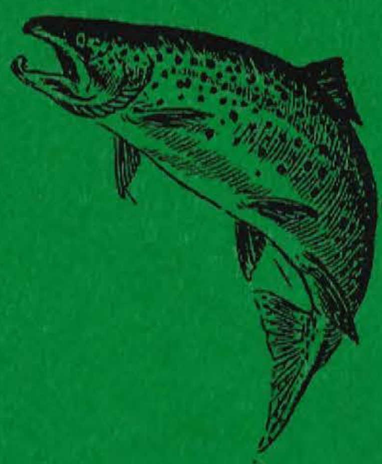
DEPLW2000-10

DIOXIN MONITORING PROGRAM

STATE OF MAINE

1999



BY

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

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Acknowledgements

Successful collection of the samples was accomplished directly by DEP staff or the Penobscot Indian Nation assisted at some locations by Acheron Inc. on behalf of participating facilities. The Department of Marine Resources and Department of Inland Fisheries and Wildlife also assisted in collecting samples and providing nets.

EXECUTIVE SUMMARY

The goal of Maine's Dioxin Monitoring Program, established in 1988, is "to determine the nature of dioxin contamination in the waters and fisheries of the State". Charged with administration of the program, the Department of Environmental Protection (DEP) is required to sample fish once a year below no more than 12 bleached pulp mills, municipal wastewater treatment plants, or other known or likely sources of dioxin. DEP is required to incorporate the results of all studies into a report to the Joint Standing Committee on Natural Resources by March 31 of the following year. Costs of sample collection and analysis are assessed to the selected facilities. DEP is advised by the Surface Water Ambient Toxic (SWAT) Monitoring Program Technical Advisory Group in implementation of the program.

The primary objective of the Dioxin Monitoring Program is to continue monitoring dioxin in fish for assessment of ecological and human health. A second objective is to monitor historical stations to measure trends, progress toward reduction in environmental concentrations, and effectiveness and need for further controls. A third objective is to determine if bleached kraft pulp mills are discharging dioxin into Maine rivers, which is prohibited by the new dioxin legislation of 1997 [38 MRSA section 420(2)(I)] as of December 31, 2002. The final test is that fish downstream have no more dioxin than fish upstream of a mill's discharge, the above/below fish test.

In 1999, the Dioxin Monitoring Program was modified significantly from that of 1997 and 1998 to continue development of a suitable 'above/below' fish test. Changes included use of 1. more game fish 2. filets instead of whole body for suckers, 3. smaller fish, 4. Fish livers, and 5. semi-permeable membrane devices (SPMDs).

Fish Consumption Advisories

Based on data through 1999, the Maine Bureau of Health revised the fish consumption advisories in March 2000 (Appendix 1). There is a 'General Consumption Advisory for All Inland Surface Waters due to Mercury Contamination'. In addition, among others, there are more restrictive Specific Freshwater Fish Consumption Advisories for the Androscoggin River, Kennebec River below Fairfield, and Salmon Falls River below Berwick due to PCBs and dioxins. Advisories for the Penobscot River, St Croix River, and Sebasticook River (including East and West branches) also due to PCBs and/or dioxins, are not listed separately since they are equal to or less restrictive than the statewide mercury advisory. An advisory on lobster tomalley was continued from 1994 along the entire coast of Maine due to PCBs and dioxins.

Findings of the 1999 Program

1. In 1999, concentrations of dioxin toxic equivalents (DTEh) in game fish from four of six stations on the Androscoggin River exceeded the Bureau of Health's Fish Tissue Action Level for cancer(FTALc=1.5 ppt).

2. The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in higher levels of total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level at other locations as well. Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition.

3. Concentrations of 2378-TCDD (TCDD) and DTEh in all fish samples collected below bleached kraft mill discharges to the Androscoggin River, Kennebec River, and Penobscot River, were significantly greater than those at reference stations unimpacted by point sources. There was no difference between concentrations of TCDD and DTEh in bass and suckers upstream and downstream of the Georgia Pacific mill on the St Croix River.

4. As result of efforts of the mills to reduce discharge of dioxin, since 1990 there have been trends of significantly decreasing concentrations of TCDD and/or DTEh in game fish from Livermore Falls and Lewiston-Auburn on the Androscoggin River and from the Penobscot River and in suckers at most locations on all rivers. There were no other significant trends for this period although concentrations in game fish from Rumford and Lisbon Falls on the Androscoggin and Fairfield on the Kennebec have been slightly lower since 1994-5 than prior to that time.

5. Concentrations of TCDD and DTEh in smallmouth bass, white perch and white suckers from Androscoggin Lake were lower than in 1998 but are significantly higher than in any other lake in the state. Concentrations of TCDD are generally similar to concentrations in fish in the Androscoggin River, but concentrations of DTEh are significantly lower than in the river.

6. Enhancement of the Dioxin Monitoring Program in 1999 for the above/below fish test showed promising results, but more development is needed before a suitable test can be identified. Studies will continue in 2000.

INTRODUCTION

Maine's Dioxin Monitoring Program (DMP), established in 1988, has been amended and reauthorized through 2002 by the Maine legislature. The goal of the program is "to determine the nature of dioxin contamination in the waters and fisheries of the State". Charged with administration of the program, the Department of Environmental Protection (DEP) is required to sample fish once a year below no more than 12 bleached pulp mills, municipal wastewater treatment plants, or other known or likely sources of dioxin. The Department is also required to sample sludge once a quarter from the same facilities.

The primary objective of the DMP is to continue monitoring dioxin in fish for assessment of ecological health and of human health. The data are used by the Maine Bureau of Health (BOH) to determine the need for any Fish Consumption Advisories to protect human consumers of fish from certain Maine rivers. The data are also used by DEP and other state and federal agencies in determining impacts of discharge of dioxin on wildlife species.

A second objective is to continue monitoring at some historical stations to measure trends. Trends are followed to measure progress toward reduction in environmental concentrations and effectiveness and need for further controls.

A third objective, to identify sources and magnitude of dioxin discharges, received new emphasis in 1997 when the Maine legislature enacted LD 1633 "An Act to Make Fish in Maine Rivers Safe to Eat and Reduce Color Pollution". The key requirement is that 'a (bleach kraft pulp) mill may not discharge dioxin into its receiving waters' [38 MRSA section 420(2)(I)]. Interim tests that concentrations of TCDD in effluent from the bleach plant must be below EPA's method 1613 nominal detection limit (10 ppq) by July 31, 1998 and TCDF must be below the same detection limit by December 31, 1999 have been achieved. As the final test, by December 31, 2002 fish below a bleached kraft pulp mill have no more dioxin than fish above the mill, the so-called "above/below (A/B) fish test". Although the DMP has successfully detected differences above and below discharges in past years, as the amount of dioxin discharged is reduced, the DMP needs to be modified to allow an enhanced ability to detect smaller differences with with some known statistical confidence.

The monitoring program is coordinated with other ongoing programs conducted by the Department, US Environmental Protection Agency (EPA), or dischargers of wastewater. The proposed annual monitoring plan must be submitted to the Surface Water Ambient Toxics (SWAT) monitoring program

Technical Advisory Group (TAG), created under 38 MRSA section 420-B, for review and advice. The selected facilities must be notified of their inclusion in the proposed program at least 30 days prior to submittal to the TAG. The Department must incorporate the results of all studies into a report due the Natural Resources Committee by March 31 of the following year. A draft of the report is reviewed by the TAG before completion of the final report. Costs of sample collection and analysis are assessed as a fee to the selected facilities. Payment of the fees is a condition of the waste discharge license granted by the state for continued operation and discharge of wastewater to waters of the State. However, if the selected facility is a publicly owned treatment works (POTW), then the fees may be assessed to the known or likely industrial generator of dioxin and payment will not be a condition of the waste discharge license of the POTW.

Due to continuing controversy over the effects of dioxin on human and ecological health, the US Environmental Protection Agency (EPA) announced that in 1991 it would begin a thorough scientific reassessment of dioxin. EPA proposed that the process would be open to the public and consequently held several meetings to share information and receive comments. Draft reports on a wide range of issues were available in 1992, 1993, and 1994. Initial results indicate that dioxin may exhibit reproductive and developmental effects, immuno-toxic effects, and neuro-toxic effects at concentrations nearly as low or lower than commonly thought to promote cancer (Frakes, 1992; Graham, 1992; Hughes, 1992; Silbergeld, 1992). In 1995 EPA's Scientific Advisory Board published its review of the draft reports recommending some revisions. New drafts scheduled for 1996 have not yet been released.

DEP has determined, from fish collected since 1984, that concentrations of dioxins in fish from locations unaffected by certain industrial discharges are normally less than 0.15 ppt, while concentrations in fish below those sources of dioxin are always greater than that. Consequently, as one method of determining known or likely sources of dioxin, a Fish Monitoring Threshold (FMT=0.15 ppt) is used by DEP as a monitoring threshold to determine stations that will be retained in the annual program.

For informing the public about potential risk from consuming fish contaminated with dioxin and dioxin-like compounds, the BOH publishes fish consumption advisories. These advisories are based on a comparison of a Fish Tissue Action Level (FTAL) for dioxin toxic equivalent concentrations (DTE) with the 95^{th} percentile upper confidence limit on the mean DTE in fish tissue. Should a tissue concentration exceed an FTAL, a fish consumption rate (e.g., #meals per month) which is unlikely to result in deleterious effects is determined. Two

FTALs have been derived for evaluating potential deleterious effects from exposure to dioxins and dioxin-like compounds. Both FTALs were developed using standard USEPA risk assessment methods (EPA 1997). For potential carcinogenic effects associated with long-term exposure, BOH has developed a FTALc of 1.5 ppt, while for reproductive and developmental effects potentially arising from shorter exposure durations, BOH has developed a FTALr of 1.8 ppt (Frakes, 1990). The FTALr for reproductive and developmental effects is relevant to women of child bearing age, pregnant women, and lactating women. The FTALs are compared to the concentration of DTE in edible portions of the fish, skinless filet data. Where whole fish data are reported, the DTE concentration is divided by a factor of 3.5, determined from previous studies with white suckers, to estimate skinless filet concentration. In this report all comparisons with DTE in fish are made with FTALc, since that is the lower of the two and protective of both effects.

PROGRAM DESIGN

The primary emphasis of the 1999 program was to collect fish samples from the appropriate stations and species from each river such that accurate, complete, and current data are available to assess impact to wildlife and human consumers. The program design included sampling at least one station below each major source to document trends and sampling of historic stations that showed dioxin above the FMT, whether or not any fish consumption advisories were issued. Finally the program was modified to evaluate the ability to detect minimum significant differences of the appropriate magnitude for the above/below fish test.

The 1999 program was initially drafted by DEP according to the objectives listed above and sent to participating facilities for comment in early April and to the SWAT TAG later in the month. The workplan was discussed finalized at the SWAT TAG meeting on June 8, 1999.

In 1999 all stations were monitored for ecological and human health assessment and trends (Table 1). At least 5 game fish (bass or other important species) were collected from each station and analyzed individually as skinless fillets.

In order for DEP to legitimately determine whether or not there is a discharge of dioxin from a mill, for the Above/Below Fish Test the minimum significant difference (MSD) that can be determined with acceptable statistical probability needs to be relatively small and relevant to background concentrations. Ideally the MSD would be established a priori at some absolute value or fraction of the background concentration. During debate in the legislature, 10 % of the background concentration was proposed as a goal by DEP. This would work for TCDF and DTE, where measurable quantities are determined, but not for TCDD, where background concentrations are generally below detection. For TCDD, the detection level (0.05-0.1 ppt wet weight) itself was proposed to serve as the goal, an MSD of 100%. Although initially thought to be achievable, results from the 1997-1998 program with whole suckers showed MSDs to be much higher.

Therefore, in 1999 the DMP was modified in a number of ways. At one pair of Above/Below stations, the Kennebec River in Norridgewock and Fairfield, changes included 1. analysis of sucker filets instead of whole body, 2. analysis of small suckers in addition to the larger fish normally caught each year, 3. focus on more bass, 4. analysis of fish livers. And 5. at one other pair of stations, above and below Lincoln on the Penobscot River, semi-permeable membrane devices (SPMDs) were installed in the river (described in a later section). Also at stations above and below Rumford, Lincoln, and Veazie, additional bass were captured. Ten fish of each species or size class were captured at each of these stations and analyzed individually, except Norridgewock (6 small suckers), Fairfield (15 small suckers), and Costigan (6 bass). And at all Above/Below stations, except the two Kennebec River stations already discussed, ten white suckers were captured and combined into 2 composites of 5 fish each. All fish were analyzed for all 2378-substituted dioxins and furans. Station locations along with specified fish species are shown in Table 1. Station location maps show exact locations of collections (Appendix 6).

At stations affected by a single discharger, sampling will continue yearly until there are at least two consecutive cycles for each species where dioxin is below the FMT and is not increasing. At stations affected by more than one discharger where fish concentrations are not below the FMT, each discharger will continue to be included in the annual sampling program until enough evidence has been gathered to demonstrate that dioxin is no longer present in the discharge in significant quantities. Such evidence must include, but not be limited to (1) at least 8 consecutive sludge analyses equally distributed over all seasons for a minimum of two years that show no 2378-TCDD (TCDD) detected at a suitably low detection level, (2) full congener analysis of sludge for all 2378 substituted dioxins and furans, (3) other pertinent information such as process changes, changes in hook-ups that show reductions in the level of dioxins and furans being discharged to insignificant levels.

Table 1. 1999 Dioxin Monitoring Program- Stations, facilities, and species

STATION	FACILITY	SPECIES
Androscoggin R		
Gilead	Mead	bass, sucker
Rumford	Mead	bass, sucker
Riley	IP	bass, sucker
Liv Fls(Otis imp)	IP	bass, sucker
Turner (GIP)	Mead & IP	bass
Lisbon Falls	Mead & IP	bass
Androscoggin Lake	Mead & IP	bass, white perch
Kennebec R		
Norridgewock	SAPPI Somerset	bass, sucker
Fairfield	SAPPI Somerset	bass, sucker
Augusta	KSTD	bass
Penobscot R		
Woodville	Lincoln P&P	bass, sucker
S Lincoln	Lincoln P&P	bass, sucker
Milford	Fort James Co	bass, sucker
Veazie	Fort James Co	bass, sucker
Salmon Falls R		
S Berwick	Berwick Sewer Distr	bass
Sebasticook R		
W Br Palmyra	Town of Hartland	bass
St. Croix		
Woodland (above)	Georgia Pacific	bass,suckers
Woodland (below)	Georgia Pacific	bass,suckers

The preferred sampling time is late in the summer when fish are likely to be more contaminated after being exposed to higher concentrations of dioxin during low river flows and after significant growth has occurred. At some locations there has been a problem collecting enough fish later in the summer. Here sampling began in mid-May to try to insure that a suitable sample was collected. These stations were also visited after the beginning of July. If fish were captured during the later period, those samples were submitted for analyses. Otherwise, the fish collected during the early period were used. Sampling at other stations began in July (Appendix 8).

SAMPLING PROCEDURES

Fish were collected by DEP with assistance of representatives of the participating facilities, state agencies and the Penobscot Indian Nation. Upon capture, fish were immediately killed, weighed and measured, rinsed in river water, wrapped in aluminum foil with the shiny side out, labeled, and placed in a cooler on ice for transport to the DEP lab. Chain of custody forms were used to record all field information and document all transfers. In the lab, all fish samples were frozen and later transported whole to the Water Research Institute at the University of Maine for analysis. All other procedures generally followed EPA's Sampling Guidance Manual for the National Dioxin Study (July 1984). A laboratory log was kept for an inventory of samples in the lab at any time and final disposition.

Most of the facilities in the program already sample sludge or effluent as part of their Maine Sludge Spreading Permit or Waste Discharge License or Federal NPDES permit. Data from those programs provide adequate information about sources of dioxin. Therefore, no additional sludge samples were collected as part of this program. Effluent data are also used when available to indicate sources and any trends.

CALCULATIONS

In this report, DTE are shown as a range with non-detects calculated at zero (DTEo) and at the detection limit (DTEd) as a mean for all samples of a given species at each station (Table 2). For comparison with the FMT and FTALc, and comparison between years and stations, DTEh were used as calculated using non-detects at 1/2 the detection limit. The upper 95th percentile confidence limit (UCL) was used for these comparisons, consistent with the policy of the BOH. In some cases (reference stations) DTEo were also discussed since those were below the FMT while DTEh exceeded the FMT, which shows the importance of low detection limits and the treatment of non-detects. For the other stations both DTEo and DTEh were above the FMT, and DTEo were not discussed.

A related issue is that of EMPCs, estimated maximum possible concentrations. Some compounds, particularly hydroxydiphenyl ethers (DPEs) are coextracted with furans. Various steps have successfully been taken to minimize these interferences, but some DPE remains. In this report, EMPCs were treated as non-detects.

Statistical analyses of differences in TCDD and DTEh between stations were performed using the non-parametric Mann-Whitney test. Trends were determined using Kendall's tau, a rank-order correlation statistic, for the period 1990-1999. In this report only differences that are statistically significant at $p=0.05$ will be reported as significant.

RESULTS AND DISCUSSION

Not all species and numbers of fish targeted were able to be collected (Appendix 2). No eels were captured from the Penobscot River below Bangor as initially planned. Due to restraints from the budget cap on the program ($250,000), the need for extensive studies dealing with the Above/Below fish test, and cessation of operation of the pulp mill at Sappi Westbrook, which placed the river in a state of transition for 1999, no samples were analyzed from the Presumpscot River. Mean concentrations of TCDD and DTEh for each species and station are compared to historical data in Table 2. A description of fish collected and results for each sample location with respect to the objectives of the program is discussed below.

Androscoggin River

Gilead Seven rainbow trout and five brown trout were collected near Peabody Island in Gilead, while ten bass and the ten suckers were caught further downsteam at Rumford Point (Appendix 7). As both stations are downstream of the American Pulp and Paper Co's bleached kraft mill in Berlin, New Hampshire, they are therefore not true reference stations unimpacted by direct discharge of dioxin. Both stations are upstream of all Maine mills on the river and are considered the same station relative to point souces. DTEh in rainbow trout and bass exceeded the FTALc, but DTEh in brown trout and suckers were 82% and 74% of the FTALc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Every year measured, TCDD and DTEh in fish have been significantly higher at this station than in fish from reference stations in Maine.

Rumford Ten smallmouth bass and ten white suckers were collected from the river reach beginning just below the discharge from Mead's bleached kraft pulp and paper mill in Rumford and extending downstream about 4 miles to Dixfield (Appendix 7). Concentrations of DTEh in the bass exceeded the FTALc, but DTEh in suckers were 69% of the FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in higher levels of total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in the suckers as well (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. TCDD and DTEh concentrations were significantly greater than

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

WATER/STATION	SPECIES	TIS	NDS/NBS 1984-86 TCDD	MAINE 1988-1990 TCDD	MAINE 1988-1990 DTE	1991 TCDD	1991 DTE	1992 TCDD	1992 DTE	1993 TCDD	1993 DTE	1994 TCDD	1994 DTE
ANDROSCOGGIN LAKE													
Wayne	bn trout	f											
	bass	f											
	sucker	w											
ANDROSCOGGIN R													
Gilead	rb trout												
	bn trout												
	bass												
	sucker	w	1.8f/6.5w										
Rumford	bass	f				1.4	2.3-2.8	0.6	1.0-1.2	2.9	4.5-5.4	3.8	5.7-6.2
	sucker	w						3.0	7.4-8.0	5.8	13.6-14.6	4.0	11.4-11.9
Riley	bass												
	sucker	w	<2.1f/13w										
Jay	bass	f		17.6	24.0-29.1			1.2	1.9-2.3	1.4	1.8-2.2	1.6	2.2-2.8
	sucker	w						5.4	12.9-13.9	4.5	10.9-11.8	4.7	11.5-12.3
Livermore Fal	bass	f				2.4	3.1-3.3	1.1	1.4-1.5	1.4	1.6-1.8	1.4	1.6-2.3
	sucker	w						3.8	7.4-8.0	3.6	6.8-7.3	2.2	4.8-5.3
N Turner	sucker	w	6.2f/30w										
Auburn-GIP	bass	f	3.7f/24w					1.7	2.6-2.8	1.2	1.8-1.9	1.3	2.0-2.7
	lm bass	f						1.1	1.6-1.8				
	sucker	w	8.3f/29w					5.6	14.3-15.4	3.7	9.0-9.8	1.6	4.4-5.4
	bullhead	w	7.8f/29.6w							2.1	3.0-3.3	1.3	2.3-2.8
Lisbon Falls	bn trout	f		5.3	6.5-6.9								
	bass	f		4.5	5.5-5.8			0.7	1.0	1.2	1.7-1.8	0.6	0.8-1.7
	sucker	w	5.1f/12w					3.4	8.1-8.7	2.7	6.1-6.6	2.4	5.8-6.2
Brunswick	sucker	w	19.0										
	carp	f	11.0										
BEARCE LAKE													
Baring	pickerel	f	<0.1										
BRAVE BOAT HARBOR													
Kittery	lobster	m										<0.1	<0.1-1.2
	lobster	t										1.3	9.7-11.5
BROOKLYN	lobster	m											
	lobster	t											
COREA	lobster	t											
JONES CREEK													
Scarborough	clam	m						<0.1	0.02-0.3				

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

WATER/STATION	SPECIES	TIS	NDS/NBS 1984-86 TCDD	MAINE 1988- 1990 TCDD	DTE	19 91 TCDD	DTE	19 92 TCDD	DTE	19 93 TCDD	DTE	19 94 TCDD	DTE
KENNEBEC R													
Madison	bn trout	f											
	bass	f						<0.1	0.02-0.1				
	sucker	w						0.1	0.3				
Norridgewock	bass												
	sucker												
Fairfield	trout	f		6.2	6.9-8.0			1.4	1.6-1.8	1.4	1.6-1.9	2.2	2.5-3.8
	bass	f				1.4	1.6-1.7	0.6	0.6-0.7	1.5	1.7-2.0	0.9	1.1-1.8
	sucker	w	6.4	10.3	16.8-18.1			2.0	3.1-3.3	1.6	2.2-2.6	2.2	2.9-3.8
Sidney	bass	f	20.3w			1.0	1.4-2.4	0.4	0.6-1.0	0.6	0.8-1.4	0.3	0.4-1.3
	sucker	w	1.2f/11.4w					2.7	4.4-4.8	1.5	2.5-2.7	2.3	3.0-4.0
Augusta	bn trout	f		2.2	2.9-4.9			1.9	2.5-4.3				
	bass	f						0.4	0.6-1.0	0.6	0.9-1.5	1.0	1.3-3.7
	sucker	w		5.0	7.3-8.4			1.5	2.6-2.8	1.9	3.3-3.6	2.3	4.0-5.8
Hallowell	smelt	c						0.2	0.5-0.8				
Richmond	eel	f								0.6	0.8-1.4		
Phippsburg	clam	m						0.3	0.6-0.9				
	lobster	m								0.2	0.3-1.2	<0.1	<0.1-1.6
	lobster	t								7.9	27.5-27.6	6.5	23.4-26.6
MESSALONSKEE LAKE													
Belgrade	bass					<0.09	0.04-0.3						
NARRAGUAGUS R													
Cherryfield	fallfish	w	<1.0										
NORTH POND													
Chesterfield	sucker	w	0.4										
	pickerel	f	<0.1										
PENOBSCOT R													
E Br Grindsto	bass	f		<0.1	0.09-0.2								
	sucker	w		<0.4	0.02-0.6								
E Millinocket	bass	f		<0.2	0.4-0.8								
	sucker	w		0.7	3.6-4.2								
Woodville	bass												
	sucker												
N Lincoln	bass	f		<0.4	0.2-0.8								
	sucker	w		<0.5-20	2.0-41.6								
S Lincoln	bass	f	5.0	1.7	2.3-2.7	0.9	1.2-1.3	0.7	1.0-1.2	1.2	1.6-1.8	0.4	0.4-1.7
	sucker	w		37.0	66.4-67.2			3.3	6.8	1.7	3.5-3.6	2.2	5.8-6.1
Passadumkeag	bass	f		1.8	2.9								
	sucker	w		2.8	7.6-7.7								
Milford	bass	f		0.9	1.4-1.7			0.3	0.4-0.5				
	sucker	w		9.7	19.9-20.1			2.2	4.6				
Veazie	bass	f	4.6w	1.9	2.4-2.6	1.2	1.5-1.7	0.4	0.6	0.6	0.8-1.0	0.2	0.2-1.3
	sucker	w	2.6f/7.6w	5.9	9.8-9.9	2.5	4.9-5.0	2.2	4.8-4.9	1.1	2.7-3.0	0.6	1.6-2.8
Bangor	eel	f								1.0	1.1-1.2		
Bucksport	clam	m						0.1	0.8-0.9				
Stockton Spri	lobster	m								0.1	0.3-1.1	<0.1	0.1-1.0
	lobster	t								4.0	28.0	2.3	18.1-27.9

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

			NDS/NBS	MAINE									
			1984-86	1988- 1990		19 91		19 92		19 93		19 94	
WATER/STATION	SPECIES	TIS	TCDD	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE
OWLS HEAD	mussel	m	<0.8										
PISCATAQUIS R													
Sangerville	bass	f				<0.2	0.03-0.3						
	bn trout	f				<0.4	0.03-0.4						
	sucker	w				0.26	0.6-0.7						
Howland	bass	f		<0.2	0.02-0.6								
PRESUMPSCOT R													
Windham	bass	f								<0.1	<0.1-0.3	<0.1	<0.1-1.1
	sucker	w								0.3	0.7-0.8	0.2	1.4-2.4
Westbrook	bass	f		1.8	2.4-4.5	0.2	0.2-0.4	0.1	0.2-0.4	<0.2	0.1-0.5	0.2	0.3-1.2
	pickerel	f		<2.6	0.06-5.9								
	w perch	f		1.2	2.5-3.1	0.4	0.9-1.0						
	sucker	w	5.2	5.1	8.2-9.6	0.6	1.6-1.7	0.3	0.8-0.9	1.1	1.8-2.3	0.9	2.1-3.7
Falmouth	clam	m						<0.1	0.2-0.4				
Portland	lobster	m								<0.1	0.1-0.8	<0.1	0.2-1.0
	lobster	t								3.4	18.5-18.7	2.5	17.2-21.3
ST CROIX R													
Woodland	bass	f											
	sucker												
Baring	bass			0.3	0.5-1.0	<0.1	0.04-0.3						
	sucker	w	<0.7	0.6	1.0-1.1								
Robbinston	lobster	t											
ST JOHN R													
Frenchville	sucker	w										0.1	0.2-1.0
Madawaska	y perch	f		<0.5	0.08-0.8								
	bk trout	f										<0.3	<0.1-2.3
	sucker	w										<0.1	0.2-0.8
SACO R													
Dayton	sucker	w	<0.3										
SACO BAY													
Scarborough	lobster	m								<0.1	0.1-0.8	<0.1	<0.1-0.8
	lobster	t								2.0	11.3-14.6	1.3	9.7-12.0
SALMON FALLS R													
Acton	lm bass												
	sucker												
S Berwick	bass	f		0.4	0.5-0.6					0.2	0.2-0.9	0.5	0.7-3.3
	lm bass												
	pickerel	f		0.2	0.3								
	sucker	w		1.5	2.1-2.2			2.4	3.4-3.6	1.9	3.6-3.8	2.1	4.7-6.1

