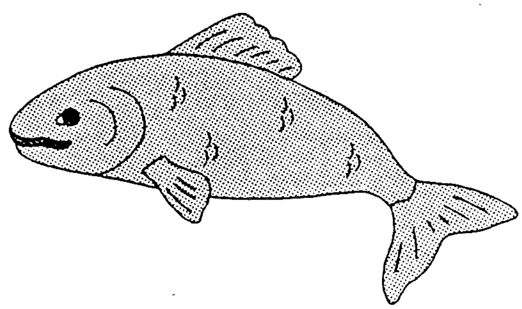
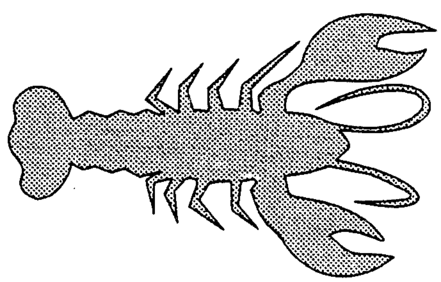
DIOXIN MONITORING PROGRAM

STATE OF MAINE

1993





BY

BARRY MOWER

DEPARTMENT OF ENVIRONMENTAL PROTECTION

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Acknowledgements

The assistance of Acheron Inc. on behalf of the Paper Industry in collection of fish made the program much more efficient and workable in 1993. Also, the assistance of the Department of Marine Resources and Department of Inland Fisheries and Wildlife in collection of samples and providing nets was greatly appreciated. Thanks to Deke Crowley and Bob Engellhardt for supplying brown trout from the Kennebec River.

EXECUTIVE SUMMARY

The goal of Maine's Dioxin Monitoring Program, established in 1988 by the Maine legislature, 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 and municipal wastewater treatment plants once each quarter. DEP is also required to sample sludge from the same facilities to determine the sources.

The Dioxin Monitoring Program is coordinated with other ongoing programs conducted by the Department, the US Environmental Protection Agency and dischargers of wastewater. DEP incorporates the results of all studies into a report to the Energy and Natural Resources Committee due December 1 of each year. Since all of the analytical results are not usually received from the laboratory until sometime in December, the report is usually sent to the Committee in late January or early February. Some of the 1993 samples had to be reanalyzed, making this year's report later than usual. Costs of sample collection and analysis are assessed to the selected facilities. Payment of the fees is a condition of the waste discharge license granted by the state for continued operation of the selected facilities.

Conclusions:

1. Concentrations of dioxin and furan toxic equivalents (TEQs) in fish at most sites remained similar to those of 1992 discontinuing a general decline in concentrations first observed in 1991.

2. Concentrations of dioxin and furan toxic equivalents (TEQs) in fish from the Androscoggin, Kennebec, Penobscot, Presumpscot, Salmon Falls, and West Branch of the Sebasticook Rivers were significant, meaning that they exceeded the Department of Human Services Bureau of Health's recommended maximum concentrations for the protection of consumers from an increased cancer risk of one in one million (10^{-6}) (0.15 ppt) and for protection of consumers from adverse reproductive effects (0.37 ppt).

3. TEQ concentrations were highest in fish from the Androscoggin River compared to fish from other rivers.

4. TEQ concentrations increased in bass and suckers from Rumford and bass at Lisbon Falls on the Androscoggin River, in bass at Fairfield on the Kennebec River, and in bass at Palmyra on the West Branch of the Sebasticook River since 1992 and in bass at Veazie on the Penobscot River since

1991. However, there was no evidence of significant increases in discharges from the known sources in any of these rivers over the same time period. These increases may represent natural variation.

5. TEQ concentrations in eels from the Kennebec River in Richmond and the Penobscot River in Bangor were similar to bass in each river and were significant.

6. TCDD concentrations in the meat of lobsters from the Kennebec River estuary, Penobscot River estuary, Presumpscot River Estuary, and Saco Bay were not significant but TEQs were marginally so. Concentrations of both TCDD and TEQs in tomalley (hepatopancreas) were highly significant, about 15-40 fold higher than in the meat. Consequently on February 2, 1994 the Maine Bureau of Health, in consultation with the Department of Environmental Protection and Department of Marine Resources, issued a consumption advisory (Appendix 1).

Recommendations:

1. The Dioxin Monitoring Program is scheduled to terminate in 1995. The program serves a useful purpose in monitoring the occurrence of dioxin in fish and shellfish to aid in the evaluation of risk to human and ecological health. The program should be continued until there is no longer any risk from dioxin in fish and shellfish.

INTRODUCTION

The goal of Maine's Dioxin Monitoring Program, established in 1988 by the Maine legislature, is "to determine the nature of dioxin contamination in the waters and fisheries of the State". Charged with administration of the program, DEP is required to sample fish once a year below no more than 12 bleached pulp mills and municipal wastewater treatment plants suspected as sources of dioxin. The Department is also required to sample sludge once a quarter from the same facilities. The monitoring program is to be coordinated with other ongoing programs conducted by the Department, US Environmental Protection Agency, or dischargers of wastewater, and the Department must seek to incorporate the results of all studies into a report due the Energy and Natural Resources Committee by 1 December of each year. Costs of sample collection and analysis are to be 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.

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 in 1991 and 1992 to share information and receive comments. Draft reports on a wide range of issues were available in 1992 and 1993. 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). Currently the reports are undergoing peer review, with final reports due in 1994.

For the purpose of water quality management, the Department of Human Services' Bureau of Health (BOH) has recommended the following maximum allowable concentrations of 2378-TCDD in fish fillets in order to protect human consumers of contaminated fish against certain involuntary health risks (Frakes, 1990). "For a one in one million (10^{-6}) upper limit cancer risk the concentration of 2378-TCDD in the edible portion (fillets) of fish should not exceed 0.15 ppt (parts per trillion) and for a one in one hundred thousand (10^{-5}) upper limit cancer risk the concentration of 2378-TCDD in the edible portion (fillets) of fish should not exceed 1.5 ppt. For protection against adverse reproductive effects, the concentration of 2378-TCDD in the edible portion (fillets) of fish should not exceed 0.37 ppt (parts per trillion)." Although no risk concentration has been selected, the Board of Environmental Protection has used a risk of 10^{-6} in setting a limit for dioxin in the sludge spreading rules in 1986. For this report concentrations of dioxin in fish exceeding any of these recommendations will be reported as significant.

For managing the risk to consumers of fish already contaminated with dioxin, the BOH publishes fish consumption advisories for dioxin for particular waterbodies using risk assessment methods with a threshold of 1.5 ppt. Based on recent research, BOH is also concerned with potential reproductive effects in women from consuming a single fish meal with a dioxin concentration greater than 7 ppt.

OBJECTIVES

Given the decline in levels of dioxin found in the fish in the 1991 and 1992 programs, the primary objective of the 1993 program was to collect fish samples from the appropriate sites and species from each river so that accurate, complete, and current data were available to meet the overall goal of the program. The program design included sampling at least one site below each major source to document trends and sampling of historic sites that showed dioxin at levels of concern (above recommended safe levels in DHS's proposed dioxin rule, whether or not any fish consumption advisories were issued). Sampling was also continued at sites which showed a significant decline from 1991. Another objective was to sample fish from any new sites or important species suspected of being significantly contaminated with dioxin.

PROGRAM DESIGN

The 1993 program was drafted initially by a team representing DEP, DHS, the Department of Marine Resources (DMR) and the Department of Inland Fisheries and Wildlife (DIFW) according to the objectives listed above. Following a meeting with representatives of the participating facilities and the Natural Resources Council of Maine, the program was finalized as described below.

Since most of the facilities in the program already sample sludge or effluent as part of their Sludge Spreading Permit or NPDES permit facilities no additional sludge samples were collected as part of the 1993 program.

The number of sites was reduced by one in 1993 based on the results from 1992. Station locations along with target species are shown in Table 1. Station location maps show exact locations of fish collections (Appendix 6).

Table 1. Sample stations and target species for the 1993 Dioxin Monitoring Program

STATION	FACILITY	SPECIES
Androscoggin R		
Rumford	Boise Cascade	bass, sucker
Jay (Bean Is)	Boise Cascade	bass, sucker
Liv Fls(Otis imp)	International Paper	bass, sucker
Turner (GIP)	International Paper	bass,sucker,hornpout
Lisbon Falls	BC & IP	trout/bass, sucker
Kennebec R		
Shawmut Dam	SD Warren	trout, bass, sucker
Sidney	Scott Paper	trout/bass, sucker
Augusta	KSTD	trout/bass, sucker
Richmond	Statler	eel
Phippsburg	Statler	lobster
Penobscot R		
S Lincoln	Lincoln P&P	bass, sucker
Veazie	James River Co	bass, sucker
Bangor	Lincoln P&P	eel
Bucksport	James River Co	lobster
Presumpscot		
Westbrook	SD Warren	bass, sucker
Falmouth	SD Warren	lobster
Salmon Falls R		
S Berwick	Town of Berwick	bass, sucker
Sebasticook R		
E Br Newport	Town of Corinna	bass, sucker
W Br Palmyra	Town of Hartland	bass, sucker
Reference site(s)	all	bass, sucker lobster

In 1992 some sites were sampled twice to investigate any seasonal differences in contaminant residues. Two of the three sucker samples from locations sampled twice showed higher residues in later samples as did the one location sampled for brown trout. Therefore, in 1993 samples were collected only once, beginning in July at most sites. However, in previous years there was a problem collecting enough fish later in the summer at some locations. At these sites, sampling was begun in early June to try to insure that a suitable sample was collected. These sites were also visited after the beginning of July. Any fish captured during the later period were submitted for analyses, otherwise the fish collected during the early period were used.

As before, ten game fish and ten bottom feeders were collected at each station. For new sites, two composites of five individuals (or more as necessary to give an adequate amount of tissue) were analyzed. For historic sites, game fish were combined into 5 two-fish composites while the bottom feeders were combined into 2 five-fish composites. Game fish were analyzed as skinless fillets and bottom feeders as whole fish.

Each fish was ground and stored separately. Half of the ground sample of each fish was combined into the composites. If any composite of game fish had a contaminant level that exceeded a threshold, determined by dividing 7 ppt by the number of fish in that composite (7/n), then the stored ground fish from each of the fish making up that composite was to be reanalyzed individually. This would be done to determine whether or not there could be a single fish that has a residue exceeding 7 ppt, the level considered by DHS to pose an unacceptable risk to humans from a single meal.

In 1991 all samples were analyzed for all 2378-substituted and all tetra through octa class congeners. Results showed that only 2378-TCDD and 2378-TCDF are present in significant quantities in most samples, although in a few others some congeners were significant. In 1993 only the 2378-TCDD and 2378-TCDF was measured initially in most of the samples, but one sample from each river was analyzed for the other congeners measured in 1991. Where values of the 1993 congeners were significantly different than the 1991 values then all samples were to be analyzed for all of the congeners referenced above. Also, where addition of the 1991 congeners would cause a sample to exceed DHS's level of concern 0.15 ppt, that sample was to be reanalyzed for all referenced congeners. In all other cases the 1991 values were to be added to the 2378-TCDD and 2378-TCDF in calculation of TEQ's and the other congeners were not be determined from the 1993 fish samples.

SAMPLING PROCEDURES

Fish were collected by DEP with assistance of representatives of the participating facilities and selected volunteer anglers. Upon capture, fish were immediately killed, weighed and measured, rinsed in river water, wrapped in aluminum foil with the shiny side out, labelled, and placed in a cooler on ice for transport to the lab. Lobsters and eels were purchased directly from commercial fishermen at each site and placed in plastic garbage bags in a cooler on ice for transport to the lab.

In the lab all samples were frozen to await shipment to Midwest Research Institute in Kansas City, Missouri for analysis. Chain of custody forms were used. 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.

RESULTS AND DISCUSSION

It was not possible to collect all species and numbers of fish targeted. A description of fish collected and analytical results follows for each sample location. Results show that concentrations of dioxin and furan in fish were slightly higher at some stations and slightly lower at others than in 1992. As a whole concentrations did not continue to decline as seen from 1990 to 1992 (Table 2, Appendix 2). Concentrations at some individual sites, however, were statistically different than in previous years. Concentrations in whole suckers were higher than in bass or trout fillets. Some sites and/or species cannot be compared since there are no previous data.

Only at the Rumford site on the Androscoggin River did any two-fish composite of game fish exceeded 3.5 pg/g, the threshold for protection of women against an unacceptable risk from comsumption of a single fish at 7 pg/g. The composite with the highest TCDD was reanalyzed as individual fish. The results show that neither fish was above 7 pg/g (Appendix 2). Therefore, it was assumed no fish composing any of the other composites at this site would exceed 7pg/g either, and no further reanalysis was done.

Although some of the 1993 full congener analyses were different than the 1991 values, in no instance did the use of either value make a difference that would cause DHS's recommended safe level or fish consumption advisory threshold to be exceeded. Consequently, no sample was reanalyzed for all congeners. Instead 1993 estimates of total dioxin toxic equivalents (TEQs) were made by using the 1991 full congener analyses. Where actual full congener analyses exist for 1993 single fish or single composites, they were used in computing the average estimated TEQs for the site.

Some errors were discovered with TEQ calculations from 1991 and estimates from 1992. They have now been corrected. Also using the 1991 full congener analyses, TEQs were estimated for the period 1988-1990 as well. In order to facilitate comparisons among years, results were reformatted to show 2378-TCDD and estimated or measured (1991) TEQs for all years beginning in 1988. TEQs are presented as a range with non-detects calculated at zero and at the detection level. Therefore, the actual value falls somewhere within the range.

Androscoggin River

Rumford Ten smallmouth bass and ten white suckers were collected from the river from Dixfield-Peru bridge downstream about 3 miles or about 4-7 miles below the

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

WATER/STATION	SPECIES	TYPE	EPA NDS/NBS 1984-86	DEP DIOXIN MONITORING PROGRAM 1988-1990		1991		1992		1993	
			TCDD	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ
ANDROSCOGGIN R											
Gilead	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
	sucker	w						3.0	7.4-8.0	5.8	13.6-14.6
Riley	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
	sucker	w						5.4	12.9-13.9	4.5	10.9-11.8
Livermore Falls	bass	f				2.4	3.1-3.3	1.1	1.4-1.5	1.4	1.6-1.8
	sucker	w						3.8	7.4-8.0	3.6	6.8-7.3
N Turner	sucker	w	6.2f/30w								
Turner-GIP	bass	f	3.7f/24w								
	sucker	w	8.3f/29w								
	bullhead	w	7.8f/29.6w								
Auburn-GIP	bass sm	f						1.7	2.6-2.8	1.2	1.8-1.9
	bass lm	f						1.1	1.6-1.8		
	sucker	w						5.6	14.3-15.4	3.7	9.0-9.8
	bullhead	w								2.1	3.0-3.3
Lisbon Falls	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
	sucker	w	5.1f/12w					3.4	8.1-8.7	2.7	6.1-6.6
Brunswick	sucker	w	19.0								
	carp	f	11.0								
BEARCE LAKE											
Baring	pickerel	f	<0.1								
JONES CREEK											
Scarborough	clam	m						<0.1	0.02-0.3		
KENNEBEC R											
Madison	bass	f						<0.1	0.02-0.1		
	sucker	w						0.1	0.3		
Fairfield	trout	f		6.2	6.9-8.0			1.4	1.6-1.8	1.4	1.6-1.9
	bass	f				1.4	1.6-1.7	0.6	0.6-0.7	1.5	1.7-2.0
	sucker	w	6.4	10.3	16.8-18.1			2.0	3.1-3.3	1.6	2.2-2.6
Sidney	bass	f	20.3w			1.0	1.4-2.4	0.4	0.6-1.0	0.6	0.8-1.4
	sucker	w	1.2f/11.4w					2.7	4.4-4.8	1.5	2.5-2.7
Augusta	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
	sucker	w		5.0	7.3-8.4			1.5	2.6-2.8	1.9	3.3-3.6
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
	lobster	t								7.9	27.5-27.6

TABLE 2. (cont.)

WATER/STATION	SPECIES	TYPE	EPA	DEP							
			NDS/NBS	DIOXIN MONITORING PROGRAM							
			1984-86	1988 - 1990		19 91		19 92		19 93	
			TCDD	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ
MESSALONSKEE LAKE											
Belgrade	bass					<0.0	0.04-0.3				
NARRAGUAGUS R											
Cherryfield	fallfish	w	<1.0								
NORTH POND											
Chesterfield	sucker	w	0.37								
	pickerel	f	<0.1								
PENOBSCOT R											
E Branch	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						
N Lincoln	bass	f		<0.4	0.2-0.8						
	sucker	w		<0.5-2	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	1.1	1.5-1.8
	sucker	w		37.0	66.4-67.2			3.3	6.8	1.7	3.5-3.6
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
	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
Bangor	eel	w								1.0	1.1-1.2
Bucksport	clam	m						0.1	0.8-0.9		
Stockton Springs	lobster	m								0.1	0.3-1.1
	lobster	t								4.0	28.0
OWLS HEAD	mussel	m	<0.8								
PISCATAQUIS R											
Sangerville	bass	f				<0.2	0.03-0.3				
	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								<0.0	0.04-0.3
	sucker	w								0.3	0.7-0.8
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
	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
Falmouth	clam	m									
Portland	lobster	m								<0.1	0.1-0.8
	lobster	t								3.4	18.5-18.7

TABLE 2. (cont.)

WATER/STATION	SPECIES	TYPE	EPA	DEP								
			NDS/NBS	DIOXIN MONITORING PROGRAM								
			1984-86	1988- 1990		19 91		19 92		19 93		
			TCDD	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ	TCDD	TEQ	
ST CROIX R												
Woodland	bass	f		0.3	0.5-1.0	<0.1	0.04-0.3					
Calais	sucker	w	<0.7	0.6	1.0-1.1							
ST JOHN R												
Madawaska	y perch	f		<0.5	0.08-0.8							
SACO R												
Dayton	sucker	w	<0.3									
SACO BAY												
Scarborough	lobster	m								<0.1	0.1-0.8	
	lobster	t								2.0	11.3-14.6	
SALMON FALLS R												
S Berwick	bass	f		0.4	0.5-0.6					0.2	0.2-0.9	
	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	
SANDY P												
N Anson	bass	f	<1.0									
SEBAGO L												
Naples	bass	w	<0.6									
SEBASTICOOK R												
E Br Newport	bass sm	f						0.1	0.3-0.4			
	bass lm	f	<0.2					<0.2	0.2-0.4			
	w perch	f		1.0	1.6-2.1							
W Br Palmyra	bass	f		1.2	1.4-1.8			0.4	0.5-0.6	0.9	1.2-1.6	
	pickerel	f	<0.1					0.2	0.2			
	sucker	w	1.57	3.3	4.3-4.6			1.1	1.4-1.6	1.0	2.6-2.7	
WEBBER POND												
Vassalboro	bass	f				<0.0	0.04-0.4					

f=fillet
m=meat
t=tomalley
w=whole
TEQ= Estimated toxic equivalents (range at nd=0 and nd=mdl) using EPA 1989 toxicity equivalency factors (TEF), 1991 full congener analyses at , in order of priority, 1. same site, 2. nearest upstream site, 3. nearest downstream site, or 4. state average for predators or bottom feeders
Existing data used in site averages

discharge from Boise Cascade bleached kraft pulp and paper mill in Rumford. This was just below where fish were captured in previous years; the water level was too low to sample upstream. Total dioxin Toxic Equivalents (TEQs) were significant even when normalized to skinless fillets (dividing by 3.5 based on historical comparisons between fillets and whole fish). TEQs for bass were also significant. TEQs were statistically higher in bass than in 1992 or 1991 and in suckers than in 1992 ($p=.05$). It is difficult to account for this increase as effluent data do not show any increase in the amount of TCDD and TCDF in the discharge from the mill since 1992 (Appendix 4). Although the fish were captured a little farther downstream than in previous years, the 1993 site was not significantly different than in previous years, being only slightly deeper and slower moving.

