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A preliminary report on the Tullibee investigation in Great Slave Lake--1946

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INTRODUCTION

Some observations made by Drs. K. H. Doan and R. B. Miller have led to an hypothesis that the rate of parasitization of tullibee, Leucichthys spp., with the tapeworm Triaenophorus crassus may vary from one taxonomic group to another. Since the value of tullibee is adversely affected by their present reputation for being heavily infested, it was decided that this matter should be investigated thoroughly, with the hope of defining a group or groups of tullibee in which infestation is low.

The problem is complex since the taxonomy of the genus Leucichthys is controversial. Many more species have been named than are at present generally recognized, and there is both disagreement among ichthyologists, and within the minds of ichthyologists, as to the proper grouping within the genus. It appears that a thoroughgoing study of the tullibee of Western Canada is required along with a study of rates of infestation.

Since it was not possible to get an experienced ichthyologist to undertake this problem, it was decided that a suitable junior man should be selected who would be trained to make the investigation. J. J. Keleher was selected as the most suitable man available, and he spent the summer of 1946 working on Leucichthys under the direction of W. A. Kennedy.

The majority of the summer was spent at Gros Cap. Collections were made over the whole northern part of the lake including Yellowknife district and the East Arm. Three hundred tullibee were measured and 1,300 scale samples were collected.

Although the immediate purpose in having the tullibee of Great Slave Lake investigated was to train Keleher, the work which he did was valuable in itself and is a step toward the solution of the general problem. Although the data have not been completely analysed, some things are now obvious, and are here reported.

METHODS

The standard attack on a taxonomic problem, namely taking various measurements and counting various parts, was followed. Standard length, head length, head depth, eye diameter, snout length, maxillary length, interorbital width, caudal peduncle length, caudal peduncle depth, body depth, body width, dorsal fin length, dorsal fin base, anal fin length, anal fin base, pectoral fin length, and pelvic fin length were measured, and dorsal fin rays, anal fin rays, branchiostegal rays, scales and gill-rakers were counted. These measurements and counts were made as described by Dymond ("The Coregonine Fishes of Northwestern Canada". Dymond, J. R. Trans. Roy. Can. Inst. Vol. XXIV, Part II pp. 171-231) except that a set of vernier calipers were used in place of dividers. Apart from previous use by Dr. R. B. Miller who suggested the idea to us, we know of no case where calipers have been used for these measurements. Calipers give essentially the same values for each measurement as dividers do, and since they are quicker, more portable, and sometimes more accurate, we recommend them highly for taxonomic measurements on fish.

Tullibee were examined for cysts of T. crassus by the standard method used by fisheries inspectors in examining samples of whitefish Coregonus clupeaformis for the same parasite. In addition the locality, depth of water and size of mesh for each individual was recorded. When analysed, this data will be used to compute the bathymetric distribution of the populations.

GROUPING BY SPOT CHARACTERS

A large number of tullibee were examined to see if they could be divided into two or more groups on the basis of some easily distinguishable characteristic. If easily separable groups were present, only a few representatives from each would need to be measured for taxonomic work, while larger numbers could be examined for cysts of T. crassus so that a good comparison between rates of infestation would be possible. Further, unless the groups were readily distinguishable, it would probably never be practical to use taxonomic differences as a basis for separating lightly infested fish from those heavily infested, even if some relationship were discovered.

There appeared to be three distinguishable groups present. Group AB was at first considered to consist of two groups which differed in colour, but later it became apparent that the difference depended entirely upon whether the fish had just died, or whether it had been dead for some time. AB's were typically small, bright green dorsally (changing to blue after death) and silvery laterally and ventrally. Group F fish were typically large, with noticeably

duller colouring than the other two. Group C fish were much like AB's in colouring and size, but the mouth was inclined to the horizontal noticeably more than in either of the other two groups and the eye appeared larger.

It soon became apparent that fish could not always be assigned to one group without reservation. There was some doubt about approximately one-twelfth of the fish regarding the group into which they should be put.

A COMPARISON OF THE GROUPS

The measurements of the various parts of each fish were plotted against standard length on log-log paper in such a way that each group was distinguishable from the others. These points, of course, tend to fall along straight lines which represent the average size of a part for a given length within each group. For each measurement, the three groups were compared to see whether they appeared to differ from one another in the size of a part for a given length. The results of these comparisons are shown in Table.1. They will be made by statistical means when time permits. Similar comparisons involving counts are shown in Table 2.

It appears from Tables 1 and 2 that in most respects the AB's and the F's are alike and that the C's differ considerably from both. The F's seem to be distinguishable from the AB's by average relative head size and by average gill-raker count. There does not seem to be any distinguishable differences between the

groups in the depth of the body, caudal peduncle, and the length of the dorsal fin base. Among the counts no differences were found in the number of rays of the anal and dorsal fins.

The distribution of gill-raker counts are particularly interesting so they are shown in Table 3. A comparison of the distributions of gill-raker counts suggests that probably some of the fish which should have been in Group AB were actually assigned to Group F and also, possibly some of those which should have been assigned to Group F were actually assigned to Group AB. This is not unexpected in view of the difficulty that was experienced in distinguishing between AB's and F's.

