Fish Assemblage Monitoring at the *M/V Wellwood* Grounding Restoration
May 2002 – August 2007
Final Report

Prepared by the Reef Environmental Education Foundation (REEF)
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Background

Figure 1. The *M/V Wellwood* aground on Molasses Reef. Photo courtesy of the FKNMS.

The *M/V Wellwood*, a 122-meter Cypriot-registered freighter, ran aground on August 4, 1984, on Molasses Reef off Key Largo, Florida (Figure 1). The ship impacted the reef's upper forereef and subsequently remained aground for 12 days. The grounding destroyed 1,285 square meters of living corals and injured 644 square meters of coral reef framework. Prior to the grounding, the area was a transition zone with high relief coral formations. The grounding transformed the area into a flattened, barren pavement covered with coral rubble.

Between 1986 and 2002, several assessment efforts were conducted to document the recovery and status of the impacted area. While most of the monitoring focused on the benthic condition, two studies included the fish assemblage (Dennis and Bright 1990, NURC 1997).

Eighteen years after the grounding, the area resembled nearby hard ground habitat with little structure and the benthic community was dominated by gorgonians (Gittings 2002). Storms in the late 1990s had disrupted and/or removed significant portions of destabilized reef framework in the area (Hudson 2007). Natural recovery to a state similar to the pre-grounding condition failed to occur within a reasonable time frame and therefore, habitat restoration was initiated. The National Marine Sanctuary Program published an environmental assessment to systematically evaluate the short- and long-term environmental and socioeconomic effects related to the restoration of the grounding site (NOAA 2002).

The restoration effort, designed by Dr. Harold Hudson (Florida Keys National Marine Sanctuary Reef Restoration Biologist), included 14 repair sites within the affected area. Nine limestone reef modules and five limestone boulder/concrete structures were installed between June 2 and July 22, 2002, which affected a total of 185 m^2 of damaged reef area. A more thorough description of the restoration effort and the affected area can be found in CPE 2001 and Hudson 2007. The primary objectives of the

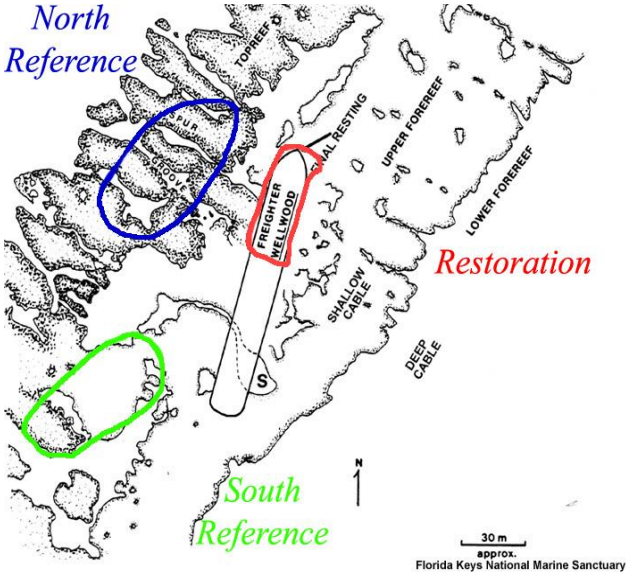

Figure 2. Location map showing areas of fish monitoring effort.

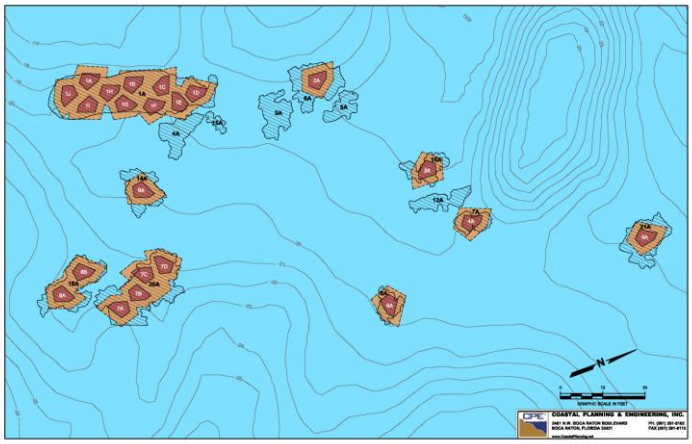

Figure 3. A bathymetric map showing the placement of the restoration modules.

restoration were to 1) stabilize damaged reef framework, 2) infill hurricane-excavated craters, and 3) rebuild reef topography (Hudson 2007). To evaluate the effects of the restoration, including temporal patterns of biological diversity, a monitoring program was implemented. Reference habitats adjacent to the restoration site are concurrently monitored to compare the condition of restored reef areas with "natural" coral reef areas unimpacted by the vessel grounding or other injury.

A benthic monitoring program conducted by National Marine Sanctuary scientists includes periodic assessments of the structural stability of installed restoration modules and coral recruitment patterns. In Summer 2002, the Reef Environmental Education Foundation (REEF) was contracted by the National Marine Sanctuary Program to begin a five-year monitoring project on the fish assemblages at the *Wellwood* grounding site and two nearby reference areas. Baseline surveys were conducted just prior to and immediately following restoration, quarterly monitoring took place through Year 1 and semi-annual monitoring in Years 2 through 5. The primary goals of the monitoring data collected during this project were to aid in the assessment of restoration efforts and provide a benchmark for long-term evaluation of the fish communities at the grounding site.

REEF is an international non-profit marine conservation organization that runs hands-on grassroots activities designed to educate and engage local communities in marine conservation-focused activities. REEF is based in Key Largo, Florida, with a Pacific office in Seattle, Washington. The mission of REEF is to conserve marine ecosystems for their recreational, commercial, and intrinsic value by educating, enlisting and enabling SCUBA divers and other marine enthusiasts to become active stewards and citizen scientists. REEF links the diving community with scientists, resource managers and conservationists through marine-life data collection and related activities. REEF coordinates the Volunteer Survey Project, which has trained and involved over 10,000 divers and snorkelers in marine life identification and the collection of useful population and distribution data. This citizen science

program has generated one of the largest marine life databases in the world, with over 114,000 surveys conducted to date.

This report includes a summary and analysis of data collected by REEF during the five year *Wellwood* fish monitoring project (May 2002 – August 2007). Results of the first two benthic monitoring events (year two and four) are presented in Hudson et al. 2007.

Study Area

The study area of this project included a portion of the grounding area that is being restored and two adjacent reference sites (Figure 2). The Restoration site (25.0105N, 80.3728W) surveyed included restoration modules and contiguous low profile hardbottom areas adjacent to and in between the restoration modules. Nearby high profile reef, ledges, and undamaged/unrestored reef were not included as part of the Restoration Site (Figures 3, 4, 5).

The reference sites were chosen to include areas that were closest in proximity to the grounding area while remaining undamaged and unrestored. It was anticipated that these sites would allow seasonal and temporal comparisons and would serve as a benchmark to measure and compare change over time at the Restoration Site. The reference areas were within nominal distance (25-75m) from the restoration area and all three sites could be visited during a normal recreational dive.

The North Reference site (25.0112N, 80.373W) was slightly shoreward of the restoration area and was comprised of non-impacted high profile spur and grove reef areas. Depth was similar to the restored area.

The South Reference site (25.0102N, 80.3733W) was located SSW of the *Wellwood* Restoration Site and was composed of both high relief spur and groove as well as hard bottom structure (Figure 6). Depth of this site was similar to that of the other two sites; however, it was slightly deeper at the base of the spurs than that of the Restoration Site.

Figure 4. A REEF diver conducts an RDT survey at the Restoration Site in October 2002, with several restoration modules in view.