<u>Jay</u> Ten smallmouth bass and ten white suckers were collected near Bean Island in the Jay Impoundment, which is about 20 miles below Boise Cascade and in the impoundment into which International Paper Company's bleached kraft mill discharges about 1 mile downstream. TEQs in bass fillets were significant although much lower than in bass fillets from the Rumford site. While TCDD was slightly higher than in 1992, TEQs were similar and still an order of magnitude lower than in 1990. The reason for such a great reduction of TEQs in bass from 1990 to 1992 and 1993 is difficult to determine since concentrations in sludge (Appendix 3) and effluent (Appendix 4) from the mill have remained similar since 1990. Although this site is above the discharge it is in the same impoundment and fish may migrate anywhere throughout. The 1990 bass may have migrated downstream and been exposed to the discharge from the mill while the 1992 bass may have stayed upstream and been exposed only to the discharge from Boise Cascade in Rumford. Alternatively, the lower concentrations in bass in 1992 and 1993 may reflect a latent effect of the earlier reductions in dioxin discharged. TCDD and TEQ concentrations in whole suckers were significant when normalized to skinless fillets. TCDD and TEQ concentrations were slightly lower than in 1992 and TCDD was only about half as high as reported in suckers at the Riley impoundment, immediately upstream, in 1984-86, which probably shows the effect of reductions in discharge of TCDD from the mills and perhaps a difference in sites.

<u>Livermore Falls</u> Ten smallmouth bass and ten white suckers were captured in the Otis Impoundment, approximately 1.5-3 miles below the discharge from International Paper Company's Jay mill. TEQs in bass fillets were significant and slightly higher than in 1992. Concentrations were similar to those from the Jay site. Concentrations in whole suckers were significant when normalized to skinless fillets. Concentrations were slightly lower than in 1992 and lower than in the Jay Impoundment. These results are consistent

with the relatively constant discharge of dioxin from Boise and International Paper Company mills in the last couple of years as shown by monitoring of sludge (Appendix3) and effluent (Appendix 4).

Auburn-GIP Five smallmouth bass, eight brown bullheads, and ten white suckers were collected in Gulf Island Pond (GIP) near Seagull Island near the deep hole, about 25-30 miles below International Paper Company. TEQs in bass were significant. TEQs were slightly lower than in 1992 and slightly lower than upstream sites. TCDD was significantly lower than in the 1984-86 EPA study from a site about 4 miles upstream in GIP. TEQs in whole suckers were significant when normalized as fillets. TEQs were slightly lower than in 1992 and TCDD was significantly lower than in the EPA study. TEQs in brown bullhead were significant when normalized as fillets and were intermedate of bass and suckers. TCDD was statistically lower in bullheads than in the EPA study. Decreased concentrations since EPA's 1984-6 study may reflect decreased discharges by Boise Cascade and International Paper Co. in recent years.

Lisbon Falls Ten smallmouth bass and ten white suckers were captured in the Pejepscot Impoundment, about 45-50 miles below International Paper Company. TEQs in bass were significant and statistically higher than in 1992. TEQs were still statistically lower than in samples of bass collected in 1988-90 and lower than in bass fillets from all other Androscoggin River sites except GIP. TEQs in suckers were significant when normalized as fillets. TEQs were slightly lower than in 1992 but TCDD was statistically lower than in the EPA study, reflecting the trend toward declining concentrations in fish from all sites along the river in recent years. The increase in TEQs in bass is not consistent with the decline in discharge of dioxin from the mills in recent years.

Kennebec River

Fairfield Four brown trout, ten smallmouth bass, and ten white suckers were collected from July through August from the Shawmut Dam to the I-95 bridge, about 7-8 miles below SD Warren's bleached kraft pulp and paper mill in Skowhegan. TEQs in brown trout were significant. TEQs were similar to those of 1992 but about 4 times lower than in brown trout from this site in 1988-90, although a complete sample has not been obtained since 1990. TEQs in bass were significant and statistically higher than in 1992, similar to those of 1991. TEQs were similar to those in brown trout, unlike previous years when the bass were lower. TEQs were the highest of all sites on the river. TEQs in suckers were significant when normalized as fillets. TEQs were slightly lower than in suckers collected above the dam in 1988-90 and similar to concentrations at other sites on the Kennebec. These declines in TEQs from 1990 are difficult to explain since concentrations of TEQs in sludge (Appendix 3) and effluent (Appendix 4) from the SD Warren mill are variable but show no significant decline in recent years to indicate a lowering in amounts in the discharge. The reason for increases in TEQs in bass but not in the other species since 1992 is also unknown.

<u>Sidney</u> Ten smallmouth bass and ten white suckers were collected from the river within one mile of the Sidney boat landing, about 25 miles below the SD Warren mill in Skowhegan and about 9-10 miles below the discharges from the Scott Paper mill in Winslow and the Kennebec Sanitary Treatment District's discharge in Waterville. TEQs in bass were significant and slightly higher than in 1992 but statistically lower than in bass from 1991. TEQs were lower than at the Fairfield station. TEQs in suckers were significant when normalized as fillets, and slightly lower than in 1992. TCDD was statistically lower than in suckers from the site analyzed in EPA's 1984-86 study. TEQs were similar to those at Fairfield. TEQs in sludge from each of the three sources have remained essentially unchanged in the last couple of years (Appendix 3). Declines in tissue concentrations of dioxin and furan may reflect a latent effect of any reduced discharges from previous years.

<u>Augusta</u> Five smallmouth bass and ten white suckers were collected about 2-2.5 miles below the Edwards Dam in Augusta. In addition to the upstream sources at the Sidney site, Statler Tissue Company dicharges effluent just above the dam. TEQs in bass were significant. TEQs were slightly higher than in 1992 but slightly lower than in 1991. TEQs were similar to the concentration found in bass fillets from Sidney. TEQs in suckers were significant when normalized as fillets. TEQs were slightly higher than in 1992 but were statistically lower than in whole suckers at this site from 1988-90. TEQs were slightly higher than other sites on the Kennebec. Since Statler recycles waste paper, dioxin in its sludge reflects the average content in its paper supply and is low but detectable and relatively constant (Appendix 3).

<u>Richmond</u> Ten eels were collected from a commercial fisherman fishing the Kennebec from Richmond to Bath. All were river eels (males residing year-round in the river). Nine were of uniform size and were combined into one composite, while one was much larger and analyzed by itself. TEQs in both samples were significant. TEQs in the single large eel were slightly higher than in the composite of smaller eels. TEQs were similar to concentrations in bass at Augusta and in eels from the Penobscot River in the Bangor area.

Phippsburg Ten lobsters were collected from a lobster fisherman fishing the estuary near Cox Head, approximately 45 miles below Augusta. This site is downstream of all the sources on the Androscoggin and Kennebec Rivers. TCDD in the meat was marginally significant but TEQs were significant. Both were highly elevated in the hepatopancreas or "tomalley", 20-40 times that found in the meat. This site had the highest TCDD concentration of all sites monitored. Consequently the Bureau of Health has issued a consumption advisory on 2 February 1994 regarding tomalley for the entire coast (Appendix 1).

Penobscot River

South Lincoln Ten smallmouth bass and ten white suckers were collected near the boat ramp in South Lincoln, about 3-4 miles below Lincoln Pulp and Paper Company's bleached kraft mill in Lincoln. TEQs in bass were significant and slightly higher than those in 1991 and 1992 but slightly lower than in 1988-90. TEQs in suckers were significant when normalized as fillets. TEQs were slightly lower than in 1992 and statistically lower than in suckers sampled in 1988-90. TEQs in both species were the highest of all sites on the Penobscot River. Recent effluent data (Appendix 4) show a reduction in amounts of dioxin discharged since 1988 which is consistent with declines in concentrations in fish from that time.

Veazie Ten smallmouth bass and ten white suckers were collected from the Veazie Impoundment about 7-8 miles below James River's bleached kraft mill in Old Town. TEQs in bass fillets were significant and slightly higher than in bass from 1991 at this site. They were, however, statistically lower than in 1991. TEQs in suckers were significant when normalized as fillets and were statistically lower than in 1991 and 1992. This is surprising since effluent data from James River show concentrations of 2378-TCDD and 2378-TCDF similar to those of 1991, both variable and sometimes higher than concentrations in late 1989 and 1990 (Appendix 4).

Stockton Springs Ten lobsters were collected from a lobsterman fishing near Verona Island, about 40 miles below James River's mill. TCDD in the meat was not significant but TEQs were significant. Both were highly elevated in hepatopancreas or "tomalley", about 30 times higher than in the meat. This site had the highest TEQ concentration of all the sites monitored. Consequently the Bureau of Health has issued a consumption advisory on 2 February 1994 regarding tomalley for the entire coast (Appendix 1).

Presumpscot River

Windham Ten smallmouth bass and ten white suckers were collected below North Gorham Pond. TCDD and TEQs in bass were not significant. TCDD in suckers was marginally significant while TEQs were slightly higher and the lowest of all suckers sampled in 1993. There are no known sources of dioxin upstream of this site. That TEQs were found to be as high as they were in suckers was surprising since in previous years, TEQs from all other "reference sites" were insignificant.

Westbrook One smallmouth bass and ten white suckers were collected near the US Route 302 bridge about 1.5 miles downstream of the discharge from SD Warren's bleached kraft pulp and paper mill. TCDD in the bass was not significant and TEQs were marginally significant, similar to 1991 and 1992. TCDD in whole suckers was marginally significant and TEQs were significant when normalized as fillets. Both were slightly higher than in 1991 and 1992. TEQs in sludge and effluent from the mill continue to be relatively low since 1990-91 (Appendices 3 and 4). It has been impossible to collect a suitable number of bass from this site since the beginning of the program in 1984.

Portland Ten lobsters were collected from a lobster fisherman fishing at the mouth of the estuary off East End Beach about 10-11 miles below the SD Warren discharge. TCDD in meat was not significant and TEQs were marginally so. Both were highly elevated in the hepatopancreas or "tomalley", at 20-30 times than in the meat. This site had the lowest TEQs of all the suspected contaminated sites, and was slightly higher than the "reference" site at Saco Bay, which is similar to the results for fish. Consequently the Bureau of Health has issued a consumption advisory on 2 February 1994 regarding tomalley for the entire coast (Appendix 1).

Saco Bay

Scarborough Ten lobsters were collected from a lobster fisherman fishing off the mouth of the Scarborough River near Prouts Neck. This site was intended to be a reference site near last years reference site for the soft-shelled clams. The TCDD concentration in the meat was not significant while the TEQ concentration was marginally so. However, concentrations of both in the hepatopancreas or "tomalley" were significant, about 15-20 times that in the meat. The source of dioxin to these lobsters is unknown. About 4 or 5 years ago there was discharge of dioxin from the Maine Energy Recovery Company to the Biddeford sewage treatment plant and thence into the Saco River estuary. In addition there is currently a small amount of dioxin in air emissions from the plant as well. Whether the residual originates from that or some other source nearby or from known sources farther away is unknown at this time.

Salmon Falls River

South Berwick One bass and ten white suckers were collected from the Rollinsford Impoundment about 2 miles below the discharge from the Berwick Sewer District in Berwick, whose discharge is 85% effluent from Prime Tanning. TCDD and TEQs in the bass were marginally significant and slightly lower than in 1990, although not enough fish were caught in either year to give a complete or good sample. TEQs in whole suckers were significant when normalized as fillets. TCDD is slightly lower and TEQs slightly higher than in 1992. Both are slightly higher than 1988-90. Concentrations are nearly twice as high as in the West Branch of the Sebasticook River below the Hartland Tannery discharge. There are no new effluent or sludge data to aid interpretation of trends.

Sebasticook River

West Branch at Palmyra Five smallmouth bass and ten white suckers were collected 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. TEQs in bass fillets were significant. TEQs were statistically higher than in 1992 and slightly lower than in 1988-90. Higher TCDD and TEQs in the one larger fish increased the mean for the site significantly from that of the other 4 smaller fish which had relatively uniform TCDD (Appendix 2). Throwing out the one large fish, however, did not affect the statistical significance. TEQs in suckers were significant when normalized as fillets. TCDD was similar to 1992 and TEQs were slightly higher but statistically lower than in 1990. There are no new sludge data to aid interpretation of any trend.

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APPENDIX 1

MAINE BUREAU OF HEALTH

FISH CONSUMPTION ADVISORY, 10 FEBRUARY 1992

LOBSTER TOMALLEY CONSUMPTION ADVISORY, 2 FEBRUARY 1994

HUMAN SERVICES News

Office of Public Affairs & Communications
Maine Department of Human Services
State House Station 11
Augusta, Maine 04333
Tel. 289-3707

JOINT STATEMENT, FEBRUARY 10, 1992:
Department of Environmental Protection
Department of Human Services
Department of Inland Fish and Wildlife

SUBJECT: REDUCED DIOXIN LEVELS PROMPT REVISED FISH ADVISORY

CONTACT: Robert Frakes
Department of Human Services
Bureau of Health
Telephone: 289-5378

Dean Marriott, Commissioner
Department of Environmental Protection
Telephone: 289-2812

AUGUSTA - Recent tests by the Department of Environmental Protection (DEP) showed reductions in levels of dioxin in fish taken from Maine's major rivers. The results are similar to those reported by the paper industry in August 1991.

Officials say the changes reflect reduced discharges of the chemical from pulp and paper mills across the state. The improvements have prompted a revision of a fish consumption advisory issued in March 1990.

The new language raises recommended consumption limits for most segments of the population. Previous advisories that pregnant women and nursing mothers not eat fish caught in the Presumpscot River below Westbrook and the West Branch of the Sebasticook below Hartland have also been lifted.

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According to State Toxicologist Dr. Robert Frakes, data from Maine's dioxin Monitoring Program supports revising the warnings to be published in the State Open Water Fishing Regulations. However, some cautions remain in place.

"Women of childbearing age still should not eat any fish from the Androscoggin River, the Kennebec River below Skowhegan and the Penobscot River below Lincoln. Furthermore, the general public should not eat more than one fish meal per month from the Androscoggin or more than two fish meals per month from those sections of the Kennebec and Penobscot".

A "fish meal" is considered to be one 8-ounce portion.

Dioxion levels in fish have been monitored under the DEP administered program since 1988. Because even very low levels of TCDD dioxin have been linked to increased cancer rates and reproductive problems in laboratory animals, health advisories were issued in 1985, 1987 and 1990.

Commenting on the latest revision to the advisories, DEP Commissioner Dean Marriott emphasized the progress that has been made in a relatively short period of time.

"Industry has been working to reduce the formation of dioxin by actually changing the manufactoring process. The recent data would seem to indicate that these efforts are showing positive results."

A full report of the 1991 Dioxin Monitoring Program is now being prepared and will be presented to the legislature's Joint Standing Committee on Energy and Natural Resources.

HUMAN SERVICES News

Maine Department of Human Services
State House Station 11
Augusta, Maine 04333
Tel. 289-3707

FEB 02 1994

JOINT HEALTH ADVISORY

CONTACT: **Maine Department of Environmental Protection**
Dean Marriott, Commissioner, 287-2812
Maine Department of Human Services
Lani Graham, MD. MPH, Director, Bureau of Health, 287-3201
Maine Department of Marine Resources
William Brennan, Commissioner, 624-6550

AUGUSTA - Preliminary analysis of data from tests conducted on lobsters taken off the coast of Maine indicate unacceptably high concentrations of dioxin in lobster tomalley, but not in lobster meat. These results have prompted state officials to issue a health advisory against the consumption (eating) of tomalley by pregnant women, nursing mothers and women of child bearing age. This recommendation is based on the principle that developing children are considered to be at highest risk for possible injury resulting from exposure to dioxin.

Others should limit their consumption of tomalley, as dioxin found in tomalley will contribute to the overall intake of this chemical, and to cancer risk generally.

The tomalley is the soft, green substance found in the body cavity of the lobster. It functions as the liver and pancreas of the lobster serving to filter, metabolize and detoxify all substances that are

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consumed by the lobster. As a result of this protective function, the tomalley concentrates certain chemicals which cannot be eliminated or detoxified.

Dioxin is a substance which has been linked to cancer and adverse birth outcomes in animals. Since 1988, Maine has been sampling fish for dioxin, but lobsters had not been included until the 1993 round of tests. This round of tests has revealed unexpectedly high concentrations of dioxin in the tomalley (13.4 - 30.7 ppt), but not in the meat.

Maine's advisory is similar to one issued by the Massachusetts Department of Public Health, and to cautionary statements issued by the seafood marketing industry.

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APPENDIX 2

DIOXIN AND FURAN IN MAINE FISH AND SHELLFISH

1993

CODES

STATIONS

ARR	ANDROSCOGGIN RIVER AT RUMFORD
ARJ	ANDROSCOGGIN RIVER AT JAY
ARLV	ANDROSCOGGIN RIVER AT LIVERMORE FALLS
ARG	ANDROSCOGGIN RIVER AT GULF ISLAND POND, AUBURN
ARLS	ANDROSCOGGIN RIVER AT LISBON FALLS
KRF	KENNEBEC RIVER AT SHAWMUT, FAIRFIELD
KRS	KENNEBEC RIVER AT SIDNEY
KRA	KENNEBEC RIVER AT AUGUSTA
KRR	KENNEBEC RIVER AT RICHMOND
KRP	KENNEBEC RIVER AT PHIPPSBURG
PBL	PENOBSCOT RIVER AT SOUTH LINCOLN
PBV	PENOBSCOT RIVER AT VEAZIE
PBB	PENOBSCOT RIVER AT BANGOR
PBS	PENOBSCOT RIVER AT STOCKTON SPRINGS
PRU	PRESUMPSCOT RIVER AT WINDHAM
PRW	PRESUMPSCOT RIVER AT WESTBROOK
PRP	PRESUMPSCOT RIVER AT PORTLAND
SCB	SACO BAY AT SCARBOROUGH
SLF	SALMON FALLS RIVER AT SOUTH BERWICK
SBW	W BR SEBASTICOOK RIVER AT PALMYRA

SPECIES

BNT	BROWN TROUT
LOB	LOBSTER
SMB	SMALLMOUTH BASS
WSU	WHITE SUCKER

DIOXIN AND FURAN IN MAINE FISH AND SHELLFISH 1993 (pg/g wet weight)

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
ANDROSCOGGIN RIVER				
Rumford				
ARR-SMB-COMP-1	2.31	7.51	3.56	4.31
ARR-SMB-COMP-2	3.80	12.10	5.83	7.06
(ARR-SMB-3)	(2.68)	(10.8)	(4.24)	(4.90)
(ARR-SMB-4)	(3.46)	(7.72)	(4.84)	(5.50)
ARR-SMB-COMP-3	3.30	15.70	5.66	6.86
ARR-SMB-COMP-4	2.78	7.05	4.05	4.91
ARR-SMB-COMP-5	2.22	5.76	3.25	3.94
mean	2.88	9.62	4.47	5.41
ARR-WHS-COMP-1	6.46	47.80	13.88	14.99
ARR-WHS-COMP-2	5.23	54.70	13.21	14.27
mean	5.85	51.25	13.54	14.63
Jay				
ARJ-SMB-COMP 01	1.89	1.74	2.40	2.91
ARJ-SMB-COMP 02	1.60	1.60	2.05	2.48
ARJ-SMB-COMP 03	1.33	1.08	1.67	2.03
ARJ-SMB-COMP 04	0.93	0.58	1.15	1.39
ARJ-SMB-COMP 05	1.09	3.49	1.67	2.03
mean	1.37	1.70	1.79	2.17
ARJ-WHS-COMP 01	4.56	45.20	11.21	12.11
ARJ-WHS-COMP 02	4.39	41.90	10.59	11.44
mean	4.48	43.55	10.90	11.77
Livermore Falls				
ARLV-SMB-COMP 01	1.19	0.60	1.25	2.00
ARLV-SMB-COMP 02	1.36	0.64	1.56	1.66
ARLV-SMB-COMP 03	1.29	0.29	1.45	1.53
ARLV-SMB-COMP 04	1.87	2.80	2.36	2.50
ARLV-SMB-COMP 05	1.20	0.51	1.37	1.45
mean	1.38	0.97	1.60	1.83
ARLV-WHS-COMP 01	4.43	23.00	8.31	8.97
ARLV-WHS-COMP 02	2.85	18.80	5.24	5.71
mean	3.64	20.90	6.78	7.34

