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A Mass Mortality Event in Coastal Waters of the Central Florida Panhandle During Spring and Summer 1998

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SHORT PAPERS AND NOTES

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A MASS MORTALITY EVENT IN COASTAL WATERS OF THE CENTRAL FLORIDA PANHANDLE DURING SPRING AND SUMMER 1998.—A mass mortality of marine organisms occurred on portions of the central Florida Panhandle shelf from mid-May through mid-July 1998. Distressed, moribund, and dead fishes and invertebrates were observed from shore to depths of 35 m and were most noticeable on reefs east and west of Panama City, FL (Fig. 1). To our knowledge, large-scale, prolonged mass mortalities involving reef-associated animals have not been reported previously in unimpounded shelf waters of the central Florida Panhandle.

Observations.—From mid- to late May 1998, commercial divers reported mass mortalities of fishes and invertebrates on wrecks and reefs at depths of 10–35 m (the limit of diver excursions) in a region approximately 3–7 km offshore and 20 km east and west of Panama City, FL. At about the same time, fishermen reported blue runners and vermilion snappers floating on the surface offshore. According to divers, fishermen, and biologists, the areal and depth distribution of dead marine animals coincided with reports of unseasonably cool water that moved on- and offshore on the surface or beneath a strong thermocline at depths of 3–12 m.

In early June, a dense population of cool-water-tolerant filamentous red algae, *Heterosiphonia gibbesii,* occurred along and offshore Panama City beaches. Concentrations of *H. gibbesii* appeared to move on- and offshore with cool water. Dead fishes and invertebrates were found in algal drifts at St. Andrew Pass and on area beaches until the second week of July. In late June, divers reported cool water and eastward currents at a depth of about 12 m, and large numbers of dead marine animals were reported on reefs off Destin, FL, at depths of 18–21 m. On 1 July, we (GF, JB) reported a strong thermocline at 5–6 m in St. Andrew Pass and observed that all animals seen below 6 m were dead except for crabs, which were moribund. Above the thermocline, fishes normally associated with deeper water and bottom habitats were seen (Table 1). In bottom water (14 m) at this location, temperature, salinity, and dissolved oxygen concentrations were, respectively, 19 C, 35.3, and <1.0 $mg \cdot l^{-1}$.

During low tides on 1–2 July, National Marine Fisheries Service (NMFS) biologists observed distressed fish in St. Andrew State Recreation Area tidal pools and dead juvenile flounders, crabs, and lethargic fishes inside St. Andrew Pass jetties. Dead eels, burrfish, cowfish, crabs, starfish, and sea cucumbers were seen on area beaches outside the pass. Dense concentrations of algae occurred near area beaches on 1–2 July, and large schools of lethargic Spanish mackerel, baitfish, and stingrays were seen in the shallows at Destin Pass. By 3–6 July, water at these locations was reported to be clear and well mixed. Distressed, moribund, and dead fishes and invertebrates continued to be observed from the intertidal zone to about 30 m depth in the St. Andrew Bay–Destin region until 12 July. Deepwater animals were observed at the surface offshore and in shallow water near shore during this period. Fishermen reported that highly stratified water, with currents setting to the east, extended 24 km offshore. Temperature measurements on 10 July indicated weak stratification in St. Andrew Pass (21 C on the surface; 19 C near the bottom at 12–13 m depth) and a strong thermocline 1.6 km offshore (25 C on the surface; 19 C at 12–13 m depth). Eastward bottom currents extended from 16 to 64 km offshore Panama City, according to fishermen.

On 11–12 July, warm (~24 C), clear surface water was reported at the *Thomas Hayward,* a 26-m-deep wreck off Destin. Nine meters beneath the surface, cool, turbid water was encountered, and at 14 m, water temperature was 18 C with about 8 m visibility. Near the bottom, numerous lethargic fishes were seen at this wreck. At the wreck *Louise,* in 17 m of water, divers reported that only dead animals were present. On 12 July, in the New Pass area at St. Andrew Bay, fishermen observed thousands of small flounder, rock shrimp, penaeid shrimp, and crabs swimming on the surface, and at Destin, live deepwater crabs were observed to be "coming ashore" in large numbers. From 13 to 16 July, charter boat captains and divers reported cool water inshore, warmer water offshore, and dense algae that extended 9–10 km offshore.

