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SEDIMENT QUALITY ASSESSMENT STUDIES IN TAMPA BAY, FLORIDA, USA

by

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EXTENDED ABSTRACT

The Tampa Bay estuary is a large complex system bordered, in part, by highly industrialized and urbanized areas. Toxic chemicals are known to exist in the sediments in relatively high concentrations near the developed areas and some peripheral harbors and ports. As part of the National Status and Trends (NS&T) Program of the National Oceanic and Atmospheric Administration (NOAA), a sediment quality assessment survey of Tampa Bay, Florida was conducted (SAIC, 1992; USFWS, 1992). The study was conducted in two phases and was designed not only to provide information on bioeffects over the entire Tampa Bay estuary but also to provide information with a fine spatial resolution within certain areas (Figure 1). Sediment toxicity was assessed using the amphipod (*Ampelisca abdita*) 10-day solid-phase test (ASTM, 1992), the sea urchin (*Arbacia punctulata*) fertilization test with sediment pore water (Carr and Chapman, 1992), and the Microtox® bioluminescence assay with organic sediment extracts. Sediments were analyzed for trace metals, and polycyclic aromatic hydrocarbons (PAHs), and chlorinated hydrocarbons at selected sites.

The sea urchin fertilization test was considerably more sensitive than the other toxicity tests (Table 1). Only 7% of the samples from both phases combined exhibited toxicity in the amphipod test as compared with 80% for the sea urchin assay with undiluted pore water and 27% for the 90 stations in phase I for the Microtox® assay. The most toxic sites in terms of both number and severity were in the northern part of Hillsborough Bay, the most heavily developed area of the Tampa Bay system (Figure 2). Toxicity was observed in some other areas with the sea urchin fertilization test (Figure 3).

MacDonald (1993) has recently developed sediment quality assessment guidelines for Florida coastal waters based on the approach recommended by Long and Morgan (1990). Using the sediment quality guidelines for 25 priority contaminants developed by MacDonald (1993), the measured and predicted toxicity (based on the bulk sediment chemical analyses) were compared. There was a high degree of concordance between the measured and predicted toxicity with the sea urchin pore water test but not with the amphipod solid-phase test with the Microtox® test being intermediate between the two (Table 2). Similar sediment quality assessment surveys have recently been conducted in Galveston Bay, Texas, Pensacola and St. Andrews Bay, Florida, Charleston Harbor, South Carolina, Boston Harbor, Massachusetts, and in the vicinity of offshore petroleum production platforms in the Gulf of Mexico which will allow the pore water toxicity test approach to be further validated and the concordance between measured and predicted toxicity to be evaluated in other geographical areas.

ACKNOWLEDGEMENTS

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Table 1. Summary of toxicity test results for three toxicity tests performed with sediment samples from Tampa Bay, Florida.

Test	Number Tested	Number Toxic[1]	Percent Toxic
Amphipod Survival			
Phase 1	90	12	13
Phase 2	78	0	0
Sea Urchin Fertilization			
Phase 1 Dilutions			
100% pore water	90	78	87
50% pore water	90	51	57
25% pore water	90	33	37
Phase 2 Dilutions			
100% pore water	78	57	73
50% pore water	75	50	64
25% pore water	75	35	45
Microtox® Bioluminescence			
Phase 1	90	24	27

[1] Significantly different ($\alpha \geq 0.05$, Dunnett's t-test) than control.

Table 2. Comparison of predicted versus measured toxicity for sediments from Tampa Bay, Florida.

Study	Number of Stations	Number Predicted Toxic[1]	Measured Toxic			Concordance		
			Amphipod[2]	Sea Urchin[3]	Microtox®	Amphipod	Sea Urchin	Microtox®
1991 Metals Only	90	16	5	15	9	31%	94%	56%
1992 Metals Only	75	9	0	9	--	0%	100%	--
1991 Metals and PAHs	16	6	0	6	5	0%	100%	83%
1992 Metals and PAHs	45	16	0	14	--	0%	88%	--

[1] Sediment predicted to be toxic if concentrations exceeded the probable effects level (PEL) for one or more contaminants (MacDonald, 1993).