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

WATER/STATION	SPECIES	TIS	NDS/NBS 1984-86 TCDD	MAINE 1988- 1990 TCDD	DTE	19 91 TCDD	DTE	19 92 TCDD	DTE	19 93 TCDD	DTE	19 94 TCDD	DTE
SANDY P													
	bass	f	<1.0										
SEBAGO L													
Naples	bass	w	<0.6										
SEBASTICOOK R													
E Br Corinna	lm bass												
	bass												
	sucker												
Newport	bass	f						0.1	0.3-0.4				
	lm bass	f	<0.2					<0.2	0.2-0.4				
	w perch	f		1.0	1.6-2.1								
W Br Harmony	bass												
	sucker												
W Br Palmyra	bass	f		1.2	1.4-1.8			0.4	0.5-0.6	0.9	1.2-1.6	0.4	0.4-1.3
	pickerel	f	<0.1					0.2	0.2				
	sucker	w	1.6	3.3	4.3-4.6			1.1	1.4-1.6	1.0	2.6-2.7	1.2	4.0-4.3
WEBBER POND													
Vassalboro	bass	f				<0.08	0.04-0.4						

f=fillet
m=meat
t=tomalley
w=whole

DTE= dioxin toxic equivalents using WHO 98 toxic equivalency factors (TEF).
Range shown at nd=0 and nd=mdl, ie DTEo-DTEd

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

			1995		1996		1997		1998		1999	
WATER/STATION	SPECIES	TIS	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE
ANDROSCOGGIN LAKE												
Wayne	bn trout	f			0.7	1.1-2.3						
	bass	f			0.6	1.2-2.2			0.2	0.4-1.0	0.1	0.2-0.8
									0.5	0.6-1.2	0.2	0.3-0.9
	sucker	w			0.4	1.4-2.5			0.4	0.9-1.1		
ANDROSCOGGIN R												
Gilead	rb trout		1.2	2.4-2.9	0.9	2.0-2.6	0.5	1.6-2.1	0.4	1.5-2.0	0.7	1.7-2.3
	bn trout				0.4	1.0-1.5					0.4	1.0-1.5
	bass		0.9	3.8-4.1							0.4	1.4-1.5
	sucker	w	1.7	6.1-6.7	0.7	4.4-5.3	0.5	3.4-3.8	0.9	3.1-3.5	0.8	2.9-3.3
Rumford	bass	f	2.2	3.5-4.1			0.5	1.2-1.8	0.4	1.1-1.5	0.6	1.5-1.9
	sucker	w			0.8	4.1-5.2	0.5	3.6-4.9	0.4	3.0-3.4	0.4	2.8-3.2
Riley	bass						0.3	1.1-2.2	0.2	0.8-1.0	<0.1	0.6-0.9
	sucker	w					0.5	3.8-4.8	0.3	2.5-2.8	0.3	2.6-2.8
Jay	bass	f			0.5	1.3-1.4						
	sucker	w	2.3	6.9-7.6								
Livermore Fal	bass	f	0.5	0.8-1.3			0.3	1.2-1.4	0.2	1.1-1.2	0.2	0.9-1.2
	sucker	w			0.6	3.4-3.9	0.5	2.8-2.9	0.5	2.8-2.9	0.4	2.4
N Turner	sucker	w										
Auburn-GIP	bass	f			0.6	2.1-2.5	0.4	2.0-2.2	0.4	1.6-1.8	0.4	1.6-1.8
	lm bass	f										
	sucker	w	1.4	3.8-5.0								
	bullhead	w										
Lisbon Falls	bn trout	f										
	bass	f	0.9	1.4-2.4			0.6	1.3-1.8	0.5	1.1-1.5	0.7	1.7-2.1
	sucker	w			0.7	1.6-2.8						
Brunswick	sucker	w										
	carp	f										
BEARCE LAKE												
Baring	pickerel	f										
BRAVE BOAT HARBOR												
Kittery	lobster	m										
	lobster	t	1.6	6.7-9.9	1.7	13.8-15.5						
BROOKLYN	lobster	m	0.8	4.9-8.2								
	lobster	t										
COREA	lobster	t			0.6	6.6-7.3						
JONES CREEK												
Scarborough	clam	m										

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

WATER/STATION	SPECIES	TIS	1995 TCDD	1995 DTE	1996 TCDD	1996 DTE	1997 TCDD	1997 DTE	1998 TCDD	1998 DTE	1999 TCDD	1999 DTE
KENNEBEC R												
Madison	bn trout	f	<0.1	0.1-0.7								
	bass	f			<0.1	0.1-0.8	<0.2	0.03-1.6				
	sucker	w	0.1	0.3-1.0	<0.1	0.3-1.0	<0.1	0.2-0.8				
Norridgewock	bass								<0.1	0.03-0.6	<0.1	0.03-0.7
	sucker								<0.1	0.2-0.7	<0.1	0.03-0.7
Fairfield	trout	f	1.6	1.7-2.5			1.2	1.3-1.9				
	bass	f					0.6	0.6-1.2	0.3	0.4-1.0	0.4	0.4-1.0
	sucker	w			1.6	2.1-2.7	1.2	1.7-2.1	0.9	1.4-1.8	0.3	0.4-1.0
Sidney	bass	f			0.2	0.4-1.0	0.2	0.3-0.9				
	sucker	w	1.2	1.7-2.5								
Augusta	bn trout	f	1.0	1.3-3.5			0.6	1.0-1.3				
	bass	f					0.5	0.8-1.6	0.3	0.6-0.9	0.3	0.6-0.9
	sucker	w			2.2	2.6-3.3						
Hallowell	smelt	c										
Richmond	eel	f										
Phippsburg	clam	m										
	lobster	m										
	lobster	t	4.6	13.5-17.1	3.6	16.7-18.6						
MESSALONSKEE LAKE												
Belgrade	bass											
NARRAGUAGUS R												
Cherryfield	fallfish	w										
NORTH POND												
Chesterfield	sucker	w										
	pickerel	f										
PENOBSCOT R												
E Br Grindsto	bass	f	<0.1	0.1-0.7	<0.1	0.1-0.8	<0.1	0.04-0.7	<0.1	0.04-0.7		
	sucker	w	<0.1	0.1-0.6	<0.1	0.1-0.8	<0.1	0.07-0.7	<0.1	0.07-0.7		
E Millinocket	bass	f					<0.1	0.04-0.7	<0.1	0.04-0.7		
	sucker	w					<0.1	0.09-0.7	<0.1	0.09-0.7		
Woodville	bass						<0.1	0.07-0.7	<0.1	0.06-0.7	<0.1	0.08-0.7
	sucker						<0.1	0.09-0.7	<0.1	0.08-0.7	<0.1	0.1-0.7
N Lincoln	bass	f										
	sucker	w										
S Lincoln	bass	f	0.5	0.7-1.3	0.3	0.5-1.2	0.2	0.4-1.0	0.2	0.4-0.9	0.4	0.6-1.0
	sucker	w			1.6	2.2-3.2	1.2	1.6-2.2	1.0	1.4-2.0	1.0	1.4-1.6
Passadumkeag	bass	f										
	sucker	w										
Milford	bass	f					0.2	0.4-0.9	0.2	0.2-0.8	0.1	0.4-0.7
	sucker	w					1.0	1.6-2.0	1.0	1.5-2.0	1.0	1.5-1.6
Veazie	bass	f	0.3	0.4-1.9	0.3	0.3-1.5	0.3	0.4-0.9	0.2	0.3-0.9	0.3	0.4-0.9
	sucker	w	0.5	1.4-2.5	0.4	0.9-2.0	1.1	1.3-1.9	1.0	1.2-1.8	1.1	1.3-1.7
Bangor	eel	f			0.3	0.4-1.5						
Bucksport	clam	m										
Stockton Spri	lobster	m										
	lobster	t	1.3	7.2-14.6	0.9	12.5-13.2						

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

			1995		1996		1997		1998		1999	
WATER/STATION	SPECIES	TIS	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE	TCDD	DTE
OWLS HEAD	mussel	m										
PISCATAQUIS R												
Sangerville	bass	f										
	bn trout	f										
	sucker	w										
Howland	bass	f										
PRESUMPSCOT R												
Windham	bass	f			<0.1	0.5-1.5	<0.1	0.5-0.7	<0.1	0.4-0.8		
	sucker	w	0.3	2.4-7.7			0.2	1.2-1.4	0.2	1.2-1.4		
Westbrook	bass	f			0.2	0.4-0.9	0.1	0.4-0.9	<0.1	0.3-0.8		
	pickerel	f										
	w perch	f										
	sucker	w	0.8	1.6-2.6			0.2	1.6-2.0	0.2	1.6-2.0		
Falmouth	clam	m										
Portland	lobster	m										
	lobster	t	2.2	9.5-12.8	2.7	18.9-21.6						
ST CROIX R												
Woodland	bass	f					<0.1	0.02-0.7	<0.1	0.06-0.7	<0.1	0.06-0.7
	sucker						<0.1	0.09-0.7	<0.1	0.08-0.7	<0.1	0.07-0.7
Baring	bass						<0.1	0.03-0.7	<0.1	0.05-0.7	<0.1	0.05-0.7
	sucker	w					<0.1	0.07-0.8	<0.1	0.08-0.8	<0.1	0.08-0.7
Robbinston	lobster	t			1.0	10.2-11.2						
ST JOHN R												
Frenchville	sucker	w										
Madawaska	y perch	f										
	bk trout	f										
	sucker	w										
SACO R												
Dayton	sucker	w										
SACO BAY												
Scarborough	lobster	m										
	lobster	t										
SALMON FALLS R												
Acton	lm bass		<0.1	<0.1-0.7								
	sucker				<0.1	0.1-1.0						
S Berwick	bass	f	0.4	0.4-4.0			0.2	0.3-0.6			0.1	0.3-0.6
	lm bass										0.2	0.5-0.8
	pickerel	f					0.6	0.8-1.0				
	sucker	w			2.0	3.2-4.5						

TABLE 2. DIOXIN AND FURAN CONCENTRATIONS IN MAINE FISH AND SHELLFISH (pg/g)

WATER/STATION	SPECIES	TIS	1995 TCDD	1995 DTE	1996 TCDD	1996 DTE	1997 TCDD	1997 DTE	1998 TCDD	1998 DTE	1999 TCDD	1999 DTE
SANDY P												
	bass	f										
SEBAGO L												
Naples	bass	w										
SEBASTICOOK R												
E Br Corinna	lm bass		0.1	0.2-1.1								
	bass						<0.1	0.1-0.7				
	sucker											
Newport	bass	f										
	lm bass	f	0.3	1.1-2.0			0.2	1.2-1.4				
	w perch	f			0.3	1.6-2.3						
W Br Harmony	bass		<0.1	0.1-0.8			<0.1	0.06-0.7				
	sucker				0.1	0.1-1.2						
W Br Palmyra	bass	f	0.8	1.7-2.2			0.3	0.6-0.9	0.2	0.5-0.8	0.2	0.6-0.8
	pickerel	f										
	sucker	w			1.2	2.2-3.6						
WEBBER POND												
Vassalboro	bass	f										

f=fillet
m=meat
t=tomalley
w=whole

DTE= dioxin toxic equivale
Range shown at nd=0 and nd

reference stations on other Maine rivers. There was no significant trend at this station for bass or trout, but concentrations of TCDD and DTEh in suckers have just begun to show a decline for the 1990s. No sludge data have been reported since 1989. Concentrations of both TCDD and TCDF in final effluent have been reported below EPA's reporting level of 10 ppt since 1995. This is a higher reporting level than used before that time, making it impossible to determine any improvements in recent years (Appendix 4).

Riley Five smallmouth bass and ten white suckers were collected from the river above the Riley Dam, about 19 miles downstream of Mead Paper Company and upstream of International Paper Company's discharge (Appendix 7). This station has not been sampled since 1985 and has been re-established for the above/below fish test. Concentrations of DTEh in the bass and suckers were 65% and 63% of the FTALc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. TCDD and DTEh were significantly greater than reference stations on other Maine rivers.

Livermore Falls Five smallmouth bass and ten white suckers were captured in the Otis Impoundment, approximately 2 miles downstream of the discharge from International Paper Company's Jay mill (Appendix 7). Concentrations of DTEh in the bass and suckers were 85% and 56% of the FTALc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. In both years TCDD and DTEh were significantly greater than reference stations on other Maine rivers. There has been a significant decline of TCDD in both bass and suckers and of DTEh in suckers since 1990. There are no new sludge data since 1996, but concentrations of TCDD and TCDF in bleach plant effluent and final effluent are well below EPA's reporting level (Appendix 4).

Auburn-GIP Five smallmouth bass were collected in Gulf Island Pond (GIP) near the deep hole at Seagull Island, approximately 30 miles downstream of International Paper Company (Appendix 7). Concentrations of DTEh in the bass exceeded the FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in higher levels of total toxic equivalents (TTEh) in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. In both years TCDD and DTEh were significantly greater than reference stations on other Maine rivers. There has been a significant decline in TCDD but not DTEh during since 1990.

Lisbon Falls Five smallmouth bass were captured in the Pejepscot Impoundment, approximately 45 miles below International Paper Company (Appendix 7). Concentrations of DTEh exceeded FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in higher concentrations of total toxic equivalents (TTEh) in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. TCDD and DTEh were significantly greater than reference stations on other Maine rivers. There was no significant trend for TCDD or DTEh for the period since 1990, although there appears to have been a slight decline since 1995.

Androscoggin Lake

Wayne Androscoggin Lake in Wayne and Leeds is a 4000 acre 38 foot deep meso-trophic lake with a unique reverse delta at the outlet formed by centuries of periodic backflow from the Androscoggin River via the Dead River into the lake. There is a dam on the Dead River that reduces but does not prevent the backflow into the lake, which usually occurs once or twice every year. Significant amounts of dioxin were found in fish from the lake in 1996 and 1998. In 1999, five smallmouth bass and ten white perch were collected from the lake. DTEh were 40% and 45% of the FTALc respectively, (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater in both species than in any species from all other lakes (n=8) that have been sampled and significantly higher than in fish from all river reference stations. Concentrations of TCDD are within the range of those found in fish from Livermore Falls on the Androscoggin River, which is most likely the source, but concentrations of DTEh appear somewhat lower than in fish from the river. Concentrations of TCDD and DTEh appear lower in 1999 than in previous years.

Kennebec River

Norridgewock Ten smallmouth bass and ten white suckers were collected from the river at Norridgewock (Appendix 7). Although downstream of the discharge from Madison Paper Industries discharge in Madison, comparison of dioxin in fish from this station in 1998 with that from fish caught at the Kennebec River reference station above Madison previously, showed no significant difference between the two stations. It therefore serves both as a reference for the river and the upstream station for the SAPPI Somerset mill. DTEh in both bass and sucker filets were 25% FTALc, but this was an artifact of unusually high detection limits as shown by DTEo at 2% and 0.6% of the FTALc respectively(Appendix 2). In fact, TCDD and most other congeners that add significantly to the DTE were below detection and therefore the FMT for all samples. Only TCDF in bass and TCDF and 1234678-hpCDF in suckers were present (in trace amounts) in most samples. The differences between DTEh and DTEo are much larger at these stations than at any station downstream of point sources on the river, and document the problem of the impact of high detection limits and treatment of non-detects. The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. TCDD and DTEo were not any higher than previous years for this or the Madison station. DTEh vary among years due to different detection limits. The trace amount of DTE measured in these fish is likely due to long-range transport and atmospheric deposition from remote sources. This station was also used for additional development of the above/below fish test described in a later section of this report.

Fairfield Ten smallmouth bass and ten white suckers were collected from the river between the Shawmut Dam and the I-95 bridge, approximately 7-8 miles below SAPPI Somerset's bleached kraft pulp and paper mill in Skowhegan (Appendix 7). Concentrations of DTEh in bass and suckers were 51% of the FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than those at the reference station at Norridgewock. There was no significant trend in concentrations in bass during the 1990s, but there appears a slight reduction in both TCDD and DTEh since 1994. There was, however, a significant reduction in TCDD and DTEh in suckers during the longer period. Effluent data (Appendix 4) and sludge data (Appendix 3) document decreases in discharges over the years especially since early 1997. Concentrations of TCDD and TCDF are well below the limits of the new law (<10ppq in the bleach plant). This station was also used for additional development of the above/below fish test described in a later section of this report.

Augusta This station is downstream of current discharges from SAPPI Somerset about 30 miles upstream in Skowhegan and Kennebec Sanitary Treatment District about 20 miles upstream in Waterville as well as former discharges from Tree-Free Fiber in Augusta and Kimberly-Clark in Winslow. Five smallmouth bass were captured from the river below the Edwards Dam in Augusta, after it was breached in early July, downstream approximately 2 miles towards Hallowell. Concentrations of DTEh in bass were 60% of the FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh in bass were significantly greater than those at the reference station Norridgewock. There has been no trend in bass during the 1990s, which have been more variable over the years, but concentrations since 1997 were slightly lower than all but one previous year. Results of a sludge test at Tree-Free in November 1997 showed concentrations of TCDD below 1 ppt, a reduction from previous years, but more data are needed for confirmation.

Penobscot River

Woodville Although this station is downstream of Great Northern's pulp and paper mills in Millinocket and East Millinocket, fish collected at this station in 1997 and 1998, had similarly low concentrations of dioxin as the historical reference station at Grindstone on the East Branch, uninfluenced by these mills. Therefore, this station may serve as a reference station for the Penobscot River and the upstream station for Lincoln Pulp and Paper. In 1999 ten smallmouth bass and ten white suckers were collected from this station. Concentrations of DTEh in bass were 26% of the FTALc for the (Appendix 2), but this was an artifact of detection levels and the impact of treatment of non-detects. Concentrations of all congeners that add significantly to DTE were below detection and therefore the FMT, except for trace amounts of TCDF. As a result concentrations of DTEo were only 5% of the FTALc for both years. The same was true for suckers, where DTEh were 8% but DTEo were 0.5 % of the FTALc. The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000).

South Lincoln Ten smallmouth bass and ten white suckers (Appendix 7) were collected from the river near the boat ramp in South Lincoln, approximately 4 miles downstream of Lincoln Pulp and Paper Company's bleached kraft mill in Lincoln. Concentrations of DTEh in bass and suckers were 57% and 33% of the FTALc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than those at the Woodville reference station. There has been, however, a significant decrease in TCDD and DTE in both bass and suckers during the 1990s. This decline is likely a result of decreased discharges from the mill as documented by decreased concentrations of TCDD and TCDF in sludge (Appendix 3) and in effluent, which shows compliance with the limits of the new law (Appendix 4), since 1997.

Milford Located at Freese Island near the boat ramp in Costigan, this station is approximately 34 miles downstream of Lincoln Pulp and Paper Company's bleached kraft mill in Lincoln and is the upstream station for the above/below test for the Fort James mill about 5 miles downstream. Six smallmouth bass and ten white suckers were captured from this station. Concentrations of DTEh in bass and suckers were 43% and 34% of the FTAlc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than those at the Woodville reference station. Like the South Lincoln station, at this station there has been a significant decrease in TCDD and DTEh in both suckers and bass during the 1990s likely due to decreased discharges from Lincoln Pulp and Paper Company during that time.

Veazie Ten smallmouth bass and ten white suckers (Appendix 7) were collected from the Veazie Impoundment about 7-8 miles below Fort James' bleached kraft mill in Old Town. Concentrations of DTEh in bass and suckers were 48% and 35% of the FTALc respectively (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than those at the Woodville reference station both years.

At this station there has been a significant decrease in TCDD and DTEh in bass and DTEh in suckers during the 1990s likely a result of decreased discharges from both upstream mills as documented by effluent (Appendix 4) and sludge (Appendix 3) data. TCDD and TCDF concentrations at the Fort James mill have continued to decline since early 1998 and have met the limits of the new law.

St. Croix River

Woodland Five smallmouth bass and ten white suckers were collected from the Grand Falls Flowage upstream of Georgia Pacific's bleached kraft pulp and paper mill in Baileyville. Concentrations of DTEh in bass and suckers were 27% and 8 % of the FTALc respectively (Appendix 2), but this was an artifact of detection levels and the impact of treatment of non-detects. Concentrations of all congeners that add significantly to DTE were below detection and therefore the FMT, except for trace amounts of TCDF. As a result concentrations of DTEo were only 4% of the FTALc in bass and 1% in suckers. The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of DTE were generally similar to those of the other reference stations in Maine. The trace amount of DTEo measured in these fish is thought to represent long-range transport and atmospheric deposition from remote sources.

Baring Five smallmouth bass and ten white suckers were collected from the river approximately 5 miles downstream of the discharge from Georgia Pacific's bleached kraft pulp and paper mill in Baileyville. Concentrations of DTEh in bass and suckers were 26% and 8% respectively. But similar to the reference station at Woodland, this was an artifact of detection levels and the impact of treatment of non-detects. Concentrations of all congeners that add significantly to DTE were below detection and therefore the FMT, except for trace amounts of TCDF. As a result concentrations of DTEo were only 3% of the FTALc in bass and 1% in suckers. The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. There was no significant difference in TCDD, DTEo, or DTEh between this station and the upstream reference station at Woodland for either year. There are no new sludge data from the mill, but effluent data document decreases in TCDD and TCDF since 1996 and compliance with the limits of the new law (Appendix 4).

Salmon Falls River

South Berwick One smallmouth bass and four largemouth bass (Appendix 7) were collected from the Rollinsford Impoundment about 2 miles below the discharge from the Berwick Sewer District's municipal wastewater treatment plant in Berwick, whose discharge is 85% effluent from Prime Tanning Company. DTEh were 51% of the FTALc all bass combined (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than in fish from previous years at an upstream reference station at Acton, which had concentrations similar to other reference stations in Maine. There was no significant trend for TCDD or DTEh in bass during the 1990s. There are no new sludge or effluent data from the treatment plant to show any changes in discharges. These results document a local source of dioxin to this reach of the river most likely the Prime Tanning discharge.

Sebasticook River

West Branch at Palmyra Five smallmouth bass were collected from the river near the US Route 2 bridge about 3-4 miles below the discharge from the Town of Hartland, whose effluent is about 85% effluent from Irving Tanning Company. Concentrations of DTEh were 52% of the FTALc (Appendix 2). The addition of dioxin-like (coplanar) PCBs, measured as part of DEP's SWAT program, to DTEh may result in total toxic equivalents (TTEh) that exceed a Fish Tissue Action Level in these fish (DEP, 2000). Sources of PCBs are unknown but likely include long-range transport and atmospheric deposition. Concentrations of TCDD and DTEh were significantly greater than in fish from the reference site upstream of the discharge in Corinna in years past. There are no significant trends for TCDD or DTEh during the 1990s. These results document a local source of dioxin to this reach of the river most likely the Irving Tanning discharge. Although the only sample result reported (1996) showed no detectable amount of dioxin in effluent (Appendix 4), low solubility and high bioconcentration of dioxin make effluent data less meaningful than sludge data. Sludge data from 1989 show measurable levels of TCDF (Appendix 3), but there are no newer sludge data to aid interpretation of current levels of discharge.

Above/Below Test

The modifications of the 1999 DMP resulted in some improvements in the Above/Below fish test. Minimum significant differences (MSDs) were closer to and actually met target levels for some tests (Table 3). Each modification is discussed separately.

Sucker filets

One of the concerns with use of whole body concentrations is that the analysis includes gut content, which could lead to greater variability as a result of stage of digestion for any species and sediment content in the case of bottom feeders such as suckers. One way to avoid this potentially confounding variable is to use filets.

Comparison of sucker whole body concentrations in 1998 with sucker filet concentrations in 1999 at Norridgewock and Fairfield above and below the SAPPI Somerset mill on the Kennebec River, showed much lower MSDs in the filets in 1999 for TCDD, TCDF and DTEh on both a wet and lipid weight basis. DTEh MSDs were closest to but still exceeded the target level (10% background) followed by TCDF and DTEo in increasing order. Interestingly, DTEo, which should have yielded lower MSDs than the DTEh, with the elimination of influence of detection levels, showed higher MSDs on a percent basis, although absolute values were not much different. The difference between the relative and absolute MSDs reflects the low concentrations of DTEo measured at the background station at Norridgewock. TCDD MSDs actually met the target level (the absolute value of the detection level). Lipid based measurements gave slightly lower MSDs than wet weight MSDs on a percent background basis. MSDs are calculated to be lower for larger sample sizes, but potential increased variance in larger samples may mitigate the effect to some extent.

It must be remembered that these differences between filet and whole body MSDs may result to some unknown extent from the fact that these were different fish from different years, a result of other objectives and the budget cap. The study should be repeated analyzing filets and offal and then calculating a whole body concentration for the same fish.