During the period 20–23 July, nearshore water in the Panama City area became clearer and surface temperature increased to 27 C

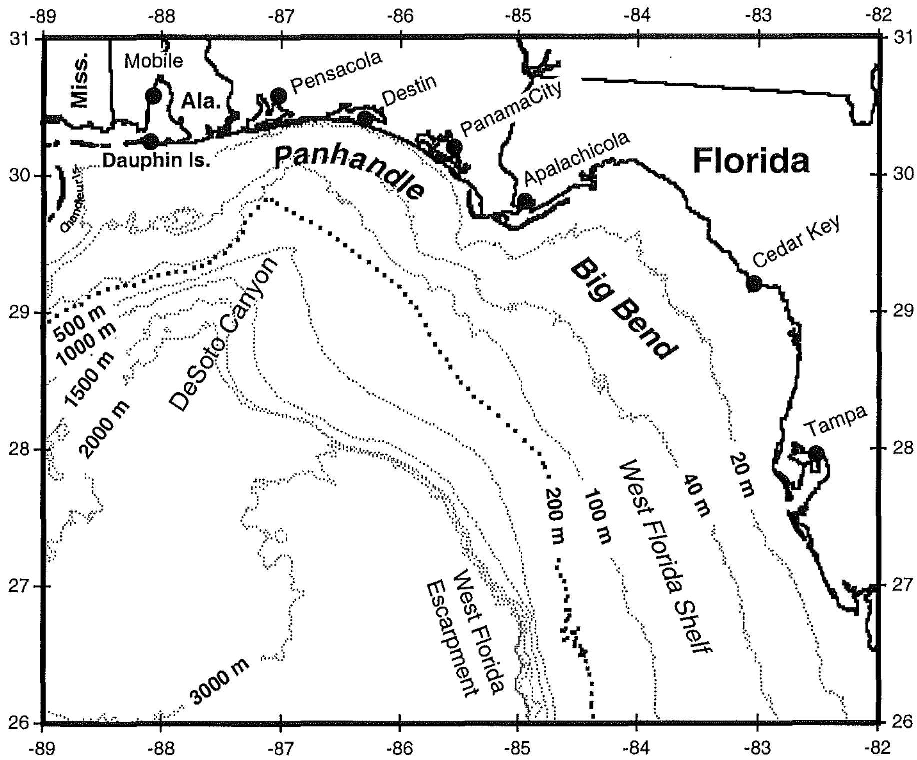

Fig. 1. Location map of place names and bathymetry (courtesy of Science Applications International Corporation, 1997).

(NMFS, unpubl.). After a shift in winds to the east and increasing sea surface temperatures (Muller-Karger, 2000; Nowlin et al., 2000), fishermen reported good catches of sharks, Spanish and king mackerel, grouper, snapper, and redfish from Panama City to St. Joseph Bay.

According to NMFS and other agency biologists, catastrophic mass mortalities on reefs progressed from east to west over time. Mortalities on reefs 20 km east of Panama City occurred in May, whereas reefs west of Destin, but east of Pensacola, experienced mortalities from June to mid-July. Dead fishes were observed on the surface offshore throughout the 10-wk period, whereas dead and dying animals were most frequently observed on and in the vicinity of Panama City area beaches between 27 June and 12 July. Fishermen reported that pelagic fishes in the vicinity of affected reefs appeared normal in abundance and diversity by late July (NMFS, pers. comm.), and we tentatively concluded that the mass mortality event had ended. No systematic sampling of dead organisms was made, and the total number of species and individuals that perished is not known. Divers avoided areas that experienced mass mortalities, and follow-up observations of benthic reef assemblages were not made.

Discussion.—Our observations and anecdotal reports permit a general description of the time frame, distribution, and magnitude of the mass mortality, but we were unable to determine causation or assess its long-term ecological consequences (see Diaz and Rosenberg, 1995). We suggest, however, that unusual climatic conditions (Collard and Lugo-Fernandez, 1999), including westerly surface winds, large-volume discharges of nutrient-rich fresh water onto the shelf in mid-March, followed by record high air temperatures and drought, contributed to a stable water column and supported a prolonged bloom of the tropical, cool-water-tolerant alga, *H. gibbesii* (Pakker et al., 1995). Coastal upwelling coincident with these climatic conditions (Nowlin et al., 2000; Muller-Karger, 2000) may have contributed to the bloom of *H. gibbesii.* We speculate that the algal population flourished in nutrient-rich coastal waters, then died and sank to the bottom, increasing biological oxygen demand and lowering dissolved oxygen concentrations to levels stressful or fatal to marine animals (re-

TABLE 1. Fishes and invertebrate groups reported by various observers to be either dead (D) or visibly distressed (S). No systematic collections were made, and the list is conservative, but a question mark following a designation means that the most common group is supposed. Common names are used when identification of the species was not verified.