[2] Survival in 10-day solid-phase test.

[3] Porewater embryological development test.

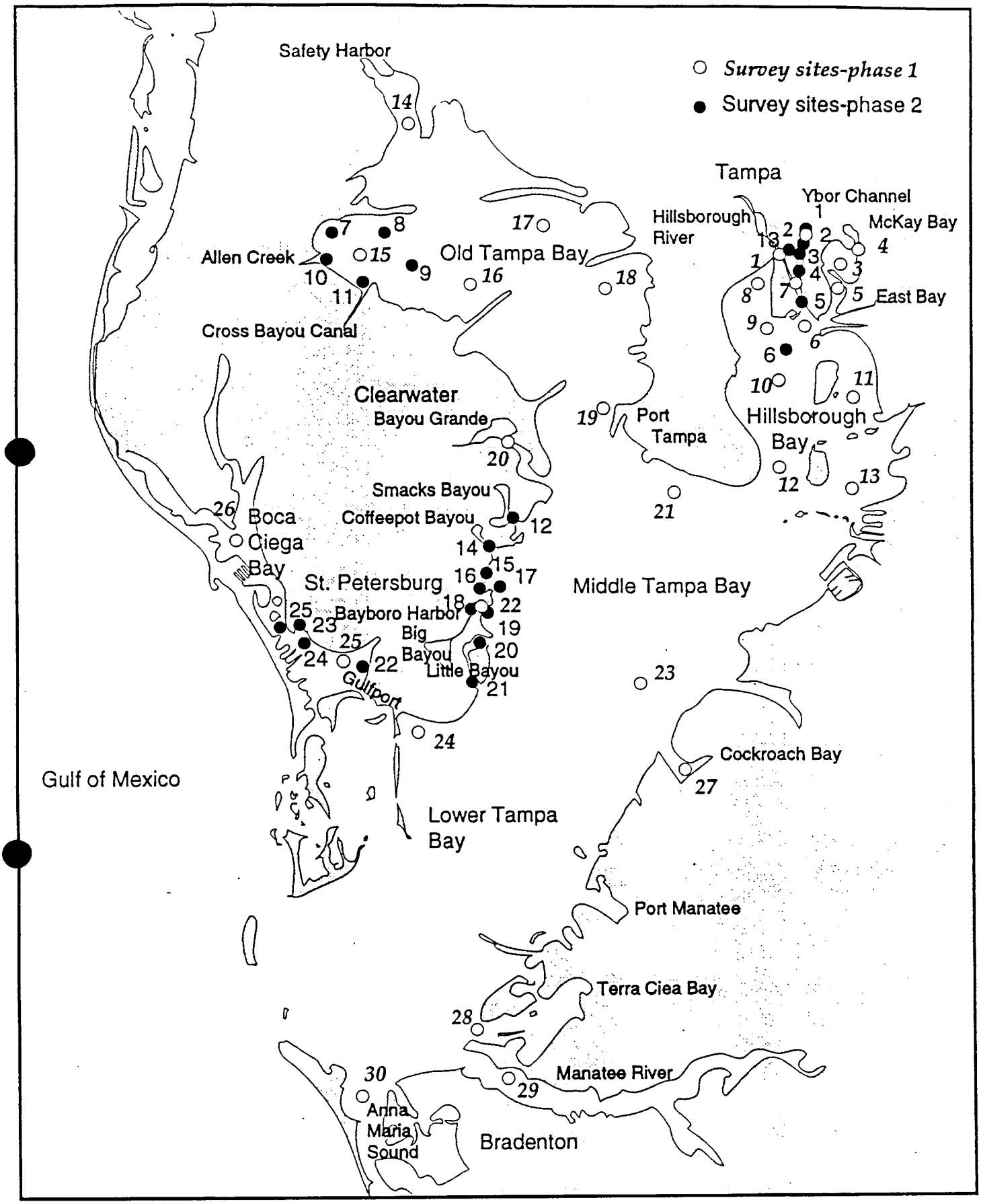

Figure 1. Locations of Phase 1 and Phase 2 sampling sites in Tampa Bay.