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
ANDROSCOGGIN RIVER cont.				
Auburn				
ARG-SMB-01	1.14	3.41	1.63	1.72
ARG-SMB-03	1.92	6.20	2.79	2.95
ARG-SMB-04	0.79	2.18	1.10	1.17
ARG-SMB-05	1.27	4.57	1.90	2.01
ARG-SMB-07	1.13	3.39	1.61	1.71
mean	1.25	3.95	1.81	1.91
ARG-WHS-COMP-1	3.52	32.80	8.40	9.07
ARG-WHS-COMP-2	3.82	40.00	9.65	10.43
mean	3.67	36.40	9.02	9.75
ARG-BUL-COMP-1	2.15	4.75	3.24	3.50
ARG-BUL-COMP-2	2.02	2.41	2.79	3.01
mean	2.09	3.58	3.02	3.26
Lisbon Falls				
ARLS-SMB-COMP 01	1.31	3.80	1.86	1.97
ARLS-SMB-COMP 02	0.64	1.29	0.85	0.90
ARLS-SMB-COMP 03	1.02	2.88	1.44	1.52
ARLS-SMB-COMP 04	1.32	5.91	2.10	2.22
ARLS-SMB-COMP 05	1.62	6.06	2.45	2.59
mean	1.18	3.99	1.74	1.84
ARLS-WHS-COMP 01	2.30	20.00	5.31	5.73
ARLS-WHS-COMP 02	3.08	25.20	6.91	7.47
mean	2.69	22.60	6.11	6.60
KENNEBEC RIVER				
Fairfield				
KRF-BNT-01	1.12	1.32	1.25	1.90
KRF-BNT-02	1.55	1.73	1.76	2.03
KRF-BNT-03	1.22	1.62	1.41	1.63
KRF-BNT-04	1.65	1.80	1.87	2.15
mean	1.39	1.56	1.57	1.93
KRF-SMB-COMP-1	3.04	4.08	3.52	4.06
KRF-SMB-COMP-2	1.28	1.93	1.50	1.73
KRF-SMB-COMP-3	ND(.92)	ND(.07)	0.95	1.09
KRF-SMB-COMP-4	1.14	1.36	1.30	1.50
KRF-SMB-COMP-5	1.03	1.33	1.19	1.37
mean	1.48	1.88	1.70	1.96
KRF-WHS-COMP-1	1.59	4.05	2.00	2.61
KRF-WHS-COMP-2	1.53	4.05	2.39	2.58
mean	1.56	4.05	2.20	2.60

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
KENNEBEC RIVER cont.				
Sidney				
KRS-SMB-COMP-1	0.80	1.21	1.11	1.88
KRS-SMB-COMP-2	0.69	1.15	0.97	1.64
KRS-SMB-COMP-3	0.93	0.78	1.21	2.05
KRS-SMB-COMP-4	0.26	0.34	0.35	0.59
KRS-SMB-COMP-5	ND(.27)	0.30	0.04	0.06
mean	0.59	0.76	0.80	1.36
KRS-WHS-COMP-1	1.58	5.08	2.58	2.78
KRS-WHS-COMP-2	1.50	4.48	2.40	2.60
mean	1.54	4.78	2.49	2.69
Augusta				
KRA-SMB-01	0.79	1.02	1.07	1.82
KRA-SMB-02	0.44	0.45	0.58	0.99
KRA-SMB-03	0.89	1.11	1.21	2.05
KRA-SMB-04	0.54	0.66	0.73	1.24
KRA-SMB-05	0.58	0.76	0.79	1.34
mean	0.65	0.80	0.88	1.49
KRA-WHS-COMP-01	2.06	7.53	3.47	3.75
KRA-WHS-COMP-02	1.76	7.56	3.11	3.35
mean	1.91	7.55	3.29	3.55
Richmond				
KRR-EEL-COMP-01	0.62	0.20	0.77	1.31
KRR-EEL-01	0.86	0.19	1.06	1.79
mean	0.64	0.20	0.80	1.35
Phippsburg				
KRP-LOB-MEAT 01	0.21	1.35	0.35	1.30
KRP-LOB-MEAT 02	0.19	1.10	0.30	1.10
mean	0.20	1.23	0.33	1.20
KRP-LOB-TOMALLEY 01	7.54	83.20	26.70	26.90
KRP-LOB-TOMALLEY 02	8.33	88.20	28.30	28.40
mean	7.94	85.70	27.50	27.65

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
PENOBSCOT RIVER				
South Lincoln				
PBL-SMB-COMP-1	1.35	3.97	1.99	2.33
PBL-SMB-COMP-2	1.03	2.29	1.43	1.68
PBL-SMB-COMP-3	1.02	2.11	1.40	1.64
PBL-SMB-COMP-4	0.55	1.03	0.74	0.87
PBL-SMB-09	1.96	2.09	2.46	2.89
mean	1.10	2.32	1.51	1.78
PBL-WHS-COMP-01	1.69	12.70	3.44	3.48
PBL-WHS-COMP-02	1.77	13.50	3.63	3.67
mean	1.73	13.10	3.53	3.58
Veazie				
PBV-SMB-COMP 1	0.53	2.01	0.73	1.40
PBV-SMB-COMP-2	0.74	2.40	1.07	1.20
PBV-SMB-COMP-3	1.05	1.80	1.35	1.52
PBV-SMB-COMP-4	0.20	0.44	0.27	0.30
PBV-SMB-COMP-5	0.35	0.80	0.47	0.53
mean	0.57	1.49	0.78	0.99
PBV-WHS-COMP-O3	1.18	12.30	2.73	3.20
PBV-WHS-COMP-04	1.10	12.50	2.73	2.76
mean	1.14	12.40	2.73	2.98
Bangor				
PBB-EEL-COMP-01	1.03	0.16	1.15	1.29
PBB-EEL-COMP-02	0.92	0.20	1.03	1.16
mean	0.98	0.18	1.09	1.23
Stockton Springs				
PBS-LOB-MEAT 01	0.13	1.21	0.35	1.20
PBS-LOB-MEAT 02	0.10	0.61	0.17	1.00
mean	0.12	0.91	0.26	1.10
PBS-LOB-TOMALLEY 01	4.28	56.60	30.60	30.70
PBS-LOB-TOMALLEY 02	3.63	48.50	25.30	25.40
mean	3.96	52.55	27.95	28.05

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
PRESUMPSCOT RIVER				
Windham				
PRU-SMB-COMP-4	ND(.08)	0.25	0.03	0.22
PRU-SMB-COMP-5	ND(.11)	0.53	0.05	0.36
mean	ND(.09)	0.39	0.04	0.29
PRU-WSU-COMP 1	0.25	1.88	0.58	0.67
PRU-WSU-COMP 2	0.39	2.48	0.84	0.98
mean	0.32	2.18	0.71	0.83
Westbrook				
PRW-SMB-01	ND(.16)	0.93	0.12	0.50
PRW-WHS-COMP-1	1.68	4.83	2.16	2.77
PRW-WHS-COMP-2	0.51	6.39	1.51	1.77
mean	1.10	5.61	1.84	2.27
Portland				
PRP-LOB-MEAT-01	ND(.09)	0.40	0.04	0.90
PRP-LOB-MEAT-02	0.10	0.60	0.16	0.80
mean	0.10	0.50	0.10	0.80
PRP-LOB-TOMALLEY	3.66	43.60	20.50	20.60
PRP-LOB-TOMALLEY	3.20	38.80	16.60	16.80
mean	3.43	41.20	18.55	18.70
SACO BAY				
Scarborough				
SCB-LOB-MEAT 01	ND(.08)	0.29	0.03	0.80
SCB-LOB-MEAT 02	0.09	0.45	0.14	0.80
mean	0.08	0.37	0.08	0.80
SCB-LOB-TOMALLEY 01	2.05	28.00	12.20	15.80
SCB-LOB-TOMALLEY 02	1.89	25.90	10.40	13.40
mean	1.97	26.95	11.30	14.60

Field ID	2378TCDD	2378TCDF	TEQ (a)	TEQ (b)
SALMON FALLS RIVER				
S Berwick				
SLF-SMB-01	0.22	0.23	0.24	0.90
SLF-WHS-COMP-01	2.20	4.61	4.85	5.00
SLF-WHS-COMP-02	1.60	3.39	2.39	2.59
mean	1.90	4.00	3.62	3.80
SEBASTICOOK RIVER				
Palmyra W Branch				
SBW-SMB-01	1.60	0.72	2.76	3.58
SBW-SMB-02	0.60	0.26	0.70	0.89
SBW-SMB-03	0.71	0.28	0.83	1.05
SBW-SMB-04	0.85	0.35	0.99	1.26
SBW-SMB-05	0.72	0.27	0.83	1.06
mean	0.89	0.38	1.22	1.57
SBW-WHS-COMP-01	1.01	0.96	3.90	3.96
SBW-WHS-COMP-02	0.99	0.94	1.33	1.44
mean	1.00	0.95	2.62	2.70
Method Blank b1	ND(.10)	ND(.08)		
Method Blank b2	ND(.08)	ND(.07)		
Method Blank b3R	ND(.04)	ND(.05)		
Method Blank b4	ND(.08)	ND(.08)		
Method Blank b6	ND(.11)	ND(.10)		
Method Blank b7	ND(.08)	ND(.08)		

(a) TEQ Estimated Toxic Equivalents using EPA (1989) Toxic Equivalency Factors (TEF) at ND = 0, and 1991 full congener analysis at 1. same site, 2. n upstream site, 3. nearest down stream site or 4. state

(b) TEQ Estimated Toxic Equivalents using EPA (1989) Toxic Equivalency Factors (TEF) at ND = detection limit, and 1991 full congener analysis at 1. same site, 2. n upstream site, 3. nearest down stream site or 4. state

APPENDIX 3

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

APPENDIX 3. DIOXIN AND FURAN IN SLUDGE FROM MAINE WASTEWATER TREATMENT PLANTS (pg/g dry weight)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
AUGUSTA SANITARY DISTRICT	900409		<1.2	<1.3	1.3
	900607		<3.9	2.5	<4.2
	900914		<20.0	E20.0	<22.0
	910220		<1.9	0.79	<11.1
ANSON-MADISON SANITARY DISTRICT	910408		<1.3	2.2	<1.5
	911001		1.7	4.6	2.2
BERWICK SEWER DISTRICT	861111		<2.5	<4.0	<2.9
	890301	76.4	14	19.9	16.1
	890927	75.3	<12.1	<12.1	<13.4
	891208	87.5	1152	872	40
BIDDEFORD	910513		<0.86	3.7	8.0
	910703		<0.57	<0.95	<2.9
	920204		<1.5	2.9	<9.4
	930121		<2.4	<3.2	<11.4
BOISE CASCADE CORP RUMFORD	850621		32.0		
	880602		105.0	674.0	171.4
	890108	77.1	114	569	171
	890407	73.1	46.5	184	65.1
	890628	76.8	E9.91	134	E23.3
BREWER	920316		<1.0	6.1	<5.0
	920901		<6.0	110	<43.1
	921116		3.8	19	<10.7
	930202		<3.7	11	<18.0
	930511		1.2	9.8	<8.7
	930826		4.1	25	<11.3
CORINNA SEWER DISTRICT	850506		10.3		
	871117		31.7		
	880302		3.18		
	890222		64.1		
	890510		2.24		
	900606		26.5		
	900919		11.2		
	910313		29.2		
	910514		13.9		
	930405		6.7		
FRASER PAPER LTD MADAWASKA	880903	68.3	13.9	233	37.2
	890106	79.1	E23.4	204	E44
	890406	71.3	E3.83	12.9	5.23
	890930	80.1	5.02	E26.6	7.54

APPENDIX 3. (CONT.)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
GARDINER WATER DISTRIC	900818		<0.87	4.6	<1.33
	910401		1.4	4.4	<1.84
	920504		<3.5	9.4	<6.6
	921116		0.9	6.4	4.8
	930407		<0.13	0.92	<0.8
	931115		<0.3	<3.3	<2.2
GEORGIA PACIFIC CO					
MILLINOCKET	850618		<0.4		
	891217		0.94	3.2	2.4
WOODLAND	880602		<1.9	7.3	<2.6
	890113	75.8	<6.2	<3.55	<6.61
	890424	74.7	<0.63	<4.74	<5.53
	890718	66.0	<1.76	12.94	<38.1
HARTLAND WASTEWATER	881007	65.0	<2.86	<1.71	<2.86
TREATMENT PLANT	881221	65.5	<7.25	E6.09	<7.83
	890312	64.3	<0.28	5.6	<0.84
	890627	63.3	<1.36	6.54	<1.91
HAWK RIDGE COMPOST	1989-90	mean n=6	6.6	15.9	8.2
UNITY	1991	(1.6-13)		mean n=4	6.6
(compost)	920101		2.6	18	17.5
	920301				14.9
	920715		<2.0	34	19.4
	921007		2.2	23	10.8
INTERNATIONAL PAPER CO	850621		51.3W		
JAY	870115		190	760	266
	880218		24	130	39
	880219		23	121	34.1
	880223		14	75	21.5
	880225		57	250	82
	880226		15	79	22.9
	880227		13	79	20.9
	881231		16.6W	143W	30.9W
	890124		15W	77W	22.7W
	890126		28	112	39.2
	890214	ash		0.63	0.2
	890323		7.7W	42.6W	12.0W
	890417		24	150	39.0
	890714	ash	0.07	0.02	0.1
	891012	ash	0.14	<.02	<0.14
	891231	ash	0.06	<0.62	<0.12
	900205		<18.7	150	<33.7
	900402	ash	0.05	<0.02	0.05
	900501	ash	<0.71	0.03	<0.71
	900614	ash	<0.60	0.36	<0.60
	901201	ash	<2.4	0.12	<2.41
	910117	ash	<3.9	0.15	<3.91
	910701	ash	<0.44	<0.1	<1.07
	910801	ash	<0.44	<1.0	<0.03
	911121	ash	<1.9	<1.9	<0.07

APPENDIX 3. (CONT.)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
INTERNATIONAL PAPER CO	920129	ash	<1.0	0.14	<0.52
JAY	920520	ash	<1.0	0.15	<0.75
	920708	ash	<1.6	0.35	<0.61
	921030	ash	<2.2	<4.8	<0.56
	930113	ash	<1.7	<1.7	<0.11
	930602	ash	<0.9	0.22	<0.39
	930812	ash	<1.1	<1.1	<0.04
	931104	ash	<1.5	<1.5	<0.15
JAMES RIVER CORP	880801		12.0	34.0	15.4
OLD TOWN	881225	78.6	301	963	398
	890423	78.7	380	1197	499
	890718	68.8	50.6	478	98.4
BERLIN, NH	88		104	2930	397
KENNEBEC SANITARY	870713				38.5
TREATMENT DISTRICT	871105				10.2
WATERVILLE	880118				7.2
	880322				5.4
	880518				18.1
	880921				3.6
	890711				42.2
	891011				106.9
	900410		E7.9	121	20.0
	900824		3.3	54.0	12.7
	900909		3.3	24	<26.0
	901101		3.6	12	<20.1
	901221		3.5	6.7	<21.3
	910408		<2.3	<3.3	<15.0
	910606		<2.9	<5.0	<19.4
	910808		3.1	4.1	<19.2
	910911		3.1	4.1	<12.2
	930914		0.3	1.6	<2.9
LEWISTON-AUBURN	871231		<1.0	for year	(n=4)
TREATMENT PLANT	881031		0.04		
	910306		<3.65	<3.65	<4.01
	930622		<2.7	<2.5	<3.5

APPENDIX 3. (CONT.)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
LINCOLN PULP & PAPER C	881119		48W	223W	70.3W
LINCOLN	890123	80.9	1194	4759	1670
	890407	85.1	332	1470	479
	890831	83.5	250	1782	428
dry wt	921019	fly ash	0.8	16.8	7.2
dry wt		bottom ash	<1.1	<1.1	<2.3
dry wt	921207	fly ash	2.1	51.3	15.6
dry wt	930324	bottom ash	<0.4	0.3	<0.9
dry wt	930524	fly ash	23.1	396	170
dry wt		bottom ash	0.9	1	2.1
dry wt	930713	fly ash	17	322	155
dry wt	930812	fly ash	4.7	124	47.4
dry wt	931011	fly ash	10	174	80
dry wt		bottom ash	<0.5	<0.4	<1.0
dry wt	931123	fly ash	8.3	214	96.5
OAKLAND TREATMENT PLAN	910304		<2.5	10	<3.5
	930408		<1.0	<1.0	<6.6
ORONO TREATMENT PLANT	900316		2.1		
	901021		3.9		
	900412		8.5		
	911019		16.1		
	920328		9.42		
	921015		1.13		
	930427		1.33		
PORTLAND WATER DISTRIC	861205				3.8
PORTLAND	870402				4.1
	871124				1.0
	880913				0.1
	891205		E1.2	11.3	3.6
	901001		<3.0	E10	0.6
	920714		0.88	6.4	5.3
	930719		1.3	2.3	<13.1
WESTBROOK	861205				0.5
	870402				4.9
	871119				0.2
	891205		E1.6	14.5	4.9
	901001		<3.0	9	5.5
	920714		<1.1	7.6	3.7
	930719		<1.0	3.2	<24
REGIONAL WASTE SYSTEMS	890111	ash	5.5	28	8.3
PORTLAND	890112	ash	6	24	8.4
	890113	ash	10	50	15
	890114	ash	10	20	12
	890121	ash	6	90	15
	900211	ash	E20	210	E41

APPENDIX 3. (CONT)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
ROBINSON MANUFACTURING	870113		10.1	17.5	18.5
OXFORD	880419		<0.4	<0.2	<0.4
	881004		<7.3	<9.6	<8.2
	890119		<2.1	<1.1	<2.2
	910305		<3	<0.3	<8.0
SCOTT PAPER CO	871008		36		49.8
WINSLOW			31		48.8
	871201		13.5		23.7
	880331		25	219	52.8
	880630		19	177	38.6
	880930		22	189	43.8
	881231		17	181	37.1
	890301	slash	9.7	89	20.3
	890331		18	177	38.5
	890630		14	89	25.1
		slash	7.4	58	14.1
		slash	9.5	63	17.5
	890930		11	67	17.7
	910330		8.3	10	20.5
		slash	6.9	12.3	47.1
	910630		4.6	6.2	13.4
		slash	8.1	16.1	28.9
	910930		6.5	6.9	15
		slash	<1.3	42.4	<10.3
	911230		6.3	6.8	14.3
SCOTT PAPER CO	920224		5.9	54.2	20.4
WINSLOW		slash	12.3	72.6	36.9
	920225		6.5	72.1	14.7
		slash	9.4	153	36.4
	920630		5.2	55	12.5
		slash	3.4	33	11.2
	920930		5.1	60	13.2
		slash	2.9	29	7.6
	921230		7.2	59	18.8
		IWT	5.7	53	13.1
		slash	4.7	55	17.7
	930322		4.7	50	14.2
		slash	7.1	91	34.8
	930707		4.2	39	<15.2
		slash	3	35	<12.1
	930928		3.9	42	11.3
		slash	6.7	80	29.1

APPENDIX 3. (CONT)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
SD WARREN CO SKOWHEGAN	850711		<1.95	pulp mill sludge	
			2.9	paper mill sludge	
	861217		<	47	5
	870519		13	21	15.2
	871201		60		60.1
	880325		27	88	39
	880628		33.0	106	43.6
			6.9	29	9.8
			39.0	149	53.9
		EPA	67.0	330	100.0
	881014		40	98	52.1
	881220		54	177	76.5
	890303		54	91	65.6
	890629		23	53	26
	890926		<	16	<1.6
	891207		18	52	26.4
	900316		<	23	4.9
	900622		35	73	52.1
	900921		45	86	68.8
	901231		39.5	115	57.8
	910331		23.1	50.5	31.8
	910630		39.4	146	66.5
	910917		69.9	260	105.9
	920331		41.2	90.4	<299
	920630		33	56	48.6
	920930		20	39	27.1
	921230		15	45	22.9
	930112		11	31	16.1
	930623		23	73	38
	930924		56	170	78.9
SD WARREN CO. WESTBROOK	850620		17.2		
	870929		31		31.1
	871231		21	135	34.7
	880331		5.6	21	7.7
	880401		8.7	3.9	14.9
	880630		13	55	18.5
	881207		19	127	34.2
			19	69	27.5
	890106		<1.8	31	<4.9
	890320		6.2	18	8.6
	890620		5.3	35	10.5
	890731		5	30	16
	890831		8	40	14.9
	890931		9	60	17.8
	891031		5	30	12.9
	891130		3	30	15.5
	891231		7	50	15.2

APPENDIX 3. (CONT)

