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Preliminary Biological Survey of

Medway River, Queens County, N.S.

by

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FISHERIES SERVICE
DEPARTMENT OF FISHERIES AND FORESTRY OF CANADA
HALIFAX, N.S.

Brent

PRELIMINARY BIOLOGICAL SURVEY OF MEDWAY RIVER, QUEENS COUNTY, N.S.

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I. INTRODUCTION

1. General

A preliminary biological survey of Medway River, Queen's County, Nova Scotia was completed in October 1965. The purpose of this survey was primarily to locate and quantify all Atlantic salmon spawning grounds and nursery areas and secondarily to report on the history, physiography and morphometry of the river system. Recommendations are made concerning a proposed flow control program which is being discussed for this river.

Requests from anglers for flow control on Medway River have been precipitated by years of poor angling success and it appears that since 1920 such control has been considered a popular panacea for any problems associated with salmon angling on this river.

Considerable discussion between ARDA, MMRA and this Department has arisen from the question of responsibility for undertaking flow control projects. Current agitation from MMRA involves promoting the idea that flood control procedures, when implemented, will in turn improve salmon angling. Qualified answers to queries raised in this discussion cannot be given at present since the results of flow control work have never been evaluated and it will require several years for a combined bio-engineering survey to develop this knowledge. It was decided to start preliminary investigations on Medway River in 1965 because of our interest in flow control methods and the agitation by other agencies claiming benefits to the salmon fishery from agricultural flood control.

2. Remarks on Water Control with Reference to Some of the Literature

Some of the hazards caused by low water conditions to fish life are as follows: (1) Inter-stream migrations necessary to secure food for growth and survival are often sharply curtailed because of insufficient water to negotiate the stream and fish may become stranded in small pools or pockets with insufficient water for existence. (c.f. Westfield River). (2) Adverse temperature conditions for salmon in the stream are sometimes created by lowering the water level during hot weather; with exposure of numerous rocks and boulders causing abnormal warming in many cases. (3) Production of aquatic insects can be reduced considerably by repeated exposure and desiccation of productive riffle and shoal areas (Briggs 1949 and Slack 1955).

In view of these hazards, a river may benefit through water control by, (1) an increase in the quantity and improvement in the quality of nursery areas for young salmon, (2) providing an easier ascent for adult salmon migrating upstream.

Conversely, such water control might harm the salmon angling by reducing the size of freshets which attract salmon into the river. Therefore, good angling during any given year requires (1) satisfactory water levels during the year in question and (2) sufficient flows in previous years during the river life of the young salmon.

A partial review of the literature on this subject reveals one study on the effects of flow control and several reports which provide indications on the subject. Smoker (1953) correlated stream run-off with the size of commercial Silver salmon landings in Western Washington. He demonstrated that the annual total commercial landings of silver salmon fluctuate in a similar manner as does the annual stream run-off during the first year of life of the fish. However, he points out that there may be other causes of catch fluctuations such as: (1) extremes in summer flows or winter floods, (2) variations from year to year in the salt water environment, and (3) different fishing intensities.

Hayes (1953) reported an attempt to improve angling success on LaHave River in Nova Scotia using artificial freshets but concluded that it was impossible to say whether the program produced an increase in the catch. He inferred that nature should be allowed to take her own course in initiating the run of fish up the river, but that the run should be maintained with controlled water levels. Finally, he postulated that, "it might be that higher summer water levels would increase smolt production and eventually improve angling in this way". Pritchard (1936) in British Columbia found "a positive significant mathematical correlation between numbers of fish migrating from the sea to the stream each day and both the maximum daily water height in the creek and the daily rainfall in the area".

Svärdson (1954) in a comprehensive Swedish paper, discusses the problem of gross periodic fluctuations in salmon stocks over many years. Variation in water levels was rejected as being an important influencing factor when strong contradictory evidence appeared during the 1940's. At that time there was a sudden rise of the Baltic salmon population to a level not seen for 50 years. However, no major change in water levels in the rivers had occurred.

Although Svardson's paper is indicative that little benefit can be gained by providing minimum flows on a river, there still remains the fact that he reports no particular work from Sweden which attempted to ascertain the specific effects of such a management program. Another factor is that Sweden does not experience as high temperatures or as dry summers as are found in Nova Scotia which is an indication that the problem would not be quite as pronounced there.

Wickett (1958) in a comprehensive review of certain environmental factors affecting the production of pink and chum salmon reports that, "stream discharge at the time the spawners are migrating upstream, at the time when the eggs are in the early stage of incubation, and extreme discharge during the period eggs and alevins are in the gravel can impose an 8-fold variation in the stock resulting from a given number of spawners in one area."

He states that favorable discharge in winter, at migration time and during incubation, combined with favorable ocean conditions could increase survival to practically 2000 percent of the spawners. However, an increase of this order will be achieved only rarely, because it requires at least four environmental factors to be favorable concurrently.

Brett (1951) states that no climatic variations were detected which might account for a declining sockeye fishery on the Skeena River in British Columbia. However, a significant relation between sockeye production and rainfall during the spawning months was apparent. He remarks that, "adversities of climate can be catastrophic if they coincide with critical times of development and...while successful prediction can not be anticipated, conservation through stream-level control is supported."

II. HISTORICAL BACKGROUND

1. Dams

It appears that for several years previous to the early 1920's at least three lumber mills and one pulp mill operated in the middle portion of this river system. A fishery officer's report, written in 1932, indicates that until 1925 these mills had provided good water control because their peak of operation coincided with the peak of salmon ascent during June. However, the mills had ceased to function after 1925 and consequently all the water ran off quickly as spring freshets during March and April.

A small pulp mill was located three miles from the mouth of the main river at Charleston and it proved to be a source of controversy for 31 years until it burned in 1947. During many years it was almost impossible to supply enough water for both Atlantic salmon ascent and the pulp mill operation. Water storage for this mill was located at (1) Molega Lake - 30 miles upstream, and (2) just above the mill itself at Charleston.

A small hydro-electric power house and dam were constructed in 1942 by the Nova Scotia Power Commission at the foot of McGowan Lake on the main river 34 miles upstream from the mouth. This development, which is still operating today, has a 1200 H.P. capacity and is provided with a fishway.

With a view to providing water control on Medway River, this Department restored two dams on Molega Lake in 1950. According to a 1953 fishery officer's report on file, these dams provided efficient water storage and the controlled flow not only improved angling but also resulted in the improvement of nursery conditions over many miles of the river. These dams deteriorated and did not function after 1958.

The only dams remaining on this river at present, apart from the Harmony Mills Hydro-Electric Power dam at the foot of McGowan Lake, are seven small former driving dams in the headwaters (photos 15, 16 and 17). These are owned by the Bowaters-Mersey Paper Company and have been operated since 1962 by the Protection Branch of the Department of Fisheries in an attempt to provide water control on the lower section of the river. The ultimate control of the water released from these dams, however, is at Harmony Mills Hydro-Electric Power House which is small and operates intermittently.

2. Pulp-wood Cutting and Driving

Extensive pulp-wood cutting is still carried out on a large area of land controlled by Bowaters-Mersey Paper Company in the headwaters of Medway River; most cutting in the lower sections of the river has now been discontinued. At the present time the cut wood is trucked to its destination; driving was discontinued on the lower section of the river about 1940 and the practice ceased in the headwaters region probably in 1961.

3. Fish Counting Traps

A fish counting trap was installed in the fishway of the pulp mill dam at Charleston during 1933 and 1934. Records reveal that 1627 and 1668 adult Atlantic salmon passed this point during the two respective years, and that the peak of the upstream migration occurred in mid to late June when more than 60 percent of the total run were counted.

During the six years, 1953 to 1958, a counting trap was situated in the fishway at Harmony Mills Power House resulting in counts of 17, 16, 2, 1, 3 and 1 adult Atlantic salmon each respective year, for a six-year total of 40 fish.

III. ANGLING HISTORY

Medway River is the best Atlantic salmon angling river in Nova Scotia; the average annual catch throughout the past 38 years (Figure 1) was 570 salmon while during the past ten years (Table 1) the annual average has increased to 630 salmon. Figure 1 shows that the total catch has been over 900 salmon per year for five years and less than 300 salmon per year for six years since 1928.

There are 55 salmon angling pools on Medway River between tidewater and the Power Dam at Harmony Mills and the majority of these (80 percent) are located along the 18 miles below Ponhook Lake. Since 1961 over 90 percent of all salmon angled on this river have come from the lower 44 pools; the most productive pool being on Ponhook Lake at Greenfield. The salmon angling season on this river is from May 25 to July 31 and 72 percent of the salmon taken in 1965 were large salmon.

Angling for brook trout (Salvelinus fontinalis) and shad (Alosa sapidissima) is also carried out on this river. Gaspereau or alewives (Pomolobus pseudoharengus) are taken commercially with dip and gill nets during their upstream migration in May; the 24th of that month is designated as "dipping day". Eels (Anguilla rostrata) are also taken commercially using weirs along the river and eel pots in the estuary. Large suckers (Catostomus sp.), sticklebacks (Gasterosteus sp.) and assorted "minnows" are also found throughout this system but these species have no direct commercial or recreational value.

Table 1 Atlantic Salmon Angled on Medway River 1956 - 1965

Year	Number of Salmon
1956	504
1957	295
1958	1038
1959	1023
1960	551
1961	819
1962	830
1963	426
1964	504
1965	315

IV. METHODS AND MATERIALS

The main river and three larger tributaries were divided for field study purposes into fifteen more or less equal sections of approximately four and one-half miles each. The entire survey was completed on foot and low water conditions at the time of survey were ideal for travelling and observation but disadvantageous when assessing the volume and rate of flow over salmon rearing areas.

