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DIOXIN CONTAMINATION IN SAMPIT RIVER WINYAH BAY SYSTEM, GEORGETOWN COUNTY SOUTH CAROLINA

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October 1991

Title: Dioxin Contamination in Sampit River, Winyah Bay System, Georgetown County, South Carolina

Abstract: Double crested cormorants feeding in the Sampit River below the International Paper co. discharge were collected for dioxin analyses. Whole body samples were submitted to the lab for 2,3,7,8 TCDD and TCDF determining. Concentrations exceeding background levels were identified in all cormorants collected.

Key Words: dioxin, cormorants, Winyah Bay

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Introduction

In 1983 the Environmental Protection Agency (EPA) began a nationwide investigation of dioxin contamination in the environment. As a result of this effort they found cause to suspect bleached craft paper mills as a source of 2,3,7,8,-tetrachlorodibenzo-para-dioxin (2,3,7,8,-TCDD) contamination to the aquatic environment. On April 1, 1988 EPA, the American Paper Institute, and the National Council of the Paper Industry for Air & Stream Improvement began a cooperative study at 104 paper mills across the nation. The study involved sampling of waste water, sludge, pulp, and fish immediately downstream of the facilities. Testing in the Sampit River below International Paper Company in Georgetown, S.C. revealed that a composite sample (whole body) of blue catfish contained a dioxin Toxicity Equivalency Concentration (TEC) of 118.16 parts per trillion (ppt). Samples collected from International Paper Company's wastewater were found to contain 640 parts per quadrillion (ppq) dioxin. These values represented the highest TEC values of all the 104 mills studied.

In January 1989 EPA released the results of a second set of fish tissue values in which fillets from Sampit River white perch site contained a dioxin TEC of 24.3 ppt. In March 1989 the South Carolina Department of Health and Environmental Control (DHEC) released values from sediments and a third set of fish samples. Sediment values ranged from .03 to 3.5 ppt. The fish fillet samples included TEC levels of 49.8, 31.9, and 21.2 ppt from white perch, white and blue catfish respectively. Based upon this information DHEC issued a health advisory which warned the public not to eat fish from the Sampit River.

In September 1990 EPA advised that dioxin levels downstream of International Paper Company could contaminate fish to a level potentially causing human liver damage after eating a single one-quarter pound meal. They calculated that the cancer risk at International Paper Company was the highest in the nation at one in 100. They also predicted that aquatic life impacts such as aberrations in growth, weight, and hatching success would occur downstream.

The high levels of dioxin, in conjunction with the obviously high bioaccumulation potential in fish collected in the study area, have caused us to be concerned about the trust resources at higher trophic levels. In order to assess levels in piscivorous trust species, we collected and analyzed double-crested cormorants (Phalacrocorax auritus) for dioxin in this study.

II. Resources at Risk

The Sampit River is a small intertidal tributary to Winyah Bay. The River is bordered by abandoned ricefields vegetated with fresh and brackish marsh vegetation. There are several large plantations that are managed for waterfowl as well as upland game species. The river supports a good freshwater fishery including largemouth bass, bream, crappie, and catfish. Estuarine species occur in the lower river near its confluence with Winyah Bay.

The Winyah Bay system is part of one of the most important overwintering refuge areas for migrating waterfowl in the Atlantic flyway. In and adjacent to the bay are over 80,000 acres of protected waterfowl refuge habitats under state and federal management. The Yawkey Wildlife Center, Samworth Management area, Santee Coastal Reserve, and Cape Romain National Wildlife Refuge collectively provide for peak waterfowl concentrations of 80,000 to 100,000 birds. Dabbling ducks that utilize fresh and brackish impoundments include mallard, black duck, gadwall, blue winged teal, green winged teal, northern pintail, wood duck, American widgeon, and northern shoveler. Diving ducks including lesser scaup, greater scaup, canvasback, redhead, red-breasted merganser, hooded merganser, ruddy duck, bufflehead, and common goldeneye utilize the more saline marshes and open water areas.

An important colonial wading bird rookery is located on Pumpkinseed Island in lower Winyah Bay. Thirty to forty thousand birds utilize this rookery including white ibis, glossy ibis, great egret, snowy egret, cattle egret, tri-colored heron, little blue heron, and black crowned night heron. White ibis are the most numerous (approximately 20,000 pairs) with substantial populations of great and snowy egrets and tricolored herons. Feeding areas include intertidal marshes, shallows, and impoundments throughout the Winyah Bay area.

The Winyah Bay system supports very productive shellfish and finfish fisheries. Trawl studies by the South Carolina Wildlife and Marine Resources Department (SCWMRD) revealed an abundance of blue crabs, pink shrimp, and brown shrimp. Wenner et al. (1981) found blue crabs throughout the Winyah Bay system. There is no significant oyster or clam resource in Winyah Bay proper. However, SCWMRD have collected 70 species of finfish including Atlantic Croaker, white catfish, weakfish, Atlantic menhaden, spot, southern kingfish, blue catfish, silver perch, red drum, black drum, sheephead, etc. The Bay also provides habitat for important anadromous fish including American shad, hickory shad, blueback herring, Atlantic sturgeon, and striped bass. The Winyah Bay is perhaps the most important refuge for the endangered shortnose sturgeon in its southern range (Dadswell, et al., unpublished manuscript).

