ± 25	4	4.00 ± 1.63
533 – West of Conch Reef	25 ± 25	1	1.00 ± 1.00	75 ± 25	3	3.00 ± 1.00
A73 – West of Conch Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0
Middle Florida Keys Total (6)	50 ± 11	30	5.00 ± 2.37	38 ± 14	13	2.17 ± 0.87
Upper Florida Keys						
638 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25B – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25 – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25A – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
627 – Mosquito Bank	75 ± 25	5	5.00 ± 1.91	0 ± 0	0	0 ± 0
629A – Mosquito Bank	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
628 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629B – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
630 – SE of Cannon Patch Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
631 – Marker 33	50 ± 29	5	5.00 ± 3.79	0 ± 0	0	0 ± 0
633 – Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
634 – Basin Hill Shoals	50 ± 29	3	3.00 ± 1.91	0 ± 0	0	0 ± 0
637 – West of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
636 – West of Turtle Rocks	0 ± 0	0	0 ± 0	75 ± 25	3	3.00 ± 1.00
Upper Florida Keys Total (15)	17 ± 7	16	1.07 ± 0.47	5 ± 5	3	0.20 ± 0.20
Mid-channel Patch Reef Total (21)	**26 ± 7**	**46**	**2.19 ± 0.82**	**14 ± 6**	**16**	**0.76 ± 0.34**
Offshore patch reefs						
Middle Florida Keys						
A802 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A801 – Inshore of Conch Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
579A – Inshore of Conch Reef	25 ± 25	1	1.00 ± 1.00	50 ± 29	3	3.00 ± 1.91
579B – Inshore of Conch Reef	0 ± 0	0	0 ± 0	75 ± 25	3	3.00 ± 1.00
Middle Florida Keys Total (4)	13 ± 7	2	0.50 ± 0.29	38 ± 16	7	1.75 ± 0.75
Upper Florida Keys						
639 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
640 – White Bank (West of Molasses)	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
641 – White Bank (West of Molasses)	75 ± 25	3	3.00 ± 1.00	50 ± 29	2	2.00 ± 1.15
642 – SE of White Bank Dry Rocks	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
B33 – East of White Bank Dry Rocks	25 ± 25	9	9.00 ± 3.42	0 ± 0	0	0 ± 0
643 – White Bank (NW of French)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B35 – West of Elbow Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
644 – Watson's Reef	25 ± 25	2	2.00 ± 2.00	0 ± 0	0	0 ± 0
645 – Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
648 – East of Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
649 – West of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B39 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00

Site number/site location	Hook-and-line debris			Lobster trap debris		
	Frequency	**N**	**No./60 m^2**	**Frequency**	**N**	**No./60 m^2**
653 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (13)	21 ± 8	18	1.39 ± 0.69	10 ± 5	5	0.38 ± 0.21
Offshore Patch Reef Total (17)	**19 ± 6**	**20**	**1.18 ± 0.54**	**16 ± 6**	**12**	**0.71 ± 0.27**
Back reef rubble						
Middle Florida Keys						
578 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
583 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555A – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555B – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
688A – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688B – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B62 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
691 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
689 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
702B – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702A – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (8)	0 ± 0	0	0 ± 0	3 ± 3	1	0.13 ± 0.13
Back Reef Rubble Total (12)	**0 ± 0**	**0**	**0 ± 0**	**2 ± 2**	**1**	**0.08 ± 0.08**
Low-relief hard-bottom (< 6 m)						
Middle Florida Keys						
A932 – Crocker Reef	100 ± 0	9	9.00 ± 2.52	25 ± 25	1	1.00 ± 1.00
556 – Davis Reef SPA**	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
A87 – Davis Reef SPA**	25 ± 25	5	5.00 ± 5.00	0 ± 0	0	0 ± 0
A84 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A85 – Little Conch Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
554 – Conch Reef C1**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
555 – Conch Reef C2**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
A86 – Conch Reef C3**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
579C – NE of Conch Reef	25 ± 25	2	2.00 ± 2.00	25 ± 25	1	1.00 ± 1.00
Middle Florida Keys Total (9)	33 ± 9	22	2.44 ± 0.94	6 ± 4	2	0.22 ± 0.15
Upper Florida Keys						
693 – Little Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
664 – North of French Reef	25 ± 25	1	1.00 ± 1.00	75 ± 25	4	4.00 ± 1.63
665 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
Upper Florida Keys Total (3)	8 ± 8	1	0.33 ± 0.33	42 ± 22	6	2.00 ± 1.16
Shallow Hard-bottom Total (17)	**27 ± 8**	**23**	**1.92 ± 0.75**	**15 ± 7**	**8**	**0.67 ± 0.36**