Each spawning and nursery area was appraised individually as it was observed and a separate table of information was completed for each area which included information on its (a) location, (b) total estimated area, (c) bottom type, (d) amount of shade, (e) amount of cover and (f) velocity of water.

A distinction between spawning gravel and nursery area for Atlantic salmon was agreed upon prior to field observations. Spawning grounds are those areas in a river or stream which have (a) a substrate of clean gravel - ideally, that which will pass through a one and one-half inch mesh (Pratt and Sturge 1965), (b) a steady flow of clean water - ideally, 0.6 - 2.7 feet per second (ibid 1965), (c) sufficient depth of water - ideally, 0.7 - 1.4 feet deep (ibid 1965), and (d) usually some shade from terrestrial vegetation, although this is not essential. Nursery areas have a capacity to support young salmon in that they have

(a) adequate supply of food, (b) a predominance of riffle water but sometimes may be pools (Saunders and Gee 1964) and (c) gravel bottom for salmon fry with cobble and rocks for salmon parr (Elson 1961).

It is recognized that these two types of salmon habitat may co-exist and furthermore that unless such areas are of sufficient size and are within a mile or so of each other, they may be of little value as natural rearing areas for Atlantic salmon unless artificial stocking is implemented. Nursery areas must be considerably larger (4-12 times) than the area of spawning gravel in order to accommodate the increase in mass and motility after hatching.

The equipment used during this survey included: (a) Surber bottom sampler (square foot), (b) 40-foot long Minnow seine, (c) dip net, (d) centigrade thermometer, (e) 100-foot long steel tape, (f) meter stick and (g) 35 MM camera. Unfortunately, no seining could be satisfactorily carried out because of the general roughness of the bottom type throughout this river.

V. PHYSICAL DESCRIPTION

1. Main Medway River

(a) General Medway River flows in a south to southeasterly direction from Annapolis County into Queens and Lunenburg counties and enters Medway Harbour on the south shore of Nova Scotia about 100 miles west of Halifax. The river has a total drainage area of 590 square miles and a total length of approximately 58 miles. It ranks as the fourth longest river in Nova Scotia, being surpassed by St. Mary's, Mersey and Tusket rivers. Table 3 includes a summary of some physical features of this river system.

The lower portion of this river system lies in volcanic and minor sedimentary rocks of slate, argillite and quartzite rocks; while the headwaters of both the main river and Pleasant River lie in coarser formations of granite, gabbro and allied rocks (Map 3), (Anon, 1953).

TABLE 2 Summary of Physical Features on Medway River and Three Tributaries

Physical Feature	Medway River			Westfield River	Wildcat River	Pleasant River
	Mouth to Ponhook L.	Ponhook L. to Harmony	Harmony to Headwaters			
Total Length (miles)	18	10	24	3	2	26
Length Examined (miles)	18	10	13	3	2	8
Date Examined	Sept 20-28	Oct 1-7	Oct.12-13	Oct 4-5	Sept 29	Oct 14-15
Width Range (feet)	150-350	90-160	40-120	45-80	Mostly	50-80
Mean Width (feet)	210	130	60	60	Long	60
Depth Range (feet)*	0.7-1.7	0.6-1.2	0.5-1.0	No water	Stills	0.5-0.9
Mean Depth (feet)	1.0	0.8	0.7	No water	"	0.7
Vol.of Flow Range(c.f.s.)	31-100	27-48	29-38	" "	"	-
Mean Vol.of Flow(c.f.s.)	51	39	34.0	" "	"	-
Mean Gradient(Yds.per 1000)	2.4	1.2	6.0	Approx 1.5	Approx. 1.0	2.9
Colour of Water	Lt.Brown	Lt.Brown	Lt.Brown	No water	Lt.Brown	Colourless
Water Temp.Range(^{o}C)	14.0-22.3	8.9-13.0	9.0-11.8	" "	15.8	11.0-13.0
Mean Water Temp(^{o}C)	16.8	10.5	10.4	" "	-	12.0
Pool to Riffle Ratio	3:2	1:1	1:1	1:1	1:1	2:3
Number of Tributaries	19	6	8	5	2	7
Number of Lakes Drained by Tributaries	41	19	21	8	9	7

*No stillwaters included

Medway River is surrounded by a plain of low relief sloping to the southeast over which are scattered more than 500 symmetrical hills. These hills, known as drumlins, make good farms and it is their presence that gives rise to the agricultural district of Lunenburg and Queens counties. Most of the islands and points of Ponhook and Molega lakes are drumlins.

(b) Tidewater to Ponhook Lake (Map I)

This 18-mile section varies in width from 350 to 150 feet having an average of approximately 175 feet. Nineteen tributaries draining 41 lakes enter the river along this section; seven tributaries are intermittent and the largest lake has been diverted into another river system. There are also at least eight cold-water springs entering here. The surrounding terrain is level to moderate and consequently there are no tributaries having a torrential velocity. The banks of the river have a precipitous slope which is more than 75 feet high at both Mountain Falls below Greenfield and at a point just above Bangs Falls. The overall gradient of the river bed on this section is gentle at 2.4 yards per 1000 yards.

The majority of salmon angling is carried out on this lower portion of the river since it contains 44 of the 55 angling pools on the river. Thirty-four rapids and riffles were counted giving a pool to riffle relationship of approximately 3:2. No obstructing falls are present but ten of the rapids are rugged and have very fast water.

It will be seen below that this section has over one half of the available rearing area on the main Medway River. In general, this part of the river provides the best environment for Atlantic salmon on Medway River.

Six eel weirs were observed on this 18-mile section at survey time. Water levels were remarkably low at the time of survey and it was estimated from width measurements that this lower part of the main river was approximately 25 percent dry.

An indication of the fishing pressure here is that two fish and game lodges and a small hotel with cabins are present, along with many privately-owned camps. The four small communities of Mill Village, Charleston, Bangs Falls and Greenfield are also situated here. This section is readily accessible by a road which parallels the left bank of the river.

A total of 30 lakes are located immediately above this section, including Ponhook and Molega lakes which are the two largest reservoirs on Medway River. Cameron and Pleasant river systems, which drain many small lakes and have drainage areas of 40 and 90 square miles respectively, also enter these two reservoirs.

(c) Ponhook Lake to Harmony Dam (Map 2)

This ten-mile section is characterized by a slight gradient (1.2 yards per 1000 yards), many long stillwaters and correspondingly short rapids. The width averages 130 feet with a range of 75-160 feet. There are six tributaries draining 19 lakes, the most important of which is Westfield River (31 miles upstream).

The eleven remaining salmon angling pools are found here, but they contribute less than 10 percent to the total catch. A total of ten rapids or riffles were noted, resulting in a pool to riffles relationship of approximately 1:1. There are no obstructing falls in this area.

One eel weir is located at the lower end of this section near Ponhook Lake. Extremely low water conditions were evidenced at the time of survey and width measurements of this middle portion of the main river indicated that approximately 10 percent was dry.

Although three highway bridges and one railway bridge cross this section at intervals, accessibility is poor because no roads parallel the river. The small community of South Brookfield is found here but there are no fish and game lodges present.

A hydro-electric power dam is located at the foot of McGowan Lake and it is provided with a fishway through which few salmon pass. A dam which formerly existed at South Brookfield is breached and no longer forms an obstruction.

(d) Dean and McGowan lakes to Medway Lake (Map 3)

The river narrows to an average width of 50 feet on this 13-mile section which has a relatively steep gradient of 6.0 yards per 1000 yards. The pool to rapid ratio is 1:1, although none of the 21 pools are recognized as salmon angling pools. There are eight tributaries draining twenty-one lakes.

The watershed of Medway River above Dean and McGowan lakes is controlled and used by Bowaters Mersey Paper Company of Liverpool, Nova Scotia. Previous to the year 1961 pulpwood was floated down the river to the above-mentioned lakes. The main river has been modified in many rough sections by blasting and bulldozing in order to facilitate this driving operation (Photo 14).

There is a dam 44.5 miles upstream at Big Falls where the Paper Company Base Camp is located and although there is no fishway provided, migrating fish can pass by ascending the spillway. There are six small wooden former driving dams upstream (Photos 15, 16 and 17), none of which have any fish-pass facilities. No salmon have been reported above these dams, but several were reportedly seen in the pool below the lowermost dam at Medway Lake within the past ten years according to local fishery protection officers.

This section of the main river has a paucity of suitable rearing area; less than one percent of the total spawning gravel for the waterways included in the survey.

Eleven miles of the main river above Medway Lake and the twelve mile long West Branch were not included in this survey.

2. Tributaries Surveyed

(a) Westfield River (Map 2)

This river is three miles long, has a total drainage area of 60 acres, and an average width of 60 feet. It enters the main Medway River directly at a point 30.5 miles above tidewater. At survey time there was no water flowing in it (Photos 18 and 19) due to dry weather conditions and the absence of a storage dam which was formerly located at Tupper Lake. This tributary has a little less than one-third of the total spawning gravel available on the entire Medway River system. The overall gradient is slight at 1.5 yards per 1000 yards while the pool to riffle ratio is 1:1. There are five tributaries draining eight lakes but no dams remain on this tributary system at the present time.

There are two highway bridges crossing this river, but apart from these accessibility is poor since there is no road which parallels the stream.

