FRESH-WATER FISHES
OF
SOUTH-EASTERN QUEBEC

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THE FRESH-WATER FISHES OF SOUTH-EASTERN QUEBEC.

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INTRODUCTION:

A careful search of the literature concerning the fishes of the fresh-waters of Canada shows that studies of an ichthyological nature ~~for~~ of the fresh-waters of the Province of Quebec in the past have been restricted to accounts of small collections made only within small areas These are typically incomplete. To the present time there has not appeared a full account of the species inhabiting the fresh-waters of this Province based on studies and collections made over a wide range.

In consequence, the fresh-waters of Quebec represent a blank space in the ichthyology of Eastern Canada. In recognition of this the present paper is descriptive in nature and deals primarily with an account of those species present in the waters of the Appalachian district to the South of the St. Lawrence River, a region commonly known as the 'Eastern Townships!

The range of these species as given in the following account is based on records obtained by a systematic study of these waters conducted during the past four summers by the Piscicultural Branch of the Department of Public Works, Game and Fisheries. The writer feels it incumbent on himself in view of the scantiness of earlier data to show the range of these species into the Laurentian waters so far as it is

at present possible to do. The latter is based largely upon the writer's observations and collections made in the vicinity of Lake Nominingue (Labelle Co.). It has been possible in many cases to show the presence of various species in other districts in the Laurentians. This information has been based upon the collections made by the parties inspecting lakes in the Laurentians and upon the recorded observations which were embodied in their reports.

Faunistically the present waters represent the most easterly extension of the fishes of the Great Lakes waters. This is obvious in a comparison of the lists of the fishes of Ontario (Hubbs 33, Dymond 17,etc.) with the present account. So far as it has been possible, data of sub-specific importance has been included in the present descriptions. In the absence of western forms with which a comparison may be made, it has not been found possible to identify the majority of species to a sub-specific standing. The typical descriptions of sub-species are commonly non-informative without material of both types for actual comparison.

In the Appalachian district, as a consequence of the more intensive and systematic nature of the routine examinations, it has been possible to show graphically the divisions of the fishes into those inhabiting the highland, intermediate or lowland sections of the streams and in this fashion to illustrate many of the features of the frequencies with which these species have been recorded. An analysis of the latter has been made

and shows that the stocking problems for that area are divided into two parts. The trout fishing is a feature of the brooks and of some of the deep lakes; the majority of the lakes are given over to bass and should be stocked along those lines.

The survey was instituted and directed by Mr. B. W. Taylor, Director of Fish Culture and Biologist for the Province of Quebec, with the aim of inspecting all the waters stocked by the Hatchery Service in ~~the~~ past years.

During the summer of 1930 two temporary biological stations were established, the one at Lake Manitou in the Laurentians, the other at Brome Lake in the lower Appalachian district. A comparative study of the two lakes was made and men trained for the future systematic examinations which commenced in 1931. The writer was in charge at Brome Lake during the first summer and since then has spent the greater part of each summer in the field in the Appalachian District.

The writer is greatly indebted to Mr. B.W.Taylor for his interest in the present work and for his practical assistance and support at all times. He is further indebted to Mr. Taylor for permission to examine all collections made both in the Laurentian and the Appalachian waters and for allowing him to draw freely from the material contained in the reports made by the several survey parties.

The examination and study of the collections has been made possible only through the excellent facilities which

the writer has enjoyed in the Department of Zoology at McGill University, and the writer is greatly indebted to Dr. H.B.Fantham, Chairman of the Department of Zoology, for his encouragement and support during the preparation of the present paper.

It is not possible to list in full the members of the parties of the various years through whose cooperation and interest the data has been accumulated. The writer is most grateful to Professor V.C.Wynne-Edwards, to Mr. R.E. Johnson and Mr. L.W.Hayter whose assistance and excellent work in the field has been of the greatest value. The excellent map of the waters in the Appalachian district was prepared by Mr. J.G.Frost, who has been most liberal in offering assistance in this and similar matters.

HISTORICAL REVIEW

The state of knowledge concerning the smaller fishes of the waters of this Province up to the present time has been limited and sketchy, due as much to the lack of systematic publications or of a single recognised complete work as to the emphasis which has been placed on the few small and irregular collections which have been sent to the United States National Museum and to the British Museum for examination (Baird Coll. 6 , Whiteaves Coll. 29, Dwylie Coll. 20, etc.).

By such collections the presence within our boundaries of P.caprodes, B.nigrum olmstedi, C.flabellaris, P.exilis, C.commersonii, M.anisurum, etc. was established and in view of the scantiness of the data no concept of the relative importance of these species could be formed. Nevertheless, such data became well-known through ~~its~~ inclusion in the lists of the fishes of the St. Lawrence River (Evermann and Kendall 20) and of Canada (Evermann and Goldsborough, 19 , Halkett, 30). At the same time the presence of many species far more common in the Province was not recognised.

Generally speaking, the use of such data has been highly injurious to a rational understanding of the species of our waters and offered a totally incorrect semblance of completeness to the previous studies and concealed the necessity for further work.

A similar result has developed from the compilation of an extensive literature concerning the larger food and game

species, a consequence of the great importance of these species in the past which attracted the attention of various workers to the almost complete exclusion of the smaller forms from their studies. Yet although in pioneer times the fishes of the lakes and streams frequently afforded the sole source of food to the early settler (Hubbard, 31), little anecdote has survived which would permit a reconstruction of the fauna of the past.

Information which may be gathered from the writings of the earlier travellers is commonly scanty and concerned solely with accounts of the larger species of commercial import and of the fisheries of the Gulf and River St. Lawrence. Boucher's account (9) is of more interest in the excellent description he gives of 'Le Poisson Arme' (L.osseus)and of the brief mention of some of the fishes of the smaller tributary waters--'les petites truites', 'le dore', 'le brochet', etc. Unfortunately he attempts no description of the minnows or other small fishes but simply groups them collectively as 'les perches', 'Carpes de Plusiers sortes'. Although brief, his list includes some twenty kinds of fishes.

Until 1859, when D'Urban (15) published a short paper concerning the fishes of the Rouge River district, no work of real value had appeared dealing with the fishes of those waters tributary to the St. Lawrence within the boundaries of the Province of Quebec. Although D'Urban's paper mentions only nine species which may be recognised

and brought to present synonomy, as the pioneer work it became widely-known and received much recognition in later publications.

In the same year several other short papers were written in which reference was made to small collections from various regions of the lower St. Lawrence (Bell,—— , Perley,——). Little information concerning the fresh waters was contained in these, attention being primarily directed to marine species of commercial value. Of the few fresh water species mentioned by these writers only one or two (O.mordax, S.fontinalis) can now be recognised owing to the general lack of description.

Dawson's description of E.inconstans from the vicinity of Montreal was published in the same volume with the preceeding papers(14). In this fashion the above all came to the attention of the compilers of the lists of fishes for the St. Lawrence.

Shortly afterwards appeared the reports of Pierre Fortin (23). These became one of the major sources utilised in compilations of the lists in reference to the species inhabiting the waters of the St. Lawrence in the Quebec section. The reports were issued in connection with the Fisheries Protection Service of which Fortin was in charge during those years. Eleven of the more common fresh water species were mentioned, and the records have been extensively quoted.

Gunther's publication of the 'Fishes of the British

Museum' in 1868 contains reference to six species found in the waters of this Province, only three of which were noted by Evermann and Kendall. Some of these specimens were sent to Gunther by J.F.W. and others. In referring to them in Zoological Notes. J.F.W. (34) also mentions that C.commersonii, C.carpio, H.notatus, R.cataractae, N.cornutus and L.corporalis were identified by Gunther from a collection which he had sent to the British Museum. J.F.W. (Whiteaves?) also refers to C.catostomus, C.cyprinus (?) and R.atronasus as inhabiting the waters of the vicinity of Montreal.

With the exception of the description of P.exilis (P.boreale) by Jordan (35), no recognition was made by Evermann and Kendall of any further works on the non-game species of this Province until the publication of Montpetit's 'Les Poissons d'Eau Douce du Canada' in 1897.

Frequent reference has been made to this latter work in an attempt to bridge the gap in the ichthyology of the St. Lawrence below the Great Lakes. In the same year, Rathbun and Wakeham (44) published a short account of the fishes in Lake Memphremagog, which they had visited during the course of an International Fisheries Commission survey. Some sixteen species are listed but of these few could be brought to their present synonomy without the data of Evermann and Kendall (21) who had visited the lower region of the same lake in 1894 while preparing a list of the Fishes of Vermont.

The two latter publications with a brief reference to several species found in Lake Megantic by Montpetit represent

the entire records from the waters of the South-eastern part of Quebec up to the present time.

The above were the only sources from which the data for the regional list of fishes of this Province has been drawn, and at the time of publication of the faunal lists of the St. Lawrence the lack of data was fully realised by Evermann and Kendall.

On this account it is to be regretted that the excellent publication by an anonymous writer in 1875 (Anon. 3) and the briefer paper by Billings (8) were not brought to Evermann's attention in the interval between the publication of the list of the fishes of the St. Lawrence and the later list of the fishes of Canada. The former work of 1875 refers exclusively to the fishes of this Province, mainly to the marine and freshwater species in the vicinity of Quebec City, and is the most outstanding contribution to the ichthyology of the Province that has yet appeared. In it are listed and described ninety-three species, of which some forty-five species belonging to the fresh waters are still valid. Emphasis was naturally placed on the larger game and commercial species. Of the smaller species, C.cognatus, G.aculeatus cuvieri, F.diaphanus and P.caprodes are included.

On the other hand, Billing's paper, though much shorter, nevertheless lists forty-five species from the vicinity of Ottawa, the majority of which are still recognised. Some of these species were recorded as present in the Gatineau

and Lievre Rivers though the complete list may be considered as representative of fishes from the western part of this Province.

Recognition of these two papers would have gone far to the clarification of the ichthyology of this Province, forming as they do comparatively exhaustive works from the eastern and the western extensions of the fresh waters.

During the interval between the publication of the check list of the fishes of the St. Lawrence and the later check list of the species of Canada a short list of fifteen species from Gaspe was prepared by Cox (13). Notable inclusions in this work are P.neogaeus, C.erythrogaster and C.plumbeus which were found in the streams flowing into the Baie de Chaleurs.

Since the time of publication of the last check-lists of Canada (Evermann and Goldsborough, 19, Halkett, 30), the status of the ichthyological knowledge in the territories adjacent to this Province has been steadily advanced. Cox (12) had previously listed the fishes of New Brunswick and had found several new species. The early works of Nash (42) and more recently of Dymond (17) have dealt with the regional lists of the fishes of the Ontario waters including many studies of the natural history and systematics of the species. In the State of New York, Greeley, Adams and Hankinson have contributed extensively to the faunal studies and natural history of the fishes in the waters adjacent to the northern boundary. In the midst of all this

activity, Quebec, lacking the ~~important~~ interest in commercial fisheries of the ~~Great Lakes~~ fresh-waters and safe in the assurance of sport fishing in the virgin lakes of the Laurentian plateau, did not feel the necessity of any intensive studies over a wide area. In consequence there have not been presented the opportunities for a work in this Province similar to those conducted in the neighbouring territories until quite recently.

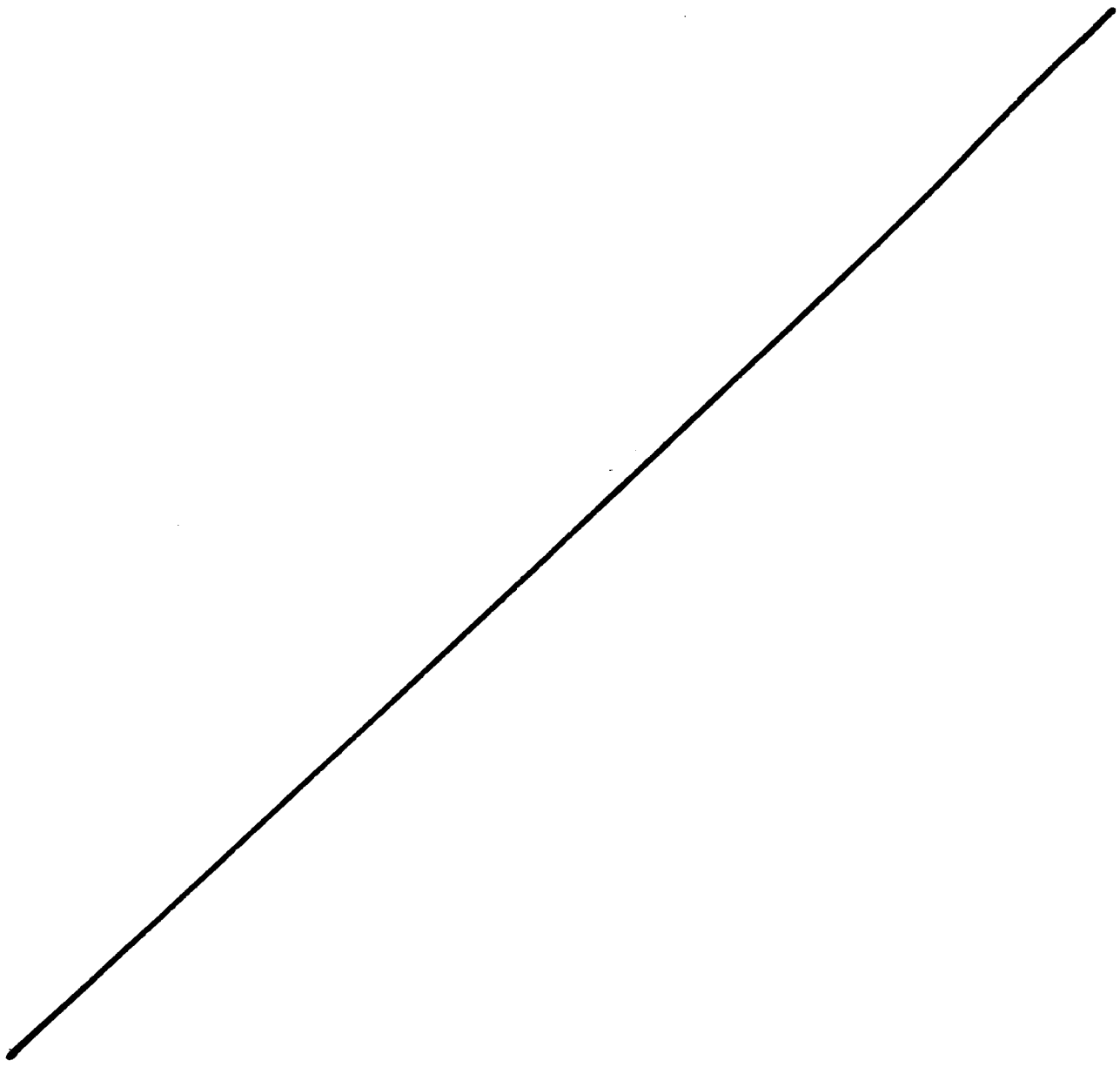
Accordingly, it is found that the literature of the past few years has been limited to a few short papers on various aspects of natural history of several of the common species, (Leonard, 40, Wynne-Edwards, 51, Richardson, 47), or concerning the life-history of the more important species such as the studies of the salmon by Macfarlane and Calderwood (Proc. Roy Soc. Edin. 1928).

A short paper by Fowler (27) mentions only S. fontinalis and a sub-species. Two more important works (Atkinson, 4, Prefontaine, Trans. Roy. Soc. Can.) are the most valuable additions to the knowledge of the species of our waters within recent years Prefontaine's paper deals only with the marine species of the St. Lawrence at Trois Pistoles and as such is not further dealt with here.

On the other hand, Atkinson in a short report prepared only for local distribution gives an account of the species present in the waters of the Seigneury Club at the western border of the Province. This account is significant in recording the presence of M.margarita nachtriebi, L artedi, C.clupeaformis, G.aculteatus cuvieri, and M.salmoides

in this district and represents the first recording of the former species from the Province.

In view of the existing state of the ichthyology of the fresh waters of this Province, in the latter half of the present paper the writer gives a list of the synonomy of each species so far as it has been possible to determine the species from the data given. This method affords the most simple means of bringing together the records by earlier writers of the species mentioned or discussed in the present report.



TOPOGRAPHY OF SOUTHEASTERN QUEBEC:

The Green Mountains of the Appalachian formation extend into Quebec and form the Notre Dame Mountains. This formation terminates in the Shickshocks of the Gaspe Peninsula. These ranges enter Quebec from the South and run obliquely North-East to approach close to the St.Lawrence River at Quebec and even to cross it in part. (Chapman 11).

The portion of this formation present in South-Eastern Quebec has been folded into three distinctive ridges under pressure from the Laurentian shield. The axis of each ridge corresponds with the general axis of the range. The most westerly ridge crosses the border near Sutton to the West of Lake Memphremagog and curves to the North-East. In its path it gradually descends in height from maximum elevations, in the form of peaks at the South of 2000 feet and more (Sutton Mountains etc.) to lower elevations of 1000 feet and less in the district to the West of the Becancour lakes. This ridge and the next to the East are considerably broken and have been cut through by several of the larger rivers (Chambers 10).

The latter fold, the Sherbrooke (Stoke) ridge, is shorter. It enters Quebec to the East of Lake Memphremagog and runs up between this lake and Lake Massawippi to terminate in the area to the West of the upper St.Francis Lake district. It reaches a maximum elevation in the Stoke Mountains (1700 feet to 1800 feet). The St.Francis River cuts through the Stoke ridge close to Sherbrooke City and through the Sutton ridge at the "Narrows" a short distance below Richmond.

The third of the three folds is broader and crosses into Canada in the eastern corner of Compton County. Its peaks form the maximum elevations in the Townships (Gosford Mt., 3800 feet) and the Megantic ridge forms the boundary between Maine and Quebec.

A series of intrusive formations reaching considerable altitudes with their ridges separate the Chaudiere and St.Francis watersheds. These are the Megantic Mountain (3400 feet), Mt.St. Cecile (2700 feet), and Mt.St.Sebastian (2700 feet). Tributaries of the St.Francis River drain the western slopes of this intrusive mass which terminates to the East of the upper end of Lake St.Francis. The tributaries of the latter in this region (Rivière des Bluettes) are poorly divided from the Rivière Grand Coulée and other branches of the Chaudière watershed. The valley of the Chaudière is situated to the East of this ridge between it and the Megantic Range. In this valley the streams are typically short and steep in contour. Below the Rivière Grand Coulée the brooks lengthen and flatten. This level forms the lower limit of the trout waters of the Chaudière. The lakes of this system are typically shallow, the only exception being the large Lake Megantic. These short rivers of the upper Chaudière contrast with those of the broad valley of the St.Francis between the Megantic Mountain mass and the Stoke Range. The waters of this valley fall into two categories: the short, steep streams entering the St.Francis from the North and draining the eastern slopes of Stoke Ridge, and the longer more gently descending rivers entering from the South which drain the western slopes of the intrusive formation and the broad com-

paratively flat expanse of the Stanstead Plains. The Plains extend from the southern border between Massawippi and the Megantic Mountains up to Bury River. The rivers on this southern side of the St.Francis gradually change in physiographical nature from the Salmon River with a steep contour as the stream runs off the western and northern slopes of Megantic Mountain, to the gently descending rivers (the Moe, Coaticook and Massawippi) which drain the Stanstead Plains. The rivers of this eastern mountain country (Chaudière R., Salmon R., Felton R., North R., etc.) are the best trout waters of this district at the present time, a natural consequence of the smaller extent to which this mountainous territory has been settled in contrast with the highly cultivated state of the Stanstead Plains (Richardson 47).

Beyond the point where the St.Francis valley turns to the North-West it receives large tributaries draining the area between the Stoke and Sutton Ridges (Magog River, Key Brook, Salmon Brook from the South, Stoke River and Watopeeka River from the North). Shortly below Richmond the streams entering the St. Francis drain the western slopes of the Sutton Ridge (Ulverton River, St.Germain River) which enter from the southern side). These streams are markedly divergent in their faunal characteristics from those higher up stream and represent the only source of collection in this system of the purely lowland species (M.m. nachtriebi, Hybognathus etc.).

The upper and lower lake districts are similarly distinctive. Lake St.Francis, Lake Aylmer etc. are for the great part shallow lakes present in the pan of a wide basin. The lakes

of the lower district (Lake Memphremagog, Massawippi, etc.) are typically deeper. Chapman (") suggests earlier deep valleys now represented only by the deep Lake Memphremagog, Lake Massawippi, Bowker Lake, etc. He also suggests a second valley of which Lake Megantic is a remnant previously connected to the above. In view of the extensive glaciation of the area it is not feasible that the presence of C.clupeaformis in both Lake Memphremagog and Lake Megantic is significant to this concept.

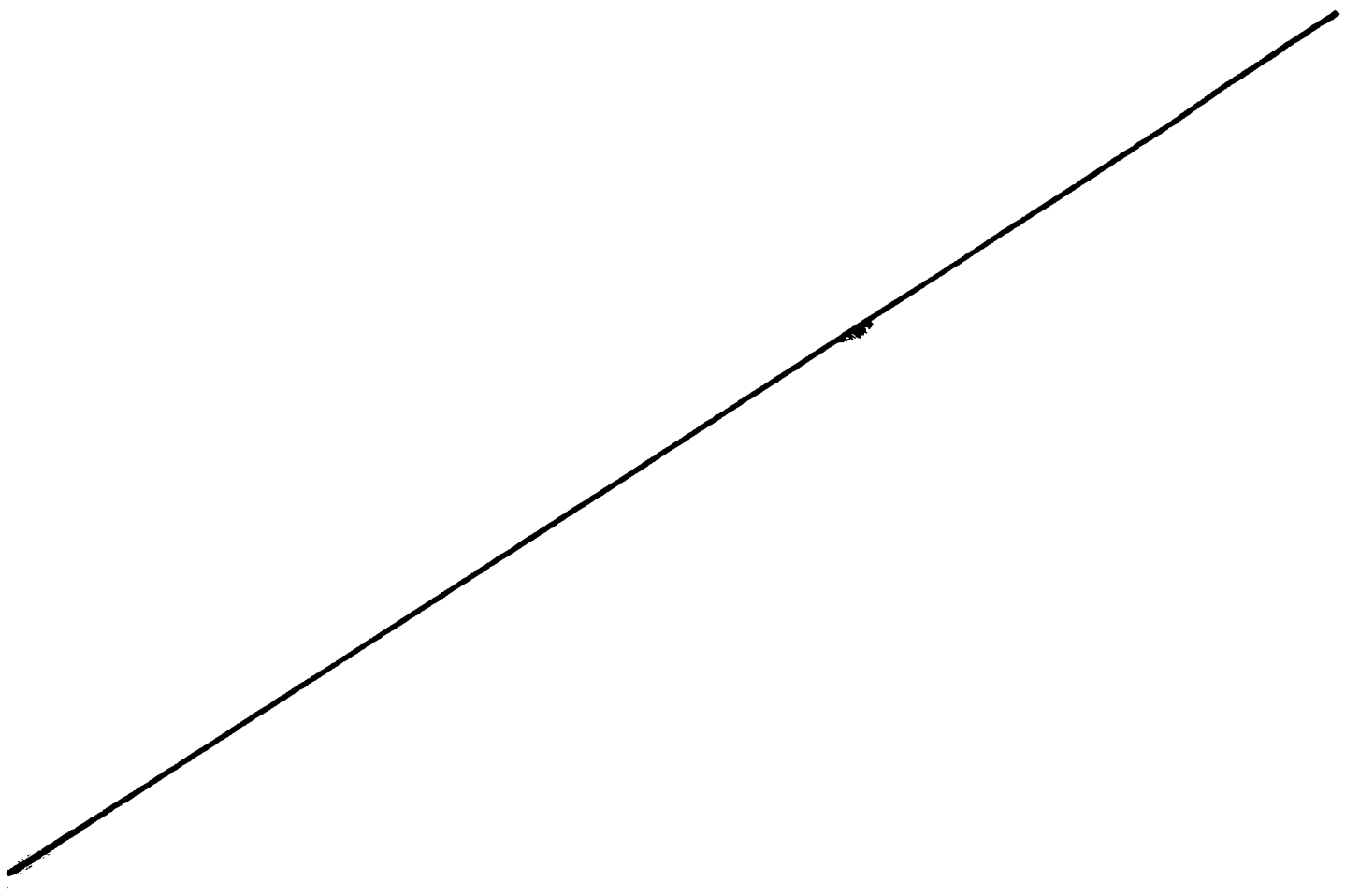
The size of the St.Francis has lent it a great erosive force, such that of these two systems it alone has cut deeply into these ridges and enabled the more lowland species to ascend to upper level waters. The result of this is pronounced in the richness of the fauna of the lower lakes which contain in addition to those species found in the upper lake district P. quadrilateris, C.culpeaformis, O.mordax and E.gibbosus. These species are present in Lake Champlain (Greely, 28).

The remaining systems do not penetrate extensively into this area. The Pike and Yamaska drain only from the western slopes of the Sutton Range. The Missiquoi is commonly steeper in contour and drains the central portion of the southern part of this ridge. This system and the Pike are distinctive from the remaining systems and belong to the Richelieu watershed.

The Nicolet system is comparatively little complicated. Its source waters arise on the western slopes of the Stoke Ridge and cross obliquely through a broad gently sloping expanse to cut through the Sutton Ridge which is low at this point. Although

erosion to low levels has not extended beyond the Sutton Ridge, this plain to the East of the ridge has been greatly dissected by the present streams.

The Becancour system is short. The chain of lakes are commonly shallow and closely resemble the St.Francis lakes of the upper level. The streams are short and drain the western and northern slopes of the end of the Stoke Ridge. The main stream cuts through the Sutton Ridge and descends gently to the Eastern Plains.



METHOD OF INSPECTION:

Two distinct types of survey were conducted. The parties working in the Laurentian area confined their attention almost exclusively to the inspection of lakes. The second party, surveying the Appalachian district of the south and south-eastern portion of Quebec a region relatively poor in lakes and contrasting in this respect with the Laurentians, proceeded with an inspection of all accessible waters, the greater part of their time being spent in visiting streams.

The typical inspection party in the southern districts was formed of four men equipped with two automobiles and operating as two individual units from a common center.

In view of the needs of the hatchery service it was found necessary to grid the country in accordance with the sheets of the Department of Militia and Defence one inch to the mile topographic maps and the work was carried out on this basis, each year four sheets being inspected a superficial area of approximately sixteen hundred square miles. (Taylor 49 et seq.).

Within such an area every accessible pond, lake and stream was visited, seined and reported upon for future stocking reference. The two parties would operate from a common center, the most strategically situated town or village on the map and would work in all directions to complete the sheet and the adjoining accessible regions.

Whether there will be a completion of the area and an inspection of the lower levels of the Chaudiere and Becancour systems cannot be predicted at this time, although these waters include a part of the country from which stocking requests have been received.

Owing to the requirements of the hatchery service on whose behalf the survey was instigated and to which the mode of inspection was adapted, the system on which the survey was based prevents the use of any of the extensive data on temperature, etc. being employed in a comparative study of these waters since at no time was any part of the district revisited in successive years nor the waters inspected for a second time.

The most important item of equipment for each party was a set of seines ranging from twenty feet to sixty feet in length and four feet deep. These were made of fine-mesh minnow netting, the larger lengths being formed by sewing together several of the twenty foot sections. With these nets it was found possible to seine all streams thoroughly. Small scoop-nets were used at first but soon discarded in favor of the above.

The standard routine for the inspection of streams included the recording of the average width and depth; notes on the nature of the bottom, which was classified as being of silt, clay, sand, gravel, stones or rock. The stream and air temperatures were noted, as also a brief description of the nature of the surrounding country (forest, cleared land, meadow or pasture). Further information included a record of falls, dams and possible pollution. Finally a brief history of fishing for the area and

an account of the results of previous plantings were obtained and a stocking policy formulated for future work in the area.

At the same time a list of the species of fish present at the localities was made and entered on the report. Much of this data was obtained by seining, although seining in the strictest sense of the term was seldom possible excepting where the bottom was of mud or fine sand, such as in the lowland streams. Stony and rock bottoms could only be worked by placing the net downstream and moving towards it turning over or removing all possible shelter. In this fashion on rough bottoms it was possible to work the majority of the fish into the net. On occasion complete sections of brooks would be closed off with nets, the bottom cleared of obstructions and the section seined.

The above work was always checked by the more experienced members of the party who developed the ability to identify the various species in the water and customarily worked a second section of the same brook that was being seined and noted the species. The latter technique enabled the records from seining to be supplemented when necessary and checked by observations over several hundred feet of stream.

In addition to the above work inspection of the lakes and ponds was carried out and necessitated including in the equipment a small, portable outboard motor, a water sampling bottle (for design see Dwyer, 16) and a sounding lead and lines for the two latter items. At times gill-nets and large seines were carried and used at various waters though this practice was greatly re-

stricted by unfavourable local public opinion, and in the case of the large seines which ranged up to two hundred feet long by twelve feet deep, by the general unsuitability of the lake bottoms. Usually damage to these seines as a result of snagging on old timbers on the lake bottoms was so severe that no successful work was possible. For the identification of species present, reliance necessarily had to be placed upon the dead fish found either floating in the water or on the shore, on material and data supplied by resident fishermen, and on the results of fishing by members of the party. To this was added the data obtained by the seining of locations suited to the young forms, the longest of the small seines being used.

By the combination of these methods complete data was collected, though in the case of some species (O. mordax, C. clupeaformis) it is possible that the distribution is really more diffuse than given in the present paper.

During the course of the inspection of a lake a sufficient number of soundings would be made to give an average depth of the off-shore waters; a record of bottom formations was noted; and a series of temperature readings taken vertically for the determination of the thermocline. The party also inspected suitable and possible spawning beds including in the report the number and nature of the brooks tributary to the lake or pond and also a short history of the fishing conditions in the waters. From this data a stocking policy was developed and filed for future use by the hatchery service.

Work commenced in the field generally in June or July following the return of the brooks to a normal level after the spring floods and continued until the middle of September, when it became inconvenient to remain longer in the field owing to the persistently bad weather.

The systematic survey of the territory commenced in the spring of 1931 and was carried on in the counties of Stanstead, Compton and Brome. During that summer, sections of the Missisquoi and St. Francis systems were visited. The season of 1932 was not commenced until the middle of July when the inspection of the Pike and Yamaska South Branch waters was begun and completed. In the same season work was undertaken in Compton, Richmond, Shefford and Sherbrooke counties on the St. Francis system.

