

Distributional patterns and community structure of Caribbean coral reef fishes within a river-impacted bay

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This study examined how riverine inputs, in particular sediment, influenced the community structure and trophic composition of reef fishes within Rio Bueno, north Jamaica. Due to river discharge a distinct gradient of riverine inputs existed across the study sites. Results suggested that riverine inputs (or a factor associated with them) had a structuring effect on fish community structure. Whilst fish communities at all sites were dominated by small individuals (<20 cm), diversity and total biomass were reduced with increased proximity to the river mouth. The abundance of all fishes, but particularly small-bodied, juvenile and herbivorous fishes was reduced in turbid water when compared to clear-water sites. Results strongly suggest that fluvial sediment inputs may play an important role in structuring fish assemblages even under intense fishing pressure.

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Key words: disturbance; environmental gradient; Jamaica; reef fishes; river; turbidity.

INTRODUCTION

Reef fishes play a principal role in the continued health and diversity of coral reef ecosystems: they are functionally important to the long-term maintenance and development of the reef framework, *e.g.* through herbivory and bioerosion (Sale, 1991; Mumby *et al.*, 2006). They also provide an essential source of income and protein to coastal human societies. Like many other taxa, coral reef fishes are increasingly encountering conditions and stressors that affect not only their ecology (*e.g.* overfishing and terrestrial inputs), but also their functional role in coral reef systems and their availability for exploitation (Jackson *et al.*, 2001). These stressors are likely to increase as human populations grow in areas adjacent to coral reefs. Increased demand on marine and coastal resources is also likely to result in increased terrestrial inputs into near-shore coastal waters (*e.g.* sediment, nutrients and other pollutants) (Polunin & Roberts, 1996; Fabricius, 2005).

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There is a growing body of literature highlighting how coral growth and reefal framework accretion can occur in naturally turbid, sediment impacted sites which until recently, were traditionally considered sub-optimal for coral growth (Perry, 2003; Smithers & Larcombe, 2003; Mallela *et al.*, 2004). Various studies have assessed the effects of anthropogenic sediment inputs on coral reefs and associated benthic communities (Rogers, 1990; Fabricius, 2005; Sanders & Baron-Szabo, 2005). Few studies, however, have considered the implications of terrestrial runoff for reef fish communities. Fish behaviour, such as mate choice (Heubel & Schlupp, 2006), may be altered in turbid water settings, whilst the ability of predator and prey to detect each other can also be impaired (Abrahams & Kattenfeld, 1997; Utne-Palm, 2002). Studies of temperate marine, freshwater and estuarine fish species indicate that turbid water environments may be more optimal for fishes with a short visual field (*e.g.* planktivores, fish larvae and benthivores), whilst visual predators such as adult piscivorous fishes, which often detect their prey over large distances, may be at a disadvantage (Utne-Palm, 2002). A small number of reef studies have documented the effects of acute anthropogenic sediment inputs (*e.g.* sediment impacts from dredging) on reef fish communities with reductions in fish diversity linked to loss of live coral cover and topographical relief (Amesbury, 1981; Galzin, 1981; Adjeroud *et al.*, 1998). Natural long-term sources of terrestrial disturbances (*e.g.* riverine sediment inputs) and the effects on reef fish assemblages, however, have largely been overlooked, the exception being Fabricius *et al.* (2005).

Sediment impacted reefs can support a diverse array of reef organisms (Perry & Larcombe, 2003). Turbid-water reef systems, whilst considered marginal (Kleypas *et al.*, 1999), are common (Perry & Larcombe, 2003) and often located in areas adjacent to land masses (McLaughlin *et al.*, 2003). Turbid reefs also provide refuge and essential habitat to numerous reef organisms, whilst fishers also utilize such areas. Clearly, fish communities that inhabit such sediment impacted reefal systems warrant further investigation. Resource managers and scientists require basic information regarding how coral reef fishes respond to such stressors in order to enable successful long-term management and conservation of coral reef ecosystems.

This study focused upon the heavily degraded reef system of Rio Bueno, situated on the north coast of Jamaica. The Rio Bueno embayment, like other sites on the north Jamaican coastline, is characterized by algal dominated reefs (Mallela *et al.*, 2004). A phase shift from coral to algal dominance was attributed to the combined effects of overfishing (Jackson *et al.*, 2001), repeated hurricane damage (Woodley, 1992), grazing urchin (*Diadema antillarum*) mortality (Hughes *et al.*, 1985), disease and anthropogenic nutrient inputs (Lapointe *et al.*, 1997). In addition to this, Rio Bueno is also characterized by riverine inputs from the Dornock River, in particular fine (<63 µm) terrestrial sediments (Mallela, 2004). As such, this embayment provides a useful location in which to examine reef fish community dynamics in alternate state turbid water reef communities. The aim of this study was to assess the effects of riverine inputs (*e.g.* sediment and fresh water) on the spatial distribution and community structure of associated reef fish assemblages.

