Appendix I: Biological Survey Of The Offshore Regions Bordering Upon The Negril/Green Island Area
By Thomas F. Goreau, 1960
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APPENDIX 1

Biological Survey Of The Offshore Regions Bordering
Upon The Negril/ Green Island Area
Report To The Negril Area Land Authority
By Thomas F. Goreau, 1960
(Summary By Thomas J. Goreau, 1991)

Purpose:
Survey of marine communities and inshore regions bordering the Negril Area Land Development Area, as defined in the Provisional Development Order of 1958, with "recommendations regarding measures to be taken for the conservations of the marine communities and objects of natural beauty which may be threatened by the current great strides being made in the economic and physical development of this part of Jamaica."

1) Light house to south Negril Point

A) Rocky coast: Caves in cliff many contain "Extremely rich growth" of marine organisms, zoned according to light levels , containing organisms which are normally found only in deep water or deep inside reef caves. "These caves are places of great natural beauty, and everything should be done to preserve them as they are now."

B) Offshore: corals small and scattered, do not go much deeper than 40 feet, no real reef structure, fleshy seaweeds on limestone blocks and eroded fossil reef.

2) Long Bay or Negril Bay

A) Inshore: Beach is "certainly one of the most attractive in the West Indies." Water very clear, bottom nearly always visible from surface. Inshore strip of "barren white sand" next to beach, making first class bathing due to nearly all white coral reef limestone sand with seagrass beds, very little living coral, rocks, sea urchins, or seaweeds. "Everything should be done to preserve this beach as a National Park, and prevent its disfigurement by the erection of hotels and other buildings too close to the sea."

B) Offshore: small bank reefs in north eastern Long Bay, Booby Cay, and at entrance to Long Bay. Much dead coral, scattered broken heads of elkhorn and brain corals. Navigational charts erroneously show barrier reef. "The absence of good reefs in this area may be a drawback from the point of view of tourism. Only a very limited amount of spearfishing will be possible on the bank reefs described above, but the size of this fish reservoir is so small that overfishing is unavoidable within a very short time."

3) Bloody Bay
A) Bloody Bay: Scattered coral heads, no reefs as such, no large fish, sand, sea grass, and coral gravel bottom, with clean white sand beaches free of sea grass and urchins. "One of the most

attractive areas" in the region, which "if suitably developed could be made most attractive as a sea-side resort area."
B) Little Blood Bay: "A spot of very great beauty," "crowned by a grove of great trees overgrown with festoons of vines and lianas." The area has been marred by a building aggregates plant, whose blasting has damaged the cliffs. "It is to be hoped that this will be removed in due course, and the natural beauty of the place restored." "A determined effort should be made to preserve this place through thorough conservation of the trees and shrubbery, and by limiting construction of houses, roads, etc. North Negril Point would make a beautiful public park overlooking the sea. It is suggested that a public park here should include not only the point but also the entire foreshore of the Bay to keep it as a natural unit."

4) Salt Creek and Orange Point
A) Salt Creek: Cliff shore with fossil reef. Building operations (canal construction for diversion of the Orange River and drainage of Negril Morass) muddied the sea water with swamp material for 300 yards from the shore. Water was far too turbid for good observation.

B) Offshore: Rocky bottom with large boulders at base of cliff. Large fish probably hide in crevices between large rocks. Typical Jamaican exposed rocky shore organisms. Thick carpet of fleshy algae (mostly Sargassum) and encrusting organisms. Very little active coral growth. Corals do not go deep, and reef development is poor.

5) Orange Bay to Green Island

A) Orange Bay: Bay water turbid, shallow, muddy. From Ireland Point to Halfmoon Bay a line of well developed patch reefs with deep, narrow, winding channels. Growth of corals is very vigorous, reef rising to near the surface. Many large corals: sides of reef have immense colonies of the massive reef-framework building coral Montastrea, tops have large branching elkhorn corals.

B) Samuels Bay: "Best part of the reef. Vigorous coral growth. Richest and most varied proliferation of coral." Great variety of other organisms, including sponges not seen elsewhere in Jamaica. Few large fish, but many small ones. Reefs are protected from waves and accessible from shore. "The great biological richness and variety of plants and animals in this reef would make this area potentially very attractive for guided tours in glass bottom boats as well as for more experienced skin divers. A strong recommendation is herewith made in favor of declaring the entire reef a Protected Area with a view to eventual creation of a National Marine Park similar to the one now planned near Ocho Rios."

C) Halfmoon Bay: Shallow inshore regions have large numbers of marine animals. Bathing may be limited by very high densities of the black sea urchin (Diadema) which can cause painful injuries to barefoot bathers.

