

KEEPING OUR COASTLINES CLEAN

A U.S. Virgin Islands
Marine Debris Curriculum





SOURCES & TRANSPORT

Links to the Next Generation Science Standards, Quick Reference Guide

Curricula by Sub-Section		Middle School						High School					Sci & Engineering Practices
		ESS 3-1	ESS 3-2	ESS 3-3	ESS 3-4	ETS 1-1	ETS 1-2	ESS 3-1	ESS 3-3	ESS 3-4	ETS 1-1	ETS 1-2	
Composition & Abundance	Beach Box Exploration			✓									✓
	Investigating Oceanic Garbage Patches			✓					✓				✓
	A Degrading Experience			✓					✓				✓
Sources & Transportation	Watershed Walk	✓		✓				✓					✓
	Sources of Microplastics: Microbeads			✓									✓
Impacts	Entanglement Problems			✓	✓				✓	✓			✓
	Natural Disasters and Marine Debris		✓	✓	✓			✓					✓
Solutions	Linked Beach-Ghut Clean Ups	✓		✓					✓				✓
	Mitigating Microplastics			✓					✓				✓
	Upcycling Plastic Bags					✓	✓				✓	✓	
	Making Connections Through Art			✓					✓				✓

SPOTLIGHT

The Great Mangrove Cleanups

Debris from our watersheds and the ocean ends up trapped in mangrove shorelines of the U.S. Virgin Islands. In recent years, efforts have focused on removing debris from these difficult to access shorelines. On April 21, 2018, 126 volunteers removed more than 3,000 lbs of marine debris during the Great Mangrove Cleanup, the first, large-scale community cleanup of mangrove shorelines in the St. Thomas East End Reserves (STEER), a marine protected area on the east end of St. Thomas, U.S. Virgin Islands (USVI).

These mangrove shorelines are difficult to get to, which makes them especially difficult to clean, and after the twin, Category 5 Hurricanes, Irma and Maria, hit the Territory in September 2017, these coastlines were chock full of marine debris. During the 2018 Great Mangrove Cleanup, the vast majority of marine debris we gathered came from land-based sources (90-95% of items) and most of the items, 65-70%, were plastic. These patterns are consistent with those observed globally. The single item we collected the most of was plastic beverage bottles – 1,765 of them! For such a small area of coastline, that's a lot. What this tells us, is if we want to reduce marine debris in the USVI, we should be thinking about what we are drinking out of, where we are disposing of trash, and where it might end up.

The USVI doesn't have widespread recycling programs, so items from the cleanup that could be reused were fenders, buoys, and pieces of wood. Metal was recycled for scrap and hard plastics (like all those plastic bottles) were recycled through the Virgin Islands Department of Planning & Natural Resources (DPNR) Division of Coastal Zone Management's recycling partnership with Terracycle, run by DPNR Education and Outreach Coordinator, Kristina Edwards.

Participating in the cleanup was a team from the University of the Virgin Islands (UVI) including members of the Center for Marine & Environmental Studies (CMES), Masters of Marine and Environmental Studies (MMES) students, and UVI undergraduates. Nearly 50 individuals from All Hands and Hearts, a volunteer organization assisting in hurricane recovery in the Territory, also participated in the



Marine debris items collected during the 2018 Great Mangrove Cleanup
(Photo credit: Kristin Wilson Grimes)

cleanup, as did members of the Virgin Islands Established Program to Stimulate Competitive Research (VI-EPSCoR), the Virgin Islands Marine Advisory Service (VIMAS), Federal Emergency Management Agency, local government agencies (DPNR Division of Coastal Zone Management, DPNR Division of Environmental Enforcement, and the Virgin Islands Waste Management Authority), and other local non-profits (USVI Marine Rebuild Fund, Perfect Heart, Blue Flag, Camp Umoja, and the Environmental Association of St. Thomas, among others).

The cleanup was sponsored by the NOAA Marine Debris Program and Coral Reef Conservation Program, in partnership with VI-EPSCoR, VIMAS, UVI CMES, DPNR Division of Coastal Zone Management, USVI Marine Rebuild Fund, and three local businesses (Virgin Islands Ecotours, Pizza Pi, and Custom Builders).

"It was only by combining our efforts, that we were able to achieve such a big impact. It shows what we can accomplish when we work together. For as much as we were able to remove, there's a lot more to go," said Mr. Howard Forbes, Jr., Virgin Islands Marine Advisory Service St. Thomas/St. John Coordinator. VIMAS is University of Puerto Rico Sea Grant's extension arm in the U.S. Virgin Islands.