Small Fish

Since small fish of a given species at a station are generally younger than larger fish, they generally have lower body burdens contaminants such as dioxin. In addition, younger fish generally have higher growth rates and uptake of contaminants that may more reflect current ambient contaminant levels better than older fish which may have residues from years past. And small fish tend to have

Table 3. Minimum Significant Differences for 1999 Above/Below Fish Test

STATIONS	SPECIES	N	TCDDw		TCDFw		DTEow		DTEhw	
			ppt	%bg	ppt	%bg	ppt	%bg	ppt	%bg
AGL/ARF	SMB	10	0.27	541	2.47	632	0.66	1108	0.66	174
AGL/ARF	SMB	20	0.19	382	1.74	447	0.47	783	0.47	123
ARY/ALV	SMB	5	0.12	240	1.28	329	0.70	1163	0.69	181
ARY/ALV	SMB	10	0.08	170	0.91	233	0.49	822	0.49	128
KNW/KFF	SMB	10	0.18	352	0.23	100	0.20	664	0.20	55
KNW/KFF	SMB	20	0.12	249	0.16	71	0.14	469	0.14	39
PBW/PBL	SMB	10	0.12	248	0.41	88	0.16	199	0.15	39
PBW/PBL	SMB	20	0.09	175	0.29	63	0.11	141	0.10	27
PBC/PBV	SMB	6,10	0.21	419	1.17	254	0.35	437	0.29	76
PBC/PBV	SMB	10	0.17	334	1.14	248	0.31	385	0.24	64
PBC/PBV	SMB	20	0.12	236	0.81	175	0.22	272	0.17	45
SCW/SCB	SMB	5	0.00	0	0.39	80	0.05	78	0.04	12
SCW/SCB	SMB	10	0.00	0	0.28	56	0.03	55	0.03	8
MEAN	**SMB**	**5**	**0.11**	**220**	**0.95**	**221**	**0.36**	**559**	**0.34**	**89**
	SMB	**10**	**0.14**	**274**	**0.90**	**226**	**0.31**	**539**	**0.29**	**78**
	SMB	**20**	**0.13**	**261**	**0.75**	**189**	**0.24**	**416**	**0.22**	**59**
97-97	SMB	10	0.20	322	1.02	313			0.53	96
		20	0.14	227	0.67	222			0.35	68
KNW/KFF	WHS	10	0.09	185	0.41	163	0.14	464	0.13	37
KNW/KFF	WHS	20	0.07	131	0.29	115	0.10	328	0.09	26
KNW/KFF	SWHS	6,15	0.34	671	0.83	297	0.58	1930	0.37	88
KNW/KFF	SWHS	10	0.26	521	0.65	232	0.45	1495	0.33	77
KNW/KFF	SWHS	20	0.18	369	0.46	164	0.32	1057	0.23	55
97-98	WHS	10	0.56	1127	1.3	226			0.78	175
KNW/KFF		20	0.40	797	0.91	160			0.55	124

Table 3. Minimum Significant Differences for 1999 Above/Below Fish Test

STATIONS	SPECIES	N	TCDDL		TCDFL		DTEoL		DTEhL	
			ppt	%bg	ppt	%bg	ppt	%bg	ppt	%bg
AGL/ARF	SMB	10	15.36	614	150.86	239	31.31	110	31.27	71
AGL/ARF	SMB	20	10.86	434	106.7	169	22.14	78	22.11	50
ARY/ALV	SMB	5	7.3	290	180	286	62.17	218	59.3	135
ARY/ALV	SMB	10	5.1	205	127	202	43.96	154	42.0	96
KNW/KFF	SMB	10	16.08	643	23.5	52	16.61	27	16.63	22
KNW/KFF	SMB	20	11.37	455	16.6	37	11.75	19	11.76	15
PBW/PBL	SMB	10	9.14	366	41.2	40	9.78	55	9.71	29
PBW/PBL	SMB	20	6.46	259	29.1	28	6.91	39	6.86	20
PBC/PBV	SMB	6,10	16.54	662	281.6	271	20.67	117	20.09	59
PBC/PBV	SMB	10	13.31	532	16.6	16	16.79	95	16.07	48
PBC/PBV	SMB	20	9.41	376	11.8	11	11.87	67	11.37	34
SCW/SCB	SMB	5	0.00	0	20.6	51	2.60	45	2.5	11
SCW/SCB	SMB	10	0.00	0	14.5	36	1.84	32	1.76	8
MEAN	**SMB**	**5**	**7.93**	**317**	**161**	**203**	**28.5**	**127**	**27.3**	**69**
	SMB	**10**	**9.84**	**393**	**62.4**	**98**	**20.0**	**79**	**19.6**	**46**
	SMB	**20**	**9.53**	**381**	**41.0**	**61**	**13.2**	**51**	**13.0**	**30**
97-97	SMB	10	97.0	1977	383	869			165	427
		20	68.6	1398	269	615			114	302
KNW/KFF	WHS	10	3.31	132	8.80	80	3.96	305	3.81	21
KNW/KFF	WHS	20	2.34	94	6.22	57	2.80	216	2.70	15
KNW/KFF	SWHS	6,15	4.88	195	14.0	185	7.98	886	20.70	94
KNW/KFF	SWHS	10	3.94	158	45.0	593	6.18	687	17.65	80
KNW/KFF	SWHS	20	2.79	112	9.9	131	4.37	486	12.48	57
97-98	WHS	10	4.88	98.0	16.0	117			6.8	38
KNW/KFF		20	2.79	69.0	11.1	83.0			4.8	27

smaller home ranges, therefore may be more representative of local conditions than larger fish which may move to different areas within the year. All of these may result in less variation in concentrations and decrease MSDs.

To examine this idea, we attempted to collect small fish from a number of stations with mixed success. Small suckers were collected at Norridgewock and Fairfield on the Kennebec (Appendix 7), which allows comparison of MSDs for large and small suckers, bass, and livers from these same stations.

Interestingly, MSDs were higher for the small suckers than for the larger suckers for TCDD, TCDF, DTEo, and DTEh both on a wet and lipid weight basis (Table 3). On a wet weight basis, small sucker MSDs were consistently 2-3 times higher than large sucker MSDs. On a lipid weight basis, small sucker MSDs were 0.2 (TCDD) to 5 (TCDF) times higher than large suckers (Appendix 7). This may result from more variable lipid content between the two stations for the small suckers than for the large suckers. Lipid content of small suckers was larger than that for the large suckers at both stations.

Additional studies with bass or other species should be conducted to determine if the test can be improved. It was difficult collecting many other species of small fish. Besides bass, fallfish were the most commonly caught species, but were not captured at all stations where there was an attempt to catch small fish.

Bass

In the 1997 and 1998 programs, better results (lower MSDs) were achieved with bass than suckers, despite the fact there were only 5 fish from each station and no attempt to standardize size. There was some differences in performance between years with wet weight MSDs lower than those based on lipid weight. In 1999 ten smallmouth bass were captured at 4 pairs of above/below stations, Gilead/Rumford on the Androscoggin River, Norridgewock/Fairfield on the Kennebec River, and Woodville/S Lincoln and Costigan(n=6)/Veazie on the Penobscot River. All bass were to be within a 25 mm size range within and between paired stations. Due to difficulty in collecting fish, the target size range was not achieved for all paired stations, but were close to that desired for all but Costigan/Veazie (Appendix 7). All bass were analyzed as individuals.

The 1999 MSDs were considerably improved (lower) over 1997 and 1998 MSDs for all analyses (Table 3). It must be remembered that these are different years, however. Among these stations there was considerable variation in MSDs with best results achieved for the Woodville/S Lincoln pair, which almost achieved the target for TCDD and would be predicted to do so at a sample size of 20. At all locations the best results were achieved with DTEh on a lipid basis, followed by DTEh on a wet weight basis. As with the suckers, DTEo, which should have yielded lower MSDs than the DTEh, with the elimination of influence of detection levels, showed higher MSDs on a percent basis, although absolute values were not much different. Interestingly, at Riley/Livermore Falls, where only 5 fish were captured at each station, the MSD for TCDD was as low as any of the four pairs with larger sample sizes and would be predicted to meet the target level at a sample size of 10 fish.

Most telling of all, however, was that for the Woodland/Baring pair on the St Croix River, where only 5 fish were captured at each station, MSDs were lowest of all and met target levels for TCDD and DTEh on both a wet and a lipid weight basis. The Baring station, downstream of the Georgia Pacific Mill is the only downstream station that does not have significantly more dioxin and furan than reference stations unimpacted by point sources.

Compared to MSDs for large suckers, those for bass at Norridgewock/Fairfield, were lower for TCDF on both a wet and lipid weight basis and for DTEo on a lipid weight basis, and similar for DTEh on a lipid weight basis. Thus bass gave better results than suckers for all but TCDD, but still did not achieve target MSD levels. Other than the St Croix, only TCDD in large suckers on the Kennebec achieved the target MSDs.

These studies need to be repeated in 2000 to verify the results.

Livers

Previous monitoring of lobsters in Maine has shown higher levels of dioxin and furans in the hepatopancreas or liver of the organism. Other studies elsewhere have similarly shown higher concentrations of these compounds in the livers of fish and shellfish. For these reasons and to compare with results from sucker and bass tissue, livers were collected from bass and suckers from the Norridgewock/Fairfield stations and analyzed individually. It was uncertain if individual livers would be large enough to analyze and contain enough dioxin and furan to measure.

Initial extractions of the fish livers resulted in a large amount of diphenyl ether interferences for the furans, especially the tetrafuran. The methods currently used for separation of these compounds from fish tissue are not adequate for the liver samples. The analytical method has been modified to minimize this interference. The livers are currently being extracted and analyzed and the data will be available the first of April.

SPMDs

Semipermeable membrane devices (SPMDs) are integrative sampling devices which combine membrane diffusion and liquid-liquid partitioning to concentrate low to moderate molecular mass hydrophobic compounds from water (Huckins et al, 1996). SPMDs have some features which give them some advantages over monitoring contaminants in fish. SPMDs can be deployed in water to accumulate single, pulsed, or continuous contaminant releases over time. SPMDs are anchored to sample at specific locations, thereby avoiding any question of origin of contaminants caused by fish movement. SPMDs do not change function under stress, unlike gills of fish. There are no biotransformations or elimination like that in fish. There are, however, a number of conditions, such as temperature, DOC, solids which can effect the efficiency of these devices. And accumulation of contaminants does not occur by the same process of uptake in fish, thereby potentially limiting their use to accumulation in a relative sense.

Made of low density polyethylene lay-flat tubing (2.5 cm wide by 91.4 cm long), containing a thin film of neutral triolein and placed inside stainless steel canisters, SPMDs are deployed in the waterbody where they accumulate contaminants until retrieved. Laboratory handling of the SPMDs after field deployment involves the removal of biofouling, which is exterior debris and periphyton, before extraction. After this initial cleanup, the devices are then spiked with a cocktail of surrogates consisting of C-13 labeled analogs of the toxic native dioxin congeners in order to monitor recovery. After surrogate addition, individual SPMDs are dialyzed and the collected dialysates are cleaned by gel permeation chromatography followed by Florisil solid phase extraction. The extracts from the three SPMDs in each deployment site canister are then combined to enhance detection and each resulting sample is concentrated to ten microliters for HR GC/MS analysis.

In order to assess the potential of SPMDs to determine if mills are discharging dioxin, WRI initiated a study in 1999 on the Penobscot River as described below.

Phase I: 1999 Field Season on the Penobscot River
Objective: To develop viable SPMD sampling techniques.

Methods: With the focus being method development, WRI tested a variety of field conditions in order to be prepared for phase II of the project which involves using SPMDs to monitor sites on the Androscoggin River in 2000.

- With the field season lasting from June to October,WRI was able to test during both low and high levels of the river. WRI deployed SPMDs at a total of nine sites and the deployments are itemized below:

Set	Deployment Date	Retrieval Date	Sites
1	6/18/99	7/16/99	❖ Site 1: Just upstream of Lincoln Sanitary District Discharge ❖ Site 2: In between Lincoln Sanitary District Discharge and Eastern Paper Discharge ❖ Site 3: 200 feet below Eastern Paper Discharge
2	7/21/99	8/18/99	❖ Site 3: 2 sets of SPMD were deployed so that WRI Could check for reproducibility ❖ Site 4: Near the southern tip of Mattanawcook Island ❖ Site 5: South Lincoln
3	8/20/99	9/16/99	❖ Site 3: Lincoln ❖ Site 5: South Lincoln ❖ Site 6: South Lincoln—on the opposite side of the Northern tip of Mahockanock Island as site 5 ❖ Site 7: Near the Northwestern tip of Mattanawcook Island
4	9/28/99	10/28/99	❖ Site 3: Lincoln ❖ Site 5: South Lincoln ❖ Site 8: Costigan ❖ Site 9: Grindstone

- combined to one sample for cleanup and analysis.
- Early analyses revealed that cleanup methods were inadequate. Therefore, WRI altered the methods and SPMDs were cleaned separately and the three were combined into one sample only after cleanup and just before analysis.
- Some retention time shifts still occurred after the cleanup method alterations, thus chromatographic techniques were altered. Instead of examining all homologue groups at one time WRI had separate tetra-penta and hexa-hepta runs.
- WRI is left with only small amounts of samples for further analyses. However, objectives for Phase I of the project have been met:

➢ WRI has seen that the SPMDs do scavenge for dioxins and that surrogate recoveries are within acceptable ranges.

➢ Appropriate cleanup methods have been developed and followed with some success.

- Development of the analytical capability will continue. Results are expected prior to the 2000 field season.

CONCLUSIONS

Concentrations of dioxin toxic equivalents (DTEh) in some fish from four of six stations on the Androscoggin River, exceeded the Bureau of Health's Fish Tissue Action Level for cancer (FTALc=1.5 ppt). Total toxic equivalents (TTEh), the combination of DTEh and dioxin-like PCBS measured in DEP's Surface Water Ambient Toxics monitoring program, may also result in an exceedance of a Fish Tissue Action Level at other locations.

Concentrations of 2378-TCDD (TCDD) and DTEh in all fish samples collected below bleached kraft pulp and paper mills, and two tanneries on the Androscoggin River, Kennebec River, Penobscot River, Salmon Falls River, and West Branch of the Sebasticook River were significantly greater than those at reference stations unimpacted by industrial sources. There was no difference between concentrations of TCDD and DTEh in bass and suckers upstream and downstream of the Georgia Pacific mill on the St Croix river.

There have been significant decreases in concentrations of TCDD and/or DTEh in bass from Livermore Falls and Auburn on the Androscoggin River, the Penobscot River, and West Branch of the Sebasticook R during the 1990s. There have been significant decreases in concentrations of TCDD and/or DTEh in suckers at some of these and most other locations. No significant declines have been measured at Lisbon Falls on the Androscoggin River or at Sidney or Augusta on the Kennebec River.

Concentrations of TCDD and DTEh in smallmouth bass and white perch from Androscoggin Lake were lower than in 1998 but are significantly higher than in any other lake in the state. TCDD concentrations are generally similar to those in fish from the Androscoggin River, but DTEh concentrations are lower than in fish from the river.

A number of new modifications of the Above/Below fish test were implemented in 1999. Sucker filets from Norridgewock and Fairfield, above and below SAPPI Somerset gave a better test (lower MSDs) of a discharge of dioxin than do whole body suckers, but still do not meet desired acceptable target levels, except for TCDD. Small suckers from the same locations gave poorer performance (higher MSDs) than did the large suckers. Increasing the sample size and standardizing the lengths of bass improved (lowered) MSDs from 1997 and 1998 results. Best results were with DTEh on both a wet and lipid weight basis. Bass gave better results than suckers for all analyses but TCDD, although still not meeting target MSDs. Only for TCDD in large suckers on the Kennebec were target MSDs achieved. These studies need to be repeated to verify the results.

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APPENDIX 1

MAINE BUREAU OF HEALTH

FISH CONSUMPTION ADVISORY, MARCH 2000

LOBSTER TOMALLEY CONSUMPTION ADVISORY, 2 FEBRUARY 1994

APPENDIX 1. Maine Fish Consumption Advisories

Maine's 'General Consumption Advisory for All Inland Surface Waters due to Mercury Contamination' and 'Specific Freshwater Fish Consumption Advisories' are available at the Bureau of Health Environmental Toxicology Program's web site at http://janus.state.me.us/dhs/bohetp/index.html or by contacting the Environmental Toxicology Program, Bureau of Health, Department of Human Services, State House Station 11, Augusta, Maine 04333, telephone number 207-287-6455.

APPENDIX 2

DIOXIN AND FURAN CONCENTRATIONS IN FISH

1999

CODES

STATIONS

AGL	ANDROSCOGGIN RIVER AT GILEAD
ARF	ANDROSCOGGIN RIVER AT RUMFORD
ARY	ANDROSCOGGIN RIVER AT RILEY
ALV	ANDROSCOGGIN RIVER AT LIVERMORE FALLS
AGI	ANDROSCOGGIN RIVER AT GULF ISLAND POND, AUBURN
ALS	ANDROSCOGGIN RIVER AT LISBON FALLS
ALW	ANDROSCOGGIN LAKE AT WAYNE
KMD	KENNEBEC RIVER AT MADISON
KNK	KENNEBEC RIVER AT NORRIDGEWOCK
KFF	KENNEBEC RIVER AT SHAWMUT, FAIRFIELD
KSD	KENNEBEC RIVER AT SIDNEY
KAG	KENNEBEC RIVER AT AUGUSTA
PBG	PENOBSCOT RIVER AT GRINDSTONE
PBR	PENOBSCOT RIVER W BR AT EAST MILLINOCKET
PBW	PENOBSCOT RIVER AT WOODVILLE
PBL	PENOBSCOT RIVER AT SOUTH LINCOLN
PBC	PENOBSCOT RIVER AT MILFORD
PBV	PENOBSCOT RIVER AT VEAZIE
PWD	PRESUMPSCOT RIVER AT WINDHAM
PWB	PRESUMPSCOT RIVER AT WESTBROOK
SFA	SALMON FALLS RIVER AT ACTON
SFS	SALMON FALLS RIVER AT SOUTH BERWICK
SEC	SEBASTICOOK RIVER E BR AT CORINNA
SEN	SEBASTICOOK RIVER E BR AT NEWPORT
SWH	SEBASTICOOK RIVER W BR AT HARTLAND
SWP	SEBASTICOOK RIVER W BR AT PALMYRA
SCW	ST CROIX RIVER AT WOODLAND
SCB	ST CROIX RIVER AT BARING

SPECIES

BNT	BROWN TROUT
CHP	CHAIN PICKEREL
LMB	LARGEMOUTH BASS
SMB	SMALLMOUTH BASS
WHP	WHITE PERCH
WHS	WHITE SUCKER

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ARP-SMB-1	ARP-SMB-2	ARP-SMB-3	ARP-SMB-4	ARP-SMB-5	ARP-SMB-6	ARP-SMB-7	ARP-SMB-8	ARP-SMB-9
WRI ID		99-310	99-311	99-312	99-313	99-314	99-315	99-316	99-317	99-318
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	**	4.01	4.66	5.57	6.79	5.14	4.91	6.22	5.10
12378-pecdf	0.25		<DL	<DL	<DL	0.21	<DL	<DL	0.12	<DL
23478-pecdf	0.25		0.31	0.42	0.63	0.64	0.49	0.51	0.59	0.39
123478-hxcdf	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25		0.40	0.51	0.72	0.44	0.61	0.39	0.48	0.53
234678-hxcdf	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50		0.35	0.49	0.61	0.52	0.33	0.46	0.57	0.67
1234789-hpcdf	0.50		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50		0.55	1.02	1.85	0.84	0.75	0.96	1.15	0.41
2378-tcdd	0.10		0.29	0.31	0.39	0.48	0.32	0.41	0.51	0.35
12378-pecdd	0.25		0.18	0.20	0.16	0.31	0.25	0.32	0.33	0.28
123478-hxcdd	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50		0.66	1.15	1.34	1.56	0.87	1.25	2.61	1.64
DTEo		0	1.070	1.242	1.500	1.849	1.393	1.520	1.817	1.395
DTEd		0	1.242	1.416	1.672	2.009	1.566	1.692	1.977	1.565
DTEh			1.16	1.33	1.59	1.93	1.48	1.61	1.90	1.48
% Lipids		2.86	0.62	0.81	0.76	1.02	0.93	0.83	1.04	0.80
Sample weight (g)		50.2	50.0	50.2	50.2	50.2	49.9	50.2	50.0	50.2
		Values less than the established MDLs are to be considered estimated values.								
		* = Values are influenced by the presence of diphenyl ethers and are estimated maximum concentrations.								
		**=Value is being rechecked								

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ARP-SMB-10	ARF-SMB-1	ARF-SMB-2	ARF-SMB-3	ARF-SMB-4	ARF-SMB-5	ARF-SMB-6	ARF-SMB-7	ARF-SMB-8
WRI ID		99-319	99-289	99-290	99-291	99-292	99-293	99-294	99-295	99-296
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	5.97	7.71	3.15	5.91	4.45	3.88	5.14	4.01	7.35
12378-pecdf	0.25	0.18	0.87	0.52	0.78	0.61	0.49	0.84	0.47	0.72
23478-pecdf	0.25	0.71	0.72	0.47	0.50	0.35	0.28	0.52	0.38	0.61
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.56	0.59	0.25	0.38	0.29	<DL	0.33	0.18	0.51
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.71	0.67	0.33	0.51	0.44	0.39	0.62	0.29	0.48
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	0.93	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.39	0.85	0.48	0.87	0.56	0.67	0.72	0.36	0.78
12378-pecdd	0.25	0.28	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	2.01	4.91	2.68	4.02	2.95	3.86	3.15	2.01	3.66
DTEo		1.694	2.091	1.085	1.794	1.244	1.227	1.576	0.996	1.912
DTEd		1.852	2.498	1.495	2.204	1.654	1.662	1.986	1.406	2.322
DTEh		1.77	2.29	1.29	2.00	1.45	1.44	1.78	1.20	2.12
% Lipids		1.08	1.32	0.71	1.10	0.74	0.75	0.84	0.53	1.16
Sample weight (g)		50.2	50.1	50.1	49.9	50.1	50.0	50.0	50.2	49.9

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ARF-SMB-9	ARF-SMB-10	ARY-SMB-1	ARY-SMB-2	ARY-SMB-3	ARY-SMB-4	ARY-SMB-5	ALV-SMB-1	ALV-SMB-2
WRI ID		99-297	99-298	99-80	99-81	99-82	99-83	99-86	99-168	99-169
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	6.71	3.52	1.02	1.88	1.35	2.06	1.27	3.08	3.21
12378-pecdf	0.25	0.91	0.35	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	0.66	0.29	0.21	0.51	0.15	0.33	0.19	0.49	0.86
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.42	0.25	0.15	0.36	<DL	0.49	0.40	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.58	0.37	0.32	0.54	0.39	0.71	0.42	<DL	<DL
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	1.06	1.33
2378-tcdd	0.10	0.83	0.41	<DL	<DL	<DL	<DL	<DL	0.21	0.25
12378-pecdd	0.25	<DL	<DL	0.12	0.25	0.18	0.36	0.39	0.18	0.24
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.63	0.75
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	4.48	2.89	0.41	1.06	0.69	1.59	0.71	2.87	3.49
DTEo		1.925	0.953	0.345	0.735	0.394	0.787	0.656	1.006	1.316
DTEd		2.335	1.364	0.618	1.407	0.692	1.060	0.929	1.184	1.491
DTEh		2.13	1.16	0.48	1.07	0.54	0.92	0.79	1.10	1.40
% Lipids		0.91	0.51	0.45	1.00	0.49	1.35	0.66	0.74	0.92
Sample weight (g)		50.2	50.0	50.3	50.2	40.6	49.7	49.9	50.1	49.7

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ALV-SMB-3	ALV-SMB-4	ALV-SMB-5	AGI-SMB-1	AGI-SMB-2	AGI-SMB-3	AGI-SMB-4	AGI-SMB-5	ALS-SMB-1
WRI ID		99-170	99-171	99-172	99-265	99-266	99-267	99-268	99-269	99-260
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	2.71	2.31	1.95	5.78	6.33	5.19	7.01	4.46	4.33
12378-pecdf	0.25	<DL	<DL	<DL	3.85	4.09	3.01	4.51	2.95	0.41
23478-pecdf	0.25	0.55	0.45	0.33	<DL	<DL	<DL	<DL	<DL	0.39
123478-hxcdf	0.25	<DL	<DL	<DL	0.63	0.41	0.33	0.78	0.39	<DL
123678-hxcdf	0.25	<DL	<DL	<DL	0.57	0.33	0.21	0.61	0.28	0.51
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	<DL	<DL	<DL	0.71	0.59	0.51	1.15	0.47	1.15
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	0.95	0.51	0.43	1.79	2.28	1.02	2.69	0.85	<DL
2378-tcdd	0.10	0.19	0.13	0.09	0.42	0.39	0.31	0.51	0.29	0.52
12378-pecdd	0.25	0.22	0.17	<DL	0.31	0.45	0.25	0.46	0.25	<DL
123478-hxcdd	0.25	0.56	0.31	0.24	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	0.67	0.88	0.41	1.06	0.39	<DL
ocdd	0.50	2.31	2.07	1.66	2.88	2.01	1.15	2.95	1.57	4.12
DTEo		1.012	0.787	0.474	1.635	1.767	1.293	2.058	1.209	1.231
DTEd		1.190	0.965	0.902	1.890	2.022	1.548	2.313	1.464	1.641
DTEh		1.10	0.88	0.69	1.76	1.89	1.42	2.19	1.34	1.44
% Lipids		0.69	0.41	0.42	0.59	0.61	0.49	0.71	0.49	0.69
Sample weight (g)		50.1	44.5	40.8	50.3	50.2	50.1	50.2	50.2	49.9

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ALS-SMB-2	ALS-SMB-3	ALS-SMB-4	ALS-SMB-5	ALW-SMB-1	ALW-SMB-2	ALW-SMB-3	ALW-SMB-4	ALW-SMB-5
WRI ID		99-261	99-262	99-263	99-264	99-162	99-163	99-164	99-165	99-166
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	5.77	7.51	6.01	6.96	0.21	0.48	<DL	0.66	0.35
12378-pecdf	0.25	0.63	0.77	0.59	0.59	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	0.41	0.63	0.57	0.48	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.67	1.00	0.63	0.87	0.26	0.36	0.18	0.69	0.40
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	1.46	1.87	1.35	1.61	0.31	0.52	0.21	0.72	0.34
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.70	0.96	0.81	0.71	<DL	0.12	<DL	0.28	0.09
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	5.10	6.33	4.45	5.25	0.46	0.83	0.25	0.96	1.02
DTEo		1.596	2.184	1.802	1.779	0.050	0.209	0.020	0.422	0.169
DTEd		2.006	2.594	2.212	2.187	0.845	0.754	0.829	0.970	0.716
DTEh		1.80	2.39	2.01	1.98	0.45	0.48	0.42	0.70	0.44
% Lipids		0.89	1.19	0.79	1.09	0.58	1.12	0.27	1.68	1.01
Sample weight (g)		49.8	50.2	50.2	49.8	50.0	49.9	49.9	50.2	49.9