In 1933 the parties entered the field early in July and then worked in the counties of Frontenac, Compton, Wolfe and Arthabaska. During this season, inspection of the Nicolet South Branch was commenced and finished in September of the same year. The remainder of the time was spent on sections of the St. Francis system.

The survey in 1934 visited streams and lakes in the counties of Frontenac, Wolfe, Megantic and Beauce. During the course of this season the St. Francis system was finally completed and the upper sections of the Chaudiere and Becancour watersheds inspected. With the conclusion of the survey at the end of that summer (1934) the best fishing waters of the southern portion of the Province had been fully inspected.

During the four years of the survey a collection of over four hundred jars ranging from pints to two quart sizes has been made. In addition a large number of specimens of particular interest were preserved individually in vials and similar small containers. In many cases specimens were preserved for later study to check on possible variations while other collections were made in consequence of peculiarities of locations, or the associations of many species at one place

Collections from the southern districts represent one in five of the localities visited where fish were present. Generally collections from the Laurentian waters are few in number but serve at least to extend the range of many of the species into those waters.

These collections have been examined for variations in the material and the parasitised, teratological and similar material set aside for future study.

GRAPHICAL & STATISTICAL ANALYSIS OF RECORDS.

Figures 2, 3 and 4 illustrate graphically the longitudinal distribution of the species present in three of the streams in the Appalachian district. These figures have been prepared by plotting the elevations of the localities where each species was found. The arrangement of the species has been made from left to right in the order of their frequency of record in these streams, and the illustrations serve to show the significance of a high or low frequency of record.

The basis on which this analysis is prepared has long been known to field-ichthyologists, who customarily refer to a species as inhabiting either a highland, intermediate or lowland section in a brook. It is generally not possible to collect a sufficiently large number of records to permit a graphic illustration to be prepared for an entire system, such as in the present case.

Adams (1) has suggested the value of a recognition of the base-levelling activities of streams in bringing about the distribution of species commonly observed. Shelford (48) has conducted an examination of a series of adjacent brooks of increasing complexity and has arrived at the conclusion that the section occupied by a species is that most able to satisfy the greater number of its requirements. He also concludes that since the biological nature of the section is determined by its physiographical form, and analysis of the distribution of the species in a stream may be conducted

utilizing a feature of the physiography of the stream as a basis for comparison.

In these figures the elevation of the stations at which records were made have been used for the comparison of the longitudinal range of each species. There is no intention of suggesting here that the actual elevation is indicative of any restriction in range other than as an expression of the difference in the nature of the streams at higher levels from those at lower elevations. This is obvious in a comparison of the figures for the Salmon and Nicolet waters.

A second feature of these figures is that they explain the high frequency of record of some species (S.atromaculatus, R.atronasus, etc.), which have a general distribution and the low frequency of other species found only in the lower intermediate levels and restricted in range.

It is pointed out here that in a single tributary the same controlling factors are effective as in the whole watershed. The records of S.atromaculatus were mostly made in the waters of the upper levels. In the lowland tributaries this species is found in large numbers only at the tops of these streams. On the other hand, such forms as N.rubifrons and A.rupestris which do not occur far up the main streams are similarly restricted in tributaries at the lower levels and consequently have a low frequency of record.

These three waters have been selected for analysis in consequence of their uncomplicated nature. Each is illustrative of a type of stream found in the Appalachian district.

The Yamaska South West Branch is selected because it drains only from the western slope of the Sutton Ridge and does not extend into the Appalachian territory beyond this ridge. A point of interest is the restriction of T.iridea (S.irideus) to the central portion of the system.

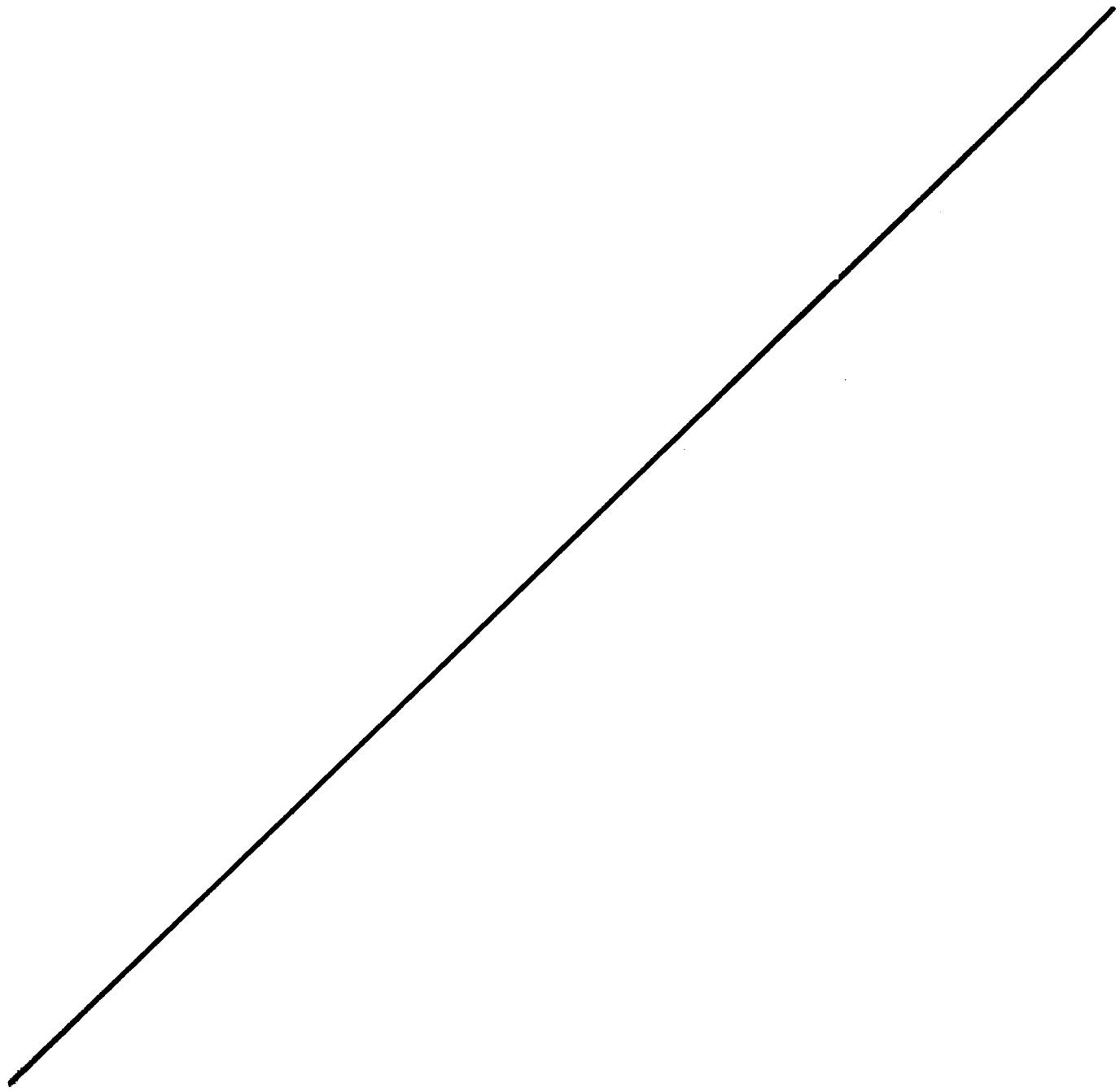
On the other hand, the Nicolet system extends into the area between the Sutton and Stoke Ridges and drains the western slopes of the latter range. This system shows a division of the fauna into lowland, intermediate and highland sections in the vicinity of 600 feet and 1000 feet which closely resemble the similar divisions at 500 feet and 700 feet in the case of the Yamaska.

The contour of the 500 feet level has been entered on the map to show the extent of erosion of these systems and roughly divides the lowland and intermediate levels.

The Salmon River contrasts with the above. It is a trout stream in the interior of the area and drains the western slopes of the intrusive Megantic formation. It is typically at higher levels. The lower end shows a mixing of intermediate and lowland faunas, dissimilar to that shown in the other systems. This is a consequence of the abrupt entry of this

stream into Weedon Lake. In reality the faunal distribution shows that the Salmon has no fully developed lowland section.

Further discussion of these figures will not he made here. Attention is drawn to them in dealing with the individual species.



	Missisquoi	Pike	Yamaska	St. Francis	Nicolet	Becancour	Chaudiere	
O. ISOSPONDYLI								
T.iridea	3	--	11	7	--	--	--	21
S.fontinalis	30	6	18	186	31	5	37	313
							TOTAL	334
O.EVENTOGNATHI								
F.Catostomidae								
C.catostomus	--	--	--	2	--	--	p*	2
C.commersonii	22	15	28	119	57	3	22	286
M.anisurum	--	--	--	p	1	--	--	1
F.Cyprinidae								
C.erythrogaster	--	--	--	14	5	p	p	19
N.crysoleucas	--	2	--	1	3	--	--	6
P.neogaeus	--	--	1	2	--	--	--	3
M.m.nachtriebi	--	1	--	2	--	--	--	3
L. corporalis	1	5	10	15	20	p	3	54
S.atromaculatus	32	40	45	225	126	16	47	531
R.atronasus	58	32	61	242	111	15	41	560
R.cataractae	9	p	2	36	12	5	6	70
C.plumbeus	--	2	--	2	6	p	p	10
N.cornutus	18	27	37	100	43	4	17	246
N.rubellus	4	1	2	6	3	p	2	18
N.heterolepis	p	--	--	p	p	--	p	--
H.notatus	--	9	13	5	11	p	2	40
P.promelas	p	p	--	p	p	1	p	1
Hybognathus sp.	--	--	--	p	--	--	--	--
E.maxillingua	--	--	--	1	6	--	--	7
							TOTAL	1857
O. HAPLOMI								
F.Umbridae								
U.limi	--	6	p	2	4	--	p	12
F.Esocidae								
E.niger	--	--	--	3	1	--	--	4
E.lucius	--	--	--	1	p	--	--	1
E.maskinongy	--	3	--	p	--	--	--	3
							TOTAL	20

* Note: The use of the letter 'p' in the above list indicates a record of the species within a watershed in cases where this was not entered on the reports.

	Missisquoi	Pike	Yamaska	St. Francis	Nicolet	Becancour	Chaudiere	
O.SALMOPERCAE								
P.omiscomaycus	6	--	--	--	--	--	--	6
O.THORACOSTEI								
E.inconstans	--	6	1	5	6	--	--	18
O.ANACANTHINI								
L.maculosa	--	--	--	2	--	--	p	2
O.ACANTHOPTERI								
F.Centrarchidae								
M.dolomieu	2	2	2	2	7	--	1	16
E.gibbosus	--	1	--	p	p	--	--	1
A.rupestris	--	p	4	2	5	5	--	16
F.Etheostomidae								
B.nigrum	1	12	16	20	16	p	--	66
P.exilis	--	--	--	2	p	p	--	2
P.caprodes	p	--	--	6	6	--	--	12
C.flabellaris	--	11	13	16	12	--	--	52
F.Percidae								
P.flavescans	1	1	--	--	--	--	1	3
S.vitreum	--	--	--	2	--	--	--	2
							TOTAL	170
O.CATAPHRACTI								
C.cognatus	p	--	--	23	p	2	5	30
Locations, fish present	146	60	88	703	137	39	168	1341
Locations, no fish present	66	16	14	281	41	42	8	468
Total locations visited	212	76	102	984	178	81	176	1809

	Deep Lakes	Shallow Lakes	Pond	Undeter-mined	Total
O.EVENTOGNATHI					
C.commersonii	8	25	19	1	53
C.erythrogaster	1	2	9	0	12
N.crysoleucas	0	0	1	0	1
L.corporalis	2	13	7	0	22
S.atromaculatus	9	20	26	1	56
R.atronasus	6	9	9	1	25
O.plumbeus	3	1	0	0	4
N.cornatus	5	8	10	0	23
H.notatus	0	0	1	0	1
P.promelas	1	2	2	0	5
				TOTAL	202
O.NEMATOGNATHI					
A.nebulosus	5	17	16	2	40
O.ISOSPONDYLI					
S.salar	4	3	0	0	7
C.namaycush	6	5	0	0	11
T.iridea	1	1	2	0	4
S.fontinalis	7	12	12	2	33
O.mordax	1	0	0	0	1
C.clupeaformis	2	1	0	0	3
				TOTAL	59
O.HAPLOMI					
F.Esocidae	5	21	11	2	39
O.ENCHELYCEPHALI					
A.rostrata	2	3	2	0	7
O.ANACANTHINI					
L.maculosa	2	1	3	0	6
O.ACANTHOPTERI					
M.dolomieu	4	20	3	2	29
E.gibbosus	1	5	5	1	12
A.rupestris	1	6	2	0	9
B.nigrum t.	1	1	2	0	4
P.exilis v.	0	3	0	0	3
P.caprodes	0	1	0	0	1
S.vitreum	0	8	2	0	10
P.flavescans	1	8	4	1	14
				TOTAL	82
Total of each type locality	11	38	39	4	92

The total number of species found within the territory inspected is forty-seven, divided between thirty-four genera, sixteen families and thirteen orders. Of these, forty-one species have been recorded in the streams. The remaining six species A.calva, S.salar, C.namaycush C.clupeaformis, O.mordax and A.brostrata are recorded only in the lakes, though the young of all (with the exception of the latter two species) have been found in the streams but then only within a very short distance of a lake or similar large body of water. The list might be similarly reduced by the extraction of E.gibbosus the single record of which is of its occurrence in the brook forming the outlet of Selby Lake (Pike Watershed) approximately half-a-mile below the lake.

In considering the comparative importance of the Orders and Families in sequence according to the frequency of record of the members of each, it is immediately obvious that the Eventognathous fishes with eight-een hundred and fifty-seven records of the nineteen species predominate both in the number of species and of the records of the species. The fishes of no other Order approach even closely to this rating. Of this number, fifteen hundred and sixty-eight recordings are of the species of the F.Cyprinidae. In this family one thousand and ninety-one records, seventy per cent of the total for the Order are of only two species, S.atromaculatus and R.atronasus and are

almost equally divided between the two. Of the remaining four hundred and seventy-five records of this Family, two hundred and forty-six, representing thirteen per cent of the total, are of N.cornutus. The remaining records are more or less evenly divided between the other twelve species with the exception of R.cataractae which was found at seventy locations and L.corporalis which was found at fifty-four. This leaves an average of approximately nine records for each of the rarer species.

The second family of the Eventognathous fishes, the F.Catostomidae, are to be ranked as the third family in frequency of record yielding place to the F.Salmonidae. With only three species recorded for the present Family it is most interesting that the ranking should be so high although C.commersonii which represents practically one hundred per cent of the records within the Family is not as common as the more common species of minnows. The remaining species M.anisurum and C.catostomus are very poorly represented. The three records of C.catostomus are peculiar in that it was found in only three localities and that these localities possessed no particular feature which would serve to set these records off as being one of a particular 'species-habitat' correlation. M.anisurum was found only in the lowland sections, never higher.

The great dominance of this Order over the remaining Orders is an expression not of the intensive specialization of many of the species to distinct types of localities

but of the longitudinal range of the more common species in the watersheds.

The second Order in rank of frequency is that of the Isospondylous fishes. Although only two species of this order may be said to be common in the waters under consideration, other species (S.salar,O.mordax) may on occasion be found in brooks close to lakes. On only one occasion have I seen young salmon in a brook remote from a large body of water. These fish did not exceed five inches in length and had resulted from eggs planted in the brook during the course of a stocking policy of several years duration at Brome Lake.

The two brook inhabiting species, S.fontinalis and the introduced T.iridea were recorded at three hundred and forty-four localities very close to twenty-five per cent of all localities at which fish were recorded. Of this number three hundred and thirteen records are of the occurrence of S.fontinalis and to those acquainted with the waters it is surprising to find that this species is still present at twenty-three per cent of the localities where fish are found. The recording of T.iridea at twenty-one locations is of interest in view of the large numbers of this species which have been planted during the past few years by the Provincial hatchery service. It may be remarked here that in those localities where the rainbow has become established it seems to thrive and fish comparatively large for these waters weighing up to one pound,

are not uncommon.

The status of the brook trout in these waters is fair. In only two watersheds does the recording of this species drop considerably below the average. In the Pike River S.fontinalis was recorded at only ten per cent of the possible locations, in the Becancour at only twelve per cent. Fortunately these represent only a small part of the waters of the south eastern section of Quebec. Contrasting with these, in the Yamaska and Missisquoi systems S.fontinalis was found at twenty per cent of the stations in which fish were found; in the Nicolet and Chaudiere systems, twenty-two and twenty-three per cent. In the St. Francis systems the frequency of the species reached a maximum of twenty-six per cent.

The O.Acanthopteri is represented by eight species in this area and in this respect ranks second to the O.Eventognathi. The frequency of the acanthopterygian species is generally low and the Order as a whole is poorly represented in the streams. Of the three Families only the members of F.Etheostomidae are to be considered as truly stream inhabiting fish. Of the four species of this family ~~(B.nigrum (olmstedi and)~~ O.exilis ~~(is)~~ rarely met with. ~~(The former (was found on only one occasion at a typically lowland location).~~ The exilis has been taken from several widely-scattered localities. The majority of the records of the Order are confined to B.nigrum and C. flabellare

which were taken at sixty-four and fifty-two locations respectively. The two species of the F.Percidae as well as the three species of the F.Centrarchidae are generally poorly recorded and then only in the lowland sections of the various watersheds. These might well be excluded from the present listing with the ~~possible~~ exception of A.rupestris. The records of M.dolomieu are based entirely upon the presence of young specimens in typically lowland, or lower transitional sections of streams. Adult smallmouth black bass do not enter streams of the types studied nor penetrate far up them excepting during the spawning season. Young specimens up to four inches long are met with in some streams even three miles distant from the nearest large water (Nicolet R. S.W.Branch above Richmond Lake is a remarkable case of this nature). Adult bass are present during the whole year at Richmond in the St. Francis River. This latter is a consequence of the several large dammed sections in this vicinity.

The planting of bass as a game species to replenish the larger streams and rivers from which the trout have disappeared was considered to be a project with a reasonable chance of success. In the absence of actual recordings of adults from streams it seems quite obvious that such would not be the case.

The O.Cataphracti is represented by only the one species, C.cognatus, with the exception of the Rhaudiere. This species has been recorded

thirty times in the various systems as a whole. During the course of the collections it was realised that as noted also by Greeley (28) there was a high coincidence in the recording of C.cognatus and S.fontinalis from the same localities. The present collections show twenty-one records of C.cognatus and S.fontinalis ~~from~~ at the same localities. This contrasts with a recording of only thirteen times with R.atronasus, five times with C.commersonii and less than four times with S.atromaculatus, N.cornutus and R.cataractae. C.cognatus was recorded only once in combination with the lowland species M.dolomieu and H.notatus. It was found that as Greeley suggests the presence of C.cognatus was most typically an indication of good trout waters.

The two families of the Haplomous fishes show but very poorly in the actual records, their lowland habits not permitting a true representation according with their actual abundance in these localities. Although recorded only twelve times, in many districts the single species of U.limi is frequently found to be the dominant species of the small water bodies, the pools and the streams. In such places Umbra finds competition only with the brook sticklebacks. The records of the F.Esocidae are for the most part based upon small specimens generally of E.lucius and E.niger. On only one occasion were the young of E.masquinongy taken in streams (Pike R.) their preference

being towards the backwaters of streams close to lakes. A twelve pound specimen of the latter species was also taken in the same river.

The O Thoracostei is represented in the district by only one of the two species found locally. G.aculeatus cuvieri seems to be restricted entirely to the North of the River St.Lawrence in this Province and has been recorded only from lakes. E.inconstans although not frequently recorded coincides in its distribution closely with U.limi. On occasion in highland marsh pools I have found E.inconstans quite isolated from U.limi.

A.nebulosus is the sole representative of the O.Nematognathi and was recorded only at thirteen of the localities. The majority of these records are of young specimens.

Members of the remaining Orders, O.Salmopercae and O.Anacanthini have been seldom recorded. P.omiscomaycus was found in only one watershed (the Missiquoi) and is one of the few cases of a concisely restricted distribution.

Records of L.maculosa included in the present list are restricted entirely to its presence in the smaller streams and rivers. Other than in lakes adult specimens are known only in the St.Francis River below Richmond. The present records are ~~entirely~~ of small specimens. The largest, nine inches long was taken in a lowland brook. The average were three inches and under and were taken in the central section of the watersheds.

A total of twenty-nine species (twenty-eight genera) have been recorded from the lakes and ponds of this district. These embrace eight orders and thirteen families. The three orders O. Salmopercae, O. Thoracostei and O. Cataphracti of which specimes were recorded in the streams were not represented in the collections from the bodies of standing water. Many specimens of Eucalia were obtained in the seining of pools, but the species was never found in the ponds. The number of Families is in excess of the number recorded for the streams owing to the presence of O. mordax, C. clupeaformis and A. tostrata in, while in the relative paucity of species as a consequence of the decrease of these in the F. Cyprinidae and the F. Etheostomidae the number of genera is decreased from thirty-two to the present rating.

By far the greater number of species was found in the waters of the St. Francis system, a natural consequence of the larger number and variety of the waters present. The twenty-six species recorded here from this system include all of the species found in the still waters with the exception of N. chrysoleucas and C. plumbeus . Only sixteen species were recorded in the Chaudiere lakes and ponds. In the latter system there were only six shallow lakes, eleven ponds and one deep lake in the limits of the territory inspected contrasting with the twenty-three shallow lakes, the twenty-three ponds and eight deep lakes listed on the St. Francis watershed. In the Becancour watershed thirteen species were recorded from two deep lakes, two

shallow lakes and two ponds. A similar number of species was recorded for the Yamaska waters from only one shallow lake and one pond. The number of species found in the remaining three systems is almost uniform corresponding with the small numbers of water bodies and the absence of deep lakes. In the Missisquoi and Nicolet waters only ten species each were found at a total of five shallow lakes and four ponds inspected within the limits of the two systems. In the Pike system nine species were taken from the one shallow lake and the one pond.

On comparing the frequency of record for the various Orders a slight reversal is found in the status of relative abundance of the various groups in the streams.

As in the streams, the Eventognathous fishes predominate in the standing waters in the sense of their actual frequency of record. Although the species are fewer in number, members of this Order are present in nearly all the various bodies of waters which were inspected. C.commersonii and S.atromaculatus were recorded more commonly than any other species of the Order with a frequency at least twice that of any other. R.atronasus, N.cornutus and L.corporalis may be grouped together as having approximately equivalent frequencies and were recorded twenty-five, twenty-three and twenty-two times respectively. Although no distinctive correlations with any one of the three types of habitat is expressed in percentage ratios of frequencies as derived from the records of S.atromaculatus and C.commersonii,

an analysis of the records of the latter three species and of C.erythrogaster are more informative. By obtaining the percent frequency of the possible total frequency for each of the three types of water it is found that R.atronasus and N.cornutus were recorded nearly twice as often in the deep lakes, where they occurred at 54% and 45% of the waters of this nature respectively, than they were in shallow lakes where their frequency ratio is only 24% and 21%, in the third type of water the ratio is in close accordance with the latter figures (R.atronasus having been recorded at only 23% and N.cornutus at 26% of the total number of ponds). The discrepancy between these ratios is sufficient to be indicative of the 'preference' of these species for the waters of the deeper lakes.

On the other hand L.corporalis was recorded in the shallow lakes with a frequency nearly double that for the other two types. In the shallow lakes the fallfish was found at 34% of the possible number of locations, while it was taken only at 18% of both of the other types. In contrast to the three preceeding species C.erythrogaster was recorded at 23% of the ponds and only in 9% and 5% of the deep and shallow lakes indicating 'preference' for the former type of water of the same nature as that shown by the other species for the deep and shallow lakes. R.cataractae has been taken in lakes on occasion but never sufficiently remote from the mouth of the stream to justify its record in the present list.

Contrasting with the ranking of the various Orders in the frequency of record of their species in the streams is the recording of the members of the O.Acanthopteri eighty-two times in the still waters, placing this Order second in frequency in the present list in contrast with the poor third place it occupied in the former list. In correlation with this change has been a change in the frequencies of the members of the Families of the Order. The principal family represented in the lakes is the F.Centrarchidae. M.dolomieu which occurred at twenty-nine localities was the most frequently recorded species. The members of the F.Percidae were recorded second to the F.Centrarchidae while the several species of the F.Etheostomidae ranking so highly in the records from the streams are very poorly represented here. P.caprodes was recorded only once in a lake, but has been found several times in the lowest stretches of the rivers entering some of the larger lakes (L.Massawippi, L.Aylmer etc.). The largest recordings of the members of the order are based on the presence of the various species in shallow lakes and to a much lesser extent in the deep lakes. The representation of the Order in ponds has been very small although isolated records are present for all the species.

The third Order in importance is that of the Isospondylous fishes. Considering the records of the members of this Order as a whole a uniformity of distribution is observed in the frequency ratios for the three types of habitat quite dissimilar to that seen in the O.Acanthopteri. The greater part (58%) of the records

are of the one species S.fontinalis which was recorded at from forty to sixty percent of the available locations for each type in such a fashion that our present data show no 'preference' of the species to any one of the types of habitat. On the other hand the various species of the O.Acanthopteri were recorded at 11% of the deep lakes, 24% of the ponds and reached a maximum frequency in the shallow lakes where they were found at 65% of the possible locations, indicating as a group a striking 'preference' for this latter type of water. In contrast, the Isospondylous fishes were found in 38% of the deep waters, 37% of the shallow lakes and 25% of the ponds.

The latter however is in consequence of the numerical dominance in the Order of S.fontinalis. The remaining species with the exception of T.iridea are restricted to the deep waters almost entirely, and in this species as well as S.salar as a result of planting operations the data is to be considered as artificial and unreliable in determinations of natural habitats.

S.salar is for the greater part recorded from lakes which have been stocked with this species -- Bowker Lake, Lovering Lake, Lyster Lake, Little Lake Magog, Lake Massawippi, Nicolet Lake and Breeches Lake. Landlocked salmon are naturally present in some of the deep lakes of the district but accounts of their distribution are lacking excepting in the case of L.Massawippi (Hubbard, 31) where salmon are recorded prior to

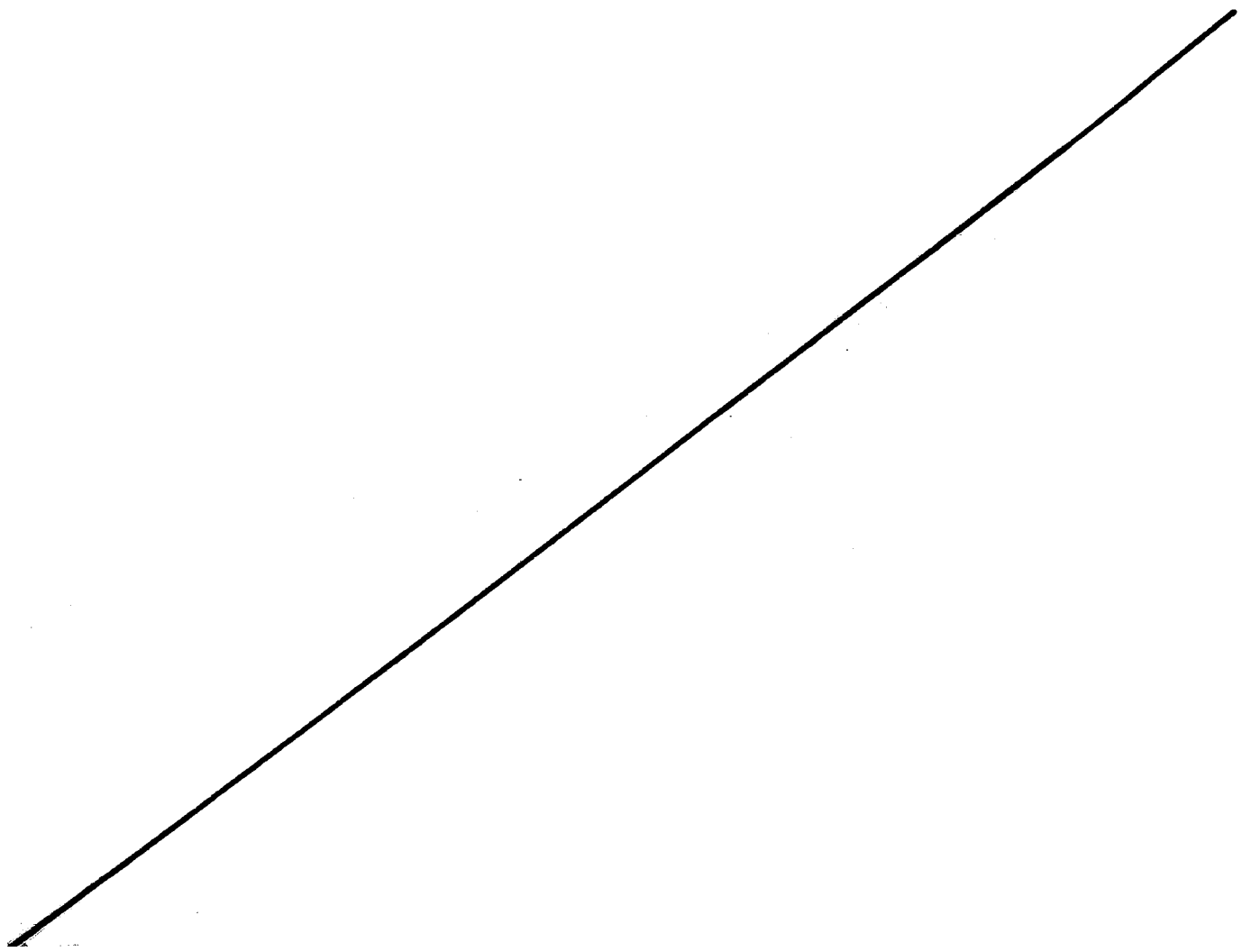
the planting of the species in this part of the Province. The presence of the species in Breeches Lake, Lyster and Nicolet Lakes is in direct consequence of stocking. Land-locked salmon have been known from Lake Memphramagog and the adjacent Little Lake Magog by popular account at least since 1860 and it is highly probable that the record at Lovering Lake may be of the same nature.

The records of S.iridea are also a direct result of stocking. C.namaycush was never recorded from any of the ponds. The records of C.clupeaformis are admittedly incomplete, the difficulty of encountering the latter species and also O.mordax without recourse to extensive netting prohibited the collection of complete data for these species.