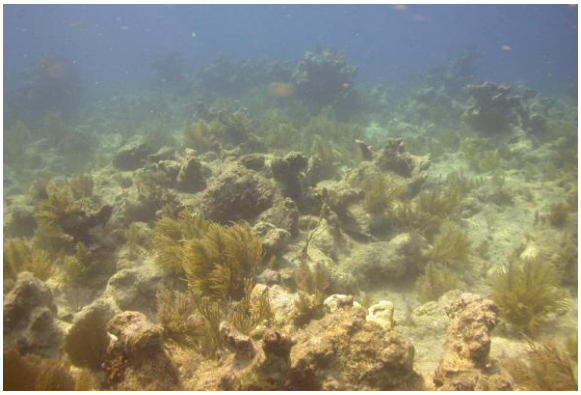

Figure 5. The Restoration Site in August 2007. Photo by Ken Nedimyer.

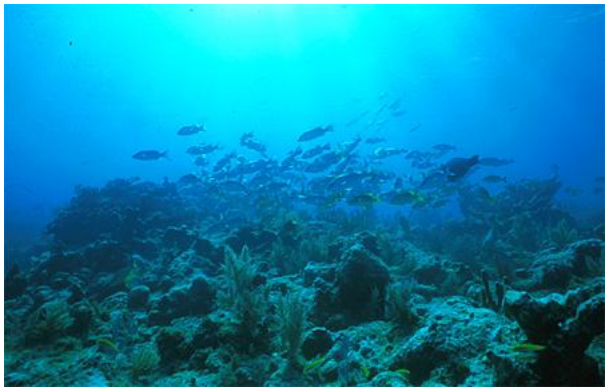

Figure 6. A large school of snapper and grunt at the South Reference site.

Figure 7. A REEF diver conducts a belt transect survey on the Restoration Site.

Method and Sampling Design

A team of Advanced Assessment Team REEF Experts conducted Roving Diver Technique (RDT; Schmitt and Sullivan 1996) and belt transect surveys on the *Wellwood* restoration site and two adjacent natural reef sites seven times during Year 1 (Figure 2). The team visited the sites once prior to restoration (May 2002) and 13 times after restoration was completed. Post restoration surveys were conducted monthly for the first three months, quarterly for the following year and semi-annually thereafter. On average, 13 surveys of each survey type (RDT and belt transect) were conducted during each survey effort.

The RDT is a non-point visual survey method specifically designed to generate a comprehensive species list and sighting frequency and relative abundance estimates. During RDT surveys, divers swim freely throughout a dive site and record every observed fish species. During each survey, divers assign each recorded species one of four $\log_{10}$ abundance categories [single (1); few (2-10), many (11-100), and abundant (>100)]. Each RDT survey is approximately 60 minutes, depending on safe diving limits. Following the dive, each surveyor records the species data along with survey time, depth, temperature, and other environmental information on a REEF scansheet. The scansheets are returned to REEF and are manually reviewed for completeness and any obvious errors. The scansheets are then scanned and digitized, and the resulting data file is error-checked using quality control data management programs. Data are then uploaded into the REEF SQL database.

Once entered into the REEF database, summary data are displayed on the Internet at the REEF Website (http://www.REEF.org) by geographic location, including a complete species list, sighting frequency of each species, and density score for each species, where

Sighting Frequency (%SF) = number of surveys reporting species / total number of surveys at that site, and

Density Score (DEN)= $[(n_S x1)+(n_F x2)+(n_M x3)+(n_A x4)] / (n_S + n_F + n_M + n_A)$, where n is the number of times each abundance category was assigned).

Using these two metrics, a weighted measure of abundance, Abundance Score, can be calculated as %SF * DEN.

In order to document size frequency shifts and more quantitative shifts in density of key taxa, belt transects were conducted (Figure 7). The AGRRA protocol for fish transects was followed (AGRRA 2001). The transect locations were randomly selected. The diver swam the length of the belt transects (2 m x 30 m) and recorded all species of the following groups: grouper (Serranidae), snapper (Lutjanidae), grunt (Haemulidae), parrotfish (Scaridae), surgeonfish (Acanthuridae), leatherjacket (Balistidae), angelfish (Pomacanthidae), butterflyfish (Chaetondontidae), and five additional species: yellowtail damselfish (*Microspathodon chrysurus*), hogfish (*Lacholaimus maximus*), Spanish hogfish (*Bodianus rufus*), barracuda (*Sphyraena barracuda*) and bar jack (*Caranx ruber*). The size of each fish was estimated and assigned to a size category (<5 cm, 5-10, 10-20, 20-30, 30-40, >40 cm) using a 50 cm bar with 5 and 10 cm increments for scale. Grunts and parrotfishes less than 5 cm in length were not recorded.

Results

A total of 585 RDT surveys and 559 belt transects were conducted by the REEF team during the five year project (Table 1). All RDT data were processed and uploaded into REEF's database, which is publicly accessible through the REEF Website. Transect data were entered into an Excel spreadsheet template (AGRRA[1]).

During the monitoring period, a total of 165 fish species were recorded at the restoration site, 189 species at the North Reference site and 207 species at the South Reference site. Richness recorded during RDT surveys varied through time at the three sites (Figure 8). The May 2002 effort was conducted prior to the installation of the restoration modules. Without the modules as a reference, the team had some difficulty defining the Restoration Site boundaries and RDT surveys during this effort included portions outside of the damaged area. This was reflected by an unusually high number of species recorded during RDT surveys (109 species) during the May 2002 effort at the Restoration Site. Therefore, the August 2002 RDT data are the best representation of the baseline condition for total species richness at the grounding location and richness values from May 2002 RDT surveys are not included in Figure 8. The belt transects conducted in May 2002 were well within the area where the modules were ultimately placed and therefore those data are included in this report.

Richness was consistently lowest at the Restoration Site and ranged between 65 species in September 2002 and 94 in August 2007. Species richness at the South Reference site was typically the highest of the three sites during the monitoring events and ranged between 107 and 135 species recorded per event (Figure 8).

Using all RDT data collected during the monitoring project, the 25 most frequently sighted species for each site were compiled (a total of 38 species). Table 2 compares the dominant species at each site, listing their abundance scores. Several species that were high in abundance at the reference sites were rare at the Restoration Site, including grunts and snappers (bluestriped grunt, smallmouth grunt, gray

[1] AGRRA Fish Analysis Datasheet Level 1, Version 3.0: August 2001. Ken Marks and Philip Kramer, modified by K. Cantelary, R. Claro.

snapper, Spanish grunt, schoolmaster) and yellow goatfish. At the *Wellwood* Restoration Site, white grunt was the only grunt that was frequently seen and in any significant numbers during RDT surveys (average sighting frequency 73%, Abundance Score 1.24). However, white grunt were rarely encountered during transect surveys (25 individuals total in the 559 transects conducted during the study period; Table 3). A complete list of species documented during RDT surveys at each site can be found on the REEF *Wellwood* Project Webpage (http://www.reef.org/programs/monitoring/wellwood).

Overall density and biomass of fish taxa recorded during the visual transects were lower at the Restoration Site than at either reference site due to the previously mentioned rarity of snappers (piscivores) and grunts (invertivores). However the density, biomass, and size of herbivores (parrotfish and surgeonfish) were similar at restoration and reference sites. Furthermore, there was no apparent increasing trend in density or biomass at the Restoration site through time (Figures 9a and 9b). Winter attrition in biomass was evident at all three sites (Figure 9b). Average biomass of the seven families recorded in transect surveys is shown in Figures 10a-g. One distinction was a seasonal pattern of significant increases in surgeonfish (primarily adults in the size class of 11-20cm) that was evident at the North Reference site (Figure 10a). Grouper, angelfish, and butterflyfish were rarely documented during transect surveys (although certain species of butterflyfish and angelfish were frequently sighted during the RDT surveys; Table 2).

The average size of parrotfish and surgeonfish during each of the monitoring events is shown in Figures 11a and 11b. On average, fish were smaller at the Restoration Site than at either of the reference sites throughout the study period. The average size of parrotfish initially increased over time at the Restoration Site, and between April 2003 and August 2004, approximately 25% of all parrotfish were greater than 30cm (Table 3). Similarly, average surgeonfish size increased in the year following restoration and in July 2003, 17% of all surgeonfish individuals were greater than 20cm. Since 2005, these proportions have dropped back to earlier levels (Table 3). However, the proportion of larger individuals in both of these families increased during the 2007 monitoring events.