It might be argued that AB's should be considered as younger stages of F's, that the greater average gill-raker count among F's results from the fact that the gill-rakers are easier to see in them and that the differences in comparative head depths should be disregarded. However, this seems unlikely when the size at maturity is considered (Table 4). Approximately one-third of the AB's were mature when 200 mm. long. We would not expect them to increase to almost 400 mm. which was attained by some F's. Table 5 is a summary of the weights of the mature and immature fish of the three groups. From these data it was found that 37 per cent of the AB's were mature at four ounces and that half of the F's attained at least a weight of thirty-six ounces. Thus, if the AB's were young stages of the F's some of them would increase more than eight times in weight after maturity. This contrasts with the usual growth curves found among fishes.

Within each group the fish tended to show little correlation between size and gill-raker count.

TAXONOMIC RELATIONSHIPS

We regard the AB's and the F's as two incipient taxonomic groups which are just beginning to diverge from one another, and between which many intergrades are available. Possibly AB's are a dwarf form of F's. The C's are more distinct and perhaps may be regarded as actually different taxonomically. In view of the unsettled nature of Leucichthys taxonomy no attempt is made to identify these groups with existing species or subspecies.

RATES OF INFESTATION

Because of the changes in rates of infestation which normally accompany growth, the overall rates among the F's could not be compared with the rates among the other two groups, since F's tended to be so much larger. Also it did not seem safe to compare the smallest F's with AB's of the same size since these F's were suspected of being misidentified. The AB's and the C's were about equally infested.

In any case the question of whether the groups differed in rates of infestation seems to have no practical importance on Great Slave Lake. Only the F's are large enough to be useful commercially, and they are infested with about 2,000 cysts per hundred pounds. The other groups were also heavily infested.

SUMMARY

J. J. Keleher carried on a study of the tullibee of Great Slave Lake, under supervision, which prepared him to take full charge of similar studies elsewhere. Valuable data were gathered which will be useful in the general problem of the taxonomy of Leucichthys and the relationship of taxonomy to rate of infestation with T. crassus. There appears to be no group of tullibee in Great Slave Lake in which the rate of infestation is low.

Table 1. A summary of the apparent differences in the average size of body parts for a given length among the three groups of Leucichthys which were encountered in Great Slave Lake in 1946.

N no apparent difference; D apparent difference; ? undecided.

	AB vs C	AB vs F	C vs F
Head Length	D	N	D
Head depth	D	D	D
Eye diameter	D	N	D
Snout length	D	N	D
Maxillary length	D	N	?
Interorbital width	?	N	?
Caudal peduncle length	N	?	D
Caudal peduncle depth	N	N	N
Body depth	N	N	N
Body width	N	?	?
Dorsal height	D	N	?
Dorsal base	N	N	N
Anal height	D	N	N
Anal base	D	N	D
Pectoral length	D	N	D
Pelvic length	D	N	?

Table 2. A summary of the apparent differences in counts of body parts among the three groups of Leucichthys which were encountered in Great Slave Lake in 1946.

N no apparent difference; D apparent difference
? undecided

	AB vs C	AB vs F	C vs F
Dorsal rays	N	N	N
Anal rays	N	N	N
Branchiostegal rays	?	N	?
Scales	N	N	N
Gill-rakers	N	D	D

Table 3. The frequency distribution of gill-rakers counts among the three groups of Leucichthys which were encountered in Great Slave Lake in 1946.

Number of Gill-rakers	Group AB	Group C	Group F	Doubtful Cases: Group AB or F	Doubtful Cases: Group AB or C
31	1				
32					
33					
34	1				
35	5			1	
36	9		1		
37	13	2		1	1
38	24	1	2	1	1
39	29	2	3	3	1
40	31	5	2		1
41	21	5	1		
42	19	3		1	
43	18	4		1	
44	13	1			
45	5	2	1	2	1
46	9		2	1	
47	5		1	3	
48	6		2	4	
49	7		12	1	
50	2		2	1	
51	1		6	1	
52	3		4		
53	3		1		
54	1		4		
55			2		
56			1		

Table 4. The frequency distribution of lengths by states of maturity among the three groups of Leucichthys which were encountered in Great Slave Lake in 1946.

M mature; I immature.

Fork length in millimeters	Group AB		Group C		Group F		Doubtful Cases Group AB or F		Group AB or C	
	M	I	M	I	M	I	M	I	M	I
100-125	2	1								
125-150	19	7	3						1	
150-175	29	15	6	1					3	
175-200	31	10	3				1	1		
200-225	29	8	6	1			2			
225-250	29	1	4		1		1	1	1	
250-275	20	5	1		7		3			
275-300	5				2		2			
300-325	1				2		1	2		
325-350	5	1			5		4			
350-375	6				7		3			
375-400	2				5					
400-425					10					
425-450					5					
450-475					3					
TOTALS	178	48	23	2	47		17	4	5	

Table 5. The frequency distribution of weights by states of maturity among the three groups of Leuicichthys which were encountered in Great Slave Lake in 1946.

M mature; I immature.

Weight in Ounces	Group AB		Group C		Group F		Doubtful Cases Group AB or F		Group AB or C	
	M	I	M	I	M	I	M	I	M	I
1-4	90	35	15	2			1	1	3	
5-8	49	9	7		2		3	1	2	
9-12	17	3	1		8		2			
13-16	7				3		3	2		
17-20	3				1		2			
21-24	5	1			3		2			
25-28	3				1		3			
29-32	1				3					
33-36	2				1		1			
37-40					6					
41-44	1				2					
45-48					4					
49-52					4					
53-56					5					
57-60					2					
61-64					1					
65-68					1					