High-relief spur and groove						
Upper Florida Keys						
697 – Pickles Reef P1	50 ± 29	3	3.00 ± 1.91	0 ± 0	0	0 ± 0
695 – Pickles Reef P3	75 ± 25	5	5.00 ± 2.52	0 ± 0	0	0 ± 0
696 – NE Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
706 – Molasses Reef SPA**	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
707 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
711 – Sand Island	75 ± 25	6	6.00 ± 2.00	0 ± 0	0	0 ± 0
704 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
705 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
699 – North of French Reef	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
662 – Grecian Rocks SPA**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0

Site number/site location	Hook-and-line debris			Lobster trap debris		
	Frequency	**N**	**No./60 m^2**	**Frequency**	**N**	**No./60 m^2**
663 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B42 – Little Grecian Rocks	75 ± 25	4	4.00 ± 1.63	0 ± 0	0	0 ± 0
660 – Key Largo Dry Rocks**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
661 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
656 – North Dry Rocks	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
657 – North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702 – Elbow Reef SPA**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
703 – Elbow Reef SPA**	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
B66 – South of S. Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700A – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B67 – Carysfort Reef C2**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
701 – Carysfort Reef C5**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
659 – Turtle Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
Upper Florida Keys Total (24)	24 ± 6	30	1.25 ± 0.35	1 ± 1	1	0.04 ± 0.04
High-relief Spur & Groove Total (42)	**24 ± 6**	**30**	**1.25 ± 0.35**	**1 ± 1**	**1**	**0.04 ± 0.04**
Deeper Fore-reef (6-15 m)						
Middle Florida Keys						
552 – SW of Crocker Reef	50 ± 29	3	3.00 ± 1.91	0 ± 0	0	0 ± 0
551 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
568 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
569 – SW of Crocker Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
A931 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
612 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
613 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A941 – North of Davis Reef	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
A942 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A94 – Little Conch Reef	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
B24 – Conch Reef RO**	75 ± 25	4	4.00 ± 1.63	0 ± 0	0	0 ± 0
625 – Conch Reef RO**	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
611 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
626 – Conch Reef RO**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
610 – Conch Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
B16 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (16)	20 ± 7	15	0.94 ± 0.32	2 ± 2	1	0.06 ± 0.06
Upper Florida Keys						
708 – NE of Conch Reef	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
709 – Pickles Reef	50 ± 29	2	2.00 ± 1.15	0 ± 0	0	0 ± 0
710 – SW of Molasses Reef SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
712 – SW of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B71 – Dixie Shoal	25 ± 25	3	3.00 ± 3.00	25 ± 25	1	1.00 ± 1.00
671 – South of Grecian Rocks	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
B51 – East of Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
713 – North of Elbow Reef	25 ± 25	2	2.00 ± 2.00	0 ± 0	0	0 ± 0
682 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B57 – SE of Watson's Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
716 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
678 – North Carysfort Reef**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
717 – North Carysfort Reef**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
679 – North Carysfort Reef**	25 ± 25	1	1.00 ± 1.00	0 ± 0	0	0 ± 0
675 – North of Carysfort Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
676 – North of Carysfort Reef	25 ± 25	2	2.00 ± 2.00	0 ± 0	0	0 ± 0
677 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
715 – North of Carysfort Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
Upper Florida Keys Total (18)	15 ± 4	15	0.83 ± 0.22	6 ± 3	4	0.22 ± 0.10
Deeper Fore-reef Total (34)	**18 ± 4**	**30**	**0.88 ± 0.19**	**4 ± 2**	**5**	**0.15 ± 0.06**

Table 8-3. Mean ± 1 SE transect frequencies (%), number of items encountered, and densities (no. items per 60 m^2) of other marine debris and total marine debris in the upper Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 120 sites during June-September 2010. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Other marine debris			Total marine debris		
