



# FLORIDA WILDLIFE FEDERATION

*Affiliated With National Wildlife Federation*

Manley K. Fuller, III, President  
2545 Blairstone Pines Drive, Tallahassee, FL 32301  
Post Office Box 6870, Tallahassee, FL 32314-6870

Phone: (850) 656-7113  
Fax: (850) 942-4431  
e-mail: wildfed@aol.com

September 24, 2002

Dear Florida Fish and Wildlife Conservation Commission:

On behalf of over 40,000 members, affiliates and supporters, the Florida Wildlife Federation officially requests that the Commission consider requesting a public health advisory on recreational fish and blue crab from Rice Creek and the St John's River near Rice Creek confluence.

In support of our request, we have examined the following data and information concerning highly-elevated levels of dioxin in sediments of Rice Creek and in recreational fish, bass, bluegill, catfish and blue crabs consumed by humans in Rice Creek and tributaries to the St Johns River near Palatka, Florida.

We believe this situation constitutes a threat to public health and wish to bring this matter to you for formal, official consideration of immediate responses including establishing a public health advisory and posted warning not to consume the fish in this area.

EPA's Fact Sheet concerning Public Health Advisory standards for Dioxin in fish tissue contains the following recommendations for fish consumption advisories:



United States  
Environmental Protection  
Agency

Office of Water  
4305

EPA-823-F-99-015  
September 1999

## Fact Sheet

### Polychlorinated Dibenzo-p-dioxins and Related Compounds Update: Impact on Fish Advisories

The purpose of this fact sheet is to summarize current information on sources, fate and transport, occurrence in human tissues, range of concentrations in fish tissue, fish advisories, fish consumption limits, toxicity, and regulations for dioxins. The fact sheets also illustrate how this information may be used for developing fish consumption advisories. An electronic version of this fact sheet and fact sheets for mercury, PCBs, and toxaphene are available at <http://www.epa.gov/OST/fish>. Future revisions will be posted on the web as they become available.

**Table 2. Monthly Fish Consumption  
Limits for Dioxins/Furans**

| <b>Risk Based<br/>Consumption Limit</b> | <b>Cancer Health<br/>Endpoints</b>                        |
|-----------------------------------------|-----------------------------------------------------------|
| Fish meals/month                        | Fish Tissue<br>Concentrations,<br>(ppt <sup>a</sup> -TEQ) |
| 16                                      | >0.019 - 0.039                                            |
| 12                                      | >0.039 - 0.052                                            |
| 8                                       | >0.052 - 0.077                                            |
| 4                                       | >0.077 - 0.15                                             |
| 3                                       | >0.15 - 0.21                                              |
| 2                                       | >0.21 - 0.31                                              |
| 1                                       | >0.31 - 0.62                                              |
| 0.5                                     | >0.62 - 1.2                                               |
| None (<0.5) <sup>a</sup>                | >1.2                                                      |

<sup>a</sup>None = No consumption recommended.

<sup>b</sup>ppt = parts per trillion on a wet weight basis.

Note: In cases where >16 meals per month are consumed, refer to EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories*, Volume 2, Section 3 to determine safe consumption limits.

These advisories are generally based on a higher cancer risk level (1 in 100,000) than the more protective risk level EPA/DEP normally applies for water quality standards (1 in 1,000,000).

When compared to data uncovered Dioxin in fish tissue sampled from tributaries to the St Johns River by industry sampling, we have found cause for a public health advisory on consumption of recreational fish caught in Rice Creek, Etonia Creek and the proximate area of the Lower St Johns River (previously reports of these levels were incorrectly compared with FDA levels applicable to commercial fish markets).

The level reported in Rice Creek and Etonia Creek exceed EPA's recommended levels for :

**“no meals per month” dioxin level “>1.2 ppt” and**

**“less than one meal per month” dioxin level of “>0.62 ppt”**

contained in EPA's health advisory for dioxin in recreational fish.

The levels detected are as follows:

**1997:**

TABLE 3-2. Sample Analytical Results for Dioxin and Furan Isomers Above the Detection Limit and Percent Lipids, Annual Fish Tissue Dioxin and Furan Monitoring, Georgia-Pacific Corporation Palatka Operations, Putnam County, Florida, September and October 1997