LOCATION	DATE	%MOIST	TCDD	TCDF	TEQ
SD WARREN CO.	900131		6	20	14.0
WESTBROOK	900228		2.7	24.6	7.7
	900331		5.1	33.6	17.1
	900430		5.9	34.6	14.9
	900531		5.3	25.8	10.5
	900630		19.0	26.0	29.5
	900730		5.2	20.6	11.6
	900831		2.9	12.1	9.8
	900930		2.5	10	7
	901231		7.7	35.7	24.8
	910331		3.4	21.5	9.1
	910630		2.9	19.6	8.4
	910930		3.8	14.2	5.22
	911231		2.4	25.1	8.2
	920331		1.2	19.4	3.8
	920505		1.6	10.8	5.4
	920821		<	24.5	2.8
S PORTLAND STP	900314		<5.3	3.5	<5.6
	910531		<5	<0.001	<11.2
	920401		<1.0	<0.8	<5.9
	930331		<2.8	<2.8	<19.3
	930324		<2.8	<2.8	<20.3
STATLER TISSUE CO	880930	62.6	36.9	414	78.3
AUGUSTA	881223	61.4	37.6	326	70.2
	890403	61.6	34.6	242	58.8
	890628	65.5	17.7	414	59.1

TEQs calculated from TEFs in Water Bureau rule chapter 567 and nd= detection level

APPENDIX 4

2378-TCDD AND 2378-TCDF IN WASTEWATER FROM MAINE PULP AND PAPER MILLS

APPENDIX 4. 2378-TCDD AND 2378-TCDF IN WASTEWATER FROM MAINE PULP AND PAPER MILLS

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
ANSON MADISON	920408	<3	<3
	921001	<3	20
BOISE CASCADE	880518	120	570
	890301	25	80
	890807	<6	20
	890810	<13	20
	890814	<5	13
	890817	<5	18
	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	

SOURCE	DATE		TCDD (pg/l)	TCDF (pg/l)
BOISE CASCADE	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
GEORGIA PACIFIC (Woodland)	880101		6.8	25
	900316		<5	4
	900423		<3	<6
	900531		<8	<5
	900619		<3	<1
GEORGIA PACIFIC	900716		<1	<3
	900807		<2	<5
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
	920129		13.7	49.9
	920312		19.3	6506
	920320		14.8	73.9
	920423		<13.9	59.1

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
INTERNATIONAL PAPER	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
JAMES RIVER	880630	39	130
	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

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
JAMES RIVER	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
	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	
	920730	16	
	920830	<4.9	
	921030	<3.0	
	921230	4.8	
	930530	<4.2	
	930630	<2.8	
	930830	<1.6	
	930930	<3.5	
	931130	<3.1	
	920330	<5.7	50
	920730	16	69
	920830	<4.9	23

SOURCE	DATE	TCDD (pg/l)	TCDF (pg/l)
LINCOLN PULP AND PAPER	881130	32	130
	920817	11.2	69.8
	920908	<10	27.3
	921117	<10	39.1
	921216	<10	9.5
	931230	<10	<17.3
SD WARREN (Skowhegan)	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
	930616	6.3	14
	930917	7	17
	931203	7.6	19
SD WARREN (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

APPENDIX 5

2378-TCDD AND 2378-TCDF IN SEDIMENTS

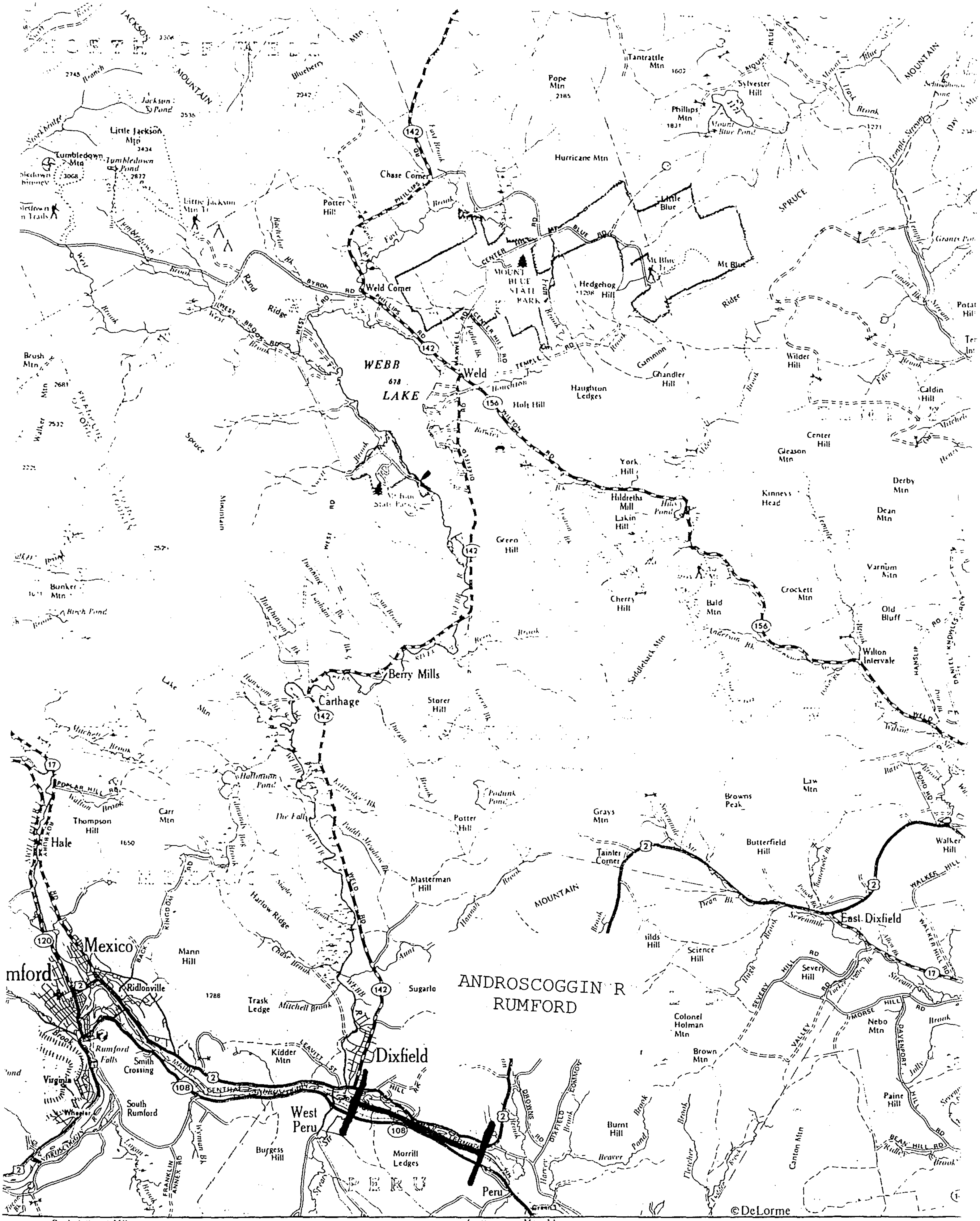
FROM VARIOUS STATIONS ON THE ANDROSCOGGIN RIVER

APPENDIX 5. 2378-TCDD AND 2378-TCDF IN SEDIMENTS FROM STATIONS ON THE ANDROSCOGGIN RIVER (pg/g)