Volunteers from the 2018 Great Mangrove Cleanup, which removed marine debris from mangrove shorelines within the St. Thomas East End Reserves, a marine protected area on the east end of St. Thomas (Photo credit: Mark Grimes).

The Second Annual Great Mangrove Cleanup of the St. Thomas East End Reserves (STEER), took place Saturday, April 13, 2019, where 115 volunteers, ages 9-70, removed 1,786 pounds of debris from mangrove shorelines in kayak- and land-based cleanups of mangrove shorelines.

Students from UVI, Ivanna Eudora Kean High School, Charlotte Amalie High School, Bertha C. Boschulte Middle School, Ulla F. Muller Elementary School, Joseph Sibilly Elementary School, and home schools, participated in the cleanup, along with individuals from 13 other organizations.

Sponsors of the event included UVI CMESs, Virgin Islands DPNR, VIMAS, VI-EPSCoR, Virgin Islands EcoTours, St. Thomas Recovery Team, Pizza Pi, Yes! Waste Management, Virgin Islands Marine Rebuild Fund, and the NOAA Marine Debris Program and Coral Reef Conservation Program.



Community Engagement Specialist for Virgin Islands Established Program to Stimulate Competitive Research (EPSCoR), Jarvon Stout, with one of the more comical marine debris items found during the April 2018 Great Mangrove Cleanup, a toy sword (Photo credit: Howard Forbes, Jr).



Students from the Ulla F. Muller, helped to pick-up marine debris from vulnerable mangrove shorelines at the 2019 Great Mangrove Cleanup on St. Thomas (Photo credit: Kristin Wilson Grimes).

In 2019, the top 10 items collected at the 2019 Great Mangrove Cleanup were:

- 246 plastic beverage bottles
- 133 plastic pieces
- 114 other plastic bottles
- 113 plastic cups and plates
- 111 glass beverage bottles
- 109 construction materials
- 92 plastic grocery bags
- 89 other plastic bags
- 83 other plastic/foam packaging
- 82 beverage cans

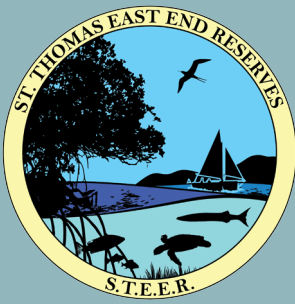
Other weird finds included:

- 2 refrigerators
- 1 television
- 1 polaroid camera
- 11 tires
- 15 life jackets

“It was exciting to see so many people come out for this event, again this year. Working together we removed nearly 1,800 pounds of trash – that’s a big impact! Like last year, the most common item we collected were plastic beverage bottles. What that tells me, is that plastic beverage bottles are a consistent marine debris problem for St. Thomas, so we should all be thinking more about what we are drinking out of, where we dispose of it, and where it may end up.” – Dr. Kristin Grimes, Assistant Professor, Center for Marine & Environmental Studies, University of the Virgin Islands.



Volunteers at the 2019 Great Mangrove Cleanup on St. Thomas (Photo credit: Kristin Wilson Grimes).



THE 2018 GREAT MANGROVE CLEAN-UP

Of The St. Thomas East End Reserves (STEER)

STEER contains one of the last remaining large mangrove forests on St. Thomas. Mangroves protect our shorelines and provide habitat for wildlife, like birds and fish.

The location of STEER makes it vulnerable to marine debris and pollution. The Great Mangrove Clean-Up was the first ever large-scale, community clean-up of the Reserves.



We collected 1,349 lbs of debris from nearshore areas. The vast majority of plastic items were plastic beverage bottles.

ST. THOMAS

RED HOOK

CABRITA POINT

VESSUP BAY

RITZ CARLTON

COMPASS POINT

SALT POND

BOVONI LANDFILL

BOLONGO BAY

St. Thomas East End Reserves

GREAT ST. JAMES

LITTLE ST. JAMES



WEIRD FINDS

11 snorkels



32 balls



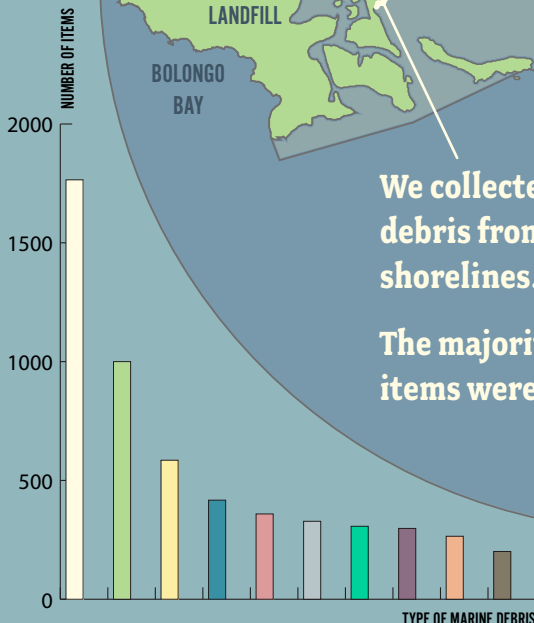
55 shoes

We collected 1,672 lbs of debris from wave-exposed shorelines.