| Sampling Location | Fish Species    | Isomer               | Analytical Concentration (PPT) | Confirmatory Analysis Concentration (PPT) |
|-------------------|-----------------|----------------------|--------------------------------|-------------------------------------------|
| Rice Creek        | Bluegill        | 2,3,7,8-TCDD         | 2.8                            | 2.7                                       |
|                   | Bluegill        | 1,2,3,4,6,7,8,9-OCDD | ND                             | 0.63                                      |
|                   | Bluegill        | 2,3,7,8-TCDF         | 2.3 (2.7)                      | 2.2 (2.5)                                 |
|                   | Bluegill        | 1,2,3,4,7,8-HxCDF    | 0.38                           | 0.33 <sup>1</sup>                         |
|                   | Largemouth Bass | 2,3,7,8-TCDD         | 0.62                           | 0.47 <sup>1</sup>                         |
|                   | Largemouth Bass | 2,3,7,8-TCDF         | 0.54                           | 0.58                                      |
|                   | Largemouth Bass | 1,2,3,4,7,8-HxCDF    | ND                             | 0.29 <sup>1</sup>                         |
|                   | Largemouth Bass | 2,3,4,6,7,8-HxCDF    | ND                             | 0.21 <sup>1</sup>                         |
|                   | White Catfish   | 2,3,7,8-TCDF         | 1.0 (ND)                       | No Data                                   |
|                   | White Catfish   | 2,3,4,6,7,8-HxCDF    | 0.36                           | No Data                                   |

PPT = parts per trillion

% = percent

TCDD = Tetrachlorodibenzo-p-dioxin

TCDF = Tetrachlorodibenzofuran

HxCDF = Hexachlorodibenzofuran

OCDD = Octachlorodibenzo-p-dioxin

ND = non detect

1998:

TABLE 3-2. Sample Analytical Results for Dioxin and Furan Isomers Above the Detection Limit and Percent Lipids, Annual Fish Tissue Dioxin and Furan Monitoring, Georgia-Pacific Corporation Palatka Operations, Putnam County, Florida, October 1998

| Sampling Location | Fish Species    | Analyte             | Analytical Concentration (PPT) | Percent Lipids (%) |
|-------------------|-----------------|---------------------|--------------------------------|--------------------|
| Rice Creek        | Bluegill        | 2,3,7,8-TCDD        | 1.8 <sup>1</sup>               | 1.6                |
|                   |                 | 1,2,3,4,6,7,8-HpCDD | 0.19 <sup>1</sup>              |                    |
|                   |                 | OCDD                | 0.29 <sup>1</sup>              |                    |
|                   |                 | 2,3,7,8-TCDF        | (1.2)                          |                    |
|                   |                 | OCDF                | 0.41 <sup>1</sup>              |                    |
|                   | White Catfish   | 2,3,7,8-TCDD        | 0.71 <sup>1</sup>              | 1.5                |
|                   |                 | 1,2,3,7,8-PeCDD     | 0.25 <sup>1</sup>              |                    |
|                   |                 | 1,2,3,6,7,8-HxCDD   | 0.33 <sup>1</sup>              |                    |
|                   |                 | 1,2,3,4,6,7,8-HpCDD | 0.21 <sup>1</sup>              |                    |
|                   |                 | OCDD                | 0.45 <sup>1</sup>              |                    |
|                   |                 | 2,3,7,8-TCDF        | 0.58 <sup>1</sup>              |                    |
|                   |                 | 1,2,3,7,8-PeCDF     | 0.14 <sup>1</sup>              |                    |
|                   |                 | 2,3,4,7,8-PeCDF     | 0.37 <sup>1</sup>              |                    |
|                   |                 | OCDF                | 0.25 <sup>1</sup>              |                    |
| Etonia Creek      | Largemouth Bass | OCDD                | 0.29 <sup>1</sup>              | 0.5                |
|                   |                 | 1,2,3,4,7,8-HxCDF   | 0.11 <sup>1</sup>              |                    |
|                   |                 | OCDF                | 0.24 <sup>1</sup>              |                    |

1999:

TABLE 4-2. Project Data Compared with Health Advisory Criteria, Annual Fish Tissue Dioxin and Furan Monitoring, Georgia-Pacific Corporation Palatka Operations, Putnam County, Florida, October 1999

| Sampling Location | Fish Specie | Analyte      | Analytical Concentration (PPT) | TEF | 2,3,7,8-TCDD Equivalent Concentration (PPT) |
|-------------------|-------------|--------------|--------------------------------|-----|---------------------------------------------|
| Rice Creek        | Bluegill    | 2,3,7,8-TCDD | 1.3                            | 1.0 | 1.3                                         |
|                   |             | 2,3,7,8-TCDF | 1.5                            | 0.1 | 0.15                                        |
|                   |             | TOTAL 1.45   |                                |     |                                             |

TEF = Toxicity Equivalence Factor  
TCDF = Tetrachlorodibenzofuran

PPT = parts per trillion  
TCDD = Tetrachlorodibenzo-p-dioxin

2000:

### Georgia-Pacific Palatka Mill

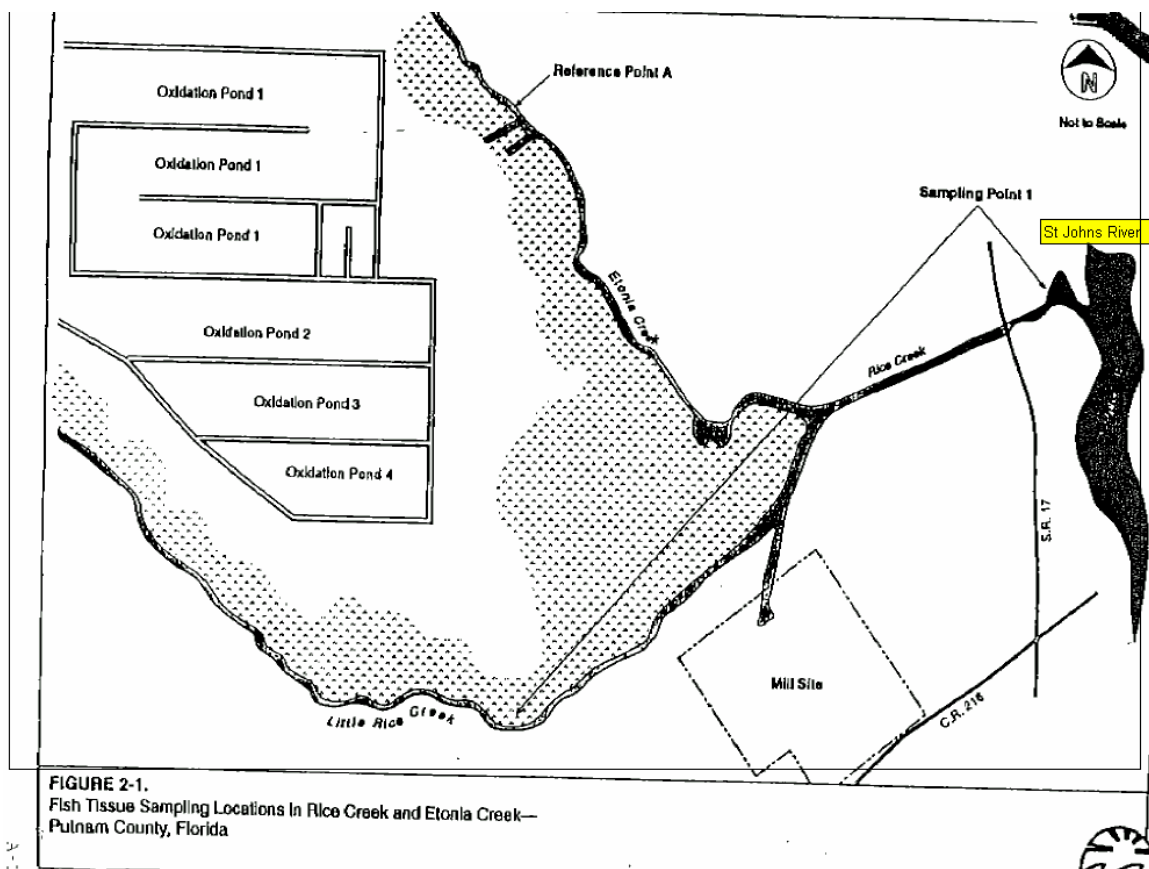
TLI Project: 52129r2  
Client Sample: RWC-1000

Toxicity Equivalents Report  
Analysis File: S005397

|                 |                  |                  |          |             |          |
|-----------------|------------------|------------------|----------|-------------|----------|
| Client Project: | Quarterly Dioxin | Date Received:   | 10/18/00 | ICal:       | SF5N070  |
| Sample Matrix:  | FISH             | Date Extracted:  | 11/15/00 | Spike File: | SPMIT32S |
| TLI ID:         | 272-60-2A-2H     | Date Analyzed:   | 11/18/00 | 1st CCal:   | S005391  |
|                 |                  |                  |          | End CCal:   | S005404  |
| Sample Size:    | 20.010 g         | Dilution Factor: | 1        | % Moisture: | n/a      |
| Dry Weight:     | n/a              | Blank File:      | S005396  | % Lipid:    | n/a      |
| GC Column:      | DB-5             | Analyst:         | DFS      | % Solids:   | n/a      |

| Analytes             | Conc. (pg/g) |   | TEF   |   | Equivalent |
|----------------------|--------------|---|-------|---|------------|
| 2,3,7,8-TCDD         | 2.6          | x | 1.    | = | 2.6        |
| 1,2,3,7,8-PeCDD      | ND           | x | 0.5   | = |            |
| 1,2,3,4,7,8-HxCDD    | ND           | x | 0.1   | = |            |
| 1,2,3,6,7,8-HxCDD    | ND           | x | 0.1   | = |            |
| 1,2,3,7,8,9-HxCDD    | ND           | x | 0.1   | = |            |
| 1,2,3,4,6,7,8-HpCDD  | ND           | x | 0.01  | = |            |
| 1,2,3,4,6,7,8,9-OCDD | ND           | x | 0.001 | = |            |
| TOTAL PCDD           |              |   |       |   | 2.6        |

These samples were taken all from Rice Creek and Etonia Creek.