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			

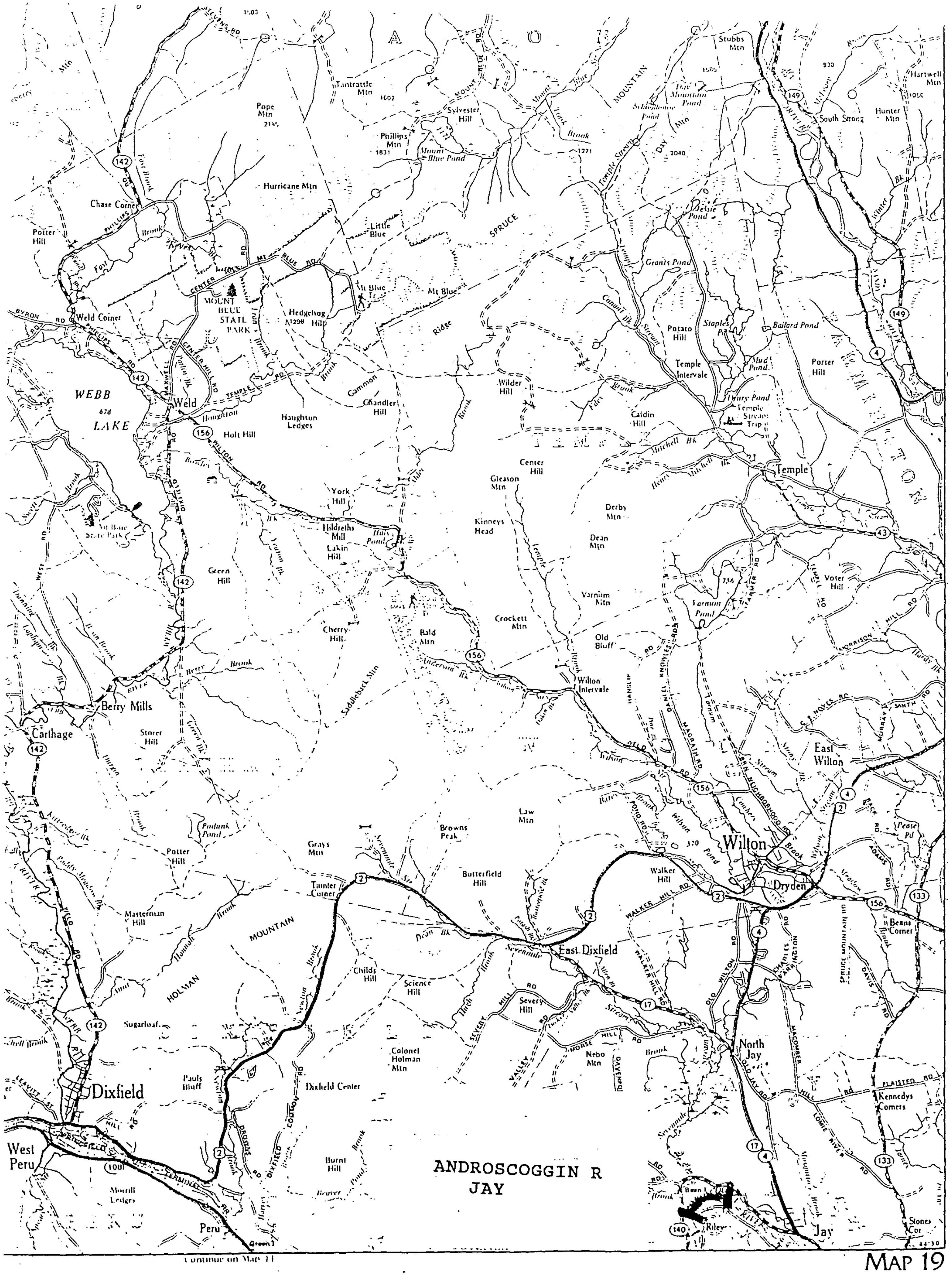
APPENDIX 6

SAMPLE LOCATION MAPS

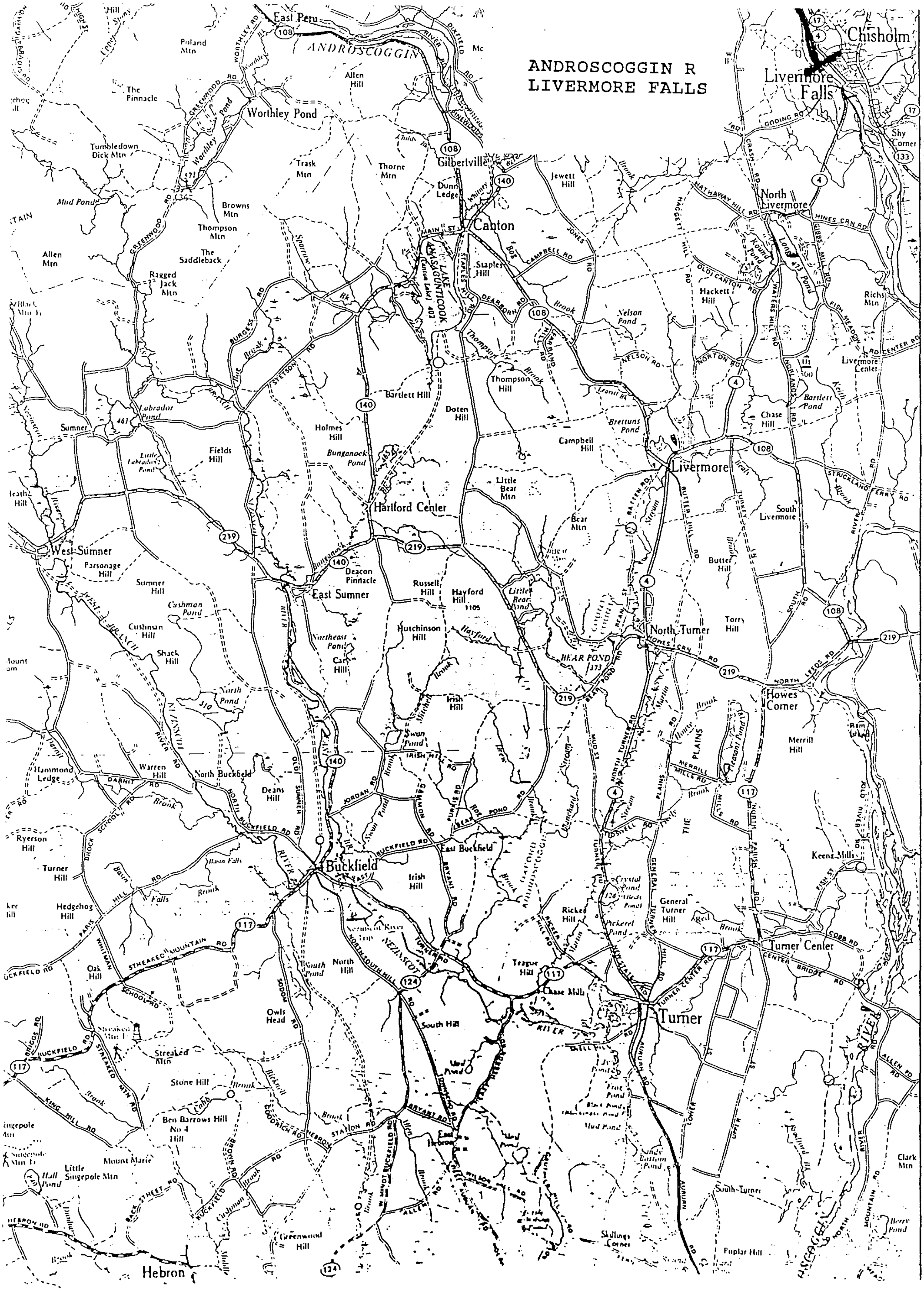


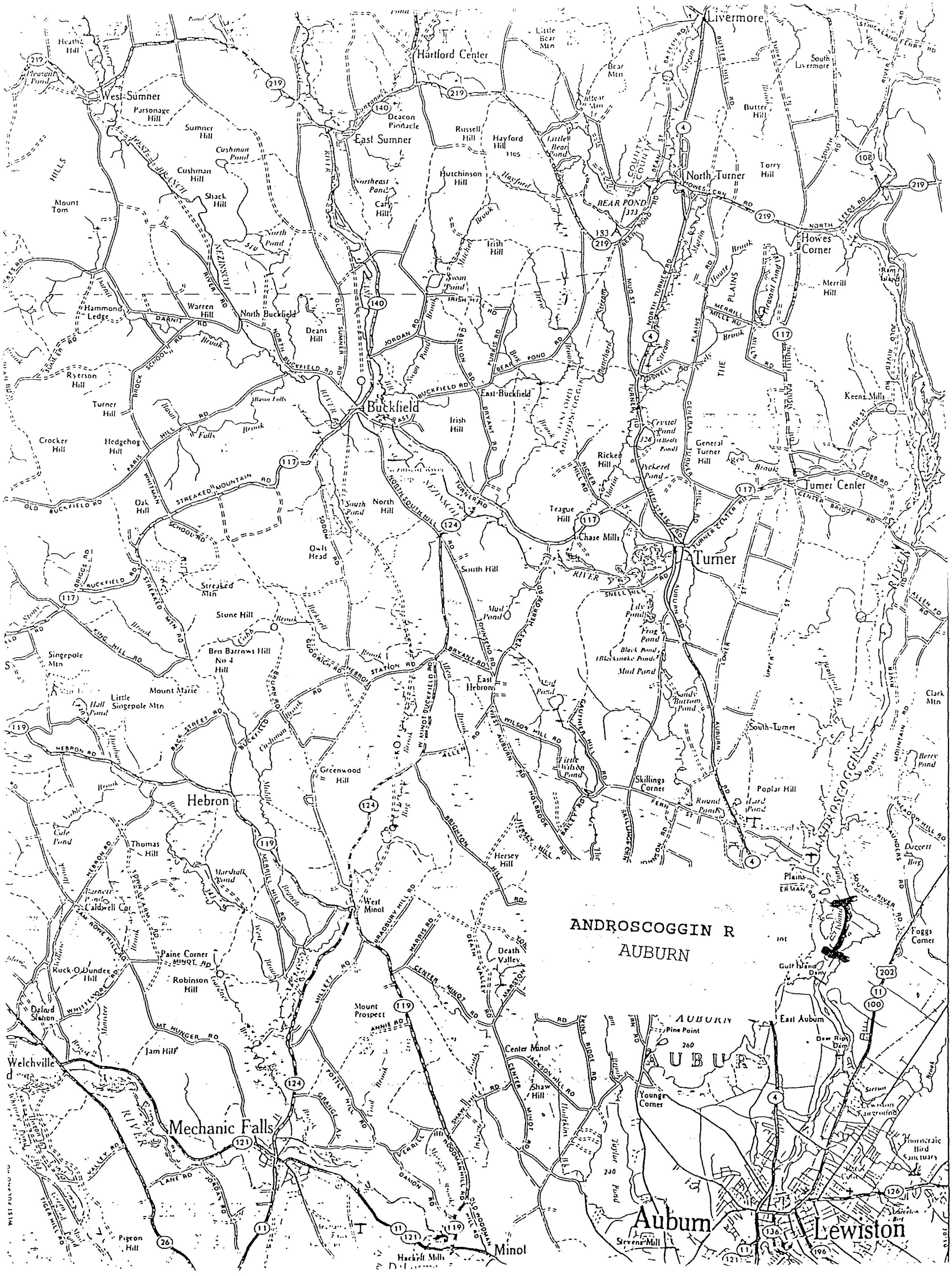
Scale ½" = 1 Mile

Continue on Map 11

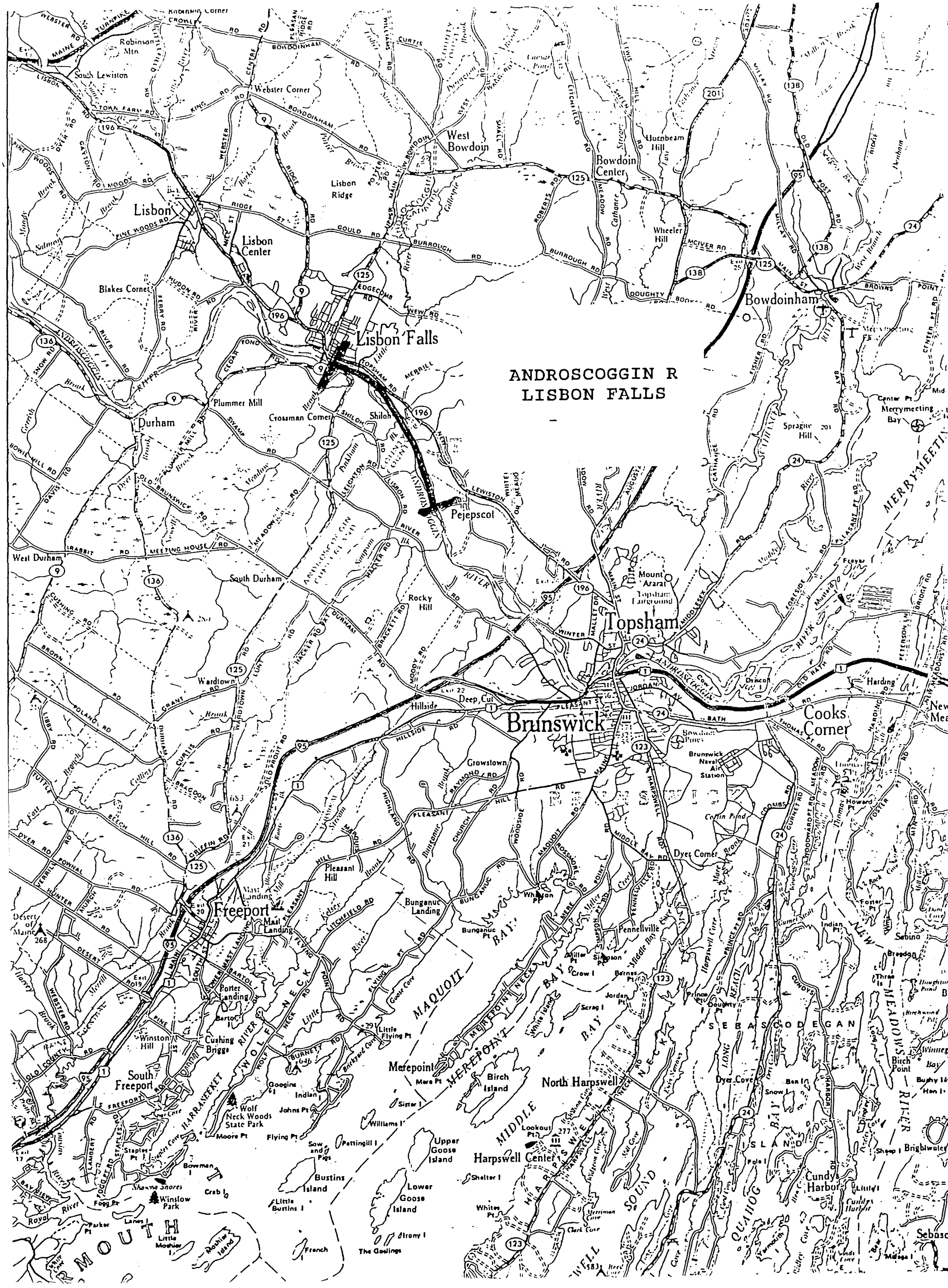


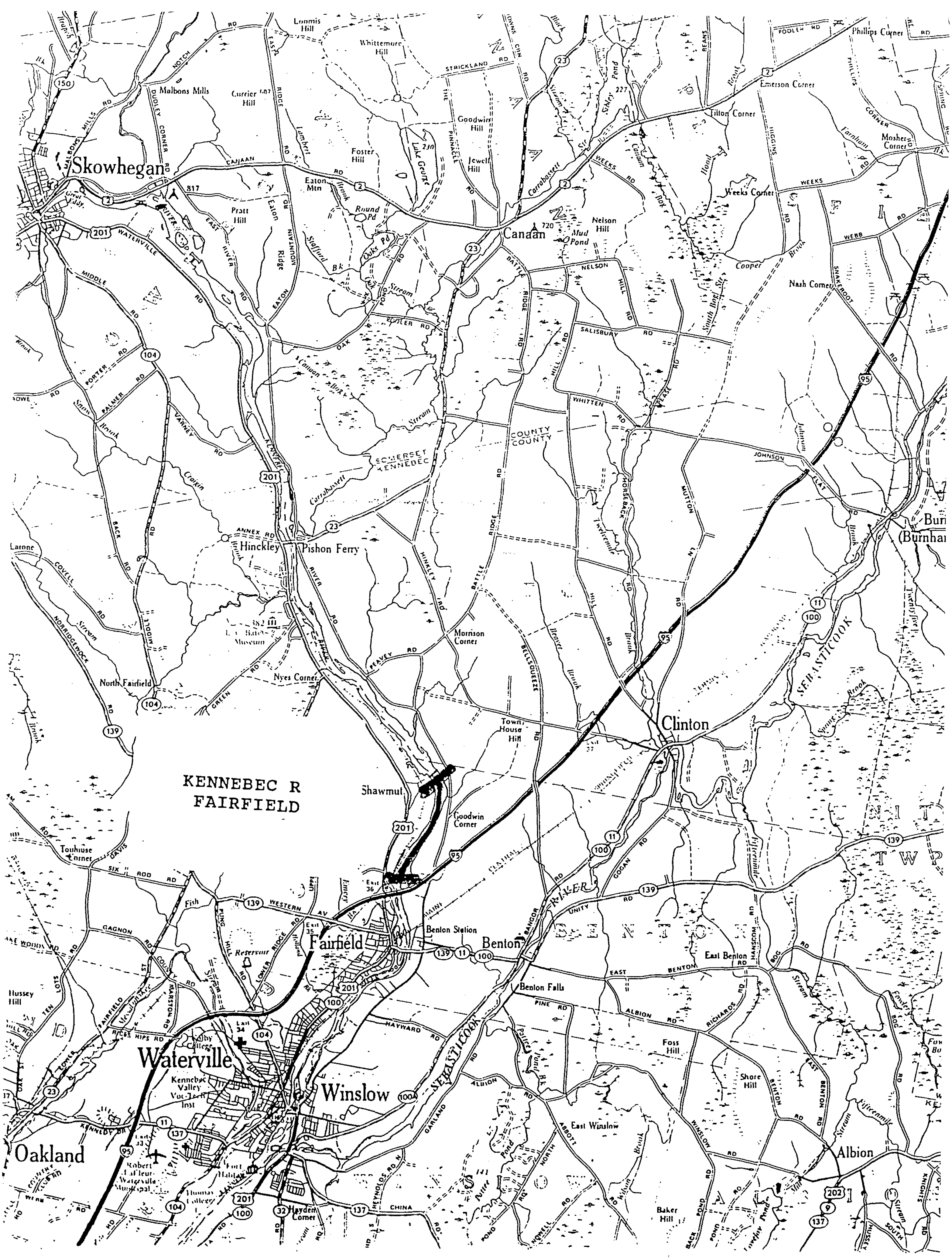
Continue on Map 11


ANDROSCOGGIN R
LIVERMORE FALLS
A
B
C
D
Chisholm
Livermore Falls
Shy Corner
North Livermore
Livermore Center
Livermore
South Livermore
East Peru
ANDROSCOGGIN
Poland Mtn
Allen Hill
The Pinnacle
Worthley Pond
Tumbledown Dick Mtn
Trask Mtn
Thorne Mtn
Gilbertville
Jewett Hill
Dunn Ledge
Canton
Mud Pond
Browns Mtn
Thompson Mtn
Allen Mtn
The Saddleback
Ragged Jack Mtn
Staples Hill
Hackett Hill
Richs Mtn
Nelson Pond
Thompson Hill
Bartlett Hill
Doten Hill
Chase Hill
Bartlett Pond
Labrador Pond
Sumner
Holmes Hill
Fields Hill
Bungonock Pond
Brettuns Pond
Campbell Hill
Little Bear Mtn
Bear Mtn
Hartford Center
West Sumner
Parsonage Hill
Deacon Pinnacle
Russell Hill
Hayford Hill
Butter Hill
East Sumner
Sumner Hill
Cushman Pond
Cushman Hill
Shack Hill
Northeast Pond
Hutchinson Hill
North Turner
Torry Hill
BEAR POND
North Pond
Irish Hill
Howes Corner
Merrill Hill
Hammond Ledge
Warren Hill
North Buckfield
Deans Hill
Swan Pond
Ryerson Hill
Turner Hill
Buckfield
East Buckfield
Keens Mills
Hedgehog Hill
Crystal Pond
General Turner Hill
Ricker Hill
Pickerel Pond
Oak Hill
North Hill
Teague Hill
Turner Center
Owls Head
Chase Mills
Turner
South Hill
Streaked Mtn
Stone Hill
Ben Barrows Hill
No 4 Hill
Mount Marie
Little Singepole Mtn
Hall Pond
Clark Mtn
South Turner
Greenwood Hill
Hebron
Poplar Hill

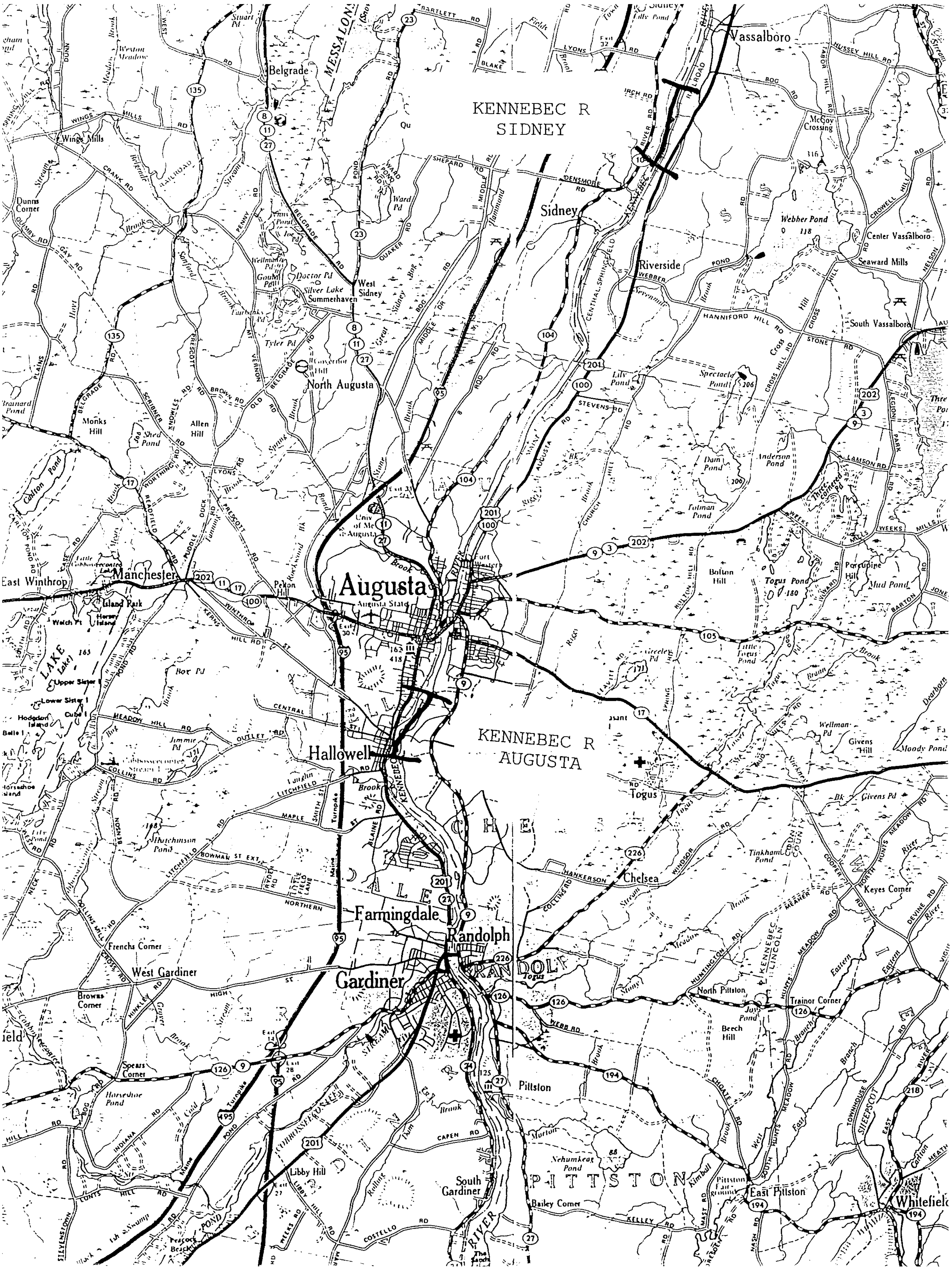


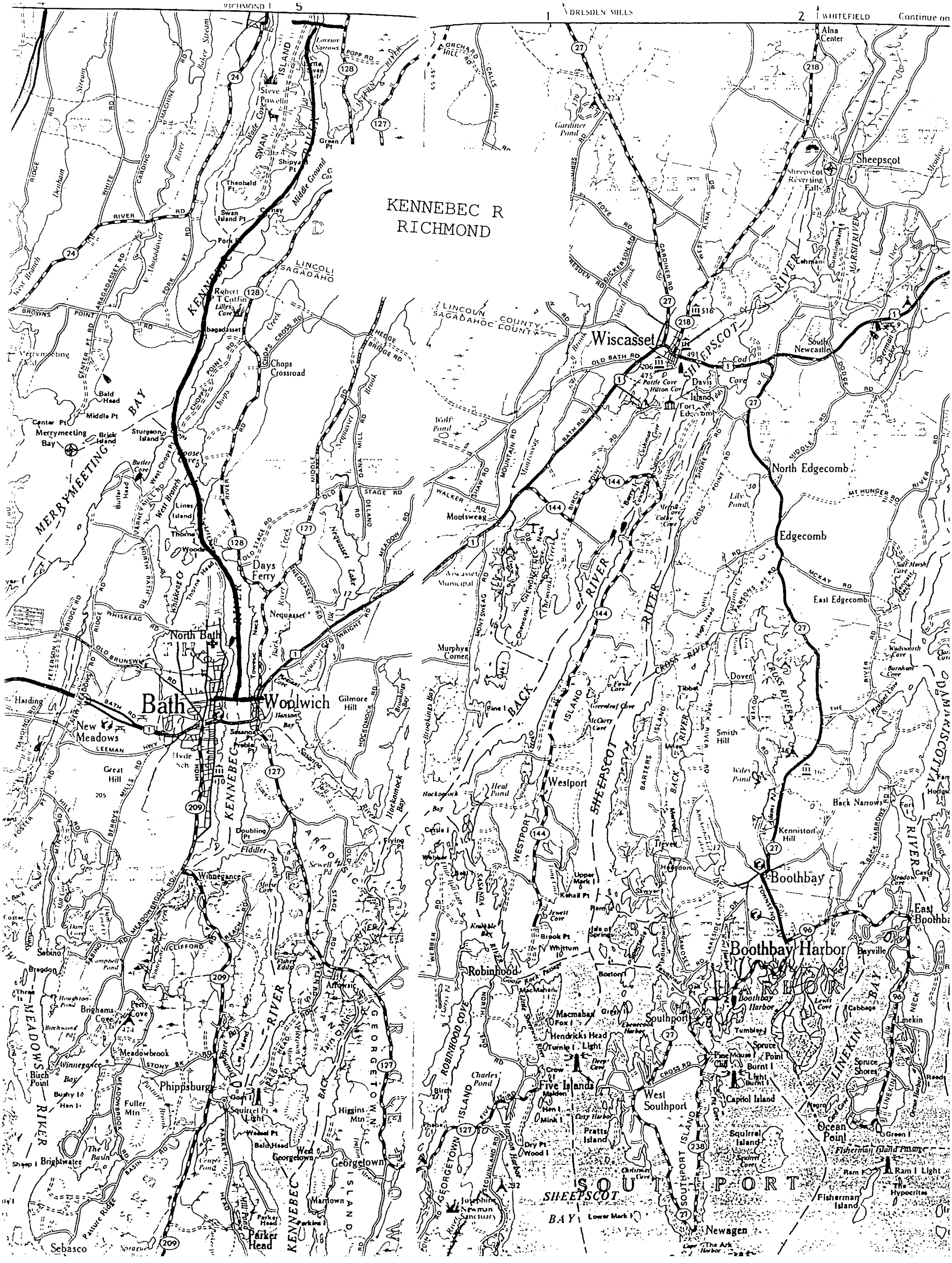
ANDROSCOGGIN R
AUBURN
Livermore
South Livermore
Hartford Center
Little Bear Mtn
Bear Mtn
West Sumner
Heath Hill
Pleasant Pond
Parsonage Hill
Sumner Hill
Deacon Pinnacle
East Sumner
Russell Hill
Hayford Hill
Cushman Pond
Cushman Hill
Shack Hill
Northeast Pond
Cary Hill
Hutchinson Hill
Butter Hill
Torry Hill
North Turner
Bear Pond
Howes Corner
Mount Tom
North Pond
Irish Hill
Swan Pond
Merrill Hill
Hammond Ledge
Warren Hill
North Buckfield
Deans Hill
Ryerson Hill
Turner Hill
Buckfield
East Buckfield
Keens Mills
Crocker Hill
Hedgehog Hill
Irish Hill
Crystal Pond
General Turner Hill
Ricker Hill
Pickerel Pond
Turner Center
Oak Hill
South Pond
North Hill
Teague Hill
Chase Mills
Turner
Owls Head
South Hill
Streaked Mtn
Stone Hill
Mud Pond
Lily Pond
Frog Pond
Black Pond
Mud Pond
Singepole Mtn
Ben Barrows Hill No 4 Hill
Mount Marie
Little Singepole Mtn
Hall Pond
East Hebron
Sandy Bottom Pond
Clark Mtn
South Turner
Berry Pond
Little Wilson Pond
Greenwood Hill
Skillings Corner
Poplar Hill
Hebron
Round Pond
Cole Pond
Thomas Hill
Hersey Hill
Duggett Bog
Marshall Pond
Caldwell Cor
West Minot
Foggs Corner
Paine Corner
Death Valley
Gulf Island Dam
Ruck-O-Dundee Hill
Robinson Hill
Mount Prospect
Oxford Station
East Auburn
Pine Point
Deer Rips Dam
Jam Hill
Center Minot
Welchville
Shaw Hill
Young Corner
Mechanic Falls
Thorncrag Bird Sanctuary
Pigeon Hill
Hackett Mills
Minot
Auburn
Stevens Mill
Lewiston
Androscoggin
Nezinscot
River
219
140
4
108
183
117
124
119
11
121
26
202
100
126
136
196


ANDROSCOGGIN R
LISBON FALLS
Lisbon Falls
Lisbon
Lisbon Center
Lisbon Ridge
South Lewiston
Robinson Mtn
Webster Corner
West Bowdoin
Bowdoin Center
Hornbeam Hill
Wheeler Hill
Bowdoinham
Blakes Corner
Durham
Plummer Mill
Crossman Corner
Shiloh
Pejepscot
West Durham
South Durham
Rocky Hill
Mount Ararat
Topsham Fairground
Topsham
Merrymeeting Bay
Sprague Hill
Wardtown
Hillside
Deep Cut
Brunswick
Cooks Corner
Harding
Growstown
Brunswick Naval Air Station
Bowdoin Pines
Coffin Pond
Dyer Corner
Pleasant Hill
Mast Landing
Freeport
Desert of Maine
Bunganuc Landing
Bunganuc Pt
Whaleboat
Pennellville
Porter Landing
Winston Hill
Cushing Briggs
South Freeport
Wolf Neck Woods State Park
Merepoint
Birch Island
North Harpswell
Harpswell Center
Upper Goose Island
Lower Goose Island
Bustins Island
Little Bustins I
Winslow Park
Little Mosher I
Mosher Island
French
The Goslings
Dyer Cove
Cundys Harbor
Sebasco
Birch Point
Brightwater
Merriconeag Sound
Maquoit Bay
Middle Bay
Harraseeket River
Wolf Neck
Meadows River
Quahog Bay
Sebascodegan Island
New Meadows River
Brunswick
Harpswell Sound