The Order Haplomi may be ranked in fourth position, thirty-nine records of the members of the F.Esocidae having been made. No U.limi were collected from the larger bodies of water, though commonly found in small pools. No interpretation of the results may be made within the present group (F.Esocidae) owing to the difficulty of obtaining accurate specific data in the absence of collections from some of the waters. Recognition of the various species by the fisherman is seldom to be relied upon and the flexibility of the popular nomenclature is such as to render any information of the present nature totally unreliable in its application to the various species.

Ranking at the same frequency with the F.Esocidae is the single species A.nebulosus of the O.Nematognathi which was found at forty of the locations, an equal number of times (sixteen) in the shallow lakes as in the ponds. The absence of this species from the headwater lakes of the Chaudiere system was a striking feature of the latter watershed.

Of the seven records of A.[illegible] only four could be actually verified. The six records of L.maculosa are too few ~~(to indicate)~~ to be of any significance, but the young of the species were most commonly taken below logs and stones in the shallow margins of ponds. The two records of the species in deep lakes were of adults only.



SPAWNING OBSERVATIONS:

A large collection of data has been made concerning the spawning time and rate of growth of the various species. Generally the field work did not commence until after many species had spawned. The writer spent the latter half of May 1934 in the field and was able to complete the data concerning the spawning of several species (S.atromaculatus, L.corporalis, R.atronasus etc.). Several species such as P.flavescans and C.commersonii had spawned prior to the 15th. of May.

In general it was found that the spawning season is not later than is commonly recorded in the districts further to the South. Comparison of the dates recorded in the following section of this paper with the ranges given by Adams and Hankinson (2) shows no significant lag in the spawning season.

A satisfactory basis for comparison can be achieved only on the broadest scale. The spawning of S.atromaculatus, L.corporalis, and R.atronasus was observed during the last week of May in streams in the vicinity of Brome Lake. In the accounts given for these species it will be noted that gravid and ripe specimens were taken at much later dates in the higher level waters. This is not indicative of a later spawning time in the latter district. The observations

made at Brome Lake were concerned with streams in which the temperature rises rapidly. The records of gravid adults obtained at the later dates were commonly made at streams in heavily timbered areas. In such streams the temperature is typically low all summer, less than 20 oC., and spawning is consequently performed at a later date. This is very obvious in the late records of gravid S.atromaculatus and B.atronasus at Breeches and Sunday Lake. The stream in which these fish were found was still only 12 oC.,

Accordingly it is not possible to deal with the spawning season of this district on a basis of the actual dates. In recognition of this in the following accounts the spawnings are referred only to an approximation with the exception of dates of interest in a comparative fashion within the area.

In dealing with the data concerning the growth of the various species during their first year I have drawn extensively from field-notes and have checked these with collections. The sizes given express an average of the fish taken during the months in any one season. In many cases it has been a common experience to find that by the end of July the fry have developed so fast that they grade smoothly into the older stages. Consequently it is not possible to give any expression of their growth after this time. This was very commonly noted in the case of C.commersonii where at the end of the season the size range in a pool

would run uninterruptedly from 4.0 cms. to 12.0 cms..

A striking feature of the collections during August and September to which attention is directed in the following data has been the records we have obtained showing the highly developed state of the reproductive organs in the adults at the end of the summer. There is also described a reappearance of the colors of the spawning adult and in some cases (S.atromaculatus, H.notatus) of the tubercles in the males. It was found that as a general rule the ovaries reach a state of development slightly less than that in the spring. The reproductive organs of the adult fish in the fall and the spring are distinguishable only by the large quantities of fat present in the adjacent tissues in the fall specimens. In the case of the male Semotilus and of the male Hyborhynchus the tubercles commonly break through the skin during the first few weeks of September.

In some instances (R.atronasus) the color of the spring adult commonly continues throughout the summer but with a lessened intensity. In the fall, the colors brighten noticeably. In the case of N.cornutus it is common to find the fins a bright red by the end of August. Occasionally brightly colored males were taken in September with the color present on the sides of the body, but the intensity was always far less than in the spring male.

AN ARTIFICAL KEY TO THE FAMILIES OF FISHES IN SOUTH-EASTERN QUEBEC.

A. With an adipose dorsal fin.

B. The body scaly; no barbels on the chin.

C. Lacking spines in the dorsal fin.

D. Scales small, more than one hundred in the lateral line :- F. Salmonidae

DD. Scales larger, less than one hundred in the lateral line.

E. Strong teeth present on the jaws.

F. Osmeridae.

EE. Teeth weak, or absent from jaws.

F. Coregonidae.

CC. With two weak spines in the dorsal fin.

F. Percopsidae.

BB. The body scaleless, eight barbels about the mouth.

F. Ameiuridae.

AA. Lacking an adipose dorsal fin.

F. Ventral fins lacking:

F. Anguillidae.

FF. Ventral fins present.

G. Ventral fins abdominal in position.

H. Fins with soft rays only.

I. Head Scaleless.

J. Lips thick, papillose or plicate:

F. Catostomidae.

JJ. Lips thin: F Cyprinidae.

II. Head with scales present, obvious on opercle and cheek.

K. Lateral line absent; scales large, less than 50; color brown to goldenish:

F.Umbridae.

KK. Lateral line present, scales numerous, color greenish:

F. Esocidae

GG. Ventrals thoracic or jugular in position.

L. The spinous dorsal entire, the spines connected by a membrane.

M. Dorsals united into a single fin:

F. Centrarchidae

MM. Dorsals divided into two fins, often contiguous but only at base.

N. Body with scales.

O. Scales large.

P. Branchiostegals 7, larger fishes without anal papilla

F. Percidae.

PP. Branchiostegals 6, small fishes not exceeding 12 cms.; with anal papilla.

F. Etheostomidae.

OO. Scales minute, embedded in skin; chin with an obvious barbel:

F. Gadidae.

NN. Body scaleless: F. Cottidae.

LL. Spines of the dorsal not connected by a membrane:

F. Gasterosteidae.

ANNOTATED LIST OF SPECIES:

In the present list it is attempted to give a brief account of the significant data collected by the writer.

The descriptions are limited as much as possible to data of specific value Major diagnostic material is included in the artificial keys to the species Measurements have been made in accordance with the methods used by Forbes and Richardson (22). An exception is made in the case of the count of scales above and below the lateral line. In the Malacopterygian species the scales are counted from the base of the pelvic fins obliquely forwards, in the Acanthopterygian species from the anal fin. In no case are the scales of the lateral line included in the count. Measurements are given as an average from generally ten species. Wherever wide variations are encountered they are included in the description.

Specific determinations are based upon agreement with the descriptions given in Jordan and Evermann (37), Forbes and Richardson (22), Jordan (36) and in many cases reference has been made to Hubbs (32) and to Dymond (17). An attempt has been made to bring all names to present synonomy as given by Hubbs, Jordan et al. (38) and others.

F. C A T O S T O M I D A E

A. The air-bladder divided into two sections only, the body almost of a uniform depth from nape to dorsal.

B. Scales small, more than 90 in a lateral row, the snout projecting markedly beyond the mouth.

------- Catostomus catostomus

BB. Scales moderate, crowded anteriorly, less than 80 in a lateral row; snout not projecting markedly beyond the mouth. ------- Catostomus commersonii

AA. The air-bladder divided into three sections; the body markedly deepest just before the dorsal fin.

C. The lips papillose, plicated, the lower lip indented with a broad v-shaped notch behind.

------- Moxostoma anisurum

The writer has obtained four species of suckers locally. Of these only C.commersonii has a general distribution and penetrates into the waters of the Laurentian and Appalachian higher levels. C.catostomus was taken as an exception in two locations remote from the Eastern Plains in the Appalachian area and is describedabeve. Moxostoma aureolum Les. is common in the St. Lawrence in the vicinity of Montreal and is frequently taken in the nets of the commercial fishermen. It is known locally as 'le carp blanc', and distinguished in this fashion from 'le carp noir' (C.catostomus). Moxostoma anisurum has been preserved from only one locality in the Eastern Townships.

CATOSTOMUS CATOSTOMUS. Forster

Cyprinus catostomus ---- Fortin (26)

Catostomus fortsterianus---- Fortin (26)

Catostomus hudsonius ---- Gunther (27)

Catostomus longirostris ---- Billings (8)

Known locally as 'le carp noir'.

Our collections from the Eastern Townships include only four small specimens of this species from 10.0 to 12.5 cms. long. Adults have been obtained only from the St. Lawrence in the vicinity of Montreal, but the present description is confined to the smaller specimens.

The body elongate not compressed, its depth (4.3) not as great as in C.commersonii; the head elongate, 4.0 in the body, broad the interorbital space 3.2 in the head, the snout long (2.1) and projecting far beyond the mouth; the mouth inferior, the lips coarsely papillose the upper lip with three rows of large papillae, the lower lip divided into two large backwardly projecting lobes; the eye moderate (5.7) and situated high on the side of the head behind its middle; the dorsal with 10 rays, moderate, its base to its tallest ray as 4:5, the base in the head 2.0; anal with seven rays its base 3.6 in head, its base to its height as 4:9; scales 16-98-10, lateral line complete but with pores lacking on a few scales.

The coloration in our specimens closely similar

to that of C.commersonii, the pattern differing and composed of several large patches of black reaching from below the lateral line to the midline of the back;the head darker than in C.commersonii. Males taken in the St. Lawrence in the fall (August to September) and in the spring brightly colored, the upper parts of the head and body a dense black the lower half of the body with a bright orange to red stripe from the head to the base of the caudal; the females only brassy in color. The males in the spring with tubercles on the lower fins and on the skin adjacent to the upper lip.

We have no further data concerning C.catostomus in the Appalachian district. The specimens collected were taken from small streams exhibiting no peculiarities which would serve to explain the presence of this species in them and not in the adjacent streams. Specimens were few in number, the largest collection being made from the Bras R. (Chaudiere) when two were collected at the same time. In the St. Francis System we obtained this species from a small mountainous brook at a location close to the Coaticook river. One specimen was obtained from the lower end of Black River (Yamaska). All these localities were small, non-permanent brooks with a stony bottom. The specimens were found in small pools.

C.catostomus has been commonly recorded in the St. Lawrence and is a well known species. We have no records of its presence in the Laurentian waters. It appears

to be a species restricted to the waters of the St. Lawrence Lowlands penetrating on occasion short distances into the higher levels of the adjacent ~~(Laurentian and)~~ Appalachian waters.

CATOSTOMUS COMMERSONII Lacepede

Catostomus sp? ----------D'Urban (15)

Catostomus communis.-----Fortin (24)

Catostomus teres --------Gunther (29)

Catostomus communis -----Anon. (3)

Catostomus bostoniensis--Anon. (3)

--------- -------- -----Billings (8)

---------- -------- -----Evermann & Bean (18)

---------- -------- -----Evermann & Kendall(20)

---------- -------- ----Montpetit (41)

---------- -------- -----Rathbun & Wakeham(44)

---------- -------- -----Cox (13)

'Le Carp', 'le carp blanche', sucker,

The following description is taken from material ranging in length from 11.0 cms. to 17.4 cms. and collected at the lower stations of the St. Francis, Yamaska and Nicolet systems.

The body elongate, little compressed; its depth 5.0 (4.7-5.1) greatest midway between nape and dorsal fin; the peduncle moderate, its length 1.6 (1.4-1.7), its depth 2.6; in profile the back lacking a marked obtuse angle and

smoothly continuous with the dorsum of the head; the head moderate 4.0 (3.8-4.2), curving smoothly from snout to nape; the interorbital region nearly flat 2.1 in head, the cheeks vertical; the eye small 5.0 (4.7-5.1, 6.0 in larger adults) situated high on cheek its center nearly at middle of head length; the snout 2.4 in head; the mouth inferior, horizontal, the upper lip, with three definite rows of large papillae, the lower lip with seven rows and its posterior edge indented; the dorsal fin typically with 11 rays more rarely 10, its basis 1.6 (1.5-1.8) in head, the basis to the tallest ray as 2.8:3.0; the anal with 7 rays, its basis 3.2 (3.1 -3.5) in head, its basis to its height as 3.0:6.4; the pectoral length 1.3 (1.2-1.4) in head; the ventrals not reaching to anus, their length 1.9 (1.7-1.8) in head; the lateral line reaching to base of caudal, lacking pores on five or six scales, deflected slightly anteriorly; the scales 9 (or rarely 10)-63 to 66-8. In young specimens (2.9 to 5.0 cms. in length) the form is typically much altered, the eye larger (3.0 to 3.6) the snout shorter (2.8 to 3.0), and the lateral line incomplete.

The color pattern changes with age. In the youngest specimens up to 6.0 cms. the back and upper portions of the body are mottled. There are three distinct patches of black on the side, the first behind the pectoral fin, the second halfway along the body and the third on the posterior portion of the peduncle. The latter is the last to disappear, it may be identified even in 12.0 cm. specimens. The others gradually become absorbed as the mottling solidifies over the upper part of the body.

The white sucker spawns early in the spring. Adults collected at Brome Lake during the middle of May had spawned some time previously. Adults ranging from 10.0 cms. upwards possessed well developed ovaries and testes from the first of August on. Young specimens have been a feature of our collections at the lower ends of many brooks. The earliest larval forms are readily distinguished and are extremely long in the body. Collections were made of these larvae (1.1 to 1.4 cms. in length) as early as the 9th of June. This size is found schooling in large numbers in the shallow marginal waters of lakes and of swampy brooks. In brooks these larvae were associated with the previous years hatch now ranging from 3.5 cms. to 4.5 cms. Larger larval forms were taken in July and ranged between 1.9 and 2.2 cms. In August the smallest taken during that month averaged 2.1 to 2.8 cms. During the first half of September we collected no specimens under 3.0 cms. The larval form changes to the immature during the latter part of July. In the streams there is a smooth intergrading of sizes above 4.0 cms. Most frequently it was not found possible to distinguished between the hatches of two successive years in any one district by the end of July.

C. commersonii is one of the more generally distributed species in the streams. It occurs usually in large numbers only in the pools of streams in cultivated districts. In such areas it is found throughout the greater part of the system and is typically absent only from the highland waters. It shows a well-defined gradation in size according to the size of the stream. The sucker was not commonly found in trout streams.

In the Salmon watershed the frequency of record (7.1%) is remarkably low in comparison with the Yamaska and the Nicolet (28.5% and 45%). The extensive range in the former system is a consequence of the record of this species in the main stream and at a few highland modified brooks of the upper levels.

The largest specimens are typically found only in lakes or in the lower sections of brooks tributary to a lake (Victoria River (Chaudiere), Nicolet River, etc.). Adults of large size (60 cms.) are present in the St.Francis River at and below Richmond. It is commonly abundant in many lakes and was found in the majority of lakes and in many ponds in the Townships. Typically all sizes are present in lakes although the species runs into brooks for spawning.

The range of this sucker in the Laurentians is equally as extensive as in the district to the South of the St.Lawrence. It is a common species in the lakes in the vicinity of Nomininguе (Labelle Co.), St. Jovite and Ste. Agathe (Terrebonne Co.), Argenteuil Co. etc., and has been frequently recorded by the Laurentian parties in Papineau, Hull and Pontiac Counties. It is present in the lakes of the systems entering the St. Lawrence between the Ottawa and the Maskinonge River at least, and is common both in the highland and lower level waters. It is commonly taken in the St. Lawrence locally.

MOXOSTOMA ANISURUM Refinesque

It has not been possible to determine with accuracy the previous synonomy of this species. Evermann and Kendall (20) assign Gunther's record of C.carpio to this species.

The following description is of specimens only 5.7 to 6.5 cms. long. We have taken no adults.

The body stout, compressed, the depth greatest just before the dorsal, 3.8 (3.5 - 3.9); the back in profile forming an obtuse angle in front of the dorsal; the head heavy, (3.5 - 3.8), the dorsum not marked off from the back by a nuchal hump, broad (interorbital space 2.3 in its length); the snout pointed; the eye moderate 3.0 (3.0 - 3.4) and situated high, its center midway between the tip of snout and the posterior edge of the opercle; the mouth small, inferior and slightly behind the tip of the snout, the lips moderate, plicated, the plications broken into low papillae, the lower lip broadly v-shaped behind and divided into two distinct sections; the dorsal fin high, the longest ray equal to the base and equals 2/3 the length of the head, its margin straight, the rays 15 or 16; anal high, its rays 7; pectorals reaching to beyond the front of the dorsal and exceeding 2/3 of the distance between the pectoral and ventral basis; caudal large, its lobes subequal; scales large, 6-42-4; the lateral line complete, its course paralleling the contour of the back.

These small specimens all of a brownish to brownish-yellow color above, lighter below. The lower fins all touched

with a faint orange.

Our collections of this species are restricted to a large number of small specimens captured in the Nicolet River at the lowest station. This location was distinctive from any of the higher streams and was a large, shallow stretch of slow-running water. The bottom was of sand and the specimens were taken by seining in the large patches of potomogeton which were present close to the shores of the stream. Large numbers were present but did not exceed 6.5 cms. Associated significant species were N.chrysoleucas, N.rubellus, H.notatus and adult L.corporalis and C.commersonii. No specimens were taken in midstream. No further records of M.anisurum were obtained in the course of our collections in the adjacent waters. We have no record of its occurrence in the Laurentian district, and it would appear to be a species restricted to the St. Lawrence Lowland waters. Several commercial fishermen in the vicinity of Montreal to whom I have spoken did not distinguish two species of Moxostoma in the St. Lawrence River and accordingly it is considered that M. anisurum is relatively rare locally.

F. C Y P R I N I D A E:

A. Anal fin with 13 rays, body strongly compressed, belly sharply keeled behind the ventral fins:

Notemigonus crysoleucas.

AA. Anal fin with less than 13 rays, belly not keeled.

B. Premaxilla protractile.

C. Gut short, less than twice the length of the body, with only the typical flexures or at most an incomplete coil below the duodenal flexure (Pfrille).

D. Lateral line incomplete, ending before the ventrals:

Pfrille neogaeus.

DD. Lateral line extending beyond the ventrals, peritoneum white.

E. Maxilla with a barbel.

F. Barbel terminal, elongate, obvious when mouth is closed:

Couesius plumbeus.

FF. Barbel subterminal, not very obvious when mouth is closed.

G. Barbel short, sub-triangular, fully concealed; sides mottled with dark scales:

Margariscus margarita nachtriebi.

GG. Barbel elongate, no special dark scales on the sides.

H. Scales reduced before the dorsal; dorsal with a black patch on the membrane at frontof fin:

Semotilus atromaculatus.

HH. Scales not reduced before dorsal, dorsal immaculate:

Leucosomus corporalis.

EE. Maxilla lacking a barbel.

I. Dorsal inserted over ventral basis, the front of dorsal midway between tip of snout and base of caudal; anal rays 8 or 9.

J. Mouth oblique, scales before dorsal more than 20:

Notropis cornutus.

JJ. Mouth horizontal, scales before dorsal less than 20.

K. Lateral stripe from base of caudal to snout, mouth not reaching beyond a vertical at back of nostril:

Notropis heterolepis.

KK. Lateral stripe not running onto head, mouth reaching beyond a vertical at back of nostril and nearly to front of eye:

Notropis hudsonius.

II. Dorsal situated distinctly behind ventral basis, the first ray midway between posterior margin of eye and base of caudal; anal rays 10:

Notropis rubellus.

CC. Gut long, more than twice the length of the body, with several coils in addition to the typical flexures.

L. Scales many, more than 70:

Chrosomus erythrogaster.

LL. Scales larger, less than 50.

M. Lateral line incomplete, scales 47:

Pimephales promelas.

MM. Lateral line complete.

N. Scales before dorsal reduced, 25;
no vertebral stripe:

Hyborhynchus notatus.

NN. Scales before dorsal large, 15 to 16:

Hybognathus sp?

BB. Premaxilla not protractile.

O. Lower jaw normal; maxilla with a barbel; scales small.

P. Snout scarcely projecting beyond the mouth:

Rhinichthys atronasus.

PP. Snout projecting considerably beyond the mouth:

Rhinichthys cataractae.

OO. Bones of the lower jaw fused in the midline and forming a narrow central platform; no barbel on maxilla; scales large:

Exoglossum maxillingua.

COUESIUS PLUMBEUS AGASSIZ Fig 5

---------- Evermann and Kendall (21)

Ceratichthys plumbeus ---- Cox (13)

Red-fin shiners ---- restricted local name

Form elongate; depth 5,0(4.8 - 5.3); little compressed; head sharp in lateral view, 4.0(3.9 - 4.2); eye large 4.0(3.6 - 4.4), high and slightly anterior to the middle of head; the mouth terminal, the premaxilla protractile, the maxilla nearly reaching to a vertical at the front of the eye; barbel subterminal, white and very distinct when the mouth is closed. Teeth 2-4-4-2 commonly * incomplete, little compressed, lacking a grinding surface and terminating bluntly or in a blunt hook. Scales moderate, variable, 10 to 12- 60 to 67- 7 to 8, generally speckled dusky. Lateral line complete, deflected sharply anteriorly. Dorsal with 8 developed rays, situated over the ventrals; anal, 8 developed rays.

The largest specimen was 10.2 cms. long.

Spawning adults taken at Lac Saugay showed no marked sexual differentiation other than in size. In both sexes a very brilliant patch of a bright red to orange present at the corner of the mouth and extended slightly onto the cheek, at the upper corner of the branchial chamber (the shoulder) and in the axilla Lesser patches of the same colour present at the base of the ventral and anal fins. The patches on the face and axilla sometimes present throughout the entire summer.

The range of this species in the Province is wide. Cox (13) records it at Gaspe; Evermann and Kendall (21) at Lake Memphremagog.

In our collections it has been scattered. It was not found commonly in the streams. Intensive seinings at locations where it was taken rarely yielded more than two or three specimens. In the streams it is characteristically a fish of the center sections of the watersheds. Isolated collections of this nature were made in Key Brook, Salmon River, Red River, and the Tomofobia River (all in the St. Francis System); from three locations on the Center Branch of the Nicolet River; from one location in the Chaudiere and from one location in the Bras R. (Becancour System). All these localities were typified by having a bottom of large stones, the water shallow and pools absent.

The species was abundant in Breeches and Black Lakes (Becancour) in the southern district. Large numbers were also collected in Lac Nominingue and Lac Saugay in the Laurentians (Labelle Co.). A few specimens have been collected in Portneuf Co..

C.plumbeus was observed migrating in large numbers at Lac Saugay early in June. The only large inlet into this lake first runs into a pond over two hundred yards across and connected to the lake proper by a short passage only two feet deep. Seining in the latter channel yielded large numbers of

gravid females and only two males. In contrast, large numbers of males were taken in the inlet close to the pond. Both sexes were fully ripe, the spawn and milt running freely when handled. The stream temperature was only 14.0 oC; that of the lake, 19.0 oC. It was obvious that the fish were migrating on the spawning run and there was a distinct sex segregation present similar to that described by Kendall (39). The site where the males were taken was a small stream with a bottom of small boulders. The water at this point was fast and shallow. Pools were lacking. It was noted that the ripe female was typically smaller than the male. An estimate of the number of eggs carried by several females gave an average of 500 eggs for a female 7.0 cms. long.

At the same time, large numbers of dead Couesius were taken at the outlet of Lac Nominingue. Examination showed that the majority had spawned.

Collections made in June 1934 at Breeches Lake consisted of ripe males and females. These were taken swimming around the shore of the lake.

Young specimens are scarce in our collections. The smallest specimen taken was found at Red River in August and was 2.8 cms. long. At this size the typical form and basic color pattern were established. Associated with this specimen was an adult female with the ovaries well developed. Late in September a similar heavy female was taken from the Nicolet River.

RHINICHTHYS ATRONASUS Mitchill

----------Gunther (29)

----------Anon (3)

----------Evermann and Kendall (21)

The form elongate, little compressed, the back continuous with dorsum of head; the depth 4.6 (4.2-4.9); the peduncle moderate, its length 1.4 (1.2-1.5), its depth 1.8 (1.6-1.9) in the head; the head sharply conical, broad, (interorbital space 2.5 (2.3-3.0), flat); the snout little beyond mouth, its length 3.0 (2.8-3.2), sharp; the mouth subterminal, the maxilla reaching to a vertical at center of nostril; the barbel terminal and obvious when mouth is closed; the eye lateral in position, its posterior margin midway in head length, its diameter 4.3 (4.0-4.6) in head; the dorsal inserted over back of ventral basis, its rays 8; the dorsal basis 2.6 (2.2-3.0) in head, the basis to the tallest ray as 1:2; the anterior edge of dorsal (as in cataractae) situated midway between posterior margin of eye and base of caudal; the anal, with 7 rays, its basis 2.7 (2.6-3.3) in head, the basis to the tallest ray as 1:2; the pectorals larger in the male, the pectoral length 1.3 (1.2-1.5) in the head; the pelvic fin 1.8 (1.6-1.9); the lateral line complete; the scales small, variable, 10 to 12-59 to 68-8 to 11; the gut short, teeth 2-4-4-2; peritoneum dusky.

Brilliantly colored gravid adults were taken as late as the middle of July, but in the vicinity of Brome Lake spawning took place during the last week in May and during early

June. These adults were commonly found in association with small nesting S.atromaculatus and interfered with the nest-building of the latter in the same fashion as did N.cornutus for the larger L.corporalis. On the 28th of May, R.atronasus was observed spawning over gravel in shallow water. There appeared to be much competition between the males for the females which were fewer in number. The temperature at this time was 18.0 degrees C. The males conducted a simple display before the female. The eggs were scattered over fine gravel. The smallest sizes 0.7 to 1.6 cms. were taken in the Missisquoi River during the latter half of June. A collection of young specimens 1.8 cms. in length was made at Gear Brook late in July. The smallest specimens in August and September were 2.1 cms. to 2.5 cms. in length. Adults with the reproductive organs well-developed were taken during the latter half of August to the close of the season.

R.atronasus was the most commonly recorded species in the streams of the Appalachian district. This is a consequence of the frequency of occurrence of this species in the smaller brooks which form the greater number of the records. It also ranges extensively in the brooks, and is apparently a pioneer species in trout streams since it was recorded at nearly 50% of the stations on the Salmon system. At the same time its frequency is practically unchanged in the poorer class of water. It is most commonly taken on a stony or similar rough bottom, less frequently on mud.

The black-nosed dace is also commonly recorded in lakes and is frequently found in the marginal waters on a clean bottom.

R.atronasus is widely-spread in the Province. It was frequently recorded in the waters in the vicinity of Lake Nominingue, and near Ste.Agathe and also St.Jovite. It featured largely in collections from Pontiac and Papineau Cos. It is a common species locally in the vicinity of Montreal, and has been previously recorded in the vicinity of Quebec. This species ranges to the East into the Gaspé waters (Cox).

RHINICHTHYS CATARACTAE Cuvier and Valenciennes Fig 6

Rhinichthys marmoratus----------Gunther (29)

Rhinichthys nasutus ----------Anon. (3)

----------Cox (13)

The body elongate, very little compressed, bluntly triangular in section; the depth 4.9 (4.7-5.0); the peduncle 1.0 (0.9-1.1) in head, its depth 2.2 (2.0-2.3), the head elongate, its length 3.9 (3.5-4.0), broad (the interorbital space 3.0 to 3.3, flat); the snout projecting beyond the mouth, its length 2.6 (2.5-3.0); the eye 5.2 (4.7-6.0), supero-lateral; the mouth inferior, horizontal, small; the maxilla not reaching to the eye; the barbel terminal, elongate and apparent when mouth is closed; the dorsal inserted behind ventral basis, its rays 8; the basis of the dorsal/2.6 (2.2-3.0)in head, thebasis to the tallest ray as 1.4:2.6; the anal with 7 rays, its basis

2.8 (2.4-3.0) in head; the pectorals reaching nearly to ventral basis in large males, falling distinctly short of ventrals in females; the ventrals reaching to vent, to anal in adult males; the gut short and with normal flexures; the teeth 2-4-4-2, hooked; the peritoneum dusky; lateral line complete, slightly deflected anteriorly; the scales 12-63 to 66-10. The largest specimen 8.4 cms..

The adult males may be distinguished from the females in having the pectoral fins longer, reaching nearly to the ventral basis and the ventrals reaching to the anal fin. In the females the fins fall short of these points.

Gravid males and females have been taken as late as June 18th (Becancour) but spawning was not observed. The males are brilliantly colored. Specimens collected June 6th from warmer waters (Outlet of Coulombe Lake) had spawned. The smallest specimens collected during the course of the survey were 2.3 cms. in length and apparently were yearlings. Adults with the ovaries and testes well-developed were not taken until September.

R.cataractae in the streams is typically a species of the fast water, stony bottom sections of the intermediate region. It is rarely present in large numbers in such brooks and the majority of our records are based on five to ten specimens collected in a distance of one hundred feet. Although this species is commonly recorded as present in the marginal

waters of lakes, we collected it only once at such a location (Lake Megantic).

This species is present in all the watersheds of the Townships and was fairly commonly recorded in each with the exception of the Pike River. Specimens were obtained from the ROuge River and North River waters (Lake Nominingue, Lake Manitou, etc.) by the writer and it is present in collections from Pontiac County. It has been recorded in the streams in the vicinity of Montreal and Quebec (Gunther [29], Anon. [3]) and is apparently widely spread. Cox has recorded its presence in Gaspe.

LEUCOSOMUS CORPORALIS Mitchill

Leuciscus pulchellus ----- D'Urban (15)

" " ----- Gunther (29)

" " ----- Anon. (3)

Leuciscus corporalis ----- Fortin (26)

Semotilus bullaris ----- Billings (8)

" " ----- Montpetit(41)

Semotilus corporalis ----- Baird Coll.(6)

" " ----- Evermann & Bean (18)

The common 'whitefish','red fish' 'Poisson blanc', 'le carp dore','le mulet'.

The body moderately elongate, compressed; the back not arched; in profile the dorsum of head and back continuous; the depth,4.4 (3.9-4.7); the peduncle length 4.6, depth 2.1 in head; the head sharp, compressed, its length 4.0 (3.6-4.3), the interorbital space flat, broad, its width 2.6 in head; the snout 3.0 in head; the mouth terminal, oblique; the maxilla not reaching to a vertical at front of eye, the jaws subequal, the lower jaw not included; the eye 4.5 (4.2-5.3), high; the dorsal with 8 rays, tall, its basis 2.4 (2.2-2.8) in head, the basis to the tallest ray as 1.3:2.0; the front of the dorsal midway between tip of snout and base of caudal; the anal with 8 rays, its basis 2.5 in head, the basis to the tallest ray as 1.3:2.0; the pectoral length 1.5 in head; the ventrals not

reaching to the anus , their length 1.3; the gut short, the peritoneum pale; the teeth 2-4-5-2, hooked and lacking a developed grinding surface; the lateral line complete, deflected anteriorly; the scales large, 7 or 8 - 46 to 50 -5; scales before dorsal not reduced, mostly 21 to 23.

