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Cisco analysis during the summer of 1956

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INTRODUCTION

The cisco project is concerned with the description and identification of the ciscoes, Leucichthys spp., of Western Canada. During the summer of 1956 it was planned to investigate the morphometry of various samples of ciscoes previously collected and measured. The analysis would be similar to that made on the Lake Manitoba ciscoes (Keleher, 1956a). Statistical computations were completed but unfortunately interpretation of the results and presentation in a manuscript was not possible. In order to have a somewhat detailed record of the work for later use and to place the information on file, this report has been prepared. The various cisco populations (cf. Table I) are treated under their respective locality headings.

RESULTS

CHURCHILL RIVER

The ciscoes from Churchill River were caught in 4 different sizes of gill nets, with the majority of fish collected in nets of 3 inch stretched mesh (Table II). Some indication of net selectivity is seen from an examination of this Table. Gill-net selection appears to affect particular ages -- 6, 7, and 8 in the 1½ inch mesh, 2 and 3 in the 3 inch mesh. The actual size of fish selected by a particular mesh undoubtedly does not correspond to the averages listed in the Table because all sizes of nets were not fished during the same time period. Gill-net selection was not allowed for in the morphometric analysis because the number of fish from a known mesh was small. If a correction factor was developed, it could not be applied to the remainder of the data.

The sex condition of the ciscoes was as follows: 366 mature fish, 43 immature fish and 91 males of which there was doubt whether to classify as immature or mature. Their gonad, although of "mature" size, was of a reddish colour. It was suspected that they might be fish that would mature for the first time in the fall. To establish if the sex condition should be taken into account in the morphometric analysis, the individual variates for head length and the standard length were plotted with the immature fish, undecided males, and mature fish in different colours. Inspection of this regression suggested that the data could be analyzed without reference to the sex condition.

Analysis of covariance tests were performed to determine whether fish of different sexes and ages could be combined with respect to the average size of their body parts. Table III gives the results of these tests. Table IV lists the calculated mean size of the body parts. Of the 16 measurements examined, the females probably differ from the males only in having a greater body width. Four measurements differed between ages at the 1 per cent level of significance, but 4 per cent was the greatest difference of the means of the significant tests (Table V).

The tests for differences between slopes were not significant at the 1 per cent level with the exception of body depth and body width.

Regression equations have been computed, and listed in Table VI. The statistics used to derive these equations and to compare this population with others are also shown in the Table. The average size of each part corresponding to three different

standard lengths is given in Table VII. Table VIII records the fiducial limits at the three different standard lengths for the average of the sample and for any individual fish.

Analysis of variance tests for 5 meristic counts were made. Tests between ages of female fish were not significant and in the tests between ages of males only the dorsal and anal rays were significant at the 5 per cent level. Tests between males and females regardless of age were not significant. Statistics of the meristic counts are given in Table IX.

LAKE MICHIGAN

During the Board's sponsored visit to the Great Lakes area in 1952, specimens collected from Lake Michigan and identified by Walter Koelz as Leucichthys artedii and L. nigripinnis, were measured at the Museum of Zoology, University of Michigan, Ann Arbor. Koelz' L. nigripinnis sample was 51 fish, of which 48 were measured. His L. artedii sample was 265 fish, of which 206 were measured. From these samples the following morphometric information was obtained.

Variation between different size groups of L. artedii was examined which is a substitute for variation between ages. The data were divided into three arbitrary length groups irrespective of sex: less than 204 mm., 204 to 224 mm., 225 mm. and larger. For the average size fifteen measurements were not significant but the caudal peduncle length was significant at the 5 per cent level. Differences in slope were noted in dorsal height and pectoral length (1 per cent level), maxillary and

anal base (5 per cent level). The tests for anal height and pelvic length would not "work" and no significant differences were found in the remaining measurements. It was considered that these three groups could be pooled without adversely affecting the value of the regression equations. This finding removes a personal opinion that some of the differences between Lake Michigan L. artedii and L. nigripinnis, as stated in Koelz' monograph (1929), were the result of dissimilar sized fish.

Regression equations and other data for the pooled data are given in Table X. Table XI records the mean size at 3 different standard lengths and Table XII lists the fiducial limits for these values.

Meristic counts of Koelz' Lake Michigan L. artedii sample were analysed. No significant differences were found between sexes but between length groups the gill-raker count and the branchiostegal count were significant at the 1 per cent level. The means are as follows: $<$204 mm., G.R. = 46.5, Br. = 8.2; 204 to 224 mm., G.R. = 48.3, Br = 8.6; $>$225 mm., G.R. = 47.9, Br = 8.7. Statistics on the combined data are listed in Table XIII.

Due to a lack of an adequate number of specimens for Koelz' Leucichthys nigripinnis sample no attempt was made to investigate differences in the measurements with respect to sex or size. The data were combined to give regression equations (Table XIV), average size at some standard lengths (Table XV) and fiducial limits (Table XVI).

Tests between sexes for the meristic counts of the preceding specimens were significant for dorsal rays (1 per cent level) and anal rays (5 per cent level). The three remaining meristic counts were not significant.

The mean values were as follows: Males, D.R. = 10.5, A.R. = 11.9; Females, D.R. = 10.0 and A.R. 11.3 Statistics on the combined data are presented in Table XVII.

Koelz' Lake Michigan specimens of L. artedii and L. nigripinnis were compared (Table XVIII). The samples differ significantly in the average size for 15 out of 16 measurements tested.

Graphs were prepared in an attempt to ascertain possible differences in measuring techniques between the writer and W. Koelz. Koelz' actual measurements were obtained by converting the ratios in his monograph. Ten L. nigripinnis and 22 L. artedii were available for a comparison with the writer's measurements. Unfortunately the results have not as yet been interpreted.

Specimens of Leucichthys artedii from Lake Michigan were secured by the U.S. Fish and Wildlife Service in 1952. These specimens came from Green Bay (cf. Kelcher, 1953). The total sample was 200 fish of which 8 specimens were 3 years old, 173 were 4 years old, and 19 were 5 years old. Consequently no tests were performed between ages and only between sexes in the age-4 group. The results of these tests and a comparison of the mean size of the body parts are given in Table XIX. No significant differences were noted in the tests for slope.

Despite the few instances of differences in the average size of the measurements, the data were grouped without respect to sex or age, to yield the regression equations listed in Table XX. Tables XXI and XXII record the calculated mean size of body parts and their fiducial limits.

Meristic counts were analyzed for differences between sexes at Age 4. No statistically significant results were obtained so that the data on both males and females were combined and tested between ages. All these tests were also not significant. Table XXIII shows the combined data.

LAKE HURON

Specimens of Leucichthys artedii from Lake Huron at South Bay were also measured. Data on a random sample of 272 fish from pound nets were analyzed. However, the preponderance of age 4 fish, n = 188, precluded tests being performed between ages and limited the tests between sexes to this one age group. Table XXIV reports on these results. The tests for slope were in no cases statistically different. The combined data were used to calculate the regression equations (Table XXV), calculated average size of body parts (Table XXVI)and their fiducial limits (Table XXVII).

Analysis of variance tests for the meristic counts between sexes of age 4 fish were not significant while between ages of combined sexes the only test with a statistically significant result was the gill-rakers. It, however, was at the 5 per cent level. Data on the meristic counts for this collection is given in Table XXVIII.

A comparison of the measurements of the F.R.B. L. artedii samples from Lake Michigan and Lake Huron was made. The results are listed in Table XXIX.

The meristic counts of the 4 samples of Great Lakes ciscoes previously discussed were compared. Two counts, anal rays and branchiostegals, were not significant while of the others,

dorsal rays was significant at the 5 per cent level and gill-rakers and scales were significant at the 1 per cent level. A similar test was performed between these four samples and the total data from the 4 Manitoba samples. All the meristic counts were found to be highly significant. The means of the counts involved in this test are reported in Table XXX.

LAKE DAUPHIN

Because of the small number of specimens in each age group, only age 5 fish were used in the tests for differences in body parts between the sexes. With respect to average size, two measurements, snout and anal base, were significantly different at the 1 per cent level. Three measurements, head depth, caudal peduncle length, and pelvic length were significant at the 5 per cent level. Only one measurement was significantly different for slope -- snout at the 1 per cent level. However, the "anal base" test did not "work" for either average size or slope.

Table XXXI records the regression equations and other statistics while Table XXXII lists the calculated average size at 3 different standard lengths. Table XXXIII records the fiducial limits for body parts.

Meristic counts of the Lake Dauphin sample showed no significant differences between the sexes of age 5 fish or, after combining the sexes, between the ages 4 to 7. The combined data are recorded in Table XXIV.

ROCKY LAKE

No examination of differences in body parts or counts

between sexes or ages was made for this sample. Various aspects of the combined data are listed in Tables XXXV to XXVIII.

LAKE WINNIPEG

Although a bimodality of gill-raker counts for the Lake Winnipeg ciscoes appears indicated, the "trough" of the distribution, when compared to that expected if each mode follows a normal curve, is too high (Keleher, 1956b). This suggests that a third group of ciscoes is present. To establish whether other "characters" agreed with this hypothesis, the relationship between gill-raker groups and the body form of selected portions of the data was examined statistically.

Within the samples examined, ciscoes having a gill-raker count of from 33 to 43 were classified as Group I, counts of 44 to 53 were classified as Group II and counts of 55 to 67 were classified as Group III. Group I fish correspond to the nominal species L. zenithicus, Group 2 corresponds to one or two nominal species, and Group 3 corresponds to nominal L. nipigon.