(b) Wildcat River (Map 2)

This river is two miles long and has slight gradient of approximately 1.0 yards per 1000 yards. It is difficult to determine average width here since the river is mostly stillwater with several short runs. Wildcat River enters the main Medway River at a wide portion 26 miles upstream from tidewater. It has two tributaries which drain nine lakes and is itself the main connecting link between Molega Lake and Ponhook Lake. The value of this stream as a rearing area for young salmon is negligible.

This river is accessible at two points by automobile and is within walking distance along its length from Molega road.

One eel weir is located about 1.5 miles upstream.

(c) Pleasant River (Map 2)

This river meanders for 26 miles through 90 square miles of mostly undeveloped country and empties directly into Molega Lake which in turn flows via Wildcat River and LaBelle Brook into Ponhook Lake. The overall gradient of the main river is gentle at 2.9 yards per 1000 yards and there are seven tributaries draining the same number of lakes.

As indicated on the map, only the lower eight miles were examined at the time of survey and this portion has an average width of 60 feet and a pool to riffle ratio of 2:3. It is reported by the fisheries warden for this area that an impassable falls exists approximately 10 miles upstream from Molega Lake. There are no eel weirs on this river and local residents report that no Atlantic salmon have been seen here for many years.

Six miles upstream the nature of the river changes abruptly from long wide stillwater sections separated by rugged runs (Photo 20) to a series of gentle

riffles alternating with small pools (Photo 21). The bottom types of these two parts of the river are also quite distinct in that the lower section has mainly mud and sedimentary rock base while the upper section has mostly good spawning and nursery gravel which forms an ideal habitat for young salmon. This tributary has about 15 percent of the total rearing area available on the Medway River system.

Accessibility in the upper 18 miles is difficult and foot or boat are the only means of transportation other than aircraft. The lower part of the river is accessible by road at five points which are sufficiently far apart to make travelling convenient.

No industrial developments are located on this river and there are no man-made obstructions. The small community of Pleasant River is located along this river and a small amount of trash is thrown into the river from the bridge. However, pollution is not a problem.

VI. ATLANTIC SALMON REARING AREAS

Generally speaking, spawning gravel is abundant and suitably scattered although it is somewhat coarse while nursery areas are in short supply (c.f. Tables 6 and 7 in the Appendix). However, many small tributaries were not examined at survey time and undoubtedly these would contribute to the total amount of available nursery area. The above-mentioned tables in the Appendix also include information on the number of young salmon observed as well as any other distinctive features of the area including degree of shade and cover and type of bottom.

Table 3 summarizes the amounts and gives the percentage of rearing areas on four sections of the main Medway River and three tributaries. That portion of the main river between Ponhook Lake and tidewater is able to support the largest number of Atlantic salmon, while secondary and tertiary portions are Westfield River and the main river from Westfield River to Ponhook Lake, respectively. Although Westfield River does not have a large amount of nursery area compared with its spawning gravel, it is possible that many of hatched fry move out of this river to the larger nursery areas of the main river below.

Pleasant River has the fourth highest amount of rearing area and it is ideal since the amount of nursery area is approximately twelve times as plentiful as the amount of spawning gravel.

Medway River above Harmony hydro-electric power house along with Wildcat River have a poor capacity for supporting salmon.

VII. ESTIMATES OF PRESENT ATLANTIC SALMON PRODUCTION ON MEDWAY RIVER

During recent years angling records are the only figures available which give any indication of the total number of fish migrating up Medway River. An estimation of the total run demands a knowledge of the percent which is angled. Background information is available from Tobique River in New Brunswick and the LaHave River in Nova Scotia where the total runs were counted and the percentages angled calculated. The number of fish angled ranged from 10 to 35 percent of the total run on the Tobique and from 29 to 34 percent on the LaHave. The average number of salmon angled on Medway River during the past ten years was 630; the total run therefore possibly ranged between 1900 and 6300 salmon. Since angling pressure on the Medway appears to be high, the lower figure may be more reliable. This figure also agrees fairly well with counting trap records during 1933 and 1934 (cf. Section II.3).

VIII. OBSTRUCTIONS AND POLLUTION

There are eight dams on Medway River at the present time, all of which are located in the upper section of the river above mile 34 at Harmony. The power dam at Harmony is the only one provided with a fishway, but very few salmon pass this point (cf. Section II.3).

Practically all the eight eel weirs observed form partial obstructions at times of low water. In addition, most of the fast runs with boulder bottom types also formed partial obstructions since the water flowed beneath the boulders rather than over them.

TABLE 3 Total Amount and Percentage of Spawning Gravel and Nursery Area on Sections of the Medway River System

Section of River	Length (Miles)	Spawning Gravel Area (Sq.Yds.)	Spawning Gravel Percentage	Nursery Area Area (Sq.Yds.)	Nursery Area Percentage
Main River					
Ponhook Lake to mouth	18	29,000	30.6	708,850	58.4
Westfield River to Ponhook Lake	5	19,900	21.0	180,800	14.9
Harmony Power House to Westfield River	3	7,300	7.7	81,000	6.7
Medway Lake to Harmony Power House	9	350	0.4	6,500	0.5
Tributaries					
Wildcat River	2	50	0.1	3,000	0.2
Westfield River	3	24,400	25.7	62,000	5.1
Pleasant River	8	13,800	14.5	172,000	14.2
TOTALS		94,800	100.0	1,214,150	100.0

Pollution is not a problem on the Medway. Tin cans and bottles were found in some places and a certain amount of trash, including rubber tires, boards and paint was seen in the river at bridges near communities.

IX. SUMMARY AND RECOMMENDATIONS

Medway River is the fourth largest river and the largest producer of Atlantic salmon to the angler in Nova Scotia. However, although the annual catch averages 630 salmon during recent years, seasonal fluctuations have ranged from less than 300 to over 1100 fish. Anglers have attributed these wide fluctuations in angling success to variations in water levels on the river from year to year. Flow control has been proposed as a practical method to alleviate this problem but an experiment with this technique has suggested that it might be better used to improve conditions for young fish in the river, and thus improve smolt production.

A preliminary bio-engineering survey was completed in 1965 to determine the feasibility of water control and it was found that although the spawning areas are well scattered there is not an abundance of salmon nursery area throughout this river system. It was found that rearing area generally is concentrated between tidewater and Ponhook Lake. All eight dams on this river are at least 34 miles above tidewater and they present no hazard to salmon since there is very little spawning gravel in the headwaters area.

Natural fluctuations in angled catches of salmon are too great to be able to show that low water levels will seriously affect future salmon stocks. It is therefore recommended that an experimental study be carried out in order to assess these effects properly. The river for such a study should be chosen on the basis of the following criteria: (1) adequate accessibility, (2) quality, quantity and location of salmon rearing areas, (3) availability of water storage, (4) salmon angling reputation and (5) size of the stream (20-30 miles long). Medway River fills all these requirements except perhaps the last. However, it is difficult to find a smaller river which will satisfy the other four criteria. It may be possible to find a suitable tributary to some larger river but the results of an experiment here would be weakened by the absence of an estuary at the mouth of the river.

A program of study would include measurements of physical and biological parameters prior to water control as well as assessment during and following minimum flow production. Size and timing of adult salmon runs should be studied during the upstream migration and possibly during the spawning season in autumn. Number, age, size and condition of smolt should be studied during their downstream migration in spring. A two-way counting fence will be necessary for these two studies. Young salmon fry and parr should be assessed by electro-seining techniques each year at carefully selected stations. Such a monitoring of salmon populations on this river at all stages of their life history would have to be continued for five years if the results are to be worth-while.

A second stream might be chosen which would serve as a control to check the effects of the minimum flow experiment. Unfortunately, mid-summer high water conditions during the period of study would nullify the effects of controlled flow.

If dams are to be built to control the water of Medway River, it is recommended that Molega Lake be used as storage and that dams be built to control the two outlets from this large lake. It has an area of 8050 acres and a present reservoir capacity of 32,000 acre-feet.

It is further recommended that a dam be constructed at Tupper Lake on Westfield River to provide water during dry periods for this valuable spawning and nursery area. There was no water flowing in this river at the time of survey.

Finally, it is suggested that Department of Fisheries Protection personnel cease to operate the seven former driving dams in the headwaters in an attempt to provide water control on the lower portion of the river. The ultimate control for any water in the headwaters is at Harmony Mills Hydro-electric Power House and this plant releases water only intermittently.