D) Green Island: Some of the best reefs in Jamaica.

APPENDIX 2
NEGRIL CORAL ABUNDANCES AND BLEACHING

CORAL SPECIES	AUG 1960	NOV 1991	BLEACHING
Millepora complanta*	common	common	2
Millepora squarrosa*	not reported	not seen	-

Millepora alcicornis*	not reported	common 2	
Stylaster roseus	uncommon	uncommon	-
Stephanocoenia michelinii	deeper water	uncommon	-
Acropora palmata	abundant	rare	1
Acropora cervicornis	common	rare	1
Acropora prolifera	not reported	not seen	-
Madracis decactis	uncommon	not seen	-
Madracis mirabilis	common	common	1
Madracis pharensis	not seen	not seen	-
Madracis formosa	not seen	not seen	-
Agaricia agaricitis*	common	common	1
Agaricia tenuifolia	not reported	not seen	-
Agaricia undata	not reported	common	2
Agaricia Fragilis*	common	common	3
Agaricia lamarcki*	not reported	common	3
Agaricia grahamae	not reported	not seen	-
Heiloseris cucullata	common	not seen	-
Siderastrea siderea*	common	common	9
Porites porites*	uncommon	uncommon	1
Porites furcata	common	common	2
Porites divaricata	not reported	uncommon	-
Porites asteroides*	abundant	abundant	2
Favia fragum*	common	common	4
Diploria strigosa*	common	common	3
Diploria clivosa*	common	common	2
Diploria labyrinthiformis*	common	common	1
Manicina areolata*	common	common	1
Colpophyllia natans*	common	common	2
Montastrea annularis*	common	common	2
Monastrea cavernosa*	common	very common	7
Solenastrea hyades	not seen	not seen	-
Astrangia solitaria	common	not seen	-
Phyllangia americana	common	not seen	-
Oculina diffusa	not seen	not seene	-
Oculina valenciennesii	not seen	not seen	-
Meandrina meandrites*	common	common	5
Dichoecenia stokesi	common	common	3
Dendogra cylindrus*	rare	rare	1
Mussa angulosa	common	uncommon	-

Isophyllia sinuosa	common	common	2
Isophyllastrea rigida	common	common	3
Mycetophllia lamarckiana	common	common	2
Mycetophyllia ferox	not reported	not identified	-
Mycetophyllia aliciae	not reported	not identified	-
Mycetophyllia danaana	not reported	not identified	-
Mycetophyliia reesi	not reported	not identified	-
Eusmilia fastigiata*	common	common	1
Tubastrea aurea	not seen	not seen	-
Scolymia lacera	not reported	uncommon	1
Scolymia cubensis	not reported	not seen	-
Cladocora arbuscula	not reported	not seen	-

Note: coral species as listed in T.F. Goreau, 1960, generally ammended for later species name changes. There still remains taxonomic uncertainty in certain genera, particularly Agaricia, Montastrea, and Mycetophylli. Underlined species have either undergone largest reductions in abundance, or are the most abundant species which were highly bleached. Species marked by asterisks have been greatly affected by bleaching in Jamaica during severe episodes, and may have largely recovered at time of the survey. Relative abundances were noted on long transects by SCUBA or snorkelling. Bleaching frequency to be meaningful, 1 indicates at least one of those seen were bleached, and 10 indicates that all coral heads showed signs of bleaching over part or all of their surface. Most species not seen bleached were very rare or are small solitary coral species which lack symbiotic algae. Estimates are pooled based on all observations, and probably accurate to within plus or minus 10%.

APPENDIX 3

NEGRIL ALGAE, NOVEMBER 1991

GREEN

Ulvaria	not seen
Ulva	not seen*
Enteromorpha	not seen*
Anadyomene	not seen*
Microdictyon boergesenii	Long Bay overgrowing sponge
Polyphysa	not seen
Acetabularia	not seen
Bryopsis	not seen*
Chaetomorpha linum	serious problem in Bay*
Cladophoropsis	not seen*
Derbesia fastigiata	S. of Booby Cay encrusting hardground
Cladophora	not seen*
Caulerpa verticillata	South Side