Samples of the Lake Winnipeg data selected for analysis were the 1954 Bull Head collection, the 1950 Doghead collection and the 1947 Mukutawa River collection. The number of fish of each gill-raker group, subdivided into various categories, is listed in Table XXXIX. Of the ciscoes listed in the Table only the following were used for the analysis:

Bull Head - Spawning females

Doghead - Spawning males and females

Mukutawa R. - mature males and females

Analysis of covariance tests were performed to establish

if, within each sex, the various age groups could be combined. A listing of those body parts, which were significant for either mean size or slope is given for the Bull Head sample in Table XL, for the Doghead sample in Table XLI, and for the Mukutawa River sample in Table XLII. Because the majority of the tests were not significant, the data were combined for the purpose of considering differences between the sexes.

The results of these tests, Table XLIII, showed that the sexes could be combined in the two samples considered.

Regression equations and other statistics for each gill-raker group for the 3 samples are given in Tables XLIV to LII.

The calculated average size of the body parts at various standard lengths were computed. Table LIII records the Bull Head ciscoes while Tables LIV and LV record the Doghead and Mukutawa River ciscoes.

Analysis of covariance tests were used to discover if the average size and the slope of the data for each gill-raker group within any one sample were significantly different. The results are recorded in Table LVI.

This Table reveals that 71 per cent of the tests were significantly different for average size and 27 per cent were significantly different for slope. Regression graphs (not presented) for this portion of the data were prepared from the data shown previously in Tables LIII to LV. Half of the graphs displayed the relationship of the greatest average size of measurement associated with group III fish. Group I fish had the smallest average measurements and group II had intermediate sized measurements. The other 50 per cent of the graphs revealed a variety of situations.

The results of the statistical analysis suggest that the heterogeneity displayed by the gill-raker counts is matched by many other measurements which strengthens the reported taxonomic discreteness of the ciscoes. However, the variation of the measurements with locality further decreases their utility for identification purposes.

Because of the dependence of the size of the body parts upon the growth rate of the fish, the average size at each age for groups I, II and III from the three localities in Lake Winnipeg is listed in Table LVII.

Although contemplated, no analysis of the differences in meristic counts between gill-raker groups is at present available. Table LVIII records the means for the data when combined with respect to age and sex.

LAKE MANITOBA

Fiducial limits for the Lake Manitoba ciscoes (Koleher, 1956a) are recorded in Table LIX.

ALL SAMPLES

Fiducial limits for the slopes for the combined data from each locality have been calculated. Table LX lists them for the Great Lakes data and Table LXI for the Manitoba data.

LITERATURE CITED

Keleher, J.J. 1953. Growth of ciscoes, Leucichthys spp., collected from five different lakes. MS Rep. Biol. Sta., No. 557, 21 pp.

1956a. Morphometry of Lake Manitoba ciscoes, Leucichthys tullibee. MS Rep. Biol. Sta., No. 610, 29 pp.

1956b. Bull Head spawning study, 1954. App. 7, Rep. Summarizing Invest. Biol. Sta., Winnipeg to March 31, 1956.

Koelz, W. 1929. Coregonid fishes of the Great Lakes. Bull. U.S. Bur. Fish. Vol. XLIII, Part 1.

LIST OF TABLES

Abbreviations used in the tables

Body parts

HL - head length
HD - head depth
EE - eye
ST - snout
MX - maxillary
IB - interorbital
CL - caudal peduncle length
CD - caudal peduncle depth
BD - body depth
BW - body width
DH - dorsal fin height
DB - dorsal fin base
AH - anal fin height
AB - anal fin base
PT - pectoral fin length
PC - pelvic fin length

Meristic counts

GR - gill-rakers
DR - dorsal rays
AR - anal rays
Sc - lateral line scales
Br - branchiostegals

Others

C - count
f - frequency
n or N - number of fish
St.L. - standard length
M - males or mean (arithmetic average)
F - females
S - sigma (sum of)

1 asterisk (*) denotes that the test exceeded the 5 per cent level.

2 asterisks (**) denotes that the test exceeded the 1 per cent level.

N.S. - denotes that the test did not exceed the 5 per cent level.

Table I. Cisco collections for which morphometric data are presented in this report.

Year Collected	Sample	I.B.M. No.	F.R.B.C. Tag Nos.	n
1953	Churchill River	18	2851-3352[a]	500
1920	Koelz Lake Michigan *L. nigripinnis*	73	...	48
1920	Koelz Lake Michigan *L. artedii*	74	...	206
1952	F.R.B. Lake Michigan *L. artedii*	75	2351-2550, 2848[b]	200
1952	F.R.B. Lake Huron *L. artedii*	76	5622-5921[c]	294
1951	Lake Dauphin	02	5463-5560	98
1951	Rocky Lake	12	5051-5109	59
1947	Lake Winnipeg Mukutawa River	57	...	491
1950	Doghead	47	1350-1772[d]	414
1954	Bull Head	41	3753-4108, 4177-4201[e]	372
				2682

a - Omit tag Nos. 2892, 2939.
b - " " " 2356.
c - " " " 5711-5715, 5726.
d - " " " 1368, 1430, 1481, 1507, 1582, 1670, 1671, 1677, 1704.
e - " " " 3842, 3987, 4061, 4062, 4066, 4070, 4072, 4073, 4093.

Table II. Statistics for standard length of Churchill River ciscoes.

Net Size	AGE 2	3	4	5	6	7	8	Total
1½" mesh								
n	2	1		3				6
SX	335	166		759				1,260
SX^2	56,153	27,556		192,851				276,560
M	167.5	166.0		253.0				210.0
2" mesh								
n	2	20	9	26	19	1		77
SX	348	4,179	2,097	6,819	5,216	319		18,978
SX^2	60,602	877,209	491,017	1,792,479	1,434,760	101,761		4,757,828
M	174.0	209.0	233.0	262.3	274.5	319.0		246.5
3" mesh								
n			5	57	105	51	7	225
SX			1,330	15,706	29,842	15,243	2,168	64,289
SX^2			354,336	4,332,994	8,497,410	4,569,693	672,684	18,427,117
M			266.0	275.5	284.2	298.9	309.1	285.7
Mixed mesh								
n	4	25	22	65	60	14	2	192
SX	668	5,131	4,972	17,113	16,745	4,150	648	49,427
SX^2	11,624	1,064,577	1,130,006	4,532,263	4,694,981	1,236,366	210,834	12,880,651
M	167.0	205.2	226.0	263.3	279.1	296.4	324.0	257.4
All meshes								
n	8	46	36	151	184	66	9	500
SX	1,351	9,476	8,399	40,397	51,803	19,712	2,816	133,954
SX^2	128,379	1,969,342	1,975,359	10,850,587	14,627,151	5,907,820	883,518	36,342,156
M	168.9	206.0	233.3	267.5	281.5	298.7	312.9	267.9

Table III. Results of analysis of covariance tests for mean size of body parts of Churchill River ciscoes.

Category	Between Sexes		Between Ages 2 to 8		
Body Part	Age 5	Age 6	Males	Females	Both Sexes
HL	NS	NS	..	..	**
HD	NS	NS	..	..	*
EE	NS	NS	..	..	**
ST	NS	NS	..	..	NS
MX	NS	NS	..	..	*
IB	NS	NS	..	..	**
CL	NS	NS	..	..	*
CD	NS	*	..	..	NS
BD	NS	*	NS	NS	NS
BW	NS	**	**	NS	**
DH	NS	NS	..	..	NS
DB	NS	NS	..	..	NS
AH	*	NS	..	..	NS
AB	NS	NS	NS	NS	*
PT	NS	NS	NS	NS	NS
PC	NS	NS	..	..	NS

Table IV. Calculated mean size in mm. of body parts of Churchill River ciscoes, at 268 mm. standard length except where noted.

	Between Sexes				Between Ages[a]							
	Age 5		Age 6[b]									Total
	M	F	M	F	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Sample[b]
HL	58.9	59.2	61.9	62.0	58.9	58.7	58.9	59.1	59.2	59.6	58.7	59.1
HD	37.6	37.9	39.6	39.8	38.1	37.5	37.8	37.8	38.0	38.1	37.3	37.9
EE	15.2	15.3	15.7	15.7	15.2	15.0	15.1	15.3	15.1	15.2	15.5	15.2
ST	15.4	15.4	16.1	16.0	15.2	15.4	15.4	15.4	15.4	15.5	15.3	15.4
MX	19.9	19.9	21.2	21.0	19.8	20.1	20.0	19.9	20.2	20.2	20.0	20.1
IB	15.1	15.0	15.8	15.8	14.8	15.0	15.1	15.0	15.0	15.2	15.4	15.1
CL	27.6	28.2	29.5	29.3	27.8	29.1	28.0	27.9	28.0	28.5	27.3	28.2
CD	20.4	20.5	21.1	21.5	20.0	20.2	20.5	20.5	20.4	20.5	20.5	20.4
BD	58.3	58.7	61.1	62.2	59.1	57.8	58.2	58.3	58.0	59.0	64.4	58.3
BW	33.4	33.2	34.6	35.3	33.1	32.7	32.2	33.2	33.1	32.9	31.9	33.0
DH	50.5	50.2	52.2	52.4	49.0	50.8	51.0	50.4	50.4	50.8	50.1	50.5
DB	34.3	34.5	35.9	35.7	34.1	34.0	34.4	34.4	34.1	34.0	34.0	34.2
AH	32.6	32.1	33.6	34.0	31.4	32.2	32.6	32.4	32.5	32.4	31.4	32.4
AB	29.8	29.8	33.7	33.4	28.3	29.6	29.9	29.8	29.8	28.6	31.1	29.6
PT	43.6	43.2	45.2	45.3	41.8	43.6	44.1	43.2	43.3	43.8	44.1	43.4
PC	43.4	42.7	45.0	44.9	42.0	43.6	43.1	43.0	43.1	43.4	43.6	43.2

[a]Sexes combined except for BD and AB (males only) and BW and PT (females only).
[b]Mean size at 282 mm. standard length.