Methods

Six double crested cormorants were collected by shotgun (loaded with steel shot) from the ricefields at Friendfield Plantation and from the vicinity of U.S. Highway 17 Bridge. Friendfield Plantation is located one mile above the International Paper Co. while the bridge is immediately below the company (Figure 1). Both areas are established cormorant feeding areas. Cormorants are migratory and most of the population use these two areas for a period of one to three months during the winter and early spring. A small percentage of the birds stay in the area for the whole year. Three of the cormorants were collected from Friendfield Plantation in March and April while the other three were collected from the Georgetown Bridge area in late May. The birds from Friendfield are believed to be normal migrants while the birds from the Georgetown Bridge are probably non-breeding residents.

The cormorants were prepared for analysis by standard Service procedures. The birds were plucked (instead of skinned) in order to preserve the subcutaneous fatty deposits. The wings, beaks and feet were clipped and removed. Contents of the gastrointestinal tracts were removed but the tracts were left intact to preserve the mesentery fat. All other organs were left intact. The prepared whole bird samples were weighed, packaged, and frozen. At the appropriate time they were shipped to the contractor for analyses of 2,3,7,-8 TCDD and Tetrachlorodibenzofurans (TCDF's).

Discussion of Results

The 2,3,7,8-TCDD concentrations in whole body cormorant tissue from the Sampit River ranged from 17.0 to 46.7 ppt., while the 2,3,7,8-TCDF values ranged from .722 to 3.25 ppt. (Table 1). Based upon existing toxicity data the 2,3,7,8-TCDF value are not considered to be of concern. However the 2,3,7,8-TCDD values are of concern. They can be compared to TCDD values detected in the Green Bay area of Wisconsin.

Whole body cormorant tissues from Green Bay contain 25 to 214 ppt. of Polychlorinated dibenzo-*para*-dioxins (PCDD's), of which an estimated 10-31% is composed of 2,3,7,8 - TCDD (Stalling, et al. 1985). This would translate to a maximum TCDD value ranging from 21.4 ppt to 66.34 ppt at the Green Bay site.

Reproductive success of the Forster's tern (*Sterna forsteri*) from organochlorine contamination of Green Bay, was 75% reduced as compared to the reproductive success of Forster's terns from relatively uncontaminated Lake Poygon, Wisconsin. The median estimated TCDD equivalents detected in tern *eggs* were 2175 ppt and 201 ppt for Green Bay and Lake Poygon respectively (Kubiak et al., 1989). Dioxin has also been