Table 4 lists the total number of individuals recorded in transect surveys at the three sites. Fifty-nine species were recorded during the study period; 43 at the Restoration Site, 45 at the North Reference Site, and 54 at the South Reference Site. Of the 43 species documented in transect surveys at the Restoration Site, relatively few species were present in significant numbers. Eight species were documented with a total density of at least 0.9 individuals per m^2 (see below for more details). The remaining species were seen in much lower densities (15 species with total density between 0.1 and 0.09 individuals per m^2; 20 species with total density between 0.09 and 0.009 individuals per m^2). In comparison, for these same density ranges, the North Reference site had 15 species, 17 species and 13 species, and the South Reference site had 15 species, 17 species and 22 species.

Changes in average density and size frequency distributions through time for the eight species that had a total density of at least $0.9/m^2$ at the Restoration Site are shown in Figures 12a-12h (striped parrotfish, redband parrotfish, stoplight parrotfish, yellowtail snapper, ocean surgeonfish, doctorfish, blue tang, and yellowtail damselfish). The dramatic increase in the density of yellowtail damselfish in August 2006 was due to a significant recruitment event, with over 90% of the individuals recorded less than 5cm (Figure 12h).

Conclusions

As expected, the diversity, density and biomass of fishes found at the *Wellwood* Restoration site initially increased immediately following the installation of the restoration modules. However, the increases have not continued and these values have remained consistently lower than those found on the reference sites. The *Wellwood* Restoration site is currently dominated by a small handful of primarily herbivorous species and lacks the biomass of grunt and snapper species found at the reference areas. On average, fish were smaller at the Restoration Site than at either of the reference sites throughout the study period. However, the average size of the two dominant families, parrotfish and surgeonfish, appear to be increasing through time and are tracking the distribution pattern trends and recruitment patterns seen at the reference sites.

While the restoration modules clearly increased the amount of available habitat suitable for reef fish communities at the *Wellwood* grounding area, the overall fish diversity as well as density and biomass of most key fish families continue to be less than that of the two nearby, non-impacted reefs that were selected as monitoring reference sites. Parrotfish and surgeonfish appear to be responding the quickest to the restoration efforts, with densities and biomass values similar to that of the reference sites. These species were often seen grazing along low relief areas and transitional zones at the Restoration site. It is expected that as more time passes, fish species diversity will increase at the grounding site. The modules provide ample recessed areas and vertical relief that will likely, in time, serve as hiding places for more groupers, snappers, and grunts. The few white grunts and snappers seen on the Restoration Site were almost always associated with the vertical relief provided by the restoration modules or natural relief on the site. However, the overall low rugosity of the Restoration site as compared to the North and South Reference Sites will likely prevent the grounding site from having biomass levels found at the reference sites anytime in the near future.

Based on results published by Hudson et al. (2007), the restoration modules appear to becoming more similar to adjacent natural reference areas through time in terms of coral recruitment and biodiversity. The Gorgonian populations in particular are no longer statistically different from the benthic monitoring reference sites. However, Hudson et al. (2007) also found that the limestone boulder surfaces boasted higher coral recruitment levels than the concrete surface areas, which have a low degree of three-dimensional relief and topographic complexity compared with the complex boulder arrangements. Surveyors on the REEF project noted that sightings during RDT surveys of species such as redpotted hawkfish, saddled blenny and seaweed blenny were much higher on one specific reef module that hosts numerous transplanted staghorn coral (*Acropora cervicornis*). The staghorn specimens, which were originally a few inches tall and transplanted in 2003, have grown into colonies 24 to 30 inches tall and appear to be providing the preferred habitat for these small and cryptic species. Given the increased diversity found in and around the one specific module that hosts the staghorn coral transplant colonies, additional transplant efforts might be warranted. Additionally, the placement of additional structures and/or increasing the height/rugosity of the existing modules could increase the fish biomass found at the Restoration site.

There are currently no funds or plans for future assessments of the fish assemblage at the *Wellwood* Restoration site. However, if funds become available, REEF recommends that monitoring and assessment work on fish assemblages continues biannually in order to ideally capture seasonal trends as well as long-term changes. The relatively short duration of this study makes it difficult for results to

be teased out from natural population variability. Similarly, definitive conclusions cannot be achieved from these data due to the limited amount of time that has passed since restoration and the well-known decadal processes that are required for coral reef development.

Acknowledgements

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Table 1. Survey effort during five years of fish monitoring at the *Wellwood* restoration site and two reference sites.

	South Reference		North Reference		*Wellwood*	
Event	N - Transects	N - RDT	N - Transects	N - RDT	N - Transects	N - RDT
May 02	12	12	12	12	12	12
Aug 02	12	12	12	12	12	12
Sep 02	12	12	12	12	12	12
Oct 02	12	15	12	15	12	16
Jan 03	10	10	10	10	10	10
Apr 03	12	12	12	12	12	12
Jul 03	12	16	12	16	12	16
Aug 04	11	12	11	12	12	12
Feb 05	14	14	15	14	15	15
Aug 05	15	15	15	15	15	15
Feb 06	12	12	14	13	14	12
Aug 06	18	18	18	18	18	18
Feb 07	16	18	16	18	16	18
Aug 07	18	18	12	12	18	18
TOTAL	**186**	**196**	**183**	**191**	**190**	**198**

Table 2. A cumulative list of the 25 most frequently sighted species at each site. Abundance score, based on RDT data collected during the five year monitoring project is shown. The species list is ranked according to the Wellwood Restoration Site abundance score.

Common Name	*Wellwood*	North Reference	South Reference
Bluehead	3.66	3.74	3.93
Bicolor Damselfish	3.54	3.66	3.93
Clown Wrasse	2.99	2.87	2.79
Ocean Surgeonfish	2.77	2.82	3.02
Redband Parrotfish	2.70	2.84	2.92
Striped Parrotfish	2.64	2.65	2.78
Yellowhead Wrasse	2.63	2.65	2.92
Blue Tang	2.63	2.94	2.98
Stoplight Parrotfish	2.47	2.93	3.02
Yellowtail Snapper	2.44	2.98	3.17
Blue Chromis	1.95	2.39	2.78
Yellowtail Damselfish	1.88	2.66	2.78
Slippery Dick	1.77	2.19	1.99
Sergeant Major	1.77	3.27	3.36
Yellowtail Parrotfish	1.69	1.67	1.72
Queen Parrotfish	1.62	2.14	2.20
Spotfin Butterflyfish	1.54	1.42	1.76
Roughhead Blenny	1.51	1.20	1.08
Doctorfish	1.49	1.93	1.85
Princess Parrotfish	1.44	1.42	1.93
Graysby	1.31	1.66	1.98
Harlequin Bass	1.31	1.43	1.57
Bermuda Chub/Yellow Chub	1.25	2.52	2.74
White Grunt	1.24	2.17	2.88
Puddingwife	1.23	2.17	2.07
Rock Beauty	1.21	1.23	1.79
Spotted Goatfish	1.21	1.40	1.60
Sharpnose Puffer	1.19	1.51	1.79
French Grunt	1.02	2.69	2.99
Foureye Butterflyfish	0.88	1.90	1.93
Spanish Hogfish	0.77	1.79	1.83
Bluestriped Grunt	0.64	3.47	3.79
Smallmouth Grunt	0.14	3.12	3.57
Gray Snapper	0.07	2.85	3.32
Yellow Goatfish	0.06	2.25	3.17
Schoolmaster	0.04	1.35	2.86
Spanish Grunt	0.03	1.71	2.04

Table 3. Percentage of individuals in each size class at the *Wellwood* Restoration site through five years of monitoring.