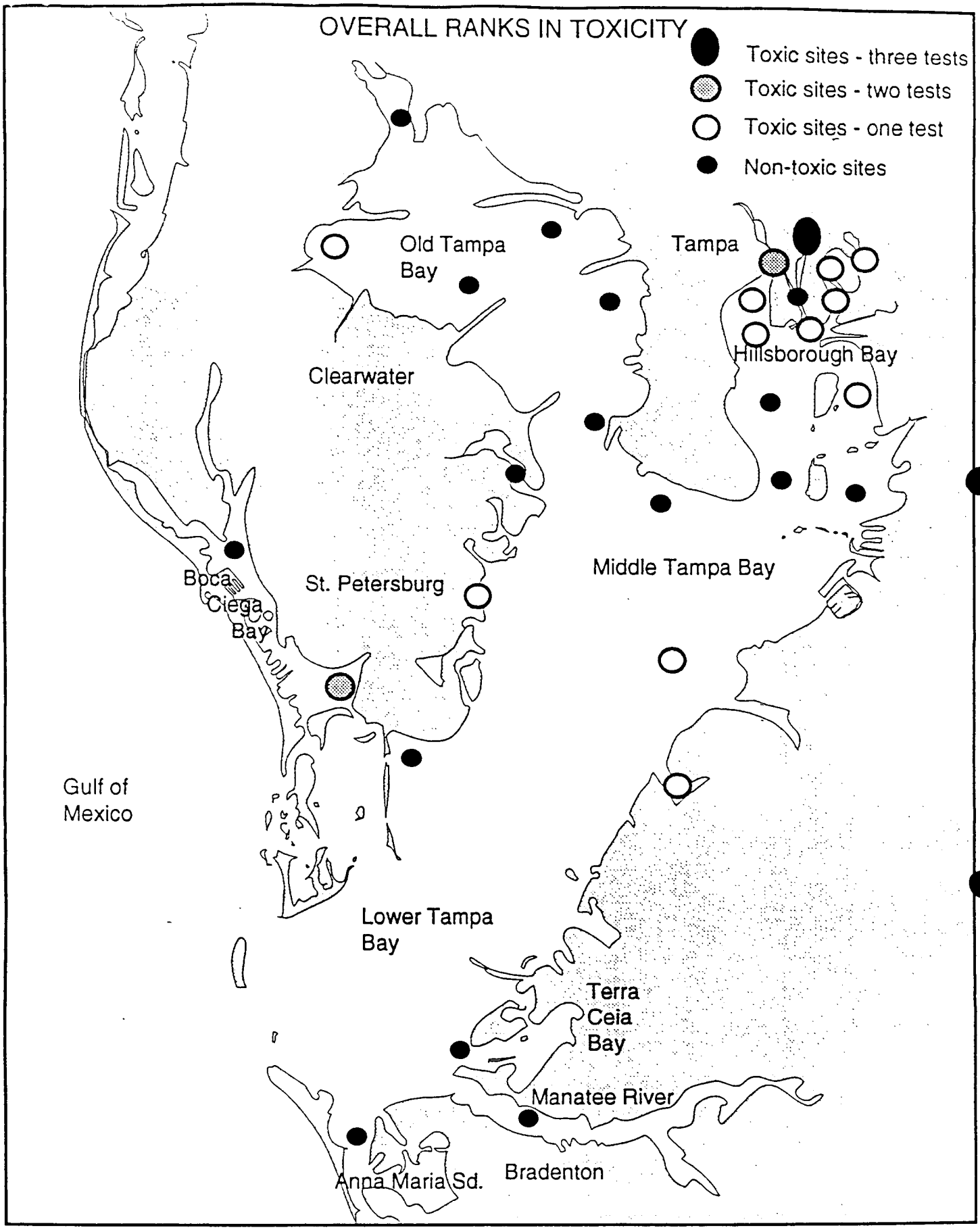

Figure 2. Phase 1 sites in Tampa Bay determined to be not toxic in any test, or significantly toxic in one, two, or three toxicity tests (amphipod, Microtox, sea urchin @25% dilution).