MATERIALS AND METHODS

STUDY AREA

The Rio Bueno embayment, north Jamaica (Fig. 1), is a drowned river valley (Woodley & Robinson, 1977), c. 0.8 km wide. The embayment is characterized by riverine inputs (e.g. fresh water, terrestrial sediment and nutrients) from the Dornock River. The daily tidal range is small (15–60 cm; Gayle & Woodley, 1998) and the local wave regime is primarily wind generated. North-easterly trade winds are responsible for circulating the Dornock River plume in a westerly direction along the north Jamaican coastline. A previous study noted that a gradient of sediment impacts (e.g. elevated turbidity) from the river plume is apparent throughout the water column (0–30 m) and north to south across the embayment, and that the greatest impacts were in the south, the inner embayment area adjacent to the river mouth (Mallela *et al.*, 2004). Changes in salinity and water temperature only occurred in the surface few metres of the water column (<2 m), and as such were not thought to influence reef communities and the associated benthos (water quality is detailed in Mallela *et al.*, 2004).

Despite substantial riverine inputs, Rio Bueno supports diverse reef communities. Prior work by Mallela *et al.* (2004) highlighted three distinct environmental zones based on water quality and benthic cover: 1) the southern, inner embayment which is chronically impacted by riverine inputs. High terrestrial sediment loads and reduced light penetration prevent any carbonate reefal production in this zone; 2) the central embayment, an area subjected to moderate to high riverine inputs. This zone represents an area of turbid reef framework development. Framework accretion is restricted to depths

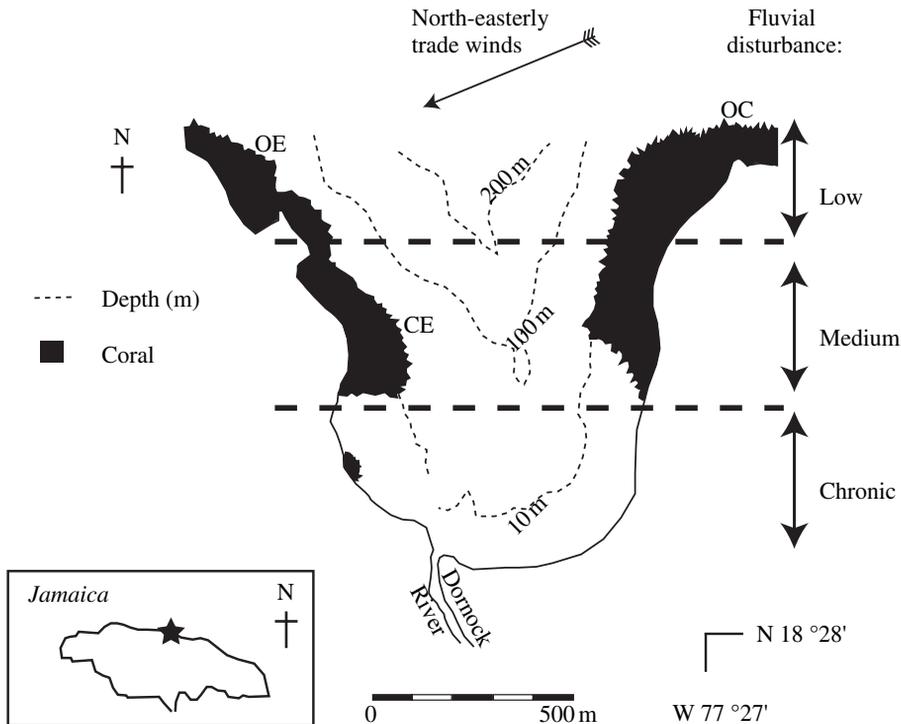


FIG. 1. Schematic map detailing the three survey sites in Rio Bueno: CE, OE and OC in relation to the degree of fluvial disturbance from the Dornock River.

of ≤ 30 m; 3) the outer embayment, which is minimally impacted by riverine inputs and represents a clear-water reef environment. Reef development occurs to depths of ≥ 40 m (J. Mallela, pers. obs.).

SITE SELECTION

Based on previous work characterizing water quality and reef framework (Mallela *et al.*, 2004), three contrasting sites along the fluvial gradient within Rio Bueno were selected in order to assess the effects of riverine inputs (*e.g.* fluvially derived sediment) on reef fish communities. Site CE was located in the central embayment, and site OE and OC in the outer embayment (Fig. 1). CE represents a highly turbid reef site, and OE represents a low impact clear-water site. Due to westward-flowing currents, OC was not impacted by the river during this study and acted as a reference site, *i.e.* an outer embayment site that was not influenced by riverine inputs.