The majority of plastic items were plastic pieces.

6,912 pieces of trash were collected

66% of items were plastic



- 1,765 plastic beverage containers
- 1,000 miscellaneous plastic pieces
- 585 random pieces of foam
- 417 aluminum beverage cans
- 359 other plastic bottles
- 328 plastic bags
- 307 glass bottles
- 289 pieces of rope
- 265 plastic cups
- 201 plastic food containers

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NUMBER OF ITEMS

Approx 1.5 miles of shoreline cleaned by 126 volunteers ages 7 – 61.

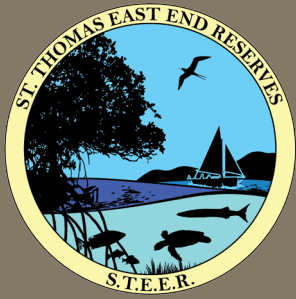


= 3,000 lbs

of marine debris collected and disposed of properly, repurposed or recycled (when able).

Tracey Saxby, IAN Image Library (ian.umces.edu/imagegallery/)





THE 2019 GREAT MANGROVE CLEAN-UP

Of The St. Thomas East End Reserves (STEER)

STEER contains the largest remaining mangrove forest on St. Thomas!

— **246** Plastic Beverage Bottles

— **133** Plastic Pieces

— **114** Other Plastic Bottles

— **113** Plastic Cups & Plates

— **111** Glass Beverage Bottles

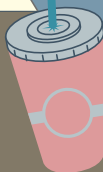
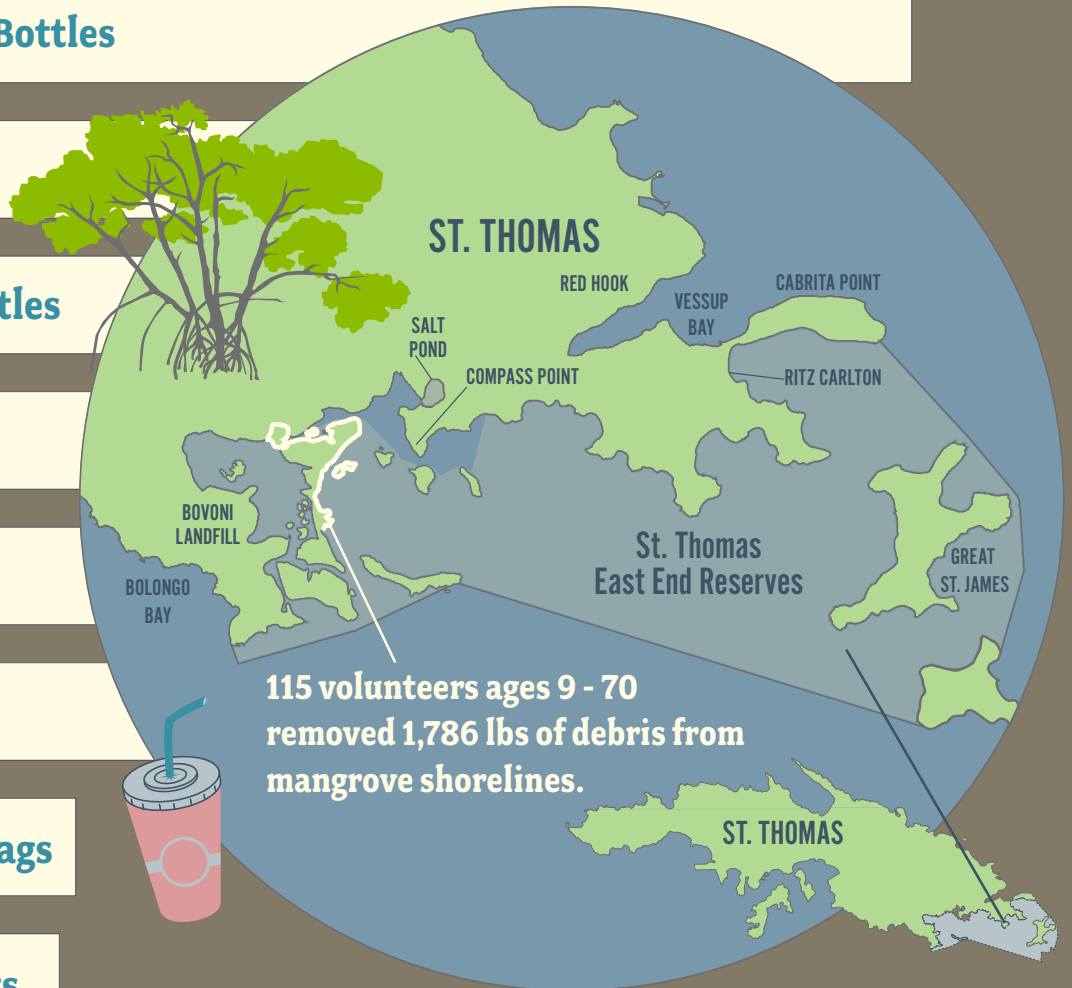
— **109** Construction Material Items