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ALW-WHP-1	ALW-WHP-2	ALW-WHP-3	ALW-WHP-4	ALW-WHP-5	ALW-WHP-6	ALW-WHP-7	ALW-WHP-8	ALW-WHP-9
WRI ID		99-60	99-61	99-62	99-63	99-64	99-65	99-66	99-67	99-68
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	0.68	0.45	0.51	0.48	0.27	0.37	0.42	0.24	0.38
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.77	0.36	0.83	0.69	0.41	0.51	0.31	0.37	0.47
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.51	0.25	0.62	0.38	0.30	0.42	0.29	0.28	0.53
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.38	0.14	0.34	0.31	0.19	0.26	0.21	0.10	0.15
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.66	0.61	0.78	0.57	0.40	0.64	0.67	0.36	0.71
ocdd	0.50	3.22	1.79	2.89	2.57	1.69	2.21	1.84	2.04	2.67
DTEo		0.537	0.230	0.488	0.437	0.265	0.359	0.293	0.168	0.248
DTEd		1.080	0.772	1.031	0.979	0.808	0.901	0.835	0.710	0.790
DTEh		0.81	0.50	0.76	0.71	0.54	0.63	0.56	0.44	0.52
% Lipids		5.28	3.35	5.31	4.65	2.52	3.13	2.45	1.49	2.77
Sample weight (g)		49.9	49.8	50.1	50.0	50.0	50.2	50.2	50.0	50.1

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ALW-WHP-10	AGL-RBT-C1	AGL-BNT-C1	ARP-WHS-C1	ARP-WHS-C2	ARF-WHS-C1	ARF-WHS-C2	ARY-WHS-C1	ARY-WHS-C2
WRI ID		99-69	99-270-C1	99-277-C1	99-70-C1	99-72-C2	99-301-C1	99-300-C2	99-92-C1	99-90-C2
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	0.33	8.65	4.51	15.3	13.8	18.2	15.1	13.3	9.25
12378-pecdf	0.25	<DL	2.47	1.09	1.24	0.93	0.71	0.55	0.35	0.22
23478-pecdf	0.25	<DL	<DL	<DL	1.47	0.81	1.44	0.98	1.63	1.31
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.28	<DL	0.33	0.84	0.75	<DL	<DL	0.44	0.29
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	0.52	0.43	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.19	0.52	0.26	0.99	1.16	<DL	<DL	0.56	0.41
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	0.74	0.66	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	0.63	0.77	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL	0.71	0.41	0.89	0.63	0.48	0.41	0.31	0.29
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.42	0.44
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.44	<DL	0.88	<DL	<DL	0.63	0.38	0.25	0.51
ocdd	0.50	2.03	<DL	1.95	2.66	3.49	3.25	2.97	3.01	2.19
DTEo		0.068	1.704	0.960	3.311	2.549	3.122	2.491	2.945	2.359
DTEd		0.710	2.264	1.490	3.721	2.959	3.527	2.896	3.100	2.514
DTEh		0.39	1.98	1.23	3.52	2.75	3.32	2.69	3.02	2.44
% Lipids		2.31	3.01	4.54	8.73	8.48	14.70	12.08	11.45	9.43
Sample weight (g)		50.0	50.1	50.1	49.3	49.3	50.0	49.9	50.2	50.3

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		ALV-WHS-C1	ALV-WHS-C2	KAG-SMB-1	KAG-SMB-2	KAG-SMB-3	KAG-SMB-4	KAG-SMB-5	KNW-SMB-F-1	KNW-SMB-F-2
WRI ID		99-30-C1	99-33-C2	99-11	99-12	99-15	99-16	99-19	99-475	99-476
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	7.31	9.88	0.41	0.33	0.38	0.58	0.47	0.19	0.21
12378-pecdf	0.25	0.59	0.61	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	0.83	0.94	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	0.56	0.42	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.29	0.21	0.15	<DL	0.12	0.29	0.24	<DL	<DL
234678-hxcdf	0.25	0.47	0.63	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	0.66	0.70	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.31	0.48	<DL	<DL	<DL	0.15	0.11	<DL	<DL
1234789-hpcdf	0.50	0.34	0.21	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	2.01	1.39	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.32	0.41	0.29	0.14	0.31	0.41	0.37	<DL	<DL
12378-pecdd	0.25	0.28	0.45	0.17	<DL	0.20	0.29	0.31	<DL	<DL
123478-hxcdd	0.25	0.84	0.97	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.49	0.66	0.24	0.21	0.38	0.35	0.29	0.15	0.26
ocdd	0.50	1.88	2.06	1.38	1.21	1.59	2.19	1.84	0.26	0.31
DTEo		2.069	2.655	0.519	0.175	0.564	0.792	0.755	0.021	0.024
DTEd		2.119	2.705	0.816	0.748	0.862	1.085	1.048	0.693	0.696
DTEh		2.09	2.68	0.67	0.46	0.71	0.94	0.90	0.36	0.36
% Lipids		6.89	9.14	0.60	0.34	0.62	1.10	1.01	0.51	0.57
Sample weight (g)		50.4	50.0	50.0	49.8	50.1	49.8	48.9	50.1	50.2

Values less than the established MDLs are to be considered estimated values.

* Detection limits have been increased due to small sample size.

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KNW-SMB-F-3	KNW-SMB-F-4	KNW-SMB-F-5	KNW-SMB-F-6	KNW-SMB-F-7	KNW-SMB-F-8	KNW-SMB-F-9	KNW-SMB-F-10
WRI ID		99-477	99-478	99-479	99-480	99-481	99-482	99-483	99-484
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	0.26	0.31	0.28	0.14	0.34	0.27	0.13	0.21
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	0.16	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.16	0.25	<DL	<DL	<DL	<DL	<DL	<DL
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.29	0.50	0.27	0.18	0.41	0.36	0.22	0.39
ocdd	0.50	0.55	0.81	0.72	0.64	0.39	0.26	0.18	0.31
DTEo		0.031	0.055	0.031	0.016	0.038	0.031	0.015	0.025
DTEd		0.698	0.709	0.703	0.688	0.711	0.703	0.688	0.697
DTEh		0.36	0.38	0.37	0.35	0.37	0.37	0.35	0.36
% Lipids		0.71	1.35	0.46	0.43	0.55	0.41	0.32	0.42
Sample weight (g)		50.5	50.1	49.8	50.2	49.7	50.4	49.9	50.0

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KFF-SMB-F-1	KFF-SMB-F-2	KFF-SMB-F-3	KFF-SMB-F-4	KFF-SMB-F-5	KFF-SMB-F-6	KFF-SMB-F-7	KFF-SMB-F-8
WRI ID		99-510	99-511	99-512	99-513	99-514	99-515	99-516	99-517
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	0.71	0.44	0.31	0.24	0.49	0.39	0.64	0.55
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.56	0.41	0.25	0.36	0.38	0.31	0.51	0.42
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.61	0.36	0.21	0.34	0.37	0.29	0.59	0.45
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.71	0.42	0.19	0.25	0.44	0.36	0.66	0.47
ocdd	0.50	2.85	2.03	1.15	1.54	1.95	1.84	2.54	2.12
DTEo		0.694	0.413	0.246	0.370	0.427	0.336	0.666	0.514
DTEd		1.262	0.980	0.813	0.938	0.995	0.903	1.234	1.082
DTEh		0.98	0.70	0.53	0.65	0.71	0.62	0.95	0.80
% Lipids		1.12	0.59	0.38	0.38	0.62	0.60	0.97	0.69
Sample weight (g)		49.9	49.9	50.2	50.2	50.0	49.7	50.1	49.8

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KFF-SMB-F-9	KFF-SMB-F-10	KNW-WHS-F-1	KNW-WHS-F-2	KNW-WHS-F-3	KNW-WHS-F-4	KNW-WHS-F-5	KNW-WHS-F-6
WRI ID		99-518	99-519	99-459	99-460	99-461	99-462	99-463	99-464
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	0.29	0.31	0.41	0.32	0.28	0.18	0.24	0.15
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	<DL	0.21	0.15	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.44	0.50	0.35	0.26	0.18	0.12	0.23	0.15
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.31	0.27	<DL	<DL	<DL	<DL	<DL	<DL
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.29	0.22	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	1.67	1.15	0.51	0.47	0.39	0.24	0.51	0.30
DTEo		0.346	0.308	0.066	0.050	0.030	0.019	0.026	0.017
DTEd		0.914	0.876	0.713	0.697	0.702	0.692	0.599	0.689
DTEh		0.63	0.59	0.39	0.37	0.37	0.36	0.31	0.35
% Lipids		0.54	0.58	5.00	3.19	2.24	1.26	2.22	2.04
Sample weight (g)		50.0	49.9	50.1	50.1	50.0	50.0	50.0	50.1

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KNW-WHS-F-7	KNW-WHS-F-8	KNW-WHS-F-9	KNW-WHS-F-10	KNW-WHS-SS-1	KNW-WHS-SS-2	KNW-WHS-SS-3
WRI ID		99-465	99-466	99-467	99-468	99-469	99-470	99-471
Compound	**DL (ng/Kg)**							
2378-tcdf	0.11	0.18	0.22	0.31	0.24	0.37	0.26	0.21
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.13	0.28	0.32	0.26	0.41	0.31	0.53
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	0.21	0.26	0.33	0.2900	0.72	0.55	0.63
DTEo		0.019	0.025	0.034	0.027	0.041	0.029	0.026
DTEd		0.692	0.697	0.707	0.699	0.714	0.702	0.699
DTEh		0.36	0.36	0.37	0.36	0.38	0.37	0.36
% Lipids		1.90	1.84	2.53	1.87	3.38	2.72	3.50
Sample weight (g)		50.0	50.2	50.3	50.1	50.3	50.2	50.2

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KNW-WHS-SS-4	KNW-WHS-SS-5	KNW-WHS-SS-6	KFF-WHS-F-1	KFF-WHS-F-2	KFF-WHS-F-3	KFF-WHS-F-4	KFF-WHS-F-5
WRI ID		99-472*	99-473*	99-474	99-485	99-486	99-487	99-488	99-489
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	0.39	0.28	0.25	0.95	0.79	0.66	1.54	1.36
12378-pecdf	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL(0.50)	<DL(0.4)	<DL	0.26	0.21	0.15	0.20	0.12
234678-hxcdf	0.25	<DL(0.50)	<DL(0.4)	<DL	0.24	0.16	0.22	0.28	0.23
123789-hxcdf	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.58	0.47	0.50	<DL	<DL	<DL	0.18	<DL
1234789-hpcdf	0.50	<DL(1.0)	<DL(0.8)	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL(1.0)	<DL(0.8)	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL(0.2)	<DL(0.15)	<DL	0.36	0.32	0.28	0.41	0.33
12378-pecdd	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL(0.50)	<DL(0.4)	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL(1.0)	<DL(0.8)	<DL	0.28	0.23	0.19	0.29	0.25
ocdd	0.50	0.87	0.71	0.66	1.06	0.94	0.75	1.41	1.37
DTEo		0.045	0.033	0.030	0.508	0.438	0.385	0.617	0.504
DTEd		1.390	1.099	0.703	1.030	0.961	0.908	1.134	1.026
DTEh		0.72	0.57	0.37	0.77	0.70	0.65	0.88	0.76
% Lipids		6.40	4.03	4.00	2.16	1.94	2.08	3.98	2.75
Sample weight (g)		21.8	36.2	50.2	49.6	50.0	50.1	49.9	50.4

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KFF-WHS-F-6	KFF-WHS-F-7	KFF-WHS-F-8	KFF-WHS-F-9	KFF-WHS-F-10	KFF-WHS-SS-1	KFF-WHS-SS-2	KFF-WHS-SS-3
WRI ID		99-490	99-491	99-492	99-493	99-494	99-495	99-496	99-497
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	1.09	0.85	1.25	1.07	0.66	1.87	2.79	2.26
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	0.21	0.26	0.31
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	0.15	0.17	0.12	<DL	0.33	0.31	0.24
234678-hxcdf	0.25	0.25	0.18	0.25	0.14	<DL	0.26	0.28	0.21
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	0.18	0.23	0.26
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.24	0.28	0.36	0.22	0.19	0.51	0.64	0.55
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	0.15	0.10
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.21	0.17	0.14	0.22	0.15	0.39	0.51	0.47
ocdd	0.50	1.12	0.83	0.96	0.87	0.66	1.85	2.26	2.07
DTEo		0.376	0.400	0.528	0.355	0.258	0.867	1.131	0.994
DTEd		0.899	0.922	1.051	0.878	0.830	1.259	1.498	1.361
DTEh		0.64	0.66	0.79	0.62	0.54	1.06	1.31	1.18
% Lipids		2.16	1.97	2.37	2.27	1.57	4.66	6.97	5.53
Sample weight (g)		50.1	50.0	49.8	50.1	50.0	50.0	50.5	49.7

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KFF-WHS-SS-4	KFF-WHS-SS-5	KFF-WHS-SS-6	KFF-WHS-SS-7	KFF-WHS-SS-8	KFF-WHS-SS-9	KFF-WHS-SS-10	KFF-WHS-SS-11
WRI ID		99-498	99-499	99-500	99-501*	99-502*	99-503*	99-504*	99-505*
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	2.38	1.45	1.69	1.28	1.15	1.39	1.31	1.56
12378-pecdf	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
23478-pecdf	0.25	0.18	0.12	0.15	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123478-hxcdf	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123678-hxcdf	0.25	0.33	0.21	0.18	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
234678-hxcdf	0.25	0.17	0.15	0.21	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123789-hxcdf	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
1234678-hpcdf	0.50	0.24	0.12	0.14	<DL(0.8)	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL(0.8)	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)
ocdf	0.50	<DL	<DL	<DL	<DL(0.8)	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)
2378-tcdd	0.10	0.48	0.35	0.39	0.14	<DL(0.2)	<DL(0.2)	0.11	0.12
12378-pecdd	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123478-hxcdd	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123678-hxcdd	0.25	0.12	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
123789-hxcdd	0.25	<DL	<DL	<DL	<DL(0.4)	<DL(0.5)	<DL(0.5)	<DL(0.5)	<DL(0.75)
1234678-hpcdd	0.50	0.39	0.44	0.49	0.22	0.29	0.36	0.14	0.39
ocdd	0.50	1.74	1.59	1.86	1.56	1.67	1.14	1.71	1.35
DTEo		0.876	0.597	0.679	0.270	0.118	0.143	0.243	0.280
DTEd		1.244	0.964	1.047	1.186	1.463	1.488	1.388	1.998
DTEh		1.06	0.78	0.86	0.73	0.79	0.82	0.82	1.14
% Lipids		5.79	3.91	4.14	2.27	2.09	2.23	2.88	3.37
Sample weight (g)		49.7	49.8	49.8	35.8	23.6	22.2	20.9	17.4

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		KFF-WHS-SS-12	KFF-WHS-SS-13	KFF-WHS-SS-14	KFF-WHS-SS-15	PBW-SMB-2	PBW-SMB-3	PBW-SMB-4	PBW-SMB-5
WRI ID		99-506*	99-507*	99-508*	99-509*	99-382	99-383	99-384	99-385
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11	1.25	1.51	1.46	1.22	0.66	0.47	0.24	0.36
12378-pecdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	0.26	<DL	<DL	<DL
123678-hxcdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	0.33	0.15	0.10	0.19
234678-hxcdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)	0.48	0.19	0.11	0.18
1234789-hpcdf	0.50	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL	<DL	<DL	<DL
ocdf	0.50	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL(1.0)	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.10	0.26	0.15	0.10	<DL	<DL	<DL	<DL
12378-pecdd	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL(0.75)	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	0.41	0.37	0.37	0.21	<DL	<DL	<DL	<DL
ocdd	0.50	0.95	0.62	1.06	0.77	1.15	0.72	0.55	0.98
DTEo		0.229	0.415	0.300	0.224	0.130	0.064	0.035	0.057
DTEd		1.967	2.132	2.017	1.962	0.686	0.665	0.659	0.668
DTEh		1.10	1.27	1.16	1.09	0.41	0.36	0.35	0.36
% Lipids		3.43	4.99	3.08	2.61	0.65	0.31	0.16	0.34
Sample weight (g)		15.9	15.5	14.4	13.3	50.2	49.9	50.0	50.1

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		PBW-SMB-6	PBW-SMB-7	PBW-SMB-8	PBW-SMB-9	PBW-SMB-10	PBL-SMB-1	PBL-SMB-2	PBL-SMB-3	PBL-SMB-4
WRI ID		99-386	99-387	99-388	99-389	99-390	99-405	99-406	99-407	99-408
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	0.59	0.51	0.48	0.51	0.37	1.81	1.48	1.71	1.63
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	0.35	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.29	0.41	0.34	0.37	0.26	0.71	0.48	0.82	0.54
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.39	0.51	0.46	0.52	0.27	0.48	0.29	0.41	0.55
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL	<DL	<DL	<DL	<DL	0.52	0.38	0.33	0.47
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	0.89	1.26	0.91	0.83	0.49	2.65	1.98	2.24	2.57
DTEo		0.092	0.132	0.087	0.093	0.066	0.777	0.579	0.587	0.693
DTEd		0.681	0.704	0.686	0.690	0.676	1.144	0.979	0.964	1.077
DTEh		0.39	0.42	0.39	0.39	0.37	0.96	0.78	0.78	0.89
% Lipids		0.71	0.61	0.61	0.55	0.46	1.36	1.13	1.18	1.21
Sample weight (g)		50.2	49.7	50.2	49.8	50.0	49.7	50.2	50.1	50.3

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		PBL-SMB-5	PBL-SMB-6	PBL-SMB-7	PBL-SMB-8	PBL-SMB-9	PBL-SMB-10	PBC-SMB-1	PBC-SMB-2	PBC-SMB-3
WRI ID		99-409	99-410	99-411	99-412	99-413	99-414	99-375	99-376	99-377
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	1.02	1.34	1.21	1.36	0.97	1.25	2.06	3.41	2.35
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.33	0.31	0.51	0.76	0.48	0.59	0.35	0.51	0.38
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.21	0.36	0.27	0.39	0.44	0.46	0.58	0.84	0.63
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.29	0.24	0.31	0.40	0.49	0.44	0.11	0.23	0.15
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	1.85	1.64	2.06	2.37	1.59	2.57	2.63	3.21	1.84
DTEo		0.427	0.409	0.485	0.616	0.640	0.629	0.357	0.631	0.429
DTEd		0.873	0.822	0.911	1.028	1.090	1.051	0.699	0.837	0.742
DTEh		0.65	0.62	0.70	0.82	0.86	0.84	0.53	0.73	0.59
% Lipids		0.85	0.90	0.89	0.94	1.00	1.04	1.00	1.80	1.20
Sample weight (g)		49.9	50.2	49.8	49.6	49.8	49.7	50.0	50.0	49.9

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		PBC-SMB-4	PBC-SMB-5	PBC-SMB-6	PBV-SMB-1	PBV-SMB-2	PBV-SMB-3	PBV-SMB-4	PBV-SMB-5	PBV-SMB-6
WRI ID		99-378	99-379	99-380	99-435	99-436	99-437	99-438	99-439	99-440
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	0.85	2.26	1.84	0.84	0.93	0.29	0.90	0.49	0.52
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	0.29	0.31	0.58	0.64	0.22	0.52	0.25	0.38
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.33	0.47	0.61	0.39	0.47	0.24	0.41	0.34	0.31
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	<DL	0.12	0.14	0.35	0.42	0.15	0.36	0.12	0.23
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	1.15	2.27	1.98	1.95	2.15	1.18	2.51	1.04	1.75
DTEo		0.088	0.380	0.361	0.496	0.582	0.204	0.506	0.198	0.323
DTEd		0.676	0.701	0.725	0.960	1.036	0.722	0.964	0.696	0.819
DTEh		0.38	0.54	0.54	0.73	0.81	0.46	0.74	0.45	0.57
% Lipids		0.41	1.11	0.94	0.90	1.19	0.37	0.95	0.78	0.50
Sample weight (g)		49.7	50.4	50.0	49.7	49.9	50.0	50.1	50.3	50.2

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		PBV-SMB-7	PBV-SMB-8	PBV-SMB-9	PBV-SMB-10	PBW-WHS-C1	PBW-WHS-C2	PBL-WHS-C1	PBL-WHS-C2	PBC-WHS-C1
WRI ID		99-441	99-442	99-443	99-444	99-350-C1	99-348-C2	99-416-C1	99-415-C2	99-426-C1
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	0.47	0.59	0.79	0.38	0.65	0.56	3.95	3.09	2.85
12378-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.31	0.47	0.61	0.29	0.52	0.39	0.37	0.25	0.18
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	0.33	0.29	0.34	0.26	0.61	0.48	0.65	0.78	0.55
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	0.20	0.31	0.45	0.18	<DL	<DL	1.06	0.84	0.95
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	0.51	0.73	0.37
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	0.79	0.58	1.18	0.94	1.41
ocdd	0.50	1.81	1.57	2.33	1.24	2.05	1.74	4.69	3.55	2.96
DTEo		0.281	0.419	0.594	0.250	0.131	0.106	1.562	1.265	1.310
DTEd		0.782	0.908	1.062	0.759	0.709	0.692	1.684	1.473	1.542
DTEh		0.53	0.66	0.83	0.50	0.42	0.40	1.62	1.37	1.43
% Lipids		0.69	0.77	0.96	0.51	5.68	3.13	10.14	8.43	8.12
Sample weight (g)		49.8	49.6	48.2	49.7	50.3	50.1	49.9	50.0	49.7

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		PBC-WHS-C2	PBV-WHS-C1	PBV-WHS-C2	SFS-SMB-1	SFS-LMB-1	SFS-LMB-2	SFS-LMB-3	SFS-LMB-4	SWP-SMB-1
WRI ID		99-425-C2	99-359-C1	99-358-C2	99-282-C1	99-284	99-285	99-286	99-287	99-194
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11	3.77	2.01	1.59						
12378-pecdf	0.25	<DL	<DL	<DL	0.78	0.88	1.13	1.06	0.81	0.29
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	0.36	0.44	0.21	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.29
123789-hxcdf	0.25	<DL	<DL	<DL	0.15	0.33	0.45	0.52	0.48	<DL
1234678-hpcdf	0.50	0.82	0.61	0.49	<DL	<DL	<DL	<DL	<DL	<DL
1234789-hpcdf	0.50	<DL	<DL	<DL	0.26	0.57	0.68	0.61	0.52	0.44
ocdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2378-tcdd	0.10	1.14	1.22	0.95	<DL	<DL	<DL	<DL	<DL	0.73
12378-pecdd	0.25	<DL	<DL	<DL	0.11	0.19	0.25	0.23	0.13	0.15
123478-hxcdd	0.25	<DL	<DL	<DL	0.09	0.14	0.21	0.11	0.09	0.18
123678-hxcdd	0.25	0.42	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	0.15	0.26	0.21	0.10	0.71
1234678-hpcdd	0.50	1.24	0.65	0.47	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	3.52	2.48	2.06	<DL	<DL	<DL	<DL	<DL	0.42
					0.41	0.66	0.84	1.02	0.72	2.01
DTEo		1.616	1.503	1.140						
DTEd		1.757	1.819	1.523	0.296	0.472	0.651	0.525	0.364	0.468
DTEh		1.69	1.66	1.33	0.593	0.744	0.923	0.798	0.637	0.735
% Lipids		9.38	4.63	3.86	0.67	0.98	1.18	0.97	0.79	0.95
Sample weight (g)		49.6	49.6	49.8	50.2	50.2	50.2	50.1	50.3	50.0
					Values less than the established MDLs are to be considered estimated values.					
					* = Values are influenced by the presence of diphenyl ethers and are estimated r					

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		SWP-SMB-2	SWP-SMB-3	SWP-SMB-4	SWP-SMB-5	SCW-SMB-1	SCW-SMB-2	SCW-SMB-3	SCW-SMB-4	SCW-SMB-5
WRI ID		99-195	99-196	99-197	99-198	99-240	99-241	99-242	99-243	99-244
Compound	**DL (ng/Kg)**									
2378-tcdf	0.11									
12378-pecdf	0.25	0.36	0.53	0.38	0.41	0.28	0.69	0.41	0.59	0.48
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	0.24	0.31	0.33	0.22	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234789-hpcdf	0.50	0.61	0.72	0.57	0.69	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	<DL	<DL	<DL	<DL	0.48	0.82	0.47	0.64	0.55
2378-tcdd	0.10	0.58	0.96	0.84	1.06	0.77	1.15	0.80	0.86	0.72
12378-pecdd	0.25	0.18	0.24	0.21	0.27	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	0.22	0.28	0.19	0.21	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	0.49	0.76	0.63	0.84	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	0.63	0.51	0.47	0.59	0.41	0.77	0.51	0.39	0.54
		1.72	1.97	1.51	2.25	1.49	1.84	1.03	0.22	0.97
DTEo										
DTEd		0.522	0.693	0.545	0.640	0.037	0.085	0.051	0.069	0.059
DTEh		0.789	0.960	0.812	0.908	0.705	0.753	0.718	0.737	0.727
% Lipids		0.98	1.00	0.84	1.29	0.96	1.87	1.03	1.24	1.05
Sample weight (g)		50.2	50.1	49.9	50.1	49.7	49.9	50.2	50.2	50.3
		naximum concentrations.								