METHODS

Data were collected over two field seasons: April to September 2001 and June to August 2002. In order to characterize water quality, light attenuation was assessed at the three study sites from 0 to 30 m using a LICOR light meter ($n = 13$ per site). Salinity and temperature measurements were recorded through the water column from 0 to 10 m using a HORIBA UW10 water probe ($n = 19$ per site). In order to assess sedimentation rates, sediment traps were positioned 50 cm above the substratum at 10 m, and retrieved bi-weekly if underwater visibility allowed. Benthic mapping was conducted using a line intercept transect at 2, 5, 10, 15, 20 and 25 m at each site (three replicates per depth zone), coral was identified to species level, and algae to family level [see Mallela *et al.* (2004) for detailed methodologies of the above].

Surveyors were trained in underwater size estimation techniques (English *et al.*, 1997). Reef fish communities were assessed at three depths at each site: 5, 10 and 15 m, with three replicates per depth zone. Fishes were observed using visual scuba census between 0700 and 1000 hours. Transects were 30 m long and fishes were observed 2.5 m on either side of the transect line and up to 5 m above the substratum, *i.e.* a $30 \times 5 \times 5$ m belt transect. Transects were positioned randomly across reef areas. Fish species (Lieske & Myers, 1996; Humann & Deloach, 2000), abundance and length estimates were noted for all species except pomacentrids. Pomacentrid counts were restricted to territorial herbivorous species (*i.e.* planktivorous chromids were not counted) and identified only to family level, and no size estimates were made. Fishes were grouped into total length (L_T) classes: <5 , 6–10, 11–20, 21–30, 31–40 cm, *etc.* Observer effort was standardized by swimming transects at a constant rate (4 m min^{-1}). Published length and mass relationships obtained from Fishbase (<http://www.fishbase.org>) were used to estimate fish biomass from size classes for each species. Information on fish trophic ecology was also obtained from Fishbase and species were classified into three basic trophic guilds, *i.e.* carnivore, herbivore or omnivore.

STATISTICAL ANALYSIS

Abundance and biomass data were compared using two-way ANOVA (depth and site as effects, with Bonferroni *post-hoc* comparisons). Species diversity was estimated according to the Shannon–Wiener diversity index (H'), $H' = -\sum P_i \ln(P_i)$ where P_i is the proportion of individuals found in the i -th species. Variation in fish community structure between the three sites was examined using three metrics of fish community structure, *i.e.* the abundance of different fish families, trophic guilds and size classes, using PRIMER 6 (Clarke & Gorley, 2006). Analyses included multidimensional scaling (MDS) ordinations and analysis of similarities (ANOSIM, 5000 permutations in all analyses) of Bray Curtis similarity matrices of dispersion-treated and square root transformed

data. Initially two-way ANOSIM tests were run with site and depth as main effects, but results showed that depth had no statistical effect based on any metric of community structure (global $R \leq 0.12$, $P > 0.05$). Subsequently, all ANOSIM comparisons were run as one-way tests, with site as the effect. Where ANOSIM showed significant differences between sites ($P < 0.05$), dissimilarities were compared using the PRIMER similarities percentages routine (SIMPER).

RESULTS

WATER QUALITY AND BENTHIC HABITAT

Clear differences in water quality were observed between the three sites. With increased proximity to the river mouth mean \pm s.d. sedimentation rates rose from 5.3 ± 3.6 at OC and 7.1 ± 2.4 at OE to 13.8 ± 4.7 mg cm⁻² day⁻¹ at CE (Fig. 2), light penetration decreased, whilst surface salinity and temperature fluctuated only in the surface few metres of the water column (Fig. 3). Benthic cover at all three study sites (≤ 25 m) was dominated by macro algae (OC 53, OE 25 and CE 25%), with live coral cover occurring to depths of ≤ 30 m at all sites. Mean live coral cover (≤ 25 m) at each site was 10.9% at OC, 13.2% at OE and 16% at CE. Coral cover was dominated by platy and submassive coral species (e.g. *Agaricia* spp. and *Porites astreoides*). A detailed description of habitat and water quality at these study sites is given in Mallela *et al.* (2004) and summaries are given in Fig. 3.