## 2001 collection for 2002 report

The newest data shows Rice Creek fish tissue dioxin levels still  $>.67$  ppt ( no more than .5 meals per month) and also show elevated dioxin fish tissue levels in Etonia Creek and Deep Creek. In the 2001 sampling reported in 2002, the levels were still above EPA health advisory, not only in Rice Creek, but also in bluegills captured in Deep Creek, (2002 Report) – see next page.

Table 3-2. Sample Analytical Results for Dioxin and Furan Congeners

| Sampling Location | Fish Species  | Congener             | Primary Sample Analytical Concentration (ppt) | Replicate Sample Analytical Concentration (ppt) |
|-------------------|---------------|----------------------|-----------------------------------------------|-------------------------------------------------|
| Rice Creek        | Bluegill      | <u>Dioxins</u>       |                                               |                                                 |
|                   |               | 2,3,7,8-TCDD         | <0.5                                          | 0.75                                            |
|                   |               | 1,2,3,7,8-PeCDD      | <0.10                                         | <0.10                                           |
|                   |               | 1,2,3,4,7,8-HxCDD    | <0.1                                          | <0.1                                            |
|                   |               | 1,2,3,7,8,9-HxCDD    | <0.1                                          | 0.15†*                                          |
|                   |               | 1,2,3,6,7,8-HxCDD    | <0.1                                          | <0.1                                            |
|                   |               | 1,2,3,4,6,7,8-HpCDD  | <0.1                                          | <0.2                                            |
|                   |               | 1,2,3,4,6,7,8,9-OCDD | 0.63†*                                        | <0.6                                            |
|                   |               | <u>Furans</u>        |                                               |                                                 |
|                   |               | 2,3,7,8-TCDF         | <0.7                                          | 0.96†                                           |
|                   |               | 1,2,3,7,8-PeCDF      | <0.07                                         | <0.07                                           |
|                   |               | 2,3,4,7,8-PeCDF      | <0.06                                         | <0.06                                           |
|                   |               | 1,2,3,4,7,8-HxCDF    | <0.06                                         | 0.27†*                                          |
|                   |               | 1,2,3,6,7,8-HxCDF    | <0.07                                         | <0.07                                           |
|                   |               | 2,3,4,6,7,8-HxCDF    | <0.07                                         | <0.07                                           |
|                   |               | 1,2,3,7,8,9-HxCDF    | <0.1                                          | <0.1                                            |
|                   |               | 1,2,3,4,6,7,8-HpCDF  | <0.09                                         | <0.09                                           |
|                   |               | 1,2,3,4,7,8,9-HpCDF  | <0.1                                          | <0.1                                            |
|                   |               | 1,2,3,4,6,7,8,9-OCDF | <0.2                                          | 0.18†*                                          |
|                   |               | <u>Dioxins</u>       |                                               |                                                 |
|                   |               | 2,3,7,8-TCDD         | 1.0                                           | 0.72                                            |
|                   |               | 1,2,3,7,8-PeCDD      | <0.2                                          | <0.07                                           |
|                   |               | 1,2,3,4,7,8-HxCDD    | <0.07                                         | <0.07                                           |
|                   |               | 1,2,3,7,8,9-HxCDD    | <0.3                                          | <0.2                                            |
|                   |               | 1,2,3,6,7,8-HxCDD    | 0.07*                                         | <0.08                                           |
|                   |               | 1,2,3,4,6,7,8-HpCDD  | 0.36†*                                        | 0.19†*                                          |
|                   |               | 1,2,3,4,6,7,8,9-OCDD | 1.0†*                                         | 0.79†*                                          |
|                   |               | <u>Furans</u>        |                                               |                                                 |
|                   |               | 2,3,7,8-TCDF         | 0.68†                                         | 0.46†*                                          |
|                   |               | 1,2,3,7,8-PeCDF      | <0.07                                         | <0.05                                           |
|                   |               | 2,3,4,7,8-PeCDF      | 0.15*                                         | 0.09*                                           |
|                   |               | 1,2,3,4,7,8-HxCDF    | 0.26†**                                       | 0.11†*                                          |
|                   |               | 1,2,3,6,7,8-HxCDF    | <0.06                                         | <0.05                                           |
|                   |               | 2,3,4,6,7,8-HxCDF    | <0.06                                         | <0.06                                           |
|                   |               | 1,2,3,7,8,9-HxCDF    | <0.09                                         | <0.08                                           |
|                   |               | 1,2,3,4,6,7,8-HpCDF  | <0.08                                         | <0.07                                           |
|                   |               | 1,2,3,4,7,8,9-HpCDF  | <0.1                                          | <0.09                                           |
|                   |               | 1,2,3,4,6,7,8,9-OCDF | 0.15†*                                        | <0.2                                            |
| Rice Creek        | White Catfish | <u>Dioxins</u>       |                                               |                                                 |
|                   |               | 2,3,7,8-TCDD         | 1.0                                           | 0.72                                            |
|                   |               | 1,2,3,7,8-PeCDD      | <0.2                                          | <0.07                                           |
|                   |               | 1,2,3,4,7,8-HxCDD    | <0.07                                         | <0.07                                           |
|                   |               | 1,2,3,7,8,9-HxCDD    | <0.3                                          | <0.2                                            |
|                   |               | 1,2,3,6,7,8-HxCDD    | 0.07*                                         | <0.08                                           |
|                   |               | 1,2,3,4,6,7,8-HpCDD  | 0.36†*                                        | 0.19†*                                          |
|                   |               | 1,2,3,4,6,7,8,9-OCDD | 1.0†*                                         | 0.79†*                                          |
|                   |               | <u>Furans</u>        |                                               |                                                 |
|                   |               | 2,3,7,8-TCDF         | 0.68†                                         | 0.46†*                                          |
|                   |               | 1,2,3,7,8-PeCDF      | <0.07                                         | <0.05                                           |
|                   |               | 2,3,4,7,8-PeCDF      | 0.15*                                         | 0.09*                                           |
|                   |               | 1,2,3,4,7,8-HxCDF    | 0.26†**                                       | 0.11†*                                          |
|                   |               | 1,2,3,6,7,8-HxCDF    | <0.06                                         | <0.05                                           |
|                   |               | 2,3,4,6,7,8-HxCDF    | <0.06                                         | <0.06                                           |
|                   |               | 1,2,3,7,8,9-HxCDF    | <0.09                                         | <0.08                                           |
|                   |               | 1,2,3,4,6,7,8-HpCDF  | <0.08                                         | <0.07                                           |
|                   |               | 1,2,3,4,7,8,9-HpCDF  | <0.1                                          | <0.09                                           |
|                   |               | 1,2,3,4,6,7,8,9-OCDF | 0.15†*                                        | <0.2                                            |