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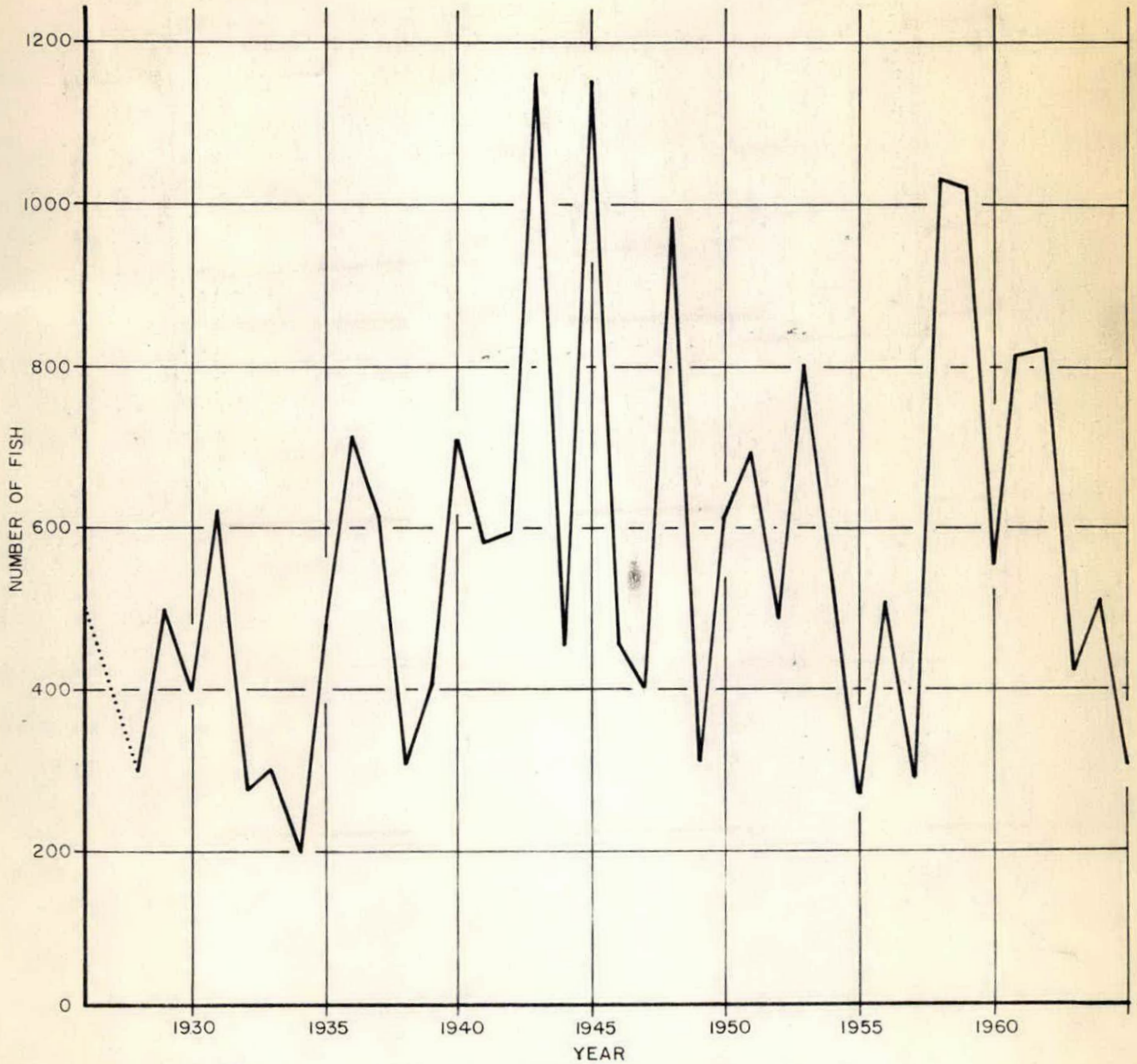
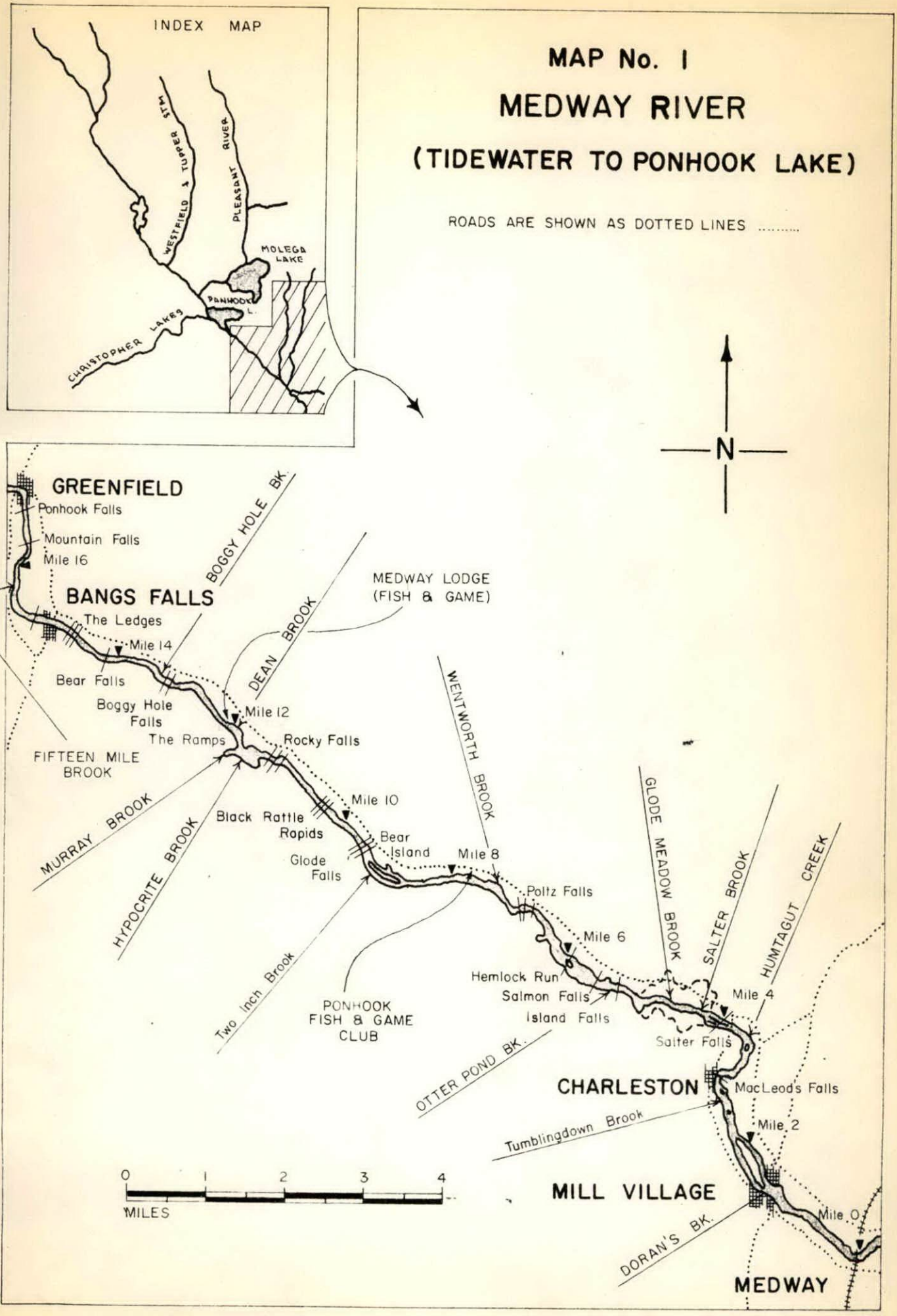
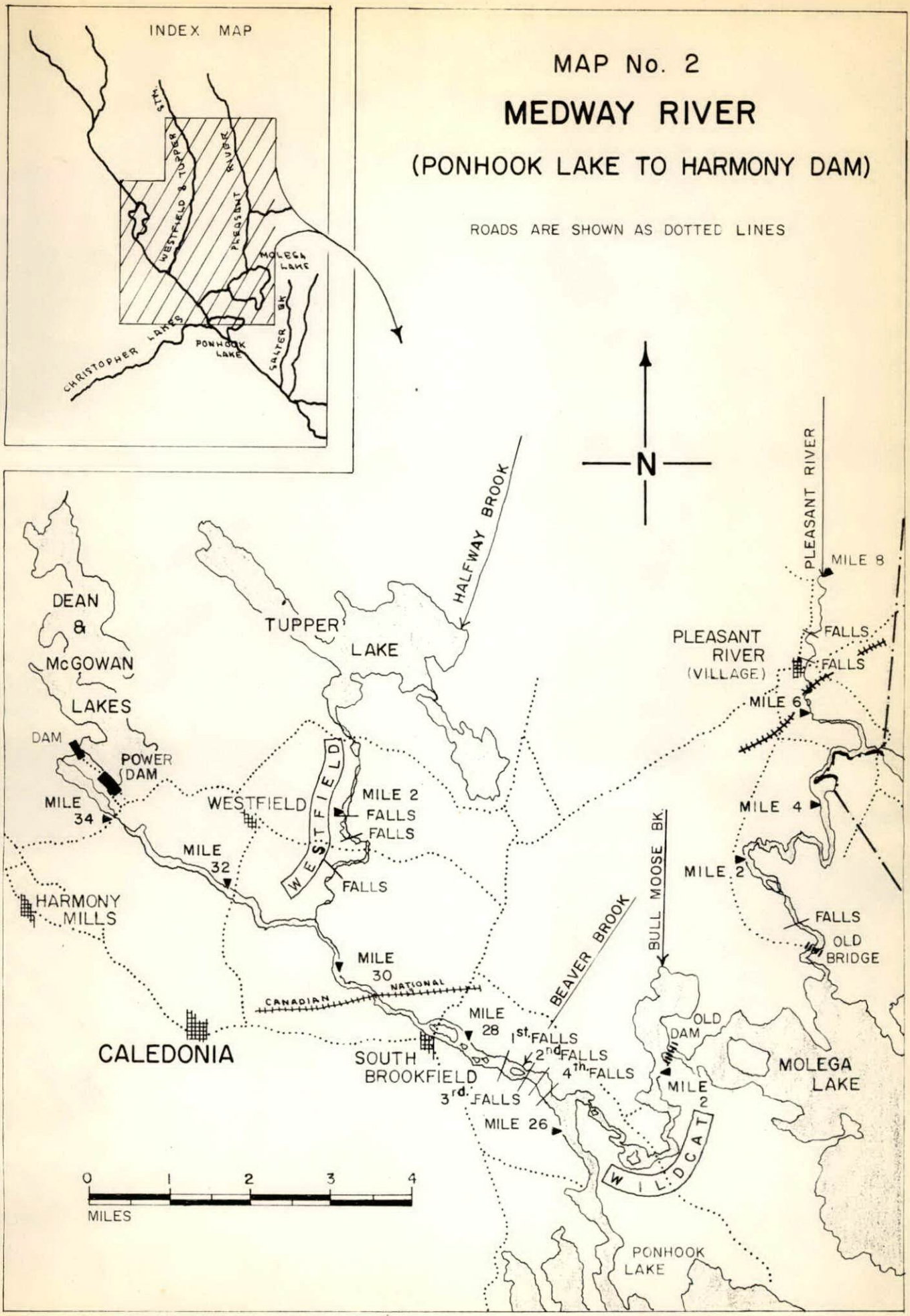
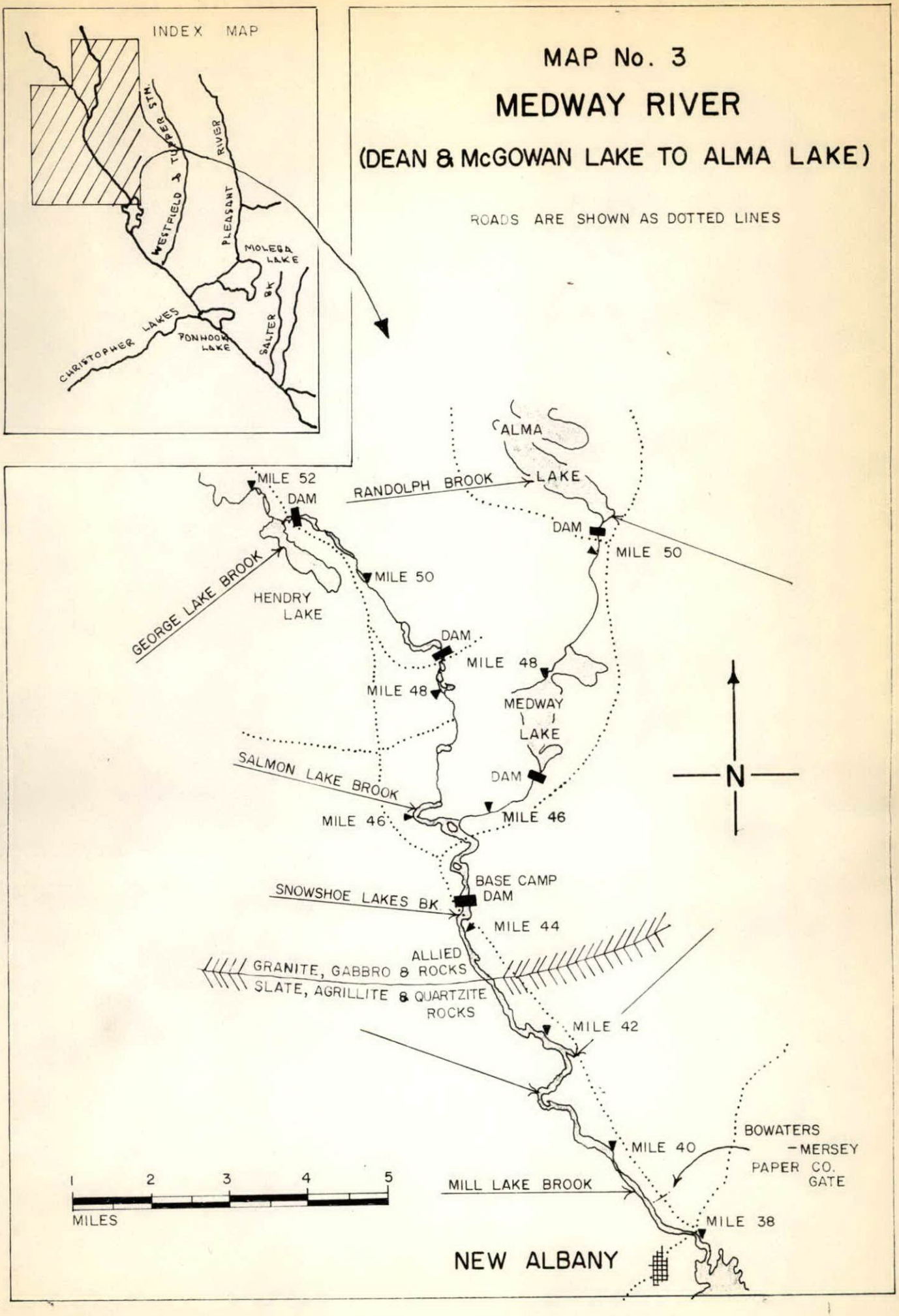