Table V. Differences in calculated mean size of body parts of Churchill R. ciscoes. For calculated mean size see Table IV.

	GREATEST ACTUAL DIFF. (mm.)		GREATEST PERCENTAGE DIFF.	
	Sex[a]	Age	Sex[a]	Age
HL	0.3	0.9	0.5	1.5
HD	0.3	0.8	0.8	2.1
EE	0.1	0.5	0.6	3.3
ST	0.1	0.3	0.6	3.9
MX	0.2	0.4	0.9	2.0
IB	0.1	0.6	0.7	4.0
CL	0.6	1.8	2.1	6.6
CD	0.4	0.5	1.9	2.4
BD	1.1	6.6	1.8	10.2
BW	0.7	1.3	2.0	3.9
DH	0.3	2.0	0.6	0.4
DB	0.2	0.4	0.6	1.2
AH	0.5	1.2	1.5	3.7
AB	0.3	2.8	0.9	9.0
PT	0.4	2.3	0.9	5.2
PC	0.7	1.6	1.6	3.7

[a]Greatest actual diff. of either age 5 or 6.

Table VI. Regression equations and other statistics for Churchill River ciscoes. X = log standard length and Y = log part.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.915 X - 0.4501	500	1211.94	883.91	2939.3604	2144.1050	1564.1527
HD = 0.958 X - 0.7478	499	1209.72	785.76	2934.4320	1906.5583	1239.0142
EE = 0.706 X - 0.5332	500	1211.94	589.07	2939.3604	1429.0807	695.0749
ST = 0.838 X - 0.8473	"	"	591.95	"	1436.2934	702.2137
MX = 0.880 X - 0.8339	"	"	649.53	"	1575.9352	845.3493
IB = 0.987 X - 1.2187	"	"	586.85	"	1424.1949	690.7075
CL = 0.946 X - 0.8473	"	"	722.83	"	1753.7222	1047.2079
CD = 0.908 X - 0.8948	"	"	653.03	"	1584.4671	854.5989
BD = 0.992 X - 0.6431[a]	"	"	881.56	"	2138.6840	1556.6222
" = 1.106 X - 0.9169[b]	-	-	-	-	-	-
BW = 1.242 X - 1.4974[b]	500	1211.94	756.27	2939.3604	1835.2549	1146.7737
DH = 0.769 X - 0.1641	499	1209.43	848.16	2933.0603	2057.0425	1442.8776
DB = 0.976 X - 0.8359	500	1211.94	764.92	2939.3604	1855.7960	1172.2892
AH = 0.818 X - 0.4759	499	1209.48	751.89	2933.3088	1823.8777	1134.4185
AB = 0.889 X - 0.6865[a]	"	1209.45	732.39	2933.1603	1776.7742	1076.9501
PT = 0.876 X - 0.4880	500	1211.94	817.66	2939.3604	1983.4537	1338.6968
PC = 0.828 X - 0.3753	"	"	815.86	"	1979.0075	1332.6526

[a]Males only
[b]Females only

Table VII. Calculated average size in mm. of body parts for Churchill River ciscoes.[a]

Standard Length	200 mm.	250 mm.	300 mm.
HL	45.2	55.5	65.5
HD	28.6	35.4	42.2
EE	12.3	14.4	16.4
ST	12.0	14.5	16.9
MX	15.5	18.9	22.2
IB	11.3	14.1	16.8
CL	21.4	26.4	31.3
CD	15.6	19.2	22.6
BD (males only)	43.6	54.4	65.2
BD (females only)	42.5	54.4	66.5
BW (females only)	22.9	30.3	37.9
DH	40.6	47.8	55.4
DB	25.7	32.0	38.2
AH	25.5	30.6	35.5
AB (males only)	22.9	27.9	32.8
PT	33.7	41.0	48.1
PC	33.9	40.8	47.4

[a]Males and females combined except where noted.

Table VIII. Lower and upper fiducial limits for body parts of Churchill River ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	44.9-45.5	42.6-48.0	55.3-55.6	52.3-58.8	65.3-65.8	61.8-69.5
HD	28.4-28.8	26.6-30.8	35.3-35.6	33.0-38.1	42.0-42.4	39.2-45.4
EE	12.2-12.5	11.3-13.5	14.4-14.5	13.3-15.7	16.3-16.5	15.1-17.9
ST	11.9-12.2	11.1-13.0	14.5-14.6	13.4-15.8	16.8-17.0	15.6-18.4
MX	15.4-15.7	14.2-17.0	18.8-19.0	17.3-20.7	22.1-22.3	20.3-24.3
IB	11.2-11.4	10.3-12.4	14.0-14.1	12.8-15.4	16.7-16.9	15.4-18.4
CL	21.0-21.7	18.1-25.2	26.2-26.6	22.4-31.0	31.0-31.6	26.6-36.9
CD	15.5-15.8	14.2-17.3	19.1-19.3	17.3-21.2	22.5-22.8	20.5-25.0
BD (M)	42.8-44.4	38.9-48.9	54.0-54.9	48.6-61.0	64.4-66.0	58.2-73.1
" (F)	41.8-43.1	38.1-47.4	54.0-54.8	48.7-60.6	66.0-67.0	59.6-74.2
BW (F)	22.6-23.3	20.7-25.4	30.1-30.5	27.4-33.4	37.7-38.2	34.3-41.9
DH	39.9-40.7	36.8-44.1	47.6-48.1	43.7-52.4	54.8-55.4	50.3-60.3
DB	25.4-26.0	22.6-29.2	31.8-32.2	28.2-36.3	37.9-38.5	33.6-43.3
AH	25.2-25.8	22.8-28.4	30.4-30.8	27.4-34.1	35.3-35.7	31.8-39.6
AB (M)	22.4-23.4	19.9-26.2	27.6-28.2	24.3-32.0	32.3-33.3	28.6-37.6
PT	33.4-34.0	30.8-36.9	40.8-41.2	37.4-44.9	47.8-48.3	43.9-52.6
PC	33.6-34.2	31.1-36.9	40.6-40.9	37.4-44.4	47.2-47.6	43.5-51.7

Table IX. Statistics of meristic counts for Churchill River ciscoes.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
39	4	..	2	..	..	..	..
40	15	64	1	..	..	..	..
41	33	65	1	..	1	1	..
42	72	66	5	6	..	..	1
43	94	67	10	7	..	..	3
44	95	68	15	8	..	1	116
45	101	69	28	9	4	..	302
46	43	70	41	10	121	20	77
47	27	71	36	11	282	167	1
48	14	72	57	12	89	247	..
49	1	73	64	13	3	62	..
50	1	74	50	14	..	2	..
..	..	75	50	..	..	..	..
..	..	76	34	..	..	..	..
..	..	77	35	..	..	..	..
..	..	78	34	..	..	..	..
..	..	79	17	..	..	..	..
..	..	80	12	..	..	..	..
..	..	81	3	..	..	..	..
..	..	82	4	..	..	..	..
..	..	83	0	..	..	..	..
..	..	84	1	..	..	..	..
n	500		498		499	499	500
Mean	43.8		73.5		10.9	11.7	8.9
SX	21,918		36,622		5,455	5,843	4,454
SX^2	962,604		2,698,916		59,869	68,709	39,890

Table X. Regression equations and other statistics for some of Koelz' Lake Michigan Leucichthys artedii specimens.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.875 X - 0.3353	206	477.65	348.39	1108.8743	808.9918	590.2763
HD = 0.980 X - 0.7976	205	475.39	302.37	1103.7667	702.5107	447.3425
EE = 0.637 X - 0.3596	206	477.65	230.18	1108.8743	534.5774	257.9466
ST = 0.842 X - 0.8527	205	475.26	225.36	1103.1622	523.5953	248.8556
MX = 0.787 X - 0.6098	203	470.65	246.63	1092.5321	572.8621	300.6089
IB = 1.087 X - 1.4386	"	470.77	219.71	1093.0817	510.9732	239.5281
CL = 0.962 X - 0.8682	206	477.65	280.66	1108.8743	652.0645	384.0268
CD = 1.082 X - 1.3047	201	465.81	236.36	1080.8357	549.2036	279.7550
BD = 1.323 X - 1.4248	188	436.65	309.83	1015.3949	721.2387	513.0917
BW = 1.286 X - 1.6348	202	468.34	272.05	1087.1660	632.4399	368.9801
DH = 0.795 X - 0.3064	204	473.12	313.62	1098.5994	728.4116	483.1518
DB = 1.014 X - 1.0227	206	477.65	273.68	1108.8743	635.9497	365.2392
AH = 0.881 X - 0.6871	202	468.28	273.75	1086.9026	635.7823	372.2983
AB = 0.895 X - 0.7451	206	477.65	274.01	1108.8743	636.5544	365.8025
PT = 0.888 X - 0.5349	"	"	313.96	"	729.1760	479.7098
PC = 0.867 X - 0.5027	"	"	310.56	"	721.2646	469.3686

Table XI. Calculated average size in mm. of body parts for Koelz' Lake Michigan *Leucichthys artedii* specimens.