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		SCB-SMB-1	SCB-SMB-2	SCB-SMB-3	SCB-SMB-4	SCB-SMB-5	SCW-WHS-C1	SCW-WHS-C2	SCB-WHS-C1
WRI ID		99-199	99-200	99-201	99-203	99-208	99-246-C1	99-245-C2	99-209-C1
Compound	**DL (ng/Kg)**								
2378-tcdf	0.11								
12378-pecdf	0.25	0.28	0.36	0.50	0.54	0.23	0.52	0.63	0.72
23478-pecdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
234678-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdf	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234789-hpcdf	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdf	0.50	0.21	0.51	0.42	0.59	<DL	0.57	0.61	0.63
2378-tcdd	0.10	0.41	0.75	0.47	0.35	0.36	0.64	0.77	0.81
12378-pecdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123478-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123678-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
123789-hxcdd	0.25	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1234678-hpcdd	0.50	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ocdd	0.50	0.26	0.63	0.46	0.31	<DL	0.59	0.72	0.81
		1.06	1.59	1.20	1.47	0.85	3.26	2.95	2.75
DTEo									
DTEd		0.033	0.048	0.059	0.063	0.023	0.064	0.077	0.087
DTEh		0.700	0.715	0.726	0.731	0.701	0.731	0.744	0.754
% Lipids		0.57	0.76	0.80	0.90	0.53	7.84	8.27	11.10
Sample weight (g)		50.1	50.1	50.1	50.2	50.1	50.3	50.3	49.9

APPENDIX 2. DIOXIN AND FURAN CONCENTRATIONS IN 1999 FISH SAMPLES

DEP ID		SCB-WHS-C2
WRI ID		99-210-C2
Compound	**DL (ng/Kg)**	
2378-tcdf	0.11	
12378-pecdf	0.25	0.58
23478-pecdf	0.25	<DL
123478-hxcdf	0.25	<DL
123678-hxcdf	0.25	<DL
234678-hxcdf	0.25	<DL
123789-hxcdf	0.25	<DL
1234678-hpcdf	0.50	<DL
1234789-hpcdf	0.50	<DL
ocdf	0.50	0.44
2378-tcdd	0.10	0.62
12378-pecdd	0.25	<DL
123478-hxcdd	0.25	<DL
123678-hxcdd	0.25	<DL
123789-hxcdd	0.25	<DL
1234678-hpcdd	0.50	<DL
ocdd	0.50	0.66
		2.19
DTEo		
DTEd		0.069
DTEh		0.737
% Lipids		9.24
Sample weight (g)		50.0

APPENDIX 3

2378-TCDD AND 2378-TCDF IN SLUDGE FROM MAINE WASTEWATER TREATMENT PLANTS

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
AUBURN VPS	951005		1.3	17.9
AUBURN FIBER	970806		<0.9	9.9
AUGUSTA SANITARY DISTRICT	900409		<1.2	1.3
	900608		<3.9	2.5
	900608		E2.1	10.2
	900914		<20.0	E20.0
	900809		<20	
	910108		<5	5.0
	910220		<1.9	0.8
	910301		<1.9	4.8
	920416		1.9	1.9
	920427		<1.0	1.9
	930223		<1.3	<1.3
	940215		<1.0	<1.0
			<0.02	0.0
			<0.23	1.8
	950227		1.9	<1
	960228		<1	<1
	970408		0.9	<0.9
	980514		<1	<1
ANSON-MADISON SANITARY DISTRICT	910408		<1.3	2.2
	911001		1.7	4.6
BANGOR	950104		20.6	20.7
	950104		20.3	20.2
BERWICK SEWER DISTRICT	861111		<2.5	<4.0
	890301	76.4	14.0	19.9
	890927	75.3	<12.1	<12.1
	891208	87.5	1152.0	872.0
BIDDEFORD	900208		7.2	30.0
	900208		39.0	310.0
	910501		<0.86	3.7
	910703		<0.57	<0.95
	920204		<1.5	2.9
	930121		<2.4	<3.2
	940209		<0.19	<0.48
	940913		<1.0	<2.9
	950815		<.22	1.6
	970218		<0.8	<1.7
BREWER	920520		<2.1	36.0
	920901		<6.0	110.0
	921116		3.8	19.0
	930202		<3.7	11.0
	930511		1.2	9.8
	930810		4.1	24.0
	931118		3.8	26.0
	940201		3.2	24.0
	940517		<0.9	14.0
	940823		4.5	26.0
	941108		5.2	36.0
	950613		<1	18.0
	960611		2.1	17.0
	970212		3.4	22.0
	980622		<1	<1
	990730		<1	1.3

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
BOWATER	850618		<0.4	
MILLINOCKET	880602		<1.9	7.3
	940414		<7.4	<8.9
	940506		<.9	6.7
	950316		<.6	4.0
	960711		<1	<1
			<1	4.0
	960914		<0.4	4.4
			<0.3	1.5
	960917		<1	<1
CORINNA SEWER DISTRICT	850506			
	871117		<11.9	<28.8
	880301		<3.0	8.5
	890222		<13.0	
	890510		<5.0	
	900131		2.3	127.0
	900606		<4.0	85.4
	900606		<4.9	82.2
	900919		<10.0	50.0
	901009		<1.5	<.8
	901024		<8.0	
	910313		<5.0	
	910514			
	920304		<3.9	<8.4
	930405		<4.8	19.9
	930811		<9.9	68.6
	940308		<13.1	46.0
	940810		<5.6	7.8
	950321		<2.1	13.3
	960206		<1.8	12.7
American Pulp and Paper BERLIN NH	88		104.0	2930.0
FORT JAMES	880801		12.0	34.0
OLD TOWN	881225	78.6	301.0	963.0
	890423	78.7	380.0	1197.0
	890718	68.8	50.6	478.0
	950103		8.8	65.0
FRASER PAPER LTD	880903	68.3	13.9	233.0
MADAWASKA	890106	79.1	E23.4	204.0
	890406	71.3	E3.83	12.9
	890930	80.1	5.0	E26.6
	940426		<.1	0.8
GARDINER WATER DISTRICT	900918		<0.87	4.6
	910401		1.4	4.4
	911002		<0.54	5.1
	920504		<3.5	9.4
	921116		<.93	<6.4
	930407		<0.13	0.9
	931115		<1.6	<18
	931115			
	931115		<0.9	
	940329		<0.2	<1.1
	941018		<1.2	<4.3
	950221		<2.8	5.2
	951003		<1.7	
	960326		4.1	27.0
	961015		0.8	11.0
	970331		<1.1	<5.8

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
GEORGIA PACIFIC CO WOODLAND	890113	75.8	<6.2	<3.55
	890424	74.7	<0.63	<4.74
	890718	66.0	<1.76	12.9
	891217		0.9	3.2
	910630		<1	2.0
	910630		<1	1.0
	910630		<1	<1
	910630		1.0	4.0
	910630		<1	<1
	910630		<1	2.0
	911231		<1	2.0
	911231		2.0	5.0
	911231		<1	3.0
	911231		<1	2.0
	930108		<1	<1
GEORGIA PACIFIC CO WOODLAND	940530		<5.0	<5.0
	941222		<5.0	11.9
	950331		<5.0	14.3
	950630		<5.0	<5.0
	950930		<5.0	24.5
	951231		<1.0	3.4
HARTLAND WASTEWATER TREATMENT PLANT	881007	65.0	<2.86	<1.71
	881221	65.5	<7.25	E6.09
	890312	64.3	<0.28	5.6
	890627	63.3	<1.36	6.5
HAWK RIDGE COMPOST UNITY (compost)	1989-90	nean n=(	6.6	15.9
	1991	(1.6-13)		mean n=4
	900420		2.9	15.0
	900507		3.4	6.0
	900628		3.4	31.0
	900712		5.0	40.0
	900817		3.4	31.0
	900820		3.0	30.0
	900820		5.0	40.0
	901010		<5	30.0
	910115		0.6	6.4
	910207		4.0	59.5
	910806		1.6	15.0
	920123		2.6	18.0
	920318		<1	
	920715		<2.0	34.0
	920818		<1.0	18.0
	921007		2.2	23.0
	930111		<2.2	12.0
	930406		1.7	16.0
	930629		1.7	22.0
	931213		3.4	28.0
	940101		2.6	27.0
	940422		<1.0	12.0
	940422		<1	9.1
	940725		1.6	13.0
	941024		<2.4	13.0
			4.9	33.0
	950724		<1	12.0
	951012		1.1	12.0
	960131		<1	8.8
	960501		<1	6.6
	960709		<1	7.6
	961007		1.4	10.0
	970110		<1	1.5
	970305		<1	3.6
	970725		<1	3.8
	971014		<1	3.8

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
INTERNATIONAL PAPER CO JAY	850621		51.3W	
	870115		190.0	760.0
	880218		24.0	130.0
	880219		23.0	121.0
	880223		14.0	75.0
	880225		57.0	250.0
	880226		15.0	79.0
	880227		13.0	79.0
	881231		16.6W	143W
	890124		15W	77W
	890126		28.0	112.0
	890323		7.7W	42.6W
	890417		24.0	150.0
	950712		7.2	39.0
	960125		2.6	16.0
	960126		2.8	16.0
	960227		<1.0	14.0
	960228		2.3	14.0
	961015		<1	4.0
	961016		<1	5.4
	961126		4.6	22.0
	961127		2.7	12.0
KENNEBEC SANITARY TREATMENT DISTRICT WATERVILLE	870713			
	871105			
	880118			
	880322			
	880518			
	880921			
	890711			
	891011			
	900410		E7.9	121.0
	900824		3.3	54.0
	901101		3.6	12.0
	901221		3.5	6.7
	901221		3.5	19.0
	910408		<2.3	<3.3
	910606		<2.9	<5.0
	910808		2.3	53.0
	910911		3.1	4.1
	920226		2.6	20.0
	920708		<1.0	11.0
	930914		1.1	6.3
	941021		<1.0	8.2
	951113		<1	1.3
	960924		<1	<1
	971010		<1	12.0
	990120		<1	<1
	990915		<1	<1
KIMBERLY-CLARK WINSLOW	871008		36.0	
	871201		13.5	
	880331		25.0	219.0
	880630		19.0	177.0
	880930		22.0	189.0
	881231		17.0	181.0
	890331		18.0	177.0
	890628		14.0	89.0
	890927		11.0	67.0
	891231		13.0	115.0
	900201		12.0	86.0
	900628		12.0	94.0
	900928		9.4	76.0
	901231		7.2	63.0

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
KIMBERLY-CLARK WINSLOW	910214		12.0	86.0
	910411		8.3	100.0
	910630		4.6	62.0
	910930		6.5	69.0
	911101		6.5	63.2
	911203		6.3	68.1
	920225		6.5	72.1
	920623		5.2	55.0
	921006		5.1	60.0
	921228		7.2	59.0
	930317		4.7	47.0
	930629		4.2	37.0
	930917		3.9	42.0
	931231		5.2	44.0
	940101		3.5	31.0
	940401		3.7	27.0
	940909		4.9	33.0
	941231			30.0
	950331		4.4	42.0
	950608		<1	24.0
	950930		2.2	25.0
	951231		3.0	34.0
	960122	RWT	3.0	34.0
	960410		3.1	29.0
	960702		4.4	36.0
	960702D		1.6	17.0
	961030		2.4	18.0
	961030D		<1	17.0
	970318	RWT	2.4	16.0
	970616	RWT	1.4	16.0
	971104	RWT	1.3	23.0
KITTERY WWTP	990319		<0.4	5.2
LEWISTON-AUBURN TREATMENT PLANT	871231		<1.0	ean for year (n=4
	881031		0.0	
	900809		E10	9.0
	910306		<7.3	<7.3
	920610		<0.8	4.5
	930625		<1	4.4
	930922		<2.7	<2.5
	950405		<2.2	0.8
	960625		<1	<1
	961202		<1	21.0
	990730		1.0	6.9
LINCOLN PULP & PAPER CO LINCOLN	881119		48W	223W
	890123	80.9	44.0	203.0
	890123		44.0	173.0
	890407	85.1	49.0	298.0
	890407		41.0	219.0
	890831	83.5	182.0	640.0
	890831		156.0	625.0
	890831		41.0	220.0
	890831		59.0	294.0
	921231		20.4	91.6
	931014		9.1	187.5
	940331	PRI SL	14.9	154.0
	940331	SEC SL	97.1	734.0
	960302		<0.4	<0.3
	960419		4.2	21.7
	960431		4.2	25.1

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
MEADE PAPER RUMFORD	850621		32.0	
	880602		105.0	674.0
	890108	77.1	114.0	569.0
	890407	73.1	46.5	184.0
	890628	76.8	E9.91	134.0
OAKLAND TREATMENT PLANT	910304		<2.5	10.0
	910329		<5	10.0
	920415		<1.0	<1.0
	920415		<1	<1
	930408		<1.0	<1.0
	930501		<1.0	11.0
	940426		<1.0	<1.0
OLD TOWN	880525		<3.0	<3.0
	900212		<2.2	16.7
	910918		<2.9	6.6
	910918		<2.2	
ORONO TREATMENT PLANT	900316		2.1	
	900412		8.5	
	901001		3.5	9.2
	901021		3.9	
	910324		<2.1	9.5
	910918		<2.9	6.6
	920323		<0.6	7.6
	920328		9.4	
	920915		<0.5	5.4
	921015		1.1	
	930427		1.3	
	930427		<0.5	3.4
	940502		<0.6	2.5
PERC	910417		<2.0	9.9
PORTLAND WATER DISTRICT PORTLAND	861205			
	870402			
	871124			
	880913			
	891206		E1.2	11.3
	891206		1.6	14.5
	901002		<3	10.0
	901002		<3	20.0
	910826		<64	<32
	910828		<66	<140
	920715		<1.1	6.4
	920715		0.9	7.6
	930719		<1	2.3
	930719		<1.1	<3.2
	940718		<1.0	0.8
	950727		0.5	1.0
	960807		<0.7	<0.1
	980811		<0.4	3.4
	980514		<1	<1
	990602		<1	5.6
WESTBROOK WWTF	861205			
	870402			
	871119			
	891205		E1.6	14.5
	901001		<3.0	9.0
	910826		<64	<32
	920714		<1.1	7.6
	930719		<1.0	3.2
	980811		<0.2	4.1

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
REGIONAL WASTE SYSTEMS PORTLAND	890111	ash	5.5	28.0
	890112	ash	6.0	24.0
	890113	ash	10.0	50.0
	890114	ash	10.0	20.0
	890121	ash	6.0	90.0
	900211	ash	E20	210.0
ROBINSON MANUFACTURING OXFORD	870113		10.1	17.5
	880419		<0.4	<0.2
	881004		<7.3	<9.6
	890119		<0.39	<1.2
	890119D		<2.1	<1.1
	910226		<3.0	<3.0
	910305		<3	<0.3
	910308		<3	<3
	910323		<5	<5
	910323		<3	<3
	920610		<1.2	<1.0
	960216		<1	0.1
	960315		<1	4.2
	970220		<1	<1
	980218		<1	<1
SAPPI -SOMERSET	861217		<2	47.0
	870519		13.0	21.0
	870930			
	871215		60.0	
	880325		27.0	88.0
	880630	EPA	67.0	33.0
	881014		40.0	98.0
	881220		54.0	177.0
	890303		54.0	92.0
	890629		23.0	53.0
	890926		<.8	16.0
	891205		18.0	52.0
	900314		<18	23.0
	900620		35.0	73.0
	900916		45.0	86.0
	901215		39.5	115.0
	910324		23.1	51.0
	910626		39.4	146.0
	910910		69.9	260.0
	920624		33.0	856.0
	920923		20.0	39.0
	921218		15.0	45.0
	930107		11.0	31.0
	930616		23.0	73.0
	930916		56.0	170.0
	931229		42.0	110.0
	940108		31.0	95.0
	940627		33.0	89.0
	940926		12.0	36.0
	941212		11.0	20.0
	950313		3.6	15.0
	950510		3.3	11.0
	950914		9.6	25.0
	951120	comb	1.2	4.2
	960327		2.0	9.6
	960624		5.1	13.0
	960910		5.2	11.0
	961014		5.2	15.0
	970319		5.5	26.0
	970624		8.5	36.0
	970917		<.71	2.0
	971216		<.28	0.7

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
SAPPI -SOMERSET	980316		<.79	<6.2
	980527		1.0	2.5
	980928	dredging	6.6	18.0
	981208		<.4	0.7
SAPPI - WESTBROOK	850620		17.2	
	870929		31.0	
	871231		21.0	135.0
	880331		5.6	21.0
	880401		8.7	3.9
	880630		13.0	55.0
	881207		19.0	127.0
			19.0	69.0
	890106		<1.8	31.0
	890600		<1.2	13.0
	890600		5.3	35.0
	890600		<.2	0.2
	890600		<.4	8.8
	890600		69.9	60.0
	891031		5.0	30.0
	891130		3.0	30.0
	891231		7.0	50.0
	900131		6.0	20.0
	900228		2.7	24.6
	900331		5.1	33.6
	900430		5.9	34.6
	900531		5.3	25.8
	900630		19.0	26.0
	900730		5.2	20.6
	900831		2.9	12.1
	900930		2.5	10.0
	901231		7.7	35.7
	910917		70.0	275.0
	910331		3.4	21.5
	910630		2.9	19.6
	910930		3.8	14.2
	911231		2.4	25.1
	920331		1.2	19.4
	920505		1.6	10.8
	920821			24.5
	940131		0.9	11.6
	940324			12.3
	940728		2.1	17.3
	941213		5.3	29.2
	950329		1.2	20.0
	950602		1.0	10.1
	950911			18.3
	951120		1.1	23.3
	960304		?	68.0
	960625		4.5	49.0
	960805		?	52.0
	961210		?	32.0
	970224		2.8	64.0
	970519		?	38.0
	990113		4.0	61.0
	990407		2.9	36.0
	990728		1.0	14.0
	990830		<0.9	4.0
	990928		<1.0	2.8
	991013		<1.0	2.2

APPENDIX 3. TCDD AND TEDF IN SLUDGE FROM WASTEWATER TREATMENT PLANTS (dw)

LOCATION	DATE	%MOIST	TCDD ng/kg	TCDF ng/kg
S PORTLAND STP	880000		<8.65	<48
	900314		<5.3	<3.5
	900314		<2.7	<5.4
	910508			<10
	910531		<5	
	920401		<1.0	<0.8
	920428		<0.8	1.4
	920714		0.9	6.4
	930324		<2.8	<2.8
	940315		<1.0	3.9
	941005		8.7	48.0
	950405		<1	3.3
	960610		<1	5.3
	970616		<1	15.0
STATLER TISSUE CO AUGUSTA	880930	62.6	36.9	414.0
	881223	61.4	37.6	326.0
	890403	61.6	34.6	242.0
	890628	65.5	17.7	414.0

D=duplicate analysis

APPENDIX 4

2378-TCDD AND 2378-TCDF IN EFFLUENT FROM

MAINE WASTEWATER TREATMENT PLANTS

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
ANSON MADISON	920408	<3	<3
	921001	<3	20
BREWER	920624	<5.9	
	930429	<3.9	
	941129	7.4	
	950503	<3.6	
	960416	<10	
FORT JAMES	880630	39	
	890131	27	120
	890222	210	340
	890223	92	290
	890224	77	340
	890320		34
	890324		24
	890325	36	73
	890405	30	110
	890410	17	52
	890411	32	89
	890824	32	94
	890831	13	150
	890911	<4.1	14
	890915	<3.3	<8.1
	890921	<5.7	13
	890927	<5.3	9.7
	891011	<3	11
	891019	<5.2	14
	891102	<6	18
	891106	6.7	22
	891114	<9.5	<7.1
	891127	<6.4	20
	891206	<8.4	13
	891213	<8.3	20
	891221	<4.7	23
	900105	<6.8	<8.3
	900111	<9	<8.5
	900118	<5.9	6.1
	900125	<6.7	10
	900207	<4.6	17
	900214	<6.6	23
	900222	<7.3	15
	900301	<6	11
	900308	<3	12
	900315	<4	16
	900329	<7.4	14
	900407	<7.2	24
	900502	<7	19
	900729	<9.9	49

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)	TCDF (pg/l)
FORT JAMES	910330		17	70
	910430		19	65
	910530		9.5	41
	910630		6.8	43
	910830		11	66
	911030			7.9
	911130		<7.7	<16
	920330		<5.7	50
	920730		16	69
	920830		<4.9	23
	921030		<3.0	
	921230		4.8	
	930130		<5.0	14
	930330		<4.9	12
	930530		<4.2	11
	930630		<2.8	15
	930830		<1.6	9.2
	930930		<3.5	7.6
	931130		<3.1	32
	931230		<3.2	19
	940230		<4.8	7.7
	940330		<4.6	12
	940530		<1.5	<4.5
	940630		<3.5	9.2
	940830		<2.0	<4.8
	940930		<4.6	<6.8
	941130		<9.5	<10
	941230		<1.1	5.8
	942730		<1.1	5.8
	950130		<2.4	8.2
	950119		<2.4	8.2
	951230		<1.1	5.8
	950430		<1.4	5.6
	950430		8	36
	950421		<1.4	5.6
	950622		<2	6.8
	950928		<3.8	8.1
	951129		<5.4	13
	951228		<1.4	6.2
	980115	BPA	<2.8	<5.8
		BPB	<11	53
	980130		<3	9.4
		BPA	<2.9	18
		BPB	<2.8	8.9
	980219	BPA	<1.7	12
		BPB	<3.9	39
	980230		<2.6	8.7
	980328	BPA	<5.8	11
		BPB	<5.2	13

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
FORT JAMES	980330		<2		9.1
	980730		<3		<4
	980830	BP	<3.5	BP	<4.2
	980930		<3.2		<4.8
		BP	5.9	BP	28
	981030		<3.2		<4.8
		BP	<3.5	BP	<4.2
	981130		<5.5		<5.4
		BP	<3.4	BP	<4.6
	981230		<1.6		8.7
		BP	<3.1	BP	6.5
	990130		<3.4		<2.6
		BP	<3	BP	<3.9
	990230		<10		<10
		BP	<10	BP	<10
	990330	BP	<2.3	BP	<1.8
	990530		<1.9<4.7		<2.9<3.3
		BP	<3.2	BP	<4.8
	990630		<1.3		<1.8
		BP	<2.3	BP	7.3
	990730		<.93		<1.4
		BP	<2.6	BP	<1.8
	990930		<.68		<2.1
		BP	<1.3	BP	<5
	991030		<2.5		<2.1
		BP	<3	BP	<3.6
GEORGIA PACIFIC	880101		6.8		25
	900316		<5		4
	900423		<3		<6
	900531		<8		<5
	900619		<3		<1
	900716		<1		<3
	900807		<2		<5
	910630		<10		<10
	910630		<10		<10
	910630		<11		<11
	910630		<11		<11
	910630		<11		<11
	910630		<11		<11
	910630		<10		<10
	910630		<11		<11
	910630		<11		<11
	911231		<10		<10
	911231		<10		<10
	911231		<11		<11
	911231		<11		<11
	911231		<10		<10
	911231		<11		<11

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
GEORGIA PACIFIC	911231		<10		<10
	911231		<11		<11
	911231		<11		<11
	930408		<10		<10
	930506		<10		<10
	930713		<10		<10
	940530		<10		<10
	941222		<10		<10
	950331		<10		<10
	950630		<10		<10
	950930		<10		<10
	951231		<10		<10
	980330				60
	980421		<10		60
	980825		<10		40
		BP	<10	BP	10
	981230		<10		<10
		BP	<10	BP	<10
	990430		<10		<10
		BP	<10	BP	<10
	990930		<4		<3
			<2		<6
		BP	<2ALK<4ACID	BP	<2ALK<7ACID
		BP	<5ALK<3ACID	BP	<4ALK<3ACID
	991030		<5		<3
		BP	<7ALK<5ACID	BP	<8ALK<3ACID
	991130		<1		<6
		BP	<1ALK<2ACID	BP	<5ALK<3ACID
INTERNATIONAL PAPER	880101		88		420
	880715		30		150
	890307		30		100
			E6		E20
			E20		E20
	890310		16		74
	890616		<8		980
	890621		17		140
	890713		<16		50
	890720	DEP	30		150
	890818		20		110
	900413		<10		90
	910924		<10		60
	910926		<10		60
	911129		50		210
	911219		<20		<80
	920125		20		110
	920126		20		110
	920127		30		100
	920128		30		100

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
INTERNATIONAL PAPER	920129		13.7		49.9
	920312		19.3		65.6
	920320		14.8		73.9
	920423		<13.9		59.1
	920610		<5.7		29.5
	920617		<6.3		30.8
	920723		<8.4		33.6
	920819		6.6		29.7
	920923		<2.6		<2.0
	921111		<6.1		22.4
	921202		<2.6		<14.4
	930125		5.4		19.6
	930222		<5.3		25.5
	930420		<2.0		16.7
	930527		4.3		10.3
	930716		<5.2		28.9
	930826		<5.3, <6.5		21.5, 19.2
	930910		<8.6		9.4
	931022				19.5
	931119		<3.6		19.5
	931224		10.9		31.1
	940125		<4.1		21.6
	940226		7.3		38
	940422		7.7		41.1
	940520		4.1		25.6
	940722		<3.4		16.7
	940829		<7.9		31.8
	941027		<3.4		25.3
	941125		<6.8		24.4
	950126		<5.0		20.9
	950222		<3.6		21.4
	950420		<2.5		25.6
	950527		<1.8		24.1
	950724		<3.2		16.1
	950826		<4.9		7.5
	950929		<6.0		15.4
	951020		<8.5		12.9
	951122		<3.8		10.5
	960228		<10		6.5
	960430		<10		12.8
	960530		<10		15.7
	961030		<10		7.7
	961130		<10		<10
	970130		<10		<10
	970228		<10		11.5
	970330		<10		<10
	970330	BPA	<6.2	BPA	<6.3
		BPB	<5.1	BPB	<3.7
	970430		<10		14.4

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
INTERNATIONAL PAPER	970522	BPA	4.9	BPA	5.6
		BPB	10.9	BPB	9.6
	970406	BPA	<4.9	BPA	10.9
		BPB	<5.6	BPB	9.6
	970630		<10		6.8
	970730		<10		<10
	970728	BPA	<5.2	BPA	11.5
		BPB	<5.4	BPB	6.3
	970830		<10		<10
	971030		<10		
	971013	BPA	<4.3	BPA	<5
		BPB	<7.2	BPB	<8.3
	971130		<10		
	980117		<2.1		7.1
	980126	BPA	<3.5		<3.2
		BPB	<1.2		<1.7
	980221		<3.7		<3.7
	980406	BPA	<0.6		<2.3
		BPB	<1.4		<1.3
	980516		<3		8
	980613		<1.4		<2.2
	980706	BPA	<2.8		19
		BPB	<1.2		4.8
	980711		<2.3		4.9
	980814		<2.2		<1.1
	981012	BPA	<2.0		45
		BPB	<2.9		<1.6
	981016		<2		5.1
	981116	BPA	<6.8		9.9
	981119		<7		<8.6
	981130	BPB	<3.3		<5.2
	990117		<2.8		3.6
	990112	BPA	<.99		54
		BPB	<.97		4
	990312		<3		7.4
	990304	BPA	<2.1		9.7
		BPB	<2.7		<5.9
	990412		<5.9		18
	990408	BPA	<2.6		7.4
		BPB	<5.5		<5
	990618		<5.1		<4.2
	990622	BPA	<8.6		<9
		BPB	<3.3		<4.1
	990723		<2.2		<1.6
	990720	BPA	<2.9		130
		BPB	<2.5		<2.3
	990917		<6.2		<6.5
	990913	BPA	<3.8		<1.6
		BPB	<3.4		<1.4