FIGURE 1: Number of Atlantic Salmon angled on the Medway River, Nova Scotia, 1926-65


SURVEY MAP
MEDWAY
RIVER
ROADS ARE SHOWN AS DOTTED LINES
Randolph Bk. Watershed
MEDWAY LAKE
West Medway Watershed
ANNAPOLIS CO.
LUNENBURG CO.
Pleasant River Watershed
NEW GERMANY
N
to Digby
NEW ALBANY
TUPPER LAKE
Tupper Lakes Watershed
POWER DAM
HARMONY MILLS
to Halifax
BRIDGEWATER
WESTFIELD RIVER
SOUTH BROOKFIELD
MOLEGA LAKE
Salter Bk. Watershed
Humtagut Creek Watershed
PONHOOK LAKE
GREENFIELD
BANGS FALLS
WILDCAT RIVER
Christopher Lakes Watershed
1 2 3 4 5 10 15
MILES
to Liverpool
LUNENBURG Co.
QUEENS Co.
CHARLESTON
MILL VILLAGE
MEDWAY


INDEX MAP
WESTFIELD & TUPPER STM
PLEASANT RIVER
MOLEGA LAKE
PONHOOK L.
CHRISTOPHER LAKES
MAP No. 1
MEDWAY RIVER
(TIDEWATER TO PONHOOK LAKE)
ROADS ARE SHOWN AS DOTTED LINES .....
N
GREENFIELD
Ponhook Falls
Mountain Falls
Mile 16
BOGGY HOLE BK.
BANGS FALLS
The Ledges
Mile 14
Bear Falls
Boggy Hole Falls
The Ramps
Mile 12
Rocky Falls
DEAN BROOK
MEDWAY LODGE (FISH & GAME)
FIFTEEN MILE BROOK
MURRAY BROOK
HYPOCRITE BROOK
Black Rattle Rapids
Mile 10
Bear Island
Glode Falls
WENTWORTH BROOK
Mile 8
Poltz Falls
GLODE MEADOW BROOK
SALTER BROOK
HUMTAGUT CREEK
Mile 6
Hemlock Run
Salmon Falls
Island Falls
Mile 4
Salter Falls
Two Inch Brook
PONHOOK FISH & GAME CLUB
OTTER POND BK.
CHARLESTON
MacLeod's Falls
Tumblingdown Brook
Mile 2
0 1 2 3 4
MILES
MILL VILLAGE
Mile 0
DORAN'S BK.
MEDWAY


INDEX MAP
STH.
WESTFIELD & TUPPER
PLEASANT RIVER
MOLEGA LAKE
SALTER BK.
CHRISTOPHER LAKES
PONHOOK LAKE
MAP No. 2
MEDWAY RIVER
(PONHOOK LAKE TO HARMONY DAM)
ROADS ARE SHOWN AS DOTTED LINES
N
HALFWAY BROOK
PLEASANT RIVER
MILE 8
FALLS
FALLS
PLEASANT RIVER (VILLAGE)
MILE 6
MILE 4
MILE 2
FALLS
OLD BRIDGE
DEAN & McGOWAN LAKES
DAM
POWER DAM
MILE 34
WESTFIELD
MILE 2
FALLS
FALLS
TUPPER LAKE
WESTFIELD
MILE 32
FALLS
HARMONY MILLS
BULL MOOSE BK.
BEAVER BROOK
MILE 30
NATIONAL
CANADIAN
CALEDONIA
MILE 28
1st. FALLS
2nd. FALLS
4th. FALLS
3rd. FALLS
SOUTH BROOKFIELD
MILE 26
OLD DAM
MILE 2
MOLEGA LAKE
WILDCAT
PONHOOK LAKE
0 1 2 3 4
MILES


INDEX MAP
WESTFIELD & TUPPER STM
PLEASANT RIVER
MOLEGA LAKE
SALTER BK
CHRISTOPHER LAKES
PONHOOK LAKE
MAP No. 3
MEDWAY RIVER
(DEAN & McGOWAN LAKE TO ALMA LAKE)
ROADS ARE SHOWN AS DOTTED LINES
ALMA
LAKE
RANDOLPH BROOK
MILE 52
DAM
DAM
MILE 50
GEORGE LAKE BROOK
HENDRY LAKE
MILE 50
DAM
MILE 48
MILE 48
MEDWAY LAKE
SALMON LAKE BROOK
DAM
MILE 46
MILE 46
N
BASE CAMP
DAM
SNOWSHOE LAKES BK
MILE 44
ALLIED
GRANITE, GABBRO & ROCKS
SLATE, AGRILLITE & QUARTZITE ROCKS
MILE 42
BOWATERS
-MERSEY
PAPER CO.
GATE
MILE 40
MILL LAKE BROOK
MILE 38
NEW ALBANY
1 2 3 4 5
MILES

APPENDIX I STOCKING RECORDS

Stocking of the Medway River system with Atlantic salmon fingerlings has continued since 1928 and the number has varied from approximately 75,000 to 300,000 fingerlings per year throughout the 38-year period. The following eight locations have been used as stocking sites (after 1958): Salter's Brook, Wentworth Brook, Bang's Falls, Greenfield, Ponhook Lake, LaBelle Brook, Cameron River and South Brookfield; Mersey Fish Culture Station supplied all the fingerlings.