	Parrotfish						Surgeonfish					
	0-5	6-10	11-20	21-30	31-40	>40	0-5	6-10	11-20	21-30	31-40	>40
May 02	N/A[1]	10%	45%	39%	6%	0%	6%	30%	57%	6%	0%	0%
Aug 02	N/A	45%	24%	17%	7%	7%	8%	47%	42%	2%	1%	0%
Sep 02	N/A	50%	15%	27%	2%	6%	6%	42%	45%	7%	0%	0%
Oct 02	N/A	27%	35%	31%	0%	8%	7%	26%	66%	1%	0%	0%
Jan 03	N/A	63%	30%	7%	0%	0%	6%	44%	48%	2%	0%	0%
Apr 03	N/A	9%	34%	31%	17%	9%	9%	36%	48%	7%	0%	0%
Jul 03	N/A	14%	50%	11%	23%	2%	0%	26%	57%	17%	0%	0%
Aug 04	N/A	40%	23%	17%	19%	0%	10%	26%	58%	6%	0%	0%
Feb 05	N/A	22%	55%	17%	5%	1%	1%	32%	61%	5%	0%	0%
Aug 05	N/A	54%	27%	13%	6%	0%	9%	44%	44%	3%	0%	0%
Feb 06	N/A	37%	37%	20%	5%	1%	10%	39%	51%	0%	0%	0%
Aug 06	N/A	42%	36%	17%	5%	0%	7%	49%	42%	2%	0%	0%
Feb 07	N/A	42%	25%	16%	16%	0%	15%	36%	36%	13%	0%	0%
Aug 07	N/A	36%	36%	17%	9%	2%	5%	55%	31%	10%	0%	0%

[1]Parrotfish less than 5 cm were not recorded.

Table 4. Total number of individuals seen during transect surveys during the 5-year monitoring period.

	North Reference	South Reference	*Wellwood*
Angelfishes	49	34	42
Queen	10	6	5
Rock Beauty	23	23	26
Blue	0	3	3
Gray	9	1	5
French	7	1	3
Butterflyfishes	120	111	61
Foureye	80	70	21
Spotfin	13	27	34
Reef	0	3	1
Banded	27	11	5
Grunts	3183	4764	78
Black Margate	8	7	1
Porkfish	7	9	2
White Margate	0	1	0
Cottonwick	2	3	0
Caesar	389	289	0
Smallmouth	1381	2113	1
French	158	289	39
Spanish	27	54	0
Sailors Choice	36	14	0
White	57	335	25
Bluestriped	1118	1650	10
Parrotfishes	893	944	946
Midnight	12	13	4
Blue	1	0	3
Bluelip	0	0	3
Striped	113	204	246
Rainbow	2	2	5
Princess	46	57	88
Queen	98	78	39
Greenblotch	0	0	10
Redband	263	289	326
Redtail	12	21	24
Redfin	46	42	47
Stoplight	300	238	151
Groupers	24	53	34
Rock Hind	0	1	0
Graysby	17	40	28
Coney	0	2	6
Red Hind	1	1	0
Nassau	0	2	0

Table 4. cont.

	North Reference	South Reference	*Wellwood*
Black	6	5	0
Tiger	0	1	0
Yellowfin	0	1	0
Snappers	1249	1675	156
Mutton	0	0	2
Schoolmaster	237	412	17
Cubera	7	3	0
Gray	620	638	0
Dog	0	21	0
Mahogany	52	250	4
Yellowtail	333	351	133
Surgeonfishes	1363	918	1324
Ocean	464	412	879
Doctorfish	58	77	107
Blue Tang	841	429	338
Leatherjacket	15	11	4
Scrawled Filefish	10	4	0
Slender Filefish	0	1	0
Whitespotted Filefish	0	0	2
Orangespotted Filefish	5	6	2
Other fishes	645	475	215
Spanish Hogfish	35	51	13
Bar Jack	93	59	24
Hogfish	11	12	13
Yellowtail Damselfish	482	347	104
Great Barracuda	24	6	61

