

Ciguatera in the U.S. Virgin Islands

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INTRODUCTION

Ciguatera is a type of fish poisoning that a person or animal can get from eating certain species of tropical fishes. Brody (1972) notes that several types of fish poisoning, including ciguatera, have been reported in the eastern Caribbean since pre-Columbian times.

Ciguatera research in the Pacific has been extensive and comprehensive reviews are given by Halstead (1967) and Banner (1965). Presently, the relationship between ciguatera in the Pacific and in the Caribbean is obscure, and no information is available on the biochemical nature of Caribbean ciguatoxin. Although ciguatera symptoms observed in the Caribbean and Pacific are similar, there is no basis to conclude similarity in origin or chemical nature.

Continued information is being developed and compiled in the Pacific on the pharmacology, chemistry, and origin of ciguatera (Yasumoto et al., 1971; Banner, 1965; Okihiro et al., 1965; Li, 1965a). This paper reviews the ciguatera problem in the U.S. Virgin Islands.

ORIGIN AND NATURE OF CIGUATERA

In the Virgin Islands and the Pacific, it is generally believed that ciguatoxin originates in the environment and then accumulates in the flesh and internal organs of affected fish. Available evidence suggests the toxin is concentrated within the food web, with its primary source as an alga, fungus, protozoan, or bacterium (Randall, 1958).

In size-age distribution, larger older fish of a species are more likely to be poisonous than smaller and younger individuals of the same species. This pattern is repeated in the Pacific (Banner et al., 1964).

The symptoms of ciguatera poisoning in the Virgin Islands are similar to those reported elsewhere (Okihiro et al., 1965; Halstead, 1967). Within 5 to 6 hours after ingestion of ciguatoxic fish, a person generally experiences abdominal pain, nausea, vomiting, and other symptoms of gastroenteritis accompanied by a rapid diuresis. There may be a tingling sensation in the extremities and numbness may occur. In almost all cases, there is a feeling of weakness which may become progressively worse. With severe poisoning there may be paradoxical sensory disturbances whereas cold objects may be described as burning or tingling, and hot objects may be described as cold.

Toxic symptoms in a living animal are the result of a complex array of toxin-receptor interactions that find expression in a limited number of target organs (Li, 1965b). Further, toxins of widely different chemical structures may give rise to similar or identical symptoms (Bagnis et al., 1970). The symptoms described above for suspected ciguatera poisoning, can equally

be applied to a variety of food poisons such as staphylococcal intoxication (Kawabata et al., 1955). Therefore, reasonable cause for assuming ciguatera poisoning exists where proper handling, preparation, and serving of fresh fish is observed.

Medical treatment of ciguatera is symptomatic and has been described by Okihiro et al. (1965). In the Virgin Islands, an estimated 10-15 percent of the yearly total cases of ciguatera poisoning are severe enough to require hospitalization or are brought to the attention of medical and health authorities. Commonly, persons are treated at home using a variety of medicinal plants as shown in Table 1 (Peterson, 1974; Little et al., 1974). At present the efficacy of these remedies has not been established by medical science.

CIGUATOXIC SPECIES AND LOCATIONS

In the Virgin Islands, the Caribbean, and in the Pacific, some species of fish are more likely to be ciguatoxic than others (Table 2). As a family, the carangids or jacks contain the most species prone to ciguatera followed by snappers and groupers. Further, ciguatoxic fish in the Virgin Islands are primary or secondary predators that prey almost exclusively on other fish.

The majority of fishing in the Virgin Islands is done with fish traps or pots (Sylvester and Dammann, 1972). In these waters, fish of a size caught in traps usually are not ciguatoxic, although there are notable exceptions

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Table 1.—Medicinal plants used in the Virgin Islands to treat the symptoms of ciguatera fish poisoning. (The efficacy of these remedies has not been established by medical science.)