Standard Length	200 mm.	250 mm.	300 mm.
HL	47.6	57.9	68.0
HD	28.7	35.7	42.7
EE	12.8	14.7	16.5
ST	12.2	14.7	17.1
MX	15.9	18.9	21.9
IB	11.6	14.7	17.9
CL	22.2	27.4	32.7
CD	15.3	19.5	23.7
BD	41.6	55.9	71.2
BW	21.1	28.1	35.5
DH	33.3	39.8	46.0
DB	20.4	25.6	30.8
AH	21.9	26.6	31.3
AB	20.6	25.2	29.6
PT	32.2	39.3	46.2
PC	31.1	37.7	44.2

Table XII. Lower and upper fiducial limits for body parts of Koelz' Lake Michigan Leucichthys artedii ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	47.4-47.8	44.9-50.5	57.6-58.2	54.6-61.4	67.4-68.6	64.1-72.2
HD	28.5-28.9	26.6-31.0	35.4-36.0	33.0-38.6	42.2-43.2	39.5-46.2
EE	12.7-12.9	11.1-14.7	14.5-14.9	12.8-16.9	16.1-16.9	14.3-19.0
ST	12.1-12.3	10.7-13.9	14.5-14.9	12.9-16.7	16.8-17.4	15.0-19.4
MX	15.8-16.0	14.1-17.9	18.7-19.1	16.8-21.3	21.5-22.3	19.4-24.7
IB	11.5-11.7	10.2-13.2	14.5-14.9	12.9-16.7	17.6-18.3	15.7-20.4
CL	21.9-22.5	18.2-27.1	26.9-27.9	22.4-33.5	31.7-33.7	26.7-40.0
CD	15.1-15.5	13.0-17.9	19.1-19.1	16.6-22.9	23.1-24.4	20.2-27.8
BD	41.0-42.2	34.4-50.4	54.8-57.0	46.1-67.7	69.1-73.4	58.7-86.4
BW	20.8-21.4	17.1-26.0	27.5-28.7	22.8-34.7	34.4-36.7	28.7-43.9
DH	33.0-33.6	29.3-37.8	39.3-40.3	35.0-45.2	45.1-46.9	40.4-52.3
DB	20.2-20.6	17.4-23.9	25.2-26.0	21.8-30.0	30.1-31.6	26.2-36.2
AH	21.6-22.2	18.5-25.9	26.2-27.0	22.5-31.5	30.5-32.1	26.4-37.1
AB	20.4-20.8	17.6-24.2	24.8-25.6	21.5-29.6	28.9-30.3	25.2-34.8
PT	31.9-32.5	28.5-36.4	38.8-39.8	34.7-44.5	45.3-47.1	40.8-52.3
PC	30.8-31.4	27.4-35.3	37.2-38.2	33.2-42.8	43.4-45.1	38.9-50.3

Table XIII. Statistics of meristic counts for Koelz' Lake Michigan Leucichthys artedii specimens.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
40	2	..	8	..	..	..	..
41	2	63	1	..	..	..	..
42	6	64	0	..	..	..	..
43	10	65	5	..	..	..	..
44	19	66	3	..	..	2	1
45	14	67	3	6	..	..	3
46	21	68	4	7	..	..	12
47	29	69	3	8	5	..	87
48	24	70	8	9	38	2	88
49	26	71	8	10	103	26	15
50	19	72	12	11	54	76	..
51	19	73	16	12	5	83	..
52	8	74	12	13	1	17	..
53	3	75	15	..	..	..	..
54	2	76	19	..	..	..	..
55	1	77	21	..	..	..	..
..	..	78	11	..	..	..	..
..	..	79	16	..	..	..	..
..	..	80	15	..	..	..	..
..	..	81	7	..	..	..	..
..	..	82	3	..	..	..	..
..	..	83	7	..	..	..	..
..	..	84	2	..	..	..	..
..	..	85	4	..	..	..	..
..	..	86	2	..	..	..	..
..	..	87	1	..	..	..	..
n	206		198		206	204	205
Mean	47.2		75.7		10.1	11.4	8.5
SX	9,722		14,983		2,079	2,331	1,740
SX^2	462,824		1,138,223		21,121	26,783	14,892

Table XIV. Regression equations and other statistics for some of Koelz' Lake Michigan Leucichthys nigripinnis specimens.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.818 X - 0.1704	48	115.49	86.29	277.9795	207.7039	155.2047
HD = 0.916 X - 0.5954	"	"	77.21	"	185.8674	124.2965
EE = 0.468 X - 0.0680	"	"	57.31	"	137.9397	68.4741
ST = 0.844 X - 0.8159	"	"	58.31	"	140.3856	70.9443
MX = 0.853 X - 0.7013	"	"	64.85	"	156.1221	87.7129
IB = 1.196 X - 1.7066	"	"	56.21	"	135.3702	66.0171
CL = 1.063 X - 1.1336	47	113.05	66.89	272.0259	161.0030	95.3937
CD = 1.123 X - 1.3767	48	115.49	63.61	277.9795	153.1671	84.4873
BD = 1.280 X - 1.2449	42	101.08	77.10	243.3692	185.6862	141.7476
BW = 1.076 X - 1.0870	48	115.49	72.09	277.9795	173.5654	108.4753
DH = 0.812 X - 0.2462	45	108.31	76.87	260.7949	185.1026	131.4025
DB = 1.019 X - 0.9861	48	115.49	70.35	277.9795	169.3728	103.2537
AH = 0.837 X - 0.4944	45	108.25	68.36	260.4977	164.5244	103.9428
AB = 0.753 X - 0.3513	47	113.00	68.58	271.7794	164.9581	100.1660
PT = 0.836 X - 0.3202	48	115.49	81.18	277.9795	195.4109	137.4068
PC = 0.896 X - 0.4862	"	"	80.14	"	192.9150	133.9038

Table XV. Calculated average size in mm. of body parts for Koelz' Lake Michigan Leucichthys nigripinnis specimens.

St.L.	200 mm.	250 mm.	300 mm.
HL	51.5	61.8	71.8
HD	32.5	39.9	47.2
EE	14.0	15.5	16.9
ST	13.4	16.1	18.8
MX	18.3	22.1	25.8
IB	11.1	14.5	18.0
CL	20.5	26.0	31.6
CD	16.1	20.7	25.4
BD	50.1	66.8	84.3
BW	24.5	31.1	37.9
DH	41.9	50.2	58.2
DB	22.8	28.7	34.5
AH	27.0	32.6	37.9
AB	24.1	28.5	32.7
PT	40.1	48.4	56.3
PC	37.6	46.0	54.1

Table XVI. Lower and upper fiducial limits for body parts of Koelz' Lake Michigan Leucichthys nigripinnis ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	50.3-52.7	48.1-55.2	61.2-62.4	57.9-66.0	70.6-73.0	67.1-76.7
HD	31.7-33.4	30.1-35.2	39.5-40.3	37.0-43.0	46.3-48.1	43.7-50.9
EE	13.4-14.5	12.5-15.6	15.3-15.7	13.9-17.3	16.4-17.4	15.1-18.8
ST	12.8-14.0	11.7-15.3	15.8-16.4	14.2-18.3	18.2-19.5	16.5-21.4
MX	17.6-18.9	16.5-20.2	21.8-22.4	20.0-24.4	25.2-26.5	23.3-28.5
IB	10.6-11.7	9.6-12.9	14.2-14.8	12.6-16.7	17.4-18.7	15.6-20.8
CL	19.2-22.0	16.7-25.2	25.3-26.8	21.4-31.7	30.0-33.3	25.8-38.6
CD	15.2-17.1	13.6-19.1	20.2-21.2	17.6-24.4	24.4-26.5	21.5-30.1
BD	47.4-53.0	42.6-59.1	65.2-68.4	57.1-78.0	80.9-87.8	71.9-98.3
BW	22.9-26.2	19.9-30.1	30.3-32.0	25.6-37.9	36.0-39.9	31.0-46.3
DH	40.3-43.5	37.4-46.9	49.4-51.0	45.1-55.9	56.6-59.9	52.2-65.0
DB	21.8-23.9	19.9-26.2	28.1-29.2	25.1-32.7	33.4-35.7	30.2-39.5
AH	25.8-28.2	23.8-30.7	32.0-33.2	28.8-36.8	36.7-39.2	33.5-43.0
AB	22.9-25.3	20.8-27.9	27.9-29.1	24.7-32.8	31.4-33.9	28.3-37.7
PT	38.3-42.0	35.0-46.0	47.4-49.3	42.4-55.1	54.4-58.3	49.2-64.4
PC	36.4-38.9	34.1-41.5	45.3-46.6	41.9-50.5	52.8-55.4	49.2-59.6

Table XVII. Statistics for meristic counts for Koelz' Lake Michigan Leucichthys nigripinnis specimens.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
42	1	68	1	..	..	..	..
43	3	69	2	..	..	..	..
44	3	70	3	7	..	..	3
45	4	71	3	8	..	..	16
46	5	72	2	9	5	..	29
47	10	73	6	10	30	2	..
48	7	74	2	11	11	21	..
49	4	75	5	12	2	22	..
50	7	76	7	13	..	2	..
51	2	77	2	14	..	1	..
52	2	78	5	..	..	..	..
..	..	79	5	..	..	..	..
..	..	80	4	..	..	..	..
..	..	81	0	..	..	..	..
..	..	82	1	..	..	..	..
n	48		48		48	48	48
Mean	47.3		75.1		10.2	11.6	8.5
SX	2,271		3,607		490	555	410
SX^2	107,731		271,627		5,024	6,443	3,520

Table XVIII. Results of analysis of covariance tests for body parts when comparing Koelz' Lake Michigan Leucichthys artedii and Leucichthys nigripinnis specimens.

Body Part	Mean Size	Slope
HL	**	NS
HD	**	NS
EE	**	NS
ST	**	NS
MX	**	NS
IB	NS	NS
CL	**	NS
CD	**	NS
BD	**	**
BW	**	NS
DH	**	NS
DB	**	NS
AH	**	**
AB	**	NS
PT	**	NS
PC	**	**

Table XIX. Comparison between sexes of age 4 F.R.B. Lake Michigan Leucichthys artedii ciscoes.