Spawning males in the spring highly colored. The heavy male with the back dark olive, the sides pinkish to red; the face and throat red; the fins reddened at their base; tubercles present on the post-orbital line but not on dorsum of head. In late summer large adults from lakes are dark olive above, and commonly of a goldenish color on the sides. The young in streams dark olive to steel blue above, silver on sides and plain on venter. In the light phases a vertebral line commonly obvious.

This species was observed nest-building and spawning at Brome Lake late in May. The first run was observed May 15th and had recently entered the brook from the lake. Nest-building commenced on the 19th, while the temperature was still only 12/oC . Spawning took place on the 20th. at a temperature of 16.6/oC.. Adult females of 17 cms. and more carried an average of 2300 eggs each. The eggs were spawned onto elongate mounds of gravel averaging two feet in length, and were later covered with gravel. The day before spawning we seined an average of eleven females to three males at several pools. Following spawning fourteen

of each sex were taken from one pool. These adults ranged from 15.5 cms. to 25.5 cms. in length; the largest male was 18.8 cms.. The courting and mating were observed and were similarly conducted as described by Reighard (45) for S.atromaculatus though no complicated manoeuvre was observed at the actual time of spawning. During the day following spawning the adults were found scattered in the brook, and by the 25th. the adults had left the stream. The stream temperature dropped to 13.0 oC. but the head and tail were free in the majority of eggs two days after spawning. Later at Coulombe River fry were present in a nest on June 6th. These were 1.2 cms. in length and left the nest two days later. Nests at Lac Tor where there is no inlet stream were built at the outlet.

A large number of nests has been seen. The general form when completed is conical, the average size is four feet in diameter by two feet high.

Fry were found in brooks until the end of June when they changed to the immature form and coloration. By the end of summer, the year's hatch apparently reaches 3.5 cms. and more. The former were the smallest we have collected at this time. Heavy females 15.0 cms. and more were collected during early September.

L.corporalis is a species of the intermediate sections of the brooks when young and grows to a large size only in the pools of this stretch or in the larger lowland rivers and the lakes. The small sizes are commonly taken

in fast water on a rough bottom. These range further upstream but do not enter the highland sections to any great extent. This species is not commonly found in trout waters although present in similar streams close by (R. Grand Coulée and adjacent brooks (Chaudière). Our largest collections were made in the lower Nicolet River and the tributaries at this level. We have recorded this fish in all the systems in the Townships.

This is a common fish in lakes and is frequently caught by persons still-fishing for bass or pike. It reaches a maximum size in lakes (28.0 cms. the largest we have taken).

L.corporalis is widely spread in the waters of this Province and is present in lakes both of the highlands and the lower levels to the North and South of the St. Lawrence. (Lake Kiamika etc.). It has been frequently recorded in the St. Lawrence, and ranges from at least Quebec in the East to the western border.

SEMOTILUS ATROMACULATUS Mitchill: Fig 7.

Leuciscus ? ---------- D'Urban (15)

Leuciscus atromaculatus -------- Fortin (26)

--------- ---------- -------- Anon. (3)

--------- ---------- -------- Cox (13)

--------- ---------- --------Evermann & Kendall(21)

Body moderately elongate, robust, little compressed; the dorsum of head continuous with back; the peduncle 1.1 in head, the depth 2.6-2.8; the head heavy, its length 3.8 (3.6-3.9), the interorbital space 2.5 in head; the snout moderate, blunt, its length 2.9 to 3.2; the eye moderate in young, small in adult 4.5 to 6.0; the front of dorsal midway between front of eye and base of caudal, its rays 8, situated behind the ventral basis; the dorsal basis 2.3-2.6 in head, the tallest ray 1.6-2.0; the anal fin with 8 rays, its basis 2.3-2.7, its tallest ray 1.8-2.0 in head; the pectorals 1.7 in head; ventrals not exceeding vent, their length 1.9 to 2.3 in head; the gut short, equals body length, the peritoneum pale, the teeth 2-5-4-2, often incomplete, hooked and lacking a well-developed grinding surface; lateral line complete, scales 10 to 12-57 to 63-6 or 7, crowded before dorsal (35 to 40).

In the spring the males with a series of large tubercles along the supra-orbital line; salmon-pink on the sides of head and body, and the throat; the anal, dorsal and

paired fins also coloured. Later in the summer dark-olive above, the sides silvery and with the base of each scale marked; a distinct vertebral line common, also a lateral stripe behind eye to base of caudal.

S.atromaculatus was found spawning in brooks at Brome Lake the same time as L.corporalis . Adults ranged in length from 8.0 cms. to 15 cms.. Nesting occurred while the water temperature was below 17.0 degrees C.. The mounds constructed by the males were only one to two feet in diameter. The construction of the nest, the mating and spawning were performed in the fashion described by Reighard (45) The eggs were not later buried in gravel. Several males commonly took part in the construction of the nest, but only one at a time. Spawning was observed at a temperature of 18.0 degrees C.. The final nest was only two feet long and nine inches high. As with L.corporalis the nests were built in the smooth running water at the head or foot of a pool. Several nests built in still water were more circular in shape than those in fast water. Eggs collected three days after spawning varied in their degree of development from early embryos to stages with the head and tail freed from the egg. The eggs are of high density and sink rapidly to the bottom. Two females were collected which had the typical male colouration and normal tubercles. In these the ovary was well-developed and the eggs flowed freely under pressure on the abdomen. The latest date of the collection of gravid adults was

June 18th. (Sunday Lake, Becancour). Larval forms were commonly taken during the first half of June. These were 0.7 to 1.5 cms. in length. The larger sizes already showed a development of the immature form. During August and September large numbers of adults were taken in which the ovaries and testes were well-developed. The males in September have the tubercles present on the head.

S.atromaculatus shares almost an equal frequency of record with R.atronasus and the two species were commonly found associated in the brooks of the upper levels. The range of this species is characteristically wide in the stream and it is found in the largest numbers in the pools of the highland and upper intermediate sections. The smaller sizes are common in fast water on gravel bottoms. S.atromaculatus is frequently found in the highland streams in modified areas, brooks which would normally be occupied solely by trout. At the margin of trout area it is common to find S.atromaculatus the most abundant species.

The chub is almost equally as common in lakes of the upper and lower levels where the larger specimens are often confused with L.corporalis.

S.atromaculatus is a common species in the Rouge,Petite Nation and North Rivers. It is present in collections from Pontiac Papineau,Argenteuil,Terrebonne and Labelle Counties. It is present in the St. Lawrence and has been commonly recorded. It is apparently wide spread in the waters of this Province and has been recorded in Gaspe and New Brunswick (Cox).

MARGARISCUS MARGARITA NACHTRIEBI U.O. Cox: Fig. 8

C.plumbeus ------ Cox (13)

---------- ------ Atkinson (4)

The body heavy, little compressed, depth 4.5 (5.0 in spawned adults) the profile little broken, the peduncle compressed; the head broad, interorbital space 2.8 moderate, the length 4.0 (3.9 - 4.2), dorsum of cranium nearly flat; the snout blunt; the mouth terminal, oblique, the maxilla reaching nearly to a vertical at front of eye; the barbel minute, triangular and subterminal on the maxilla; the jaws subequal, the premaxilla protractile; the eye large, 4.2 (4.0 - 4.3), situated with its center 1/3 of head from tip of snout; the dorsal and anal fins each with 8 rays, tall, their basis equal, 2.9 in head, the ratio of the basis to the tallest ray as 7:11 and 7:9 respectively; the front of dorsal situated behind the ventral basis; scales 10 to 11 - 66 to 75 - 8 to 9; the scales with radii only on the apical field, the focus basal; the lateral line deflected anteriorly extending to base of the caudal but lacking a few pores on some scales; the gut 80% of the standard length, with a gastric and a duodenal flexure only; the peritoneum pale; the teeth 2-4-5-2, the lower teeth of the main row blunt and the grinding surface troughlike, the upper teeth of the same row more slender and bluntly hooked.

The head and body dark, the sides with dusky

punctulations and a lateral band from back of eye to base of tail, more pronounced on the peduncle than on the body or head. Specimens taken by us in June and early July with a broad band of rose below the lateral bar on body and passing posteriorly onto the ventral surface of the peduncle.

Our specimens are restricted to collections from the lower tributaries of the Pike River and the Ulverton River (St. Francis system). At both localities it was found in slow streams with the bottom of mud or algae-covered stones. The temperatures at these locations were typically high (25 oC.). The species was common in pools in these streams and was associated with S.atromaculatus, L.corporalis, L.cornutus, R.atronasus, C.commersonii, Hybognathus, B.nigrum and A.rupestris.

The data concerning this species is necessarily scanty. We have obtained no specimens less than 2.4 cms. in length. A heavy female taken late in August was carrying nearly 500 eggs and is the largest specimen that we have taken (8.5 cms.).

M.m.nachtriebi was recorded by Atkinson (4) in lakes of the Petite Nation River. We have no further data to show the presence of this species in the Laurentian district, but judge that it is a common species of the St. Lawrence Lowlands.

PFRILLE NEOGAEUS Cope: Fig 9

Pfrille neogea ---- Cox (13)

------- ------ ---- Atkinson (4)

The body heavy, depth 4.5 (4.0-4.7) stout and little compressed; the head heavy, 4.0 (3.5-4.3 in smaller specimens) broad, the interorbital space 2.5 in head; the mouth terminal and oblique, the maxilla nearly reaching to a vertical at front of the eye, lacking a barbel; premaxilla protractile, the lower jaw not included, chin tipped with black; the dorsal and anal fins each with 8 rays, both fins high the base of dorsal to the tallest ray as 3:4, dorsal inserted just posterior to the ventral basis; the lateral line markedly incomplete and usually not exceeding the tip of the pectorals, curved ventrally; the scales small, 88 in a longitudinal row, weak, subcircular with the focus nearly median and radii present on all fields, the ridges concentric (agreeing with Hubbs' description, (32 , p.33); the peritoneum black, the gut short, with only a simple gastric and duodenal flexure, the teeth compressed 2-4-4-2, bluntly hooked and with an excavated grinding surface the edges of which are roughened. Our largest specimen 7.3 cms.

Our specimens all with the back and dorsum of head dark; on the body a lateral band reaching to the base of the tail, above this a light band intermediate between the lateral band and the sharply delimited lower edge of the dark area of the back; a thin but distinct vertebral band before the dorsal.

The presence of P.neogaeus in our collections was not recognised in the field, this species being confused with the closely similar C.erythrogaster. In examining the preserved collections the distinctness of the two species is obvious. P.neogaeus is present with specimens collected from the St. Francis, Nicolet and Chaudière systems. In these watersheds it was frequently associated with C.erythrogaster in collections made from small isolated pools and some ponds (Dell Pond). The largest specimen was seined from a flooded ditch draining into the Ulverton River (St. Francis) and was associated with M.m.nachtriebi and Hybognathus. The average of our other specimens is only 4.5 to 5.0 cms. in length. So far as I can determine the species was invariably taken from brooks where the bottom was of mud and at low elevations. There was always some vegetation present in these brooks. In this respect its record in the streams differs from those of Chrosomus.

P.neogaeus is widely distributed in the Province. The majority of the collections of C.erythrogaster from the Laurentian district also contain one or two specimens of the present species. It is present in the Gatineau, Lievre, Rouge and North River watersheds. Atkinson records its presence in the Petite Nation River system.

NOTROPIS HETEROLEPIS Eigenmann and Eigenmann: Fig. 10.

The following description is taken from a uniform collection of specimens ranging from 4.3 cms. to 4.5 cms. in length made at the lowest station on the Rivière des Rosiers. These specimens are typically more slender than the description given by Dymond (17) but fall within the range of variation of this species as recorded by Bensley (7).

The body moderately elongate, slightly compressed, the depth 5.0 (4.8 - 5.1), the back in profile little elevated before dorsal; the peduncle elongate, its length 0.9 in head, its depth 2.5 (2.4- 2.6); the head moderate, 3.9 (3.8 - 3.9) in standard length, broad, (interorbital space 2.6); the snout blunt, subequals eye, 4.0 (3.9 - 4.0) in head; the eye moderate, 3.9 (3.7 - 4.0), high; the mouth subinferior, slightly oblique, its gape small the maxilla reaching to a vertical at middle of nostrils; the dorsal inserted over the ventral basis, its anterior edge midway between tip of snout and base of caudal, its length when depressed 1.4 (1.3 - 1.6) in the distance from occiput to front of dorsal; the dorsal rays 8, the fin high, its basis to the tallest ray as 5:9, its basis 2.5 (2.2 - 2.7) in head; the anal fin with 8 rays, the basis to the tallest ray as 4:8, its basis 2.7 (2.7 - 2.8) in head; the ventrals reaching to the vent; the scales large, 5 - 34 to 36 - 3 or 4;

the scales before the dorsal slightly irregular and 14 to 16 in a row; the teeth 0 - 4 - 4 - 0, compressed, hooked and with developed, elongate grinding surfaces.

No record was made of the colour during life but in stream collections these specimens did not differ from the dull phases of H.notatus. The pattern simple, the back with a broad sharply delineated dark band from nape to base of caudal, anteriorly four scales wide on either side of mid-dorsal line. The scales within this area strongly outlined. Vertebral line, lacking. The lateral band is thin but prominent and passes from the caudal basis forward onto the head, around the snout and varies little in depth, the crescentic pattern of the scales showing through this band. The chin and premaxilla clear. The largest specimen 5.4 cms.

The present species was confused in the field with H. notatus which it resembles in having large scales, a prominent lateral stripe and the pronounced snout. N. heterolepis is readily distinguished from the latter species by the unreduced scales before the dorsal, the weak lateral line etc..

It was first recognised by the writer at Lake Nominigue in the Laurentians and later taken in the St.Francis (Salmon Brook) , Nicolet (Rivière des Rosiers and Rivière

des Pins) and the Chaudière (Rivière Grand Coulée) Systems. So far as our collections show it was found only at the lower ends of these brooks. Although taken during the months of June, July and August we did not obtain any gravid specimens. A single jar from Mechan Lake, Pontiac Co. contained adults and a smaller size (2.7 cms.). Adults were taken from the Rouge River near Labelle. Greeley (28) records it in the Lake Champlain drainage. It has not previously been recorded in the waters of this Province or further to the East

NOTROPIS HUDSONIUS Clinton: Fig 11.

The present species is represented in our collections by five adults and a small number of immature specimens taken at Clay Lake in the Laurentian district.

The species has not been recorded previously from this Province and on this account the present description is included here.

The body elongate, compressed, the greatest depth just anterior to the dorsal fin, depth 4.2 (4.0 - 4.9, 3.5 in the young); in profile, the dorsum of the head smoothly continuous with the back, the latter rising to an obtuse hump at the front of the dorsal; the head small 4.3 (4.2 - 4.5, 4.0 in the young), conical; the snout blunt, 3.8 in the head; the interorbital space 3.0 (2.9); the mouth moderate, subterminal and nearly horizontal; the upper jaw 4.2, maxilla reaching to a vertical at front of eye; the lower jaw included and not tipped with black, the premaxilla protractile; lips thin; the eye large, 3.4 (3.2 to 3.4, 3.5 in the young); the scales large, 6 - 38 to 40 - 4, deeper than long on the anterior part of the body, not crowded before the dorsal (18); the fins clear, the dorsal and anal with 8 rays, tall their basis to their tallest ray as 4 : 7 ; dorsal inserted over ventrals, when depressed its tallest ray reaching beyond front of anal; the teeth various from 0-4-3-0 to 2-4-4-1, the upper teeth of the main row hooked, the grinding surface reduced; the gut short and with only a gastric

and a duodenal flexure.

The color pattern is simple, the dorsum of head and the back dark olive, the body lighter below and with a black lateral band running forward from base of tail above the lateral line but not extending onto the head; the fins clear; a prominent black spot in center of base of caudal only one scale deep. The scales above the lateral line distinctly outlined. In the young specimens the body is clear, the coloration confined to the outlining of the scales over the entire body and the very pronounced caudal spot.

N.hudsonius has not been collected by us in the Appalachian waters. Our only specimens were taken at Clay Lake, Villineuve Tp., Papineau Co. Late in June adults associated with a young stage of 2.2 to 2.7 cms. were taken over a clean sandy bottom. It was recorded that attention was readily drawn to the presence of the species by the caudal spot which showed plainly in the water. Other species recorded for the lake are P.flavescans and P.caprodes.

NOTROPIS RUBELLUS Agassiz:

Minnilus rubellus ------- Billings (8)

Notropis rubrifrons ----- Evermann & Bean(18)

The body elongate, moderately compressed; the

back slightly convex, and continuous with the dorsum of the head; the depth 5.2 (5.1-5.7); the pedunele 1.3 (1.4-1.6) in head, its depth 1.9; the head moderate, broad (interorbital space 2.6 (2.5-2.8), sharp in profile, its length 4.3 (4.0-4.5) in standard length; the snout 3.0 in head, bluntly rounded; the mouth terminal, oblique, the gape large, the maxilla reaching to a vertical at back of nostril; the chin clear; the eye moderate, high, its diameter 3.9 (3.8-4.0) in head; the dorsal fin with 8 rays, inserted behind ventral basis and midway between posterior edge of eye and base of caudal; the dorsal basis 2.1 (2.0-2.4), its tallest ray 1.4 (1.3-1.5), its length when depressed equals half the distance from dorsal base to occiput; the anal with 10 rays, elongate, the basis equalling tallest ray, the basis 1.9 (1.8-2.1) in the head; the pectorals 1.5 (1.4-1.6) in head; the ventrals 1.9 (1.8-2.3) the teeth 2-4-4-2, (rarely complete) compressed, hooked; the lateral line strongly developed before ventrals, weaker behind and on peduncle.

A readily recognised species in our collections owing to the elongate form of the head and body and the typical redness of the head. The dorsum of body and of head later in the summer dark olive; on the sides a lateral greenish bar; vertebral bar present. The largest specimen 6.5 cms.

Females taken in May and early June averaged nearly 6.0 cms. in length and carried approximately 580 eggs. Heavy females were obtained as late as the middle of July (Missisquoi River). In early June this fish was observed spawning in

very fast water in the Maskinongé River (St. Francis). At this locality the water was shallow and the bottom of gravel. The water temperature was 19.5 oC.. Owing to the roughness of the water it was not possible to observe the actions of these fish, but it was the only species present and eggs were obtained by placing a net in the stream and disturbing the gravel. Although gravid N.cornutus were obtained from adjacent brooks, none were present at this location. The smallest specimens which we have collected were 2.5 cms. in length and were taken in late July (Pike R.). During September adults with the reproductive organs well developed were collected.

N.rubellus is typically a species of the brooks of a lowland type and was taken on occasion short distances upstream in the lower portions of the adjacent mountainous section but were never abundant in these locations. It was taken most commonly in the large rivers and from the immediately adjacent sections of their tributary brooks. The largest collections were taken from the lower Rivière des Rosiers and the Nicolet River. These also showed the greatest range in size, (3.5 cms. to 6.5 cms). This species was also collected from the lower ends of brooks flowing into Lake Aylmer (St. Francis). Collections of a similar nature were made at the junction of the Tomofobia River and Nigger River above Lake Massawippi. Typically this species is taken from brooks

with a sandy bottom. Our collections in the Missisquoi River were taken among stones and small boulders.

N.rubellus was present in all the systems in the Eastern Townships. It has been recorded by Greeley in the Champlain watershed. It is a common species in Ontario (Hubbs,33). The present record of this species in the Chaudiere is the most easterly yet obtained. I have no account of this species in the Laurentian district and Atkinson (4) does not record its presence in the Kinonge watershed.

NOTROPIS CORNUTUS Mitchill:

Leuciscus frontalis ---- D'Urban (15)
Leuciscus vittalus ---- Fortin (26)
Leuciscus cornutus ---- Gunther (29)
Plargyrus cornutus ---- Anon. (3)
Minnilus cornutus ---- Billings (8)
------- ------- ---- Evermann & Kendall (21)
------- ------- ---- Cox (13)

The red-fin shiner.

The body moderately elongate in young to deep in adult, strongly compressed; the back elevated, continuous with dorsum of head; the greatest depth at dorsal, 4.0 (3.7-4.2); the peduncle equalling head (1.1), its depth 2.3 (2.2-2.4) in head; the head sharp, its length 4.0 (3.8-4.6), the interorbital region 2.5 (2.3-2.7); the snout blunt, 3.1

(2.7-3.4), slightly longer than eye; the eye 4.0 (3.5-4.0) decreasing relatively with growth; the mouth oblique, maxilla to vertical at back of nostrils; the dorsal fin inserted over ventral basis, the first ray nearer tip of snout than base of caudal; the dorsal rays 8, its tallest ray 1.3 (1.1-1.4) in head, the basis 1.8 (1.7-2.0); the length of the depressed dorsal 1.0-1.3 in distance from nape to dorsal; the anal with 9 rays, its basis 2.0 (1.7-2.1), its tallest ray 1.5 (1.5-1.7); the pectorals 1.3 in head, nearly reaching to ventral basis; the ventrals, 1.7 (1.5-1.8), not reaching to vent; the lateral line complete, depressed on body; the scales deeper than long (3:1) on body, 8 or 9-41 to 42-4 or 5; scales before the dorsal not greatly reduced, 21-24; the teeth 2-4-4-2, compressed, weakly hooked.

The coloration plain excepting in breeding fish. Typically the upper part of head and body dark olive, the sides silvery, the venter plain; the scales on body with base of each marked in black; a constant vertebral line. The spawning male brilliant, silvery on body and dark olive above; the fins strongly marked with red; the throat red; the venter light red to salmon; the dorsal and caudal dusky; the back before dorsal and dorsum of head tuberculated, the snout and mandibles with fewer but coarser tubercles. The female brilliantly silver on sides and venter; the fins clear, only the dorsal, anal and ventrals margined with red.

Ripe adults were taken at Brome Lake from the middle to the end of May; at Lake Aylmer until the middle of June. Spawning took place in the vicinity of Brome Lake at a temperature of 18.0 oC.. The average female 10 cms. long carries 2000 eggs. These adults were most commonly found in brooks where L.corporalis was nesting and in spawning slightly later than that species interfered with the latter's nest building. The display of the male is most brilliant. He draws the attention of the female by suddenly spreading his fins to their fullest extent. Males were often seen fighting but did not build nests. Spawning took place on beds of gravel in the unbroken, shallow water at the foot of a pool. The latest date on which a heavy female was recorded was June 15th, (Missisquoi River). The youngest larvae were 1.3 cms. and were collected during the middle of July. The smallest specimens in late August averaged 2.3 cms. Adults with well developed ovaries and testes were taken from the first of August on. The male coloration disappeared by the middle of July. Coloration of the fins and tuberculation of the head reappears by the end of August.

Notropis cornutus was commonly recorded in the streams. The largest specimens frequent slow-water lowland streams and pools in the faster intermediate sections. The smaller sizes (6.0 cms. to 10.0 cms.) are commonly found in faster water adjacent to these locations. In the Salmon River, N.cornutus

was restricted to the main stream and to the modified brooks. It is not commonly taken in association with S.fontinalis as the low frequency in this system shows. The isolated records at high elevations were made near the open area at La Patrie. It is most commonly taken in association with C.commersonii . We recorded this species in all the watersheds in the Eastern Townships.

It is a common minnow in lakes and ponds and is more frequently recorded in the deeper lakes.

The red-fin shiner is widely distributed in this Province and is featured commonly in reports and collections in the Laurentians. In the vicinity of Lake Nominingue it was present in the larger lakes but seldom found in the smaller. We are able to record it definitely for the Rouge and North Rivers. A few specimens were present in collections from Papineau Co.. It has been frequently recorded in the St. Lawrence River, and is common in the vicinity of Ottawa (Billings, 8). Billings also mentions the presence of this fish in the Gatineau system. There can be no doubt that N.cornutus is present in all the systems at least from Quebec to the West of the Province. Cox has recorded its presence in the Gaspe waters and in New Brunswick.

EXOGLOSSUM MAXILLINGUA Le Sueur: Fig. 12.

The body stout, its depth 4.4 (4.0-4.5); the back little elevated; the peduncle heavy; its length equals head, its depth 1.8 (1.6-2.0); the head heavy, broad (the inter-orbital space flat, 2.2), the length 4.1 (4.0-4.2) in standard

length; the snout sharply pointed, its length 3.0 in head; the mouth terminal, oblique, the maxilla reaching to a vertical at back of nostrils, the lower jaw included; the eye moderate 4.0 (3.5-4.5); the dorsal inserted level with the ventral basis, the anterior ray midway between base of caudal and the nostrils; its rays 8, the basis 2.0 (1.9-2.1) in head, basis to the longest ray as 1:2; the anal with 7 rays, its basis 2.6 (2.2-3.0), the basis to longest ray as 1.1:2.0; pectorals short, their greatest length 1.2-1.5 in head; the pelvic fin 1.5 in head; the lateral line complete, slightly decurved anteriorly; the scales moderate, 9 or 10-54 (52 to 56) -7; gut short, peritoneum pale; the teeth in several specimens only 0-4-4-1, relatively small, not compressed, bluntly hooked.

Adult specimens light-olive to dark above, straw-colored to silvery below. The smaller fish with a definite lateral band commencing in a dark spot on caudal basis and continued forwards onto opercle and snout. The largest specimens 8.9 cms., a fall female.

E.maxillingua has been one of the rarest of the minnows in the Eastern Townships. It has not been collected by us in the spring or early summer. Specimens ranging from 4.5 cms. to the maximum size were collected during the latter half of August and early September. These commonly had the ovaries and testes well developed. The smallest specimens

averaged 3.2 cms. and were taken early in September. A large collection seined in the Nicolet South West Branch River ranged uniformly from 3.4 cms. to 6.8 cms..

This species was not found in the Pike, Missisquoi, Yamaska, Bécancour or Chaudière systems. Our only collection made in the St. Francis was taken from the upper section of the Ulverton River. The range of this species was wider in the Nicolet system and from the data obtained is apparently confined to the slower waters of pools in the intermediate sections of the tributary streams of the lower levels. Specimens were obtained from the Nicolet River and the Nicolet South West Branch, Rivière des Rosiers, and Francoeur Brook. At these latter stations this species was found in slow water and in pools typically with a bottom of fine silt or mud and generally some equatic vegetation present. The largest collections were seined from pools above dams on the Nicolet South West Branch. These situations were quite divergent from the stations on the Ulverton River (St.Francis) where Exoglossum was taken from below large boulders in exceptionally fast water. The latter specimens were more uniform in size and ranged from 4.0 cms. to 4.3 cms. in length.

E.maxillingua has been recorded in the Champlain drainage by Greeley (28). We have not collected it in the Laurentian district and have not yet been able to show its presence in the waters of the Eastern Plains. The present

account is the first record of this species for this Province. It is common in Lake Ontario (Nash) and further to the West (Hubbs, 32).

NOTEMIGONUS CRYSOLEUCAS Mitchill:

Abramis versicolor ------ Anon. (3)

------- --------- ------ Billings (8)

Abramis chrysoleucas ---- Evermann and Kendall (20)

------- ---------- ---- Cox (13)

The body moderate, strongly compressed, the back arched before dorsal; the depth 3.4 (3.3-3.6); the belly sharply keeled between ventral basis and anus; the peduncle, its length 1.4 (1.3-1.5); the head small, sharp in lateral view, its length 4.1 (4.0-4.3), little compressed; the interorbital space 2.3 (2.1-2.5); the snout blunt, its length 4.7 (4.1-5.0) in the head; the eye large, 3.2 (3.1-3.3); the mouth terminal, oblique, the gape moderate, the lower jaw protruding, premaxilla protractile; the dorsal with 8 rays, situated back of ventral basis, its anterior edge midway between base of caudal and a vertical at back of eye, tall, the basis 2.1 (2.0-2.2) in head, the basis to the height as 1:2 ; the anal with 13 rays, its basis elongate 1.3 in head, the basis to the tallest ray as 1:1, its free margin falcate; the pectoral length 1.1 to 1.2 in head; the ventral length 1.4; the ventrals not reaching to the vent; the gut short; the teeth 0-5-5-0, compressed, hooked with well developed grinding facet, the edge of grinding surface strongly serrate; the lateral line complete, strongly decurved, present on lower third of body for greater length of its course; the scales 10-45 or 46-3, little reduced before dorsal (19-24).

Upper half of head and body darker, below this base of scales marked with crescents. In life the body brassy to gold in color.

Specimens taken May 20th from a weedy backwater of a tributary of the Richelieu River near Iberville were ripe. These adults averaged 5.0 cms. to 6.7 cms. in length. The males were brilliantly colored, the females less brilliant more silvery than brassy or gold. Small specimens have not been taken frequently. The smallest was 2.5 cms. and was taken in mid-September from the lower Rivière des Rosiers (Nicolet). Associated with this were adults 6.0 cms. long. Our Other collections consist only of adults.

N. crysoleucas has not appeared frequently in our collections. Essentially it is a species of slow or standing weed choked waters. It was not abundant at any of the localities where it was taken by the survey, but I have collected large numbers from pools adjacent to the Richelieu River at Iberville. Specimens were obtained from the lower level tributaries of the Pike, and from the lower stations on the Riviere des Rosiers and Rivière des Pins (Nicolet). I have not taken this species in the St. Francis, but it was recorded at a tributary of the Black River. A single record of one adult (not shown in the table) was made at Lac à la Barbotte situated at the top of Dupuis River (Chaudière). Evermann and Kendall (21) recorded the presence of this species in Lake Memphremagog, but it is uncommon to take it from localities above the 500 foot level.

This record is the only one of its presence in the lower St. Francis lake district. A single specimen was given me which had been collected in the Lac Maskinonge district (Berthier Co.) and is the only record from the Laurentian district. Apparently N. crysoleucas may but seldom does extend its range above the St. Lawrence Lowlands into the adjacent waters. The species in this Province ranges from Gaspe (Cox, 13) to the western boundary (Billings, 8). Greeley (28) records it in Lake Champlain.

HYBOGNATHUS species: Fig. 13.