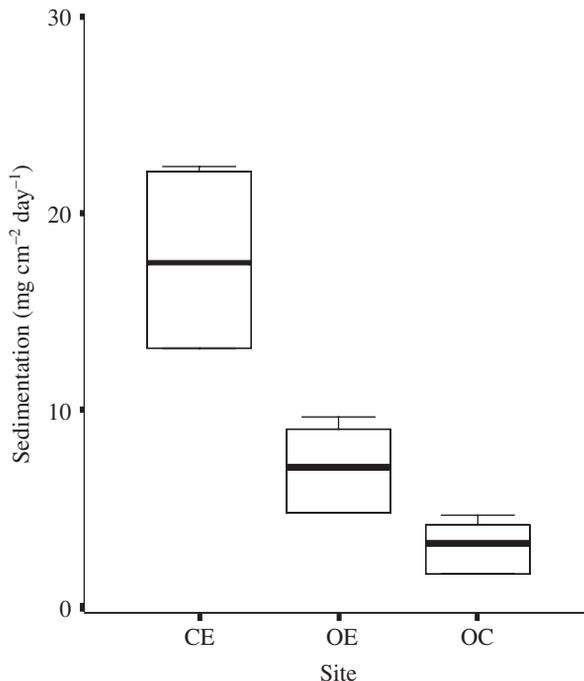


FIG. 2. Box whisker plots showing sedimentation rates at the three survey sites (see Fig. 1). Sedimentation rates rose with increased proximity to the shoreline.

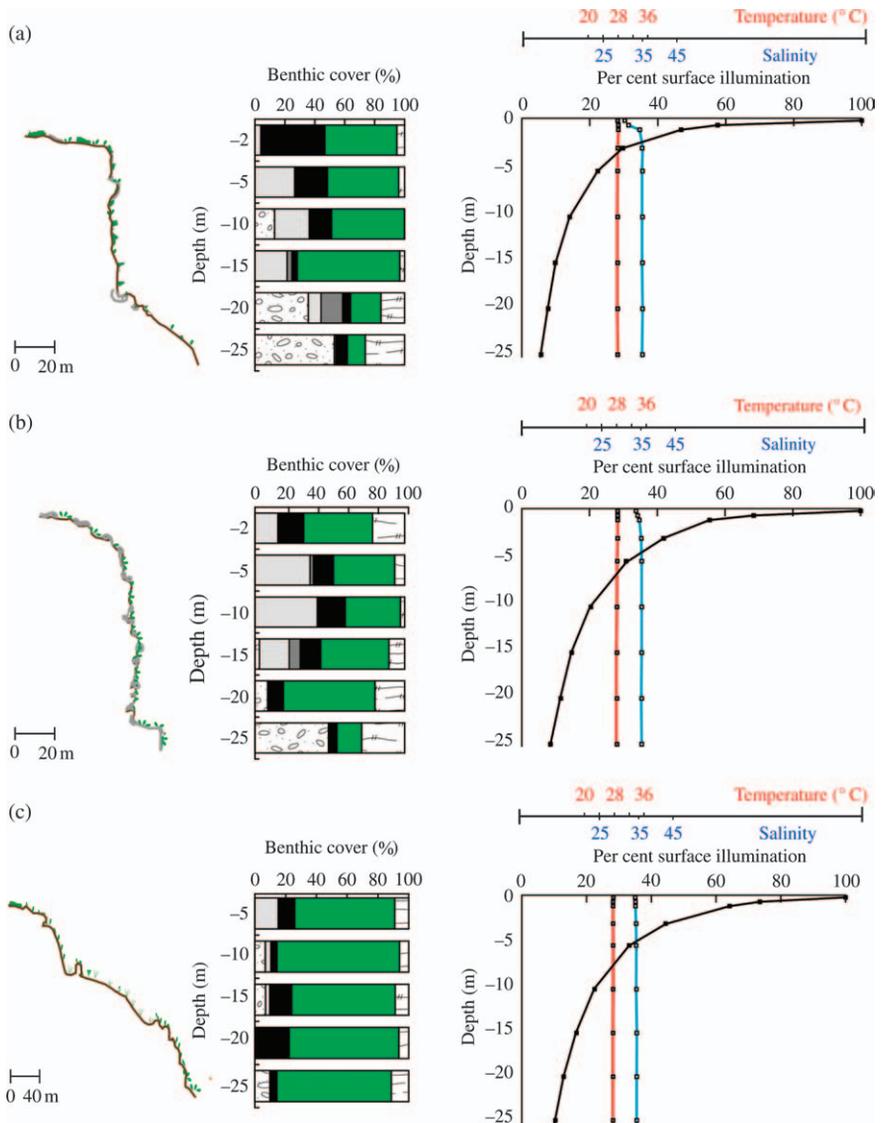


FIG. 3. Illustrations of reef profiles at (a) CE, (b) OE and (c) OC (see Fig. 1). Bar graphs summarize benthic cover (■ hard coral, □ other, ▒ rock, ▒ rubble, ■ algae and ▒ sediment, adapted from Mallela *et al.*, 2004), and bathymetric plots of salinity (—), temperature (—) and light attenuation (—) (0–25 m). Note all sites are algal dominated.