but also in bluegills captured in Deep Creek, (2002 Report)

Table 3-3. Calculated TEQ and Lipid Normalized Concentration

| Species         | Wet Weight<br>ND = 0<br>ND = 1/2 DL | Deep Creek           |                       |         | Durbin Creek         |                       |         | Rice Creek           |                       |         | Trout Creek          |                       |         |
|-----------------|-------------------------------------|----------------------|-----------------------|---------|----------------------|-----------------------|---------|----------------------|-----------------------|---------|----------------------|-----------------------|---------|
|                 |                                     | Replicate Results    |                       |         | Replicate Results    |                       |         | Replicate Results    |                       |         | Replicate Results    |                       |         |
|                 |                                     | DBG-1001<br>DB-5 '01 | DBG-1001R<br>DB-5 '01 | Average | DBG-1001<br>DB-5 '01 | DBG-1001R<br>DB-5 '01 | Average | DBG-1001<br>DB-5 '01 | DBG-1001R<br>DB-5 '01 | Average | DBG-1001<br>DB-5 '01 | DBG-1001R<br>DB-5 '01 | Average |
| Bluegill        | ND = 0                              | 0.47                 | 0                     | 0.23    | 0.001                | 0                     | 0.0005  | 0                    | 0.55                  | 0.4     | 0.09                 | 0.02                  | 0.06    |
| Catfish         | ND = 1/2 DL                         | -                    | -                     | -       | -                    | -                     | -       | 1.2                  | 0.77                  | 1.0     | -                    | -                     | -       |
| Largemouth Bass | ND = 0                              | 0                    | 0                     | 0       | 0                    | 0                     | 0       | -                    | -                     | -       | 0.03                 | 0                     | 0.01    |
| Bluegill        | ND = 1/2 DL                         | 0.63                 | 0.08                  | 0.35    | 4.12                 | 0.09                  | 6.10    | 0.34                 | 1.96                  | 0.7     | 0.15                 | 0.18                  | 0.17    |
| Catfish         | ND = 0                              | -                    | -                     | -       | -                    | -                     | -       | 1.3                  | 0.86                  | 1.1     | -                    | -                     | -       |
| Largemouth Bass | ND = 0                              | 0.13                 | 0.11                  | 0.12    | 0.13                 | 0.11                  | 0.12    | -                    | -                     | -       | 0.2                  | 0.13                  | 0.2     |
| Bluegill        | ND = 0                              | 23                   | 0                     | 11.7    | 0.18                 | 0                     | 0.09    | 0                    | 37                    | 18.4    | 18                   | 2.4                   | 10.3    |
| Catfish         | ND = 1/2 DL                         | -                    | -                     | -       | -                    | -                     | -       | 57                   | 77                    | 66.9    | -                    | -                     | -       |
| Largemouth Bass | ND = 0                              | 0                    | 0                     | 0       | 0                    | 0                     | 0       | -                    | -                     | -       | 4.8                  | 0                     | 2.4     |
| Bluegill        | ND = 1/2 DL                         | 32                   | 16                    | 23.9    | 21                   | 9.6                   | 15.1    | 24                   | 42                    | 32.8    | 29                   | 20                    | 24.9    |
| Catfish         | ND = 0                              | -                    | -                     | -       | -                    | -                     | -       | 66                   | 86                    | 76.1    | -                    | -                     | -       |
| Largemouth Bass | ND = 0                              | 32                   | 110                   | 73.3    | 33                   | 36                    | 34.5    | -                    | -                     | -       | 33                   | 44                    | 38.4    |

Source: AMBC, 2002.