Table 4 includes the stocking history on this river from 1958-1965 and the predicted adult return as calculated using Elson's (1962) survival rates.

Table 4 Salmon Stocking Record, Medway River, 1958-1965, with Predicted Adult Return (Elson)

LOCATION	1958	1959	1960	1961	1962	1963	1964	1965
Medway River	14,500A4	102,650A4		94,500A1	65,560A1 46,400A3 10,500A4	96,000A1 97,125A3 16,215A4	16,156A2 7,500A3	91,750A3
Bangs Falls (East)	9,000A2 15,000A4 20,400A5	6,100A3	14,200A5				2,000A3	
Ponhook Lake	9,000A2 27,600A5	10,000A2 5,800A3	14,200A3 5,200A4 20,500A5	22,500A1 40,900A3	20,000A3 21,800A4		21,708A2 7,500A4	
Bangs Falls (W)		6,000A3	11,400A4					
Ponhook Lake (E)		6,100A3	6,000A5		20,000A3			
South Brookfield			20,000A5					
Wentworth Brook				22,500A1				
Cameron River				16,875A1			16,156A2 5,128A3	
Salters Brook				22,500A1				
LaBelle Brook				22,500A1				
Greenfield	9,000A2 14,000A5							
TOTAL	118,500	136,650	91,500	242,275	184,260	209,340	76,148	91,750
ADULTS	901	1,039	695	1,841	1,400	1,591	579	697

APPENDIX II POTENTIAL SALMON PRODUCTION

(a) Available Nursery Area

The amount of nursery area available on Medway River is at least 1,214,150 square yards. Elson (1962) states that on a river with no merganser control, the optimum smolt production will be 1-2 smolts per 100 square yards. Since Medway River has no merganser control, smolt production may be expected to range between 12,150 and 24,300 per year. Also according to Elson's data, the survival rate from smolt to adult will be 8 $\pm$ 3 percent and this results in a possible adult return of between 970 to 1950 salmon (using 8 percent). Hayes (1953:36) indicates that survival from smolt to adult may approach 20 percent which would result in a possible adult return of 2400 to 4800 salmon.

(b) Available Stream Area

Another estimate of potential is again derived from Elson (1962) and is based on the total amount of stream area; 175 to 350 smolts will be produced per mile of stream 10 yards wide on which there is no merganser control. Medway River upstream to Harmony power house and including the three tributaries mentioned has approximately 36 miles averaging 30 yards wide. This results in a potential range of 18,900 to 37,800 smolts and using the smolt to adult survival rate of eight percent, the potential adult return should range from 1500 to 3000 salmon, while a survival rate of 20 percent would result in 3800 to 7600 returning salmon.

It must be remembered that only three tributaries of the Medway have been used in these calculations.

APPENDIX III CORRELATIONS BETWEEN WATER LEVEL FLUCTUATIONS AND ANGLED CATCH

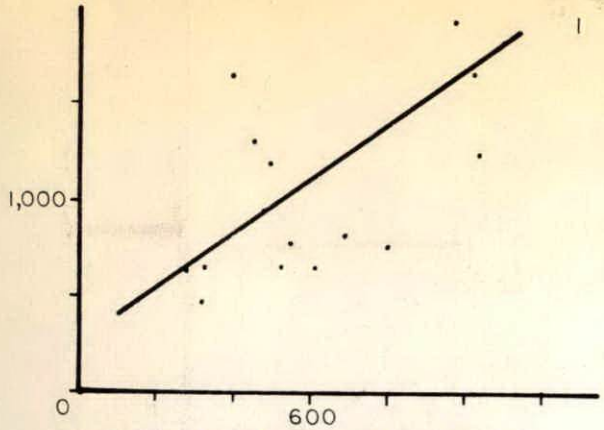
Many combinations of mean, minimum and maximum flows have been correlated with angling catch on Medway River for a 15-year period in an attempt to demonstrate what relationship, if any, there is between these two parameters. Figure 2 illustrates these relationships.

The highest correlation coefficient found was that between the mean rate of flow during the angling season of May to July and the corresponding annual angling catches ($r=+0.57$). The next best coefficients were those between the angling catch of one year correlated with minimum ($r=+0.31$) and maximum ($r=+0.26$) rates of flow five years previous. These correlations indicate that salmon eggs and fry may be the stages that are most affected by extremes of water flows.

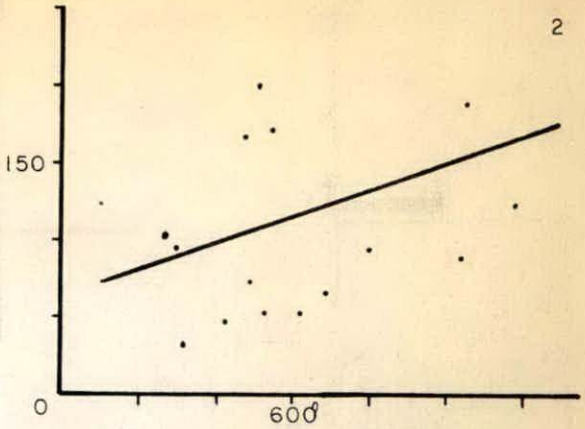
Finally, poor coefficients were found when angling catches of one year were correlated with minimum ($r=+0.17$) and maximum ($r=+0.17$) rates of flow three years previous. The indication here is that large parr are not greatly affected by extreme water levels.

Generally speaking, it was found by inspection that extremely low angling catches usually resulted from poor water conditions during the fry year combined with poor water for angling in the year that the fish were caught. Conversely, high angling catches usually resulted from good water conditions for fry survival one year combined with good water for angling five years later.

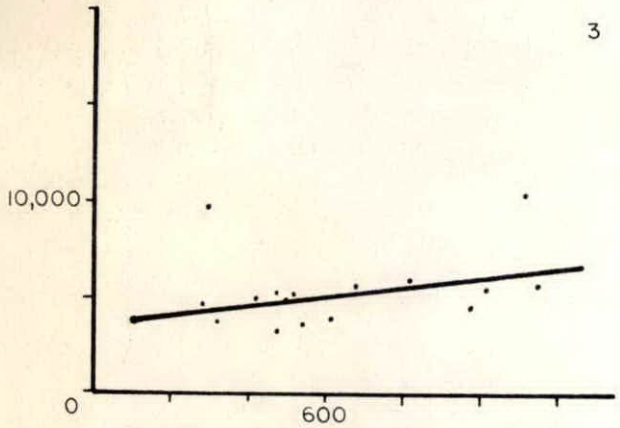
It must be emphasized that natural fluctuations in angled catch caused by factors other than changing water levels are probably too great to be able to demonstrate that these water level fluctuations by themselves will seriously affect future salmon stocks.



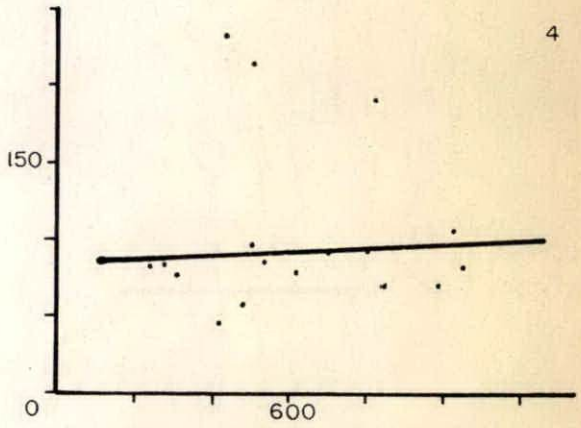
Mean rate of flow (Y) of May–July with angled catch (X) of same year.
r = +0.57



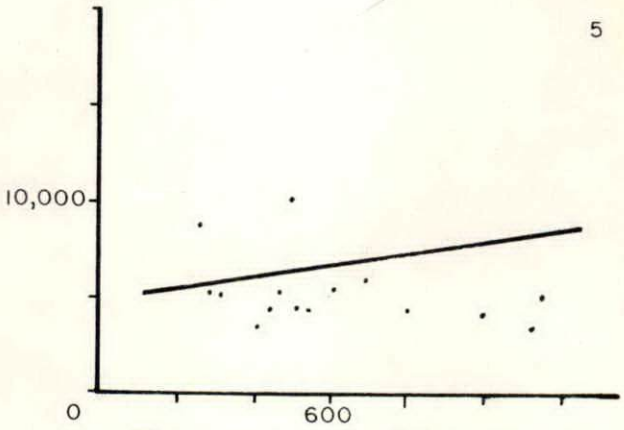
Minimum rate of flow (Y) of one year with angled catch (X) five years later
r = + 0.31



Maximum rate of flow (Y) of one year with angled catch (X) five years later.
r = + 0.26



Minimum rate of flow (Y) of one year with angled catch (X) three years later.
r = + 0.17



Maximum rate of flow (Y) of one year with angled catch (X) three years later.
r = + 0.17

FIGURE 2: Correlations between rate of flow and angling catch on the Medway River, Nova Scotia. 1946–1960

APPENDIX IV PREDATORS

Table 7 includes a summary of the predators to Atlantic salmon observed during the field survey indicating that a total of 48 predators were seen, 34 of which were mergansers. Eight herons were also recorded along with three sea gulls and one each of fish hawks, kingfishers and otters. Almost 70 percent of these predators were observed on the section of river between tidewater and Ponhook Lake. This is an indication that there are more young fish here than elsewhere.