REEF FISH COMMUNITY CHARACTERISTICS

A total of 43 fish species were observed on fish transects in Rio Bueno (species richness: OC 31, OE 31 and CE 21 species). Fish communities at all three sites were relatively diverse: $H' = 2.42$ (OC); 2.62 (OE) and 2.30 (CE). Dominant species at OC were redband parrotfish *Sparisoma aurofrenatum* (Valenciennes, 1840), yellow-headed wrasse *Halichoeres garnoti* (Valenciennes, 1839) and

damselfishes (Pomacentridae) accounting for 56% of all observations. At OE dominant species included: stoplight parrotfish *Sparisoma viride* (Bonnaterre, 1788), damselfishes and princess parrotfish *Scarus taeniopterus* Desmarest, 1831, which accounted for 53% of all observations, whilst at CE, the turbid water site, the most common species included pomacentrids, barred hamlets *Hypoplectrus puella* Cuvier, 1828, and redband parrotfish (55% of all observations).

A two-way ANOVA was used to compare the mean abundance of fishes at each site [Fig. 4(a)] and three depth zones in the embayment. Abundance varied significantly by site (d.f. = 2 and 18, $P < 0.001$). There was, however, no effect of depth on the abundance of fishes (d.f. = 2 and 18, $P > 0.05$), or any interaction between site and depth (d.f. = 4 and 18, $P > 0.05$). A Bonferroni *post-hoc* comparison showed that abundance (mean \pm s.e.) was similar at sites OE (47.90 ± 4.59) and OC (57.56 ± 5.33), but significantly reduced at the turbid site CE (20.20 ± 3.49).

A similar approach was applied to examine variation in the estimated biomass of fishes [Fig. 4(b)]. There were significant differences in mean biomass between sites (d.f. = 2 and 18, $P < 0.001$), with no effect of depth (d.f. = 2 and 18, $P > 0.05$). There was no significant interaction between site and depth (d.f. = 4 and 18, $P > 0.05$). A Bonferroni *post-hoc* comparison revealed significant differences between mean \pm s.e. biomass estimates at each site: biomass recorded per transect was lowest at the turbid site CE (209.00 ± 42.12 g), intermediate at site OE (533.00 ± 40.80 g) and greatest at OC (832.00 ± 99.50 g). Throughout Rio Bueno, the majority of reef fishes were small: 6% of observed fishes were in the 1–5 cm category, 70% were 6–10 cm, and 24% were 11–20 cm L_T . Only three fishes >20 cm were observed on transects: one great barracuda *Sphyrna barracuda* (Walbaum, 1792) in the 51–60 cm size class at site OE, and at OC one lizard fish *Synodus* sp. and one trumpetfish *Aulostomus maculatus* Valenciennes, 1837, both in the 21–30 cm size class. No fishes >20 cm were observed on transects at CE. Cumulative species curves for fishes observed

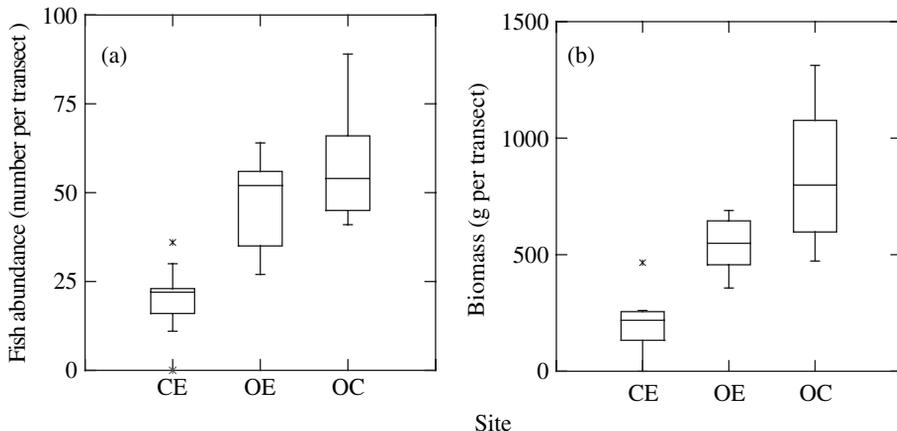


FIG. 4. Box whisker plots showing (a) fish abundance and (b) fish biomass at each site (see Fig. 1).

at each site are detailed in Fig. 5. Clear differences are apparent between central and outer sites with outer sites having greater species richness (CE = 21, OE and OC = 31 each). Table I summarizes the results of visual surveys at each of the three sites and compares the total abundance and estimated biomass of the different fish families, species richness and species diversity (H') are also summarized.

Multivariate analyses (ANOSIM and MDS ordinations) suggested that fish community structure (according to classification by family, trophic guilds and size) differed between sites along the riverine gradient, but that the greatest differences were between the turbid water, central site CE, and the outer embayment sites (OE and OC). ANOSIM tests found no effect of depth on fish community structure at any site.