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
INTERNATIONAL PAPER	991008		<5.6		6.6
	991005	BPA	<2		<1.6
		BPB	<3		<1.3
	991112		<2.7		<6.5
	991110	BPA	<2.7		<4
		BPB	<2.1		<2.1
HARTLAND	960530		<0.06		
KIMBERLY-CLARK	930308		<10		<12
	930623		<4.6		<3.9
LINCOLN PULP AND PAPER	881130		32		130
	920817		11.2		69.8
	920908		<11		27.3
	921117		7.7		39.1
	921216		<1.9		9.5
	931230		<5.5		<17.3
	940417		1.9		7.5
	950824		1.3		8.5
	960409		1.3		8.5
	970116	BP	25.4	BP	103
	970212	BP	11	BP	43.1
	970522	BP	11.4	BP	27.6
	970813	BP	6.4	BP	14.4
	971001	BP	1.6	BP	1.9
	971231	BP	<2.4	BP	<3.83
	980330	BP	<3.4	BP	<3.7
	980430	BP	<10	BP	13.2
	980630	BP	<8.9	BP	<4
	980830	BP	<7.1	BP	<7.6
	980930	BP	<2.3<4.1	BP	<2.3<3.2
	981130	BP	<2.6<4.9	BP	<2.7<3.6
	981230	BP	<1.5	BP	<1.3
	990230	BP	<1.1	BP	<2.1
	990330	BP	<2.5	BP	<3.8
	990430	BP	<2.8	BP	<3.2
	990630	BP	<4.4	BP	<4.5
	990830	BP	<4.3	BP	<2.8
	990930	BP	<1.3	BP	<.44
	991030	BP	<2.3	BP	<2.2
	991130	BP	<3	BP	<2.9
MEADE PAPER	880518		120		570
	890301		25		80
	890807		<6		20
	890810		<13		20
	890814		<5		13
	890817		<5		18

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
MEADE PAPER	890821	<8	21
	890824	<5	10
	890829	<5	18
	890831	<11	20
	890905	<11	20
	890907	<9	18
	891023	<3	7
	891026	<5	6
	891222	<5	20
	900216	<2	6
	900216	<1	7
	900515	<10	<8
	900515	<1	5
	900627	<3	8
	900627	<3	9
	920217	<4.6	14
	920221	<4.6	13
	920311	<4.6	9.9
	920316	3.2	8.7
		3.5	12
		4.6	17
	920326	4.5	8.5
	920412	6.3	24
	920613	<4.6	6.8
	920708	<4.6	<5.8
	920831	<4.6	3.5
	920904	<3.8	
	921104	<3.7	
	921201	<2.4	
	930105	<2.4	
	930201	<2.4	<10
	930401	<2.8	<10
	930501	<2.4	<10
	930701	<3.9	12
	930801	<2.8	<3.4
	931001	<3.2	<10
	931101	<3.9	<3.6
	940130	<2.8	<5.2
	940219	<1.9	<1.3
	940417	<3.3	<2.4
	940509	<3.6	<1.2
	940728	<3.7	<1.7
	940829	<2.7	<2.0
	941024	<2.1	<1.1
	941205	<2.7	<1.8
	950131	<10	<10
	950229	<10	<10
	950430	<10	<10

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)		TCDF (pg/l)
MEADE PAPER	950531		<10		<10
	950731		<10		<10
	950831		<10		<10
	951031		<10		<10
	951130		<10		<10
	960130		<10		<10
	960330		<10		<10
	960430		<10		<10
	960530		<10		<10
	960730		<10		<10
	960830		<10		<10
	961030		<10		<10
	961130		<10		<10
	970317		<10		<10
	980130		<10		<10
	980230		<10		<10
	980430		<10		<10
	980530		<10		<10
	980609	BP	<10		<10
	980730		<10		<10
	980830	BP	<10		<10
	981030	BP	<10		<10
	981130	BP	<10		<10
	990130		<10		<10
		BP	<10	BP	<10
	990230		<10		<10
		BP	<10	BP	<10
	990430		<10		<10
		BP	<10	BP	<10
	990530		<10		<10
		BP	<10	BP	<10
	990730		<10		<10
		BP	<10	BP	<10
	990830		<10		<10
		BP	<10	BP	<10
	991030		<10		<10
		BP	<10	BP	<10
	991130		<10		<10
		BP	<10	BP	<10
SAPPI - SOMERSET	880630		16,19		63,100
	900710		<7.1		8.4
	900716		<6.1		5.9
	dup		<5.5		<7.3
	900724		<3.6		<3.9
	930105		<3.4		9.2
	930224		<4.7		15
	930311		<4.0		10
	930409		6.8		18

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE		TCDD (pg/l)	TCDF (pg/l)
SAPPI - SOMERSET	930616		6.3	14
	930917		7	17
	931203		7.6	19
	940107		<3.8	9.2
	940624		<10	13
	940923		<11	8.7
	941209		<4.6	6.6
	950310		9	11.6
	950505		<10.3	6.6
	950616		<3.9	<9.4
	950807		5.8	14.5
	950911		2.8	15.3
	951124		<4.2	38.7
	951208		<7.4	29
	960112		<1.6	<2.3
	960209		<3.2	<4.8
	960405		<2.7	<2.7
	960610		<3.6	6.5
	960712		<3.0	4.2
	960809		5.8	15
	961108		<4.9	11
	961206		<4.1	9.7
	970103		<4.3	6.2
	970207		<2.0	7.5
	970411		<2.2	5.7
	970509		8.2	12
	970708	BP	<3.0	
	970711		<3.2	<2.9
	970805	BP	<2.9	
	970807	BP	<3.5	
	970815		<3	<3.3
	970820	BP	<3.7	
	980825	BP	<2.3	
	970916	BP	<2.6	
	971017		<9.1	<6.3
	971114		<3.8	<0.51
	980109		<3.5	<1.9
	980112	BP	<3.2	
	980206		<4.3	<2
	980410		<1.6	<1.6
	980608		<5.7	<1.7
	980810		<1.6	<2.5
	980911		<1.9	<2
	981009		<1.9	<1.9
	981106		<2.2	<1
	990210		<1.5	<1.2
	990310		<2.6	<2
	990410		<4.6	<3.3
	990510		<3.4	<4.5

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN EFFLUENT FROM WASTEWATER TREATMENT PLANTS

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
SAPPI - SOMERSET	990710	<3.5	<3.9
	990910	<7.3	<6
	991010	<4.1	<6.1
	991110	<2.2	<1.1
SAPPI - WESTBROOK	880101	6.3	
	1989	1	
	901118	<3	8
	910425	<5	<5
	910716	<8	<5
	911203	<8	<5
	920218	<2.8	7
	920507	<1.2	4.6
	920715	<5.8	<4.9
	921114	<1.8	3.9
	930303	<7.8	16
	930617	<1.5	<6.4
	930915	<2.4	5.7
	931208	<3.4	<7.3
	940130	<6.5	<9.8
	940324		<5.9
	940727	3.6	7.8
	941212	<6.0	<15.8
	950730	<5.4	9.8
	950615	<2.8	<9.9
	950815	<4.3	<21.9

APPENDIX 5

2378-TCDD AND 2378-TCDF IN SEDIMENTS

FROM VARIOUS STATIONS ON THE ANDROSCOGGIN RIVER

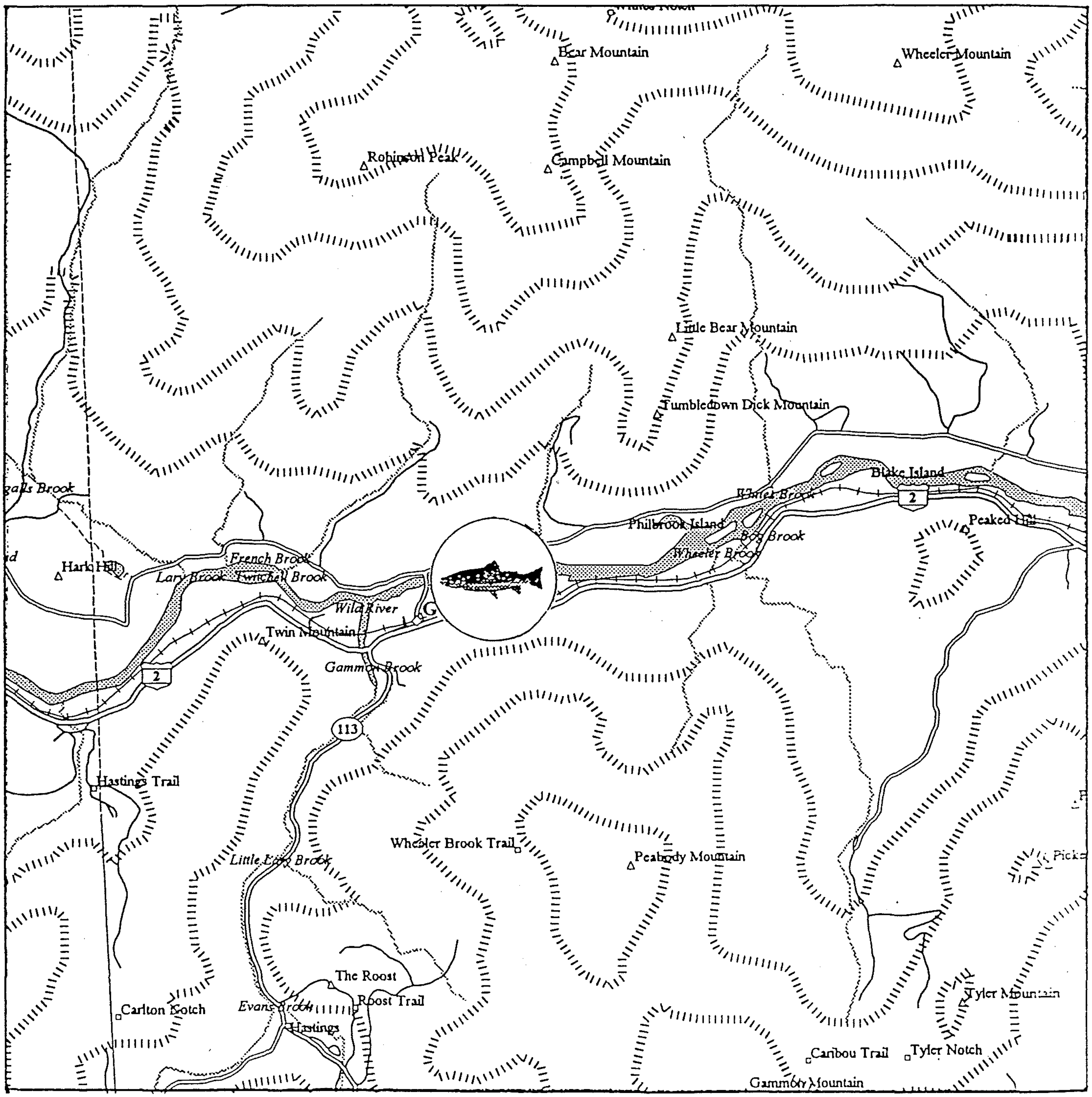
APPENDIX 5. 2378-TCDD AND 2378-TCDF IN SEDIMENTS FROM STATIONS ON THE ANDROSCOGGIN RI

LOCATION	DATE	2378-TCDD	2378-TCDF	% MOISTURE	% DOC
Virginia Impoundment Rumford N443147 W703217	910308	4.4	185		2.35
Riley Impoundment Jay N443002 W701458	910306	5.3	168		3.31
Otis Impoundment Livermore Falls N442846 W701213	910327	E6.8	162		2.85
Gulf Island Pond Turner N441520 W701050	850711	23.1			
Gulf Island Pond Turner N441420 W701125	850711	30.3			
Gulf Island Pond Turner N441225 W701210	850711	20.4			
Gulf Island Pond Greene N441040 W701240	850711	39.5 42.6dup			
Gulf Island Pond Greene N440932 W701222	910313	27.4	371		6.79
Worumbo Impound. Lisbon Falls N435950 W700405	910327	4.7	64.2		2.31
Brunswick below dam N435445 W695550	850711	2.5			
Brunswick Cow Island N435520 W695745	850711	1.7			

APPENDIX 6

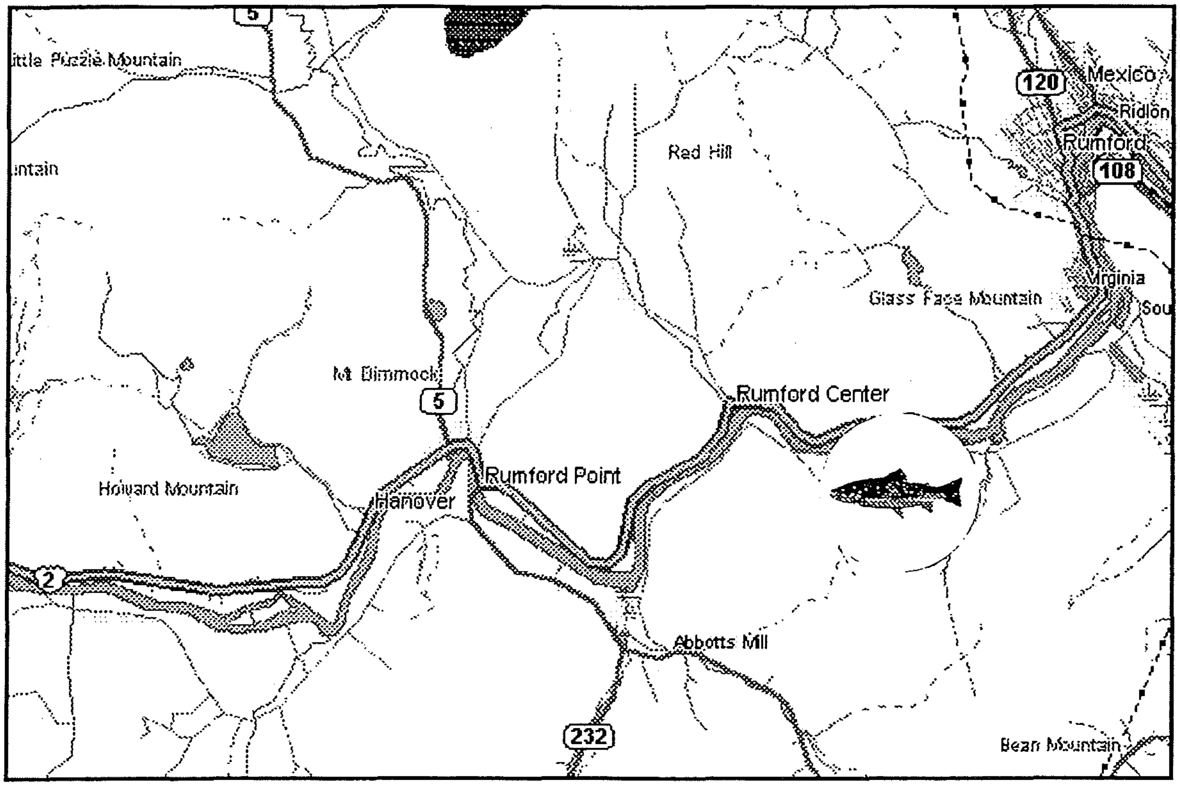
SAMPLE LOCATION MAPS

AGL ANDROSCOGGIN RIVER AT GILEAD

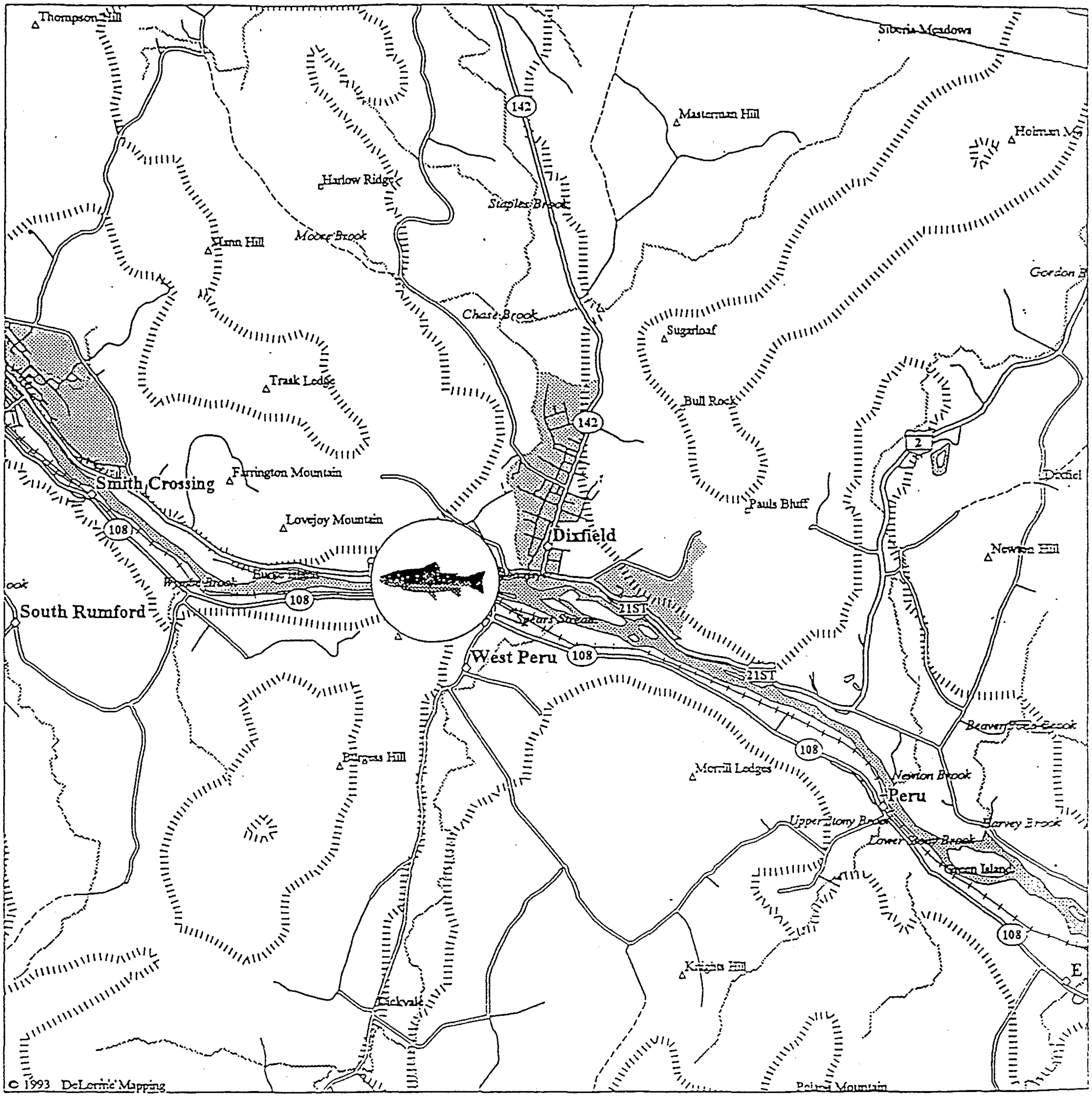


Androscoggin River at Rumford Point

ARP



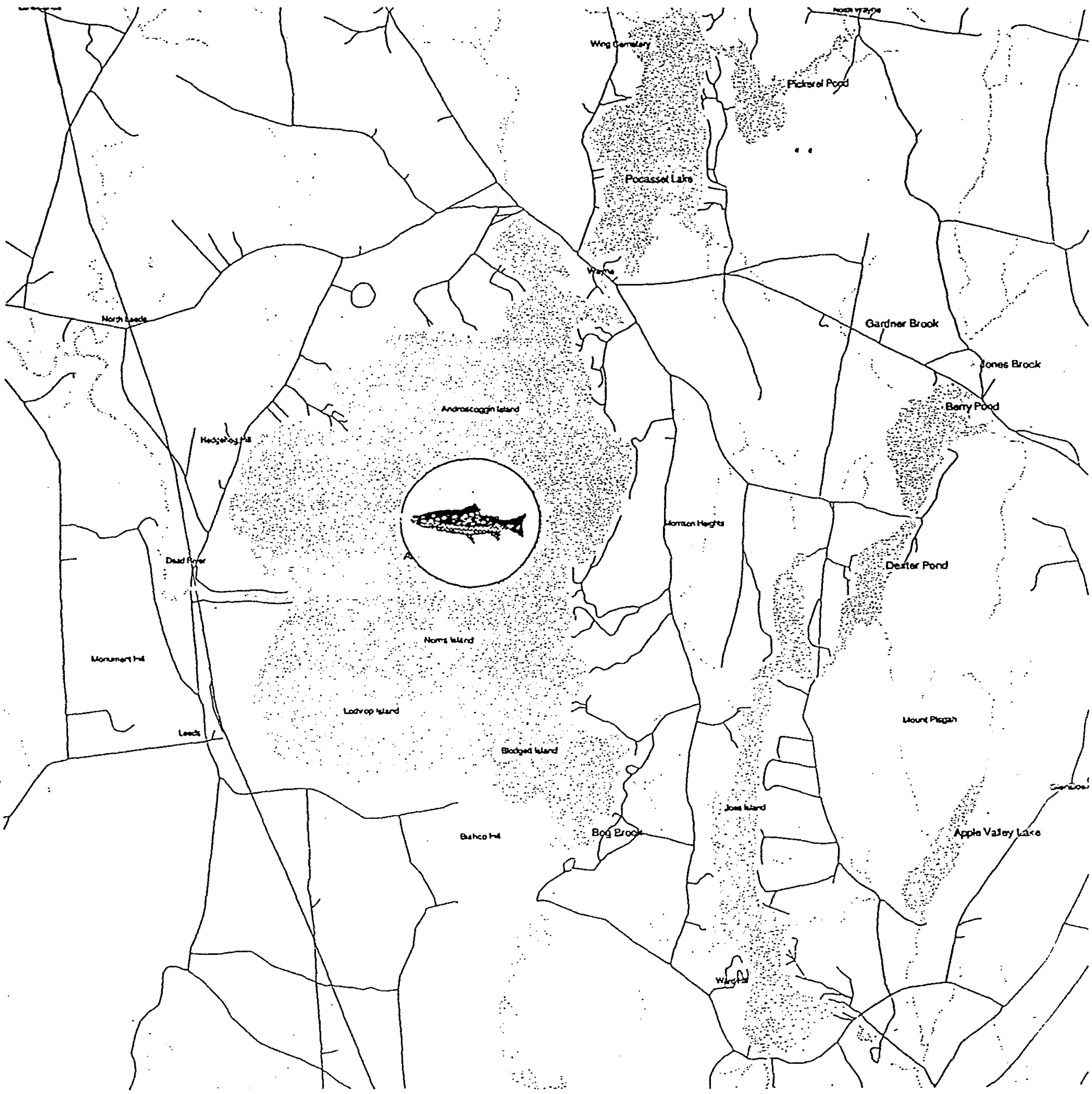
ARF ANDROSCOGGIN RIVER AT RUMFORD



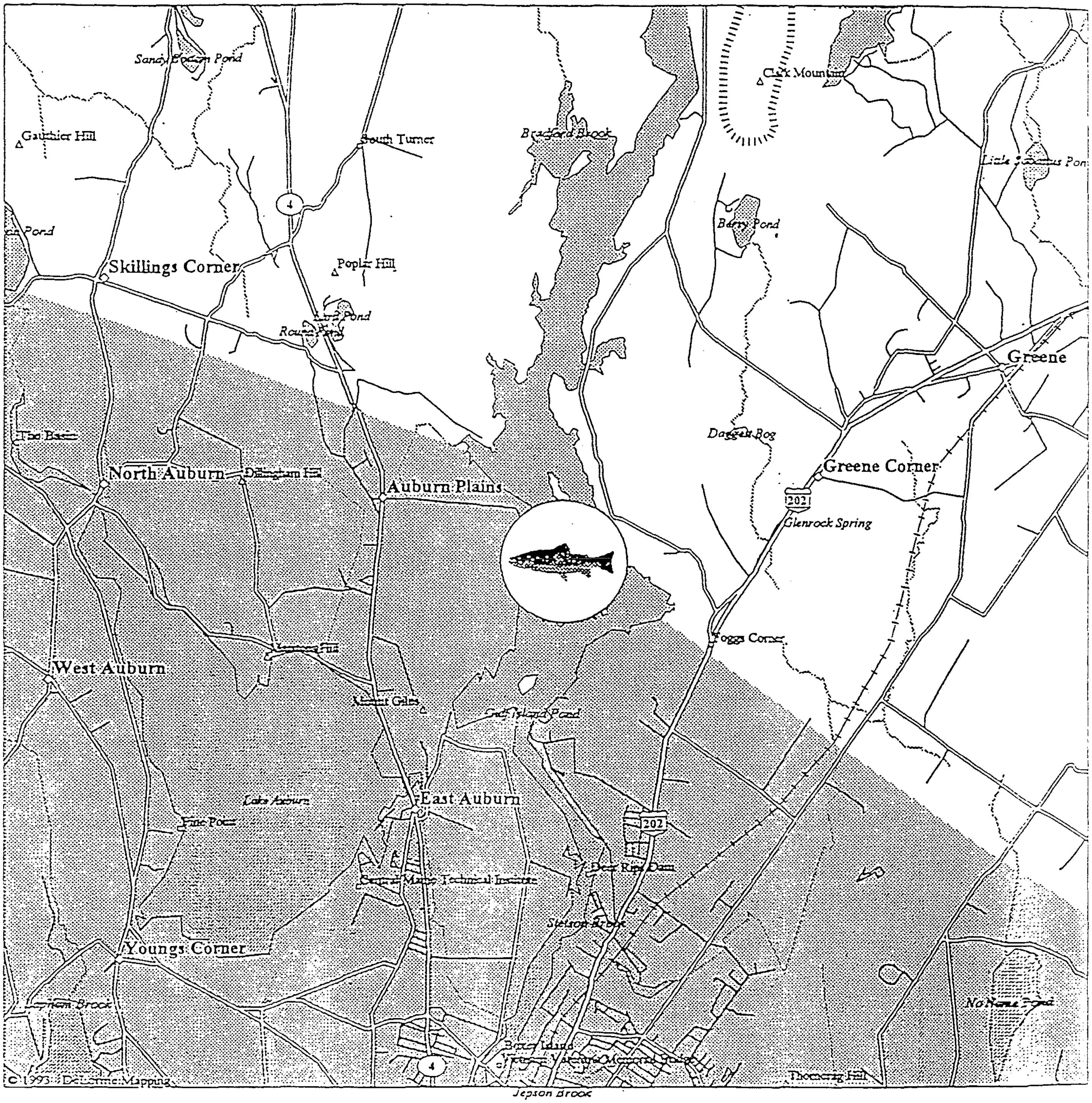
ALV ANDROSCOGGIN RIVER AT LIVERMORE FALLS