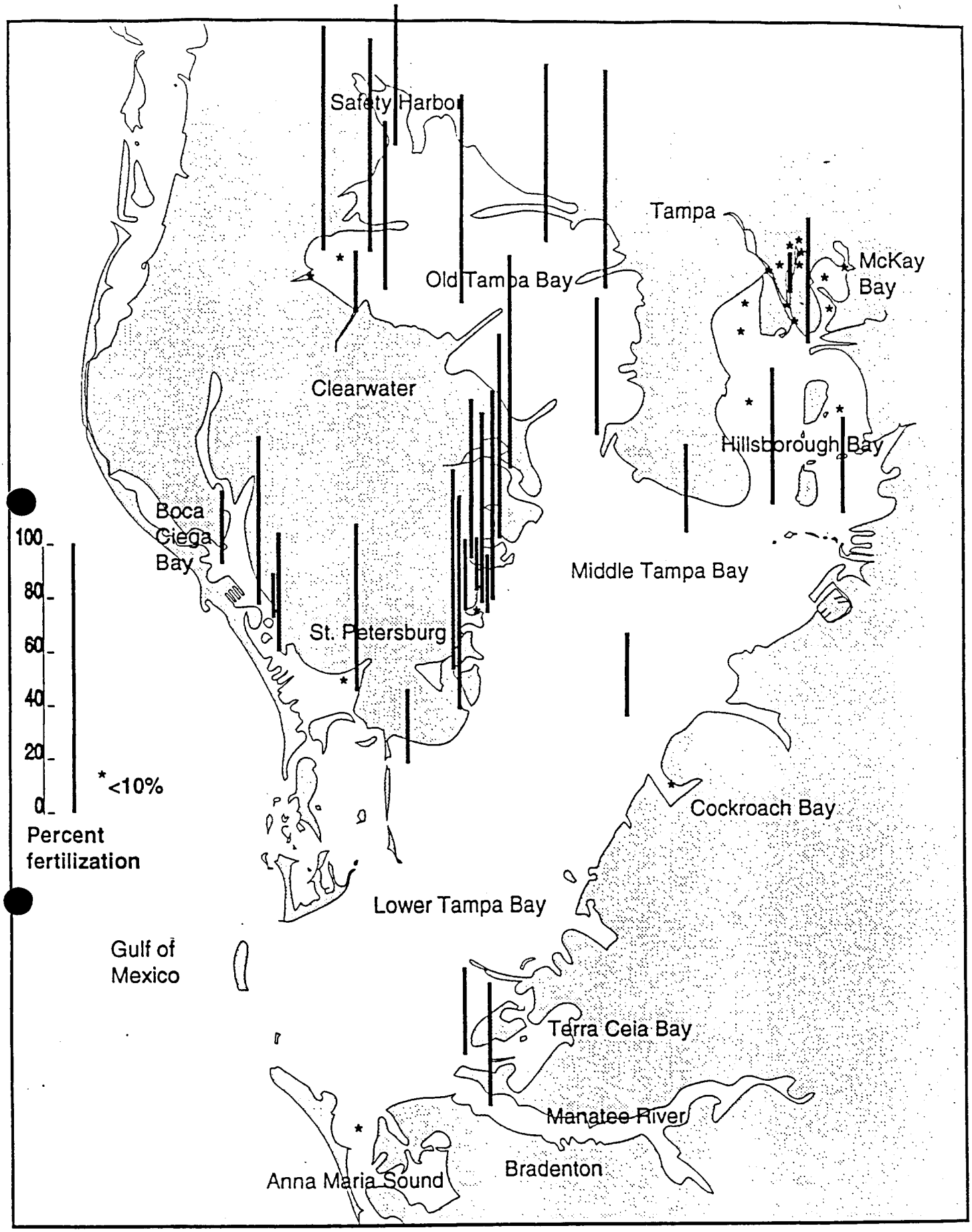

Figure 3. Combined results of Phase 1 and Phase 2 sea urchin toxicity tests; average percent fertilization success of sea urchin eggs exposed to 100% sediment pore water from 55 sites.