TABLE 5 Summary of Predators Observed During Field Survey

Name of Predator	Medway River Mouth to Ponhook L.	Ponhook L. to Harmony	Harmony to Headwaters	Westfield River	Wildcat River	Pleasant River	Totals
Mergansers	25(approx)	2			4	3	34
Herons(or Cranes)	4	2	1		1		8
Fish Hawks	1						1
Kingfishers				1			1
Sea Gulls	2		1				3
Otters	1(or more)						1
	33	4	2	1	5	3	48

APPENDIX V — DETAILS OF ATLANTIC SALMON REARING AREAS

The two tables which follow contain a detailed breakdown of each piece of spawning gravel and nursery area found during the field survey of the main Medway and three tributaries.

Reference is made to the photographs in Appendix VII.

For an accurate indication of where the areas mentioned in the tables may be found, refer to Maps 1, 2 and 3.

TABLE 6 Quantity, Location and Description of Individual Nursery Areas on the Main Medway River and Three Tributaries

Distance Upstream (Miles)	Location	Nursery Area (Sq.Yds.)	Adjectival Description: Cover	Adjectival Description:	Remarks
2.0	Mill Village-above highway bridge	15,000	excellent	fair	Lower part of this section may be influenced by tides. Suffers from drought. Cold spring water enters at Doran's Brook.
2.2	Above island at Mill Village	10,000	excellent	fair	Mostly boulders
2.3	Below Freeman's Run	10,000	excellent	excellent	Good supply of rubble among boulders.
2.5	Mouth Tumblingdown Bk.	8,500	excellent	excellent	Spawning gravel nearby
3.6	Charleston, below Road Bridge	5,000	excellent	fair	Paint in water at time of survey.
6.7	Below Poltz Falls	40,000	fair	fair	Much gravel and rubble, few boulders (Photo 1).
7.8	Shoal Grounds	25,000	excellent	excellent	Nearest spawning gravel ½ mile upstream.
8.2	Near Bluff Pool	15,000	excellent	excellent	Saw one salmon parr.
8.4	Below Kempton's Run	5,000	excellent	excellent	Ideal for amount of spawning gravel present.
8.8	Below Harley's Run	16,800	excellent	excellent	Saw one salmon parr. Two cold springs enter above and below this section.
9.5	Right side Bear Island Mouth Two Inch Brook	19,500	excellent	excellent	Dry at time of survey - no flow (Photo 2).
9.6	Left side Bear Island	5,500	excellent	excellent	See Photo 3
9.7	Below Glode Falls	40,000	excellent	excellent	Practically dry at time of survey.
10.1	Above Glode Falls	20,000	fair	fair	Very little spawning gravel in area.

Distance Upstream (Miles)	Location	Nursery Area (Sq.Yds.)	Cover	Adjectival Description	Remarks
10.3	Below Black Rattle Rapids	7,500	excellent	fair	Water sometimes very rapid.
10.9	Below Rocky Falls	22,500	excellent	fair	Water sometimes very rapid.
11.4	The Ramps	33,000	excellent	excellent	River runs among three islands here.
11.9	Mouth Dean Bk.	24,000	fair	fair	Spawning gravel nearby.
12.0	At Medway Lodge	20,000	fair	fair	See Photo 5.Few large boulders.Saw two fry.
12.4	Near Eel Weir Pool	40,000	excellent	excellent	See Photo 6.
12.8	Near Diving Rock Pool	40,000	excellent	excellent	See Photo 7. Very little water flowing at time of survey.
13.0	Mouth Boggy Hole Bk.	40,000	excellent	excellent	See Photo 8.Water regulation needed.
13.4	Below Bear Falls	17,500	excellent	excellent	Saw three salmon fry, ideal cover.
13.9	Below Bear Falls	12,800	excellent	excellent	Mostly large rubble, cobble and boulders.
14.2	Above Bear Falls	8,000	excellent	excellent	Flow probably very rapid with higher water.
14.8	Below Bangs Falls Road Bridge	20,000	excellent	excellent	Boulders scattered. (Photo 9). Located around small island.
15.1	Above Bangs Falls Road Bridge	11,250	excellent	excellent	Also found around small island.
15.5	Below mouth Fifteen Mile Brook	60,000	excellent	excellent	Ideal - lacks water during dry periods. (Photos 10 and 11).
16.0	Above Black Rattle Falls	37,500	excellent	excellent	Ideal
16.3	Below Mountain Falls	20,000	excellent	excellent	See Photo 12

Distance Upstream (Miles)	Location	Nursery Area (Sq.Yds.)	Cover	Adjectival Description	Remarks
16.5	Above Mountain Falls	12,000	excellent	excellent	Spawning gravel scattered throughout area.
16.6	Near Trout Cove	20,000	excellent	excellent	Ideal-alternating pools and riffles.
16.8	Below Mill Pool	7,500	fair	fair	Five salmon parr were taken from nearby eel weir at time of survey.
17.5	Above Greenfield Bridge	20,000	excellent	excellent	Good riffle. Saw two parr.
28.2	Below South Bkfield Island	17,000	excellent	fair	Area strewn with rubbish (tires, wood, etc.).
28.3	Right side South Brookfield Island	16,800	satisfactory	excellent	One salmon fry and one parr observed.
28.4	Below South Brookfield Road Bridge	17,000	excellent	excellent	Saw one salmon fry.
29.0	Below South Brookfield Railway Bridge	40,000	satisfactory	fair	Saw two salmon fry.
29.2	Below South Brookfield Railway Bridge	25,000	excellent	excellent	Coarse spawning gravel in area
29.5	Above South Brookfield Railway Bridge	10,000	excellent	excellent	" " " " "
29.7	Above South Brookfield Railway Bridge	10,000	excellent	excellent	" " " " "
30.6	Below Mouth Westfield River	45,000	satisfactory	fair	Plenty coarse spawning gravel in area.
31.7	Below Caledonia Road Bridge	10,000	excellent	excellent	Some trash in water.
32.1	Above Caledonia Road Bridge	40,000	excellent	excellent	Ideal
32.3	Above Caledonia Road Bridge	5,000	excellent	excellent	Good shade from trees on banks.

Distance Upstream (Miles)	Location	Nursery Area (Sq.Yds.)	Cover	Adjectival Description	Remarks
32.4	Below Mahar's Stillwater	5,000	excellent	excellent	Mostly boulders
33.2	Above Mahar's Stillwater	15,000	excellent	excellent	Good riffle
34.2	Below Harmony Road Bridge	6,000	excellent	fair	Rapid flow when water higher. Saw one salmon parr.
38.2	Below New Albany Road Bridge	1,000	excellent	excellent	Small
41.3	Below Perch Lake River	2,500	excellent	excellent	Good supply of bottom fauna (Appendix VI).
46.5	Below Medway Lake	2,000	excellent	excellent	See Photo 13
46.7	Below Medway Lake	1,000	excellent	excellent	Sufficient flow of water even in dry season.
	MEDWAY RIVER TOTAL	977,150			
30.8(0.2)	Westfield River	7,000	fair	fair	River narrow. Good spawning gravel and cover.
31.4(0.6)	Westfield River	6,000	excellent	excellent	
32.0(1.2)	Westfield River	12,000	fair	fair	Few boulders
32.4(1.6)	Westfield River	16,000	fair	fair	Mostly gravel-few boulders (Photos 18 and 19).
32.6(1.8)	Westfield River	12,000	fair	fair	Mostly gravel and cobble.
33.1(2.3)	Westfield River	9,000	excellent	excellent	No flow on entire Westfield River at survey time.
	WESTFIELD RIVER TOTAL	62,000			
28.1(1.4)	Wildcat River	3,000	excellent	excellent	Well shaded.
	WILDCAT RIVER TOTAL	3,000			
39.0(6.4)	Pleasant River Below Village	87,000	fair	fair	Insufficient cover
40.1(7.5)	Pleasant River Above Village	85,000	fair	fair	Insufficient cover (Photo 21)
	PLEASANT RIVER TOTAL	172,000			
	MEDWAY " "	977,150			
	WESTFIELD " "	62,000			
	WILDCAT " "	3,000			
	GRAND TOTAL	1,214,150 Sq. Yds.			

TABLE 7 Quantity, Location and Description of Individual Spawning Grounds on the Main Medway River and Three Tributaries

Distance Upstream (Miles)	Location	Spawning Gravel (Sq.Yds.)	Shade	Adjectival Description	Remarks
2.3	Below Freeman's Run	300	Poor-low grassy banks	fair	Very little water on gravel at time of survey.
2.5	Tumblingdown Bk.	150	Poor-low grassy banks	fair	Good quality gravel.
6.7	Below Poltz Falls	1,100	Poor-area near centre of river	fair	See Photo 1
8.2	Near Bluff Pool	100	Poor-river wide	poor	Saw one parr a short distance below.
8.4	Below Kempton's Run	100	Poor-river wide	fair	Nursery area available if flow regulated.
8.8	Below Harley's Run	400	Poor-river wide	excellent	Saw one salmon parr. Two cold springs enter river immediately above and below this.
9.5	Right side Bear Island mouth Two Inch Bk.	200	Satisfactory large deciduous trees	excellent	Saw one salmon fry. Two Inch Brook possibly good nursery area. (Photo 2).
9.6	Left side Bear Island	150	Satisfactory	excellent	See Photo 3.
9.7	Below Glode Falls	100	Satisfactory (near shore)	fair	See Photo 4-shows close-up of gravel.
11.4	The "Ramps"	3,100	Excellent	excellent	River flows around four tree-covered islands at this point. Saw adult salmon here in November.
11.9	Mouth Dean Bk.	550	Satisfactory (near shore)	fair	Quality depends on water height.
12.0	In front of Medway Lodge	9,000	Poor-river very wide	fair	Saw two salmon fry. Quality depends on water height. Severely reduced as a nursery area during low water (Photo 5).

