NOTES

MASS MORTALITY OF SCIAENID FISHES IN THE GULF OF NICOYA, COSTA RICA[1]

An unusual fish mortality, nearly specific for the family Sciaenidae (corbinas, croakers, drums), is reported for the Gulf of Nicoya, Costa Rica. The gulf is a large, estuarine embayment located on the Pacific coast of Costa Rica (Fig. 1). Its waters provide roughly 50% of Costa Rican commercial finfish landings, with sciaenids accounting for about 43% of the artisanal catch, or about 2,700 metric tons per year (Araya 1984; Ministerio de Agricultura y Ganadería unpubl. data 1985).

Initial observations of the mortality by residents of the inner gulf were made in late September 1985. By mid-October, extensive sciaenid mortalities had been reported throughout the inner gulf northwest of Puntarenas and Playa Naranjo, and observed by us in the middle of the gulf between Puntarenas and Isla Chira (Fig. 1). Local fishermen noted that fishes were not affected in the gulf oceanward of Puntarenas. They also noted that members of the corbina

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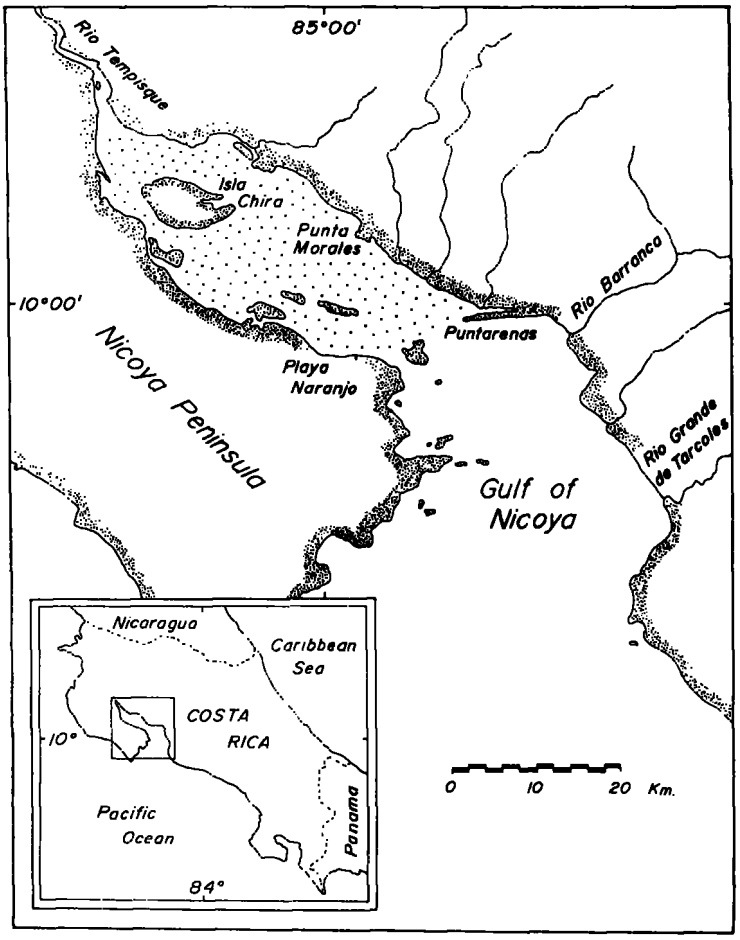

FIGURE 1.—Gulf of Nicoya, Costa Rica. Shading indicates suspected extent of sciaenid mortality.

family were almost exclusively killed, particularly the commercially important *Cynoscion squamipinnis*. Mortalities appeared to decline by late October, and after 4 November, no sciaenid mortalities were reported.

Six fish collections were made between 12 October and 4 November 1985 in the vicinity of Punta Morales, by following flotsam windrows in a skiff and indiscriminately collecting fishes from the water surface with a landing net. Collections lasted from 1 to 2 hours, and the fishes were subsequently sent to the laboratory and identified.

Fishes taken in the collections were almost entirely (98%) sciaenids, including 15 sciaenid species from 7 genera (Table 1). Affected sciaenids ranged in size from 46 to 490 mm SL. Species observed in the mortality, but not taken in the quantitative collections, included *Anchovia macrolepidota*, *Oligoplites* sp., *Chaetodipterus zonatus*, *Sphoeroides tricocephalus*, and the sciaenid *Cynoscion stolzmanni*.

Nearly all fishes were dead upon collection, with few moribund individuals observed. Dead fishes were generally found floating belly-up, while the moribund ones often were floating motionless and taking slow, intermittent breaths. No lacerations or other obvious external marks were noticeable at the time of collection, and most of the fishes appeared fresh. Digestive tracts of several examined specimens were empty. Some of the larger species were collected by local fishermen and eaten or sold for food, with no apparent deleterious effects.

