



Marine Reef Fish Community: Monitoring in the United States Virgin Islands (USVI)

2020

Importance: *A critical resource for fisheries, tourism and marine biodiversity*

Historically reef fish populations are valued by recreational and commercial fisheries, as popular attractions for divers, and a component for healthy reef ecosystems. The health and sustainability of reef fish populations have a large impact on both the economy and ecology of the United States Virgin Islands.

Objectives and Approach: *Multi-agency monitoring*

Long term monitoring assists management decision-making by documenting trends in reef fish abundance, community composition, distribution, and size structure; identifying potential causes of changes and evaluating the effectiveness of actions in different management zones.

Data were collected using a Reef Visual Census (RVC) stationary point count in which all fish were identified to species, counted and size estimated by a diver within a 15 meter (49 foot) diameter cylindrical sampling unit. Sites were selected in below 30 meter (98 feet) water depth in various reef habitats using a stratified random survey design. Within the United States Virgin Islands, 528 sites were surveyed in 2017 and 2019 to monitor reef fish populations and will continue on a biennial basis. This report summarizes trends within the economically and/or ecologically important (or “focal”) reef fish species including Coney



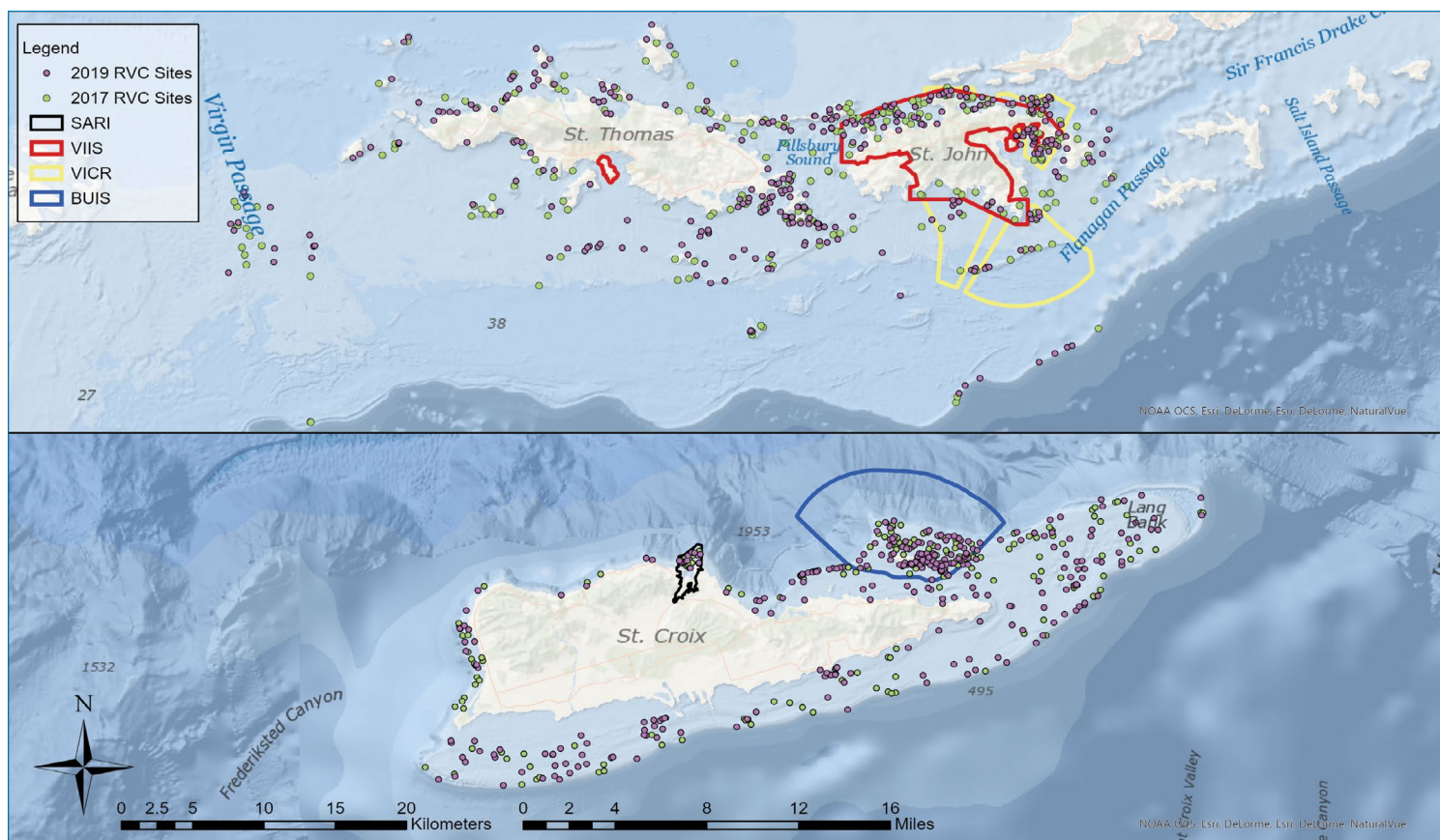
Above: Select focal fish species monitored in the United States Virgin Islands (USVI). (A) Coney (Fishbase photo/John Randall); (B) Yellowtail Snapper (Fishbase photo/John Randall); (C) Red Hind (Fishbase photo/David Bryan); (D) Stoplight Parrotfish (Fishbase photo/John Randall) and (E) Queen Triggerfish (NPS photo/Lee Richter).