7/9/02

This additional finding in Deep Creek could indicate either migration of the problem, migration of individual fish through the St Johns River, or warranted public health fish consumption advisory in a separate contamination area. No largemouth bass samples were taken in Rice Creek and no sufficient reason or explanation for this lack of sampling is given; or why re-sampling was not required.

### 3.1 SAMPLES COLLECTED FOR ANALYSIS

White catfish (*Ictalurus catus*) and bluegill (*Lepomis macrochirus*) were collected from Rice Creek on October 15, 2001. Largemouth bass (*Micropterus salmoides*) were collected on October 16 and 17, 2001, from Deep Creek. Largemouth bass and bluegill were collected from Trout and Durbin Creek on October 18 and 23 and October 23, 2001, respectively. The rationale for the sample species selected for each creek was the specie(s) observed during shocking that would provide sufficient numbers needed for composite samples (primary and replicate) and meet the size uniformity requirement. Information regarding fish species collected, sample identification, and physical specifications has been compiled (Table 3-1).

To understand and interpret this industry sampling data, it is important to know a few things about the unique riverine system of the St Johns River. Although located many miles upstream (to the south) and primarily freshwater, due to a rise of less than 12 inches in topography this area of the Lower St Johns River and tributaries (depicted in the map above) experience both frequent diurnal tide reversals and extended periods of negative flow up the tributaries due to tide (1 to 5 days).

An independent (i.e., *non-industry sponsored*) fish tissue dioxin study conducted in 1993 reflected bioaccumulation in **largemouth bass** at **8.8 ppt** (exceeding bluegill levels at that time) exceeding the no meals per month level by eight times; and dioxin levels in **bowfin** fish as high as **48 ppt**.

EPA's previously-cited fact sheet states that:

The half-lives for various dioxin congeners in humans are reported to range from 2.9 to 26.9 years. Some studies suggest longer half-lives in individuals with higher levels of body fat.

Similarly, dioxin in Rice Creek sediment and in the treatment lagoon sludges and sediment will remain for years to come.

In addition, additional dioxin will likely be produced and available for sediment adsorption and additional bioaccumulation. Rice Creek sediments (as well as fish and blue crab) were found to contain dioxin in 1993 peer reviewed study

Table 1. TCDD concentration, TOC, and percentage of moisture for Rice Creek (northeastern Florida) sediments

|            | Site 1* | Site 2 | Site 3 |
|------------|---------|--------|--------|
| TCDD (ppt) | 32.2    | 52.8   | 6.8    |
| TOC (mg/g) | 32.0    | 39.0   | 25.0   |
| % Moisture | 81.3    | 79.4   | 54.7   |

\*Sites 1 and 2 were located in Rice Creek, within one-half mile of the mill outfall. Site 3 was collected at the confluence of Rice Creek and the St. Johns River, approximately two miles from the mill outfall.

*Environmental Toxicology and Chemistry*, Vol. 12, pp. 2077-2082, 1993  
Printed in the USA. Pergamon Press Ltd.

0730-1268/93 \$6.00 + .00  
Copyright © 1993 SETAC

## BIOACCUMULATION OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN FERAL FISH COLLECTED FROM A BLEACH-KRAFT PAPER MILL RECEIVING STREAM

JOHN D. SCHELL, JR.\*† DEAN M. CAMPBELL‡ and EDGAR LOWE†  
†TERRA, Inc., 325 John Knox Road, Tallahassee, Florida 32303-4516  
‡St. Johns River Water Management District, Palatka, Florida 32178

(Received 3 April 1992; Accepted 20 February 1993)

The results of limited sediment analysis indicate that this water body contains significant levels of TCDD, which may pose a risk to the ecosystem. Sediments collected approximately one-quarter and one-half mile from the outfall contained TCDD as high as 52.8 ppt. Considering the discharge history and shallow topography of this area, TCDD contamination is likely to occur throughout the creek. A sediment sample collected at the mouth of Rice Creek contained only a fraction of the TCDD found in the main creek channel, likely a result of mixing 1993 Schell supra.