The body moderate, compressed; the back elevated before the dorsal, not continuous with dorsum of head; the depth 3.6 (3.3-3.4); the peduncle compressed 1.2 in head, its depth 2.0 (2.0-2.5); the head moderate, conical, its length 3.9 (3.8-4.0); the dorsum of head flat, broad (interorbital width 2.3 (2.1-2.5); the snout 3.4 (3.3-3.7), fleshy and overhanging the mouth; the mouth inferior, oblique, the maxilla reaching only to a vertical at back of nostril, the premaxilla protractile, lower jaw the shorter; the eye small, 4.5 (4.0-5.0), its posterior margin situated at middle of length of head; the dorsal inserted slightly before ventral basis, its rays 8, its basis 2.3 in head, the basis to the longest ray as 6:10; the length of depressed dorsal 1.2 in distance from front of dorsal to occiput; the anal with 7 rays (8 in one specimen), its basis 2.7 (2.5-2.8) in head,

the basis to the longest ray 6.3:10; the pectoral length 1.5 (1.3-1.5) in head, the ventrals 1.9; the gut elongate, 4.3 to 5.3 times the standard length; the peritoneum black; the teeth 0-4-4-0, compressed, not hooked, grinding surface not grooved but elongate and triangular (as in Pimephales); the lateral line extending to base of caudal, lacking a few pores only, slightly depressed anteriorly; the scales 6 or 7-37 to 39-5 or 6, 15-16 before dorsal the focus basal, radii moderate (20 to 30) and confined to apical field. A well defined, dense vertebral stripe from nape to base of caudal.

In the absence of complete descriptions of the species in this genus I am unable to assign the present specimens to their specific standing. These specimens do not compare favorably with Jordan's account of H.nuchalis Agassiz (36). The head is longer, its profile not evenly curved; the eye is smaller; the gut a variable feature nevertheless is shorter. The specimens differ similarly from the data given by Forbes and Richardson (22) for the same species. The smallness of the eye excludes these specimens from assignation to H.regia Girard the form ranging to the East and recorded along with H.hankinsoni Hubbs in the Champlain drainage by Greeley (28). I have been unable to find a description of the latter species. Apparently none has been published (Hubbs, 33). The account given by Jordan is too brief for satisfactory comparison.

Our collection of this species is restricted to only eight fish ranging in length from 5.3 cms. to 6.1 cms. and taken from a tributary (designated L4) of the Ulverton River (St. Francis). Associated with these specimens were

M.m.nachtriebi, S.atromaculatus, R.atronasus, N.cornutus, P.promelas, N.rubellus, C.commersonii, C.flabellaris and B.nigrum. The stream was small, the velocity of the water slow; the bottom was formed of mud and stones.

CHROSOMUS ERYTHROGASTER Rafinesque:

----------Cox (13)

----------Atkinson (4)

The body moderately elongate, not compressed; the depth 4.6 (4.3-5.0); the peduncle slender, its length 1.0 in body; the head moderate, 4.0 (4.0-4.2), pointed, broad (interorbital space 2.6); the mouth terminal, oblique, the maxilla not reaching to the eye, the premaxilla protractile, chin black; the eye 3.6 (3.3-4.0); the dorsal with 8 rays, inserted slightly behind ventral basis; anal with 7 or 8 rays, the basis 2.6 (2.4-2.8) in head, basis to the tallest ray as 1.2: 2.0; pectoral 1.5 in head; pelvic length 2.0; lateral line incomplete, not reaching to level of dorsal; scales small, 18-80-10; the teeth, 0-4 or 5-5-0, weakly hooked, compressed.

Deep olive above, the lower portion of head and body bronzed or plain white to silvery. A prominent lateral stripe of black passing from snout to base of caudal, above this a second band not reaching onto the head; on the back a pronounced vertebral stripe, on either side of which is a series of irregular black spots commonly joined to form a third stripe broken posteriorly and extending onto the dorsum of peduncle. The brilliant breeding colors usually lost by

the middle of August.

Ripe adults were taken during June. At Lac Saugay (Labelle Co.) gravid females were taken with migrating C.plumbeus. At Breeches Lake (Bécancour) yearling specimens taken in June were 2.5 cms. long and showed the typical adult color pattern. Adults taken as early as the beginning of August have the ovaries and testes well developed.

C.erythrogaster was found in the St. Francis, Nicolet, Bécancour and Chaudière systems. It is not common in streams and our records were mostly based on only two or three specimens. In the streams it was characteristically restricted to the intermediate sections of the watershed. Essentially it is a species of pools, ponds and small lakes both of the upper and lower levels where it was ~~most~~ commonly found associated with P.neogaeus.

Chrosomus has a wide range in this Province and is a common species in the Laurentian waters. It is present in large numbers in jars containing collections made in the Counties of Pontiac, Argenteuil, Terrebonne and Labelle. Cox (12) has recorded its presence in New Brunswick and in the rivers of Gaspe(13). Atkinson (4) found it a common species in the Kinonge system.

HYBORHYNCHUS NOTATUS Rafinesque:

Hyborhynchus ? ---------Baird Coll. (6)

----------Gunther (29)

Pimephales notatus -----Evermann and Bean (18)

The body elongate, moderately compressed, dorsum of head continuous with back; the depth 4.5 (4.2-4.8); the peduncle equalling head, its length 1.0 (0.9-1.0), its depth 2.0 (1.9-2.1); the head small, heavy, broad, the interorbital space 2.0(1.9-2.4); the snout blunt, extended beyond mouth, its length 3.4 (3.1-3.8); the mouth inferior, horizontal, the maxilla reaching to a vertical at posterior margin of nostrils; the eye moderate, 3.5 (3.0-4.2); the dorsal inserted over back of ventral basis, its anterior edge midway between base of caudal and the nostrils; the dorsal rays 1-8(in one specimen only, 1-9), its basis 1.6 (1.3-1.7) in head, the basis to the tallest ray as 10: 10; the anal fin with 7 rays, its length 2.6 (2.5-2.8), the basis to the tallest ray as 7.5:10; the pectoral length 1.4 (1.3-1.4) in head; the ventrals not to vent, 1.5 (1.5-1.6); the gut long, coiled, its length 2.0 to 2.3 in standard length; the peritoneum black; the teeth 0-4-4-0, compressed, with an elongate triangular grinding surface; the lateral line complete, slightly decurved on body and straight on peduncle; the scales 6 or 7-43 to 45-4, crowded and reduced before the dorsal (24-26).

Color pattern typical. The young and adult with light to dark olive on head and upper portion of body, the lower sides and venter plain; a lateral band commencing at a distinct caudal spot runs forward onto head; the dorsal in adult with a black

patch situated half way up the anterior portion of fin membrane; scales of upper portion of body plainly marked out.

The largest specimen 7.8 cms..

Heavy adults were taken until the middle of July, but spawning takes place typically in June. The mature males have the back more elevated, and tubercles arranged in four rows on the snout. The upper lip swollen in ripe males and has a barbel-like appearance.

Larval forms were taken early in June and ranged from 0.7 to 1.6 cms. in length. Late in July the smallest specimens were 2.0 cms. in length and a similar size was commonly taken in August. Yearling specimens collected in the spring were 3.5 cms. in length. Fall adults with well-developed reproductive organs and in the males with small tubercles appearing on the snout were taken during late August and September.

H.notatus was a commonly recorded species in all the watersheds with the exception of the Missisquoi and Bécancour. The single record in the latter case was made at Black Lake. In the streams it is most common and shows the greatest size variations at typically lowland levels. At the lowest stations on the Rivière des Rosiers specimens collected ranged in size from 4.0 cms. to 7.8 cms. This species ranges upstream into the lower mountainous sections where it is occasionally found in the quiet waters of pools. It is not common in the fast waters and only a few specimens are found at such localities.

This species is common in the collections from the lower level lakes of the Laurentian district. I found several adults in the marginal waters of Lake Nominingue. Specimens were collected at Cold Lake, Argenteuil Co., and from several lakes in the vicinity of Buckingham, Papineau Co.. This species has been recorded in the Lake Champlain drainage, but not to the East of the present records.

PIMEPHALES PROMELAS Rafinesque:

-------- Atkinson (4)

-------- Wynne-Edwards (51)

The body heavy and compressed, short, the depth 3.6 (3.5 - 3.8); the head heavy, its length 4.0 (3.6 - 4.3), broad, the interorbital space 2.0; the mouth subinferior, oblique, small, the maxilla lacking a barbel and not reaching to a vertical at the front of the eye, jaws subequal, the lower not included, the premaxilla protractile; the eye small, 4.6 (4.4 - 5.0); the dorsal inserted over the ventral basis, the first ray short and not closely bound to the second, its rays 1 - 8, the anal 1 - 7, the basis of each in a proportion to their height as 5 : 7; the ventrals reaching typically to the anal fin; the scales in a longitudinal row 41 to 48; the lateral line incomplete, extending only to the level of the vent or less; the teeth 0-4-4-0; the gut 1.5 to 2.5 of the standard length and with several coils obscuring the typical duodenal and gastric flexures.

Spawning males in the spring with the face coarsely tuberculated; the dorsum of the head swollen; and a thickened epidermal pad on the back reaching from the nape to the front of the dorsal fin; the dorsal bearing a black smudge along the lower half of the fin. The largest specimen a mature

male from Lac Gagnon, Terrebonne Co., 7.3 cms. in length.

Pimephales is more of a lake and pond inhabiting species than the closely related Hyborhynchus and as such is seldom recorded in the Eastern Townships, much less so than in the Laurentian region where it is one of the commonest minnows encountered by that survey.

The spawning of P.promelas has been observed several times during the course of the survey. Wynne-Edwards (51) first observed nesting males at lakes in Terrebonne Co.. Males in breeding dress were observed in the middle of June, a month later males were observed nesting. In this instance the eggs were attached to the lower surface of lily-pads. The following year the writer observed the complicated spawning manouevres necessary for the attaching of the eggs to the lower surface of an object serving for the nest. In the latter instance spawning took place on the 19th of June. The water temperature had risen markedly that day from the previous temperatures of 14 oC. to 16 oC. to 20.0 oC. Many nests came under the writer's observations. The average length of the males was only 5.5 cms..

A jar containing a collection made at Lost River, July 18th 1934, includes a nest of P.promelas in which the larvae were hatching. The length of these larvae is0.6 cms.. No record was made of the water temperature.

Our other collections are of adults only. I have no records showing the growth of this species during the summer.

Although typically a species of ponds and lakes, P.promelas is occasionally found in streams in the lowland district. Its distribution in the ponds, lakes and similar waters of the Laurentians has been mentioned. In the Appalachian district it was taken at Lac Vaseau and at Lake Aylmer (St. Francis), ~~and~~ at Black Lake and Breeches Lake (Bécancour). In the streams it was confined to brooks below the 500 foot elevation and was taken in the Ulverton River (a single female) and in several tributaries of the main stream at this point. A few specimens were obtained from the Nicolet Watershed at two small backwaters on the lower end of the River des Rosiers about eight miles from the mouth of this stream. Pimephales was collected only once from the Pike River (near Bedford) and from the Yamaska River (Gear Brook). It was not found in the Missisquoi River. A few adults were taken from the Bras R. (Chaudière). In the lower St. Francis, it was taken at the bottom of Steele Brook and at the lower end of Weedon Lake.

As suggested above, the distribution of this species in the Province is a wide one. It has been collected by the parties operating in the Laurentians, in Pontiac, Papineau and Argenteuil Cos., as well as in Terrebonne Co.. Atkinson records its presence at the Petite Nation River.

F. A M E I U R I D A E

A. Adipose fin free posteriorly, anal rays 20, supra-occipital not solidly joined to shield at base of dorsal spine, caudal fin not forked.

Ameiurus nebulosus

The present species and Villarius lacustris are the only members of the F.Ameiuridae so far reported from this Province. I have not yet obtained specimens of the latter species but it has been recorded in the St. Lawrence River in this region. Commercial fishermen who net the shallow waters of the St. Lawrence near Boucherville recognize only the one catfish-- A.nebulosus. Villarius catus (A.catus) has been reported in the Ottawa River (Billings, 8).

AMEIURUS NEBULOSUS Le Sueur:

Pimelodus coenosus ------ D'Urban (15)

Pimelodus nebulosus ------ Fortin (26)

Pimelodus atrarius ------ Anon. (3)

-------- -------- ------ Montpetit (41)

-------- -------- ------ Evermann & Kendall (21)

'La Barbotte,' 'le chat noir,' 'la barbue', Catfish, bullpout.

The body broad and heavy anteriorly, not compressed; the depth 4.0 (3.8-4.2); the dorsal contour in profile almost

straight from nape to base of adipose fin, the ventral contour curving upwards from belly to the peduncle; the peduncle compressed, its length 2.3 in head; the depth 2.9; the head broad, heavy, its length 3.4 (3.2-3.5), the inter-orbital space 2.0 (1.7-2.1) flat in adult but convex in specimens less than 12 cms.; the dorsum of head distinct from back, a slight nuchal hump present; the eye 6.0 (6.0-7.0), placed high; the mouth terminal, the gape broad, jaws sub-equal, the maxilla reduced, the corner of mouth reaching to a vertical at the posterior nostril, the lips fleshy; the maxillary barbel 1.0 in head (0.9-1.2); the dorsal inserted before ventrals, the formula 1-6, tall, its basis 3.0 (2.7-3.4) in head; the basis to the tallest ray as 10:10; the pectoral spine 2.6 (2.4-3.0) in head, its posterior edge always armed with sharp barbs; the caudal truncate; lateral line extending nearly to base of peduncle.

Specimens from light localities greyish to light red above and on both sides. The dorsal, caudal, ventrals and anal dusky; the latter uniformly dusky over the distal 2/3 of its surface. In our collections mottling was rarely obvious and then restricted to the lower 1/3 of the body.

A.nebulosus spawns during the latter half of May

or in early June in the Appalachian district. Adults taken in the St. Lawrence at the beginning of May were gravid and the spawn ran freely from the females. These specimens were small (20.0 cms.). During the last week of May at Brome Lake (Yamaska) more than a dozen large catfish both males and females were seen in a shallow backwater at the mouth of a tributary of this lake. Several were taken in a gill-net. These were from 26 cms. to 30 cms. in length and fully ripe. The bottom at this spot was of deep, fine mud. Our earliest collections of young fish were made in early July when part of a large school was taken. . These specimens averaged 1.2 cms. and were still heavy with yolk. Schooling was observed only during the first half of July. Older specimens taken at the same time were 8.0 cms. in length. Early in August, specimens averaging 2.8 cms. were taken. Other specimens obtained during the same month averaged 5.0 cms. and 10.0 cms.. By the end of September the collections of A. nebulosus range from 4.0 cms. to 12.0 cms. and up, but commonly the average length attained at the end of the first summer is 5.0 cms..

The young specimens have been most frequently taken while seining ponds and occasionally isolated pools. In these it is not uncommon to find catfish practically dominating the waters. At. Pell Pond (Pike R.) a small pond about one acre in extent connected to Selby Lake only during the rainy season, small bullpout were present in

astoundingly large numbers. Also at the top of a brook in the lower levels of the Nicolet S.W. Branch a pool similarly isolated contained large numbers of catfish. At the latter location a single haul with a twenty foot seine yielded over sixty specimens ranging from 5.0 cms. to 18.0 cms.. In this case the catfish were associated with S.atromaculatus which ranged up to 20.0 cms.. A small mill-pond at Knowlton (Yamaska) also contains large numbers of young catfish. At this place young E.niger are very common.

Characteristically such waters have an abundance of vegetation and a bottom of fine mud. At Richmond Lake young catfish are common around the shores in shallow water. In this lake specimens were found on a light, sandy bottom and were of a typical greyish red hue. We have also taken young catfish in slow brooks (Basswood Creek (Pike), Steele Brook (St. Francis), etc.) where the bottom was of stones or gravel.

The spawning congregation of the adults of this species is well recognized by local fishermen who travel sometimes thirty or forty miles to fish at some of these localities. Large catches are made at this time. On several occasions at Brome Lake I have seen fifty to a hundred specimens taken during an evening's fishing by a party of two or three people. These fish are usually small, few being longer than 20.0 cms.. Yet the species does not appear to suffer by this excessive fishing and contrary to the usual accounts of other species falling off

in numbers the catfish are not reported to have decreased in recent years.

A.nebulosus is present in all the systems visited with the exception of the Chaudière. It has been recorded at many of the still water locations we have inspected throughout the Appalachian district. It is as common in the deep lakes as the shallow lakes and ponds and from our records shows no association with any one type.

The bullpout ranges extensively both in the highland and the lowland lakes of the St. Francis. In the former it was recorded at Moffat, Magill, Silver, St. Francis, Bisby Lakes and at Lac Aux Isles; in the latter, at Brompton Lake, Lake Memphremagog, Lake Massawippi and the adjacent smaller waters. It is common in the Missisquoi System and was taken from pools and backwaters down the length of this river. It is present in Orford Lake, Eastman Lake, Long Pond, Sally Pond etc.. In the Nicolet we collected it from several small mill-ponds in the section above Richmond Lake, as well as at that lake itself. In the Yamaska, it occurs in Brome Lake and mill-ponds on tributaries to this lake. It is also present in ponds throughout this system and also the Pike System. We took our only specimens in the Bécancour water-sheds from the main river.

This catfish ranges extensively throughout the Laurentian waters and has been found in the lakes and ponds of the upper and lower levels of this district. It is present in the Rouge River (Kiamika, Nomininguе, and lakes of that vicinity etc., etc.), in the North River (Lac St.Joseph, etc.) in the Lievre River, Kinonge River (Atkinson, 4) and the Gatineau. In the Laurentian district it is not so heavily fished as in the Townships. It has been previously recorded for the St. Lawrence and is taken locally by commercial fishermen in large numbers and is boned and cleaned for the market.

F.C O R E G O N I D A E

Prosopium quadrilaterale, Leucichthys artedi and Coregonus clupeaformis have all been previously recorded in the waters of this Province. P.quadrilaterale was identified in collections made at Lake Memphremagog and the Chateaugay Lakes (Evermann and Kendall, 20) L.artedi has been recorded by Atkinson in the Petite Nation Watershed along with C.clupeaformis. The Dwylie collection from Thirty-One Mile Lake records the presence of L. artedi in the Gatineau.

Our collections in this family consist only of specimens of C.clupeaformis from Lake Megantic.

COREGONUS CLUPEAFORMIS Mitchill

---------- --- Bell (Lower St. Lawrence)
---------- --- Anon. (3)
Coregonus albus --- " (3)
---------- --- Evermann & Kendall (21)
C.labradoricus --- Cox (13)
---------- --- Atkinson (4)

Often known locally as 'smelt'. Commonly called 'le poisson blanc" a name also given to C.commersonii and L.corporalis.

The specimens from which the following description is taken were picked up dead at various points on the shores of Lake Megantic and of the adjacent Spider Lake. The

description cannot be given in full formowing to the damaged nature of the material.

The body elongate, slender, depth 4.2; head moderate, 4.5; the eye large, 4.0; the mouth small, jaws toothless, the upper jaw short, 4.0, its edge vertical when the mouth is closed, the lower jaw included; gill-rakers short, the longest only 9% of the head, 8 + 16 on each side of the first arch; scales moderate, 10-81-9; lateral line complete, straight; the dorsal with 11 rays.

The larger specimens a steel blue above, pale below; the smallest specimens showing 6 to 8 faint longitudinal bands each a row of large, faint spots on the sides of the body.

Our specimens from L. Megantic were elongate and slender in form.

The presence of this species in our waters is not commonly recognised by fishermen, being rarely taken other than by nets used illegally or for commercial purposes. Occasional accounts are heard of whitefish being taken on the fly by persons fishing for trout. In the St. Lawrence it is a common commercial species. In the inland lakes and streams it is most difficult to obtain accounts of the presence of this species in many of the waters. Both at Megantic and at Spider Lake large specimens up to four pounds weight have been taken on occasion.

The distribution of this species in the Province seems

to be restricted to the larger, deep lakes and the immediately adjacent waters of the various systems. Specimens of this species of the elongate form were taken at Ste. Jovite from Lac Ouimet (Rouge R.) by the Laurentian survey, but unfortunately lost before they could be more closely examined Atkinson (4) records it in the Petite Nation system.

F. O S M E R I D A E

OSMERUS MORDAX Mitchill:

Osmerus viridescens ---- Fortin (23)
" " ---- Anon. (3)
" " ---- Montpetit (41)
Osmerus eperlanus ---- Fortin (23)
---------- ---- Evermann and Kendall (21)

The smelt, whitefish; 'l' eperlan';

Our only collections of smelt have been of the small transparent fry. These have been collected in large numbers at the outlet of Lake Memphremagog.

The fry are first collected in July and range in length from 2.5 to 4.0 cms.. Late in August the largest specimens (7.0 cms.) commence to lose their transparency. By the end of August specimens collected ranged in length from 5.5 cms. to 8.0 cms..

A small collection of mature spring fish were sent in from Lac Brule and Lac aux Sables, Portneuf Co.. These

were taken from the outlet streams of the lakes during the latter half of April. The eleven males in the collection ranged from 10.8 to 12.0 cms., the single female was 11.8 cms..

Tubercles were present on the head, body and fins of the males, similar to the brief description by Kendall(39). The largest tubercles were present on the scales of the side of the body, and were arranged in longitudinal bands giving the appearance of a strong ribbing on the sides. On the back and on the venter these large tubercles were replaced with many smaller and more irregular ones. The tubercles on the head were largest on the dorsum and smaller on the face and throat. On the fins the tubercles are minute and restricted to the region over each of the rays. The presence of minute tubercles on the head and sides of the body of the female was shown by an examination of the sections of the skin from these regions.

Eggs have been collected by hatchery officers at Lake Memphremagog in the early spring.

The smelt is a common fish in the lower St.Lawrence. Its presence in Lake Memphremagog was first described by Evermann and Kendall (21). At Lake Megantic (Chaudière) C.clupeaformis which is found in that lake is confused with the present species.

F. S A L M O N I D A E

A.. Vomer flat; teeth on vomer alternating in one row or two; species black-spotted; scales larger, obvious.

B. Teeth few, deciduous on shaft of vomer.

Salmo salar.

BB. Teeth well developed on shaft of vomer, arranged in one or two zig-zag rows.

Trutta irides.

AA. Vomer boat-shaped, the shaft without teeth; scales smaller.

C. The vomer with a raised crest armed with teeth; caudal forked: Cristivomer namaycush.

CC. Vomer without a crest, caudal emarginate.

Salvelinus fontinalis.

(The above key is modified from Jordan, 36)

Descriptions of these species are not included in the present account. Our collections with the exception of S.fontinalis have been poor. The brook-trout and the lake-trout have been frequently recorded in the waters of this Province and range extensively in all the systems. Taylor (49) gives a brief account of the present status of fish-culture in this Province with regard to the Salmonidae which are planted in large numbers in this Province by the Hatchery Service.

SALMO SALAR Linnaeus:

This species has been seldom collected by the

field parties. It was recorded as being present in several of the deep lakes of the St. Francis systems- Lyster Lake, Lovering Lake, Bowker Lake, Lake Magog and Lake Massawippi. Its presence has been established in Lake Memphremagog, Breeches Lake and Nicolet Lake. The largest specimen was one weighing twelve pounds. This was taken in Lake Memphremagog.

A record of the presence of this species outside of the St. Francis system was the taking of specimens four inches and less from the upper Fisher Brook (tributary to Brome Lake). These had developed from eggs planted in the stream previously.

In Breeches Lake the salmon do not grow to a size larger than two pounds. The size commonly taken is less than one pound.

From the accounts of Hubbard (31), it is obvious that the salmon is an indigenous species in Lake Massawippi. Its presence in the lake prior to the installation of the dams on the outlet was well-known. Similarly it was present in Lake Memphremagog before the plantings of the hatchery services began. Since 1914 large numbers of salmon have been planted in the waters of the Townships and of the Laurentians.

TRUTTA IRIDEA Gibbons:

The rainbow is an alien species and has been introduced through the activities of the Hatchery Service. Although large numbers have been planted (Repts. of the

Prov. Hatchery Service) this species was not commonly found to have established itself. We obtained no data concerning the spawning of this species, but it is collected from some of the brooks tributary to Lake Memphremagog for use as parent fish in the hatcheries.

Our records showed that plantings in the Yamaska South Branch River, in the St. Francis System (Eaton River, Tomofobia River, Coaticook River, and Castle Creek), have been successful.

Our personal experience of T.iridea is that it is a most sensitive fish and difficult to take using a rod and line. In the majority of these streams where it grows to a large size it is seldom taken other than by netting or snaring. The writer has frequently attempted to take some of the larger fish, but although a wide range of baits and lures have been used he has not met with any success.

As shown by its position in the Yamaska System the rainbow trout inhabits the central sections of the streams. We most commonly found it in large, deep pools with a bottom of clean stones or gravel. These pools were typically well stocked with minnows and large suckers.

The few smaller specimens which have been taken were collected from small brooks. Two specimens were obtained from stagnant pools in a dry stream tributary to the Coaticook River. At Sawyerville I was shown the heads of twelve specimens which had been taken from the Eaton River. These were

fished when the water was murky following a heavy rain.

Typically these situations were of a type not suited to brook-trout and were warm water streams with little shelter.

SALVELINUS FONTINALIS Mitchill:

The brook-trout has been frequently referred to in earlier literature and is one of the most favoured of the game species of the Province.

In the Eastern Townships the areas still remaining as good trout water coincides with the timber limits of the pulp companies. Essentially S.fontinalis is a stream-inhabiting species in this district. Very few lakes remain where it is still an important game species. These lakes are Breeches and Sunday Lakes, Lyster Lake, Bowker Lake, Nicolet Lake and the smaller lakes in the headwaters of the Missisquoi and Chaudière systems.

In the streams it is seldom found exceeding a quarter of a pound. The Spider and Bergeron Rivers are striking exceptions to this. In these waters it reaches a size of two pounds and more, but the majority of the larger fish are found only in the sections close to the lakes to which these streams are tributary.

The majority of our records were of fry or finger-lings. These are common in the higher level waters in unmodified districts. The earliest records of fry were made during June. These did not exceed 3.0 cms. in length. In

late July the average range of the smallest specimens was from 2.8 cms. to 3.8 cms.. At the end of the season in the field, our collections included no specimens less than 4.5 cms..

The ovaries of the females was first noted to become enlarged during the latter part of July and early August, but the spawn did not run freely even by the middle of September when the parties left the field.

S.fontinalis matures at a small size in the streams. Specimens collected in the upper Tomofobia River during August ranged from 10.0 cms. to 12.5 cms., and the females carried an average of only 130 eggs.

It is common to find that in the best trout streams only trout are present (Upper Spider River, Mountain Brook, Rivière Grand Coulée etc.). Where these waters pass into modified areas there is typically an appearance of minnows in the stream. Collections made at the lower ends of the streams of this nature draining off the East slopes of Stoke Mountain contained large numbers of S.atromaculatus and C.commersonii. The S.fontinalis which were present were larger than commonly found further upstream where there were no minnows. In such pools the trout occupies the head of the pool and forcibly keeps the minnows to the foot of the pool.

CRISTIVOMER NAMAYCUSH Walbaum:

We did not preserve any specimens of this species. It was recorded in the larger lakes of the lower St. Francis lake district (Lake Memphremagog, Lake Massawippi, Lyster Lake etc.) but was not reported as common. It is present in Lake Orford (Missisquoi), Breeches Lake, East Lake and Sunday Lake (Bécancour) and Lake Megantic (Chaudière)

In Orford and Megantic lakes it is an important game species and at least in the latter it grows to a size of twelve pounds.

Plantings have been made in many of the waters of the Townships but generally without success. On the other hand the plantings in Lyster and Breeches lakes have been successful and many small fish are taken from the latter water but these seldom exceed two pounds in weight.

C.namaycush was not recorded in the streams.

F A N G U I L L I D A E

---------- Anon. (3)

---------- Billings (8)

Anguilla vulgaris --- Montpetit (41)

Anguilla muraena " "

---------- Rathbun and Wakeham (44)

Anguilla chryspa --- Evermann and Kendall (21)

The eel (Anguilla rostrata Lesueur) is a well known commercial fish of the waters of this Province. In the Eastern Townships we made no collections of this species although repeated efforts were made at several of the lakes in which it is present.

We have been able to verify its presence in Lake Magog and Lake Memphremagog (St. Francis), in Brome Lake (Yamaska) and have recorded it from reliable local account as present in Silver Lake, Clear Lake and Lindsay Pond (St. Francis) and Selby Lake (Pike). There can be little doubt that it is a widely spread species in the St. Francis system, but is seldom taken excepting while fishing at night for bull-pout. Its presence is not definitely known in many of the lakes in the Townships, but at least it is present in many lakes of the lower St. Francis lake districts. Large numbers are taken in the Richelieu River at St.Johns. Atkinson records its presence in the waters of the Kinonge River. It has been reported from a few lakes in the Laurentian district (Beavens' Lake, Argenteuil Co.) but we

are uncertain of its range in this area.

F. U M B R I D A E

UMBRALIMI Kirtland:

---------- Billings (8)

The body stout, little compressed, moderately elongate; the depth 4.5 (4.3 - 4.7), the peduncle compressed, its length 1.6 in the head; in profile the contours of the body smooth and little interrupted; the head heavy, the sides rounded, the dorsum flat, broad (interobital space 3.2 in head); the snout blunt, short (4.0 in head); the eye moderate, high, it's center situated 1/3 from front of head, it's diameter 3.8 (3.8 - 4.0) in head; the mouth terminal, oblique, the premaxilla not protractile, the gape moderate, the maxilla reaching to front of pupil, the lower jaw longer than upper, the dorsal situated behind the ventral basis, it's height to it's basis as 3.4, the basis 1.6 in head, the rays 14; the anal high, it's height to it's basis as 10: 7, the rays 13 or 14; the caudal, anal and pectorals rounded; the ventrals reaching to insertion of the anal fin; lateral line absent; the scales large, present on chest and belly, scales on head not reduced in size, on body 35 in longitudinal row, 11 or 12 counted between anal and dorsal insertions; branchiostegals 3 on each side (Jordan and Evermann (37) state this as 6 apparently counting both sides, in dealing with the Esocidae their counts are made for only one side)

Colour variable, dark brown to reddish brown above, bronzed on sides, a prominent vertical black bar on base of caudal two scales wide; a horizontal black bar on face from top of opercle to snout; the head mottled below, the throat and venter clear; the dorsal, anal and caudal fins dusky. The largest specimen collected was a female 8.4 cms. in length.

We have not observed the spawning of this species. Adults taken in late July (Pike River) had spawned some time previously. At the same time we obtained the smallest specimens in our collection (1.7 - 2.0 cms). Late in August the average size of the smallest specimens taken was 2.8 cms.. Gravid adults collected in September ranged from 6.2 to 8.4 cms and possessed well developed ovaries and testes. These were associated with two distinct immature sizes averaging 3.0 and 4.7 cms. respectively. The smaller is the size attained at the end of the first summer.