Examination of the MDS ordination of reef fish family data [Fig. 6(a)] indicated that fish community structure varied within the embayment. This was due, however, to clear differences between the fish communities at site CE and sites OC and OE, where data effectively overlapped. ANOSIM results confirmed these conclusions (global $R = 0.33$, $P < 0.01$). Pair-wise comparisons demonstrated that community structure based on family data was statistically indistinguishable at sites OE and OC ($R = 0.06$, $P > 0.05$), but differed between the turbid CE and other sites: CE v. OC ($R = 0.34$, $P < 0.001$) and CE v. OE ($R = 0.64$, $P < 0.001$). SIMPER analyses indicated that the differences between the fish community at sites OC and OE, and CE were largely associated with increased abundances of most fish families at the outer sites (see Table I), and only Haemulidae, Carangidae and Priacanthidae were more abundant at site CE.

MDS ordination indicated that the trophic guilds (carnivore, herbivore or omnivore) contributing to the fish communities at each site differed. Patterns

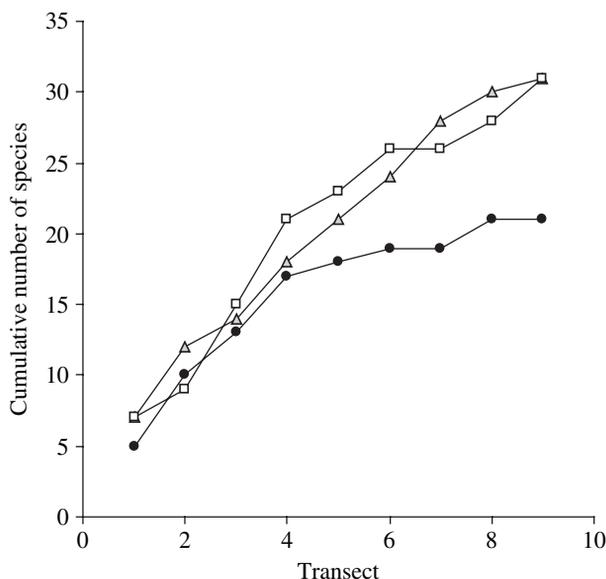


FIG. 5. Cumulative species curve for fish observed on transects at CE (●), OE (▲) and OC (□) (see Fig. 1).

TABLE I. Comparison of the total abundance (●) and total biomass (O) of fish families recorded during visual census (5–15 m) at each site: CE, OE and OC (see Fig. 1). Species richness and species diversity (Shannon–Wiener, in H') are summarized

Family	CE		OE		OC	
Acanthuridae	●	○	●	○	●	○
Aulostomidae					●	○
Carangidae	●	○	●	○	●	○
Chaelodontidae			●	○		
Haemulidae		○	●	○	●	○
Holocentridae			●	○	●	○
Labridae	●	○	●	○	●	○
Lutjanidae	●	○	●	○	●	○
Mullidae	●	○	●	○	●	○
Pempheris	●	○				
Pomacentridae	●	○	●	○	●	○
Priacanthidae	●	○				
Scaridae	●	○	●	○	●	○
Serranidae	●	○	●	○	●	○
Sphraenidae			●	○		
Synodontidae					●	○
Tetraodontidae					●	○
Species richness	21		31		31	
Species diversity (H')	2.30		2.62		2.42	

Abundance: ● 1–10, ● 11–50, ● 51–100, ● 101–150, ● 151–250.

Biomass (g): ○ 1–50, ○ 51–100, ○ 101–500, ○ 501–1000, ○ 1001–5000.

were similar to that shown from fish family data [Fig. 6(b)]: data from the inner, turbid-water site CE showed little overlap with those from the outer sites (OE and OC) embayment sites. Again, ANOSIM demonstrated significant differences between the sites (global $R = 0.32$, $P < 0.01$), and pair-wise comparisons showed that this was due to differences between site CE and the outer sites: CE v. OC ($R = 0.71$, $P < 0.001$) and CE v. OE ($R = 0.38$, $P = 0.006$). Data from sites OE and OC overlapped ($R = 0.07$, $P > 0.05$). SIMPER analysis suggested that the differences between inner and outer sites were due to a slightly reduced contribution of herbivorous fishes at site CE.

According to MDS ordinations, there was evidence that the size structure of the fish community differed between sites, and that fishes from site CE were most distinct [Fig. 6(c)]. ANOSIM analyses confirmed this conclusion (global $R = 0.43$, $P < 0.01$). The size structure of fishes observed at sites OC and OE was indistinguishable ($R = 0.1$, $P > 0.05$), but significant differences were recorded between inner (CE) and outer (OC and OE) sites: CE v. OE ($R = 0.43$, $P < 0.01$) and CE v. OC ($R = 0.67$, $P < 0.01$). SIMPER analyses demonstrated that these differences were associated with a lack of small individuals (<5 cm) at the turbid site CE.