Table 2. Results of TCDD and lipid analysis of tissue samples from fish collected in Rice Creek (northeastern Florida)

| Sample no. | Species and tissue <sup>a</sup> | Composite no. <sup>b</sup> | TCDD (ppt) | Percentage lipids | Age (years) <sup>c</sup> |
|------------|---------------------------------|----------------------------|------------|-------------------|--------------------------|
| 1          | LM bass liver                   | 3                          | 1.8        | 3.9               | 2, 3                     |
| 2          | LM bass liver                   | 2 <sup>d</sup>             | 2.9        | 2.4               | 4                        |
| 3          | LM bass gonads                  | 2 <sup>d</sup>             | 8.8        | 7.6               | 4                        |
| 4          | Bowfin liver                    | 1                          | 11.2       | 5.2               | 6-7                      |
| 5          | Bowfin liver                    | 1 <sup>e</sup>             | 18.6       | 6.1               | 6-7                      |
| 6          | Bowfin gonad                    | 1 <sup>e</sup>             | 46.1       | 13.7              | 6-7                      |
| 7          | Catfish liver                   | 4                          | 1.8        | 3.4               | 1-2                      |
| 8          | Catfish liver                   | 3                          | 2.6        | 2.9               | 1-2                      |
| 9          | Catfish liver                   | 3                          | 2.8        | 3.2               | 1-2                      |
| 10         | Blue crab HP <sup>f</sup>       | 5                          | 8.2        | 7.6               | 1                        |

<sup>a</sup>Species abbreviations: LM bass = largemouth bass; catfish = brown bullhead catfish.

<sup>b</sup>Number of individual tissues composited to make sample.

<sup>c</sup>Ages are approximations from Florida Game and Fresh Water Fish Commission length/age tables (Fred Cross, personal communication).

<sup>d</sup>Composite samples from same two LM bass.

<sup>e</sup>Composite sample from same bowfin.

<sup>f</sup>Hepatopancreas.

three fish was four years of age. Blue crab HP was remarkably similar to largemouth bass ovary in both the percentage of lipid and the TCDD content.

On an individual basis, approximately three times as much TCDD was found in the ovaries compared to hepatic tissue (Table 2). This pattern of distribution has been demonstrated in a number of fish species for other lipophilic chemicals [12,19,20]. The apparent sequestering of lipophilic chemicals in the egg mass during formation can have significant environmental consequences. Embryo and sac fry are reported to be the life stages most sensitive to chemical effects [21]. Both the bowfin and the largemouth bass ovaries were actually large egg masses, and it appeared the females were very close to spawning. A TCDD concentration of 46.1 ppt (found in bowfin ovary) is very near the calculated LC50 for lake trout sac fry [5] and Japanese medaka embryo [22]. Whether these species are as sensitive as the lake trout and medaka is, as yet, undetermined. However, once tissue burdens reach these levels, it may be prudent to assume that these animals are at risk. It should be noted that the only chemical measured in this study was 2,3,7,8-TCDD; other PCDDs (and polychlorinated dibenzofurans) may be present and could contribute to the absolute TCDD toxicity [5].

(1993, Schell).

Endocrine disruption effects include hormone mimics, receptor blocking and cellular changes, include "fish masculinization" have also been identified in Rice Creek by *Cody and Bortone* in 1999 and could be caused by dioxins or other chemicals, but also warrant fish, wildlife and public health concern.

Bull. Environ. Contam. Toxicol. (1999) 63:150–156  
© 1999 Springer-Verlag New York Inc.

Environmental  
Contamination  
and Toxicology

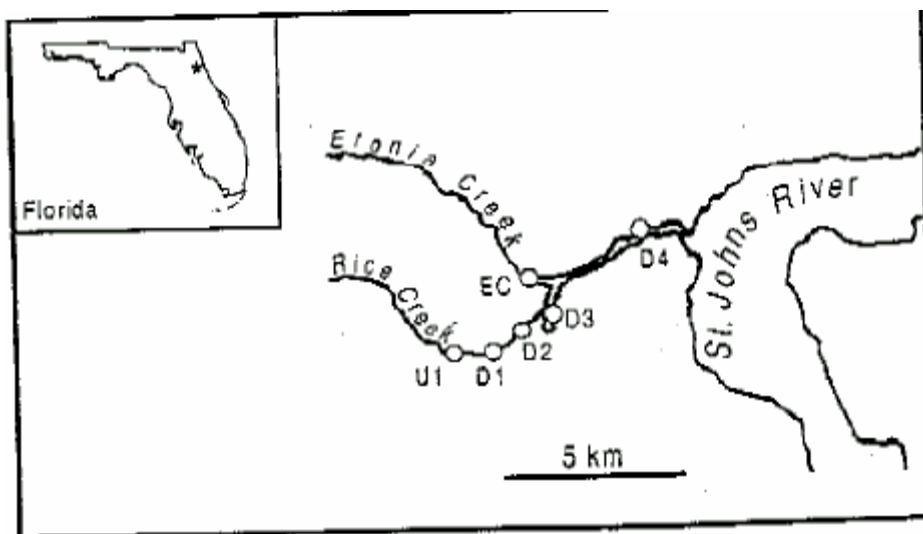
## Morphological Masculinization in Poeciliid Females from a Paper Mill Effluent Receiving Tributary of the St. Johns River, Florida, USA

S. A. Bortone,<sup>1</sup> R. P. Cody<sup>2</sup>

<sup>1</sup> Florida Center for Environmental Studies, FL, USA

<sup>2</sup> Florida Marine Research Institute, Division of Marine Resources, 100 Eighth Avenue, S.E., St. Petersburg, FL 33701-5095, USA

Received: 15 December 1998/Accepted: 4 June 1999



**Figure 1.** Location of collection sites on Rice Creek and Etonia Creek. The effluent discharge site is situated between sites U1 and D1 on Rice Creek. Within the map of Florida, the location of Rice Creek and Etonia Creek sites is denoted by a star.