ARY ANDROSCOGGIN RIVER AT RILEY

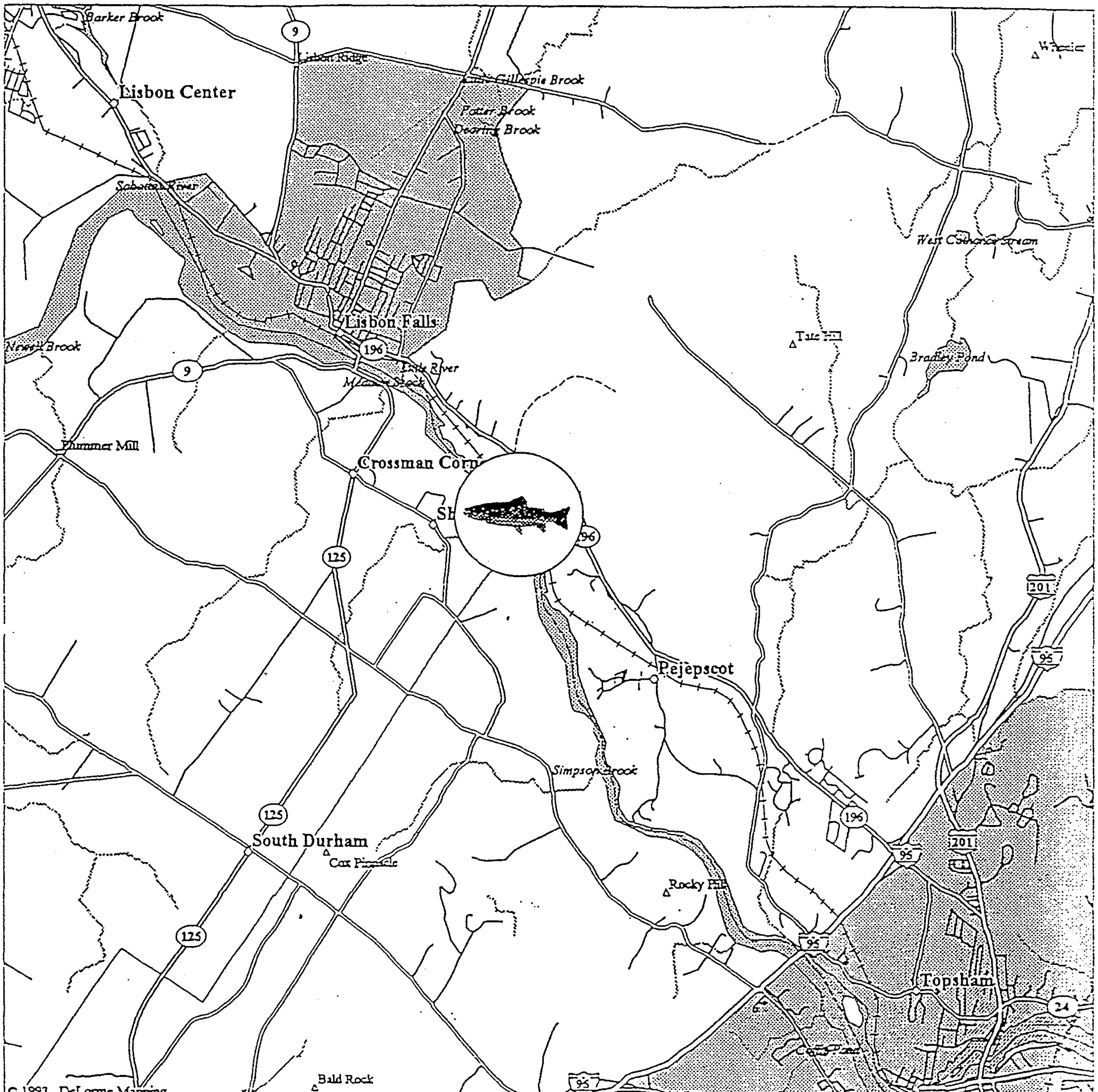
ALW Androscoggin Lake



AGI ANDROSCOGGIN RIVER AT GULF ISLAND POND, AUBURN

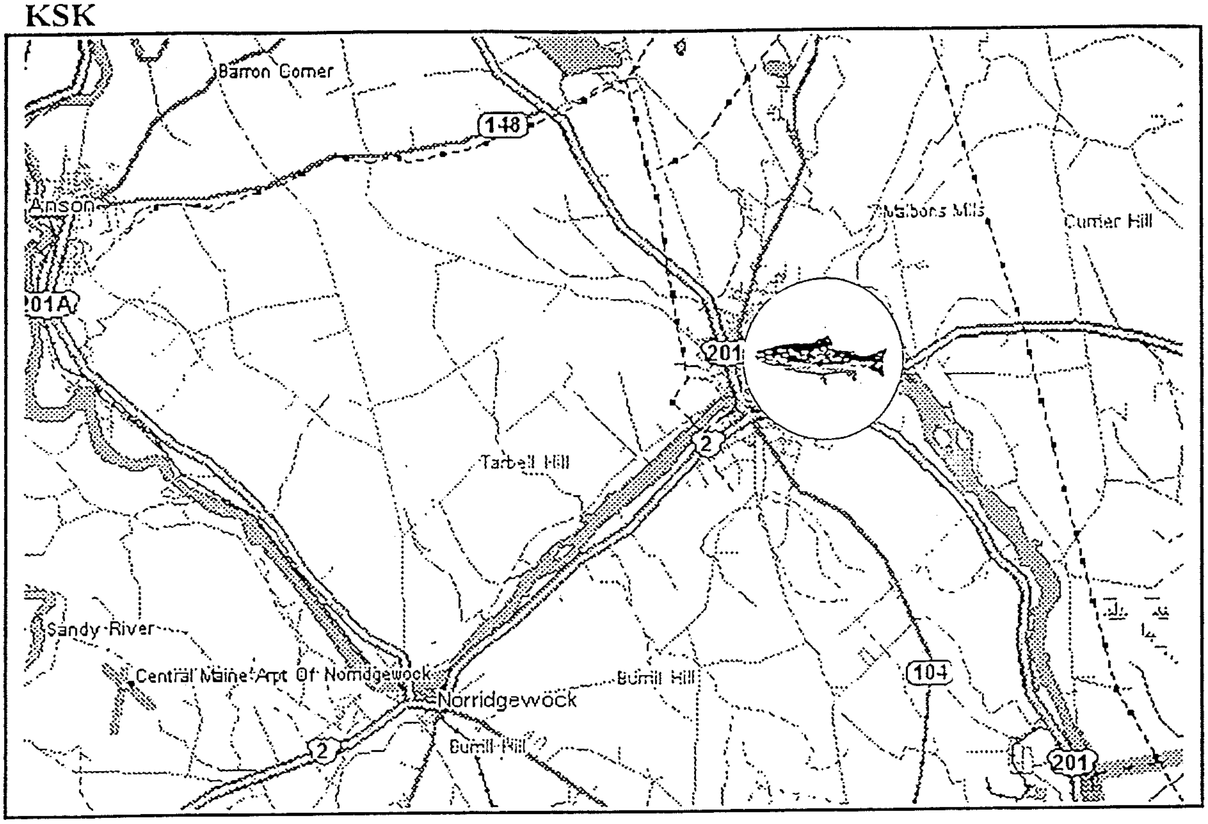


ALS ANDROSCOGGIN RIVER AT LISBON FALLS



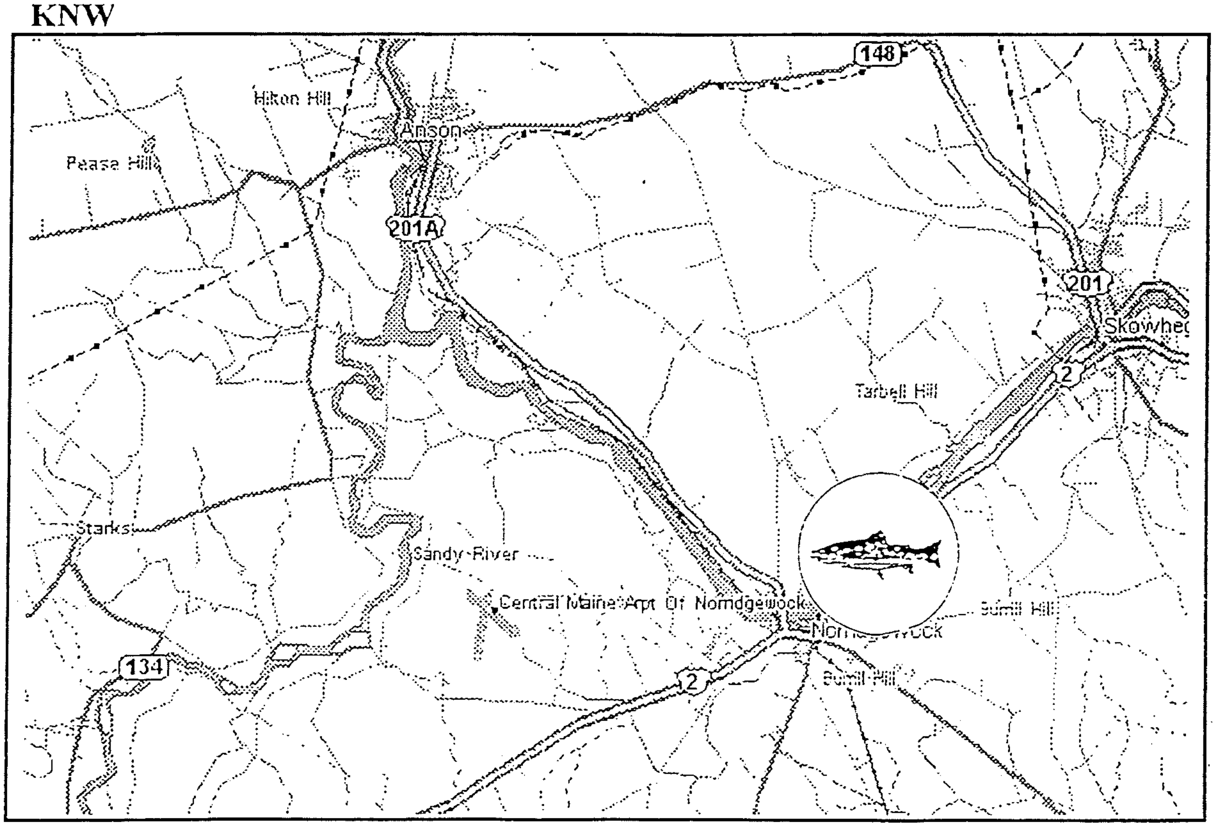
Kennebec River
Skowhegan

KSK



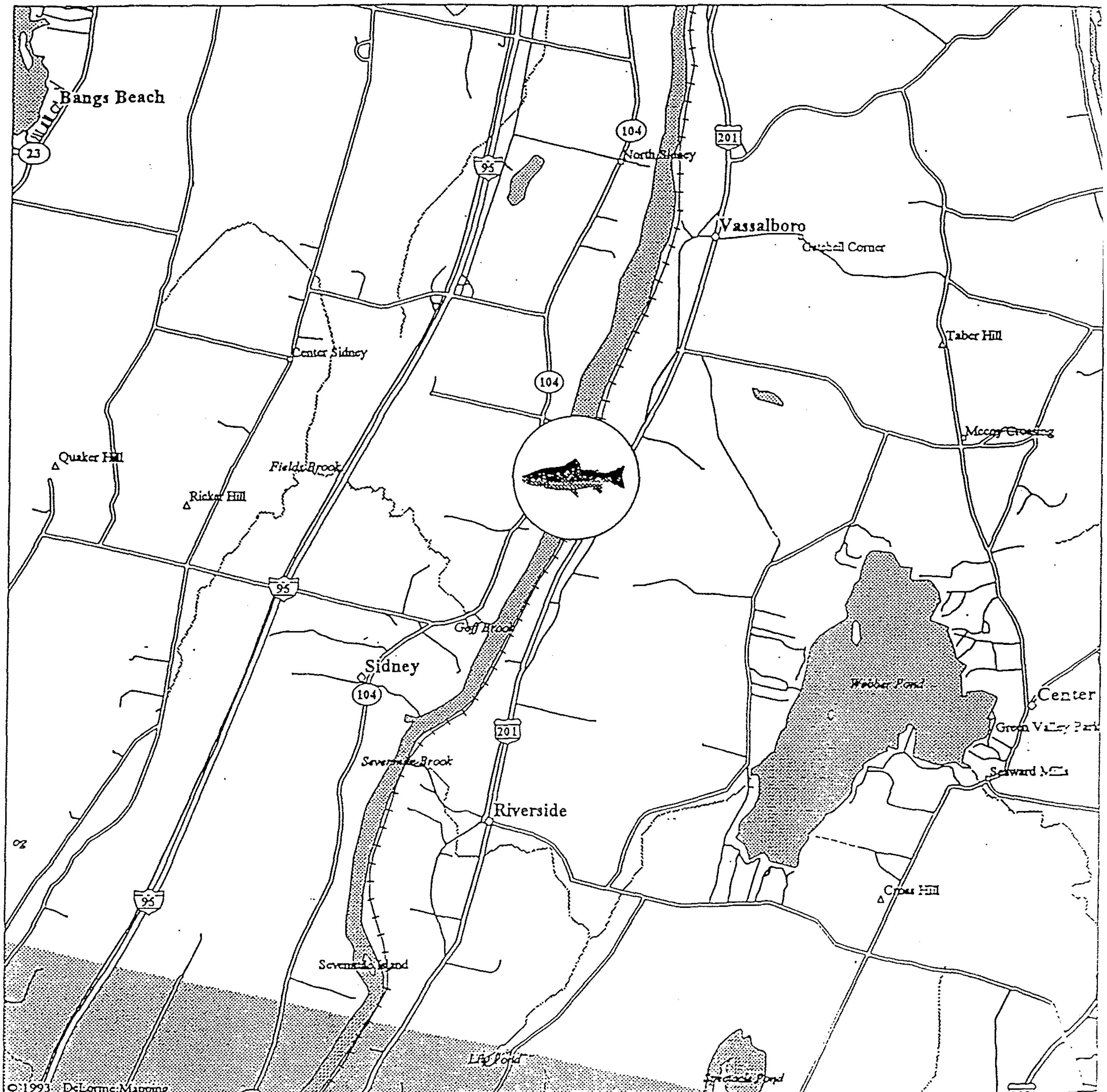
Kennebec River
Norridgewock

KNW



KFF KENNEBEC RIVER AT SHAWMUT, FAIRFIELD

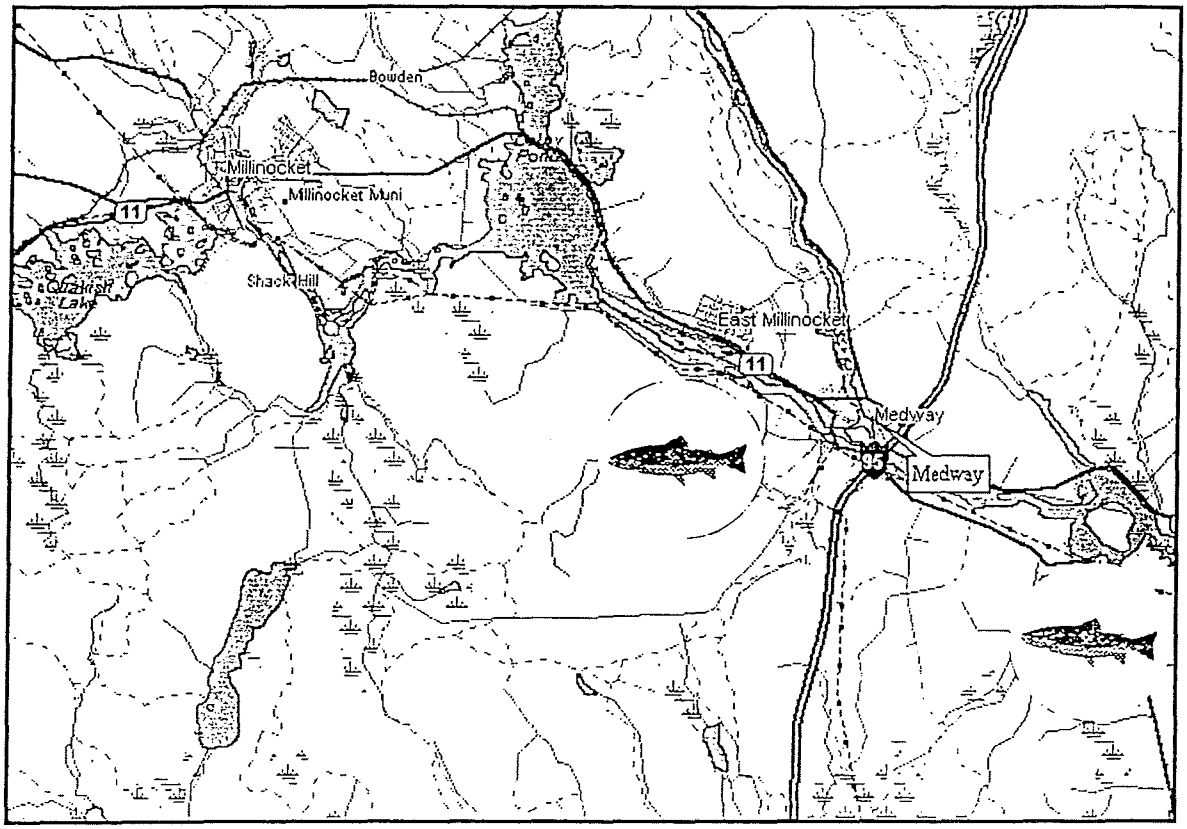
KSD KENNEBEC RIVER AT SIDNEY



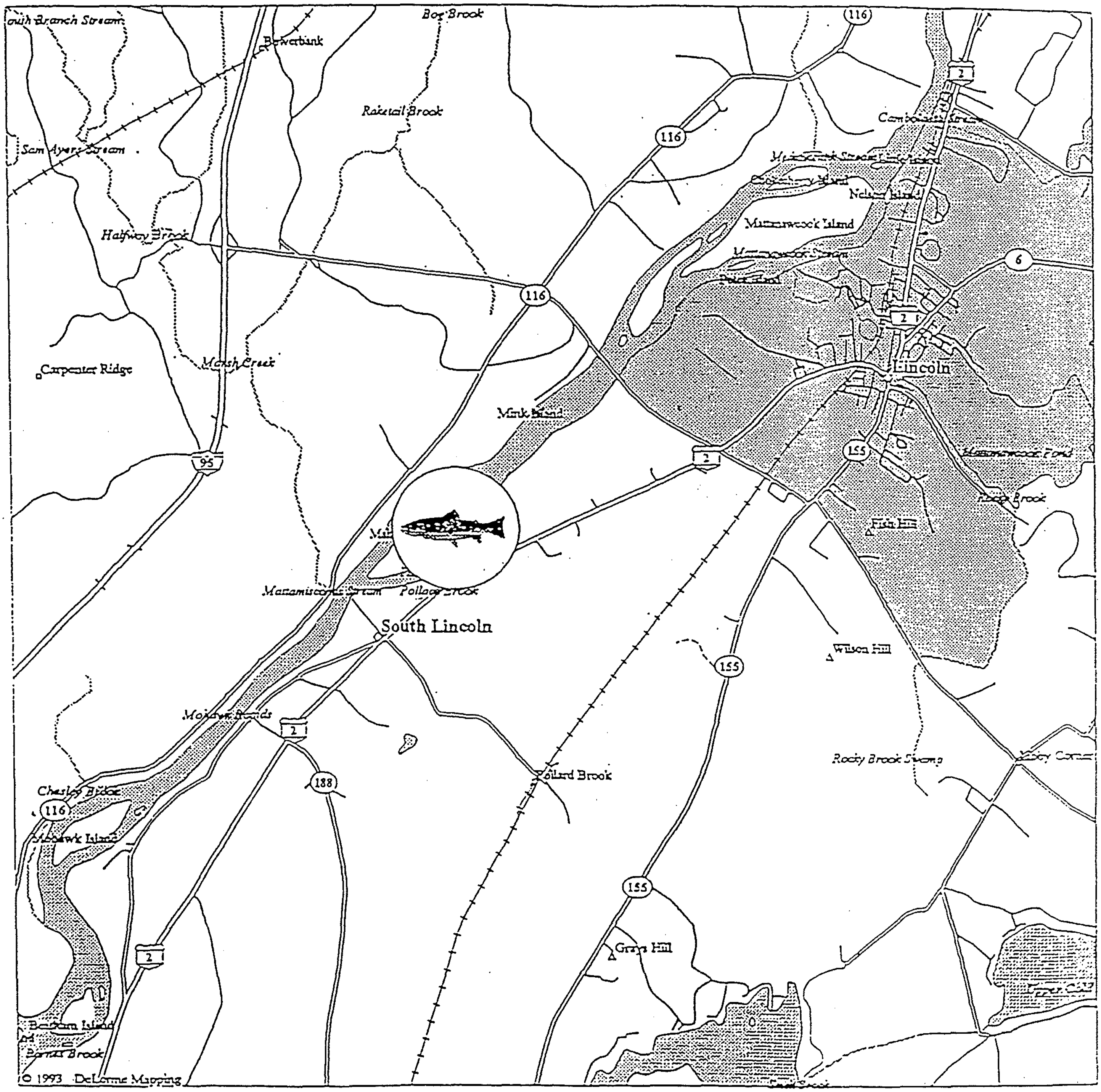
KAG KENNEBEC RIVER AT AUGUSTA

PBR **Penobscot River**
E.Millinocket

PBW **Penobscot River**
Woodville

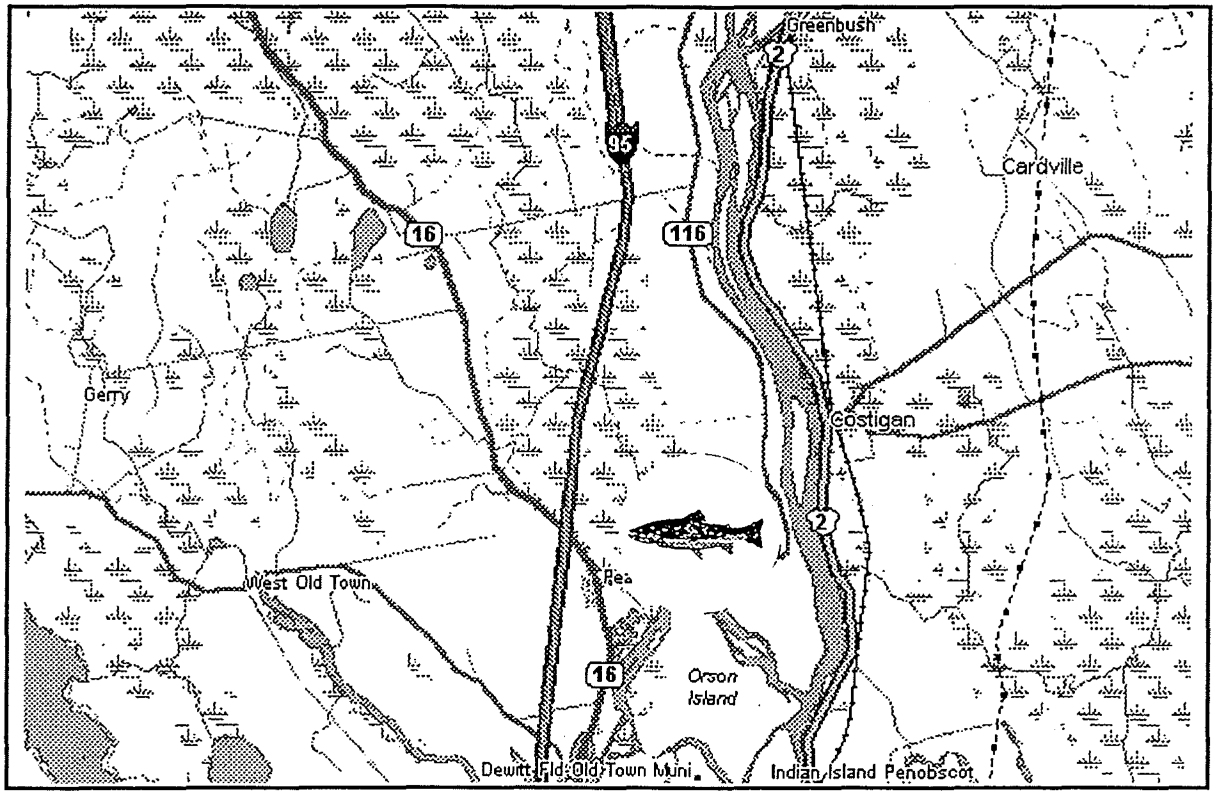


PBL PENOBSCOT RIVER AT SOUTH LINCOLN

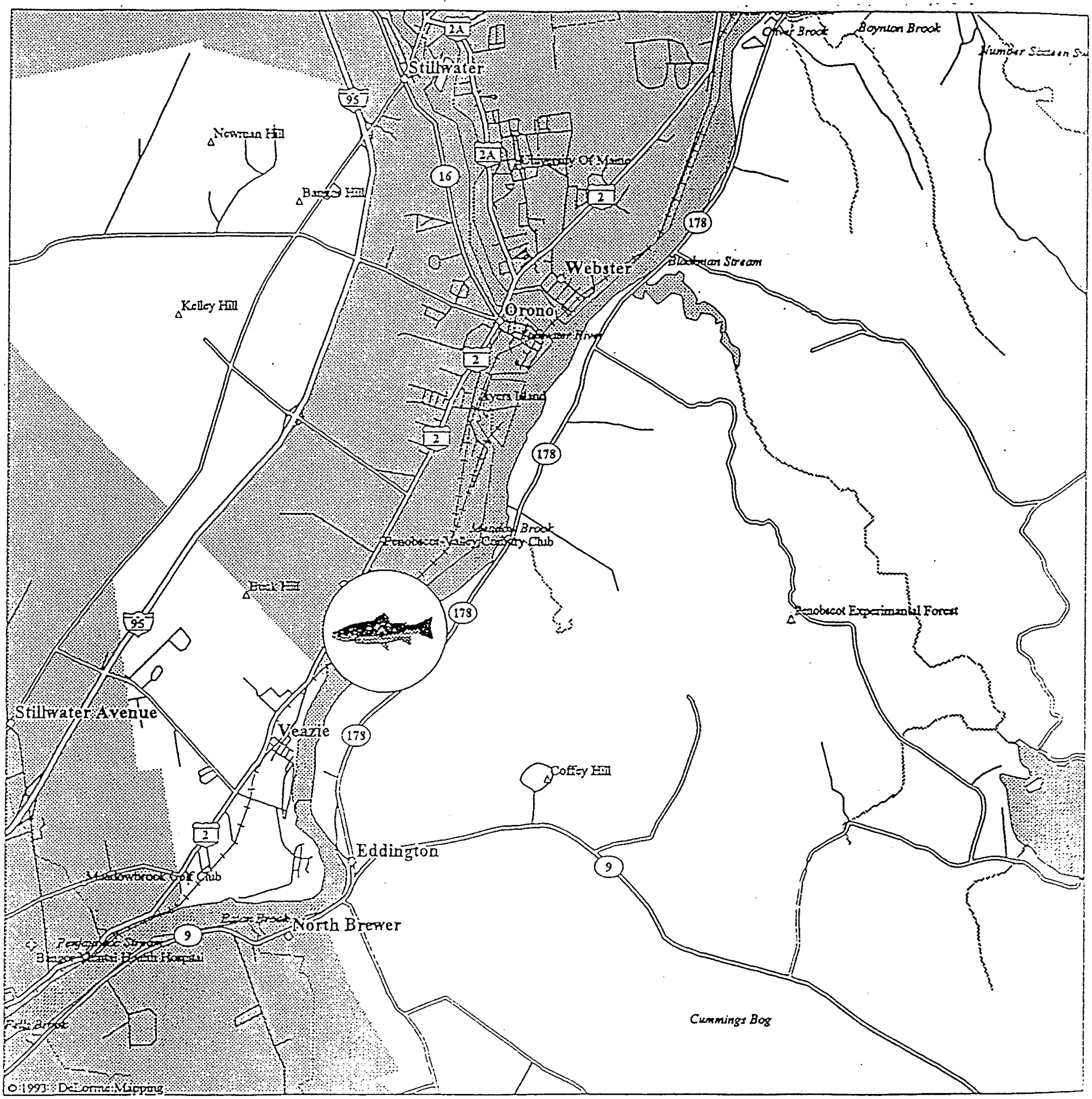


Penobscot River
Costigan

PBC



PBV PENOBSCOT RIVER AT VEAZIE

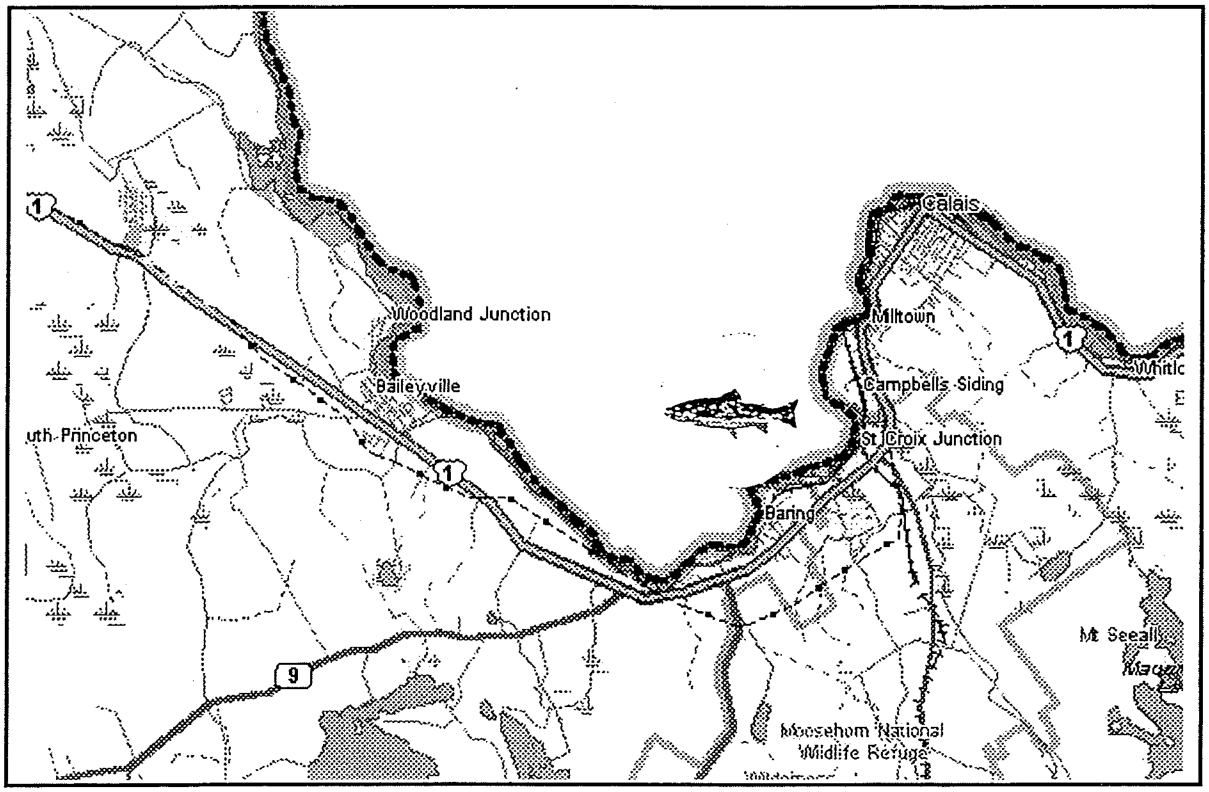


SFS SALMON FALLS RIVER AT SOUTH BERWICK

SWP W BR SEBASTICOOK RIVER AT PALMYRA

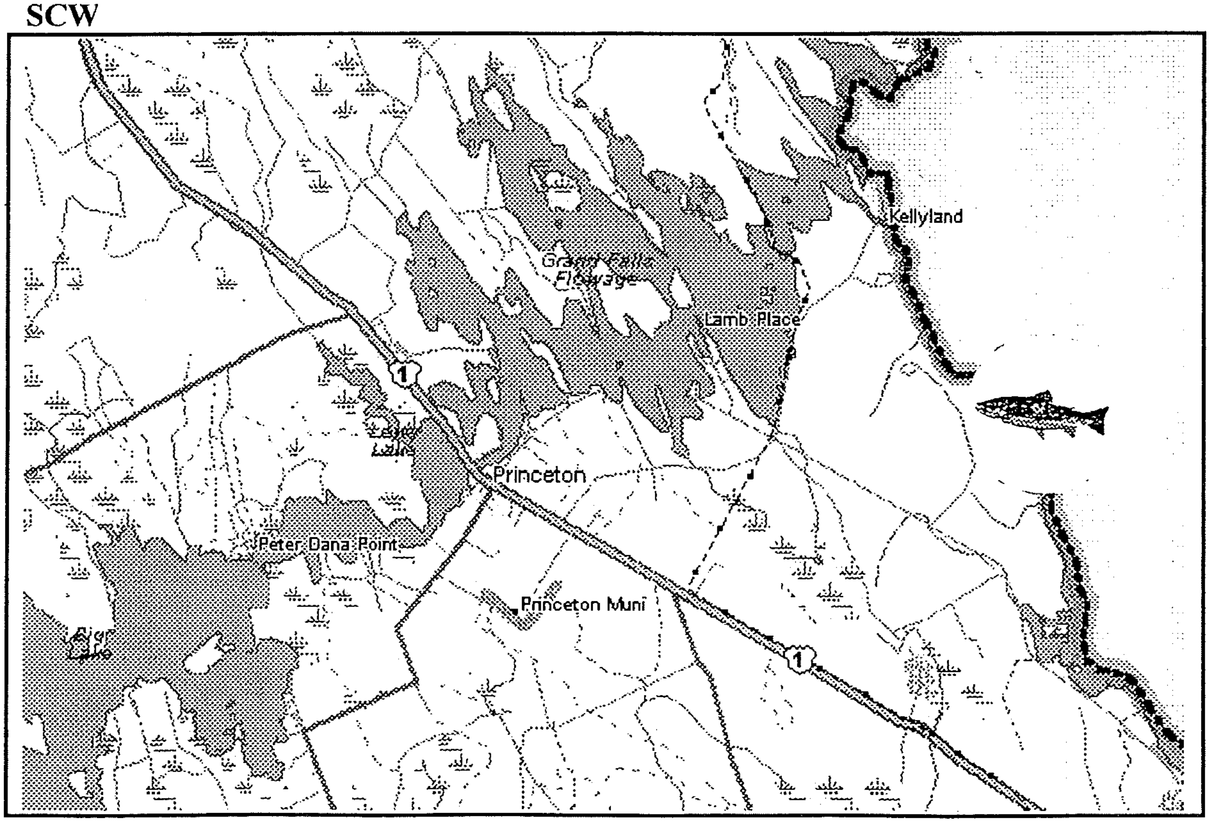
St. Croix River
Baring

SCB



St. Croix River
Woodland

SCW



APPENDIX 7

LENGTHS AND WEIGHTS

IN 1999 FISH SAMPLES

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
DMP			
ANDROSCOGGIN RIVER			
Gilead			
AGL-RBT-1	06/03/1999	287	300
AGL-RBT-2	06/03/1999	260	190
AGL-RBT-3	06/03/1999	320	380
AGL-RBT-4	06/03/1999	290	290
AGL-RBT-5	06/15/1999	320	390
AGL-RBT-6	06/15/1999	325	360
AGL-RBT-7	06/15/1999	290	250
AGL-BNT-1	06/15/1999	275	240
AGL-BNT-2	06/15/1999	268	220
AGL-BNT-3	06/15/1999	280	230
AGL-BNT-4	06/15/1999	320	410
AGL-BNT-5	06/15/1999	277	250
Rumford Point			
ARP-SMB-1	07/19/1999	292	460
ARP-SMB-2	07/22/1999	298	490
ARP-SMB-3	07/22/1999	295	480
ARP-SMB-4	07/22/1999	290	470
ARP-SMB-5	07/22/1999	285	430
ARP-SMB-6	07/22/1999	337	740
ARP-SMB-7	07/22/1999	328	700
ARP-SMB-8	07/22/1999	367	990
ARP-SMB-9	07/22/1999	315	600
ARP-SMB-10	07/22/1999	335	780
ARP-SMB-11	07/22/1999	365	920
ARP-SMB-12	07/22/1999	375	1240
ARP-SMB-13	07/22/1999	302	480
ARP-SMB-14	07/22/1999	302	560
ARP-SMB-15	07/22/1999	310	680
ARP-WHS-1	07/20/1999	440	1340
ARP-WHS-2	07/20/1999	440	1330
ARP-WHS-3	07/20/1999	445	1480
ARP-WHS-4	07/20/1999	433	1340
ARP-WHS-5	07/20/1999	442	1450
ARP-WHS-6	07/20/1999	432	1320
ARP-WHS-7	07/20/1999	441	1410
ARP-WHS-8	07/20/1999	450	1510
ARP-WHS-9	07/20/1999	430	1230
ARP-WHS-10	07/20/1999	434	1220

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
Rumford			
ARF-SMB-1	07/14/1999	295	420
ARF-SMB-2	07/14/1999	305	410
ARF-SMB-3	07/14/1999	284	430
ARF-SMB-4	07/14/1999	292	400
ARF-SMB-5	07/14/1999	289	390
ARF-SMB-6	07/14/1999	295	390
ARF-SMB-7	07/14/1999	302	440
ARF-SMB-8	07/14/1999	283	380
ARF-SMB-9	07/14/1999	286	400
ARF-SMB-10	07/14/1999	282	340
ARF-WHS-1	07/15/1999	424	1210
ARF-WHS-2	07/15/1999	433	1320
ARF-WHS-3	07/15/1999	430	1300
ARF-WHS-4	07/15/1999	425	1090
ARF-WHS-5	07/15/1999	422	1220
ARF-WHS-6	07/15/1999	425	1120
ARF-WHS-7	07/15/1999	421	1120
ARF-WHS-8	07/15/1999	443	1500
ARF-WHS-9	07/15/1999	449	1380
ARF-WHS-10	07/15/1999	424	1260
Riley			
ARY-SMB-3	07/08/1999	304	410
ARY-SMB-4	07/08/1999	300	560
ARY-SMB-7	07/09/1999	300	440
ARY-SMB-8	07/09/1999	292	400
ARY-SMB-9	07/09/1999	292	400
ARY-WHS-21	07/15/1999	320	470
ARY-WHS-22	07/15/1999	322	520
ARY-WHS-12	07/15/1999	417	1410
ARY-WHS-4	07/09/1999	422	1240
ARY-WHS-5	07/09/1999	423	940
ARY-WHS-11	07/15/1999	424	1370
ARY-WHS-8	07/15/1999	430	1350
ARY-WHS-1	07/08/1999	432	1300
ARY-WHS-2	07/09/1999	440	1400
ARY-WHS-3	07/09/1999	440	1350
ARY-WHS-7	07/15/1999	440	1300
ARY-WHS-10	07/15/1999	440	1250
ARY-WHS-6	07/15/1999	444	1580
ARY-WHS-9	07/15/1999	444	1520

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
Livermore Falls			
ALV-SMB-1	07/08/1999	302	430
ALV-SMB-2	07/08/1999	297	450
ALV-SMB-3	07/27/1999	302	480
ALV-SMB-4	07/27/1999	288	440
ALV-SMB-5	07/27/1999	296	450
ALV-WHS-1	07/27/1999	440	1780
ALV-WHS-2	07/27/1999	443	1710
ALV-WHS-3	07/27/1999	434	1640
ALV-WHS-4	07/27/1999	422	1600
ALV-WHS-5	07/27/1999	420	1440
ALV-WHS-6	07/27/1999	430	1530
ALV-WHS-7	07/27/1999	440	1720
ALV-WHS-8	07/27/1999	437	1680
ALV-WHS-9	07/27/1999	439	1420
ALV-WHS-10	07/27/1999	428	1640
Androscoggin Lake			
ALW-SMB-1	07/29/1999	280	440
ALW-SMB-2	07/29/1999	330	660
ALW-SMB-3	08/03/1999	412	1180
ALW-SMB-4	08/03/1999	371	1010
ALW-SMB-5	08/03/1999	420	1380
ALW-WHP-1	07/29/1999	289	500
ALW-WHP-2	07/29/1999	287	460
ALW-WHP-3	07/29/1999	290	550
ALW-WHP-4	07/29/1999	291	540
ALW-WHP-5	07/29/1999	282	490
ALW-WHP-6	07/29/1999	292	560
ALW-WHP-7	07/29/1999	293	560
ALW-WHP-8	07/29/1999	291	490
ALW-WHP-9	07/29/1999	303	550
ALW-WHP-10	07/29/1999	305	610
Turner			
AGI-SMB-1	07/30/1999	300	490
AGI-SMB-2	07/30/1999	295	510
AGI-SMB-3	07/30/1999	285	380
AGI-SMB-4	07/30/1999	299	490
AGI-SMB-5	07/30/1999	327	650
Lisbon Falls			
ALS-SMB-1	Aug-99	322	610
ALS-SMB-2	Aug-99	302	570
ALS-SMB-3	Aug-99	315	660
ALS-SMB-4	Aug-99	398	1180
ALS-SMB-5	Aug-99	358	890

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
KENNEBEC RIVER			
Norridgewock			
KNW-SMB-1	Aug-99	321	530
KNW-SMB-2	Aug-99	308	500
KNW-SMB-3	Aug-99	319	600
KNW-SMB-4	Aug-99	322	580
KNW-SMB-5	Aug-99	309	550
KNW-SMB-6	Aug-99	319	560
KNW-SMB-7	Aug-99	310	620
KNW-SMB-8	Aug-99	308	520
KNW-SMB-9	Aug-99	327	600
KNW-SMB-10	Aug-99	305	500
KNW-WHS-1	Aug-99	419	1200
KNW-WHS-2	Aug-99	440	1500
KNW-WHS-3	Aug-99	438	1500
KNW-WHS-4	Aug-99	437	1480
KNW-WHS-5	Aug-99	420	1300
KNW-WHS-6	Aug-99	420	1310
KNW-WHS-7	Aug-99	442	1340
KNW-WHS-8	Aug-99	424	1550
KNW-WHS-9	Aug-99	424	1500
KNW-WHS-10	Aug-99	429	1390
KNW-WHS-11	Aug-99	430	1510
small suckers			
KNW-WHS-21		225	190
KNW-WHS-22		216	180
KNW-WHS-30	09/09/1999	202	90
KNW-LNS-31	09/09/1999	137	25
KNW-LNS-32	09/09/1999	156	40
KNW-WHS-33	09/09/1999	205	100
Fairfield			
KFF-SMB-1	Aug-99	320	580
KFF-SMB-2	Aug-99	312	540
KFF-SMB-3	Aug-99	305	500
KFF-SMB-4	Aug-99	305	500
KFF-SMB-5	Aug-99	313	415
KFF-SMB-6	Aug-99	312	400
KFF-SMB-7	Aug-99	319	390
KFF-SMB-8	Aug-99	325	420
KFF-SMB-9	Aug-99	317	390
KFF-SMB-10	Aug-99	316	400

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
KFF-WHS-1	Aug-99	420	950
KFF-WHS-2	Aug-99	422	770
KFF-WHS-3	Aug-99	425	1020
KFF-WHS-4	Aug-99	435	1040
KFF-WHS-5	Aug-99	430	940
KFF-WHS-6	Aug-99	441	1090
KFF-WHS-7	Aug-99	437	1210
KFF-WHS-8	Aug-99	436	1010