Body Part	Results of Covariance Tests	Mean Size[a] M	Mean Size[a] F	Greatest Actual Diff. mm.	Greatest Percentage Diff. mm.
HL	*	50.5	51.0	0.5	1.0
HD	NS	29.8	29.9	0.1	0.3
EE	NS	14.5	14.6	0.1	0.7
ST	NS	14.0	14.1	0.1	0.7
MX	NS	17.9	17.9	0	0
IB	**	12.2	11.9	0.3	2.5
CL	NS	22.6	22.6	0	0
CD	*	14.7	15.0	0.3	2.0
BD	NS	43.5	44.0	0.5	1.1
BW	NS	24.2	24.5	0.3	1.2
DH	**	36.4	35.6	0.8	2.2
DB	NS	22.7	22.2	0.5	2.2
AH	**	25.2	24.5	0.7	2.8
AB	**	23.7	22.8	0.9	3.8
PT	**	36.3	35.0	1.3	3.6
PC	**	34.8	33.4	1.4	4.0

[a]At 219 mm. standard length.

Table XX. Regression equations and other statistics for F.R.B. Lake Michigan *Leucichthys artedii* specimens.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.702 X + 0.0639	200	468.30	341.53	1096.6256	799.7635	583.3001
HD = 0.692 X - 0.1436	"	"	295.34	"	691.6086	436.2570
EE = 0.311 X + 0.4360	199	465.95	231.68	1091.1031	542.5002	269.8466
ST = 0.568 X - 0.1806	200	468.30	229.89	1096.6256	538.3449	264.3839
MX = 0.575 X - 0.0914	"	"	250.99	"	587.7513	315.0963
IB = 0.840 X - 0.8858	"	"	216.22	"	506.3641	233.9770
CL = 1.135 X - 1.3008	"	"	271.36	"	635.5043	368.5428
CD = 0.723 X - 0.5197	"	"	234.64	"	549.4828	275.4392
BD = 0.967 X - 0.6202	199	465.95	327.14	1091.1031	766.0821	538.0658
BW = 0.928 X - 0.7857	"	"	276.04	"	646.4297	383.2090
DH = 0.519 X + 0.3413	"	465.97	309.76	1091.1967	725.3733	482.3086
DB = 0.787 X - 0.4910	200	468.30	270.35	1096.6256	633.1041	365.6955
AH = 0.610 X - 0.0320	"	"	279.26	"	653.9490	390.1110
AB = 0.803 X - 0.5142	"	"	273.20	"	639.7791	373.4490
PT = 0.625 X + 0.0898	"	"	310.65	"	727.4503	482.6919
PC = 0.439 X + 0.5048	"	"	306.54	"	717.8078	469.9466

Table XXI. Calculated average size in mm. of body parts of F.R.B. Lake Michigan *Leucichthys artedii* specimens.

St.L.	200 mm.	250 mm.	300 mm.
HL	47.8	55.9	63.5
HD	28.1	32.8	37.2
EE	14.2	15.2	16.1
ST	13.4	15.2	16.8
MX	17.0	19.4	21.5
IB	11.1	13.4	15.7
CL	20.5	26.4	32.4
CD	13.9	16.4	18.7
BD	40.3	50.0	59.6
BW	22.4	27.5	32.6
DH	34.3	38.5	42.4
DB	20.9	24.9	28.7
AH	23.5	27.0	30.1
AB	21.6	25.8	29.8
PT	33.7	38.8	43.4
PC	32.7	36.1	39.1

Table XXII. Lower and upper fiducial limits for body parts of F.R.B. Lake Michigan Leucichthys artedii ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	47.4-48.2	45.0-50.7	55.3-56.5	52.6-59.3	61.9-65.1	59.6-67.7
HD	27.7-28.5	25.6-30.8	32.2-33.4	29.9-36.0	35.8-38.7	33.7-41.1
EE	14.0-14.4	12.8-15.8	14.9-15.5	13.7-16.9	15.4-16.8	14.4-18.0
ST	13.2-13.6	12.0-14.9	14.9-15.5	13.7-16.9	16.1-17.6	15.0-18.9
MX	16.8-17.3	15.6-18.7	19.0-19.7	17.7-21.3	20.7-22.4	19.5-23.8
IB	10.9-11.3	9.8-12.6	13.1-13.8	11.9-15.2	14.9-16.5	13.7-17.9
CL	20.0-20.9	17.5-23.9	25.6-27.1	22.5-30.8	30.3-34.6	27.4-38.4
CD	13.7-14.1	12.5-15.5	16 0-16.7	14.7-18.2	17.9-19.5	16.7-20.9
BD	39.5-41.1	35.1-46.2	48.7-51.3	43.5-57.4	52.2-63.2	51.4-69.1
BW	21.9-22.9	19.2-26.0	26.7-28.3	23.6-32.0	30.5-34.8	27.7-38.4
DH	33.8-34.9	30.7-38.3	37.7-39.3	34.5-43.1	40.4-44.4	37.6-47.7
DB	20.5-21.3	18.1-24.1	24.2-25.6	21.6-28.7	27.0-30.5	24.7-33.5
AH	23.1-24.0	20.8-26.6	26.3-27.6	23.8-30.5	28.6-31.8	26.4-34.4
AB	21.1-22.0	18.7-24.8	25.1-26.5	22.3-29.8	28.1-31.7	25.6-34.8
PT	33.2-34.3	29.9-38.0	37.9-39.7	34.4-43.7	41.3-45.7	38.2-49.4
PC	32.3-33.2	29.6-36.2	35.4-36.8	32.6-40.0	37.5-40.8	35.1-43.6

Table XXIII. Statistics for meristic counts for F.R.B. Lake Michigan Leucichthys artedii specimens.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
41	1	67	2	..	..	..	..
42	4	68	1	..	..	..	..
43	14	69	5	..	..	..	..
44	23	70	2	..	..	..	..
45	27	71	1	..	..	..	..
46	31	72	17	..	..	1	1
47	44	73	16	7	..	..	7
48	27	74	13	8	..	..	105
49	18	75	26	9	21	..	83
50	5	76	27	10	115	9	4
51	4	77	22	11	63	86	..
52	2	78	15	12	1	94	..
..	..	79	20	13	..	10	..
..	..	80	6	..	..	..	..
..	..	81	15	..	..	..	..
..	..	82	8	..	..	..	..
..	..	83	1	..	..	..	..
..	..	84	0	..	..	..	..
..	..	85	1	..	..	..	..
..	..	86	1	..	..	..	..
..	..	87	1	..	..	..	..
n	200		200		200	199	199
Mean	46.3		76.2		10.2	11.5	8.4
SX	9,268		15,250		2,044	2,294	1,676
SX^2	430,356		1,165,234		20,968	26,532	14,186

Table XXIV. Comparison between sexes of age 4 of F.R.B. Lake Huron Leucichthys artedii ciscoes.

Body Part	Results of Covariance Tests	Mean Size[a] M	Mean Size[a] F	Greatest Actual Diff. mm.	Greatest Percentage Diff. mm.
HL	NS	49.4	49.4	-	-
HD	NS	28.6	28.6	-	-
EE	NS	14.9	14.8	0.1	0.7
ST	NS	13.5	13.5	-	-
MX	NS	17.1	16.9	0.2	1.2
IB	NS	11.7	11.6	0.1	0.8
CL	NS	22.3	22.3	-	-
CD	NS	14.0	14.0	-	-
BD	NS	39.2	38.6	0.6	1.5
BW	NS	22.5	22.4	0.1	0.4
DH	NS	34.0	33.6	0.4	1.2
DB	NS	21.5	21.2	0.3	1.4
AH	NS	22.9	22.7	0.2	0.9
AB	NS	21.8	21.6	0.2	0.9
PT	**	34.1	33.2	0.9	2.6
PC	**	32.3	31.5	0.8	2.5

[a] At 208 mm. standard length.

Table XXV. Regression equations and other statistics for F.R.B. Lake Huron *Leucichthys artedii* specimens.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.837 X - 0.2469	272	630.89	460.89	1,463.4231	1,069.0995	781.0813
HD = 0.853 X - 0.5220	"	"	396.13	"	918.8937	577.0809
EE = 0.704 X - 0.4628	"	"	318.27	"	738.2857	372.6161
ST = 0.830 X - 0.7948	"	"	307.45	"	713.2027	347.7395
MX = 0.737 X - 0.4782	"	"	334.89	"	776.8384	412.6209
IB = 0.992 X - 1.2361	"	"	289.61	"	671.8409	308.6979
CL = 0.981 X - 0.9263	"	"	366.92	"	851.1562	495.4252
CD = 1.103 X - 1.4113	"	"	311.99	"	723.7618	358.2119
BD = 0.914 X - 0.5288	"	"	432.78	"	1,003.9080	688.8426
BW = 1.154 X - 1.3255	"	"	367.50	"	852.5199	496.8948
DH = 0.749 X - 0.2077	269	624.08	411.57	1,447.9522	954.9073	629.8883
DB = 0.781 X - 0.4832	272	630.89	361.31	1,463.4231	838.1228	480.2499
AF = 0.929 X - 0.7957	271	628.56	368.29	1,457.9942	854.3140	500.8051
AB = 0.875 X - 0.6917	"	"	362.55	"	840.9947	485.3493
PT = 0.823 X - 0.3820	272	630.89	415.31	1,463.4231	963.3776	634.3533
PC = 0.768 X - 0.2767	"	"	409.25	"	949.3159	615.9313

Table XXVI. Calculated average size in mm. of body parts of F.R.B. Lake Huron *Leucichthys artedii* specimens.