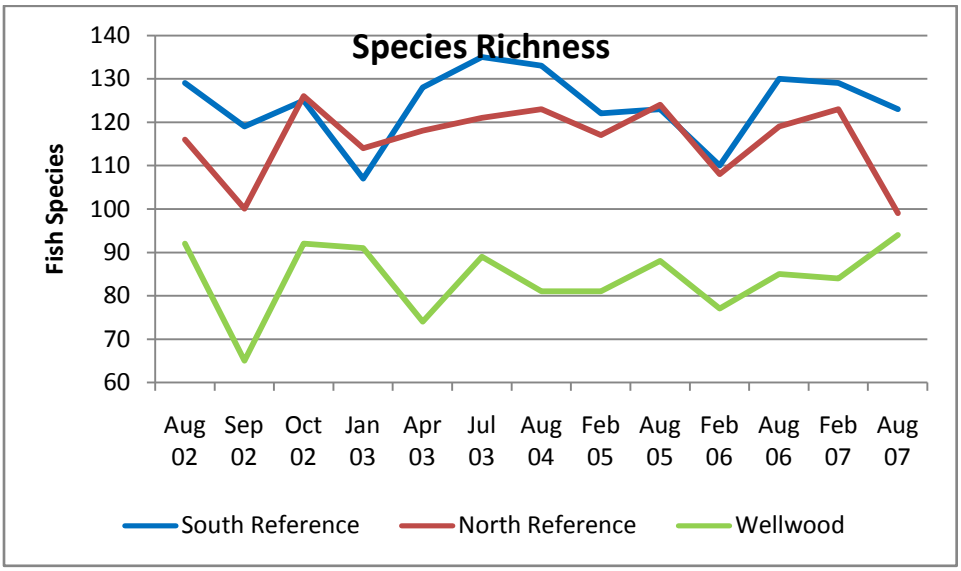
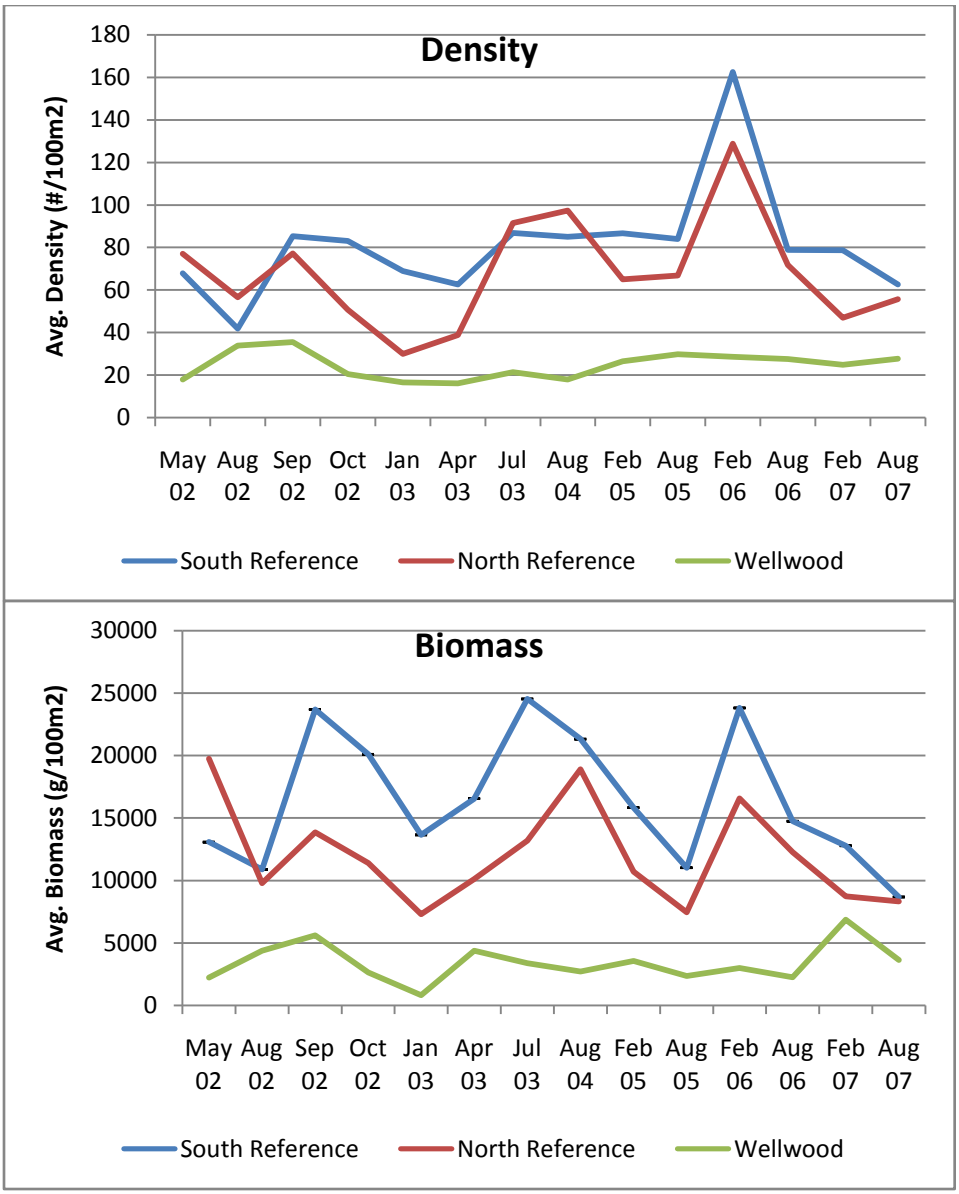
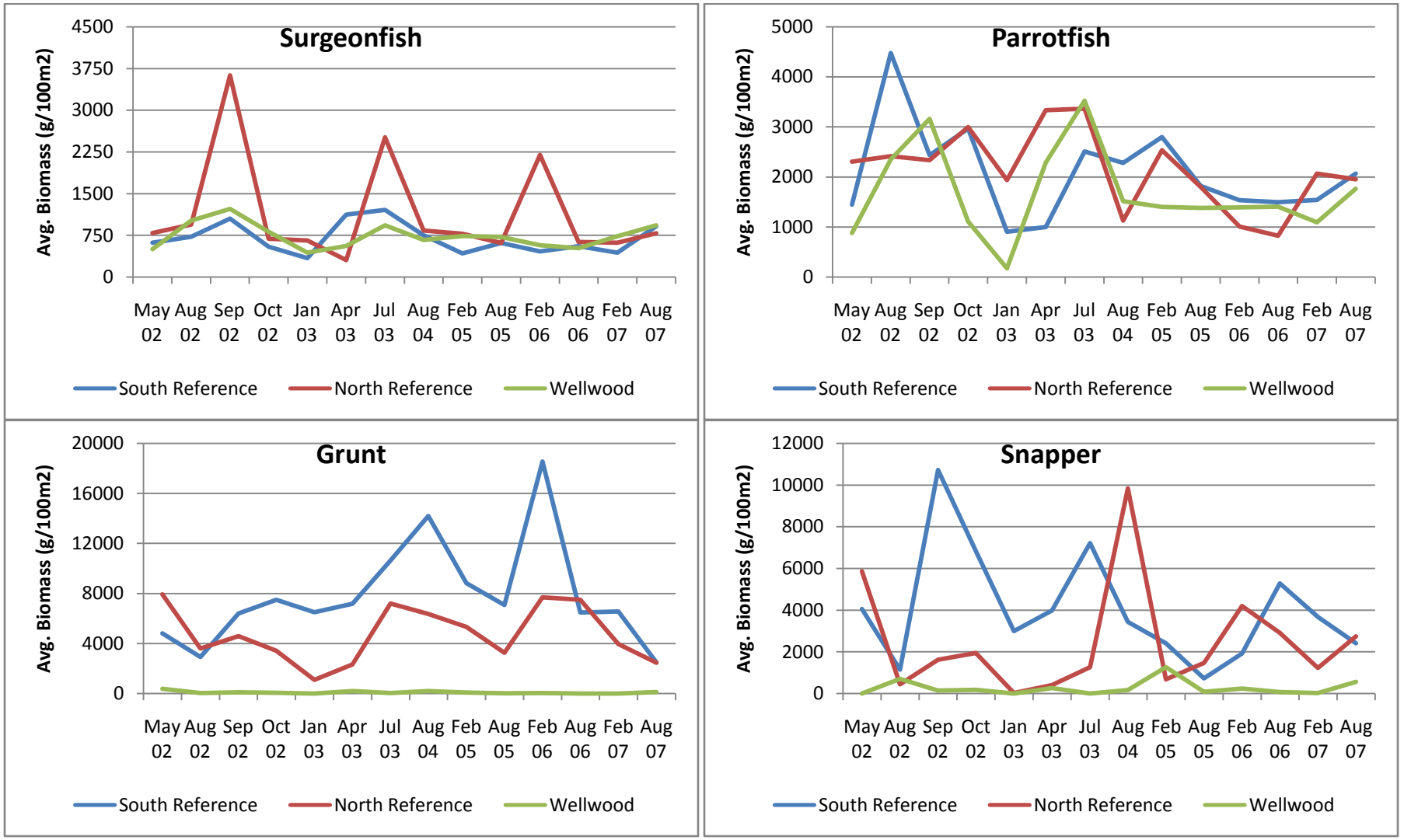


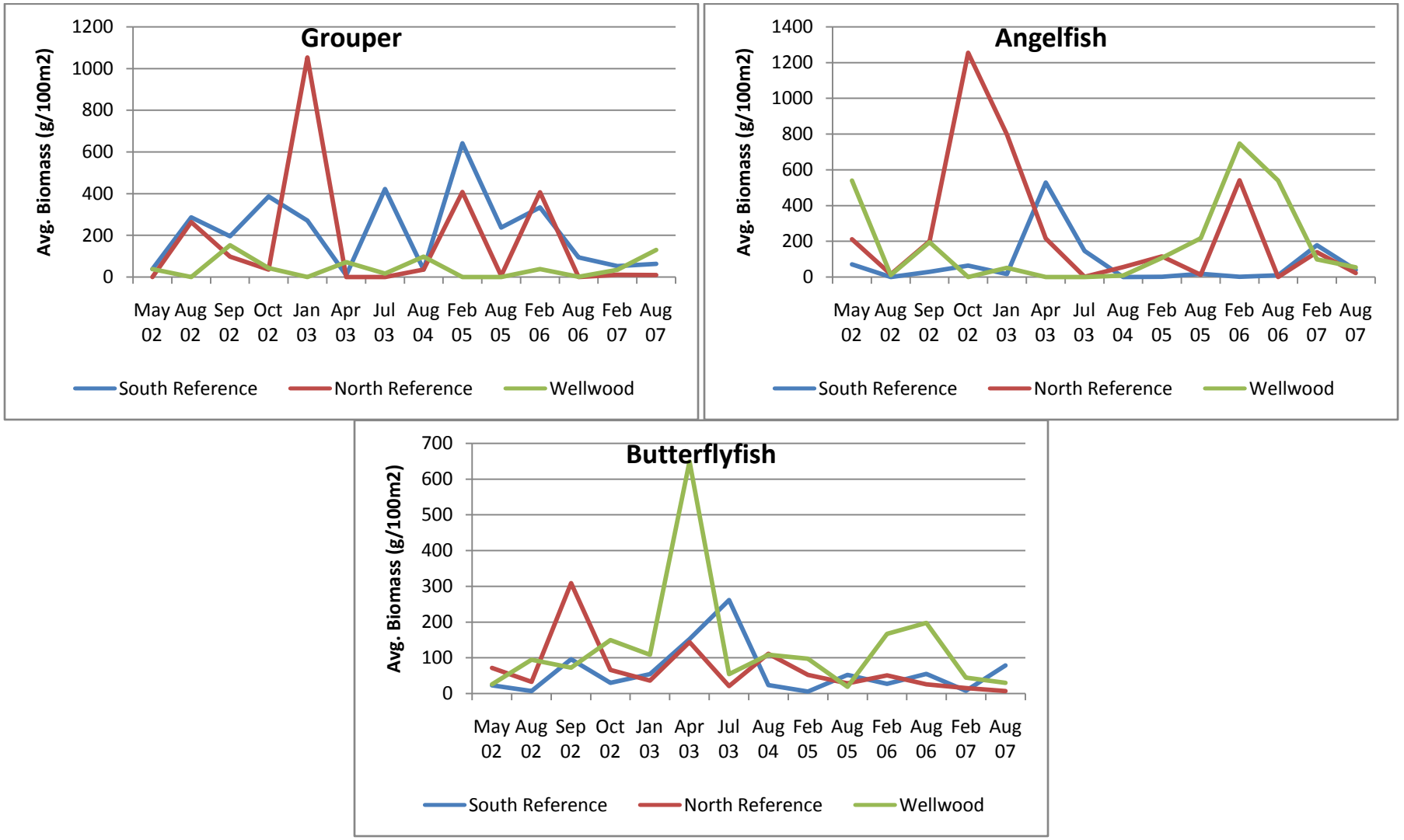
Figure 8. Total number of fish species recorded during RDT surveys during five years of monitoring.