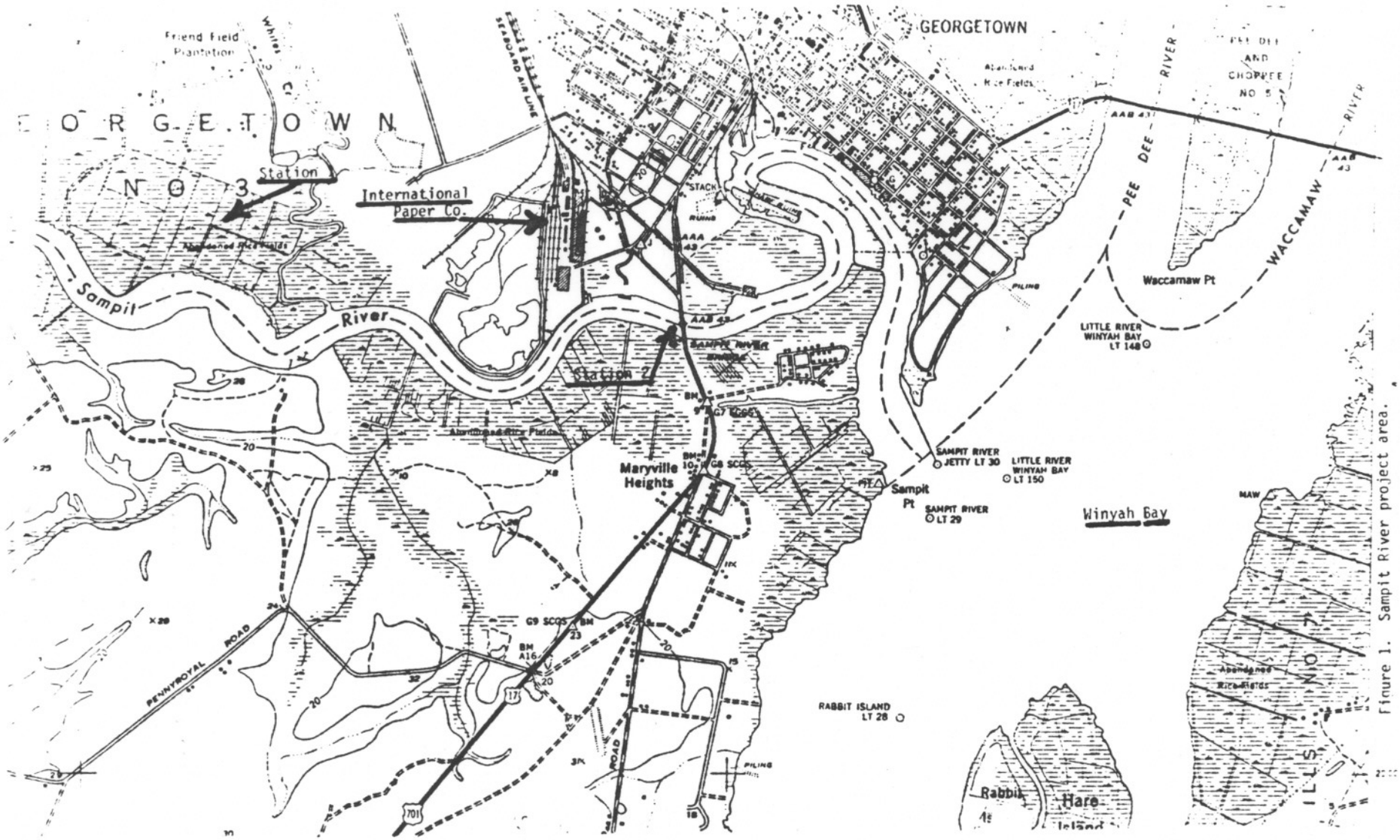

Figure 1. Sampit River project area.

Table 1. Dioxin Levels In Cormorant Tissue From The Sampit River

Sample No.	Common Name	Matrix	Sample Location	Sample Weight	2,3,7,8 -TCDD (ppt)	2,3,7,8 -TCDF (ppt)
SB1	Cormorant	Whole body	G. Bridge	3.5 Lbs	19.9	.722
SB3	Cormorant	Whole body	G. Bridge	4.1 Lbs	33.7	1.15
SB4	Cormorant	Whole body	G. Bridge	3.6 Lbs	46.7	1.04
SP2	Cormorant	Whole body	Friendfield Plantation	4.1 Lbs	17.0	1.18
SP5	Cormorant	Whole body	Friendfield Plantation	4.6 Lbs	31.4	3.25
SP6	Cormorant	Whole body	Friendfield Plantation	3.8 Lbs	27.0	.86

shown to have an adverse effect on the development of great blue heron embryos (Hart et al., 1990).

A recent study by the Service on wood ducks in Arkansas detected levels of dioxin from 30-300 ppt in wood duck eggs. The high levels were believed to be the cause of poor hatching success (D. White, unpublished data). Similar levels of dioxin in birds from other locations were found to have caused reproductive impairment (Ellenton, J.A., 1985; Hoffman, D.J. 1987).

Conclusions

The concentrations of 2,3,7,8-TCDD's detected in cormorant tissues from the Sampit River are above ambient levels. A limited comparison suggests that the TCDD levels in cormorants from the Sampit River are as high or slightly higher than those in the highly contaminated Green Bay area. Levels in this study are generally higher than what were observed in recent tests in Green Bay (Kubiak, pers. com).

Based upon EPA's warning about anticipated damages to aquatic organisms in the Sampit River and the studies that show birth defects to wood ducks and Forster's terns, it appears highly probable that trust resources and other fish and wildlife resources in the study area may be impacted by the existing dioxin contamination.

The existing 2,3,7,8-TCDD contamination problem could be worsened by current and proposed dredge and fill activities in the Sampit River/Winyah Bay system. Extensive maintenance dredging and open water disposal of sediments may re-suspend dioxin in the water column.

Recommendations for Further Work

1. Additional cormorants should be collected, using resident cormorants if available.

2. Fish from the Sampit should be collected for a preliminary histo-pathological examination. Bullheads should be used if possible. The literature clearly shows that some contaminants cause tumors and lesions in certain species of fishes, especially in the livers of brown bullheads.

3. A study should be developed to determine whether or not dredge and spoil disposal methods in the Sampit/Winyah Bay system are re-suspending dioxin in the water column.

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January 25, 1993

Memorandum

To: Chief, Division of Environmental Contaminants, FWS, Washington, D.C.

From: Environmental Contaminants Coordinator (AES), FWS, Atlanta, GA (TS/EC)

Subject: Contaminant Study Reports

Find attached copies of two contaminant study reports: "Toxicity of Sediments and Pore Water From Brunswick Estuary, GA" and "Dioxin Contamination in Sampit River Winyah Bay System, Georgetown County, South Carolina". The associated study ID's are 89-4-054 and 90-4-060, respectively. Please note the first of these reports has been submitted to a journal for publication and should not be distributed or cited at this time. I received one copy of the latter report. If you have not previously received the customary number of copies, please advise me and I will have more copies forwarded to you.

Charles F. Facemire, Ph.D.
Regional Contaminants Coordinator

Enclosures