U.limi was taken in all the watersheds with the exception of the Missisquoi and Bécancour. The writer obtained a small specimen in the lower Missisquoi last spring. The low frequency of record in these systems and the restriction to the lowland levels in the Nicolet system show that in these waters Umbra is a species of the lowland district. Our records of the greatest abundance of this species were made at Gear Brook, Basswood Creek and adjacent waters of the Yamaska and Pike systems; Francoeur Brook, and the lowest stations on the

Rivière des Rosiers and contiguous waters of the Nicolet; the Ulverton River, St. Germain River and pools in this vicinity on the St. Francis We also obtained Umbra from pools on Steele Brook in the latter System.

Although a species characteristic of these slow waters, it is found on rare occasions in rapid mountain brooks. We obtained one record of this nature. Specimens 4.5 cms. long were taken in late fall from fast water far up a tributary of Brome Lake (Yamaska) In size and season this is distinctive from the migrating runs of the spawning fish. In view of this it was not surprising that we found U.limi in pools in marshes near Scotstown and Richmond

Essentially a species of the lowland waters it is common throughout the Eastern Plains and is frequently found in isolated pools, ponds and backwaters close to the St. Lawrence River. Although it has invaded the Appalachian highlands to a slight extent, we have no records of its presence in the waters of the Laurentian district, remote from the St. Lawrence lowlands.

F. E S O C I D A E

A The cheeks and opercles fully scaled; the pattern reticular, the sides golden, marked out with fine irregular lines, branchiostegals 16; the middle of eye midway between opercle and tip of lower jaw.

Esox niger.

A A The cheeks scaled, lower half of opercle naked, the coloration on sides of body dark green, flecked with white, caudal and dorsal mottled. Br. 15, dorsal with 14 to 16 rays.

Esox lucius

A A A Lower half of cheeks and opercles both naked, the sides striped or spotted with black.

Esox maskinongy.

In addition to above species E.vermiculatus has been recorded in the Champlain drainage (Greeley, *28*) and is present in the St. Lawrence. It was not collected in the Appalachian or Laurentian waters.

The local nomenclature applied to these species is most awkwardly tangled. Both the small pike and pickerel are termed pickerel; a large pike; a muskellunge; a large pickerel, a pike. Small muskellunge are called pike. There is no consistency from district to district of any one popular name and it is obvious that there is no appreciation of the several characters specific of each fish. Much of this is a consequence of the absence of the latter species in the highland waters.

ESOX NIGER Le Sueur:

Esox reticulatus - Fortin (24)
" " - Rathbun and Wakeham (44)
" " - Billings (8)

The body elongate, compressed, slender; the depth variable with size 7.0 (6.2 - 8.0); the head elongate, 3.4 (3 1 - 4.4) broad (interorbital space 4 5); the snout broad, depressed, its length 2.3 in head; the cheeks and opercles fully scaled, the mouth large, the maxilla reaching to front of eye, the lower jaw the longer and protruding; as in the other species the mandibles armed with canine teeth which loosen during the early summer; the eye small (6.2 - 7.5 in head), posterior but inserted before ventrals, its rays 14, the basis 2 7 in head, square, the basis to the tallest ray as 10; 11; the anal with 13 rays, its basis to its height as 10;12; the pectorals small, their length equals that of the ventrals, 2.8 in head; the peduncle 2.0 in the head, its depth 5.3 in head; lateral line weakly developed, complete to base of caudal; branchiostegals 15 or 16
The largest specimen (53 cms) was taken from Brome Lake and weighed $3\frac{1}{2}$ lbs.

The adult dark olive green above on body and head; sides of body golden, marked out with thin irregular connected lines of black to form reticular pattern on the light golden background. In the young the reticular pattern represented

by 13 to 15 irregular more or less vertical dark greenish bars branching variously above and below and joined by a few short horizontal bars. The areas between these barrings increase with size and a further linking takes place to form the adult pattern.

Esox niger featured commonly in our collections from the marginal waters of many lakes and from the lowest sections of their tributary streams

Small adults taken in Brome Lake May 19th, had already spawned. Other gravid females were taken a week later from the swampy backwater at the mouth of the largest tributary to this lake. These carried an average of 7500 eggs. The smallest specimens were obtained at Brome Lake at the beginning of July. These were 4.0 cms. in length. Late in July other specimens 7.5 cms. long were taken from Bisby Brook (St. Francis). This size and up to 15 0 cms are occasionally[1] taken in fast water brooks and were frequently recorded in the Missisquoi R.. Associated with the smaller size in lakes at this time are specimens 15.0 to 20.0 cms in length. In September small specimens collected at Richmond Lake ranged from 8.0 to 12.0 cms..

E.niger has been collected at the majority of lakes in the lower St. Francis system (Chain Ponds, Memphremagog, Magog etc) It was reported present in several of the smaller lakes of the higher levels (Coulombe, Lac Tor, etc)

It was not possible to confirm the latter accounts. It is present in the Nicolet (Richmond Lake) and was the only species found in this system. It is common in Brome Lake (Yamaska), Eastman Lake and Orford Lake (Missisquoi) and in several of the small lakes and ponds in the latter system.

Esox niger was identified at Selby Lake (Pike River). We have no records of this or the following species occurring in the Bécancour or the Chaudière Systems. Although said to be present in many of the Laurentian lakes, I have not yet obtained a specimen from these waters. It is a common species in the St. Lawrence and Richelieu Rivers, and is taken by commercial fishermen and sold on the market. A catch made in the Richelieu near Lacolle consisted of 8 of the present species and twenty seven E.lucius.

On the basis of our present data E.niger is a fish of the lower level waters and does not range far into the Appalachian or Laurentian districts With the exception of the large lakes of the lower St Francis E.niger may be considered as confined to the Eastern Plains and some closely adjacent waters.

ESOX LUCIUS Linnaeus: Fig. 14

Esox boreus?---------- D'Urban (15)

Esox estor ---------- Fortin (24)

" " ---------- Anon (3)

---------- Evermann and Kendall (21)

---------- Rathbun and Wakeham (44)

Esox estor ---------- Montpetit (41)

---------- Atkinson (4)

Form much as in the previous species; the depth 6.5 (6.1 - 6.6) in adult; the head, 3.0 (2.8 - 3.3), the lower half of opercles lacking scales; the eye small, 7.0 (6.0 in youngest); the maxilla reaching to a vertical at the front of the pupil, the upper jaw 2.0 in head; the snout 2.2 in head; the dorsal fin with 16 or 17 rays, its basis to the height as 9:10, the membrane spotted or mottled irregularly; the anal with 14 rays, its basis 3.0 in head, its basis to its height as 8:10. The youngest in July deeper bodied than the similar size of E.niger.

E.lucius may be readily distinguished from E.niger by the colour pattern in specimens more than 12.0 cms. long. The adult is dark olive on the back and sides, the latter have a greenish background flecked everywhere with small patches of white. In the young, the body with approximately 12 broad oblique bars extending from the dorsum onto the

lower half of the body. Each bar is typically thicker than the clear space to either side of it. The caudal and anal are faintly mottled. In a larger specimen(22.0 cms.) many of the intermediate clear bars remain, but all show indications of breaking up to form the pattern characteristic of this species. The largest specimen was 8¼ lbs. The largest fish taken at Lake St. Francis weighed 27 lbs.

Escox lucius has been poorly represented in our collections, although ranging more widely than E.niger

The smallest specimens were obtained during the middle of June. These ranged from 3.0 to 5.0 cms. and were collected at L. Aylmer and at L Nominingue, the latter in the Laurentians. It would appear from the time of these collections that E.lucius is an earlier spawning species than E.niger in this district. Specimens 13.0 cms in length were taken from the lower Tomofobia River. Many of the records of this species are based on local accounts, but specimens were taken at Lake St. Francis, Aylmer Lake, Silver Lake, and Lake Massawippi. It is abundant in the majority of the larger lakes on the St. Francis River, and is also taken commonly in the river itself near Drummondville. It has been recorded in Lake Memphremagog (Evermann & Kendall, 21). E.lucius was reported present in Selby Lake (Pike) but the report is unconfirmed Young specimens were taken from the lower Pike River.

E.lucius is widely spread in the Province, and is the pike most frequently taken in the St. Lawrence and Richelieu Rivers. It is present in the upper Laurentian waters of the Lievre and the Rouge Rivers. Specimens were taken at Lake Kiamika (Lievre R.) and at Lake Nominingue (Rouge R.). An additional specimen was collected at Bark Lake (Argenteuil Co.). Of the three species dealt with here, this is the most widely spread, and in being confused with the muskellunge in many parts has given an excessive range in popular account to the latter

E S O X M A S Q U I N O N G Y Mitchill:

Esox nobilior ---------- Montpetit (41)
" " ---------- Billings (8)

During the course of the survey no specimens of this species were preserved. The largest fish recorded weighed 25 lbs and was taken in the Richelieu River near Lacolle. A smaller specimen of only 12 lbs. was taken in the Pike River. The muskellunge is commonly taken in the latter system and grows to sixteen pounds. It is occasionaly taken in the St. Francis River below Drummondville At this point specimens shown the writer were definitely large E. lucius, but a small 'pike' taken at the same point on examination proved to be a muskellunge. This specimen

weighed six pounds. In the absence of other verified accounts I am unable to support the popular accounts of the presence of this species in the Appalachian or Laurentian waters, and judge it is restricted to the larger rivers of the lowland district and penetrates very little, if at all, into adjacent upper levels. 'Muskellunge' at Lake Nomininge were all northern pike, but locally were distinguished by 'la croix sur le nez' a configuration formed by the contour of the nasal and jaw bones when the mouth was opened and obviously unreliable as a diagnostic feature.

It is present in the St. Lawrence River locally and an occasional specimen appears on the market. E.masquinongy has frequently been recorded in the St. Lawrence River. It is also found in the lower Ottawa River.

F. P E R C O P S I D A E

PERCOPSIS OMISCO-MAYCUS Walbaum: Fig 15

The body elongate; depth 4.4 (4.0-4.6) greatest at front of dorsal, the back in profile with a pronounced obtuse angle at front of dorsal; in section the body widest at base forming an acute-angled isosceles triangle; the head large, 3.3 (3.0-3.6), conical, the dorsum smoothly continuous with the back; the nape naked; the mouth subterminal, horizontal, the maxilla reaching to a vertical at the center of the nostrils, premaxilla not protractile, lips fleshy; the eye moderate, 4.3 (4.4-4.6), high; the dorsal inserted above the

ventrals, 1 or 2 weak spines and 10 or 11 rays, its basis to the tallest ray as 9:12; the anal with 1 or 2 weak spines and 6 rays (5 to 7), the basis to the height as 7: 12; the adipose dorsal inserted half way between the posterior ray of the dorsal and the rudimentary rays of the caudal; the caudal forked; pectorals elongate, 1.5 in head; exceed the ventral basis; lateral line straight, complete, pores lacking on only a few scales; the scales moderate, 6 to 7 - 47 to 55 - 7 to 8.

Adults typically a light straw colour tinged with brownish above; on the sides of the body a row of 5 to 9 oblong blotches of brown along the lateral line, above this a second row of smaller irregular patches; on the back several patches which cross the midline; the lower parts of the head and body, clear.

The largest specimen 5.7 cms. long.

At all stations on the Missisquoi where this species was taken the bottom was composed of mixed sand and gravel. Associated species were C.commersonii, S.atromaculatus, N.rubellus and N.cornutus

Our collections made in the middle of June consist largely of gravid females 4.5 to 5.0 cms. in length. A few males were taken. These were commonly larger (5.7 cms.). Associated with these adults were smaller specimens 2.1 to 2.5 cms. long.

The collections of this species were all taken from the Missisquoi River West Branch and from a smaller tributary in the vicinity of Sutton. The fish were present in large numbers in several of the pools on the stream. It has not been previously recorded in the Province. Greeley (28) found it at several places in the Champlain drainage to which the present river is tributary.

F. G A S T E R O S T E I D A E

Two species of this family have been recorded by us in these waters

G.aculeatus cuvieri was taken by members of Laurentian survey at Blais Lake and at Clay Lake in the Papineau Co. It has also been recorded from the lower Kinonge River by Atkinson (4), but has not yet been found in the waters of the district to the South of the St.Lawrence. The two-spined stickleback in our records differs in its habits from the brook-stickleback. The former was reported as schooling in the open waters at both lakes where it was taken, contrasting with the restriction to the marginal region of lakes and ponds commonly described for the latter species. The majority of the specimens of the former species are parasitized, A large cestode larva is present in the abdominal cavity. The largest specimens of G.aculeatus cuvieri were 8.0 cms. long.

EUCALIA INCONSTANS Kirtland: Fig. 16

Gasterosteus gymnetes ---- Dawson (14)

" " ---- Anon. (3)

Apeltes quadracus ---- Billings (8)

Eucalia inconstans ---- " (8)

---------- ---- Atkinson (4)

The body compressed; depth 4 (3.0-4.7), the greatest depth in front of the soft dorsal; the head moderate 3.8 (3.4-4.0), sharp in profile; the mouth terminal and oblique, the maxilla not reaching to a vertical at the front of the eye, the lower jaw distinctly longer than upper, not included, the lips fleshy; the eye large, 3.3 (3.0-3.6), high and protruding; the interorbital space subequal to the eye; the dorsal fin typically iv-i 9 or 10 (rarely with the first spines reduced to iii or increased to v), the spines short and when depressed not reaching beyond the next posterior; the spine of the soft dorsal variously deflected or curved to either side of the mid-dorsal line; the anal i-9 or 10; the ventrals with one spine and a very weak ray; the skin scaleless, sides unarmored; the reduced peduncle lacking a keel, its depth two-thirds that of the eye; the lateral line incomplete reaching only to the middle of the second dorsal.

Typically the adult and young with the body a dark green to brown, reticular; the belly, throat and chin clear.

Specimens in our collections do not exceed 5.4

cms. in length, and are smaller than G.aculeatus cuvieri from Blais Lake.

Gravid females have been taken as late as July 22nd., (Pike R.) but spawning has not yet been observed by us. The smallest sizes were found late in July. These specimens were collected from a small stream blocked with weeds and averaged 1.5 cms. in length. Associated with these were adults averaging over 4.0 cms. and an intermediate stage 2.5 to 3.0 cms. in length. The commonest associations of the brook stickleback was with U.limi, the two competing in pools and small lowland streams. Variously at other locations it has been taken with M.m.nachtriebi and in marshes at higher levels with C.erythrogaster, P.neogaeus and once with advanced fry of S.fontinalis. It has also been taken at localities where S.atromaculatus, C.commersonii, and N.cornutus were present, and it has been associated with N.rubellus, H.notatus, N.chrysoleucas and others of the lowland species. We have no records showing its presence in the Missisquoi or Chaudière systems. Our records of this species in the Bécancour Waters are restricted to a single capture made at the lower end of the Palmer River.

Specimens of E.inconstans were rarely taken above the 500 ft.level, as shown by the small number of records made for this species in the St. Francis and Nicolet systems. It was recorded once at a higher altitude in both watersheds

(800ft., in isolated pools). The brook stickleback is abundant only in the waters of the lowland levels and is a common species of the smaller weed-choked brooks of the Eastern Plains. Our records of it show it to be abundant in the lower level tributary waters of the Pike, Yamaska and St. Francis systems. Although many small ponds were seined we obtained no record of the presence of E.inconstans in these waters. It was common in small isolated pools sometimes remote from any stream and in one such pool had v dorsal spines. We have obtained it from small pools in the vicinity of Montreal. It has previously been recorded as a common species in this vicinity by Dawson (14).

Although collected by Billings (8) in the vicinity of Ottawa, and by Atkinson from the waters of the Kinonge System, the only record of its occurrence in the waters to the North of the St. Lawrence which I have is a report of its presence in a small lake near St. Alexis on the Oureau System. E.inconstans is to be recognised as a common species of the Eastern Plains and does not penetrate far into the adjacent higher waters.

F. G A D I D A E

LOTA MACULOSA Lesueur:

Lota inornata ---------- Fortin (26)

Lota compressa ---------- Anon. (3)

---------- " "

Gadus lota ---------- Montpetit (41)

---------- --------- Billings (8)

---------- --------- Rathbun and Wakeham (44)

'Le burbot', 'la loche', cusk -- Local synonomy.

The following descriptions refer to specimens 5.0 to 15.2 cms. in length. It is not possible to determine the fin formulae or the scales in these specimens.

The body elongate; depth 8.5 (7.6-9.5); broadly elliptical in section, behind the abdomen the body compressed and terminating in a pointed tail; the head short 4.5 (4.4-4.9) its length decreasing from the smaller to the larger specimens, broad, the interorbital space twice the eye; the mouth large, the upper jaw reaching to a vertical at the front of the eye in the smaller specimens, to the middle in the larger specimen, the premaxilla not protractile; the eye small 6.0 (5.6-6.5) high, and situated 1/3 the length of the head from the snout; a single, obvious barbel

present below the chin, a minute barbel on the anterior narial flap; the dorsals low, subequal in height, the basis of the anterior only 1/6 that of the posterior, the formula 11-67 in one specimen; anal low and elongate; the pectorals short, not reaching to the front of the anterior dorsal; the ventrals ending at a level with the pectorals; the lateral line complete; scales minute, imbedded, present on the skin covering the fins and head; teeth villiform, present on the premaxilla, mandibles, head of the vomer and on the palatines, no lingual or hyoid teeth.

The head closely mottled; the body typically light blue-green on the back, the sides variously mottled with black; caudal, dorsals and pectorals mottled.

The largest specimen seen by us in the Eastern Townships was 74 cms. long and was found dead on the shore of Lake Memphremagog.

The cusk is a common inhabitant of large lakes of the lower level of the St. Francis (Lake Memphremagog, Lake Massawippi, Lake Magog, Moffat Lake, etc.). Its presence is seldom recognised as the fish is rarely taken other than by persons netting illegaly or using night-lines. It is also present in the headwater lakes of the Chaudière System (Lake Megantic, Spider Lake, Lac Trois Milles, Lac aux Rats Musques) and has been verified at these locations by us. In Lake Megantic it is reported that it is occasionaly taken by persons

still-fishing for grey trout. The cusk is seldom found in the rivers of this district. We have been able to verify its presence in the St. Francis River below the level of Richmond. Small specimens were taken in the lowest station of the Red River (St. Francis) close to the backed up waters of Weedon Lake.

The specimens collected by the survey are all small the largest was only 15.0 cms.. During the latter part of the summer young cusk are commonly found in ponds and shallow lakes where they are present in large numbers around the margin in the shallow water. In these places they conceal themselves under half-buried timbers and may be easily taken by hand. Collections of specimens 5.0 cms. to 7.0 cms. were made in this fashion at Lac Rats Musques and Rush Lake (Chaudière). In the adjacent Lac aux Trois Milles and Lake Megantic respectively, where bass and grey trout are common, these young sizes are rare. Several specimens of the same size were taken in August at the lower end of the Red River, a tributary of the Salmon River (St. Francis). In all cases, the young cusk were collected on a clear bottom of sand or gravel. In the latter locality these specimens were associated with P.caprodes, B.nigrum, R.atronasus, R.cataractae and N.cornutus.

Larger specimens 15.0 cms. to 20.0 cms. were seen at Moffat Lake (St.Francis). This is a shallow lake, and cusk of this size were abundant in the large weed-beds in water up to six feet deep. A similar size (15.2 cms.) was

taken in the upper St. Germain River (St. Francis). At this point the river was quite small, only eight feet to twenty feet wide and the water less than three feet deep. The young cusk was found concealing itself in thin crevices between large boulders. Shortly above this point there was an abundance of trout in the brook. Our smallest specimen (2.0 cms.) was taken at Chambly Basin (Richelieu River) May 27th, on a sandy bottom in shallow water.

The cusk is a well-known species in the Province and has been frequently recorded. It is common in the St. Lawrence and often taken in seines operated by commercial fishermen. Its presence has been previously reported for the Lower St. Lawrence and the Ottawa Rivers. We have no account of its presence in the Laurentian waters.

F. C E N T R A R C H I D A E

A. The maxilla reaching to a vertical at the middle of the eye.

B. Anal fin with three spines, scales small 75.

---Micropterus dolomieu.

BB. Anal fin with six spines, shorter than dorsal, scales large 40,

---- Ambloplites rupestris.

AA. The maxilla not reaching to the eye, the pharyngeal bones short and broad, preorbital smooth.

C. Anal fin with three spines--

---- Eupomitis gibbosus.

Our collections in the present family include only the above three species. Huro salmoides, Pomoxis sparoides have also been recorded from the St. Lawrence River in Quebec. (Atkinson, Montpetit et.al.) and Helioperca incisor and Lepomis auritus are also present in the Champlain drainage (Greeley, 28) but were not found in the present waters.

MICROPTERUS DOLOMIEU Lacepede

Centrarchus fasciatus ---- Anon. (3)

---------- --------- ---- Billings (8)

--------- --------- ---- Rathbun and Wakeham (44)

--------- --------- ---- Montpetit (41)

--------- --------- ---- Atkinson (4)

'L'achigan,' black bass, small-mouth black bass-
Local synonomy.

In view of the accepted stability of this species and the frequent previous record of its presence in this Province, it is not considered necessary to include a description of our specimens. These agree closely with the descriptions given in standard works and show no tendency to variation in any one direction away from the typical description.

Our collections contain large numbers of small specimens (4.5 cms. to 10.0 cms). We did not preserve any bass exceeding 15.0 cms. in length. The largest specimens seen by us was 43.4 cms. in length. This was taken at Brome Lake.

Bass were not seen either spawning or nesting. Specimens collected late in May were heavy, but the milt and spawn was not yet running freely. Spawning and nesting takes place during the first half of June. Our first collections of young specimens were made during the course of several years, between the 10th and 16th of July. The smallest specimens taken during that period were 2.2 cms. in length. These lacked the distinctive pink bar at the base of the caudal fin. Early in August the smallest specimens taken

averaged 3.2 cms. and were associated with larger specimens ranging from 3.0 to 7.0 cms.. In September it was not possible to distinguish any average sizes and the specimens collected ranged from 5.5 to 10.0 cms. in length.

These young specimens were commonly found in large numbers in the marginal waters of many lakes (Stukeley Lake, Tor Lake, Rush Lake and Lac aux Trois Milles were exceptionally rich in this respect). In these lakes they are most numerous in shallow water on a gravel or rocky bottom. Occasionally, as in Richmond Lake the bass were abundant on a sandy bottom. The small sizes have been frequently taken at the lowest stations on the main streams of the various watersheds and also at similar stations on brooks tributary to lakes and the larger streams. The rivers and streams at these points are characteristically wide and shallow. The bottom is most commonly of sand or small gravel and usually there are large patches of vegetation. Specimens seined at each location typically show little variation in size. Collections of this nature have been made on the lower Nicolet and Nicolet South-West Branch Rivers, the St. Francis, the Missisquoi, Pike and Yamaska systems.

Rarely small bass will be found in streams somewhat remote from any large body of water. One case of this nature was the capture of young bass at stations three miles above Richmond Lake in the Nicolet River South-West Branch. In this stream the bass were taken both from pools and from fast water and were mostly found sheltering themselves from the

current behind boulders. At this location specimens did not exceed 10.0 cms. in length, the maximum size they reach in streams.

Adult bass were never found in the rivers with the exception of the St. Francis River below Richmond. Large bass up to four pounds have been taken from this stretch. Large numbers of bass fingerlings are present in the river below this point. In view of these records of the bass in the rivers it is obvious that it would not be feasible in the absence of trout to attempt to develop the fishing of the larger streams with bass.

The large bass are essentially restricted to the lakes and are found throughout the entire area. M.dolomieu has not yet been recorded in the Bécancour system. Bass are common in the lakes of both the upper and the lower levels of the St. Francis system. The larger lakes in each case are well stocked and correspondingly heavily fished. In consequence of the ability of the young bass to ascend streams it is not surprising to find that M.dolomieu is present in the majority of the smaller lakes, of the upper St. Francis lake district, (Silver Lake, Bear Lake, Brochet Lake, Little Lake St. Francis, Lambton Lake, etc.). Its distribution in this respect contrasts with that of E.gibbosus and P. flavescans. M.dolomieu is abundant in these smaller waters but does not grow to any large size such as they do in the bigger lakes. The typical catch from the small lakes will frequently consist of thirty fish none exceeding three-quarters of a pound. Lac Brochet is an interesting example

of a small bass lake. This lake is only forty acres in superficial extent and is accessible only through several miles of dense second growth. When visited it was found that there were large numbers of small bass none exceeding 25 cms. around the edge of the lake. Similar records have been common in the case of more accessible waters.

On the other hand in the larger lakes such as Brompton Lake, Lake Memphremagog, Lake Magog, Lake Massawippi, Brome Lake and Spider Lake etc, specimens up to four and five pounds weight are sometimes taken.

The small-mouth black bass is present in the lakes of the Chaudière, Nicolet, Yamaska, Pike and Missisquoi systems. In the Chaudière system bass are present in Megantic and Spider Lake and in the majority of the smaller lakes further downstream. It is absent however from Douglas Lake and from Lac Grand Coulée which are in the center of the timber limits of the Breakey Co. and contain only trout. Both of these latter lakes are very shallow and contrast physiographically with others in this system.

The range of the small-mouth bass in this Province is extensive. It has penetrated fully into the systems of the Appalachian area with the exception of the Bécancour. It is a common species in the St. Lawrence River and is associated with A. salmoides at many points. The range of the small-mouth bass into the Laurentian district is difficult to determine. It is present in the waters of the lower

levels of the streams entering the St. Lawrence to the west of Montreal. It has been recorded in many lakes on the Rouge and North Rivers, but is patchy in its distribution in these upper waters. Atkinson records its presence in the waters of the lower Kinonge River where it is associated in one lake with A.salmoides . D'Urban (15) did not report it in Beavens' Lake (Rouge R.) where it is now commonly taken.

AMBLOPLITES RUPESTRIS Rafinesque: Fig. 17

Centrarchus aeneus----- Fortin((25)

" " ----- Anon. (3)

Ambloplites ------ ---- Montpetit (41)

---------- ------ ---- Billings (8)

---------- ------ ---- Atkinson (4)

Rock bass, Red eye bass, 'l'achigan.'

The following description is taken from specimens 7.0 cms. to 14.0 cms. in length.

The body compressed, oblong, more elongate, than in E. gibbosus, the depth 2.5 (2.4-2.5); in profile the dorsum of the head continuous with the back; the peduncle small, its depth 2.6 in head, its length 2.2; the head large 2.7 (2.6-2.8), compressed (the interorbital space 3.5 in head); the cheek and opercle completely scaled, the latter lacking an elongate fleshy extension; the eye large, its diameter 3.4 (3.3-3.5) in the head, noticeably bulging; the mouth terminal and oblique, large, the maxilla reaching to a vertical at the center of the eye, the jaws unequal the lower protruding; the dorsal fin with xi or xii spines and 10 or 11 rays, larger than anal, their basis as 3.2:2.3; the anal fin vi-10; the membrane of the spinous portion of both dorsal and anal incised between each spine; the caudal large, emarginate; the ventrals i-5, reaching to the front of the anal, a membrane joining the length of the last ray to the body; the pectorals terminating slightly before the ventrals; the lateral line complete, curving dorsally and running parallel

with the dorsal contour of the body; the scales 7-41-11 or 12, reduced before the dorsal, the belly and chest fully scaled. The pharyngeal bones elongate, in the form of an obtuse-angled scalene triangle.

The color pattern of the large adult very constant in our specimens and consisting of longitudinal stripes on the body below the lateral line each formed by the serial arrangement of a dark brown to black patch at the base of each scale; above the lateral line the body dark brownish; the head plain, the opercular patch confined to the skin covering the posterior corner of the opercular bone; the iris a deep rich red; the caudal and soft dorsal strongly barred, the spinous dorsal with black patches present on the distal border of its membrane. The color pattern of the young formed by several large rectangular patches on the sides of the body, the number increasing with the size. These distinguished it readily from the young of E. gibbosus.

Ripe males and females were occasionally taken in May and June(in the streams) and ranged in length from 7.0 to 12.0 cms.. On May 15th., a male and two heavy females were collected from a small stony bottomed tributary of the Pike. At the same location two years previously two ripe females were taken in the middle of June. The color of the heavy fish in the brooks was not remarked as brighter from the average summer coloration with the exception of a very jet black border developed on the edge of the anal fin. The male taken in May

had a color pattern intermediate between the young and the adult. The collection of young bass during the course of the summer has been confined mostly to the later months. The earliest captures of young specimens were made in mid July. These were 1.7 cms. in length. Associated with these were adults 6.2 cms. and an intermediate stage of 3.8 cms., the latter representing the size at the end of the first years growth in the streams. In September the smallest fish taken were 2.1 to 2.4 cms. long. Our largest specimens from the rivers did not exceed 10.6 cms. in length. At Brome Lake the largest specimen was 14.6 cms. long. The largest size commonly sold on the local market seldom exceeds the latter. Specimens 18.0 cms. in length were seen in the Richelieu River at St. Jehn.

A. rupestris is widely spread in the St. Francis and is found in the upper and lower lake districts of this system. We made collections of this species at Moffat Lake, Coulombe Lake, Lake Aylmer and Weedon Lake in the higher waters; at Dudswell pond and Silver Lake in the intermediate region; and at Lake Magog, Lake Memphremagog and Lake Massawippi in the lower section. It was reported to be present in Brompton Lake. It is common in the St. Francis below Richmond, and was taken from the lower sections of the majority of the brooks entering the river at this point (Steele Brook, Salmon River, etc.). It was also present in brooks at points adjacent to the above lakes. In the Nicolet system we recorded it at the lowest stations on the main streams and on the Rivière des Rosiers and Rivière des Pins. It was scattered at the lower stations on Francoeur Brook in the same system. Both adults

and young specimens were taken from the lower end of Gear Brook (Yamaska) within a hundred feet of the main stream. The rock bass is a common inshore species at Brome Lake on the same system and is frequently taken at the mouths of large inlets. In the Pike system it was found only in the smaller tributary creeks (Basswood Creek, Pearceton Brook, etc.). Small specimens were obtained from isolated backwaters along the Missisquoi River but not from the stream itself. It is common in the lakes of this system (Eastman Lake, and several adjacent ponds). It is not present in the upper Chaudière waters, and in the Bécancour system was recorded only at the lowest crossing of the Palmer River.