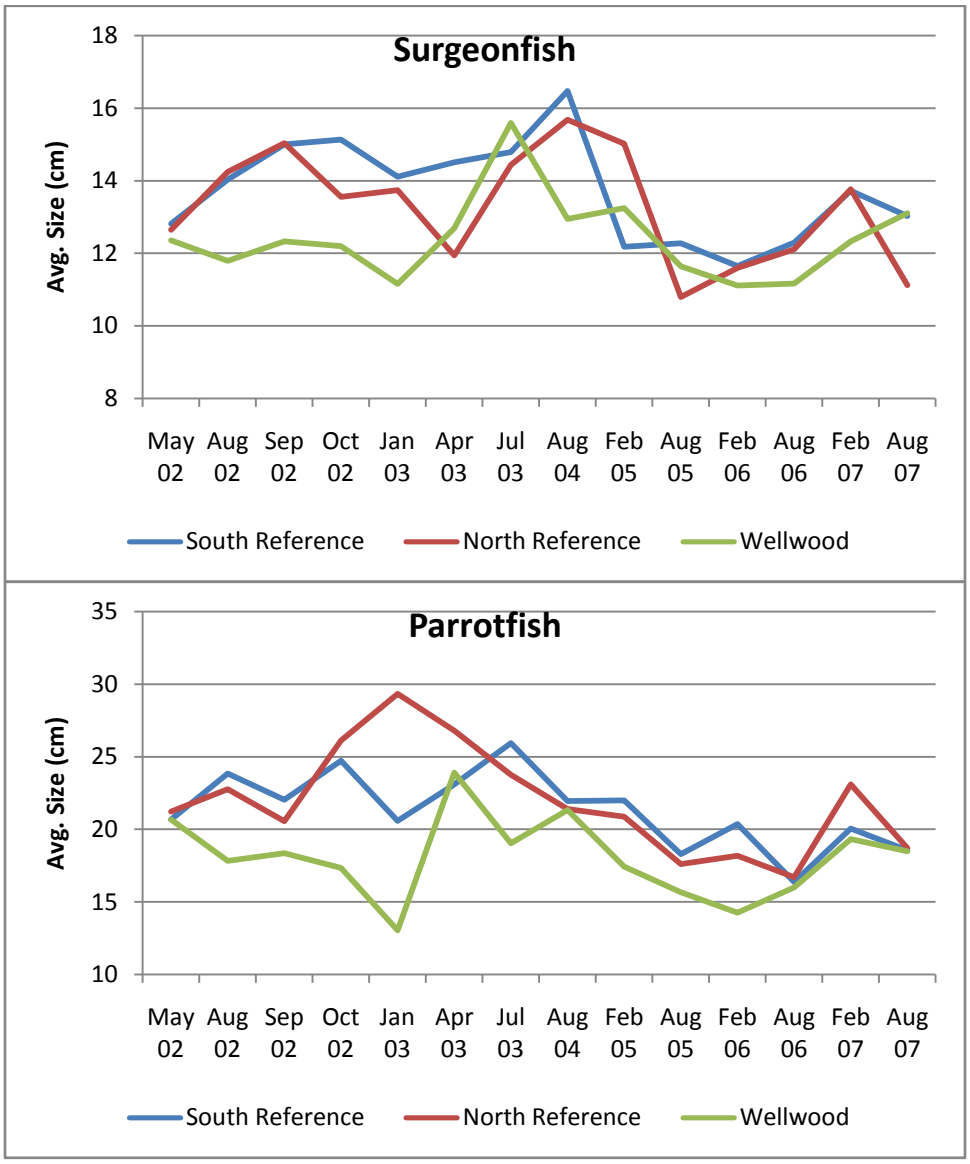
Figures 9a and 9b. Average Density and Biomass of fish species recorded during belt transect surveys conducted during five years of monitoring on the *Wellwood* restoration site and two reference sites.



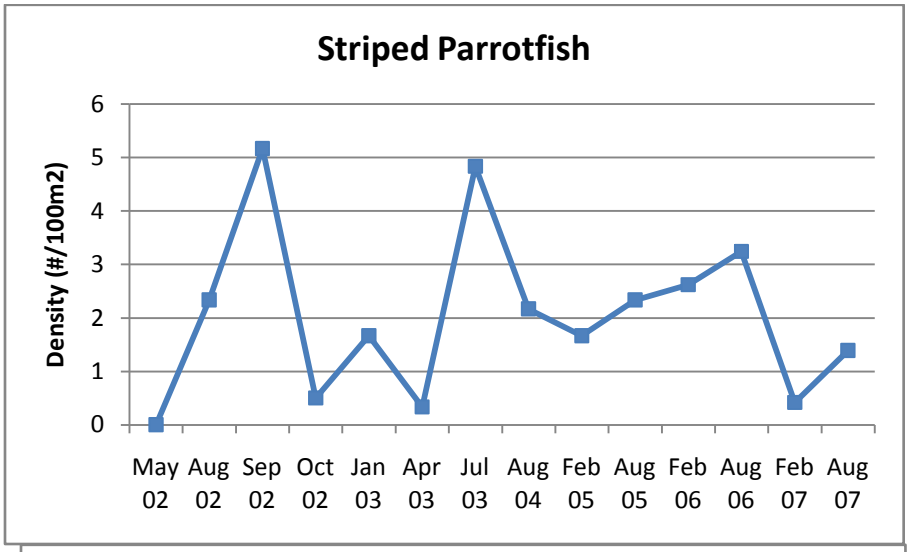
Figures 10a, 10b, 10c, 10d. Average biomass of selected fish families recorded in belt transect surveys at the *Wellwood* restoration site and two reference sites during five years of monitoring. See Table 4 for a list of species included in the family groupings.