TABLE 1.—Fish species taken in periodic collections during fish mortality in the Gulf of Nicoya, 12 October–4 November 1985. Data pooled for six collections.

Species	No. collected	Size range (mm SL)
Sciaenidae		
Bairdiella armata	1	114
Cynoscion phoxocephalus	45	54–300
C. squamipinnis	162	46–490
Isopisthus remifer	6	180–200
Micropogonias altipinnis	1	151
Ophioscion sciera	6	111–217
O. typicus	4	113–139
Ophioscion sp.	11	91–149
Paralonchurus dumerilii	4	162–314
Stellifer chrysoleuca	2	154–230
S. furthii	36	105–164
S. illecebrosus	18	85–229
S. oscitans	112	66–148
S. zestocarus	7	89–115
Stellifer sp (undescribed)	7	82–105
	422	46–490
Other families		
Muraenesox coniceps	1	640
Ilisha furthii	2	220–243
Ariopsis seemani	1	194
Pomadasys macracanthus	1	335
Trichiurus nitens	3	397–800
	8	194–800

Four moribund sciaenids (3 *Cynoscion squamipinnis*, 1 *Ophioscion sciera*) and a puffer (*Sphoeroides tricocephalus*) were collected and preserved in 10% buffered formalin (pH 7.2), and the internal organs were sectioned and stained using standard histological methods. Control sections were made from *C. squamipinnis* and *C. phoxocephalus* collected several months after the mortality. Major macroscopic abnormalities in all specimens included

1) Presence of petequial hemorrhages in the oral cavity, gill arches, operculum, and base of the pectoral fins.
2) Destruction of the distal third and hyperemia in the proximal two-thirds of the secondary gill lamellae.
3) Presence of blood and blood clots between the two layers of the pericardium.
4) Pronounced paleness of the liver, very crumbly upon cutting.
5) Congestion and hemorrhages in the intestinal serosa. Fibrous bands adhering some segments of the intestinal serosa to the abdominal wall.
6) Kidney and spleen crumbly and of a semiliquid consistency.
7) Gastrointestinal system containing a yellow-green mucous.

Major microscopic findings included

1) Large numbers of eosinophilic granulocytic cells in the submucosa of the gastrointestinal system, apparently in response to a high load of nematode and intermediate stage cestode parasites encysted in the layers of those organs. Intense development of connective tissue around the peripheries of those parasites.
2) Necrosis of haemopoietic tissue of the spleen with the proliferation of melanomacrophage centers.
3) Generalized vacuolar degeneration of the hepatic parenchyma with areas of extensive necrosis.
4) Necrosis of renal hematopoietic tissue and degeneration of the renal tubule epithelium (nephrosis).

The combination of tissue irregularities observed is compatible with pollutant-induced damage (King 1962; Buhler et al. 1969; Walsh and Ribelin 1975), but we have no direct evidence linking pollution to the mortality. We suspect that an agricultural toxin may be involved because a large number of agrochemicals are currently in rather indiscriminate

use in the area. The beginning of the year's heavy rains in late September could have served as a vector for an agrochemical. Also, a fish mortality of unknown cause in Lake Arenal, located approximately 45 km NE of the upper Gulf and draining adjacent lands, occurred simultaneously with the sciaenid mortality, killing primarily *Cichlasoma nicaraguense* (J. Cabrera[2]). However, in neither case were there reports of dead fishes or invertebrates in nearby rivers that might serve to transport an agrochemical. Tests detecting the presence of possible pollutants were not available. The possibility that the sciaenid deaths were caused by toxins from red tides that occurred in parts of the gulf between April and November (Víquez 1985; R. Víquez[3]) cannot be ruled out. Likewise, disease cannot be discounted, although attempts to isolate any infectious agents (bacteria, fungi) from fresh specimens were unsuccessful.

The near specificity for sciaenids remains a mystery, and we are not aware of any other fish kill specific at the family level. Cardeilhac et al. (1981) reported acute deaths of large red drum (a sciaenid) in Florida, which they attributed to metal poisoning resulting from ingestion of contaminated prey. Gulf of Nicoya sciaenids are generally bottom fishes known to consume a variety of benthic fishes and invertebrates (Araya 1984). Their benthic distributions or food habits alone do not explain their susceptibility because a large number of benthic fishes with similar food habits are common in the gulf (León 1973). The wide size range of sciaenids affected also argues against the specificity being due to consumption of common prey.

No measure of total number of fishes killed in this mortality is available. However, we estimated that at its height (mid-October), a thousand fishes could be sighted along a few hundred meter stretch of a flotsam windrow. Since the mortality, fishermen reported no noticable decline in the catch of sciaenid species. Although no mortalities of this nature have been reported in the past, their recurrence could endanger the livelihood of Gulf of Nicoya fisheries.

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