Common name	Scientific name	Symptoms treated
Anise	<i>Pimpinella anisum</i>	Cramps, abdominal pain
Arrowroot	<i>Moranta arundinacea</i>	Diarrhea
Balsam	<i>Ocimum sanctum</i>	Nervous disorders, abdominal pain
Bitterash	<i>Picraena excelsa</i>	Abdominal pain, fever
Black torch	<i>Exastemma caribaeum</i>	Nausea
Button wood	<i>Conocarpus erecta</i>	Nausea, vomiting
Kenip	<i>Melicocca bijuga</i>	Diarrhea
Lignum vitae	<i>Guaicum officinalis</i>	Debility to restore energy
Maubi bark	<i>Rhamabaceae</i> sp.	Cramps
Pap vine	<i>Passifloraceae</i> sp.	Nervous disorders
Rosemary	<i>Rosmarinus officinalis</i>	Nervous disorders
Black sage	<i>Cordia ulmitolia</i>	Fevers, nervous disorders
Snakeroot	<i>Strychnos nuxvomica</i>	Cramps
Stack-ma-hark	<i>Rivina humilis</i>	Diarrhea
White bark	<i>Canelia alba</i>	Cramps, pain
Worm wood	<i>Artemisia absinthium</i>	Cramps

Table 2.—Fish species most likely to be ciguatoxic in the U.S. Virgin Islands (Randall, 1958; Bohle and Chaplin, 1968).

Family	Common name	Scientific name
Sphyraenidae	Barracuda	<i>Sphyraena barracuda</i>
Serranidae	Yellowfin grouper	<i>Mycteroperca venenosa</i>
	Yellowmouth grouper	<i>M. interstitialis</i>
	Misty grouper	<i>Epinephelus mystacinus</i>
Carangidae	Amberjack	<i>Seriola dumerili</i>
	Bar jack	<i>Caranx ruber</i>
	Crevalle jack	<i>C. hippos</i>
	Horse-eye jack	<i>C. latus</i>
	Black jack	<i>C. lugubris</i>
	Blue runner	<i>C. crysos</i>
Lutjanidae	Pompano	<i>Alectis crinitus</i>
	Cubera snapper	<i>Lutjanus cyanopterus</i>
Labridae	Schoolmaster	<i>L. apodus</i>
	Dog snapper	<i>L. jocu</i>
	Mahogany snapper	<i>L. mahogoni</i>
	Spanish hogfish	<i>L. bodianus rutus</i>
Balistidae	Spotfin hogfish	<i>B. pulchellus</i>
	Hogfish	<i>Lachnolaimus maximus</i>
Balistidae	Triggerfish	<i>Balistes vetula</i>

which include some carangids and groupers.

Some areas in the islands are more likely to produce poisonous fish than other areas. Fishermen in the Virgin Islands believe the areas south of St. Thomas-St. John yield more poisonous fish than areas north of St. Thomas-St. John (Figure 1). Around the island of St. Croix, about 40 miles south of St.