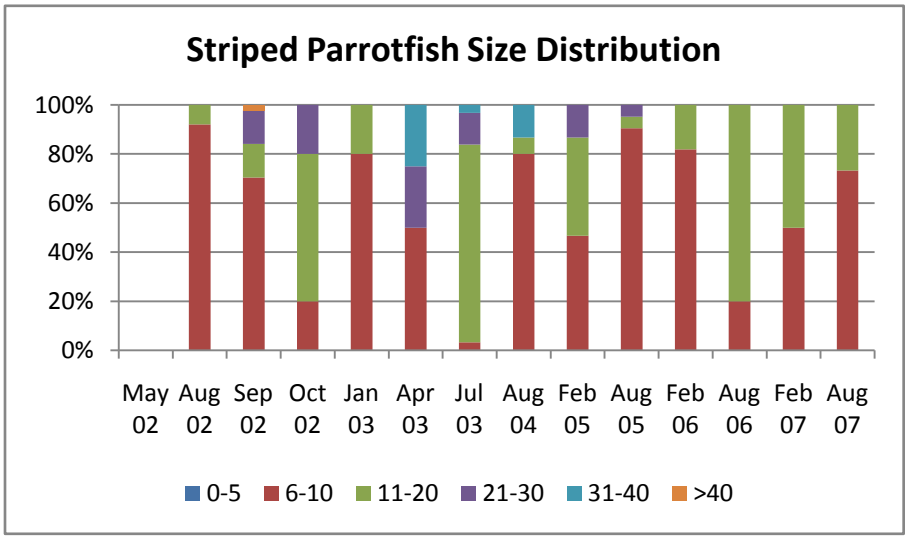


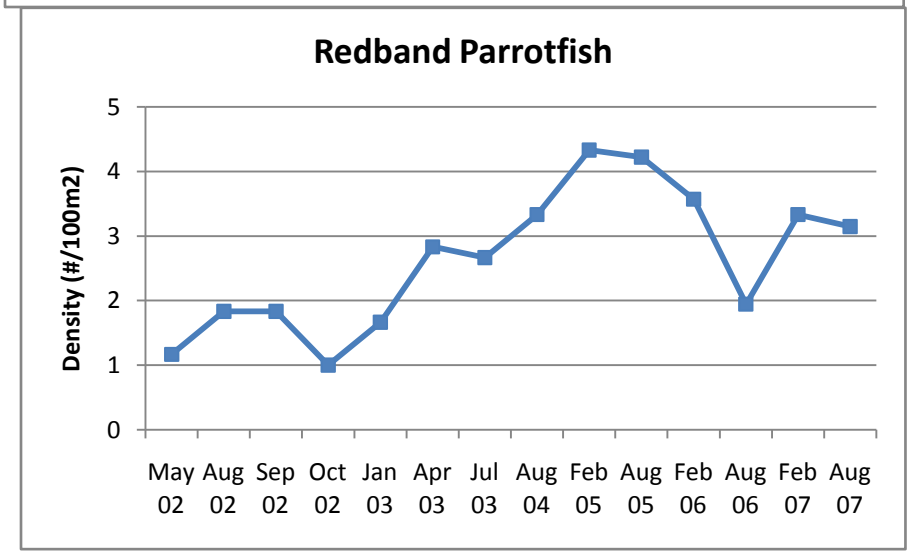
Figures 10e, 10f, 10g. Average biomass of selected fish families recorded in belt transect surveys at the *Wellwood* restoration site and two reference sites during five years of monitoring. See Table 4 for a list of species included in the family groupings.

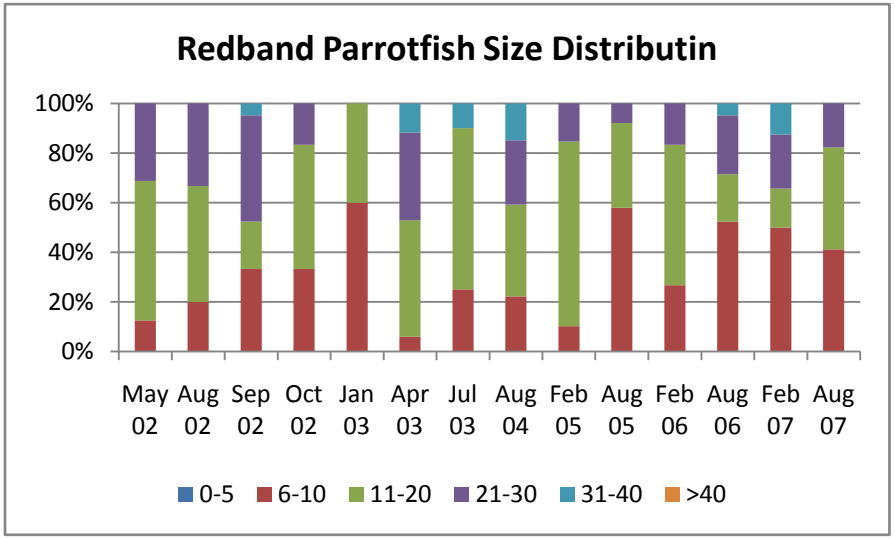


Figures 11a and 11b. Average size of surgeonfish and parrotfish recorded in belt transect surveys at the *Wellwood* restoration site and two reference sites during five years of monitoring.