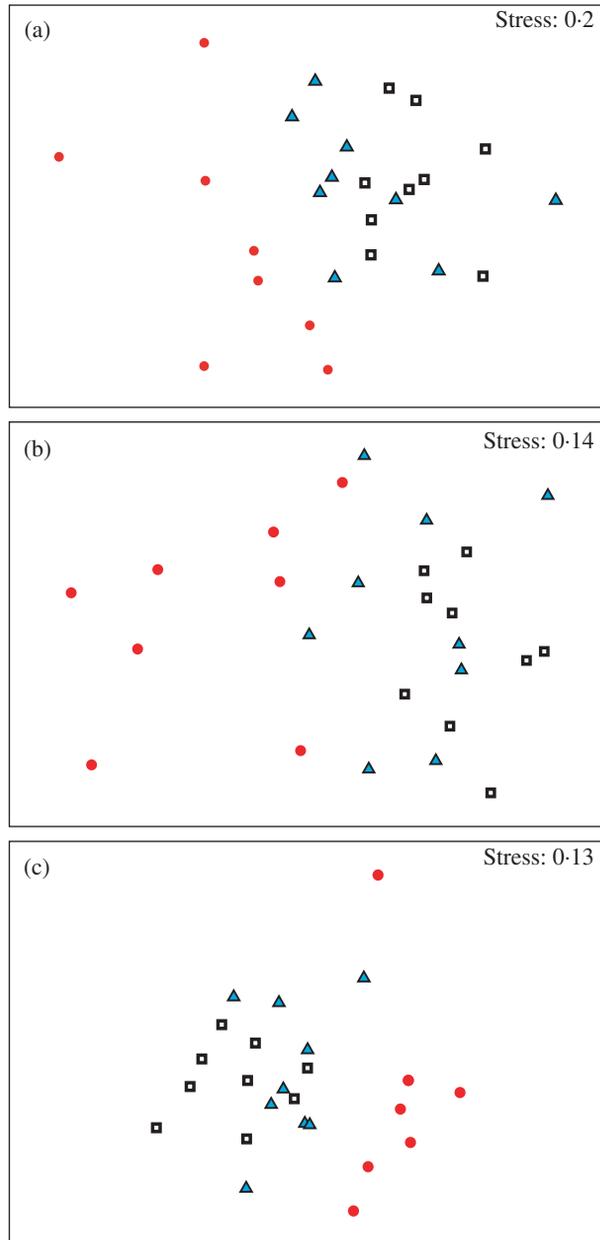


FIG. 6. Multidimensional ordinations (MDS) of fish community structure at three contrasting sites [CE (●), OE (▲) and OC (■); see Fig. 1] according to (a) fish family, (b) fish trophic guild and (c) size structure. Each point represents a single transect, and in the MDS ordination proximity represents increased similarity. A stress value <0.2 represents a useful two-dimensional representation of the data (Clarke & Gorley, 2006).

DISCUSSION

Worldwide, numerous reefs are located in close proximity to shorelines and are increasingly subjected to disturbances from terrestrial and riverine runoff (Fabricius, 2005). Despite this, there is a paucity of knowledge with regards to how terrestrial runoff and associated sediment inputs influence reef fish communities. This study examined variation in reef fish community structure along an environmental gradient within a small, turbid, riverine impacted embayment in north Jamaica. The results highlight significant differences in fish community structure at the three study sites within the bay. A parallel study (Mallela *et al.*, 2004) detailed this environmental gradient and the associated benthic communities. The major disturbance identified in Rio Bueno related to riverine sediment inputs which ranged from chronic (sedimentation rates: $>20 \text{ mg cm}^{-2} \text{ day}^{-1}$) to low ($<2 \text{ mg cm}^{-2} \text{ day}^{-1}$). Salinity and temperature were not thought to influence fish community structure as only the surface of the water column ($<2 \text{ m}$ depth) was characterized by reduced marine salinities (≤ 34) and temperatures ($<28^\circ \text{ C}$).

Reef fish communities differed significantly along the riverine gradient with the greatest differences observed between the turbid central embayment and the outer embayment reference site. Depth was not found to influence fish abundance within sites. The fish community at the most disturbed site, CE, was characterized by low abundance, reduced species richness, and a distinct lack of small and juvenile fishes. Interestingly, certain species and families were only observed at the turbid water site. For example, juveniles and intermediate phases of the blackfin snapper *Lutjanus buccanella* (Cuvier, 1828) were repeatedly observed at CE but not at any other location, as were large shoals of small herring (Clupidae). In contrast, the outer embayment sites were characterized by increased fish abundance, a more diverse fish community and a wider size distribution. Multivariate analyses indicated that the fish community (*i.e.* the abundance of reef fish families, trophic guild and size structure) recorded from the turbid inner site (CE) contrasted with those of the intermediate CE and reference (OC) sites, which were generally similar.