(*Cephalopholis fulva*), Red Hind (*Epinephelus guttatus*), Yellowtail Snapper (*Ocyurus chrysurus*), Stoplight Parrotfish (*Sparisoma viride*), and Queen Triggerfish (*Balistes vetula*).

Below: Long term monitoring of marine fish in the United States Virgin Islands is a multi-agency effort. Partners include the University of the Virgin Islands, the United States Virgin Islands Department of Planning and Natural Resources, the University of Miami Rosenstiel School of Marine and Atmospheric Science, the National Park Service (NPS), the National Oceanic and Atmospheric Administration (NOAA), the Nature Conservancy, and the United States Environmental Protection Agency (EPA).



Status and Trends: *Effect of protection on relative density and length-frequency distributions of focal species.*



Above: Locations of the RVC sites by sampling year 2017 (green) and 2019 (purple). On St. John and St. Thomas, surveyed park units include Virgin Islands Coral Reef National Monument (VICR) and Virgins Island National Park (VIIS). On St. Croix, surveyed park units include Buck Island Reef National Monument (BUIS) and Salt River Bay National Historical Park and Ecological Preserve (SARI).

Studying the relationship of different species densities and length frequencies in managed (closed) areas versus open use areas allows managers to understand how fishing pressure and fishing regulations affect fish populations and form the scientific basis for effective management. National Park Service park units are designed to function as either no-take marine reserves or multiple use areas. Virgin Islands Coral Reef National Monument, Buck Island Reef National Monument and Salt River Bay National Historical Park and Ecological Preserve are managed as no-take marine reserves; while Virgin Islands National Park is open to recreational fishing but closed to commercial fishing, so it is grouped as “protected” (closed) in this analysis. Relative density of fishes and length-frequency distributions can provide insight into the reproductive success and sustainability of fish populations.

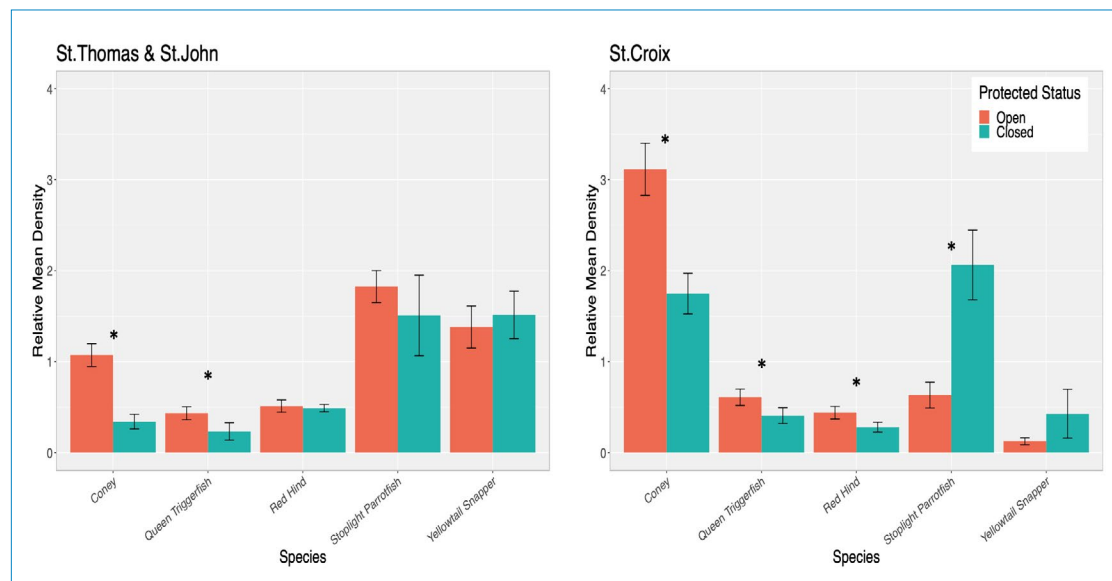
The relative mean density of five focal species were compared by protection (open vs closed areas) as shown in the graphs on the next page. Slightly higher densities of Queen Triggerfish and Coney were observed in open fished waters compared to closed protected areas in both St. Croix and St. Thomas/St. John ($p < 0.05$). Red Hind also exhibited a higher relative density in open areas of St. Croix while Stoplight Parrotfish had a higher density in the closed areas of St. Croix.