— **92** Plastic Grocery Bags

— **89** Other Plastic Bags

— **83** Other Plastic & Foam Packaging

— **82** Beverage Cans



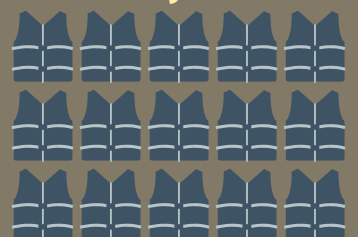
115 volunteers ages 9 - 70 removed 1,786 lbs of debris from mangrove shorelines.

“...the data tell us we should all be thinking more about what we eat and drink out of, where we dispose of it, and where it may end up.”

Dr. Kristin Grimes, Assistant Professor,
Center for Marine & Environmental Studies,
University of the Virgin Islands

WEIRD FINDS

15 life jackets



2 refrigerators



1 television



11 tires



1 polaroid camera



Tracey Saxby, IAN Image Library (ian.umces.edu/imagegallery/)



ST. CROIX

US Virgin Islands

THE 2020 GREAT MANGROVE CLEAN-UP

MANGROVE
CLEAN-UP AREA

Salt River Bay
is home to vital
mangroves
habitats

82 volunteers
ages 4 – 71

880 lbs of
marine debris
removed!

30% of all debris
collected was
beverage
cans &
bottles
(glass &
plastic)



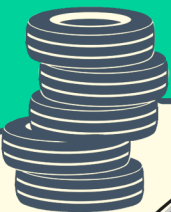
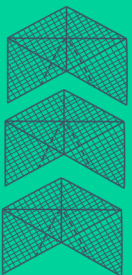
Weird Finds

1 pregnancy test

2 mattresses

1 DVD player

5 tires



1.8 miles of
shoreline
cleaned!

SALT RIVER BAY NATIONAL HISTORIC
PARK AND ECOLOGICAL PRESERVE

Thank You Sponsors!



How do the 2018 Great Mangrove Cleanup data compare to 2016 beach cleanup data?

We compared the top 10 marine debris items collected in the 2018 Great Mangrove Cleanup to the top 10 marine debris items collected through territory-wide beach cleanups for 2016 (the year for which we have the most recent data). Many of the top 10 marine debris items collected along mangrove shorelines were the same that are found in large numbers along territorial beaches (e.g., plastic pieces, glass beverage bottles, plastic beverage bottles, and beverage cans; see Table 1). But, if the density of the top 10 marine debris items collected per mile of mangrove shoreline cleaned are compared to totals from a historical analysis of all territorial beach cleanups from 2008-2016, similarly normalized by mile of beach cleaned, we find that marine debris densities are much greater along mangrove shorelines compared to beaches (Table 2).

