

Assessment of Coral Reef Fishes in Virgin Islands National Park

By Jim Beets

Disturbance has been demonstrate to be extremely important to community structure (Sousa 1984). Coral reef fishes are particularly vulnerable to disturbance. When different components of the coral reef community are disturbed either by natural or anthropogenic disturbances, species in the fish assemblage are differentially affected based on their association, e.g., plankton-planktivores, algae-herbivores, invertebrates-predators. Catastrophic storms tend to affect most trophic levels of fishes by disrupting their food supplies or, more generally, by affecting their shelter. Lack of shelter, which enables fishes to avoid predation, may limit fish abundance.

Observed effects of Hurricane Hugo and recovery

The sustained monitoring program, which began in 1988 in Virgin Islands NP, has provided a rare opportunity to observe the effects of a hurricane on coral reef fishes and their subsequent recovery. We selected three different reef types around St. John and sampled them monthly with a random point visual technique (Bohnsack and Bannerot 1986). We censused fishes in the two predominant zones present on the fringing reef system within the park, the upper forereef and lower forereef.

Census data demonstrated that the abundance of all fish species declined at the monitoring sites as a result of Hurricane Hugo and remained depressed for the next three months (Fig. 1). Some herbivorous fishes (primarily surgeonfishes) significantly increased following the storm, probably in response to the enormous increase in algal growth (Mann-Whitney U Test, $P < 0.001$).

Most species showed substantial recovery during the first year following Hurricane Hugo (e.g., parrotfishes, Fig. 1). Although total fish abundance has returned to pre-storm levels, the proportion of the surgeonfishes was greater one year after the storm than before it (Fig. 1). There herbivorous fishes have maintained much greater abundance compared to pre-storm levels.

A few species, such as planktivorous fishes (e.g., *Chromis* spp.) were greatly affected by the storm and have shown very slow recovery. The abundance of most species is dominated by juveniles.

The storm had a varied effect on different fish species within the study area. Most larger species were probably displaced from the shallow water monitoring sites to deeper reefs as previously observed by Walsh (1983) for a reef in Hawaii. Predation of small individuals due to habitat loss and displacement was also certainly an important factor. Declines in abundance, habitat shifts and behavioral changes in many species were observed during the first month following the storm, as described in previous investigations (Woodley et al. 1981, Kaufman 1983, Walsh 1983). Displaced species appeared to redistribute themselves during the several weeks following the storm. The redistribution of fishes and colonization by juveniles contributed to recovery in abundance of most species during the 6 months after Hugo.

Storm-generated change in coral assemblages in exposed sites, especially the decrease in topographic complexity, decreased the amount of shelter available for many fish species, especially cryptic species,

such as basslets, cardinalfishes, blennies and gobies, and for recently-recruited juveniles. The loss of topographic complexity and decline in living coral cover may favor the abundance of larger, schooling herbivorous fishes and turf-tending damselfishes living in the coral rubble. The effect of the hurricane on reef fish assemblages was most pronounced in areas where branching corals (particularly, elkhorn and staghorn) previously comprised the structure of the reef and shelter for fishes was dramatically reduced. The slow recovery of some planktivorous species may be due to reduced recruitment or slow recovery of the associated plankton community, which has been shown to change following major storms (Woodley et al. 1981).

What's in the Future?

Although we have been able to observe the local effect of a major storm, we need a more thorough understanding of coral reef fish ecology and a determi-

nation of the best methods for monitoring reef fishes. We will continue to sample different habitats and to evaluate various methods to provide a more complete view of the fishes and fisheries within the park and surrounding shelf area. Many questions may not be answered until we have accumulated several years of data. We can expect natural fluctuations in species abundances, but we may see shifts in species dominance based on successful recruitment, changes in ecological and oceanographic conditions, and human influence.

One of our greatest concerns is the effect of commercial, artisanal, and sport fishing on fish assemblages within the park. We look forward to cooperating with the National Park Service on a major fisheries project to begin this year.