	Frequency	N	No./60 m^2	Frequency	N	No./60 m^2
Inshore and mid-channel patch reefs						
Middle Florida Keys						
A741 – Tavernier Rocks	25 ± 25	1	1.00 ± 1.00	75 ± 25	11	11.00 ± 4.43
534 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	75 ± 25	20	20.00 ± 9.38
535 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	75 ± 25	3	3.00 ± 1.00
A74 – West of Conch Reef	0 ± 0	0	0 ± 0	75 ± 25	5	5.00 ± 2.52
533 – West of Conch Reef	0 ± 0	0	0 ± 0	75 ± 25	4	4.00 ± 1.63
A73 – West of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
Middle Florida Keys Total (6)	4 ± 4	1	0.17 ± 0.17	67 ± 8	44	7.33 ± 2.88
Upper Florida Keys						
638 – Inshore of Pickles Reef	75 ± 25	3	3.00 ± 1.00	75 ± 25	3	3.00 ± 1.00
B25B – Inshore of Molasses Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
B25 – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25A – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
627 – Mosquito Bank	0 ± 0	0	0 ± 0	75 ± 25	5	5.00 ± 1.91
629A – Mosquito Bank	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
628 – Mosquito Bank	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
629 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629B – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
630 – SE of Cannon Patch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
631 – Marker 33	50 ± 29	2	2.00 ± 1.15	100 ± 0	7	7.00 ± 3.00
633 – Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
634 – Basin Hill Shoals	0 ± 0	0	0 ± 0	50 ± 29	3	3.00 ± 1.91
637 – West of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
636 – West of Turtle Rocks	0 ± 0	0	0 ± 0	75 ± 25	3	3.00 ± 1.00
Upper Florida Keys Total (15)	12 ± 6	7	0.47 ± 0.24	33 ± 9	26	1.73 ± 0.55
Mid-channel Patch Reef Total (21)	**10 ± 4**	**8**	**0.38 ± 0.18**	**43 ± 8**	**70**	**3.33 ± 1.03**
Offshore patch reefs						
Middle Florida Keys						
A802 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A801 – Inshore of Conch Reef	25 ± 25	1	1.00 ± 1.00	50 ± 29	3	3.00 ± 1.91
579A – Inshore of Conch Reef	25 ± 25	1	1.00 ± 1.00	75 ± 25	5	5.00 ± 1.91
579B – Inshore of Conch Reef	0 ± 0	0	0 ± 0	75 ± 25	3	3.00 ± 1.00
Middle Florida Keys Total (4)	13 ± 7	2	0.50 ± 0.29	50 ± 18	11	2.75 ± 1.03
Upper Florida Keys						
639 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
640 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
641 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	75 ± 25	5	5.00 ± 1.91
642 – SE of White Bank Dry Rocks	25 ± 25	1	1.00 ± 1.00	75 ± 25	3	3.00 ± 1.00
B33 – East of White Bank Dry Rocks	0 ± 0	0	0 ± 0	75 ± 25	9	9.00 ± 3.42
643 – White Bank (NW of French)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B35 – West of Elbow Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
644 – Watson's Reef	0 ± 0	0	0 ± 0	25 ± 25	2	2.00 ± 2.00
645 – Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
648 – East of Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
649 – West of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B39 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00

Site number/site location	Other marine debris			Total marine debris		
	Frequency	N	No./60 m^2	Frequency	N	No./60 m^2
653 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (13)	2 ± 2	1	0.08 ± 0.08	33 ± 11	24	1.85 ± 0.72
Offshore Patch Reef Total (17)	**4 ± 2**	**3**	**0.18 ± 0.10**	**37 ± 9**	**35**	**2.06 ± 0.60**
Back reef rubble						
Middle Florida Keys						
578 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
583 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555A – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555B – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
688A – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688B – Pickles Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
B62 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
691 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
689 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
702B – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702A – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (8)	3 ± 3	1	0.13 ± 0.13	6 ± 4	2	0.25 ± 0.16
Back Reef Rubble Total (12)	**2 ± 2**	**1**	**0.08 ± 0.08**	**4 ± 3**	**2**	**0.17 ± 0.11**
Low-relief hard-bottom (< 6 m)						
Middle Florida Keys						
A932 – Crocker Reef	0 ± 0	0	0 ± 0	100 ± 0	10	10.00 ± 3.46
556 – Davis Reef SPA**	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
A87 – Davis Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	5	5.00 ± 5.00
A84 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A85 – Little Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
554 – Conch Reef C1**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
555 – Conch Reef C2**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
A86 – Conch Reef C3**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
579C – NE of Conch Reef	0 ± 0	0	0 ± 0	50 ± 29	3	3.00 ± 1.91
Middle Florida Keys Total (9)	0 ± 0	0	0 ± 0	36 ± 9	24	2.67 ± 1.04