Caulerpa secularizes	abundant, South Side
Caulerpa mexicana	abundant, Negril Bay
Caulerpa racemosa	abundant, Bay, South Side
Caulerpa cupressoides	abundant, Bay
Batophora	not seen
Dasycladus	not seen
Neomeris annulata	South Side
Siphonocladus	not seen
Ernodesmis	not seen
Valonia ventricosa	Bay
Dictyosphaeria cavernosa	S. Negril transect*
Codium isthmocladum	S. Negril, Bay*
Codium intertextum	S. Negril transect
Avrainvillea sp.	abundant, Bay
Udotea cyathiformis	abundant, Bay
Udotea flabellum	abundant, Bay
Rhipocephalus	not seen
Penicillus sp.	abundant
Chamaedoris	not seen
Cymopolia	not seen
Halimeda goreauii	abundant, deeper sites*
Halimeda copiosa	abundant, deeper sites*
Halimeda tuna	abundant, Bay*
Halimeda opuntia	S. Negril transect* Brown
Dictyota divaricata	abundant, Bay*
Dictyota bartraysii	S. Negril transect*
Dictyota cervicornis	Bay, South Side*
Dictyota jamaicensis	abundant, Bay, South Side*
Rosenvingea	not seen
Dictyopteris	not seen*
Spatoglossum	not seen
Dilophus	S. Negril
Stypopodium zonale	South Side, S. Negril, Bay
Padina sanctae-crucis	all sites
Lobophora variegata	serious overgrowth of corals in Bay*
Cladosiphon	not seen
Hydroclathrus	not seen
Colpomenia	not seen
Chnoospora	not seen

Cytoseira	not seen
Sargassum hystrix	serious overgrowth of corals in Bay*
Sargassum polyceratium	S. Negril transect
Turbinaria tricostata	most shallow sites, Bay, South Side RED
Martensia	not seen
Halymenia	not seen
Kallymenia	not seen
Anotrichum	not seen
Griffithsia	not seen
Callithamnion	not seen
Champia	not seen
Catenella	not seen
Gigartina	not seen
Centroceras	not seen*
Sphacelaria	not seen
Ceramium sp.	serious coral overgrowth in Bloody Bay*
Wrangelia argus	South Side
Crouiana	not seen
Heterosiphonia	not seen
Spyridia	not seen
Asparagopsis	not seen
Dasya rigidula	Bay
Eupogodon	not seen
Chondria	not seen*
Liagora	not seen
Trichogloepopsis	not seen
Dictyurus	not seen
Haloplegma	not seen
Coelothrix irregularis	S. Negril transect
Gelidium pusillum	S. Negril
Pterocladia americana	S. Negril
Bostrychia	not seen
Ochtodes	not seen
Cryptonemia	not seen
Grateloupia	not seen
Hypnea	not seen*
Digenia simplex	S. Negril, Bay, South Side*
Laurencia intricata	Bay, S. Negril, South Side*
Laurencia poitei	S. Negril*

Laurencia obtusa	S. Negril
Laurencia papillosa	S. Negril
Heterosiphonia	not seen
Botryocladia	not seen
Acanthophora spicifera	abundant, Bay*
Bryocladia	not seen
Bryothamnium triquetrum	abundant, Bay, S. Negril, S. Side*
Gracilaria	not seen
Polycavernosa	not seen
Caloglossa	not seen
Murayella	not seen
Lobosiphonia	not seen
Herposiphonia	not seen
Polysiphonia	not seen
Amansia	not seen
Meristiella	not seen
Galaxaura marginata	S. Negril, S. Side, Bay
Scinaia	not seen
Jania rubens	S. Side
Amphiroa rigida	S. Side
Amphiroa fragilissima	Bay
Corrallina	not seen
Goniolithon	not seen
Neogoniolithon	S. Side
Lithophyllum	not seen
Mesophyllum	not seen
Titanoderma	not seem
Pyssonellia rubra	deep reef
Fosliella	not seen
Hildenbrandtia	not seen
Porolithon	not seen
Sporolithon	not seen
Hydrolithon	not seen

Note: Species listed according to Chapman and Littler et al., without correction for recent name changes. Algae are listed only to genera if not seen, and generally to species when noted. Only macrophytic (larger) algae were identified, no effort was made to identify small filamentous, turf, or microalgae. Most calcareous reds, especially encrusting species, many common browns, calcareous greens, and some genera with several similar species such as Avrainvillea or Penicillus, were identified to genus rather than species. Because of the rapid nature of this survey several more species were certainly present but were not recognized, infrequent, or occur mostly

in habitats which were not examined, such as very deep, shallow or turbid water. Closer examination would probably reveal more Dictyota, Caulerpa, Penicillus, Halimeda, Avrainvillea, Ceramium, calcareous reds, and other species. Underlined species were a major problem species in Negril during November 1991. Algae marked with an asterisk have been important reef overgrowers in other parts of Jamaica and the Caribbean undergrowing severe eutrophication or reduced herbivory.