Distance Upstream (Miles)	Location	Spawning Gravel (Sq.Yds.)	Shade	Adjectival Description	Remarks
12.4	Near Eel Weir Pool	350	Satisfactory - large overhanging trees	excellent	Good nursery area in vicinity.
12.8	Near Diving Rock Pool	100	Poor-forest thin	fair	See Photo 7.Section needs water regulation.
13.0	Mouth Boggy Hole Brook	2,500	Satisfactory	excellent	See Photo 8.Section needs water regulation.
13.9	Below Bear Falls	150	Satisfactory	fair	Saw three salmon fry.Good nursery area in vicinity.
14.2	Above Bear Falls	100	Satisfactory	fair	Small. Maybe unusable because of fast water.
14.8	Below Bangs Falls Bridge	150	Excellent	excellent	Small.Located on either side of an island. (Photo 9).
15.1	Above Bangs Falls Bridge	1,100	Excellent	excellent	Also located on either side of a small island.
15.5	Below mouth Fifteen Mile Brook	6,700	Excellent	excellent	More water required. Excellent nursery area available nearby. (Photos 10 and 11).
16.0	Above Black Rattle Falls	150	Fair	fair	Spawning gravel scattered.
16.3	Below Mountain Falls	200	Excellent	fair	Coarse gravel. Trees overhang spawning gravel. (Photo 12).
16.5	Above Mountain Falls	250	Excellent	fair	Spawning gravel scattered.
16.6	Near Trout Cove	1,700	Satisfactory	fair	Coarse gravel.
16.8	Below Mill Pool	50	Fair	poor	Coarse gravel.Took five salmon parr from eel weir immediately below this area.
17.5	Above Greenfield Bridge	250	Satisfactory	fair	Good flow of water here because of proximity of Ponhook Lake. Saw two parr.
28.2	Below South Brookfield Island	4,000	Excellent	fair	Area strewn with rubbish (tires, cans, wood).
28.3	Along Right Side of South Brookfield Island	7,000	Excellent	excellent	No water flowing over area at survey time. One fry and one parr observed.

Distance Upstream (Miles)	Location	Spawning Gravel (Sq.Yds.)	Shade	Adjectival Description	Remarks
28.4	Below South Brookfield Dam	6,100	Satisfactory	excellent	Threat of poaching here. Saw one salmon fry.
29.1	Below Railway Bridge-South Brookfield	1,100	Satisfactory	excellent	Saw two fry.
29.2	Below Railway Bridge-South Brookfield	550	Excellent	excellent	Gravel somewhat coarse.
29.5	Above Railway Bridge at South Brookfield	100	Excellent	fair	Coarse gravel
29.7	Above Railway Bridge at South Brookfield	150	Excellent	fair	" "
30.6	Below mouth Westfield River	900	Excellent	fair	" "
31.7	Below Caledonia Road Bridge	300	Fair	fair	Some trash in water
32.1	Above Caledonia Rd.Bridge	6,000	Excellent	excellent	Good nursery area available.
33.2	Above Mahar's Stillwater	1,000	Excellent	fair	Large percentage of rubble.
38.2	Below New Albany Bridge	50	Fair	fair	Coarse
41.3	Below Perch Lake River	300	Satisfactory	fair	Somewhat coarse gravel
Main Medway River TOTAL		56,550			
30.8(0.2)	On Westfield River above mouth	4,800	Excellent	excellent	No flow at time of survey.
31.4(0.8)	On Westfield River below first Road Bridge	3,800	Excellent	excellent	" " " " " "
32.0(1.2)	On Westfield River at first Road Bridge	12,000	Excellent	excellent	" " " " " " See Photos 18 and 19.
32.4(1.6)	On Westfield River between first and second Road Bridges	1,300	Excellent	excellent	No flow at time of survey. Protection Officer reports seeing salmon spawn here in 1964.
32.6(1.8)	" " " " "	2,500	Excellent	excellent	No flow at time of survey. Saw one parr here.
Westfield River TOTAL		24,400			

Distance Upstream (Miles)	Location	Spawning Gravel (Sq.Yds.)	Shade	Adjectival Description	Remarks
28.1(1.4)	On Wildcat River above Molega Road	50	Poor	fair	Adequate nursery immediately above to support young salmon.
	Wildcat River TOTAL	50			
29.0(6.4)	Pleasant River below Pleasant River Village	7,200	Excellent	excellent	Ideal gravel.
40.1(7.5)	Pleasant River above Village	6,600	Excellent	excellent	" " (Photo 21)
	Pleasant River TOTAL	13,800			
	Main Medway TOTAL	56,550			
	Westfield River TOTAL	24,400			
	Wildcat River TOTAL	50			
	GRAND TOTAL	94,800 Sq. Yds.			

APPENDIX VI BOTTOM FAUNA

Table 8 includes the kinds and numbers of bottom organisms found at eight sites on Medway River. Only one sample was taken from each site using a square foot Surber stream bottom sampler.

Volumes are given for the total sample from each site. Better food supplies were apparently available in the upper section of the river.

Food grades are assigned using the outline presented by Lagler (1956:300). Grade 1 is "exceptional richness", grade 2 is "average richness" while grade 3 is "poor in food".

The Charleston sample was taken while a highway bridge upstream was being painted and there was paint in the water and clinging to the stream bottom. This may account for the low number of bottom organisms here. The sample from below Perch Lake was taken shortly after heavy rain and flood conditions. A small number of bottom organisms were also found here, contrary to expectations; Mottley, et al. (1939) report that the food grade also dropped after flood conditions in their more intensive study.

Table 8 Numbers of Bottom Organisms Per Square Foot on Medway River Including Total Volume from Each Station

Bottom Organisms	Charleston	Glode Falls	Medway Lodge	Below Bangs Falls	At 15-Mile Brook	Above Caledonia Bridge	Below Perch Lake	Above Base Camp	Total
Ephemeroptera nymph	1	-	-	4	15	31	2	8	61
Zygoptera nymph	-	-	-	-	1	4	-	-	5
Trichoptera larva	1	15	17	10	72	42	4	184	345
Coleoptera larva	2	5	-	3	7	7	3	7	34
Diptera larva	2	10	2	3	-	12	-	2	31
Plecoptera nymph	-	6	2	2	12	16	-	24	62
Megaloptera nymph	-	-	-	-	-	-	-	2	2
Hemiptera	-	-	1	-	-	-	-	-	1
Mollusca	1	18	-	12	-	8	2	9	50
Unidentified	-	-	-	-	-	-	-	1	1
Total number(per Sq.Ft.)	7	54	22	34	107	120	11	237	592
Total volume (c.c.)	T*	0.25	0.25	0.25	1.00	0.75	0.25	2.25	5.00
Food grade	3	3	3	3	2	3	3	1	-

T* = Trace

APPENDIX VII

PHOTOGRAPHS

Photo 1. Wide portion of river 6.7 miles upstream. Just below Poltz Falls. Coarse gravel.

Photo 2. Right side of Bear Island, 9.5 miles from mouth, looking downstream. Near Two Inch Brook tributary. No flow at survey time.

Photo 3. Left side of Bear Island, 9.6 miles from mouth, looking upstream. Little flow.

Photo 4. Close-up of gravel mound at the foot of Glode Falls, 9.8 miles upstream.

Photo 5. Wide portion of river in front of Medway Lodge, 12.0 miles from the mouth. Abundance of gravel, few boulders. Looking downstream.

Photo 6. Rearing area near Eel Weir Pool, 12.4 miles from the mouth, looking upstream. Approximately 400 feet wide.

Photo 7. Rearing area near Diving Rock Pool, 12.8 miles from mouth, looking upstream. Very little water flowing.

Photo 8. Good rearing area near Boggy Hole Brook tributary, 13.0 miles upstream, looking upstream. Boulders provide excellent cover for small fish.

Photo 9. Right side of island below Bang's Falls Highway Bridge, 14.8 miles from mouth, looking downstream. Boulders few and scattered.

Photo 10. Good rearing area on main river at Fifteen Mile Brook, 15.5 miles from mouth, looking downstream.

Photo 11. Good rearing area on main river at Fifteen Mile Brook, 15.5 miles upstream. Rate of flow when photograph taken: 45 c.f.s. approximately.

Photo 12. Nursery area below Mountain Falls, 16.3 miles from mouth, looking downstream. Stream width about 225 feet.

Photo 13. Below Medway Lake, 46.5 miles from mouth of main river, looking upstream. Rate of flow approximately 29 c.f.s. Abundant bottom fauna.

Photo 14. Below Medway Lake, 46.7 miles from mouth, looking upstream. Section of stream blasted and bulldozed to facilitate log-driving operation during the 1950's.

Photo 15. Former driving dam at Croker Lake in the headwaters of the main river.

Photo 16. Former driving dam at Long Lake in the headwaters of the main river.

Photo 17. Former driving dam at Hendry Lake in the headwaters region on the West Medway River.

Photo 18. Westfield River tributary. Looking <u>downstream</u> at first highway bridge, 1.2 miles from mouth. No water flowing.

Photo 19. Westfield River tributary. Looking upstream from first highway bridge, 1.2 miles from mouth. No water flowing.

Photo 20. Pleasant River tributary. Looking upstream at a point 0.3 miles upstream. Coarse boulders and ledge rock. No salmon habitat on this section.

Photo 21. Pleasant River tributary. Looking upstream, 7.5 miles from mouth. Good spawning gravel. Little water flowing at survey time.