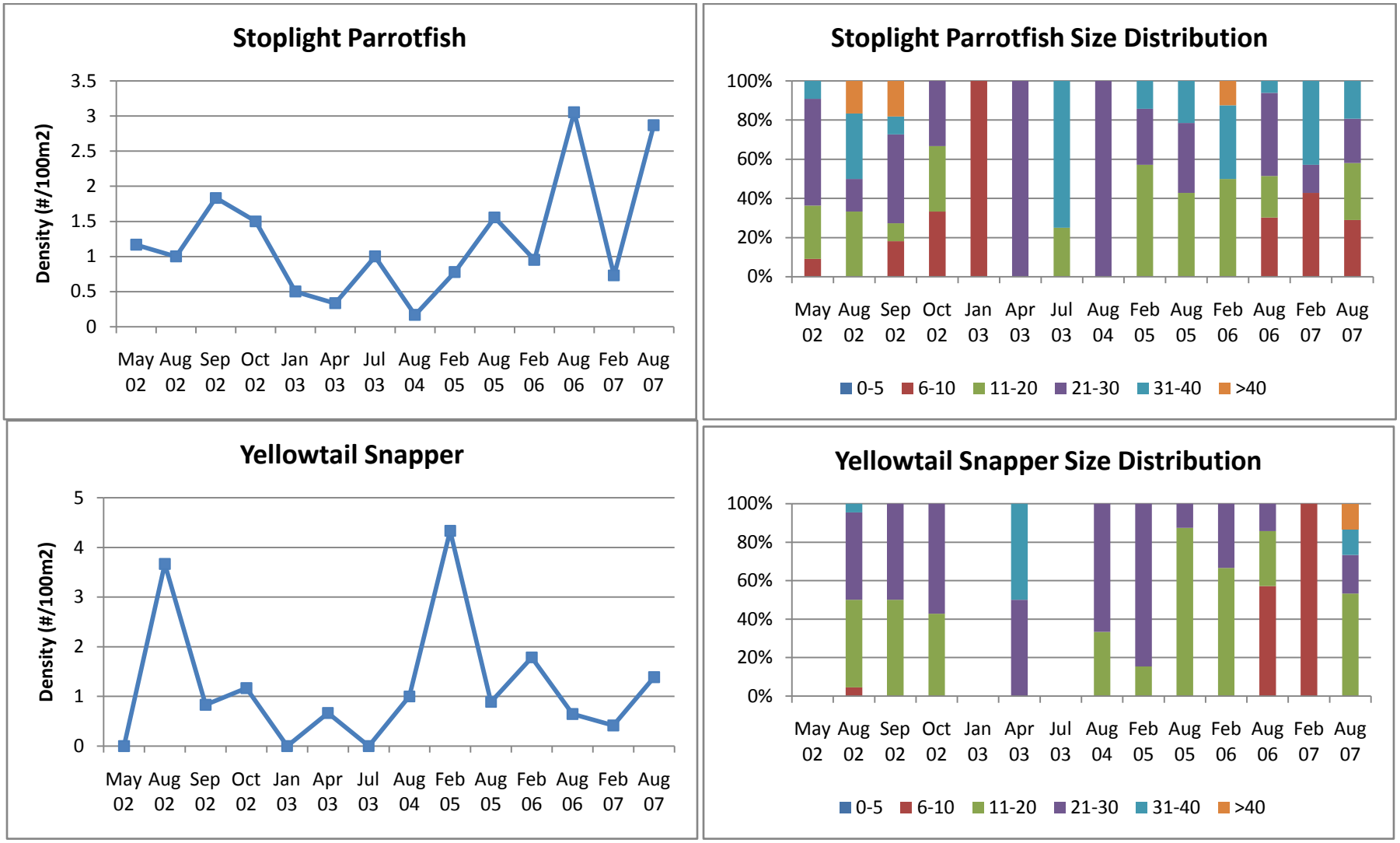




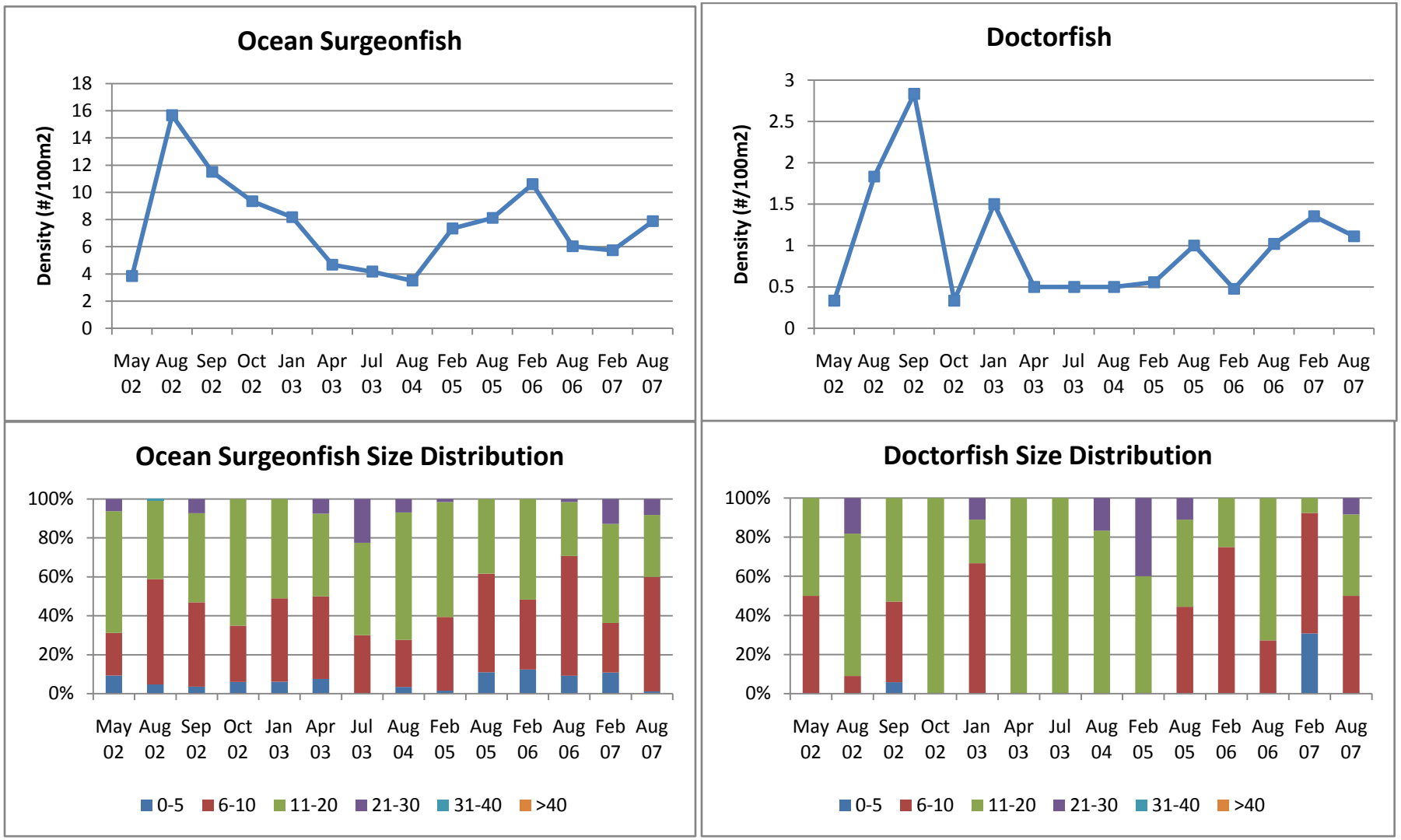




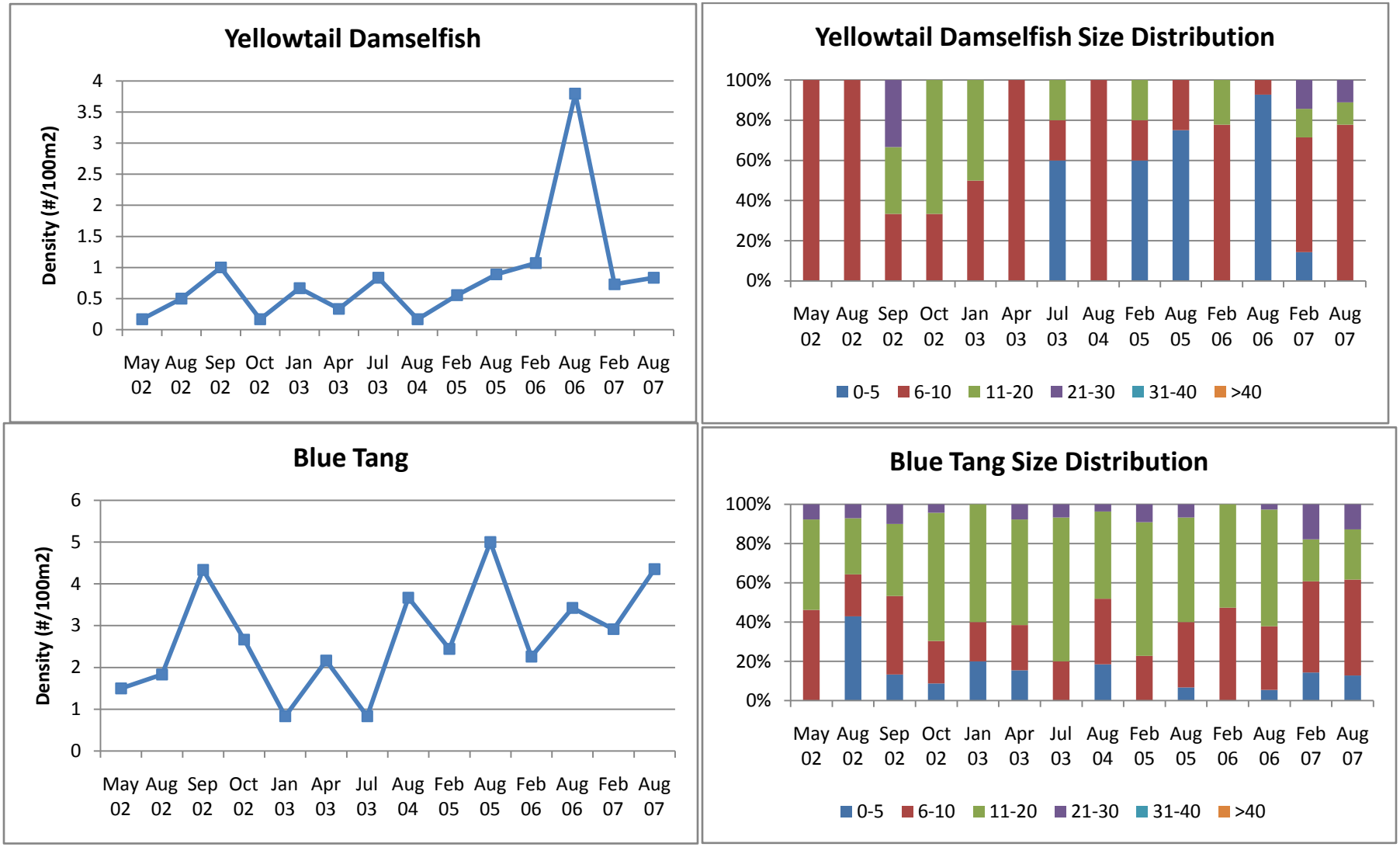
Figures 12a and 12b. Average density and size distribution of selected species at the *Wellwood* restoration site during five years of monitoring. Size classes are given in cm.



Figures 12c and 12d. Average density and size distribution of selected species at the *Wellwood* restoration site during five years of monitoring. Size classes are given in cm.



Figures 12e and 12f. Average density and size distribution of selected species at the *Wellwood* restoration site during five years of monitoring. Size classes are given in cm.



Figures 12g and 12h. Average density and size distribution of selected species at the *Wellwood* restoration site during five years of monitoring. Size classes are given in cm.