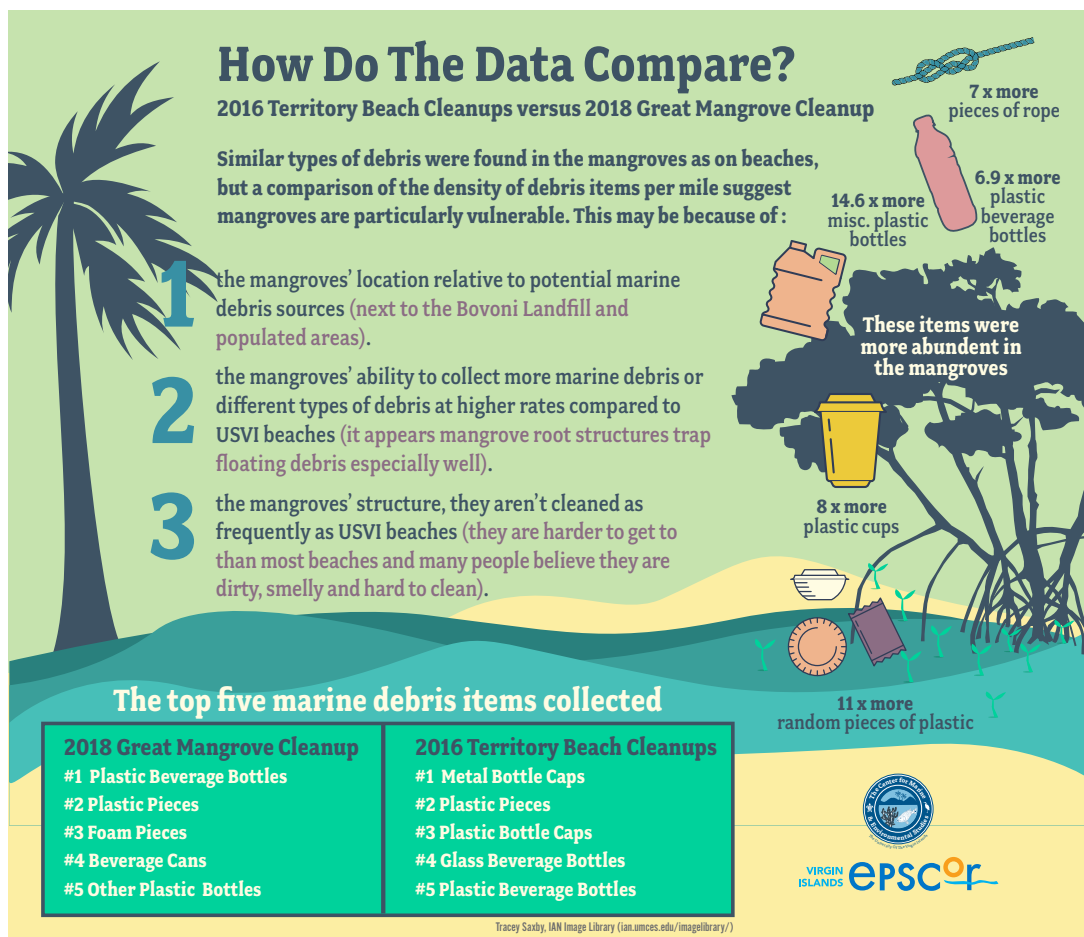
These results show that all USVI coastlines are vulnerable to marine debris, but that mangrove shorelines may be especially susceptible, either because of, (1) their location relative to potential marine debris sources (in this case, Bovoni Landfill); (2) their ability to collect more marine debris or different types of debris at higher rates compared to USVI beaches (e.g., red mangrove root structures may trap floating marine debris especially well); or (3) the low frequency with which they are cleaned, compared to USVI beaches. More data from additional mangrove cleanups are needed to tell which of these reasons best explain our results.

Table 1. Top 10 marine debris items collected during the 2018 Great Mangrove Cleanup and all 2016 territorial beach cleanups. The number in parentheses is the total number of that item collected.

Ranking	2018 Great Mangrove Cleanup	2016 Territorial Beach Cleanups
1	plastic beverage bottles (1,765)	metal bottle caps (4,994)
2	plastic pieces (1,000)	plastic pieces (4,524)
3	foam pieces (585)	plastic bottle caps (3,765)
4	beverage cans (417)	glass beverage bottles (3,532)
5	other plastic bottles (359)	plastic beverage bottles (3,432)
6	plastic bags (328)	food wrappers (2,946)
7	glass beverage bottles (307)	cigarette butts (2,858)
8	rope pieces (289)	straws/stirrers (2,516)
9	plastic cups (265)	beverage cans (2,368)
10	plastic food containers (201)	glass pieces (1,816)

Table 2. The density of marine debris items collected per mile of shoreline, comparing territorial beach cleanup data from 2008-2016 to the 2018 Great Mangrove Cleanup data.

Marine Debris Item	2008-2016 territorial beach cleanups	2018 Great Mangrove Cleanup	Magnitude of difference
plastic beverage bottles	170	1,177	6.9x greater
plastic pieces	61	667	11x greater
foam pieces	814	390	half as small
beverage cans	114	278	2.4x greater
other plastic bottles	16	239	14.6x greater
plastic bags	136	219	1.6x greater
glass beverage bottles	155	205	almost no difference
rope pieces	29	193	7x greater
plastic cups	23	177	8x greater
plastic food containers	98	134	almost no difference



Marine debris along a less-frequented shoreline in the East End Marine Park, a marine protected area on St. Croix. Most of the marine debris that can be seen is plastic (Photo credit: Kristin Wilson Grimes).