Gonopodial development was evident in females of all three poeciliid species (eastern mosquitofish, least killifish, and sailfin molly) present in Rice Creek. ...

Morphological evidence of masculinization was found in mosquitofish females from sites U1, D1, D2, and D3 on Rice Creek (Fig. 3).



**Figure 2.** Anal-fin morphology of normal and masculinized mosquitofish from Rice Creek. A. Anal-fin morphology of a male. B. Anal-fin structure of a normal (unmasculinized) female. C. Anal-fin structure of a masculinized female. Numbers 3-5 refer to the third-fifth anal fin rays. Note the presence of dorsal projections on the fifth anal fin ray of the male. Increased segmentation is evident in the third anal-fin ray of the masculinized female.

and other hormonal effects were documented by *Sepúlveda et. al* in Largemouth Bass (a species consumed by humans) :

### **Assessment of Reproductive Effects in Largemouth Bass (*Micropterus salmoides*) Exposed to Bleached/Unbleached Kraft Mill Effluents**

M. S. Sepúlveda,<sup>1,2</sup> D. S. Ruessler,<sup>2</sup> N. D. Denslow,<sup>3</sup> S. E. Holm,<sup>4</sup> T. R. Schoeb,<sup>5\*</sup> T. S. Gross<sup>1,2</sup>

<sup>1</sup> Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32610, USA

<sup>2</sup> USGS-BRD Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653, USA

<sup>3</sup> Department of Biochemistry and Molecular Biology, College of Medicine, and Interdisciplinary Center for Biotechnology Research (ICBR), University of Florida, Gainesville, Florida 32610, USA

<sup>4</sup> Georgia-Pacific Corporation, 133 Peachtree Street NE, Atlanta, Georgia 03030, USA

<sup>5</sup> Department of Pathobiology, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32610, USA

In conclusion, this work constitutes one of the first thorough characterization of the physiological effects associated with exposure to paper mill effluents being discharged by the Palatka Operation. Largemouth bass exposed to this B/UKME respond with changes at the biochemical level (decline in sex steroids in both sexes and of VTG in females) that are usually translated into tissue/organ-level responses (declines in GSI in both sexes and in ovarian development in females).

Other aquatic organism and human health effects from endocrine disrupters warrant a public health advisory not to consume fish from Rice Creek. EPA has also published guidance for pregnant women and young children (who frequently catch and eat bluegills, which tested high for dioxin)

For sensitive populations, such as pregnant women, nursing mothers, and young children, some states have issued either "no consumption" advisories or "restricted consumption" advisories for dioxins/furans. Additional information on calculating specific limits for these sensitive populations is available in EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories*, Volume 2, Section 3.

We believe that such effects should be examined in Etonia Creek due to tidal reversal and periods of extended flow which could transport these materials upstream into the Etonia. In addition the movement of fish between the St Johns River and among its interconnected tributaries is further cause for concern.

Due the historic (1993-present) levels of dioxin found in fish tissue in these tributaries and the possible movement of fish between tributaries and the mouth of the St Johns River we believe that fish in the St Johns River may also contain high levels of toxic contaminants including dioxin and endocrine disrupters (Cody and Bortone, 1999).

We request your help and assistance in the following actions that we believe are warranted due the historic (1993-present) levels of dioxin found in fish tissue as set forth above:

- 1) Please review this data and **place a public health advisory warning the public not to consume fish and blue crab caught in Rice Creek, Deep Creek and their confluence with the St Johns River until testing reveals fish and blue crab are safe for consumption.**
- 2) Please initiate **a fish tissue sampling program for the St Johns River** which we believe is warranted due the historic (1993-present) levels of dioxin found in fish tissue in these tributaries and the possible movement of fish between tributaries and the mouth of the St Johns River.
- 3) Please ensure that **dioxin-sludges** are prevented from entering the riverine environment and any historic spills or deposition is removed and **properly disposed.**
- 4) Please ensure actions are taken to **assess and remediate dioxin-sediments** that may be present in Rice Creek, Deep Creek and St Johns River sediments so that it is not available for further bioaccumulation.

Thank you for your efforts on behalf of the public in this matter of great concern.

Sincerely yours,

Manley Fuller, President, FWF  
&  
Ralf Brookes Attorney  
1217 E Cape Coral Parkway #107  
Cape Coral, Florida 33904  
Fax (208) 441-5423  
ralf@ralfbrookesattorney.com