Upper Florida Keys						
693 – Little Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
664 – North of French Reef	25 ± 25	1	1.00 ± 1.00	100 ± 0	6	6.00 ± 1.15
665 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
Upper Florida Keys Total (3)	8 ± 8	1	0.33 ± 0.33	50 ± 29	8	2.76 ± 1.76
Shallow Hard-bottom Total (17)	**2 ± 2**	**1**	**0.08 ± 0.08**	**40 ± 9**	**32**	**2.67 ± 0.86**
High-relief spur and groove						
Upper Florida Keys						
697 – Pickles Reef P1	25 ± 25	2	2.00 ± 2.00	75 ± 25	5	5.00 ± 1.91
695 – Pickles Reef P3	25 ± 25	1	1.00 ± 1.00	75 ± 25	6	6.00 ± 2.58
696 – NE Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
706 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
707 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
711 – Sand Island	25 ± 25	1	1.00 ± 1.00	75 ± 25	7	7.00 ± 2.52
704 – French Reef SPA**	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
705 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
699 – North of French Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
662 – Grecian Rocks SPA**	25 ± 25	1	1.00 ± 1.00	25 ± 25	2	2.00 ± 2.00

Site number/site location	Other marine debris			Total marine debris		
	Frequency	**N**	**No./60 m^2**	**Frequency**	**N**	**No./60 m^2**
663 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B42 – Little Grecian Rocks	0 ± 0	0	0 ± 0	75 ± 25	4	4.00 ± 1.63
660 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
661 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
656 – North Dry Rocks	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
657 – North-North Dry Rocks	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
702 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
703 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
B66 – South of S. Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700A – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B67 – Carysfort Reef C2**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
701 – Carysfort Reef C5**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
659 – Turtle Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
Upper Florida Keys Total (24)	6 ± 2	7	0.29 ± 0.11	28 ± 6	38	1.58 ± 0.41
High-relief Spur & Groove Total (42)	**6 ± 2**	**7**	**0.29 ± 0.11**	**28 ± 6**	**38**	**1.58 ± 0.41**
Deeper Fore-reef (6-15 m)						
Middle Florida Keys						
552 – SW of Crocker Reef	25 ± 25	1	1.00 ± 1.00	50 ± 29	4	4.00 ± 2.83
551 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
568 – SW of Crocker Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
569 – SW of Crocker Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
A931 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
612 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
613 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A941 – North of Davis Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
A942 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A94 – Little Conch Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
B24 – Conch Reef RO**	0 ± 0	0	0 ± 0	75 ± 25	4	4.00 ± 1.63
625 – Conch Reef RO**	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
611 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
626 – Conch Reef RO**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
610 – Conch Reef SPA**	25 ± 25	1	1.00 ± 1.00	50 ± 29	2	2.00 ± 1.15
B16 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (16)	5 ± 3	3	0.19 ± 0.10	25 ± 6	19	1.19 ± 0.34
Upper Florida Keys						
708 – NE of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
709 – Pickles Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
710 – SW of Molasses Reef SPA	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
712 – SW of French Reef	25 ± 25	1	1.00 ± 1.00	25 ± 25	1	1.00 ± 1.00
B71 – Dixie Shoal	0 ± 0	0	0 ± 0	50 ± 29	4	4.00 ± 2.83
671 – South of Grecian Rocks	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
B51 – East of Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
713 – North of Elbow Reef	0 ± 0	0	0 ± 0	25 ± 25	2	2.00 ± 2.00
682 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B57 – SE of Watson's Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
716 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
678 – North Carysfort Reef**	25 ± 25	1	1.00 ± 1.00	50 ± 29	2	2.00 ± 1.15
717 – North Carysfort Reef**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
679 – North Carysfort Reef**	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
675 – North of Carysfort Reef	0 ± 0	0	0 ± 0	25 ± 25	1	1.00 ± 1.00
676 – North of Carysfort Reef	0 ± 0	0	0 ± 0	25 ± 25	2	2.00 ± 2.00
677 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
715 – North of Carysfort Reef	0 ± 0	0	0 ± 0	50 ± 29	2	2.00 ± 1.15
Upper Florida Keys Total (18)	4 ± 2	3	0.17 ± 0.09	25 ± 4	22	1.22 ± 0.24
Deeper Fore-reef Total (34)	**4 ± 2**	**6**	**0.18 ± 0.07**	**25 ± 4**	**41**	**1.21 ± 0.20**