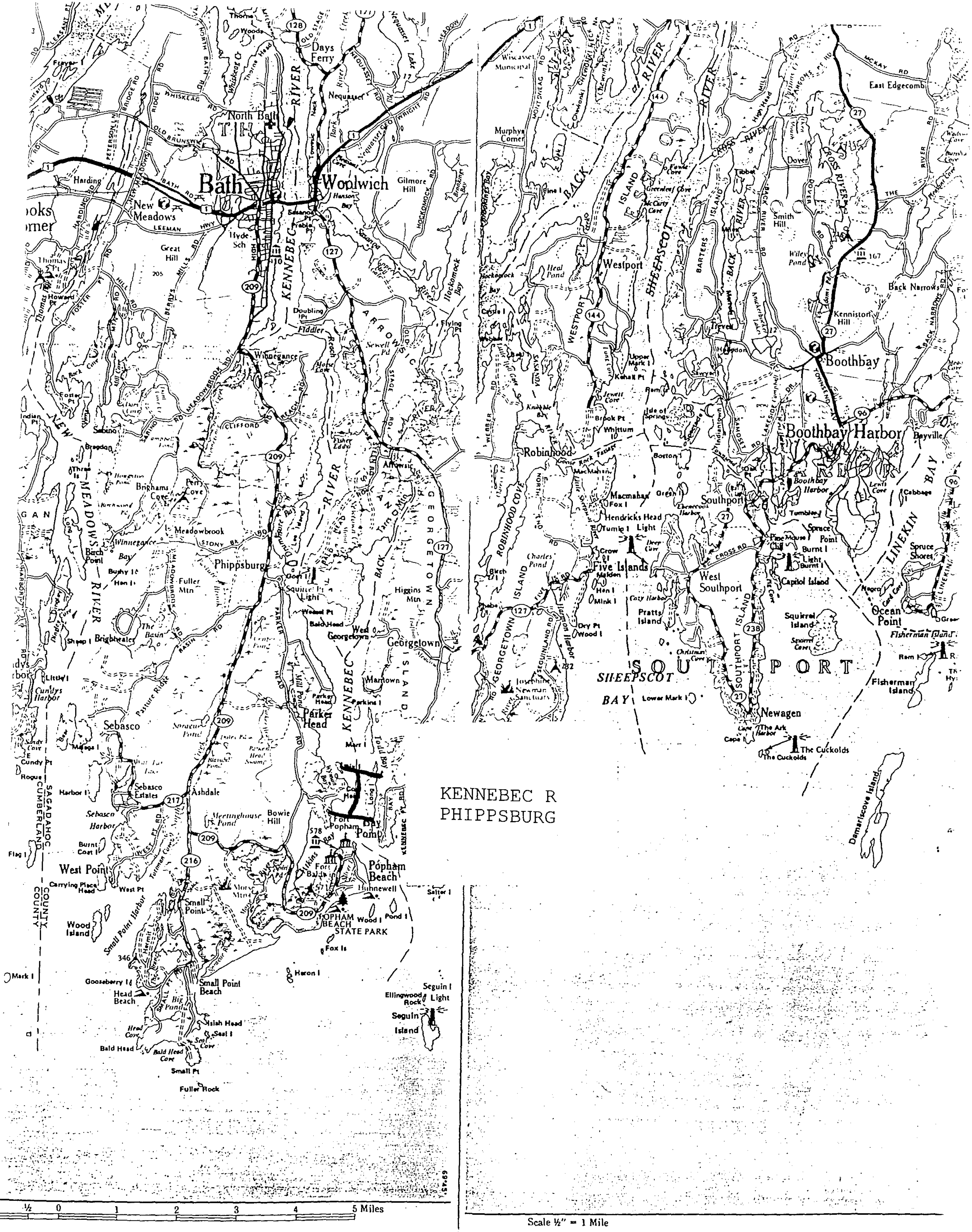


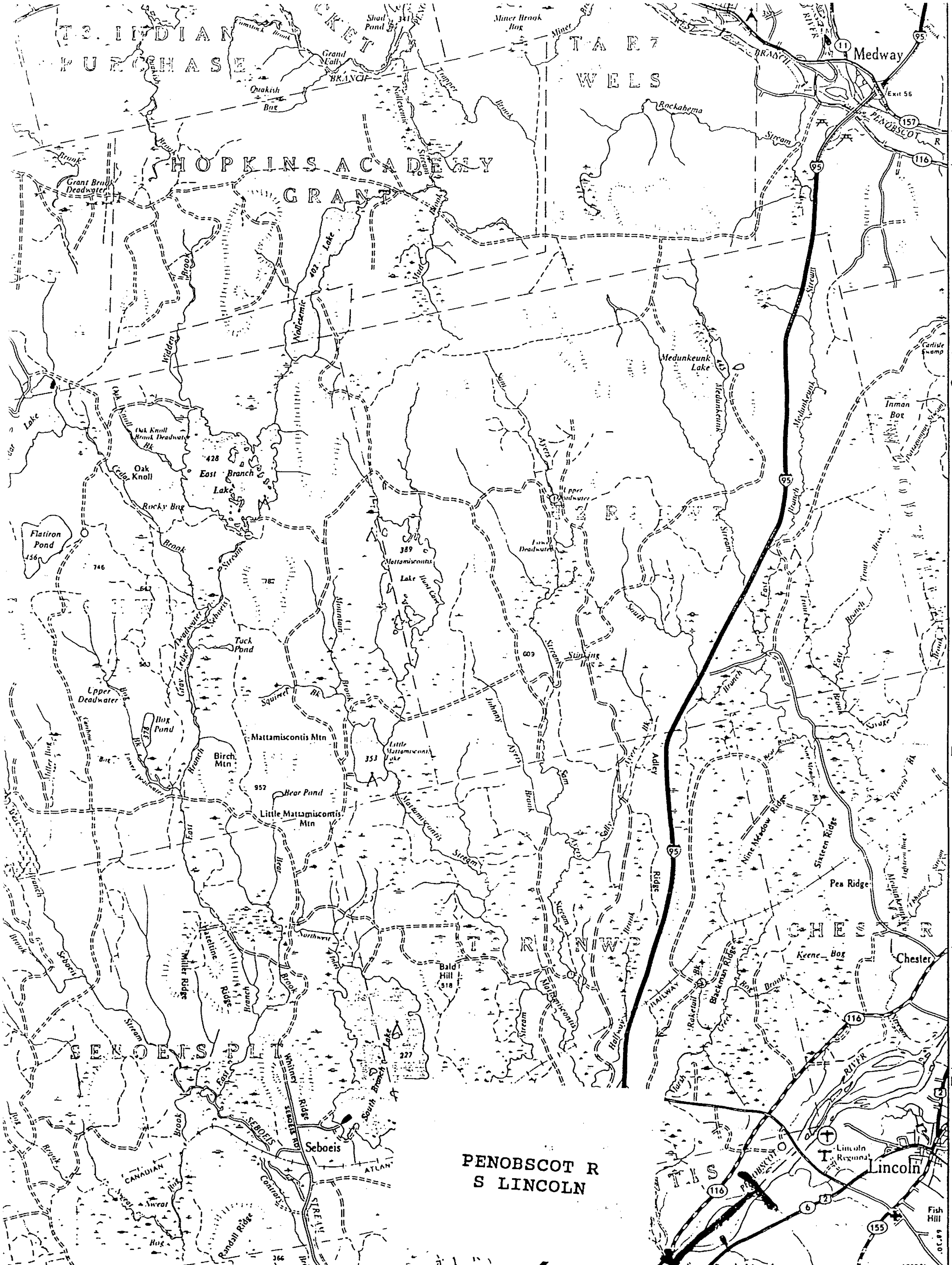
Skowhegan
Canaan
Clinton
Hinckley
Pishon Ferry
Shawmut
KENNEBEC R
FAIRFIELD
Fairfield
Benton
Benton Station
Benton Falls
East Benton
Waterville
Winslow
Oakland
Albion
East Winslow
North Fairfield
Nyes Corner
Morrison Corner
Goodwin Corner
Town House Hill
Malbons Mills
Currier Hill
Loomis Hill
Whittemore Hill
Goodwin Hill
Jewell Hill
Foster Hill
Eaton Mtn
Pratt Hill
Nelson Hill
Mud Pond
Round Pd
Oaks Pd
Phillips Corner
Emerson Corner
Tilton Corner
Mosher Corner
Weeks Corner
Nash Corner
Touhiuse Corner
Hussey Hill
Foss Hill
Shore Hill
Baker Hill
Hayden Corner
Colby College
Kennebec Valley Voc-Tech Inst
Thomas College
Fort Halifax
SOMERSET
KENNEBEC
SEBASTICOOK


KENNEBEC R
SIDNEY
KENNEBEC R
AUGUSTA
Vassalboro
Belgrade
Wings Mills
Dunns Corner
Sidney
Riverside
Center Vassalboro
Seaward Mills
South Vassalboro
McCoy Crossing
Webber Pond
West Sidney
Silver Lake
Summerhaven
North Augusta
Monks Hill
Allen Hill
Shed Pond
Manchester
East Winthrop
Island Park
Pekon Hill
Augusta
Augusta State
Univ of Me at Augusta
Fort Western
Bolton Hill
Togus Pond
Porcupine Hill
Mud Pond
Anderson Pond
Dam Pond
Tolman Pond
Spectacle Pond
Lily Pond
Greeley Pd
Hallowell
Box Pd
Jimmie Pd
Hutchinson Pond
Togus
Wellman Pd
Givens Hill
Moody Pond
Givens Pd
Chelsea
Tinkham Pond
Keyes Corner
Farmingdale
Randolph
Gardiner
West Gardiner
Frenchs Corner
Browns Corner
Spears Corner
Horseshoe Pond
North Pittston
Trainor Corner
Joys Pond
Beech Hill
Pittston
Libby Hill
South Gardiner
Bailey Corner
Nehumkeag Pond
PITTSTON
East Pittston
Whitefield
Upper Sister I
Lower Sister I
Cube I
Hodgdon Island
Welch Pt
Hersey Island
RANDOLPH
HANKERSON
HANNIFORD HILL RD
STEVENS RD
DENSMORE RD
SHEPARD RD
BARTLETT RD
LYONS RD
HUSSEY HILL RD
WINGS MILLS RD
CRANK RD
MEADOW HILL RD
OUTLET RD
CENTRAL
COLLINS RD
LITCHFIELD
MAPLE ST
BOWMAN ST EXT
NORTHERN
WEBB RD
CAPEN RD
COSTELLO RD
KELLEY RD
LUNTS HILL RD
LAMSON RD
WEEKS MILLS RD



RICHMOND
5
DRESDEN MILLS
1
2
WHITEFIELD
Continue on
KENNEBEC R
RICHMOND
Steve Powell
Swan Island
Theobald Pt
Swan Island Pt
Lovejoy Narrows
Popp Rd
Green Pt
Shipyard Pt
Middle Ground
Pork Pt
Robert T Coffin
Lillys Cove
Abagadasset
Lincoln
Sagadahoc
Chops Crossroad
Chops Cross Rd
Hedge Bridge Rd
Browns Point Rd
Center Pt Rd
Bald Head
Middle Pt
Center Pt
Merrymeeting Bay
Brick Island
Sturgeon Island
Butler Cove
Butler Head
West Chops Pt
Goose Cove
Lines Island
Thorne
Woods I
Days Ferry
Nequasset
Nequasset Lake
Old Stage Rd
Dana Mill Rd
Stage Rd
Delano Rd
Meadow Rd
Whiskeag Rd
North Bath
Old Brunswick Rd
Peterson Ln
Bath Rd
Harding
Bath
Woolwich
Gilmore Hill
New Meadows
Leeman Hwy
Hyde Sch
Great Hill
Hanson Bay
Sasanoa
Preble Pt
Hockomock Rd
Hockomock Bay
Berrys Mills Rd
Foster Pt Rd
Doubling Pt
Fiddler Reach
Winnegance
Sewell Pd
Flying Pt
Arrowsic
Meadowbrook Rd
Clifford Rd
Sabino
Bragdon
Campbell Pond
Brighams Cove
Perry Cove
Birchwood Pd
Meadowbrook
Winnegance Bay
Stony Bk
Birch Point
Phippsburg
Bushy Id
Hen I
Fuller Mtn
Squirrel Pt Light
Goat I
Weasel Pt
Bald Head
Higgins Mtn
West Georgetown
Georgetown
The Basin
Brightwater
Sheep I
Basin Rd
Center Pond
Pasture Ridge
Marrtown
Parker Head
Parkers Head
Sebasco
Meadows River
Kennebec River
Back River
Georgetown Island
Gardiner Pond
Orchard Hill Rd
Alna Center
Sheepscot
Sheepscot Reversing Falls
Foye Rd
Dickerson Rd
Gardiner Rd
West Alna Rd
Dresden Rd
Lehman I
Marsh River
Lincoln County
Sagadahoc County
Wiscasset
Sheepscot River
Old Bath Rd
Pottle Cove
Hilton Cove
Davis Island
Fort Edgecomb
Cod Cove
South Newcastle
Sherman Lake
Dodge Rd
Wolf Pond
Mountain Rd
Bath Rd
Middle Rd
Shaw Rd
Walker Rd
Montsweag
North Edgecomb
Mt Hunger Rd
Lily Pond
Merrill Cove
Colby Cove
Birch Point Rd
Edgecomb
Wiscasset Municipal
McKay Rd
East Edgecomb
Chewonki Neck Rd
Murphys Corner
Cross River
Doyen
Tibbet
Parsons Pt Rd
Salt Marsh Cove
Wadsworth Cove
Burnham Cove
Back River
Barters Island
Smith Hill
Westport
Heal Pond
Hockomock Bay
Castle I
Wiley Pond
Back Narrows
Kenniston Hill
Trevett
Hodgdon
Boothbay
Back Narrows Rd
Damariscotta River
Cavis Pt
Upper Mark I
Kehail Pt
Jewett Cove
Sawyer
Isle of Springs
Brook Pt
Whittum
Knubble Bay
Robinhood
Boothbay Harbor
Bayville
East Boothbay
Townsend Ave
Lakeside Dr
Boston I
MacMahan
Macmahan
Fox I
Hendricks Head Light
Southport
Ebenecook Harbor
Boothbay Harbor
Tumbler I
Lewis Cove
Cabbage
Lmekin
Pine Cliff
Mouse I
Spruce Point
Burnt I Light
Spruce Shores
Linekin Bay
Charles Pond
Crow I
Five Islands
Malden
West Southport
Capitol Island
Cross Rd
Ocean Point
Green I
Hen I
Mink I
Cozy Harbor
Pratts Island
Squirrel Island
Fisherman Island Passage
Ram I Light
The Hypocrites
Dry Pt
Wood I
Christmas Cove
Southport Island
Robinhood Cove
Josephine Newman Sanctuary
Sequinland Rd
Sheepscot Bay
Lower Mark I
South Port
Fisherman Island
Newagen
Cape
The Ark Harbor

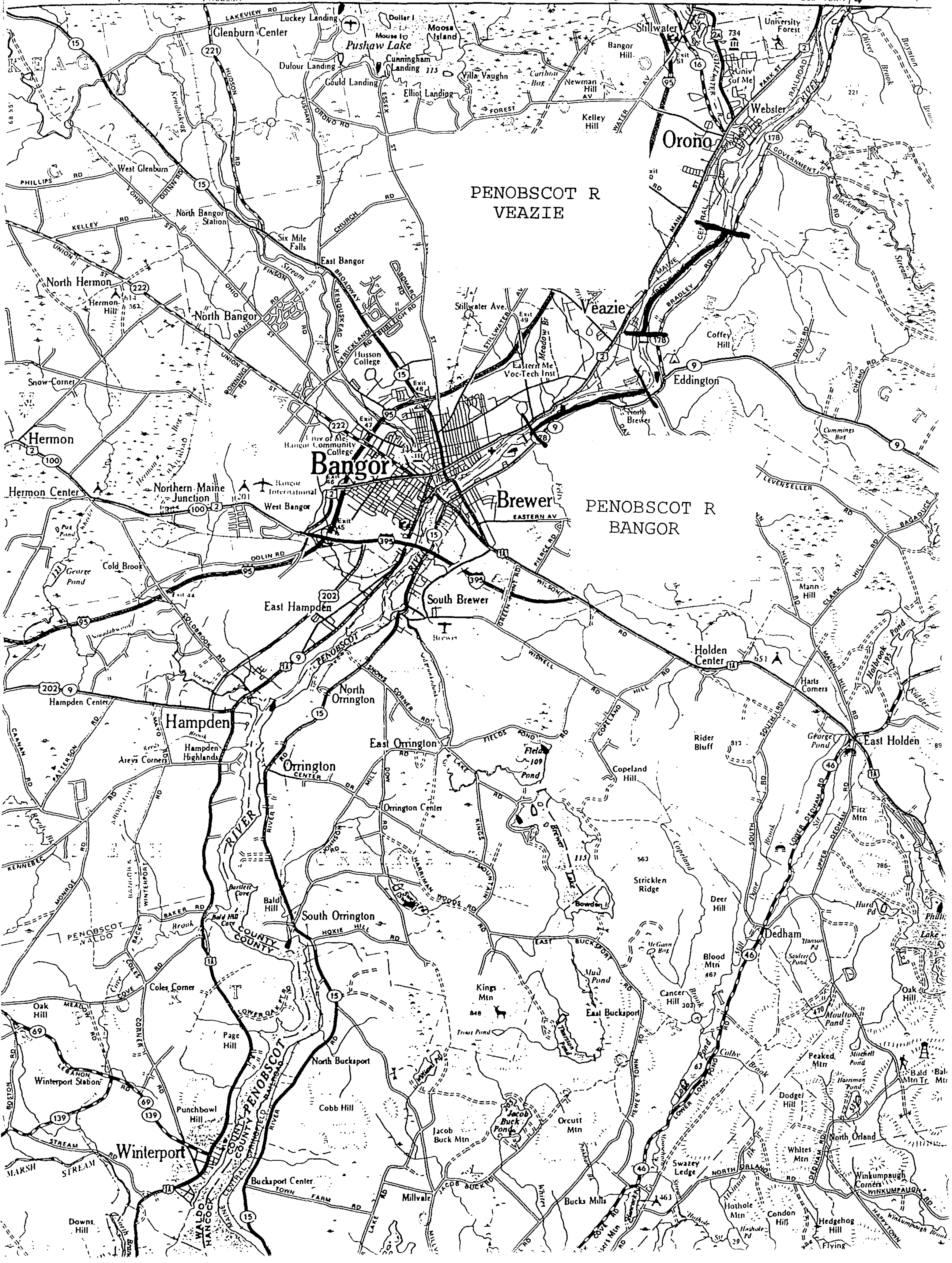

KENNEBEC R
PHIPPSBURG
Bath
Woolwich
North Bath
New Meadows
Days Ferry
Nequasset
Gilmore Hill
Hyde Sch
Great Hill
Winnegance
Phippsburg
Brighams Cove
Meadowbrook
Birch Point
Fuller Mtn
Brightwater
Sebasco
Sebasco Estates
Ashdale
Bowie Hill
West Point
Small Point
Small Point Beach
Popham Beach
POPHAM BEACH STATE PARK
Fort Popham
Parker Head
Georgetown
West Georgetown
Higgins Mtn
Arrowsic
Seguin Island
Seguin I Light
Fox Is
Heron I
Fuller Rock
KENNEBEC
RIVER
NEW MEADOWS RIVER
SAGADAHOC COUNTY
CUMBERLAND COUNTY
East Edgecomb
Murphys Corner
Westport
Robinhood
Five Islands
Boothbay
Boothbay Harbor
Bayville
Southport
West Southport
Newagen
Ocean Point
Capitol Island
Squirrel Island
Fisherman Island
The Cuckolds
Damariscove Island
Kenniston Hill
Smith Hill
Back Narrows
Dover
Trevett
Hendricks Head Light
SHEEPSCOT BAY
SOUTHPORT
SHEEPSCOT RIVER
BACK RIVER
LINEKIN BAY
Scale ½" = 1 Mile
½ 0 1 2 3 4 5 Miles