St.L.	200 mm.	250 mm.	300 mm.
HL	47.8	57.6	67.6
HD	27.6	33.4	39.0
EE	14.4	16.8	19.1
ST	13.0	15.7	18.2
MX	16.5	19.5	22.3
IB	11.1	13.9	16.6
CL	21.4	26.7	31.9
CD	13.4	17.1	20.9
BD	37.5	46.0	54.5
BW	21.4	27.7	34.1
DH	32.8	38.8	44.4
DB	20.6	24.5	28.3
AH	22.0	27.0	32.0
AB	21.0	25.5	29.9
PT	32.5	39.0	45.4
PC	30.9	36.7	42.2

Table XXVII. Lower and upper fiducial limits for body parts of F.R.B. Lake Huron Leucichthys artedii ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	47.5-48.0	44.8-50.9	56.7-58.5	53.9-61.5	65.0-69.2	62.5-72.0
HD	27.4-27.8	25.3-30.1	32.7-34.1	30.5-36.5	37.4-40.7	35.4-42.9
EE	14.2-14.5	12.9-16.0	16.4-17.3	15.0-18.8	18.1-20.1	16.9-21.6
ST	12.9-13.1	11.7-14.5	15.3-16.1	14.1-17.5	17.3-19.2	16.2-20.5
MX	16.3-16.7	14.4-18.9	18.8-20.1	16.9-22.4	20.8-23.8	19.1-25.9
IB	11.0-11.3	9.8-12.7	13.4-14.4	12.1-15.9	15.6-17.7	14.4-19.3
CL	21.1-21.7	18.2-25.2	25.6-27.8	22.5-31.6	29.5-34.5	26.6-38.2
CD	13.2-13.5	11.7-15.3	16.6-17.7	15.0-19.6	19.6-22.3	18.1-24.2
BD	37.2-37.9	33.6-41.9	44.8-47.3	41.1-51.5	51.5-57.3	48.2-61.4
BW	21.1-21.6	18.7-24.4	26.8-28.6	24.1-31.7	32.0-36.4	29.5-39.5
DH	32.5-33.1	29.5-36.4	37.7-39.9	34.8-43.2	42.0-47.0	39.5-50.0
DB	20.4-20.8	18.0-23.6	23.7-25.4	21.3-28.2	26.5-30.2	24.3-32.9
AH	21.7-22.2	19.3-25.0	26.2-27.9	23.7-30.8	30.1-34.1	27.8-36.9
AB	20.7-21.2	18.3-24.0	24.6-26.4	22.2-29.3	28.0-32.0	25.7-34.8
PT	32.2-32.8	29.1-36.2	38.0-40.1	34.9-43.7	43.0-47.8	40.2-51.2
PC	30.7-31.2	28.2-33.9	35.9-37.6	33.4-40.3	40.4-44.2	38.2-46.7

Table XXVIII. Statistics for meristic counts for F.R.B. Lake Huron *Leucichthys artedii* specimens.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
..	1	69	1	..	..	..	..
41	3	70	3	..	..	..	..
42	1	71	10	..	..	..	..
43	4	72	18	..	..	..	..
44	10	73	14	..	1	1	..
45	26	74	13	6	..	..	..
46	41	75	18	7	..	..	15
47	46	76	25	8	..	..	132
48	47	77	18	9	33	..	110
49	40	78	18	10	133	15	14
50	34	79	22	11	98	124	1
51	12	80	36	12	7	113	..
52	7	81	20	13	..	19	..
..	..	82	18	..	..	..	..
..	..	83	11	..	..	..	..
..	..	84	12	..	..	..	..
..	..	85	4	..	..	..	..
..	..	86	7	..	..	..	..
..	..	87	2	..	..	..	..
..	..	88	1	..	..	..	..
..	..	89	1	..	..	..	..
..	..	90	..	..	..	..	..
n	271		272		271	271	272
Mean	47.6		78.1		10.3	11.5	8.5
SX	12,887		21,237		2,789	3,117	2,302
SX^2	614,051		1,662,741		28,839	35,987	19,614

Table XXIX. Results of analysis of covariance tests for body parts when comparing F.R.B. samples of Leucichthys artedii from Lakes Michigan and Huron.

Body Part	Mean Size	Slope
HL	**	*
HD	NS	NS
EE	**	**
ST	NS	**
MX	**	NS
IB	NS	NS
CL	**	NS
CD	*	**
BD	**	NS
BW	**	NS
DH	**	*
DB	NS	NS
AH	**	**
AB	**	NS
PT	**	**
PC	**	NS

Table XXX. Average count of meristic characters for samples of ciscoes.

I.B.M. No.	Sample	GR	DR	AR	Br	Sc
73	Koelz Lake Michigan *L. nigripinnis*	47.3	10.2	11.6	8.5	75.1
74	Koelz Lake Michigan *L. artedii*	47.4	10.1	11.4	8.5	75.7
75	F.R.B. Lake Michigan *L. artedii*	46.3	10.2	11.5	8.4	76.2
76	F.R.B. Lake Huron *L. artedii*	47.6	10.3	11.5	8.5	78.1
01	Lake Manitoba	49.9	11.0	11.7	8.3	61.3
02	Lake Dauphin	54.0	11.3	12.1	8.2	62.6
12	Rocky Lake	45.3	11.3	12.6	8.4	68.9
18	Churchill River	43.8	10.9	11.7	8.9	73.5

Table XXXI. Regression equations and other statistics for Lake Dauphin ciscoes.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.762 X - 0.0252	98	233.79	175.67	557.8173	419.1453	314.9615
HD = 0.805 X - 0.2970	"	"	159.09	"	379.5955	258.3363
EE = 0.365 X + 0.3297	"	"	117.64	"	280.6744	141.2652
ST = 0.753 X - 0.6078[a]	"	"	116.04	"	276.8965	137.5054
" = 0.880 X - 0.9197[b]						
MX = 0.720 X - 0.4150	"	"	127.66	"	304.6084	166.3712
IB = 0.874 X - 0.8729	"	"	118.79	"	283.4612	144.1221
CL = 1.075 X - 1.2326	"	"	130.53	"	311.4854	174.1925
CD = 0.887 X - 0.6939	"	"	139.37	"	332.5582	198.3425
BD = 0.906 X - 0.2822	"	"	184.16	"	439.4113	346.1972
BW = 1.164 X - 1.2097	"	"	153.58	"	366.4812	240.8690
DH = 0.644 X + 0.2452	46	109.71	81.93	261.6993	195.4295	145.9685
DB = 0.846 X - 0.4822	98	233.79	150.53	557.8173	359.1781	231.3737
AH = 0.382 X + 0.6777	22	52.51	34.97	125.3441	83.4717	55.6085
AB = 0.712 X - 0.1870	98	233.79	148.13	557.8173	353.4412	223.9933
PT = 0.896 X - 0.4477	73	174.33	123.52	416.3723	295.0278	209.0928
PC = 0.786 X - 0.1654	72	171.81	123.13	410.0447	293.8686	210.6455

[a]Males only.
[b]Females only.

Table XXXII. Calculated average size in mm. of body parts of Lake Dauphin ciscoes.

St.L.	200 mm.	250 mm.	300 mm.
HL	53.5	63.4	72.8
HD	35.9	43.0	49.8
EE	14.8	16.0	17.1
ST (Male)	13.3	15.8	18.1
" (Female)	12.7	15.5	18.2
MX	17.4	20.5	23.4
IB	13.7	16.7	19.6
CL	17.4	22.1	26.9
CD	22.2	27.1	31.9
BD	63.5	77.7	91.6
BW	29.4	38.2	47.2
DH	53.3	61.6	69.3
DB	29.1	35.2	41.1
AH	36.0	39.2	42.1
AB	28.3	33.1	37.7
PT	41.1	50.2	59.1
PC	44.0	52.4	60.5

Table XXXIII. Lower and upper fiducial limits for body parts of Lake Dauphin ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	52.6-54.4	50.5-56.6	63.0-63.8	60.0-67.0	71.5-74.2	68.8- 77.2
HD	35.2-36.6	33.6-38.4	42.7-43.3	40.3-45.8	48.7-50.8	46.5- 53.2
EE	14.4-15.2	13.4-16.3	15.9-16.2	14.6-17.6	16.6-17.7	15.6- 18.9
ST(M)	12.8-13.9	12.0-14.8	15.5-16.0	14.4-17.3	17.3-18.9	16.3- 20.1
ST(F)	12.2-13.3	11.4-14.3	15.3-15.8	13.9-17.3	17.4-19.1	16.2- 20.5
MX	17.0-17.9	16.0-19.0	20.3-20.7	18.9-22.3	22.7-24.0	21.4- 25.5
IB	13.3-14.3	12.1-15.6	16.5-16.9	14.8-18.8	18.8-20.4	17.3- 22.2
CL	16.2-18.7	13.7-22.1	21.6-22.7	17.6-27.9	25.0-29.0	21.2- 34.3
CD	21.4-23.1	19.5-25.3	26.8-27.5	24.0-30.8	30.6-33.2	28.0- 36.3
BD	61.4-65.6	56.6-71.2	76.8-78.6	69.6-86.7	88.4-95.0	81.6-102.8
BW	28.3-30.6	25.9-33.5	37.6-38.7	33.7-43.2	45.3-49.1	41.4- 53.7
DH	50.7-56.1	47.0-60.5	60.5-62.7	54.8-69.3	65.5-73.2	60.9- 78.8
DB	27.9-30.4	25.1-33.8	34.6-35.7	30.5-40.6	39.2-43.0	35.4- 47.7
AH	31.8-40.8	29.6-43.9	37.8-40.7	33.5-46.0	37.0-47.9	34.4- 51.4
AB	27.4-29.2	25.5-31.4	32.8-33.5	30.0-36.7	36.5-39.0	33.9- 41.9
PT	39.4-43.0	36.4-46.5	49.5-50.9	44.7-56.4	56.6-61.8	52.3- 66.9
PC	42.3-45.7	39.3-49.2	51.7-53.1	47.1-58.3	58.1-63.0	54.0- 67.7