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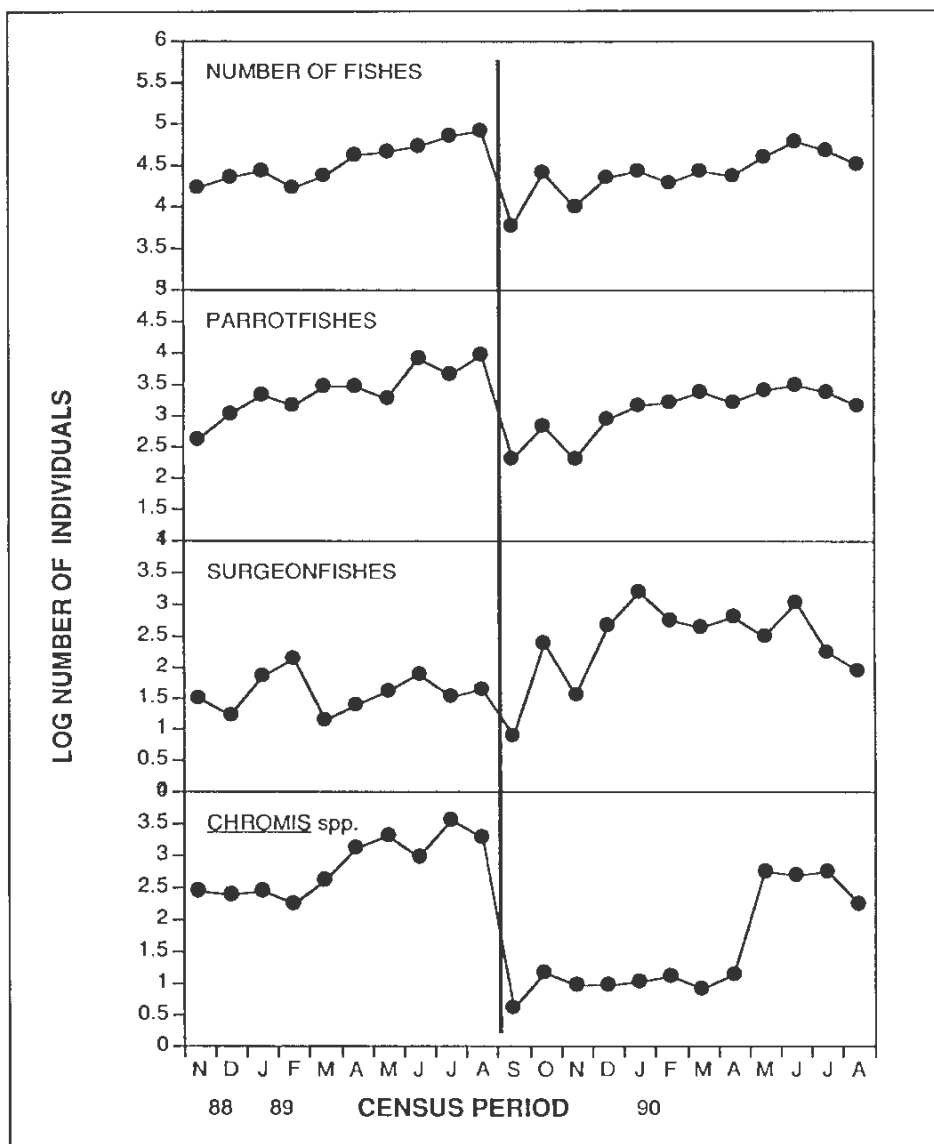


Figure 1. Relative changes in total abundance of fishes and of dominant fish taxa before and after Hurricane Hugo. Data are presented log-transformed ($\ln X - 1$). Parrotfishes and surgeonfishes are herbivorous species; Chromis spp. are planktivorous damselfishes. Vertical line represents date of Hurricane.

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