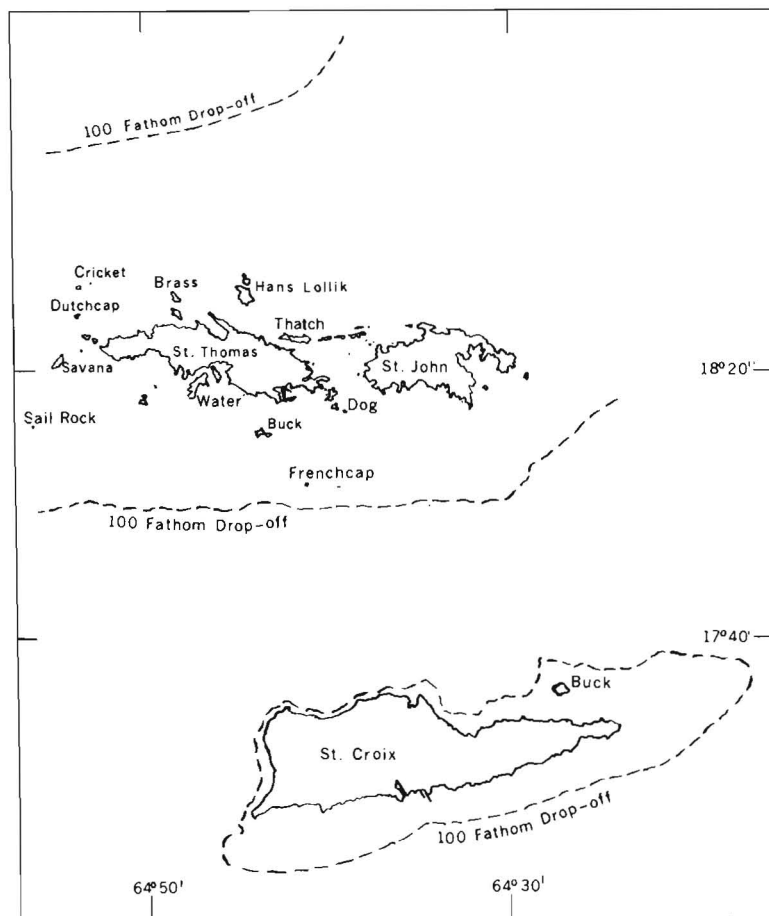


Figure 1.—Map of the U.S. Virgin Islands with major islands and cays. St. Croix is approximately 40 miles south of St. Thomas-St. John.

Thomas, yields of poisonous fish are highest about the eastern tip of the island.

Some suspected ciguatoxic species are not eaten from certain locations but are consumed from other areas within the Virgin Islands. Large barracuda (*Sphyraena* sp.) are not usually eaten from the St. Thomas-St. John area, but on St. Croix they are marketed and sold for consumption. Species that are commonly ciguatoxic in the Virgin Islands are ciguatera-free in other areas of the Caribbean. For example, amberjack, *Seriola dumerili*, notoriously ciguatoxic in the Virgin Islands, are marketed and eaten in Puerto Rico, 100 miles west of St. Thomas.

The depth at which fish are caught is important in the distribution of ciguatoxic fish. Exploratory fishing for

ciguatera-free fish populations has shown a very low incidence of poisonous fish from areas near and on the 100-fathom curve in the Virgin Islands (Dammann, 1969; Brownell, 1971; Sylvester and Dammann, 1974).

CIGUATERA AND FISHERIES MANAGEMENT IN THE VIRGIN ISLANDS

Fisheries management in the tropics poses unique problems because of the nature of the resources. Tropical fisheries are characterized by large numbers of species, with relatively few individuals within each species. Commercially and recreationally, few species are sought for food or sport. Ciguatera is not a problem for the sports fisherman who does not eat or sell his

catch. However, for fish intended for human consumption, the ciguatera problem is of great importance.

Fisheries management in the Virgin Islands has, as one of its main objectives, the task of maximizing catch in terms of pounds and numbers of fish on a sustained basis. Due to the nature of the fishery, i.e., a tropical fishery, maximum yield levels must be determined for many different species; however, yields in pounds and numbers are generally low (Dammann, 1969; Brownell, 1971; Sylvester and Dammann, 1974).

Demand for fresh fish in the Virgin Islands exceeds supply (Dammann and Sylvester, In press) and to meet this demand, the fishery must concern itself with as many different species as possible. In the islands, species prone to ciguatera are not, in effect, available for commercial exploitation. Hence, the ciguatera problem in the Virgin Islands inhibits full utilization of available and acceptable resources because of its sporadic and unpredictable nature.

SUMMARY AND CONCLUSIONS

Ciguatera has a long and continuing history in the U.S. Virgin Islands. Throughout the years, much folklore has accumulated about its origins, mode of transmission in the environment, and treatment of its symptoms.

Little reliable evidence is available on the biological and ecological nature of ciguatera in the islands. Quantitative data is sparse on species, location, and areal and seasonal distributions. Probability statements with adequate confidence limits cannot be made for individual fish caught from any location. A simple, effective, reliable test for individual fish which does not involve human or animal consumption is not available.