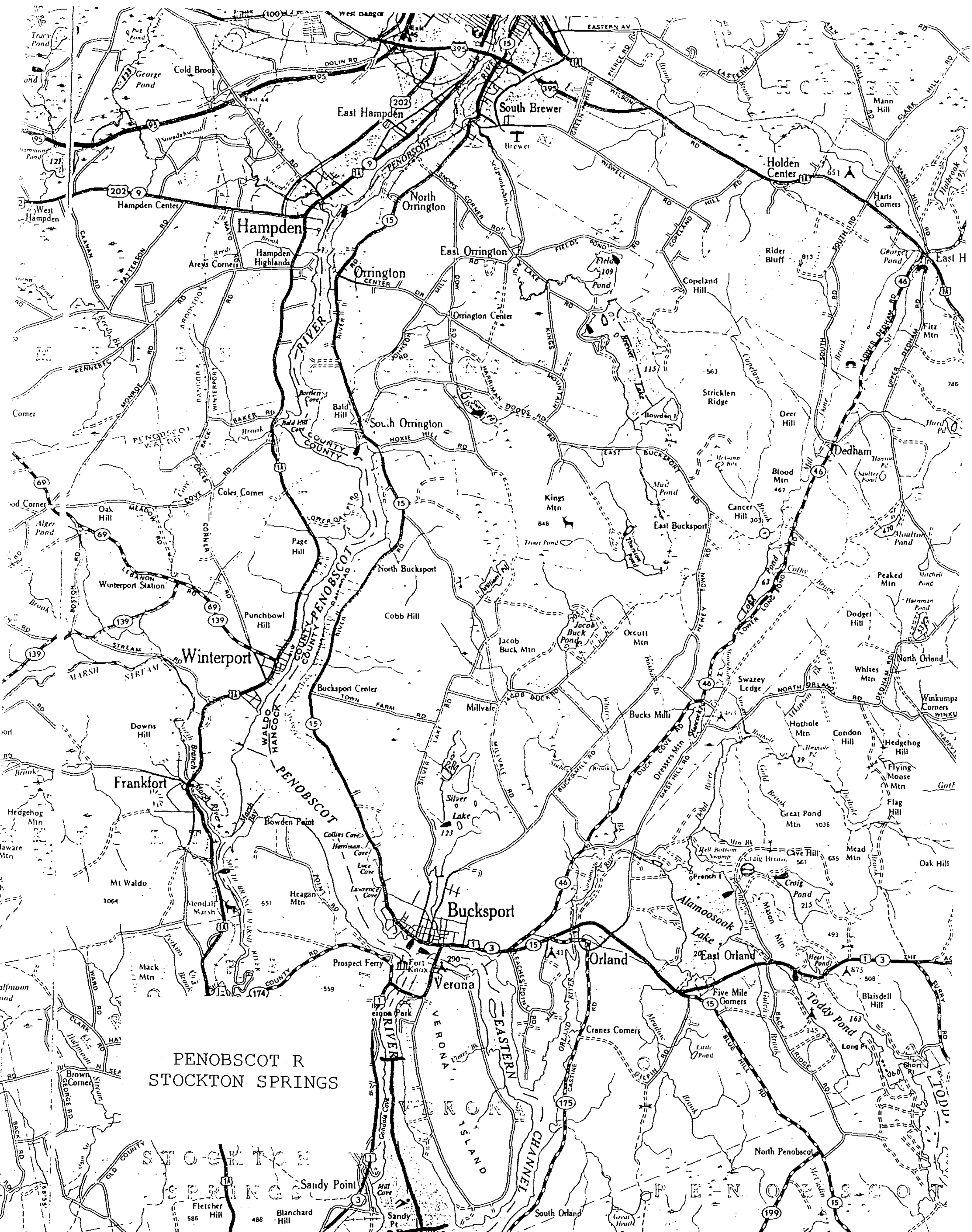


Continue on Map 44

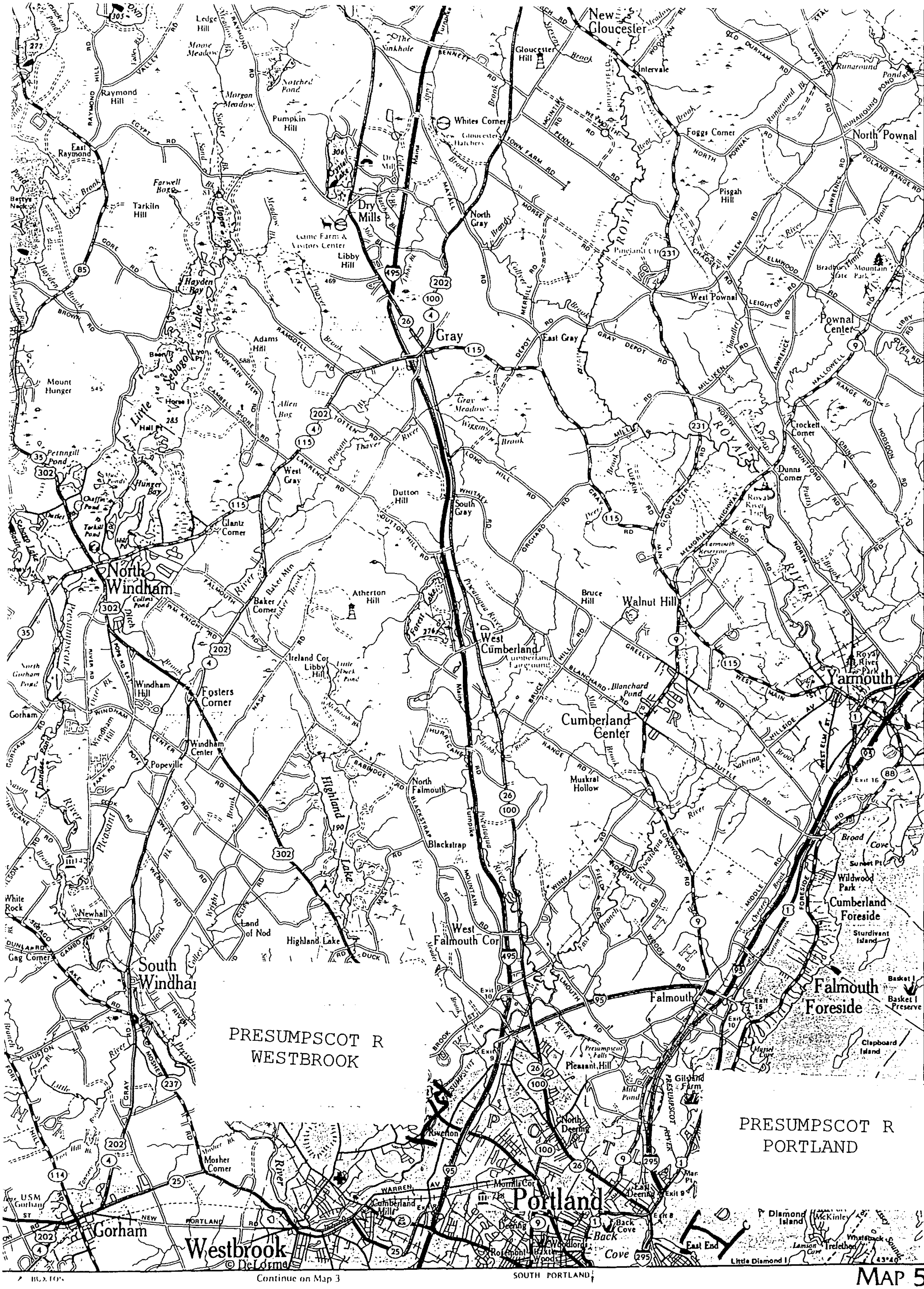
Continue on Map 35

1 HUDSON 2 3 Continue on Map 33 OLD TOWN 4



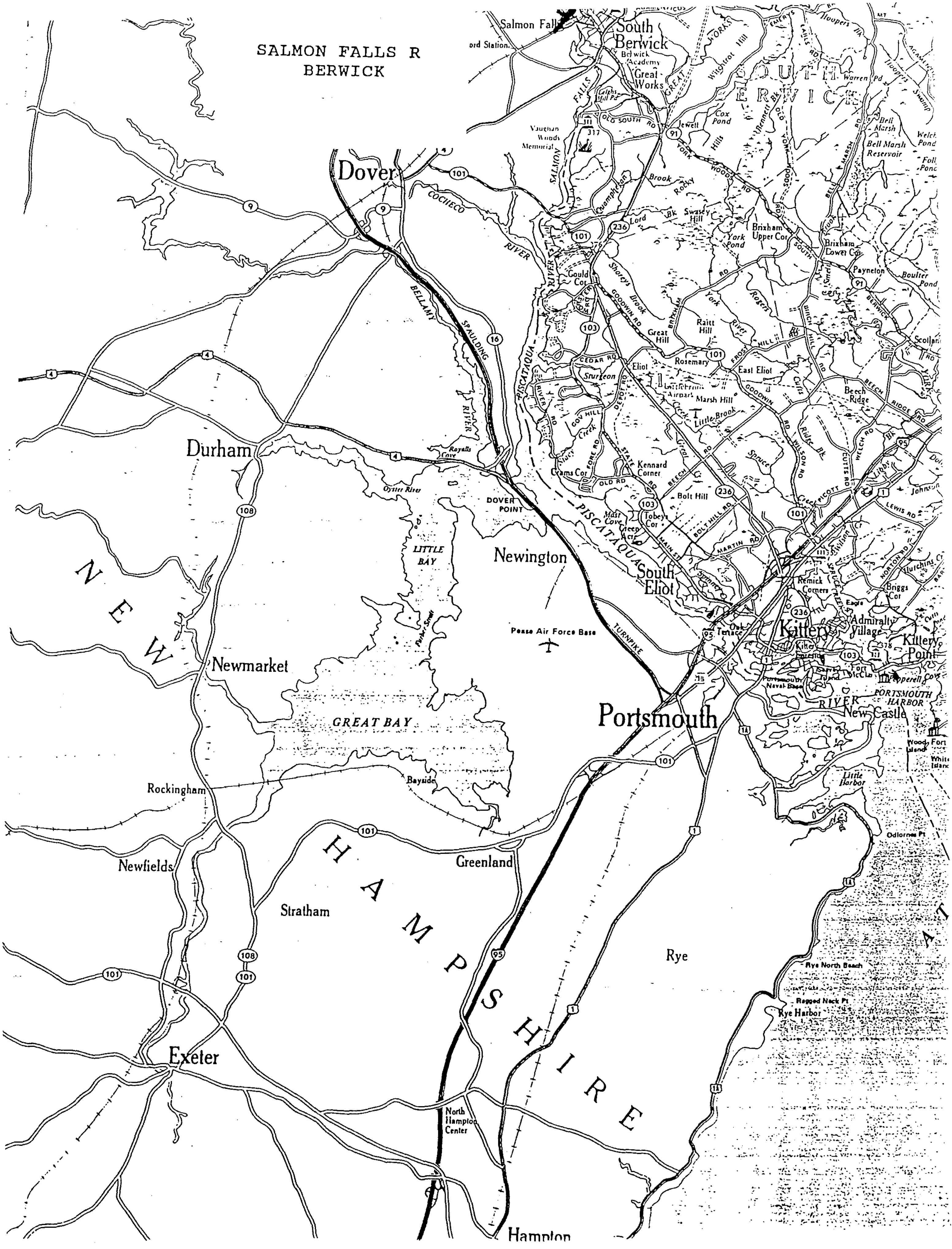


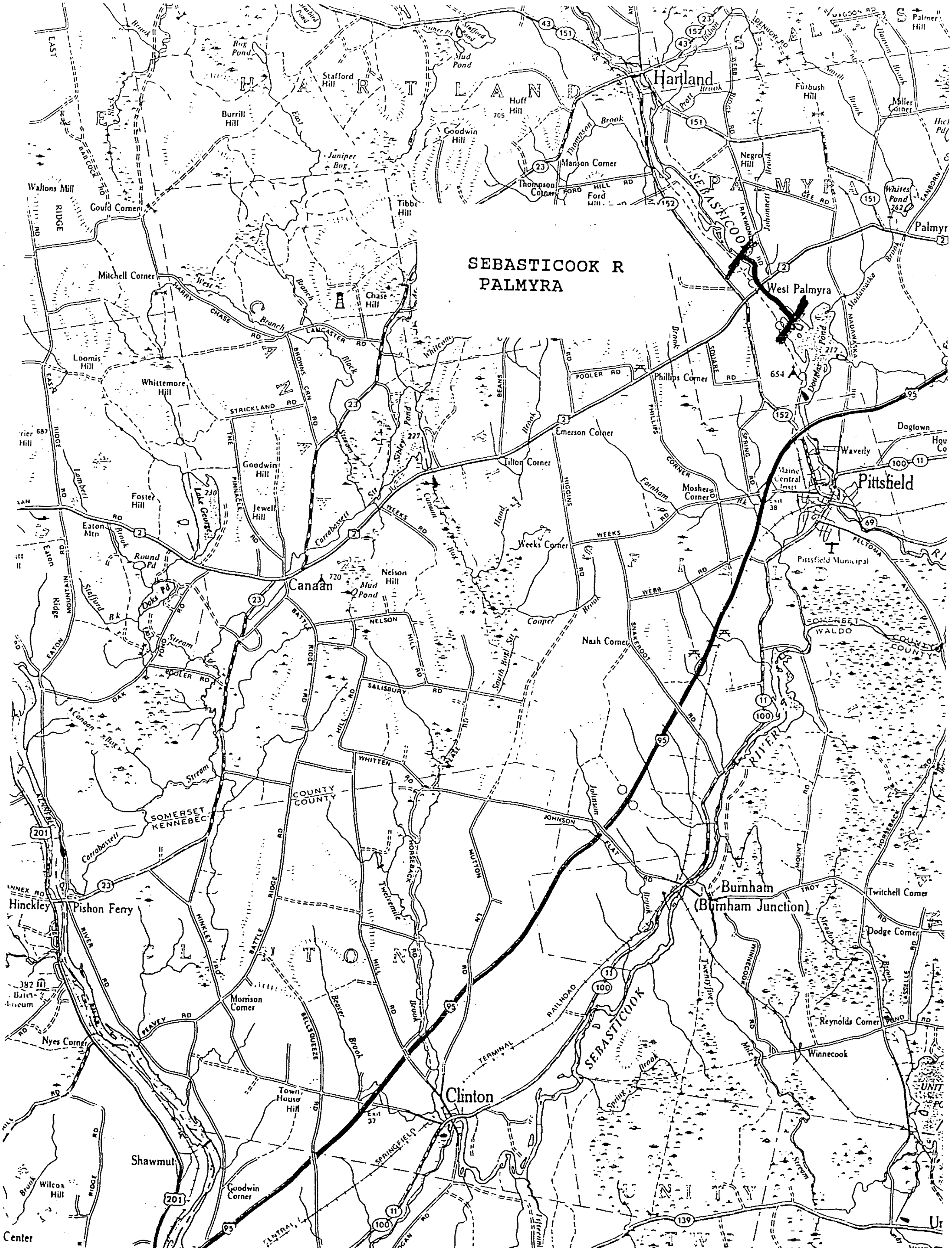
Scale ½" = 1 Mile SEARSPORT PENOBSCOT Continue on Map 15



Continue on Map 3
SOUTH PORTLAND

SACO BAY
SCARBOROUGH
South Portland
Cape Elizabeth
Cape Cottage
Fort Williams
Portland Head Light
Delano Park
Chimney Rock
Pond Cove
Smugglers Cove
Zeb Cove
Pleasant Hill
Oak Hill
Scarborough
Black Point
West Scarborough
(Dunstan)
Boothbay Park
Eight Corners
Thornton Heights
Sunset Park
Cash Corner
South Buxton
Beech Ridge
Higgins Beach
Crescent Beach State Park
Two Lights
Two Lights Battery
Richmond Island Harbor
Richmond Island
Little Cove
Broad Cove
Adams Head
Scarborough Beach State Park
Massacre Pond
Prouts Neck
Prouts Neck Bird Sanctuary
East Pt
Western Beach
Pine Point
Grand Beach
Blue Point
Milliken Mills
Surfside
Surfside Beach
Old Orchard Beach
Ocean Park
Kinney Shores
Bay View
Ferry Beach State Park
Ferry Beach
Eagle Island
Camp Ellis
Univ of New England
Hills Beach
Wood Island
Wood Island Light
Wood Island Harbor
East Point Sanctuary
Biddeford Pool
Beach Island
Fortunes Rocks Beach
Fortunes Rocks
Horseshoe Cove
Hoyt Neck
New Barn Cove
Curtis Cove
Timber Island
Goose Rocks Beach
East Goose Rocks
West Goose Rocks
Goosefare Bay
Saco
Biddeford
Tattle Corner
Tea Kettle Corner
Oak Ridge
Newtown
Beacon Corner
Adams Cor
Clock Farm Cor
Millers Crossing
Arundel
Cape Porpoise
Stage Island
Stage Island Harbor
Cape I
Trott Island
Goat Island
Folly Island
Green Island
Vaughns I Preserve
Turbats Creek
Bumpkin I
Kennebunkport
Walkers Pt
Cape Arundel
Blowing Cave
Kennebunk Lords Pt Beach
Gulf of Maine
ATLANTIC OCEAN


SALMON FALLS R
BERWICK
Salmon Falls
South Berwick
Berwick Academy
Great Works
Vaughan Woods Memorial
Dover
COCHECO RIVER
BELLAMY
SPAULDING
PISCATAQUA RIVER
SALMON FALLS
Gould Cor
Great Hill
Raitt Hill
Eliot
Rosemary
East Eliot
Marsh Hill
Beech Ridge
Durham
Oyster River
DOVER POINT
LITTLE BAY
Newington
Kennard Corner
Crams Cor
Bolt Hill
Tobeys Cor
South Eliot
Remick Corners
Kittery
Admiralty Village
Kittery Point
Pease Air Force Base
TURNPIKE
Newmarket
GREAT BAY
Portsmouth
New Castle
PORTSMOUTH HARBOR
Little Harbor
Rockingham
Bayside
Newfields
Greenland
Stratham
Rye
Rye North Beach
Ragged Neck Pt
Rye Harbor
Exeter
North Hampton Center
Hampton
NEW HAMPSHIRE


SEBASTICOOK R
PALMYRA
Hartland
Palmyra
West Palmyra
Pittsfield
Canaan
Clinton
Burnham
(Burnham Junction)
Hinckley
Pishon Ferry
Shawmut
Waverly
Twitchell Corner
Dodge Corner
Reynolds Corner
Winnecook
Morrison Corner
Nyes Corner
Goodwin Corner
Nash Corner
Weeks Corner
Tilton Corner
Emerson Corner
Phillips Corner
Mosher Corner
Mitchell Corner
Gould Corner
Waltons Mill
Manson Corner
Thompson Corner
Stafford Hill
Burrill Hill
Huff Hill
Goodwin Hill
Chase Hill
Loomis Hill
Whittemore Hill
Foster Hill
Jewell Hill
Nelson Hill
Negro Hill
Furbush Hill
Town House Hill
Wilcox Hill
Eaton Mtn
Round Pd
Oaks Pd
Mud Pond
Bog Pond
Whites Pond
Lake George
Juniper Bog
Doglown
Pittsfield Municipal
SOMERSET
KENNEBEC
COUNTY
WALDO
SEBASTICOOK
KENNEBEC
Center