This study has shown significant variation in fish community structure across a riverine gradient within a small embayment. It should be noted that the small size of fishes observed throughout this study is attributed to the effects of overfishing and not riverine impacts. Fishes at all three sites were found in low numbers and were dominated by small-bodied fishes of low commercial value. The most abundant fish families observed at sites throughout Rio Bueno were wrasse (Labridae), parrotfishes (Scaridae) and damselfishes (Pomacentridae). In contrast, highly valuable commercial species, such as groupers (Serranidae), snappers (Lutjanidae) and grunts (Haemulidae) were observed in low numbers. Almost all individuals observed were $<20 \text{ cm } L_T$. This is consistent with other studies which indicate that Jamaican reef fishes have long been over-exploited (Jackson, 1997), and are currently dominated by small, low value species (Hughes, 1994; Klomp *et al.*, 2003).

Prior studies have suggested that differences in the community structure of reef fish assemblages between sites can be linked to differences in the physical and biological environment (Williams, 1982; Williams & Hatcher, 1983; Russ,

1984). Such factors include turbidity, sediment load, incident light, wave energy, food availability (*e.g.* algal composition and abundance), larval supply, reefal zonation, topographical complexity and habitat diversity. Anthropogenic factors which effect fish community structure include differences in fishing pressure (Fabricius *et al.*, 2005). Within this study it was not possible to control for all of these factors. All three sites, however, were surveyed for fishes at 5, 10 and 15 m. In this depth range, certain site characteristics were similar, for example macroalgal assemblages dominated benthic cover and platy and sub-massive morphotypes dominated scleractinian coral assemblages. Whilst CE and OE were characterized by vertical walls, however, OC was characterized by a steeply sloping fore-reef (Mallela *et al.*, 2004). It is possible that wave energy may be partly responsible for the difference observed between the outer and central sites. OE and OC were classed as high energy sites as wind driven waves occurred daily after 1000 hours. In contrast, CE was sheltered to an extent from the north-easterly trade winds and associated wave energy. In order to limit the effects of wave energy, fish transects were conducted prior to 1000 hours when sea conditions were calm. As all sites were in close proximity to each other (<1000 m) it is also assumed that the potential for recruitment was similar at all sites. Sites were fished on a daily basis (J. Mallela & C. Roberts, pers. obs.) and fishing effort was uniform between sites (J. Mallela & C. Roberts, unpubl. data). Fishers were observed using traps and spear fishing whilst snorkelling, and gillnets were occasionally used. Based on these factors, it seems likely that the observed differences in reef fish community structure between sites may be due to the direct or indirect effects of fluvial sediment inputs (*e.g.* reduced visibility, or smothering of eggs). Further studies are needed to examine these factors in more detail.

Results from this study confirm the findings of Chave & Eckert (1974) in Fanning Island and Letourneur *et al.* (1998) (New Caledonia), where depauperate herbivore assemblages were reported in turbid water lagoonal settings and species richness was found to decrease with increasing terrestrial runoff. Fabricius (2005) also described a decline in fish abundance with decreasing water quality in the inshore Great Barrier Reef, whilst overall species richness remained similar. These sites, however, were also characterized by different fishing pressures making it difficult to interpret results clearly. In the Eastern Caroline Islands, Amesbury (1981) detailed how dredging activities during construction of an airport runway resulted in high sediment inputs onto local reefs. At sites that were inundated by sediment, fish abundance and diversity was reduced, and Amesbury (1981) attributed this primarily to habitat loss (*e.g.* burial of coral colonies). Interestingly, at sites that were highly turbid, but where sediment did not accumulate, fish assemblages remained stable.

It is essential that future studies examine how reef fish communities function in turbid water near-shore settings. The number of sediment impacted reefs worldwide is increasing as a direct result of human activities (*e.g.* land clearance, urbanization and population growth; Fabricius, 2005). Turbid water reef fish assemblages are also coming under increasing pressure from coastal populations wishing to exploit them. According to the present study, fluvially impacted reef fish communities were characterized by reductions in: fish abundance, biomass, species diversity and herbivorous fish species, whilst small and

juvenile fishes were also less common. The implications of this for near-shore reef fisheries and reef health are unclear. The lack of herbivores on Jamaican reefs undoubtedly facilitates macroalgal development, whilst the limited occurrence of mature bioeroding fish species (Scoffin *et al.*, 1980) such as *S. viride* may also influence rates and styles of framework accretion (Mallela & Perry, in press). In order to confirm these findings and effectively manage turbid water fish stocks, further studies of reef fish communities exposed to terrestrial inputs need to be conducted on reefs that are not characterized by decades of overfishing.

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