In conclusion, ciguatera is a serious hindrance to full commercial exploitation of the limited Virgin Islands fisheries resources, and much work needs to be done here in the islands and throughout the Caribbean.

LITERATURE CITED

- Bagnis, R., F. Berglund, and P. S. Elias. 1970. Problems of toxicants in marine food products: I. Marine biotoxins. *Bull. WHO* 42:69-88.
- Banner, A. H. 1965. Ciguatera in the Pacific. *Hawaii Med. J.* 24:353-354.
- Banner, A. H., P. Helfrich, P. J. Scheuer, and T. Yoshida. 1964. Research on ciguatera in the tropical Pacific. *Gulf Caribb. Fish. Inst., Proc.* 16th Annu. Sess., p. 84-98.
- Böhlke, J. E., and C. C. G. Chaplin. 1968. *Fishes of the Bahamas and adjacent tropical waters.* Livingston Publ. Co., Wynnewood, Pa., 771 p.
- Brody, R. W. 1972. Fish poisoning in the eastern Caribbean. *Gulf Caribb. Fish. Inst., Proc.* 24th Annu. Sess., p. 100-116.
- Brownell, W. N. 1971. Fisheries of the Virgin Islands. *Commer. Fish. Rev.* 33(11-12):23-30.
- Dammann, A. E. 1969. Study of the fisheries potential of the Virgin Islands. *Caribb. Res. Inst., Virgin Islands Ecol. Res. Stn., Contrib. No. 1.* 197 p.
- Dammann, A. E., and J. R. Sylvester. In press. Review of the status of the Virgin Islands fisheries. *Caribb. Fish. Manage. Council. Rep.*
- Halstead, B. W. 1967. Poisonous and venomous marine animals. Vol. II. U.S. Gov. Print. Off., Wash., D.C., 1,070 p.
- Kawabata, T., K. Ishizaka, and T. Miura. 1955. Studies on the allergy-like food poisoning associated with putrefaction of marine products. II. Separation of causative substance and some of its chemical characteristics. *Jpn. J. Med. Sci. Biol.* 8:503-519.
- Li, K. M. 1965a. A note on ciguatera fish poison and action of its proposed antidotes. *Hawaii Med. J.* 24:358-361.
- _____. 1965b. Ciguatera fish poison: a cholinesterase inhibitor. *Science (Wash., D.C.)* 147:1580-1581.
- Little, E. L., Jr., R. O. Woodbury, and F. H. Wadsworth. 1974. *Trees of Puerto Rico and the Virgin Islands.* U. D. Dep. Agric., Handb. 449, Wash., D.C., 1,024 p.
- Okhiro, M. M., J. P. Keenan, and A. C. Ivy. 1965. Ciguatera fish poisoning with cholinesterase inhibition. *Hawaii Med. J.* 24:354-357.
- Peterson, A. 1974. *Herbs and proverbs of the Virgin Islands.* St. Thomas Graphics. St. Thomas, V.I., 78 p.
- Randall, J. E. 1958. A review of ciguatera, tropical fish poisoning, with a tentative explanation of its cause. *Bull. Mar. Sci. Gulf Caribb.* 8(3):236-267.
- Sylvester, J. R., and A. E. Dammann. 1972. Pot fishing in the Virgin Islands. *Mar. Fish. Rev.* 34(9-10):33-35.
- _____. 1974. Some observations on the deepwater fishery resources of the Virgin Islands. *Caribb. J. Sci.* 14:163-165.
- Yasumoto, T., Y. Hashimoto, R. Bagnis, J. E. Randall, and A. H. Banner. 1971. Toxicity of the surgeonfishes. *Bull. Jpn. Soc. Sci. Fish.* 37(8):724-734.
- MFR Paper 1260. From Marine Fisheries Review, Vol. 39, No. 8, August 1977. Copies of this paper, in limited numbers, are available from D822, User Services Branch, Environmental Science Information Center, NOAA, Rockville, MD 20852. Copies of Marine Fisheries Review are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for \$1.10 each.*