APPENDIX 7

LENGTHS, WEIGHTS, AND PERCENT LIPID IN 1993 FISH SAMPLES

LENGTHS, WEIGHTS, AND PERCENT LIPID IN 1993 FISH SAMPLES

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
ANDROSCOGGIN RIVER				
Rumford				
ARR-SMB-01	435	1200	4.32	ARR-SMB-COMP-01
ARR-SMB-02	387	910	4.32	ARR-SMB-COMP-01
ARR-SMB-03	333	580	5.26	ARR-SMB-COMP-02
ARR-SMB-04	352	700	5.26	ARR-SMB-COMP-02
ARR-SMB-05	314	450	5.30	ARR-SMB-COMP-03
ARR-SMB-06	314	450	5.30	ARR-SMB-COMP-03
ARR-SMB-07	362	660	3.22	ARR-SMB-COMP-04
ARR-SMB-08	387	750	3.22	ARR-SMB-COMP-04
ARR-SMB-09	359	700	4.49	ARR-SMB-COMP-05
ARR-SMB-10	470	1480	4.49	ARR-SMB-COMP-05
mean	**371**	**788**		
ARR-WHS-01	400	720	7.80	ARR-WHS-COMP-01
ARR-WHS-02	400	750	7.80	ARR-WHS-COMP-01
ARR-WHS-03	371	590	7.80	ARR-WHS-COMP-01
ARR-WHS-04	397	640	7.80	ARR-WHS-COMP-01
ARR-WHS-05	387	640	7.80	ARR-WHS-COMP-01
ARR-WHS-06	400	695	6.22	ARR-WHS-COMP-02
ARR-WHS-07	419	800	6.22	ARR-WHS-COMP-02
ARR-WHS-08	394	665	6.22	ARR-WHS-COMP-02
ARR-WHS-09	401	770	6.22	ARR-WHS-COMP-02
ARR-WHS-10	399	720	6.22	ARR-WHS-COMP-02
mean	**397**	**699**		
Livermore Falls				
ARLV-SMB-01	352	560	2.04	ARLV-SMB-COMP-01
ARLV-SMB-02	378	660	2.04	ARLV-SMB-COMP-01
ARLV-SMV-03	324	350	0.91	ARLV-SMB-COMP-02
ARLV-SMB-04	311	310	0.91	ARLV-SMB-COMP-02
ARLV-SMB-05	343	500	0.85	ARLV-SMB-COMP-03
ARLV-SMB-06	394	620	0.85	ARLV-SMB-COMP-03
ARLV-SMB-07	343	410	1.50	ARLV-SMB-COMP-04
ARLV-SMB-08	422	790	1.50	ARLV-SMB-COMP-04
ARLV-SMB-09	422	870	3.17	ARLV-SMB-COMP-05
ARLV-SMB-10	343	430	3.17	ARLV-SMB-COMP-05
mean	**363**	**550**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
ANDROSCOGGIN RIVER				
Livermore Falls				
ARLV-WHS-01	356	570	5.97	ARLV-WHS-COMP-01
ARLV-WHS-02	368	600	5.97	ARLV-WHS-COMP-01
ARLV-WHS-03	333	450	5.97	ARLV-WHS-COMP-01
ARLV-WHS-04	349	450	5.97	ARLV-WHS-COMP-01
ARLV-WHS-05	333	350	5.97	ARLV-WHS-COMP-01
ARLV-WHS-06	318	350	6.13	ARLV-WHS-COMP-02
ARLV-WHS-07	305	340	6.13	ARLV-WHS-COMP-02
ARLV-WHS-08	308	330	6.13	ARLV-WHS-COMP-02
ARLV-WHS-09	292	320	6.13	ARLV-WHS-COMP-02
ARLV-WHS-10	254	190	6.13	ARLV-WHS-COMP-02
mean	**322**	**395**		
Jay				
ARJ-SMB-01	419	1040	1.26	ARJ-SMB-COMP-01
ARJ-SMB-02	340	500	1.26	ARJ-SMB-COMP-01
ARJ-SMB-03	394	750	1.23	ARJ-SMB-COMP-02
ARJ-SMB-04	362	570	1.23	ARJ-SMB-COMP-02
ARJ-SMB-05	368	600	1.22	ARJ-SMB-COMP-03
ARJ-SMB-06	381	620	1.22	ARJ-SMB-COMP-03
ARJ-SMB-07	340	440	0.73	ARJ-SMB-COMP-04
ARJ-SMB-08	410	780	0.73	ARJ-SMB-COMP-04
ARJ-SMB-09	387	740	1.65	ARJ-SMB-COMP-05
ARJ-SMB-10	445	1090	1.65	ARJ-SMB-COMP-05
mean	**384**	**713**		
ARJ-WHS-01	381	610	7.06	ARJ-WHS-COMP-01
ARJ-WHS-02	352	500	7.06	ARJ-WHS-COMP-01
ARJ-WHS-03	432	860	7.06	ARJ-WHS-COMP-01
ARJ-WHS-04	394	830	7.06	ARJ-WHS-COMP-01
ARJ-WHS-05	406	740	7.06	ARJ-WHS-COMP-01
ARJ-WHS-06	429	740	7.22	ARJ-WHS-COMP-02
ARJ-WHS-07	314	350	7.22	ARJ-WHS-COMP-02
ARJ-WHS-08	343	470	7.22	ARJ-WHS-COMP-02
ARJ-WHS-09	406	750	7.22	ARJ-WHS-COMP-02
ARJ-WHS-10	384	600	7.22	ARJ-WHS-COMP-02
mean	**384**	**645**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
ANDROSCOGGIN RIVER				
Auburn				
ARG-WHS-01	381	470	4.09	ARG-WHS-COMP-01
ARG-WHS-02	445	840	4.09	ARG-WHS-COMP-01
ARG-WHS-03	375	550	4.09	ARG-WHS-COMP-01
ARG-WHS-04	337	400	4.09	ARG-WHS-COMP-01
ARG-WHS-05	343	365	4.09	ARG-WHS-COMP-01
ARG-WHS-06	346	400	4.84	ARG-WHS-COMP-02
ARG-WHS-07	375	505	4.84	ARG-WHS-COMP-02
ARG-WHS-08	375	570	4.84	ARG-WHS-COMP-02
ARG-WHS-09	359	470	4.84	ARG-WHS-COMP-02
ARG-WHS-10	397	670	4.84	ARG-WHS-COMP-02
mean	**373**	**524**		
ARG-BUL-01	292	290	3.71	ARG-BUL-COMP-01
ARG-BUL-02	232	150	3.71	ARG-BUL-COMP-01
ARG-BUL-03	251	190	3.71	ARG-BUL-COMP-01
ARG-BUL-04	267	260	3.71	ARG-BUL-COMP-01
ARG-BUL-05	279	260	4.17	ARG-BUL-COMP-02
ARG-BUL-06	283	270	4.17	ARG-BUL-COMP-02
ARG-BUL-07	232	160	4.17	ARG-BUL-COMP-02
ARG-BUL-08	257	215	4.17	ARG-BUL-COMP-02
mean	**262**	**224**		
ARG-SMB-01	290	290	2.34	
ARG-SMB-02	287	285		
ARG-SMB-03	305	380	1.91	
ARG-SMB-04	284	280	0.82	
ARG-SMB-05	310	350	1.69	
ARG-SMB-06	254	230		
ARG-SMB-07	305	340	1.22	
mean	**291**	**308**		
Lisbon Falls				
ARLS-SMB-01	279	250	2.94	ARLS-SMB-COMP-01
ARLS-SMB-02	260	215	2.94	ARLS-SMB-COMP-01
ARLS-SMB-03	356	540	2.12	ARLS-SMB-COMP-02
ARLS-SMB-04	289	270	2.12	ARLS-SMB-COMP-02
ARLS-SMB-05	349	520	2.49	ARLS-SMB-COMP-03
ARLS-SMB-06	279	260	2.49	ARLS-SMB-COMP-03
ARLS-SMB-07	305	305	3.58	ARLS-SMB-COMP-04
ARLS-SMB-08	432	1000	3.58	ARLS-SMB-COMP-04
ARLS-SMB-09	292	320	4.80	ARLS-SMB-COMP-05
ARLS-SMB-10	429	920	4.80	ARLS-SMB-COMP-05
mean	**327**	**460**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
ANDROSCOGGIN RIVER				
Lisbon Falls				
ARLS-WHS-01	324	420	5.98	ARLS-WHS-COMP-01
ARLS-WHS-02	330	390	5.98	ARLS-WHS-COMP-01
ARLS-WHS-03	403	690	5.98	ARLS-WHS-COMP-01
ARLS-WHS-04	387	610	5.98	ARLS-WHS-COMP-01
ARLS-WHS-05	330	420	5.98	ARLS-WHS-COMP-01
ARLS-WHS-06	337	410	6.66	ARLS-WHS-COMP-02
ARLS-WHS-07	349	470	6.66	ARLS-WHS-COMP-02
ARLS-WHS-08	343	485	6.66	ARLS-WHS-COMP-02
ARLS-WHS-09	359	470	6.66	ARLS-WHS-COMP-02
ARLS-WHS-10	292	260	6.66	ARLS-WHS-COMP-02
mean	**345**	**463**		
KENNEBEC RIVER				
Fairfield				
KRF-SMB-01	410	810	6.38	KRF-SMB-COMP-01
KRF-SMB-02	318	400	6.38	KRF-SMB-COMP-01
KRF-SMB-03	318	400	3.45	KRF-SMB-COMP-02
KRF-SMB-04	343	545	3.45	KRF-SMB-COMP-02
KRF-SMB-05	324	490	2.63	KRF-SMB-COMP-03
KRF-SMB-06	397	900	2.63	KRF-SMB-COMP-03
KRF-SMB-07	381	760	3.12	KRF-SMB-COMP-04
KRF-SMB-08	279	295	3.12	KRF-SMB-COMP-04
KRF-SMB-09	273	285	4.01	KRF-SMB-COMP-05
KRF-SMB-10	295	390	4.01	KRF-SMB-COMP-05
mean	**334**	**528**		
KRF-BNT-01	438	975	1.50	
KRF-BNT-02	419	900	3.82	
KRF-BNT-03	457	1120	4.61	
KRF-BNT-04	432	850	4.32	
mean	**437**	**961**		
KRF-WHS-01	356	320	9.53	KRF-WHS-COMP-01
KRF-WHS-02	337	480	9.53	KRF-WHS-COMP-01
KRF-WHS-03	318	340	9.53	KRF-WHS-COMP-01
KRF-WHS-04	286	280	9.53	KRF-WHS-COMP-01
KRF-WHS-05	330	470	9.53	KRF-WHS-COMP-01
KRF-WHS-06	286	290	8.63	KRF-WHS-COMP-02
KRF-WHS-07	314	410	8.63	KRF-WHS-COMP-02
KRF-WHS-08	305	350	8.63	KRF-WHS-COMP-02
KRF-WHS-09	340	420	8.63	KRF-WHS-COMP-02
KRF-WHS-10	260	200	8.63	KRF-WHS-COMP-02
mean	**313**	**356**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
KENNEBEC RIVER				
Sidney				
KRS-SMB-01	314	390	3.28	KRS-SMB-COMP-01
KRS-SMB-02	438	1150	3.28	KRS-SMB-COMP-01
KRS-SMB-03	330	440	3.07	KRS-SMB-COMP-02
KRS-SMB-04	320	400	3.07	KRS-SMB-COMP-02
KRS-SMB-05	328	460	2.58	KRS-SMB-COMP-03
KRS-SMB-06	267	210	2.58	KRS-SMB-COMP-03
KRS-SMB-07	300	300	2.32	KRS-SMB-COMP-04
KRS-SMB-08	333	420	2.32	KRS-SMB-COMP-04
KRS-SMB-09	297	270	2.35	KRS-SMB-COMP-05
KRS-SMB-10	279	200	2.35	KRS-SMB-COMP-05
mean	**321**	**424**		
Sidney				
KRS-WHS-01	397	880	9.69	KRS-WHS-COMP-01
KRS-WHS-02	343	435	9.69	KRS-WHS-COMP-01
KRS-WHS-03	343	485	9.69	KRS-WHS-COMP-01
KRS-WHS-04	289	330	9.69	KRS-WHS-COMP-01
KRS-WHS-05	381	690	9.69	KRS-WHS-COMP-01
KRS-WHS-06	307	400	8.19	KRS-WHS-COMP-02
KRS-WHS-07	343	500	8.19	KRS-WHS-COMP-02
KRS-WHS-08	351	540	8.19	KRS-WHS-COMP-02
KRS-WHS-09	300	350	8.19	KRS-WHS-COMP-02
KRS-WHS-10	381	780	8.19	KRS-WHS-COMP-02
mean	**343**	**539**		
Augusta				
KRA-WHS-01	381	700	5.67	KRA-WHS-COMP-01
KRA-WHS-02	376	550	5.67	KRA-WHS-COMP-01
KRA-WHS-03	399	735	5.67	KRA-WHS-COMP-01
KRA-WHS-04	381	770	5.67	KRA-WHS-COMP-01
KRA-WHS-05	345	550	5.67	KRA-WHS-COMP-01
KRA-WHS-06	378	700	5.78	KRA-WHS-COMP-02
KRA-WHS-07	386	690	5.78	KRA-WHS-COMP-02
KRA-WHS-08	427	830	5.78	KRA-WHS-COMP-02
KRA-WHS-09	414	850	5.78	KRA-WHS-COMP-02
KRA-WHS-10	389	700	5.78	KRA-WHS-COMP-02
mean	**388**	**708**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
KENNEBEC RIVER				
Augusta				
KRA-SMB-01	361	650	2.79	
KRA-SMB-02	396	840	1.91	
KRA-SMB-03	363	690	3.01	
KRA-SMB-04	406	870	1.53	
KRA-SMB-05	353	650	1.50	
mean	**376**	**740**		
Richmond				
KRR-EEL-01	686	720	12.20	
KRR-EEL-02	516	250	10.60	KRR-EEL-COMP-01
KRR-EEL-03	457	200	10.60	KRR-EEL-COMP-01
KRR-EEL-04	445	750	10.60	KRR-EEL-COMP-01
KRR-EEL-05	511	250	10.60	KRR-EEL-COMP-01
KRR-EEL-06	536	270	10.60	KRR-EEL-COMP-01
KRR-EEL-07	465	170	10.60	KRR-EEL-COMP-01
KRR-EEL-08	472	200	10.60	KRR-EEL-COMP-01
KRR-EEL-09	460	250	10.60	KRR-EEL-COMP-01
KRR-EEL-10	551	260	10.60	KRR-EEL-COMP-01
mean	**510**	**332**		
PENOBSCOT RIVER				
South Lincoln				
PBL-SMB-01	324	500	2.28	PBL-SMB-COMP-01
PBL-SMB-02	430	1100	2.28	PBL-SMB-COMP-01
PBL-SMB-03	355	650	1.80	PBL-SMB-COMP-02
PBL-SMB-05	360	655	1.80	PBL-SMB-COMP-02
PBL-SMB-06	322	510	1.61	PBL-SMB-COMP-03
PBL-SMB-07	380	640	1.61	PBL-SMB-COMP-03
PBL-SMB-08	309	370	1.49	PBL-SMB-COMP-04
PBL-SMB-09	380	620	1.65	
PBL-SMB-15	363	600	1.49	PBL-SMB-COMP-04
mean	**358**	**627**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
PENOBSCOT RIVER				
South Lincoln				
PBL-WHS-04	374	735	7.90	PBL-WHS-COMP-01
PBL-WHS-07	412	880	7.90	PBL-WHS-COMP-01
PBL-WHS-08	307	320	7.90	PBL-WHS-COMP-01
PBL-WHS-09	380	750	7.90	PBL-WHS-COMP-01
PBL-WHS-10	355	520	7.90	PBL-WHS-COMP-01
PBL-WHS-11	332	420	9.35	PBL-WHS-COMP-02
PBL-WHS-12	362	500	9.35	PBL-WHS-COMP-02
PBL-WHS-13	323	410	9.35	PBL-WHS-COMP-02
PBL-WHS-14	373	600	9.35	PBL-WHS-COMP-02
PBL-WHS-15	377	640	9.35	PBL-WHS-COMP-02
mean	**360**	**578**		
Veazie				
PBV-SMB-01	279	254	2.37	PBV-SMB-COMP-01
PBV-SMB-02	413	800	2.37	PBV-SMB-COMP-01
PBV-SMB-03	292	300	2.49	PBV-SMB-COMP-02
PBV-SMB-04	305	258	2.49	PBV-SMB-COMP-02
PBV-SMB-07	445	1100	1.90	PBV-SMB-COMP-03
PBV-SMB-08	394	670	1.90	PBV-SMB-COMP-03
PBV-SMB-09	324	370	1.17	PBV-SMB-COMP-04
PBV-SMB-10	337	390	1.17	PBV-SMB-COMP-04
PBV-SMB-11	305	300	1.53	PBV-SMB-COMP-05
PBV-SMB-12	324	360	1.53	PBV-SMB-COMP-05
mean	**342**	**480**		
PBV-WHS-01	381	630	8.67	PBV-WHS-COMP-03
PBV-WHS-02	381	650	8.67	PBV-WHS-COMP-03
PBV-WHS-03	349	450	8.67	PBV-WHS-COMP-03
PBV-WHS-04	318	370	8.67	PBV-WHS-COMP-03
PBV-WHS-05	349	480	8.67	PBV-WHS-COMP-03
PBV-WHS-06	413	710	9.45	PBV-WHS-COMP-04
PBV-WHS-07	375	570	9.45	PBV-WHS-COMP-04
PBV-WHS-08	362	510	9.45	PBV-WHS-COMP-04
PBV-WHS-09	337	420	9.45	PBV-WHS-COMP-04
PBV-WHS-10	337	370	9.45	PBV-WHS-COMP-04
mean	**360**	**516**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
PENOBSCOT RIVER				
Bangor				
PBB-EEL-01	590	450	17.60	PBB-EEL-COMP-01
PBB-EEL-02	700	560	17.60	PBB-EEL-COMP-01
PBB-EEL-03	660	570	17.60	PBB-EEL-COMP-01
PBB-EEL-04	640	500	17.60	PBB-EEL-COMP-01
PBB-EEL-05	710	710	17.60	PBB-EEL-COMP-01
PBB-EEL-06	780	1100	16.50	PBB-EEL-COMP-02
PBB-EEL-07	630	480	16.50	PBB-EEL-COMP-02
PBB-EEL-08	745	1100	16.50	PBB-EEL-COMP-02
PBB-EEL-09	585	420	16.50	PBB-EEL-COMP-02
PBB-EEL-10	735	940	16.50	PBB-EEL-COMP-02
mean	**678**	**683**		
PRESUMPSCOT RIVER				
Windham				
PRU-SMB-01	318	410	4.04	PRU-SMB-COMP-01
PRU-SMB-02	318	400	4.04	PRU-SMB-COMP-01
PRU-SMB-03	343	520	2.99	PRU-SMB-COMP-02
PRU-SMB-04	283	390	2.99	PRU-SMB-COMP-02
PRU-SMB-05	302	430	4.87	PRU-SMB-COMP-03
PRU-SMB-06	302	330	4.87	PRU-SMB-COMP-03
PRU-SMB-07	343	540	1.62	PRU-SMB-COMP-04
PRU-SMB-08	330	460	1.62	PRU-SMB-COMP-04
PRU-SMB-09	394	785	2.57	PRU-SMB-COMP-05
PRU-SMB-10	352	500	2.57	PRU-SMB-COMP-05
mean	**328**	**477**		
PRU-WHS-01	422	945	5.81	PRU-WHS-COMP-01
PRU-WHS-02	448	1150	5.81	PRU-WHS-COMP-01
PRU-WHS-03	413	835	5.81	PRU-WHS-COMP-01
PRU-WHS-04	419	825	5.81	PRU-WHS-COMP-01
PRU-WHS-05	425	860	5.81	PRU-WHS-COMP-01
PRU-WHS-06	476	1200	7.80	PRU-WHS-COMP-02
PRU-WHS-07	432	900	7.80	PRU-WHS-COMP-02
PRU-WHS-08	413	825	7.80	PRU-WHS-COMP-02
PRU-WHS-09	457	1100	7.80	PRU-WHS-COMP-02
PRU-WHS-10	445	1060	7.80	PRU-WHS-COMP-02
mean	**435**	**970**		

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
PRESUMPSCOT RIVER				
Westbrook				
PRW-WHS-01	394	710	9.79	PRW-WHS-COMP-01
PRW-WHS-02	419	900	9.79	PRW-WHS-COMP-01
PRW-WHS-03	356	530	9.79	PRW-WHS-COMP-01
PRW-WHS-04	432	1000	9.79	PRW-WHS-COMP-01
PRW-WHS-05	391	800	9.79	PRW-WHS-COMP-01
PRW-WHS-06	337	420	5.17	PRW-WHS-COMP-02
PRW-WHS-07	429	915	5.17	PRW-WHS-COMP-02
PRW-WHS-08	384	650	5.17	PRW-WHS-COMP-02
PRW-WHS-09	356	550	5.17	PRW-WHS-COMP-02
PRW-WHS-10	375	600	5.17	PRW-WHS-COMP-02
mean	**387**	**708**		
PRW-SMB-01	308	490	3.80	
SALMON FALLS RIVER				
South Berwick				
SLF-WHS-01	455	1020	6.97	SLF-WHS-COMP-01
SLF-WHS-02	378	700	6.97	SLF-WHS-COMP-01
SLF-WHS-03	462	1310	6.97	SLF-WHS-COMP-01
SLF-WHS-04	437	960	6.97	SLF-WHS-COMP-01
SLF-WHS-05	406	900	6.97	SLF-WHS-COMP-01
SLF-WHS-06	493	1370	6.18	SLF-WHS-COMP-02
SLF-WHS-07	333	450	6.18	SLF-WHS-COMP-02
SLF-WHS-08	399	760	6.18	SLF-WHS-COMP-02
SLF-WHS-09	483	1190	6.18	SLF-WHS-COMP-02
SLF-WHS-10	406	800	6.18	SLF-WHS-COMP-02
mean	**425**	**946**		
SLF-SMB-01			9.75	

FIELD ID	LENGTH (mm)	WEIGHT (g)	% LIPID	COMPOSITE ID
SEBASTICOOK RIVER				
Palmyra W Branch				
SBW-WHS-01	361	460	2.84	SBW-WHS-COMP-01
SBW-WHS-02	330	380	2.84	SBW-WHS-COMP-01
SBW-WHS-03	432	730	2.84	SBW-WHS-COMP-01
SBW-WHS-04	363	470	2.84	SBW-WHS-COMP-01
SBW-WHS-05	356	400	2.84	SBW-WHS-COMP-01
SBW-WHS-06	396	600	2.14	SBW-WHS-COMP-02
SBW-WHS-07	356	450	2.14	SBW-WHS-COMP-02
SBW-WHS-08	376	520	2.14	SBW-WHS-COMP-02
SBW-WHS-09	406	610	2.14	SBW-WHS-COMP-02
SBW-WHS-10	348	360	2.14	SBW-WHS-COMP-02
mean	**372**	**498**		
SBW-SMB-01	439	1180	2.76	
SBW-SMB-02	345	550	1.90	
SBW-SMB-03	259	200	1.75	
SBW-SMB-04	356	500	2.44	
SBW-SMB-05	290	310	1.35	
mean	**338**	**548**		

APPENDIX 8

SAMPLING SCHEDULE FOR THE 1993 DIOXIN MONITORING PROGRAM

Appendix 8. Sampling schedule for 1993 Dioxin Monitoring Program

JUNE (early stations)

Androscoggin R at Gulf Island Pond for bass
Androscoggin R at Lisbon Falls for brown trout
Kennebec R at Augusta for brown trout
Presumpscot R at Westbrook for bass
Salmon Falls R at South Berwick for bass
East Branch Sebasticook R at County Road, Newport for bass

JULY-AUGUST (all rivers by 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