- Fishes
  - Batrachoididae
    - Gulf toadfish, *Opsanus beta* (D/S)
  - Bothidae
    - Bay whiff, *Citharichthys spilopterus* (D)
    - Dusky flounder, *Syacium papillosum* (D)
    - Fringed flounder, *Etropus crossotus* (D)
    - Gulf flounder, *Paralichthys albigutta* (D/S)
  - Carangidae
    - Blue runner, *Caranx crysos* (D)
    - Leatherjacket, *Oligoplites saurus* (D)
    - Lookdown, *Selene vomer* (S)
    - Round scad (cigarfish), *Decapterus punctatus* (D)
  - Carcharhinidae (?)
    - Sharks (D)
  - Dasyatidae
    - Stingray, *Dasyatis* sp. (S)
  - Diodontidae
    - Striped burrfish, *Chilomycterus schoepfi* (D)
  - Haemulidae
    - French grunt, *Haemulon flavolineatum* (D)
    - Pigfish, *Orthopristas chrysoptera* (D)
    - White grunt, *Haemulon plumieri* (D)
  - Labridae
    - Pearly razorfish, *Hemipteronotus novacula* (D)
    - Unidentified wrasses (D)
  - Lujanidae
    - Vermilion snapper, *Rhombiplites aurorubens* (D)
  - Narcinidae
    - Lesser electric ray, *Narcine brasiliensis* (D/S)
  - Ogcocephalidae
    - Batfish (D)
  - Ophichthidae (?)
    - Eel (D)
  - Ophidiidae
    - Bearded brotula, *Brotula barbata* (D)
  - Ostraciidae
    - Cowfish, *Lactophrys* sp. (D)
  - Rajidae
    - Skate, *Raja* sp. (D/S)
  - Scaridae
    - Parrotfish (S)
  - Sciaenidae
    - Red drum, *Sciaenops ocellatus* (S)
  - Scombridae
    - Spanish mackerel, *Scomberomorus maculatus* (S)
  - Scorpaenidae
    - Scorpionfish (S)
  - Serranidae
    - Gag grouper, *Mycteroperca microlepis* (D/S)
    - Gulf black seabass, *Centropristis striata* (D/S)

TABLE 1. Continued.

  - Soapfish, *Rypticus* sp. (D)
  - Sparidae
    - Pinfish, *Lagodon rhomboides* (D)
    - Spottail pinfish, *Diplodus holbrooki* (D)
  - Sphraenidae
    - Northern sennet, *Sphyraena borealis* (D)
  - Uranoscopidae
    - Southern stargazer, *Astroscopus y-graecum* (D)
- Invertebrates
  - Annelida polychaetes (D)
  - Arthropoda (Crustacea: Decapoda)
    - Calico crab, *Hepatus epheliticus* (D/S)
    - "Deepwater" crabs (S)
    - Pink shrimp (S)
    - Portunid crabs (D/S)
    - Shrimp, *Penaeus* sp. (D/S)
  - Chordata (Urochordata: Ascidiacea)
    - Sea squirts (D)
  - Cnidaria
    - Jellyfish (D)
  - Echinodermata
    - Sea cucumbers (D)
    - Sea urchins (D)
    - Starfish (D)
  - Mollusca
    - Bivalvia: clams
    - Cephalopoda: *Octopus*
- Gastropoda: snails; nudibranchs
  - Porifera
    - Sponges (D)

viewed in Brongersma-Sanders, 1957; Diaz and Rosenberg, 1995). Low dissolved oxygen concentrations may explain the lethargic behavior we observed in fish and crabs (Ogren and Chess, 1969) and the mass mortality observed in reef animals. Similar climate and ocean conditions resulted in a mass mortality event in the New York Bight (Swanson and Sindermann, 1979). Toxic dinoflagellates were not present in samples collected and analyzed by the Florida Marine Research Institute (unpubl. data), and we believe it unlikely that mortalities resulted from thermal stress associated with cool water upwelling.

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