A. rupestris is a common species in this Province and is present in the lower waters of the Appalachian district and of the Eastern Plains. It is frequently taken in large numbers from the Richelieu River at St.John, from the St. Lawrence in the rapids near Montreal and in the Back River. Although it has penetrated extensively into the upper waters of the St. Francis system in the Eastern Townships, we did not find it in the vicinity of Lake Nomininge. Our records of its presence in the lower level waters to the North of the River St.Lawrence are few and have been confused with those of E. gibbosus. One jar contains A. rupestris 3.0 cms. long and was collected from Cold Lake, Buckingham Tp., Papineau Co.. Atkinson (4) records the presence of this species in several of the lakes of the Kinonge River. It is considered that it will be found a common species in the lakes of the lower level of this district.

EUPOMITIS GIBBOSUS Linnaeus:

Pomotis vulgaris ---- Fortin (25)

" " ---- Anon. (3)

Lepomis gibbosus ---- Montpetit (41)

" " ---- Billings (8)

------- ------- --- Rathbun & Wakeham (44)

------- ------ ---Atkinson. (4)

'Le lapelin,' 'le crapet', sunfish, punkin seed.

The body short, compressed and oval in profile, its depth 2.8 (2.8-30) greatest at middle of body; the peduncle oblong, short, its length 1.7 in the head; the head small, its length 4.0 in adult (3.0 in young) the snout sharp in profile; the preorbital smooth; the cheek and opercle fully scaled; the opercular bone not forming the ear but extended by broad fleshy margin; the posterior margin of the dorsal limb of the preopercle vertical in adult; the eye small, 4.7 (4.7-4.9); the mouth terminal, oblique, the upper jaw short its length 3.4 in head, the maxilla reaching to a vertical at front of eye, the lower jaw included; in correspondence with the short head the pharyngeal bones short, the body of the bone broadly quadrangular, teeth obtuse; the dorsal x- 11 or 12, the longest ray 1.8 in head; the anal iii - 9 or 10, its height equalling that of dorsal, its basis to that of dorsal as 1:2.4; the pectorals reaching to a

vertical at the front of the anal; ventrals not reaching to anal; the caudal emarginate; scales 7-44 to 46-13 to 14, markedly deeper than long on body; lateral line complete, its course paralleling the contour of back.

Our largest specimen 15.0 cms. long.

The form changes considerably during growth. The body increases much faster than the head. In the young at 5.0 cms. the head is 3.0 in the body; the eye at the same stage also larger, 3.0 in the head. A noticeable feature is the turning of the dorsal limb of the preopercle from an oblique position in the young to a vertical in the adult.

The coloration brilliant; the body and dorsum of head olive to black; the belly greenish to bronze; the sides of body with the scales centered with orange, longitudinal bands when present irregular; the cheek and opercle variously marked with curving bands of orange interspaced with blue to purple; a series of blue scales below eyes; the ear with a large black oval extending onto the fleshy flap, the lower portion of the rim at margin of flap red. In the young the pattern on the body consisting of 8 to 10 well-defined narrow vertical bars.

Spawning sunfish were not observed. Heavy males and females were taken during the last week of May at Brome Lake. Our records of the growth of this species are incomplete, a result of the general absence of the smaller sizes from the streams. At the latter end of July we obtained two sizes 4.6

cms. and 8.7 cms. at the outlet of Selby Lake. In September we obtained specimens 2.8 cms. in the Nicolet System. This constitutes the growth at the end of the first summer.

Eupomitis gibbosus has not been taken very frequently by us but is a common species in the marginal waters and flooded brooks of the lakes and ponds of the lower levels.

It is a common species in Brome Lake (Yamaska) and has been collected from Lake Memphremagog, Lake Magog, Lovering Lake and adjacent waters in the lower St. Francis. We have no record of its presence in the upper St. Francis lakes. We found this species abundant in Selby Lake (Pike). It is also present in the Missisquoi waters and was taken at Eastman Lake, Long Pond and Orford Lake. Our only specimens in the Nicolet systems were obtained from an isolated pond close to the river below Asbestos.

E.gibbosus is abundant only in shallow weed-filled bays and in the backwaters and swampy ends of the inlets to these lakes. In such situations we have frequently taken large numbers while fishing for perch. Our largest specimens were taken in a shallow backwater at the mouth of a stream entering Brome Lake. We have obtained some specimens from weed beds in the shallow open waters of Brome Lake.

This sunfish is widely spread in the Province but is confined to the lakes of the lower levels and to the wide, slow, tributary waters adjacent to these lakes. We have

obtained specimens near Montreal in the St. Lawrence, and from the Richelieu River where large numbers are taken along with A.ruprestris. The collections made in Buckingham Tp., Papineau Co. contain many young sunfish and form our only records from the Laurentians. We did not obtain this species in the waters of Labelle, Terrebonne, or of upper Argenteuil Co.. Atkinson (4) records it in the Petite Nation waters.

F. P E R C I D A E

A. Lacking canine teeth on the jaws.
---- Perca flavescans.

AA. Canine teeth present, the pyloric caecae three or four, subequal and nearly the length of the empty stomach.
---- Stizostedion vitreum.

Both P.flavescans and S.vitreum have been frequently recorded from these waters. S.canadense and S.griseum have been recorded from the St. Lawrence (Fortin,25, Montpetit,41) but neither were found in the Laurentian or Appalachian waters by the survey parties. It has generally been difficult to determine the synonomy of S.vitreum in the previous literature.

PERCA FLAVESCANS. Mitchill.

---------- D'Urban (15)

---------- Baird Coll. (6)

---------- Fortin (24)

---------- Anon. (3)

Perca Americana -- Billings (8)

---------- Rathbun and Wakeham (44)

Perch, 'le perche, 'le perchaude' ('perche jaune') - local.

The following description is included in view of the recognised variability of this species. Specimens have been collected over a wide range. No significant variation was noted in our material, and no indication was found of a

consistent variation away from the typical descriptions. The following data is taken from specimens ranging in length from 9.0 cms. to 18.0 cms.

The body elongate, compressed, varying in profile with age, the greatest depth below the anterior third of the spinous dorsal 4.0 (3.6-4.3); the peduncle 2.2 in head; the head sharp in profile, moderate, its length 3.5 (3.3-4.3), the snout 4.0; the cheek and opercle scaled, the latter ending in a sharp spine; the preopercle serrate behind, the teeth large on the ventral limb; the eye small, 4.6 (4.0-5.0): the mouth terminal, oblique, moderate, the maxilla not reaching beyond the center of the eye, the premaxilla protractile, the lower jaw included; the upper jaw 3.0 (3.0-3.6) in head; the dorsal with xii to xiii - ii or iii 12 to 14 spines and rays; the spinous and soft dorsals contiguous or but slightly separated; the basis of first dorsal equalling the head, the highest spine 2.0 to 2.4 in head; the soft dorsal basis 1.5 in head, its height 2.5; the anal ii - 7 or 8, its basis variable, 2.2 to 2.6 in head, its height 2.0; the pectorals 2.0 in head, not reaching beyond the ventrals, the latter not reaching to the vent; the scales slightly variable, 7 to 9 - 58 to 60 - 12 to 14; lateral line complete.

The colour of the species varies considerably with the size and the water inhabited. In smaller cold lakes the perch commonly adopts a greenish-blue tinge, in warmer waters it is bright yellow and the fins touched with red. The pattern however varies little and is typically formed by seven to nine broad vertical bars of black extending from the middle of the back onto the lower half of the body. These are present and readily identify the young even at a length of 3.0 cms.. The lower fins in the adult vary from a bright red to dusky. The membrane of the spinous dorsal is commonly dusky and often bears a distinct black patch on the membrane behind the last three dorsal spines.

P.flavescans spawns early in the spring. Specimens collected at Brome Lake in the middle of May had already spawned. I was informed that in this locality large runs of perch were seen in the middle of April entering the larger tributaries of this lake. The collections made during the course of the survey although large in number have rarely contained small perch earlier than the latter half of July. During this part of the season specimens averaging 3.5 cms. were taken in the larger rivers, backwaters of smaller streams, shallow bays and the marginal waters of lakes. From this material it is not possible to give any description of the growth of this species. During the summer, from June to August, perch 8.0 cms. to 15.0 cms. commonly school in the

morning and evening at the surface of many lakes(Nomininguo, Brome, etc.).

P.flavescans is restricted in the streams to larger rivers and to the lowest sections of brooks entering lakes. In lakes it is commonly found schooling in large numbers near weed-beds and in shallow water. The largest sizes taken were obtained near bars in the open water.

Our collections of perch are complete over a wide range. It is a common species in the upper and lower lake districts of the St. Francis system and is more frequently found in the larger lakes than in the smaller. In the upper district it was found in Lake St. Francis, Lake Aylmer and Weedon Lake. It was not present in the smaller lakes remote from these and does not exhibit any great ability to spread itself into highland waters other than along paths of little resistance. We did not obtain any specimens in the Chaudière lakes, the single record of this species in that watershed being of a small specimen in a backwater of the river. No specimens were found in the Bécancour or Nicolet systems. It is a common species in the Missisquoi and was found at Orford Lake, Eastman Lake and in many of the small lakes of the headwaters of this system, contrasting in this respect with similar lakes of the St. Francis. Large numbers of small specimens (5.0-7.0 cms.) were taken at the lowest station on the Pike but it was not common in the river above this point. Our collections from the Yamaska were all made at Brome Lake where this fish is present in large numbers.

During July and August there is a high mortality of the species in this lake and large numbers die and are washed up dead onto the shore.

P.flavescans is also a common species in the Laurentian lakes and has been found in lakes on the North River (L.St.Joseph), Rouge River (Kiamika, Nomininguе and other small lakes of this district), Petite Nation River, Lievre River and in several lakes on the Gatineau. It is not present in the majority of smaller lakes or ponds. Atkinson (4) records it in the Kinonge River.

The perch is a well-known species in this Province. The abundance in which it is commonly found and the ease with which it is taken brings it to almost immediate attention at any lake which is fished. It has been frequently recorded from the St. Lawrence and the Richelieu and during the winter months it is one of the common commercial fish.

STIZOSTEDION VITREUM Mitchill:

----------Billings (3)

'le dore','pike', 'wall-eyed pike' etc.--- Local.

S.vitreum is represented in our collections by one adult 33.0 cms. long and two collections of immature specimens 10.0 cms. and 14.0 cms. long. The following description and proportionate measurements are taken from these specimens.

The body elongate, 5.0 (in the young 6.0), moderately compressed, the dorsal and ventral contours in profile not markedly broken; the head long (3.3-3.5), compressed, sharp in

profile; the snout long 3.5; the eye moderate 6.0 (5 in the young), situated high; the gape large, the maxilla reaching to a vertical from the middle of the eye; the bones of the upper and lower jaw and of the palatines bearing strong canine teeth, smaller teeth present on the head of the vomer. The bones of the head little armed, the preoperculum obviously serrate behind on its vertical limb and with four strong spines concealed by the flesh at the corner and on the lower limb; the dorsals not contiguous; the spines typically xii, the rays 19 to 20, a black patch covering the whole of the membrane behind the second last spine of the dorsal to the base of the fin; the anal, ii-12; the pectorals in the young reaching to the middle of the first dorsal; the ventrals not reaching to the end of the first dorsal; the scales small, 10 to 12-86 to 91 - 14 or 15; the lateral line complete, straight with only minor deflections in its course. Pyloric caecae 3 in these specimens, subequal, their length nearly that of the empty stomach. The cheek and opercle in the adult clad with fully developed scales, a bare patch present on the upper posterior portion of the cheek; in the young both scaleless, a few scales present only on the upper border of each.

The young straw colored, with seven or more vertical oblong patches of brown on the sides of the body variously crossing the lateral line and fusing with asymetrical patches on the back; the spinous dorsal generally black but with a

dense patch on membrane of last two spines; the patch at base of pectorals indefinite in the young.

S.vitreum is one of the commoner freshwater commercial species and is taken in large numbers for the market. In many waters it is fished by residents for food and is frequently taken by still-fishing with live bait or by trolling along on the edge of weed beds. Large numbers of young fish (15.0 cms, to 25.0 cms.) are taken by illegal netting in Lake St.Francis, and are used for bait for large pike. Although the young typically live in the marginal waters of such lakes with the exception of a specimen from Coulombe L. small specimens were taken while seining streams within a hundred yards of the open waters of Lake Aylmer and close to the St.Francis River near Richmond These were taken from shallow pools over stony bottoms. The smaller size averaging 7.5 cms. were taken in August in Bury R., the larger size 11.5 cms. in late September from Steele Brook. In both cases the fish were common in the lower end of the stream and were absent from adjacent similar waters. Adults are present in the St. Francis River in the vicinity of Drummondville and large specimens up to five pounds are taken in fast water below the dams of the hydroelectric installations. We were informed of the presence of this species in Moffat, Magill, Bolduc Lakes on the St. Francis system but were unable to verify the accounts. It is also said to be present at Selby Lake (Pike).

S.vitreum was seldom recorded in the southern lakes, its distribution being confined to the St. Francis River and the larger of the lakes in this system; Lake St. Francis, Lake Aylmer, the shallow Lake Weedon, Lake Memphremagog, etc. Although little reference is made to its presence in the waters of the Laurentians by fishermen, it is very common in some lakes of that area, though so far as it was possible to determine the distribution in the north is confined also to the larger waters. Many small specimens averaging a pound in weight were seen taken from Lake Kiamika on the Lievre River, by fishermen from Labelle Co.. These were associated with E.lucius , the two being commonly found in the same lakes.

F. E T H E O S T O M I D A E

A. Lateral line complete.

B. Premaxilla protractile; gill membranes broadly connected; scales on mid-line of belly normal.

Boleosoma nigrum.

BB. Premaxilla not protractile; the snout sharply pointed; scales of mid-ventral line enlarged and spinous; gill membranes narrowly connected.

Percina caprodes.

AA. Lateral line incomplete

C. Tallest spine of anterior dorsal only 1/3 height of tallest ray; gill-membranes broadly connected; lower jaw protruding.

Catonotus flabellaris

CC. Dorsals of almost equal height; gill-membranes only narrowly connected; lower jaw included.

Poecilichthys exilis.

PERCINA CAPRODES Rafinesque:

--------- ---------- -- Baird Coll. (6)

Etheostoma Semifasciata -- Anon. (3)

--------- ---------- -- Billings (8)

'Bottom pike', in many places erroneously believed to be the young of the dore.

The form elongate, moderately compressed; the depth 5.5 (5.4-6.2); the dorsum of the head and back little separated; the back not elevated; the peduncle equalling the head 1.1, its depth in the head 1.7; the head 3.9 to 4.0, terminating in a sharp pointed snout; the snout extended beyond the mouth, its length 2.8 in the head; the interorbital space 3.5 in the head; the eye large, 4.0 to 4.6 in the head; the mouth inferior, oblique, small, the maxilla reaching past the nostrils but not to a vertical at the fromt of the eye; the spinous dorsal long 0.9 in the head, the tallest ray 1.9 in head; the soft dorsal basis 1.3 in head, its tallest ray 1.7; the dorsal with xii to xiv spines and 13 or 14 rays, the two fins contiguous; the anal basis 1.9 in the head, with ii spines and 8 to 10 rays; the pectorals equalling the head and terminating before, or level with, the tip of the ventrals; lateral line complete, straight; the scales 6 to 9-65 to 85- 9 to 14.

The belly with large spinous scales along the midventral line, some lacking in older specimens; the cheek and opercle scaled, or with scales lacking on the lower half

of the cheek; breast and nape naked.

The color pattern is similar to that illustrated for P.c. semifasciata Dekay (as the older P.c.zebra is now termed, Hubbs, 33). It consists of a series of narrow vertical bars on the body which extend from well below the lateral line and continue up onto the back. There is a very distinct round spot of black on the base of the caudal.

Adults of this species were seen spawning in fast water over a gravel bottom during the first week of June. The water temperature at this location was high, 25.0 oC.. This observation was made at the foot of the Maskinonge River (St.Francis) shortly above Lake Aylmer. Large numbers of adults were present. The males could easily be distinguished from the females by the smaller size of the latter. The males were seen to congregate in groups of ten to twenty and to loosen the gravel with their bodies. Their behaviour was similar to that described by Reighard (46). A few cases of a single male and a female spawning together were observed, but generally the females spawned with a group of males. The following morning the fish had left the stream.

Percina caprodes has not been taken very frequently, and the majority of our records are based upon less than five specimens. In the streams it occupies only the lower sections of the watersheds or tributary brooks and is seldom found at any distance from a large stream or a lake. We have not collected any specimens from the lakes or ponds. Typical locations at which we have taken this

species are the foot of the Nigger River, the lowest station on the Salmon River, and in the Nicolet system in pools on the main stream. These locations characteristically had a clean sandy bottom.

Percina caprodes has previously been recorded for the Province. I have collected specimens from the Lake of the Two Mountains near Montreal. Several small specimens were taken from a brook at Lac Clair in lower Papineau Co.. This species is present in Ontario (Dymond, 17) and in the Champlain drainage (Greeley, 28).

BOLEOSOMA NIGRUM Rafinesque :

Boleosoma olmstedi ---- Baird Coll (6)

--------- -------- ---- Billings (8)

The body elongate in immature specimens to heavier in adults; moderately compressed; the depth 5.0 (4.5 - 5.3); the head heavy, decurved in profile, its length 4.0 (3.6 - 4.4); the interorbital space narrow, 6.0 in head; the snout blunt, its length 3.3; the mouth situated at the lower angle of the snout, horizontal, the maxilla reaching to a vertical at front of eye; the eye moderate 4.0 (3.4- 4.5) high and protruding;the dorsal fins with viii or ix spines and 14 (12 to 15) rays; the height of first dorsal in mature specimens only 1.6 in head, its basis 0.9 to 1.0; the tallest ray of second dorsal 1.2 to 1.5 in head; the basis of second dorsal equal to length of head;

in specimens with the largest fins it is not possible to raise the entire length of the dorsal by pulling on the front ray; the anal basis 1.8 in head, with i spine and 8 to 10 rays; the pectorals terminating level with the tip of the ventrals in young specimens, in mature adults reaching to the anus; the ventrals reaching to a vertical at division between the dorsals; the lateral line complete; the scales 4 or 5- 48 to 52- 7 to 9.

The nape naked or partly scaled at base of dorsal, never completely scaled; the cheeks commonly naked, or occasionally with a few scales back of the eye, or (most rarely) completely scaled (Pike River); the opercle partly or fully scaled, occasionally with the scales only incompletely developed; the breast naked.

So far as it is possible to determine all our material consists of the subspecies B.n.olmstedi (Storer). In the smaller forms the typical large development of the fins is not obvious. In the mature adults the dorsals, anal and caudal are colored lightly with black; the first dorsal has an obvious black patch on the front of the fin; the second dorsal is faintly marked with many lighter wavy lines. The body in these specimens is almost unmarked. The tips of the rays of the pectoral and ventral fins are swollen.

We have not observed the spawning of this species. Gravid adults were taken only during the latter half of May, not later. The smallest specimens were first collected late

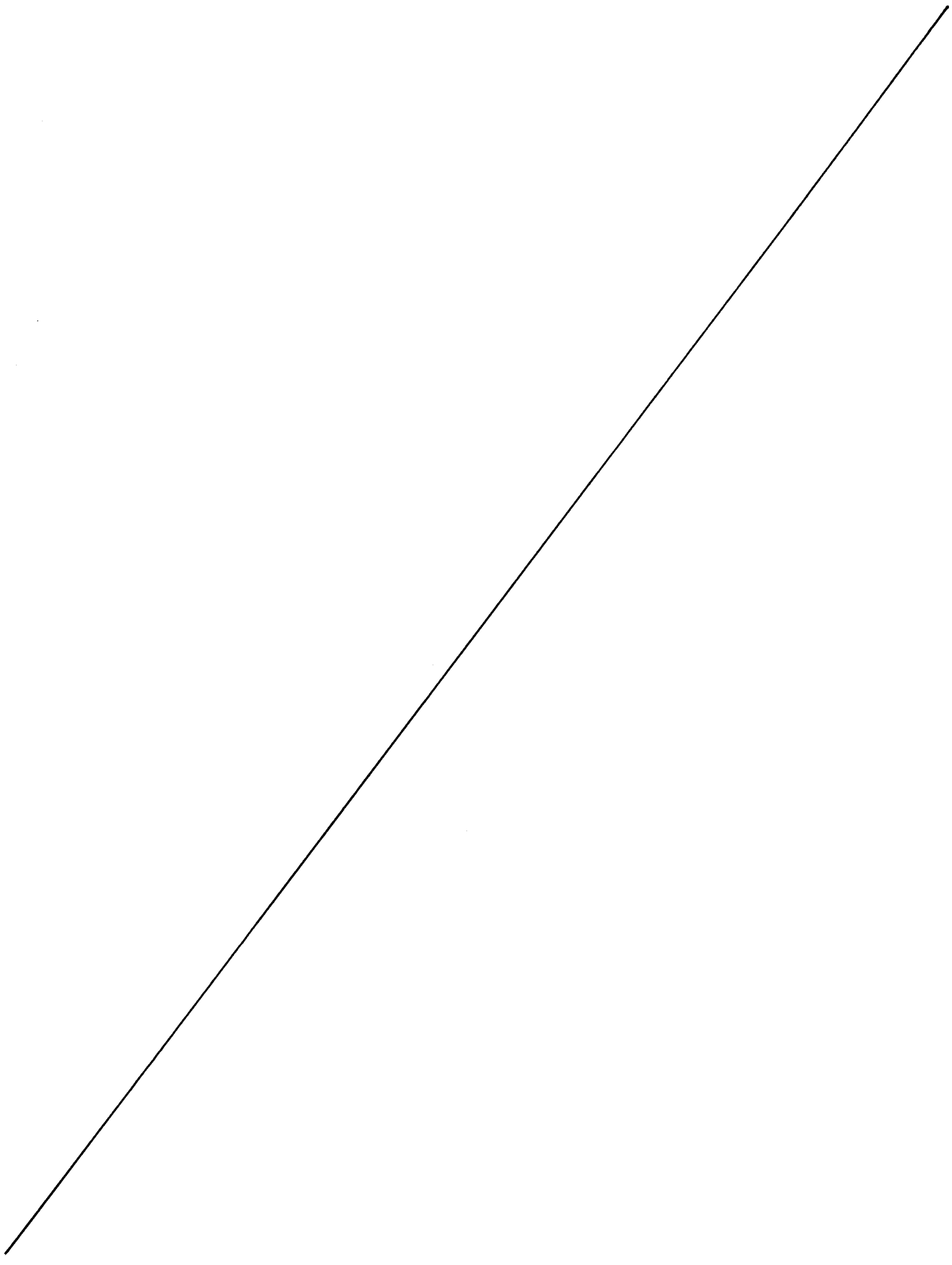
in June and were then 1.2 to 1.6 cms. in length. These are characteristically translucent and were taken only on a clean sandy or coarse gravel bottom. The latest collection of similar small specimens was made towards the end of July (Yamaska). In September the smallest specimens collected ranged from 2.5 cms. to 3.0 cms.. Adults with the ovaries and testes well developed were taken only in September.

B. nigrum was the most commonly recorded of the darters in the streams and also was taken quite commonly from the marginal waters of lakes. It is most commonly associated with a clean gravel or sandy bottom, but is occasionally found in mud-bottomed stretches. It is the typical darter of the lowland stretches of the larger rivers and frequently occurs in great abundance in the shallow slow sections of this level.

B.nigrum ranges more freely in the watersheds than do the other darters and is found associated not only with P.caprodes in the lowest stretches but ranges upstream and is associated with C. flabellaris. The latter two species have been found associated at one locality, the abnormally terminating Salmon River.

B.nigrum has been collected in all the watersheds of the Eastern Townships and has been collected at a few of the lakes in lower Papineau Co.. It is also present in the St.Lawrence in the vicinity of Montreal. Greeley (28) has

recorded this subspecies in the Champlain drainage, and it is common in the Lake Ontario basin in Ontario. This water is also the eastern limit of the subspecies B.nigrum which replaces B.n.olmstedi in the more westerly waters (Hubbs, 33).



CATONOTUS FLABELLARIS Rafinesque:

Catonotus flabellatus ---- Baird Coll. (6)

The body moderately elongate, the depth 6.0 (5.7-7.0), little compressed; the head naked, elongate, sharp; the dorsum of the head and the back almost continuous in profile; the head 3.5 (3.2-3.7); the mouth terminal and oblique, the maxilla reaching to front of the eye; the jaws subequal, the lower not included; the eye moderate, little protruding, its diameter 4.0 (3.7-4.3) in head; the anterior dorsal not exceeding 1/3 the height of the second dorsal; the spines of the first dorsal,viii, in the male distinctively padded at the tip; the second dorsal with 12 or 13 rays; the anal fin short, its basis 1.6 in the head; the anal with ii spines and 8 rays; caudal bluntly rounded; the lateral line incomplete, straight, terminating below the second dorsal; the scales moderate, 7 - 49 to 54 - 7; a conspicuous black patch at the shoulder.

The pattern on the body essentially nine to eleven short broad vertical bars variously branching above and continuous with large square patches on the back which do not cross the mid-line; the pectorals, second dorsal and caudal distinctly barred; the pads on the first dorsal, a bright orange.

The spawning of this species was not observed. Gravid females were common in our collections during May and early June. The smallest specimens were collected during the middle of June and were 1.6 to 1.8 cms. in length. (Pike) Even at this size they are more dense than the translucent young of B.nigrum. By September the smallest specimens had grown to a length of 2.5 cms. and were typical in form and coloration of the older immature sizes.

C.flabellaris was collected in the Pike, Yamaska, St. Francis and Nicolet Systems. The frequency of record closely parallels that of B.nigrum and the two are commonly taken at the same stations. The largest collections of C.flabellaris are typically made in the lower waters of the intermediate sections. Other records showing its presence in the lowland sections were for the greater part based only on one or two specimens. In the streams of the lowest levels it is found in a similar section of the tributary to that which it occupies in the main stream. It was not collected in any of the lakes, and in this respect differed from B.nigrum.

C.flabellaris has not yet been collected in the Laurentian waters. The present range of this species so far as it is known is that it is present in the 'vicinity of Montreal' (Baird Coll.) and in the western waters of the Townships. It is present in Ontario (Hubbs,33) and in the Lake Champlain drainage (Greeley,28).

POECILICHTHYS EXILIS Girard:

Etheostoma boreale ------ Jordan (35)

The form moderately elongate, the body slightly compressed, the back little elevated, dorsum of head and body almost continuous; the depth 5.4 (5.0-5.6); the peduncle compressed, its length 0.9 to 1.0 in the head, its depth 2.6 to 2.8; the head blunt, its length 3.6 (3.2-3.8), narrow (the interorbital space 5.0 (4.7-5.1)); the snout abruptly decurved; the mouth little oblique, the maxilla reaching the front of the eye, the premaxilla not freely protractile but bound medially by a narrow strip of flesh to the head; the eye moderate 3.7 (3.3-4.0); the dorsal fins with ix spines and 11 or 12 rays; the basis of the first dorsal 1.4 in the head, its tallest ray 2.0 to 2.3; the basis of the soft dorsal 1.7 in head (approximates the tallest ray); the anal with ii spines and 7 or 8 rays, the first spine the stronger; the pectorals terminating approximately with the tip of the ventrals, the ventrals not reaching to the vent; the caudal bluntly rounded to slightly emarginate; the lateral line incomplete, terminating below the second dorsal, straight and not obviously deflected anteriorly; the scales 5 or 6 - 56 to 59 - 7 to 9; the cheeks mostly naked (in some specimens with fully developed scales in one or two rows rimming the orbit); the opercle fully scaled; the nape and breast naked.

A humeral 'scale' present and marked with black in life. Examination of transparent preparations of this specimen shows the presence of small, incompletely developed scales on the cheek which cannot otherwise be observed. The coloration closely resembles the description of Dymond (17) for this species in Ontario waters, and is similar to the illustrations of Forbes and Richardson (22) and Greeley (28).

The largest specimen 6.2 cms..

These specimens were distinguished from others collected in the vicinity of Montreal by Mr. G. Prevost which have the cheeks completely scaled but the two are otherwise indistinguishable The latter specimens were taken from a quarry and are somewhat emaciated. They do not show the low dorsal fins described for P.boreale by Jordan (35), but have the black humeral spot present. Otherwise they closely resemble the descriptions of P.exilis. Hubbs has taken P.exilis from the St. Lawrence River near Prescott (33), and Greeley records it in the Champlain watershed.

P.exilis has not been taken very often by us. Until the collection was made at Black Lake it was represented by not more than a dozen specimens. These had been collected from tributaries of the St. Francis in the lower lake District. Four specimens were collected from a small inlet at Webster Lake. Two specimens were taken from the lower Salmon River, and six small specimens were collected at the top of Key Brook.

It was reported as present in the Nicolet River, but no specimens were taken.

The largest collection of this species was made while seining in shallow water over a sandy bottom at Black's Lake (Bécancour). A single specimen was taken at East Lake (Bécancour).

This species is widely spread in the Townships but has a restricted distribution. The presence of this species in the Bécancour system is the most easterly record so far made. It is a common species in the Great Lakes region.

F. C O T T I D A E

A. With the ventral rays four, palatine teeth present and symmetrical on the palatines.

---- C.bairdii bairdii.

AA. Only three rays in the ventral fin, palatine teeth lacking or if present weak and not symmetrical on both sides.

---- C.cognatus.

The majority of our collections of the species of this family are of C.cognatus, C. bairdii bairdii was taken only in the Chaudière system where it was associated with C.cognatus at one of the three localities.

COTTUS BAIRDII BAIRDII Girard: Fig. 18

The body heavier and more squat forwards than in C.cognatus; depth 4.5; peduncle 2.3; the head heavy, 3.3 - 4.2, in profile the dorsum of the head of the mature specimen rising more evenly to the nape and smoothly continuous with the back; the eye large, 3.0 to 3.5; protruding, set high on the head; the interorbital space narrow; the mouth large, the maxilla reaching to a vertical at front of eye in one specimen and to center of eye in the second, the lips fleshy; teeth present on premaxillae, mandibles, head of vomer and a short row on each of the palatines, teeth on the palatines symmetrical on both sides; the armature of the head as in C.cognatus, in

our specimens the actual spine of the preopercle curved dorsally rather than deflected as commonly in C.cognatus; the fins pliable and less fleshy than in the latter species, the dorsals contiguous viii - 17, the anterior dorsal ½ height of posterior (6:10), their basis in a ratio of 5:8; the anal with 13 or 14 rays; the ventrals distinctly i-4, the spine reduced and concealed in the fleshy edge of the fin, ventrals not reaching to end of first dorsal; the skin with an hispid patch below anterior end of lateral line, otherwise naked; the lateral line ending midway along second dorsal or near its end. The distance from vent to tip of snout in largest specimen 3.0 cms., from vent to base of tail 2.9 cms., from vent to distal end of tail 4.1 cms. (subspecies C.b. bairdii (Hubbs, 32,p.75). Our largest specimen only 5.9 cms. long.