Table XXXIV. Statistics for meristic counts for Lake Dauphin ciscoes.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
48	1	..	1	..	..	..	..
49	3	56	2	..	..	..	..
50	3	57	1	..	..	..	..
51	5	58	7	..	..	..	..
52	13	59	5	..	..	..	..
53	19	60	11	..	2	29	2
54	14	61	10	7	..	..	5
55	12	62	10	8	..	..	64
56	12	63	14	9	..	..	26
57	7	64	10	10	4	..	1
58	5	65	13	11	57	12	..
59	3	66	8	12	34	40	..
60	1	67	2	13	1	17	..
..	..	68	1	..	..	..	..
..	..	69	..	..	..	..	..
..	..	70	1	..	..	..	..
..	..	71	..	..	..	..	..
..	..	72	2	..	..	..	..
n	98		97		96	69	96
Mean	54.0		62.6		11.3	12.1	8.2
SX	5,297		6,071		1,088	833	791
SX^2	286,897		380,893		12,362	10,085	6,547

Table XXXV. Regression equations and other statistics for Rocky Lake ciscoes.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.924 X - 0.4267	59	136.87	101.29	318.4965	235.8824	174.7405
HD = 1.019 X - 0.8119	"	"	91.57	"	213.4269	143.1759
EE = 0.616 X - 0.2670	"	"	68.56	"	159.6520	80.0664
ST = 0.909 X - 0.9977	"	"	65.55	"	152.9571	73.6711
MX = 0.854 X - 0.7406	"	"	73.19	"	170.6266	91.5395
IB = 1.027 X - 1.2585	"	"	66.31	"	154.8361	75.6071
CL = 0.848 X - 0.6962	"	"	74.99	"	174.7958	96.1685
CD = 1.065 X - 1.1618	"	"	77.22	"	180.1822	102.2374
BD = 1.322 X - 1.3024	"	"	104.10	"	242.7919	185.4444
BW = 1.380 X - 1.7599	"	"	85.04	"	198.6329	124.5152
DH = 0.788 X - 0.1476	52	121.06	87.72	282.6878	204.8897	148.5330
DB = 0.913 X - 0.6433	59	136.87	87.01	318.4965	202.7448	129.1821
AH = 0.958 X - 0.7049	56	130.15	85.21	303.4411	198.9553	130.5729
AB = 0.852 X - 0.5323	59	136.87	85.21	318.4965	198.5090	123.8841
PT = 0.948 X - 0.5880	54	125.34	87.07	291.8206	202.9452	141.2141
PC = 0.865 X - 0.3873	59	136.87	95.54	318.4965	222.4855	155.4692

Table XXXVI. Calculated average size in mm. of body parts of Rocky Lake ciscoes.

St.L.	200 mm.	250 mm.	300 mm.
HL	50.0	61.5	72.8
HD	34.1	42.8	51.6
EE	14.1	16.2	18.2
ST	12.4	15.2	17.9
MX	16.8	20.3	23.7
IB	12.7	16.0	19.3
CL	18.0	21.7	25.4
CD	19.4	24.7	29.9
BD	54.9	73.7	93.8
BW	26.0	35.4	45.6
DH	46.3	55.2	63.7
DB	28.7	35.2	41.5
AH	31.6	39.1	46.6
AB	26.8	32.4	37.9
PT	39.2	48.4	57.6
PC	40.1	48.6	56.9

Table XXXVII. Lower and upper fiducial limits for body parts of Rocky Lake ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	49.7-50.5	47.1-53.2	61.0-62.1	57.9-65.4	71.8-73.7	68.5- 77.4
HD	33.6-34.6	30.4-38.3	42.1-43.6	38.1-48.1	50.4-52.8	45.8- 58.0
EE	14.0-14.3	12.8-15.6	16.0-16.5	14.7-17.9	17.8-18.5	16.4- 20.0
ST	12.2-12.6	11.1-13.9	15.0-15.5	13.6-17.0	17.5-18.4	16.0- 20.1
MX	16.5-17.0	15.1-18.7	20.0-20.6	18.2-22.6	23.2-24.2	21.3- 26.4
IB	12.5-12.9	11.2-14.5	15.7-16.3	14.0-18.2	18.8-19.8	16.9- 22.0
CL	17.4-18.6	14.2-22.8	21.0-22.5	17.1-27.6	24.2-26.2	20.0- 32.3
CD	19.1-19.8	16.8-22.6	24.1-25.2	21.2-28.6	29.1-30.9	25.8- 34.8
BD	53.9-55.9	47.5-63.4	72.1-75.4	63.8-85.2	91.1-96.6	81.1-108.6
BW	25.5-26.6	22.0-30.8	34.5-36.3	30.0-41.9	44.0-47.1	38.5- 54.0
DH	45.6-47.0	41.6-51.6	54.3-56.1	49.6-61.5	62.3-65.2	57.2- 71.1
DB	28.2-29.2	25.2-32.7	34.5-35.9	30.9-40.1	40.4-42.6	36.4- 47.4
AH	31.1-32.1	28.0-35.7	38.4-39.8	34.6-44.2	45.4-47.7	41.2- 52.7
AB	26.1-27.5	21.9-32.7	31.4-33.4	26.5-39.6	36.4-39.4	30.9- 46.4
PT	38.7-39.7	35.9-42.8	47.8-49.1	44.3-52.9	56.5-58.7	52.6- 63.0
PC	39.6-40.6	36.4-44.2	47.9-49.4	44.1-53.6	55.8-58.1	51.6- 62.8

Table XXXVIII. Statistics for meristic counts for Rocky Lake ciscoes.

GR		Sc			DR	AR	Br
c	f	c	f	c	f	f	f
40	1	..	23	..	..	..	..
41	2	59	1	..	..	..	..
42	4	60	2	..	..	..	..
43	1	61	..	..	..	..	..
44	8	62	3	..	1	3	1
45	9	63	..	6	..	..	..
46	18	64	..	7	..	..	4
47	13	65	1	8	..	..	27
48	2	66	1	9	..	..	25
49	1	67	2	10	4	..	2
..	..	68	2	11	32	4	..
..	..	69	5	12	22	22	..
..	..	70	1	13	..	20	..
..	..	71	8	14	..	10	..
..	..	72	4	..	..	..	..
..	..	73	2	..	..	..	..
..	..	74	3	..	..	..	..
..	..	75	1	..	..	..	..
n	59		36		58	56	58
Mean	45.3		68.9		11.3	12.6	8.4
SX	2,674		2,480		656	708	489
SX^2	121,394		171,500		7,440	8,992	4,149

Table XXXIX. Number of ciscoes of various gill-raker groups for 3 samples from Lake Winnipeg.

1. BULLHEAD

Males				Females			
GR Group	Sex Condition	Age	n	GR Group	Sex Condition	Age	n
-	Questionable	2	4	-	Ripe	3	1
I	"	1	1	-	Spawning	5	2
	"	2	39	I	"	2	2
	"	3	39		"	3	1
	"	4	5		"	4	9
	Ripe	1	1		"	5	65
	"	2	3		"	6	41
	"	3	2		"	7	3
	Spawning	5	9		Spent	2	2
	"	6	4		"	3	3
II	Questionable	1	2	II	Immature	3	1
	"	2	23		Spawning	4	2
	"	3	15		"	5	12
	"	4	2		"	6	10
	Immature	3	2		"	7	1
	Ripe	2	1		Spent	2	2
					"	3	1
III	Spawning	5	2		"	4	1
				III	Spawning	2	1
					"	4	4
					"	5	32
					"	6	22
			—				—
Total			154				218

Table XXXIX continued.

2. DOGHEAD

Males				Females			
GR Group	Sex Condition	Age	n	GR Group	Sex Condition	Age	n
I	Mature	..	1	I	Mature	3	3
	"	1	1		"	3	1
	"	2	15		"	4	4
	"	3	39		"	5	26
	"	4	11		"	6	17
	Spawning	4	6		"	7	2
	"	5	20		Spent	4	1
	"	6	7				
	"	7	1	II	Mature	3	1
					Spawning	4	2
II	Mature	2	3		"	5	15
	"	3	12		"	6	7
	"	4	3		"	7	1
	"	5	1				
	Spawning	4	3	III	Spawning	4	6
	"	5	11		"	5	52
	"	6	11		"	6	59
	"	7	1		"	7	5
					"	8	1
III	.....	6	1				
	Spawning	4	3				
	"	5	41				
	"	6	18				
	"	7	2				
Total			211				203

Table XXXIX continued.

3. MUKUTAWA RIVER

Males				Females			
GR Group	Sex Condition	Age	n	GR Group	Sex Condition	Age	n
I	Immature	3	5	I	Questionable	2	1
	"	4	13		"	3	1
	"	5	19		"	4	3
	"	6	3		"	5	1
	"	9	1		"	6	1
	Mature	2	3		Immature	3	1
	"	3	8		"	6	1
	"	4	7		Mature	2	2
	"	5	23		"	3	7
	"	6	26		"	4	7
	"	7	21		"	5	18
	"	8	3		"	6	35
	"	9	2		"	7	25
					"	8	7
II	Immature	3	1		Small eggs	..	1
	"	4	2		"	3	1
	"	5	2		"	4	4
	"	7	1		"	5	17
	"	9	1		"	6	9
	Mature	3	1		"	7	8
	"	5	8		"	8	1
	"	6	14				
	"	7	5	II	Questionable	2	1
	"	8	9		Immature	5	1
	"	9	1		Mature	4	1
					"	5	4
III	Immature	4	3		"	6	13
	"	5	4		"	7	6
	"	6	3		"	8	7
	"	8	1		"	9	7
	Mature	..	1		"	10	2
	"	4	1		"	11	1
	"	5	7		Small eggs	4	2
	"	6	13			5	3
	"	7	9			6	2
	"	8	1			7	1
	"	9	1			8	1
				III	Questionable	4	1
					Mature	4	1
					"	5	12
					"	6	20
					"	7	16
					Small eggs	4	4
						5	3
						6	2
						7	5
						8	1
Total			223				268

Table XL. Statistically significant results for body parts of tests between ages for spawning female ciscoes from Bull Head.