KFF-WHS-9	Aug-99	420	1020
KFF-WHS-10	Aug-99	422	990
small suckers			
KFF-WHS-11	Sep-99	259	220
KFF-WHS-12	Sep-99	240	160
KFF-WHS-13	Sep-99	240	150
KFF-WHS-14	Sep-99	215	100
KFF-WHS-15	Sep-99	200	90
KFF-LNS-16	Sep-99	183	70
KFF-WHS-17	Sep-99	165	40
KFF-WHS-18	Sep-99	135	20
KFF-WHS-19	Sep-99	130	20
KFF-WHS-20	Sep-99	122	20
KFF-WHS-21	Sep-99	118	20
KFF-WHS-22	Sep-99	118	20
KFF-WHS-23	Sep-99	115	20
KFF-WHS-24	Sep-99	115	
KFF-WHS-25	Sep-99	111	
Augusta			
KAG-SMB-1	08/09/1999	329	660
KAG-SMB-2	08/09/1999	333	680
KAG-SMB-3	08/09/1999	326	580
KAG-SMB-5	08/09/1999	321	620
KAG-SMB-6	08/09/1999	372	1100
PENOBSCOT RIVER			
Woodville			
PBW-SMB-1	08/26/1999	351	485
PBW-SMB-3	09/21/1999	334	490
PBW-SMB-4	09/21/1999	360	520
PBW-SMB-5	09/21/1999	365	550
PBW-SMB-6	09/22/1999	340	550
PBW-SMB-8	09/22/1999	332	440
PBW-SMB-9	09/22/1999	351	560
PBW-SMB-10	09/23/1999	351	560
PBW-SMB-12	09/23/1999	336	440
PBW-SMB-14	09/23/1999	354	550

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
PBW-WHS-1	08/26/1999	418	790
PBW-WHS-2	08/26/1999	402	750
PBW-WHS-3	08/26/1999	404	750
PBW-WHS-4	08/26/1999	401	650
PBW-WHS-5	08/26/1999	419	720
PBW-WHS-9	09/21/1999	429	800
PBW-WHS-16	09/21/1999	405	700
PBW-WHS-17	09/21/1999	414	830
PBW-WHS-18	09/21/1999	415	770
PBW-WHS-19	09/21/1999	405	615
S Lincoln			
PBL-SMB-1	08/25/1999	352	620
PBL-SMB-2	08/25/1999	350	560
PBL-SMB-4	09/01/1999	347	640
PBL-SMB-9	09/29/1999	338	540
PBL-SMB-10	09/30/1999	362	680
PBL-SMB-11	09/30/1999	360	630
PBL-SMB-12	10/13/1999	346	480
PBL-SMB-13	10/13/1999	349	470
PBL-SMB-15	10/14/1999	356	600
PBL-SMB-16	10/22/1999	366	720
PBL-WHS-7	09/02/1999	410	800
PBL-WHS-12	09/02/1999	423	890
PBL-WHS-13	09/02/1999	419	870
PBL-WHS-16	09/02/1999	420	770
PBL-WHS-17	09/02/1999	413	780
PBL-WHS-18	09/02/1999	421	820
PBL-WHS-21	09/02/1999	411	670
PBL-WHS-22	09/02/1999	403	700
PBL-WHS-23	09/02/1999	411	750
PBL-WHS-25	09/02/1999	408	790
Costigan			
PBC-SMB-1	08/31/1999	445	1050
PBC-SMB-2	08/31/1999	465	1400
PBC-SMB-3	09/01/1999	385	830
PBC-SMB-4	09/03/1999	335	510
PBC-SMB-5	09/03/1999	435	1100
PBC-SMB-6	09/03/1999	325	490

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
PBC-WHS-2	08/31/1999	455	1150
PBC-WHS-6	08/31/1999	375	600
PBC-WHS-10	09/01/1999	426	900
PBC-WHS-12	09/01/1999	434	1000
PBC-WHS-13	09/01/1999	436	1000
PBC-WHS-15	09/01/1999	453	1000
PBC-WHS-16	09/01/1999	450	1200
PBC-WHS-17	09/03/1999	395	680
PBC-WHS-18	09/03/1999	364	600
PBC-WHS-19	09/03/1999	360	570
Veazie			
PBV-SMB-1	08/20/1999	305	330
PBV-SMB-2	08/31/1999	310	350
PBV-SMB-3	08/31/1999	365	505
PBV-SMB-4	08/31/1999	392	520
PBV-SMB-5	08/31/1999	348	540
PBV-SMB-8	09/02/1999	313	390
PBV-SMB-9	09/03/1999	309	360
PBV-SMB-10	09/03/1999	328	440
PBV-SMB-11	09/15/1999	303	350
PBV-SMB-12	09/16/1999	309	360
PBV-WHS-1	08/31/1999	270	230
PBV-WHS-2	09/01/1999	333	320
PBV-WHS-3	09/02/1999	308	380
PBV-WHS-4	09/03/1999	300	320
PBV-WHS-5	09/03/1999	340	520
PBV-WHS-6	09/03/1999	266	240
PBV-WHS-7	09/15/1999	342	460
PBV-WHS-8	09/15/1999	334	510
PBV-WHS-9	09/16/1999	353	510
PBV-WHS-10	09/16/1999	334	510
SALMON FALLS RIVER			
S. Berwick			
SFS-SMB-1	07/01/1999	268	320
SFS-SMB-2	07/02/1999	375	860
SFS-LMB-1	09/21/1999	350	590
SFS-LMB-2	09/21/1999	307	470
SFS-LMB-3	09/21/1999	268	310
SFS-LMB-4	09/21/1999	258	240

APPENDIX 7. LENGTHS AND WEIGHTS OF 1999 FISH SAMPLES

field ID	Date	Length mm	Weight gm.
SEBASTICOOK RIVER			
W BR -Palmyra			
SWP-SMB-1	09/08/1999	416	840
SWP-SMB-2	09/08/1999	310	390
SWP-SMB-3	09/08/1999	300	320
SWP-SMB-4	09/08/1999	310	400
SWP-SMB-5	09/08/1999	325	450
ST CROIX R			
Woodland			
SCW-SMB-1	Sep-99	329	580
SCW-SMB-2	Sep-99	304	400
SCW-SMB-3	Sep-99	311	460
SCW-SMB-4	Sep-99	353	620
SCW-SMB-5	Sep-99	366	760
SCW-WHS-1	Sep-99	454	1010
SCW-WHS-2	Sep-99	446	1040
SCW-WHS-3	Sep-99	451	1000
SCW-WHS-4	Sep-99	450	1080
SCW-WHS-5	Sep-99	744	990
SCW-WHS-6	Sep-99	452	1110
SCW-WHS-7	Sep-99	453	1080
SCW-WHS-8	Sep-99	450	1050
SCW-WHS-9	Sep-99	453	1080
SCW-WHS-10	Sep-99	449	1080
Baring			
SCB-SMB-1	Sep-99	320	660
SCB-SMB-2	Sep-99	325	680
SCB-SMB-3	Sep-99	331	740
SCB-SMB-5	Sep-99	321	680
SCB-SMB-15	Sep-99	318	780
SCB-WHS-1	Sep-99	453	2000+
SCB-WHS-2	Sep-99	440	1790
SCB-WHS-3	Sep-99	452	2000+
SCB-WHS-4	Sep-99	446	1760
SCB-WHS-5	Sep-99	454	1990
SCB-WHS-6	Sep-99	450	1920
SCB-WHS-7	Sep-99	440	1860
SCB-WHS-8	Sep-99	454	1910
SCB-WHS-9	Sep-99	430	1620
SCB-WHS-10	Sep-99	460	2000+

APPENDIX 8

SAMPLING SCHEDULE FOR THE 1999 DIOXIN MONITORING PROGRAM

Sampling schedule for the Dioxin Monitoring Program

May (early stations)

Androscoggin R at Lisbon Falls for brown trout
Kennebec R above Madison for brown trout
Kennebec R at Augusta for brown trout
Kennebec R at Fairfield for brown trout
E Br Sebasticook R at County Rd, Newport for bass/wh perch
W Br Sebasticook R at Rt 2 Palmyra for bass

JULY-AUGUST (all rivers in order, beginning at upstream stations)

Androscoggin R - July
Kennebec R - July
Penobscot R - August
Presumpscot R - August
Salmon Falls R - August
Sebasticook R (East and West Branches) - August

APPENDIX 9

TOXIC EQUIVALENCY FACTORS FOR PCDDS AND PCDFS

Appendix 9. Toxicity Equivalency Factors for PCDDs AND PCDFs (Van den Berg et al, 1998)

Congener	Toxic Equivalency Factor (TEF)		
	Humans/ Mammals	**Fish**	**Birds**
Dioxins			
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	1	1	1
1,2,3,4,7,8-HxCDD	0.1	0.5	0.05
1,2,3,6,7,8-HxCDD	0.1	0.01	0.01
1,2,3,7,8,9-HxCDD	0.1	0.01	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.001	<0.001
OCDD	0.0001	<0.0001	0.0001
Furans			
2,3,7,8-TCDF	0.1	0.05	1
1,2,3,7,8-PeCDF	0.05	0.05	0.1
2,3,4,7,8-PeCDF	0.5	0.5	1
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01
OCDF	0.0001	<0.0001	0.0001
PCBs			
3,4,4',5-TCB (81)	0.0001	0.0005	0.1
3,3',4,4'-TCB (77)	0.0001	0.0001	0.05
3,3',4,4',5-PeCB (126)	0.1	0.005	0.1
3,3',4,4',5,5'-HxCB (169)	0.01	0.00005	0.001
2,3,3',4,4'-PeCB (105)	0.0001	<0.000005	0.0001
2,3,4,4',5-PeCB (114)	0.0005	<0.000005	0.0001
2,3',4,4',5-PeCB (118)	0.0001	<0.000005	0.00001
2',3,4,4',5-PeCB (123)	0.0001	<0.000005	0.00001
2,3,3',4,4',5-HxCB (156)	0.0005	<0.000005	0.0001
2,3,3',4,4',5'-HxCB (157)	0.0005	<0.000005	0.0001
2,3',4,4',5,5'-HxCB (167)	0.00001	<0.000005	0.00001
2,3,3',4,4',5,5'-HpCB (189)	0.0001	<0.000005	0.00001