Relative length-frequency distributions for Queen Trigger reveal positive trends within protected (closed) and open use waters in the territory (see graphs on next page). A greater relative frequency of sexually mature Queen Triggerfish were observed within the boundaries of protected areas as well as adjacent open fishable waters which are under no designation. Queen Triggerfish exhibit high site fidelity and while many individuals seasonally migrate to spawn, there appear to be non-migratory, resident contingents of the population (Bryan et al. 2019). As a result, protection from fishing can have a large impact on highly resident species that spend most of their lifetime within a protected area.

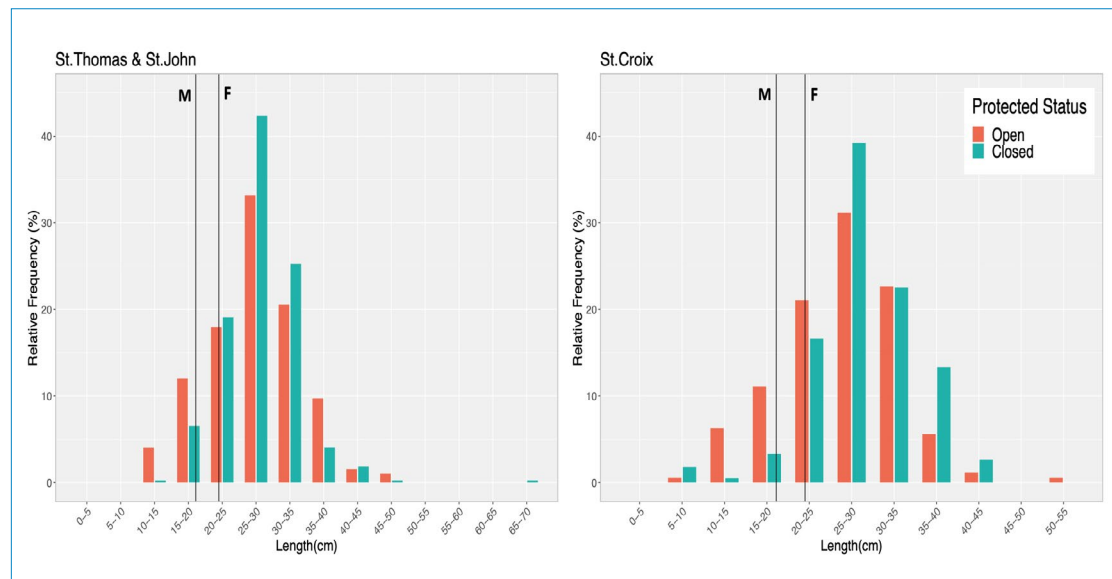


Status and Trends (continued): Effect of protection on relative density and length-frequency distributions of focal species.

This analysis shows relative densities and size distributions inside the designated closed areas compared to open fished areas. Surprisingly, after 18+ years of being designated as no-take marine reserves, the overall densities of the focal species are not significantly greater inside managed areas. For these focal species, we expect to significantly higher densities inside the protected areas than in the openly fished areas. Although several explanations exist, it could indicate a lack of compliance with regulations or underlying issues with marine reserve design. Resource managers may need to adapt to effectively manage reef fish populations and promote the sustainability of these valuable resources. Increased compliance, education, and community involvement could result in higher densities and larger size (more sexually mature fish) distributions in years to come.



Left: Relative mean density $\pm$ SE for unprotected (open) and protected (closed) park waters in St. John/St. Thomas and St. Croix for five focal species. Blue indicate closed waters (Buck Island Reef National Monument, Salt River Bay National Historical Park and Ecological Preserve, Virgin Islands National Park, and Virgin Islands Coral Reef) and orange indicate open waters, * indicates a significant ($p < 0.05$) difference.



Left: Relative length-frequency distributions of Queen Triggerfish in St. Croix and St. Thomas/St. John for protected (closed) and unprotected waters (open). Often males (M) reach sexual maturity at sizes of 21.1 cm fork length and females (F) at 24.5 cm (vertical lines in graphs; Hernández et al. 2019.).

Bryan, D., Feeley, M.W., Nemeth, R.S., Pollock, C., & Ault, J.S. (2019). Home range and spawning migration patterns of queen triggerfish *Balistes vetula* in St. Croix, US Virgin Islands. *Marine Ecology Progress Series* (Halstenbek), 616, 123-139.

Hernández, J.M., Alvarado N.P., Vélez K.C., Nemeth, R., Appeldoorn, R., Shervette, V. (2019) Queen triggerfish *Balistes vetula* reproductive biology in US Caribbean waters. *Trans Am Fish Soc* 148: 134-147.