The color greenish, the pattern tending to large patches but little divergent from that of C.cognatus. The present specimens with a distinct reticular pattern on the head and ventral aspect of the body posterior to the anus.

Superficially this and the next species are little divergent in appearance C.b.bairdii may be distinguished by the more squat form of the body, the shorter peduncle, the larger eye, and by the presence of four well-developed rays in the ventrals.

C.b.bairdii was taken at only three stations in the Chaudière system. A single specimen was seined from the lower Kokombis River (Tributary to the Nebnellis), and two specimens from the Bras R.. In two cases the habitat was indistinguishable from that typically occupied by C.cognatus, Associated species were C.commersonii, S.atromaculatus and R.atronasus. In the third case the locality was quite dissimilar and C.b.bairdii was taken from below a log in a shallow pool with a bottom of mud situated on a short tributary of the main stream (Bras R.). Associated at this latter station was only a large trout, (S.fontinalis, 6.0 cms)

A small specimen 4.5 cms. long was collected at Baie D'Urfe, in the vicinity of Montreal by Professor Wynne-Edwards. This was also the subspecies C.b.bairdii. Hubbs mentions that he has examined specimens of this species from Quebec and found them not divergent from the typical form of the Great Lakes region. He gives no record of the locality at which his specimens were taken.

COTTUS COGNATUS Richardson: Fig. 18

Cottus gracilis ------ Anon. (3)

---------- ------ Billings (8)

Uranidea gracilis ------ Cox (13)

The synonomy of this species in much of the early literature is difficult to determine.

Body elongate, depth 5 (4.5 - 5.4), rounded in section, the greatest width immediately behind the head, tapering smoothly to the tail; a nuchal hump obvious in the young and the majority of adults; the ventral surface almost flat between the chin and the base of the caudal; the dorsal contour of head rising sharply to the nape, the back curving smoothly to peduncle, the latter 1.7 in head; the head large its greatest width nearly equalling its length, the length 3.6 (3.4 - 4.0); the eye 4 (3.8 - 4.5) high and protruding; the mouth wide, maxilla reaching beyond the vertical at the front of the eye but not back of the orbit; the lips thick and fleshy; preopercular spine short, thickly covered with skin, deflected dorsally, often preceeded by one or two minute spines or even (rare) with the ventral edge serrate and the tip divided; the teeth strong and in broad bands on the premaxilla and mandible, a smaller band on head of vomer, typically no teeth on the palatines rarely one or two but not duplicated on both sides. The fins pliable, fleshy, the rays and spines covered; the dorsal vii or viii - 16 to 18, the two sections contiguous or nearly so, the anterior fin only one half height of the posterior in the mature adult, their basis in a ratio of 4:8; the anal, 12 less commonly 11, its basis slightly less than that of the second dorsal; the pectorals large, when turned forwards reach to front of head, exceed length of ventrals; ventrals, i-3 the spine very small only half the length of the first ray and

concealed in fleshy edge of fin; the lateral line terminating near the center of the basis of the second dorsal; the skin scaleless, smooth with the exception of a triangular patch of prickles in the axilla extending onto the side of the body; minute tubercles on the head of adults of both sexes. The largest specimen in our collections 9.0 cms. long.

Coloration plain, generally brownish to red and variously closely marbled or mottled with black, the dorsal fins bordered with bright orange in adults, the ventral surface of body behind the anus clear and not reticular. Very young specimens straw coloured, unmottled.

Spawning of the present species was not observed and females heavy with eggs were seldom taken even in September. Young specimens were not commonly encountered, but our records show that specimens 1.2 cms. long were taken in the Missisquoi R. in early June Towards the latter end of July the smallest specimens were 2.0 - 2.8 cms long. These were translucent and of a light straw colour Sizes intermediate between the above and the adult were commonly taken at all times during the season. The youngest specimens were invariably taken on a bottom of stones or gravel and in water only a few inches deep

An adult taken by hatchery officers was feeding on trout eggs.

C.cognatus is typically a fish of the fast waters and was most frequently recorded from the intermediate sections of the smaller tributary brooks. The majority of our records show that this species is most commonly taken on a stony or gravel bottom. Less frequently we obtained it at localities where the bottom was of sand. It conceals itself below small boulders, stones, ledges of rock or beneath sunken timber at points where these are clear of the bottom by one ot two inches only. It was present in large numbers only in a few brooks (Red River, Haseltine Brook, Ruiter Brook). Such situations were characteristically at the edge of a modified section on these streams. In unmodified sections of streams C.cognatus was not found in large numbers at any one spot, but was taken a few specimens at a time scattered over the greater part of the system (Salmon River, Chaudière Headwaters) It is commonly recognised as being a reliable indicator of the suitability of waters for trout. Twenty-three of the thirty records we have of the presence of this species in the Eastern Townships were made in the St. Francis system. Nearly 50% of these (11) are of its occurrence in the Salmon River which drains only 5% of the St. Francis watershed. S.fontinalis was recorded at seventy five per cent of the locations on this tributary, comparing with the average of twenty-six per cent for the whole St. Francis to

show the Salmon as being an excellent trout system, and indicating the significance of the high frequency of C.cognatus in such waters. This has been commonly recognised and the species is frequently referred to (Greeley, 28) as being a reliable indicator of the suitability of waters for trout. On the other hand, C.cognatus is poorly represented in many of our best trout waters (e.g. Spider River, Arnold R. (Chaudière)) and it is pointed out that its absence is insufficient for the condemning of a stream or system, although its presence is typically an indication of the excellence of the waters for trout

The distribution of the present species in the Province is wide. It has been recorded in all the systems in the Appalachian district. I obtained a small specimen (3.0 cms.) at Lake Anne, Argenteuil Co.. This forms the only record we have of its presence in the Laurentian waters of the upper levels. It has been recorded in the vicinity of Ottawa (Billings), near Quebec (Anon.) and from the Gaspe waters draining into the Baie de Chaleur. The account of its presence at Quebec does not distinguish fully between the present and the previous species, but mentions the presence of 4 ventral rays in some specimens which doubtless were C.b.bairdii. The illustration, poor as it is, may be recognised as C.cognatus.

SUMMARY:

No complete study has been previously made of the species of fishes in the fresh-waters of the Province of Quebec.

During the course of a four year systematic examination of the waters of the Appalachian region of Quebec conducted by the Department of Public Works, Game and Fisheries, approximately 1800 stations have been made on streams, and 90 lakes and ponds have been visited within an area of 5,400 square miles. Records of the species present at these locations have been made, and collections have been preserved at approximately one station in five where fishes were present. With the exception of a small collection made at Lake Memphremagog, these constitute the first collections from these waters. This material has been examined and the specimens identified by the writer.

An analysis has been made of the frequency of records of each species or group of species and their relative importance in the streams and lakes pointed out wherever possible. On certain uncomplicated systems it has been possible to illustrate graphically the position which each species occupies in the system. This enables a ready classification of the species into those of general or of restricted distribution. The figures prepared show that Shelford's method of analysis of such data by reference to physiographic factors is equally applicable to an analysis of a watershed as of a stream. The species of restricted distribution are confined either to the

lower sections of the watersheds or to the intermediate region.

Data ~~is~~ are given concerning the spawning and the growth of many of the species. It is pointed out that the reproductive organs of the adult spring-spawning fish are well-developed by the end of summer and the early fall. Secondary sexual characters, tubercles etc. are commonly developed by the end of summer. Generally, little further development of either is necessary during the winter. The spawning season of the district was not found to be later than for the adjacent waters to the West and the South.

Forty-six species were recorded in these waters. Thirty-eight species are described in detail. The majority of these are small, non-game species not commonly known to be present in these waters. Analytical keys are supplied for the Families and for the species. An account is given of the range of these species in the Appalachian waters and also in the Laurentian waters wherever the latter is possible. The great majority of these fish have not been previously recorded from the waters of southern Quebec but have been recorded to the West of the Province. Although the collections and the records for the Laurentian waters have been much fewer than for the southern, the majority of these fish have been taken in both districts.

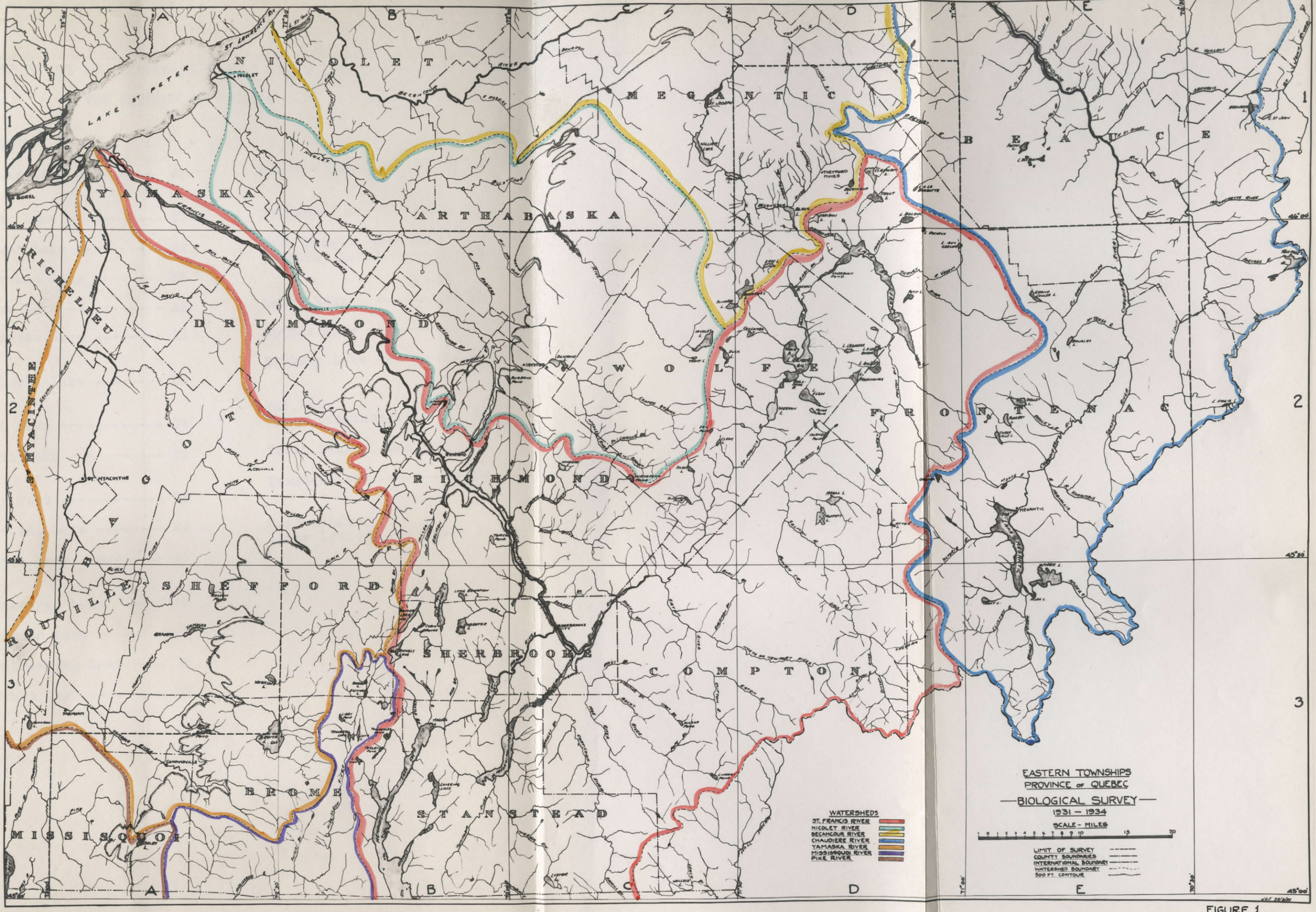

A
B
C
D
E
1
2
3
LAKE ST PETER
ST LAWRENCE RIV.
NICOLET
YAMASKA
ARTHABASKA
MEGANTIC
BEAUCE
RICHELIEU
DRUMMOND
WOLFE
FRONTENAC
ST HYACINTHE
RICHMOND
SHEFFORD
SHERBROOKE
COMPTON
BROME
STANSTEAD
MISSISQUOI
ROUVILLE
WATERSHEDS
ST. FRANCIS RIVER
NICOLET RIVER
BECANCOUR RIVER
CHAUDIERE RIVER
YAMASKA RIVER
MISSISQUOI RIVER
PIKE RIVER
EASTERN TOWNSHIPS
PROVINCE OF QUEBEC
BIOLOGICAL SURVEY
1931 – 1934
SCALE - MILES
LIMIT OF SURVEY
COUNTY BOUNDARIES
INTERNATIONAL BOUNDARY
WATERSHED BOUNDARY
500 FT. CONTOUR

FIGURE 1.

A KEY TO THE MORE IMPORTANT LAKES AND STREAMS IN

THE EASTERN TOWNSHIPS:

LAKES:-

Aylmer, Lake ---------- D2

Black Lake ---------- D1

Bowker Lake ---------- B2

Breeches Lake -------- D2

Brome Lake ---------- A3

Brompton Lake -------- B3

Coulombe Lake -------- D2

East Lake ---------- D2

Elgin Lake ---------- D2

Long Pond ---------- B3

Lovering Lake -------- B3

Lyster, Lake ---------- C3

Massawippi Lake ------ B3

Megantic Lake -------- E3

Memphremagog Lake ---- B3

Moffatt Lake --------- D2

Nicolet Lake ---------- C2

Richmond Lake --------- C2

Rats Musque, Lac aux
(Muskrat Lake) -------- E2

Selby Lake ---------- A3

Spider Lake ---------- E3

Stukely Lake ---------- B2

Tor, Lac
(Lake Maskinonge) ----- D2

Trois Milles, Lac aux - E2

Trouser Lake ---------- B3

Weedon Lake,
(Lake Louise) --------- D2

STREAMS:-

Arnold River ------- E3

Black River -------- B2

Bowen Creek -------- D2

Bury Brook --------- C3

Castle Brook ------- B3

Cherry River ------- B3

Chesham River ------ D3

Clinton River ------ E3

Coaticook River ---- C3

Coulombe River ----- D2

Ditton River ------- D3

Eaton River -------- C3

Francoeur Brook ---- B2

Grand Coulee River - E2

Gulf Stream -------- B2

Haseltine Brook ---- C3

Key Brook ---------- B3

Kokombis River ----- E3

Miller Brook ------- B2

Missisquoi R.,E.Br - B3

Missisquoi R.,W.Br.- A3

Moe River ---------- C3

Nicolet River ------ C2

Nicolet River,
S.West Branch ------ C2

Nicolet River,
Center Branch ------ C2

Nigger River ------- C3

North River -------- D3

Pike River --------- A3

Pins,Riviere des --- B2 & C2

Prevost River
(Tributary to Bras R.) -- D1

Red Brook ---------- B3

Rosiers, Riviere des - B2 & C2

Ruiter Brook ------- B3

Salmon River ------- D2 & D3

Samson River ------- E2

Spider River ------- E3

Steele Brook ------- B2

Tierney River ------ D2

Tomofobia River ---- B3

Ulverton River ----- B2

Yamaska River ------ A3

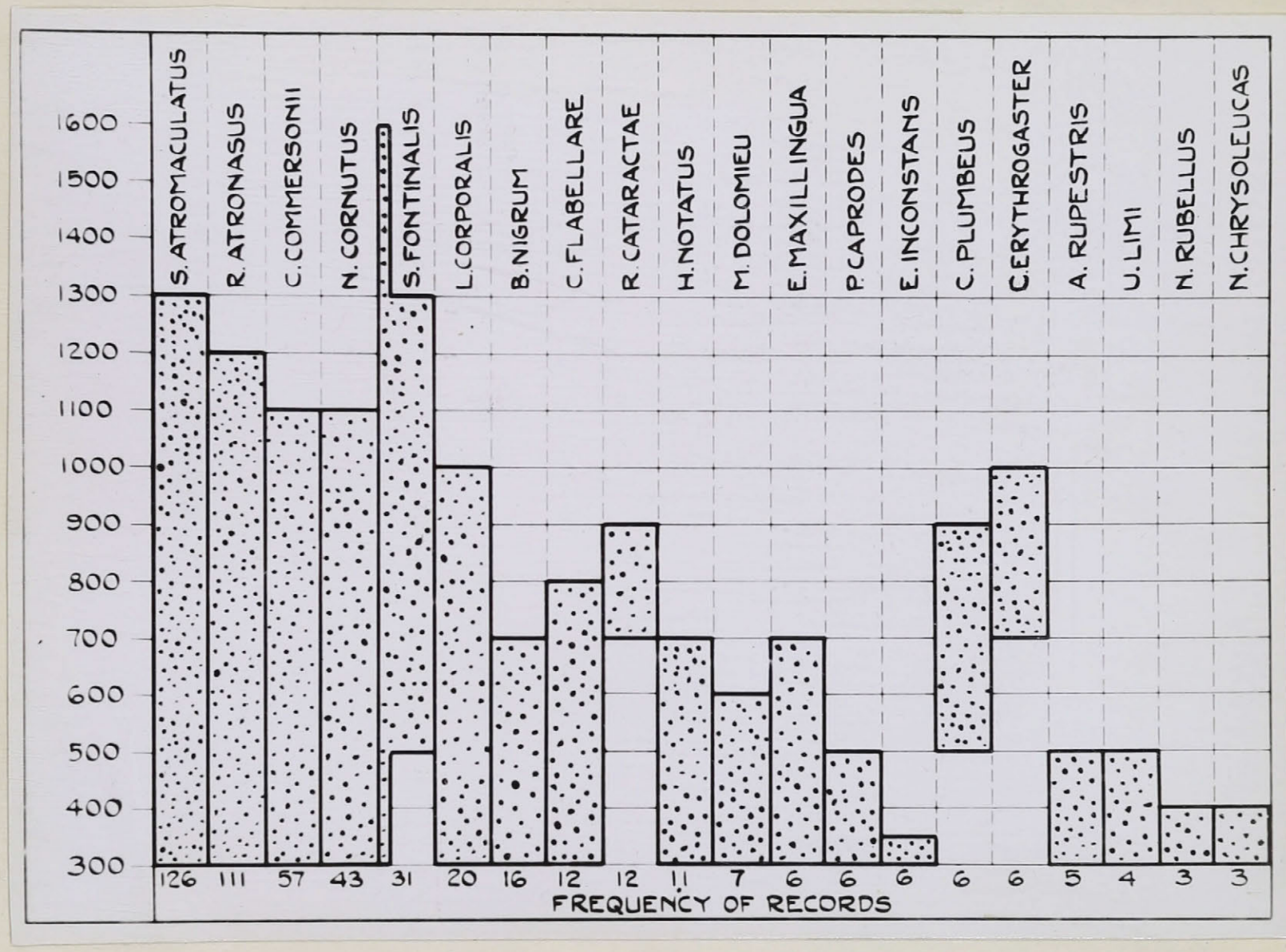


Figure 2 : The distribution of the fishes in the Nicolet System draining a portion of the western slopes of the Appalachian formation.

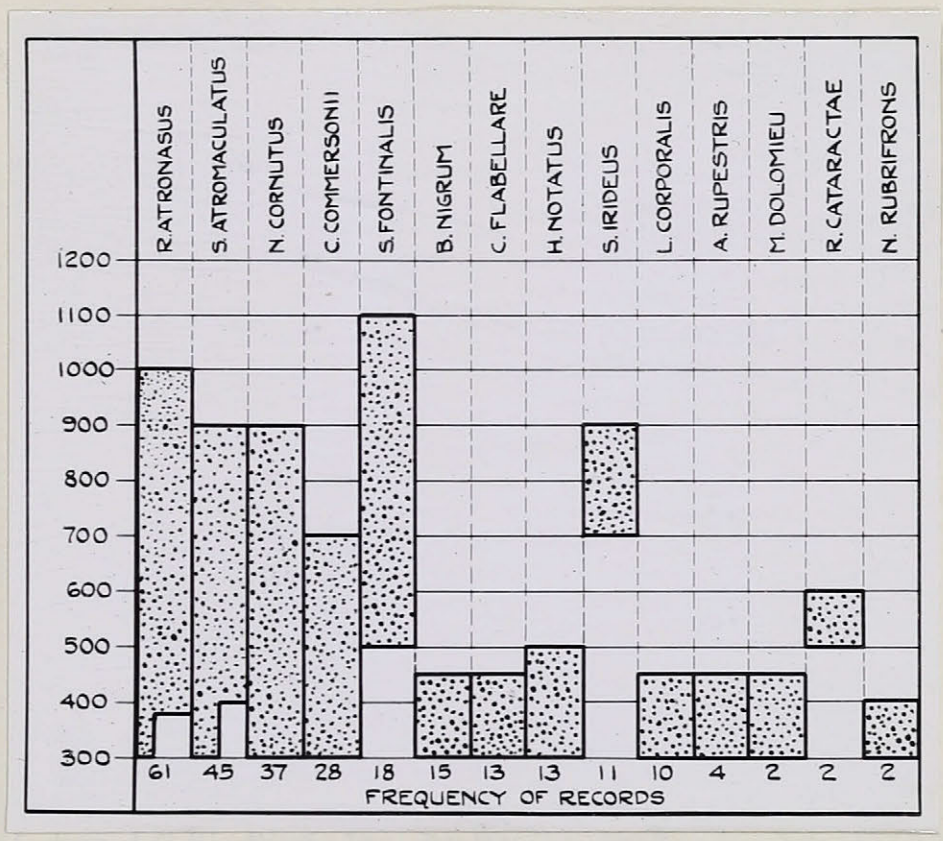


Figure 3: The distribution of the fishes in the Yamaska South-West Branch. A stream draining the western slope of the Sutton Range.

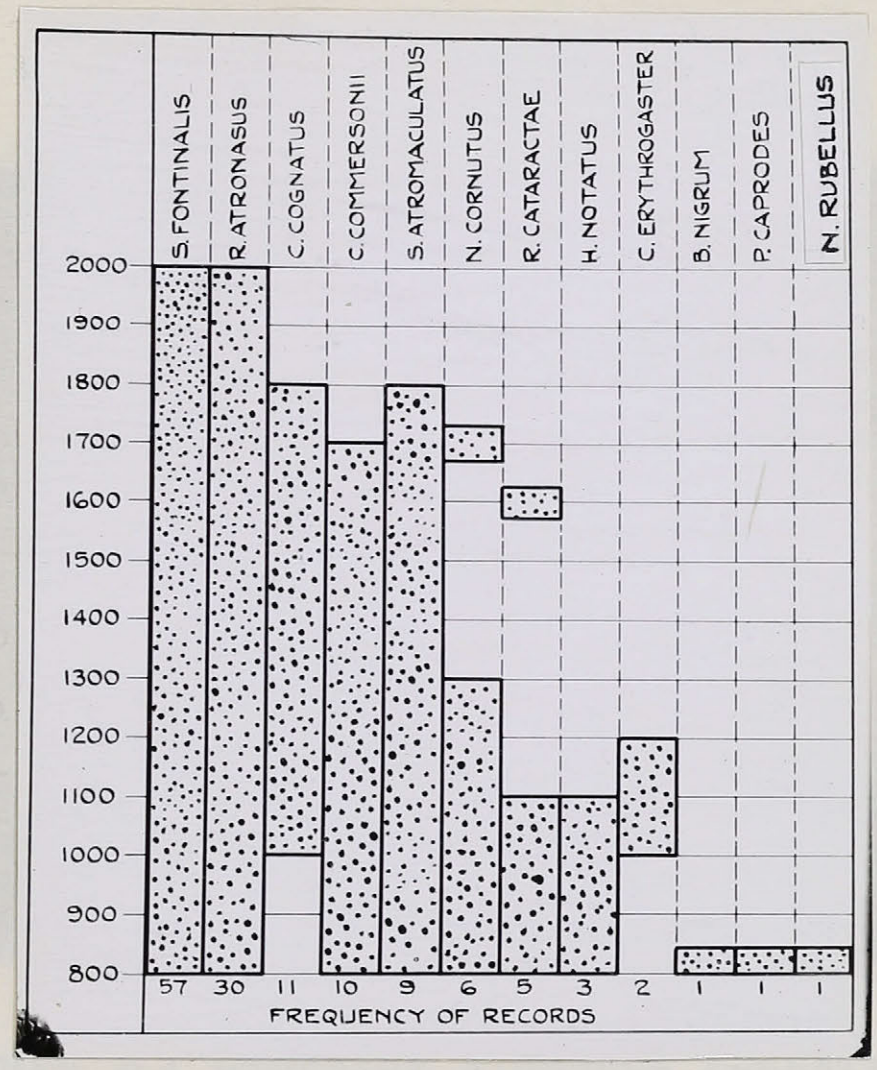


Figure 4: The distribution of the fishes in a typical trout stream (Salmon River, St. Francis), in the interior of the Appalachian district.

Figure 5 : Couesius plumbeus Agassiz

Fall female, length 7.7 cms., the coloration dark, typical of this species in streams; Nicolet River.

Figure 6: Rhinichthys cataractae Cuvier & Valenciennes
Heavy autumn female, length 7.6 cms.;
Nicolet River.

Figure 7 : Semotilus atromaculatus Mitchill

Heavy autumn male, length 7.5 cms.;

Nicolet River.

Figure 8 : Margariscus margarita nachtriebi Cox

Fall adult, length 7.0 cms,;

Ulverton River (St. Francis).

Figure 9 : Pfrille neogaeus Cope
Heavy fall female, length 6.1 cms.,
color pattern tending towards
C. erythrogaster; Ulverton River
(St. Francis.).

Figure 10 : Notropis heterolepis Eigenmann & Eigenmann

Summer adult, length 5.0 cms.;

Riviere des Rosiers (Nicolet).

Figure 11 : Notropis hudsonius Clinton

Summer female, length 7.5 cms.;

Clay Lake, Papineau Co.

Figure 12 : Exoglossum maxillingua Le Sueur

Green summer male, length 8.8 cms.;

Nicolet River.

Figure 13: Hybognathus Sp. ?
Fall adult, length 5.3 cms.;
Ulverton River (St. Francis).

Figure 14 : Esox lucius Linnaeus
Immature fall specimen, length 13.0 cms. showing typical juvenile color pattern of this species; Lake Aylmer (St. Francis).

Figure 15: Percopsis omisco-maycus Walbaum

Ripe spring female, length 5.0 cms.;

West Branch Missisquoi River.

Figure 16: Eucalia inconstans Kirtland

Summer adult, length 4.1 cms.;

Basswood Creek (Pike).

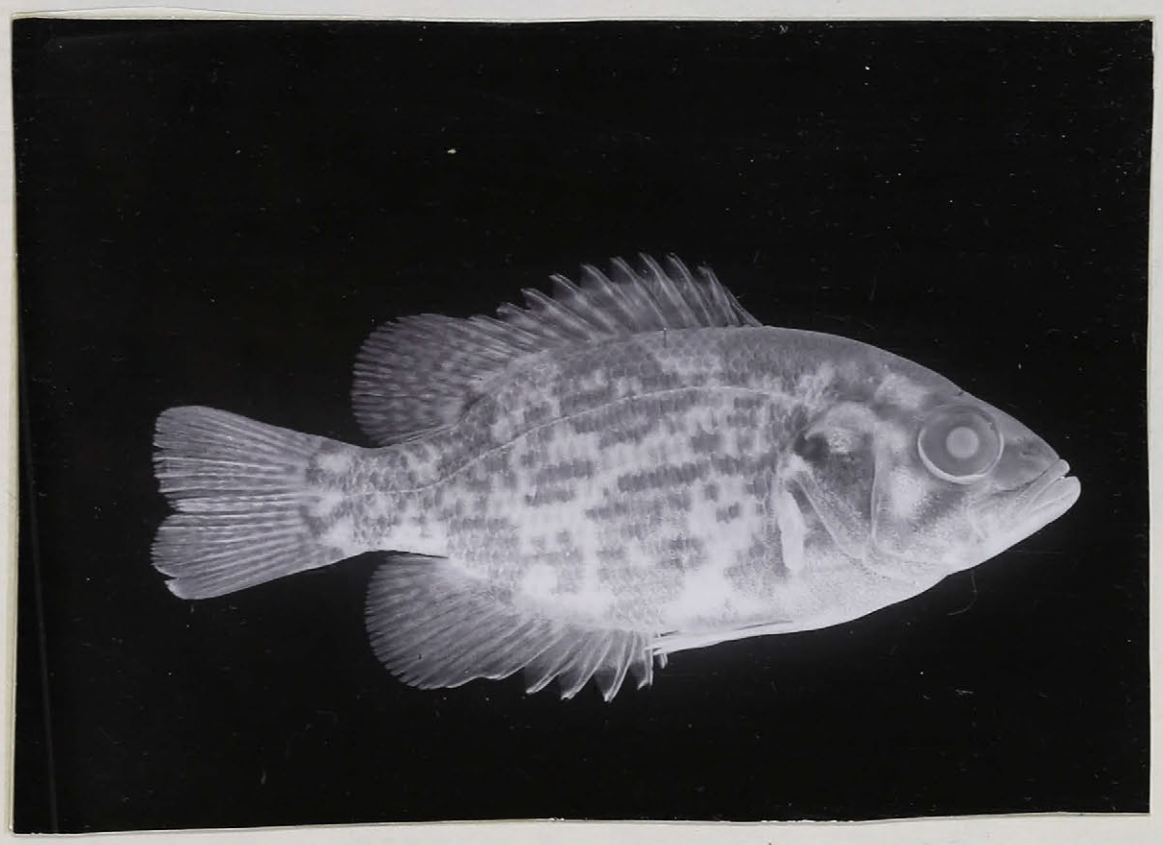


Figure 17 : Ambloplites rupestris Rafinesque
Mature spring male, length 7.8 cms., color pattern intermediate between juvenile and adult; Pearceton Brook (Pike).

Figure 18 : Cottus b. bairdii Girard, above;
5.9 cms.; Bras River (Chaudiere).
Cottus cognatus Richardson, below;
5.7 cms.; Red Brook (St. Francis).

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