GR Group	Body Part	Mean Size	Slope
I	EE	NS	*
	BD	*	NS
II	CD	**	NS
	DH	*	*
	PC	*	NS
III	-	-	-

Table XLI. Statistically significant results for body parts of tests between ages for spawning Doghead ciscoes.

Sex	GR Group	Body Part	Mean Size	Slope
Males	I	HL	**	NS
		DH	*	NS
		PT	NS	*
		PC	*	NS
	II	PC	*	NS
	III	BW	*	NS
Females	I	HL	*	NS
		EE	*	*
		ST	**	NS
		CD	NS	*
		AH	*	NS
		PC	**	NS
	II	-	-	-
	III	HD	*	NS

Table XLII. Statistically significant results for body parts of tests between ages for Mukutawa River ciscoes.

Sex	GR Group	Body Part	Mean Size	Slope
Males	I	EE	**	NS
		BD	*	NS
		PT	NS	**
	II	-	-	-
	III	DH	NS	**
Females	I	HL	NS	*
		EE	NS	*
		MX	NS	*
		AH	NS	*
	II	-	-	-
	III	HL	*	NS
		HD	**	NS
		IB	*	NS
		BD	**	NS
		BW	*	NS
		AH	**	NS
		PT	**	NS
		PC	**	NS

Table XLIII. Results of analysis of covariance tests between sexes for body parts of Lake Winnipeg ciscoes.

Sample	DOGHEAD						MUKUTAWA RIVER					
GR Group	I		II		III		I		II		III	
Body Part	Mean Size	Slope	Mean Size	Slope	Mean Size	Slope	Mean Size	Slope	Mean Size	Slope	Mean Size	Slope
HL	NS	NS	..	NS	NS	NS	NS	NS	NS	NS	..	NS
HD	*	**	..	NS	NS	NS	NS	NS	NS	NS	NS	NS
EE	NS	NS	NS	NS	NS	NS	..	NS	*	NS	NS	NS
ST	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MX	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
IB	NS	NS	*	NS	NS	NS	**	NS	NS	NS	NS	NS
CL	NS	NS	NS	NS	*	NS	..	NS	NS	*	NS	NS
CD	**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BD	NS	NS	NS	NS	NS	NS	NS	NS	..	NS	NS	NS
BW	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DH	NS	..	NS	NS	..	NS	*	NS	NS	NS	NS	NS
DB	NS	NS	NS	NS	*	NS	NS	**	NS	NS	NS	NS
AH	NS	NS	NS	NS	*	NS	*	*	NS	NS	NS	NS
AB	*	NS	NS	NS	**	NS	NS	NS	NS	NS	NS	NS
PT	NS	NS	NS	NS	*	NS	**	NS	NS	NS	NS	NS
PC	NS	NS	*	NS	NS	NS	**	*	NS	NS	NS	NS

Table XLIV. Regression equations and other statistics for spawning female ciscoes of gill-raker group I from Bull Head.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.855 X - 0.2555	121	285.31	213.02	672.8399	502.3707	375.1134
HD = 0.980 X - 0.7442	"	"	189.55	"	447.0422	297.0657
EE = 0.490 X + 0.0329	"	"	143.79	"	339.0952	170.9397
ST = 0.833 X - 0.7840	"	"	142.79	"	336.7709	168.6169
MX = 0.827 X - 0.6260	"	"	160.20	"	377.8219	212.2350
IB = 1.002 X - 1.2329	"	"	136.69	"	322.4040	154.5843
CL = 0.806 X - 0.6121	"	"	155.90	"	367.6807	201.1444
CD = 0.891 X - 0.8044	"	"	156.88	"	369.9998	203.5262
BD = 1.021 X - 0.6125	"	"	217.18	"	512.1960	390.0122
BW = 1.053 X - 1.0099	"	"	178.23	"	420.3575	262.7851
DH = 0.713 X + 0.0290	109	257.04	186.43	606.2356	439.6989	318.9685
DB = 0.776 X - 0.3906	120	282.95	172.69	667.2703	407.2645	248.7059
AH = 0.752 X - 0.2168	107	252.14	166.41	594.2454	392.2047	258.9317
AB = 0.939 X - 0.7805	121	285.31	173.47	672.8399	409.1226	248.8895
PT = 0.957 X - 0.6007	"	"	200.35	"	472.5056	331.8915
PC = 0.829 X - 0.2972	120	282.95	198.90	667.2703	469.0707	329.7908

Table XLV. Regression equations and other statistics for spawning female ciscoes of gill-raker group II from Bull Head.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.895 X - 0.3383	25	58.98	44.33	139.1570	104.5935	78.6217
HD = 0.886 X - 0.5086	"	"	39.54	"	93.2929	62.5532
EE = 0.272 X + 0.5503	"	"	29.80	"	70.3073	35.5284
ST = 0.807 X - 0.7047	"	"	29.98	"	70.7380	35.9846
MX = 0.482 X + 0.1965	"	"	33.34	"	78.6612	44.4772
IB = 0.684 X - 0.4505	"	"	29.08	"	68.6133	33.8528
CL = 1.000 X - 1.0624	"	"	32.42	"	76.4967	42.1208
CD = 0.474 X + 0.1697	"	"	32.20	"	75.9716	41.4824
BD = 0.395 X + 0.8697	"	"	45.04	"	106.2629	81.1592
BW = 1.219 X - 1.3843	"	"	37.29	"	87.9885	55.6647
DH = 0.064 X + 1.5469	23	54.23	39.05	127.8757	92.0738	66.3071
DB = 0.386 X + 0.5354	25	58.98	36.15	139.1570	85.2895	52.2927
AH = 0.460 X + 0.4564	22	51.89	33.91	122.4009	79.9865	52.2901
AB = 1.035 X - 1.0074	25	58.98	35.86	139.1570	84.6127	51.4762
PT = 0.521 X + 0.4196	24	56.58	39.55	133.3970	93.2441	65.1845
PC = 0.474 X + 0.5249	25	58.98	41.08	139.1570	96.9213	67.5144

Table XLVI. Regression equations and other statistics for spawning female ciscoes of gill-raker group III from Bull Head.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.663 X + 0.2321	59	140.14	106.61	332.8886	253.2394	192.6595
HD = 0.546 X + 0.3243	"	"	95.65	"	227.2043	155.0887
EE = 0.546 X - 0.0977	"	"	70.75	"	168.0604	84.8749
ST = 0.698 X - 0.4323	"	"	72.31	"	171.7689	88.6753
MX = 0.795 X - 0.5366	"	"	79.75	"	189.4428	107.8413
IB = 0.937 X - 1.0097	"	"	71.74	"	170.4199	87.2884
CL = 0.941 X - 0.9195	"	"	77.62	"	184.3865	102.?688
CD = 0.580 X - 0.0698	"	"	77.16	"	183.2865	100.9470
BD = 0.673 X + 0.2164	"	"	107.08	"	254.3560	194.3990
BW = 1.073 X - 1.0100	"	"	90.78	"	215.6476	139.7626
DH = 0.733 X - 0.0355	43	102.18	73.37	242.8232	174.3586	125.2149
DB = 0.783 X - 0.3961	58	137.74	84.88	327.1286	201.5909	124.2936
AH = 0.855 X - 0.4877	53	125.88	81.78	298.9928	194.2488	126.2170
AB = 1.088 X - 1.1254	59	140.14	86.07	332.8886	204.4604	125.6239
PT = 0.688 X + 0.0239	"	"	97.82	"	232.3615	162.2092
PC = 0.630 X + 0.1504	58	137.80	95.54	327.4130	227.0020	157.4028

Table XLVII. Regression equations and other statistics for spawning ciscoes of gill-raker group I from Doghead.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.792 X - 0.1132	84	197.43	146.86	464.2149	345.3190	256.8964
HD = 0.858 X - 0.4684	"	"	130.05	"	305.8217	201.5185
EE = 0.617 X - 0.2806	"	"	98.25	"	231.0361	115.0373
ST = 0.750 X - 0.5880	"	"	98.68	"	232.0712	116.0724
MX = 0.741 X - 0.4367	"	"	109.61	"	257.7588	143.1759
IB = 0.871 X - 0.9302	"	"	93.83	"	220.6941	105.0103
CL = 1.027 X - 1.0833	"	"	111.77	"	262.8882	149.1415
CD = 0.926 X - 0.8855	"	"	108.44	"	255.0430	140.1948
BD = 1.281 X - 1.2276	"	"	149.80	"	352.3191	267.4954
BW = 1.356 X - 1.6782	"	"	126.75	"	298.1571	191.6563
DH = 0.763 X - 0.1116	57	134.00	95.86	315.1258	225.4377	161.3400
DB = 0.850 X - 0.5655	84	197.43	120.31	464.2149	282.9278	172.5117
AH = 0.901 X - 0.5831	59	138.46	90.35	325.0952	212.1758	138.5385
AB = 0.825 X - 0.5028	82	192.68	117.74	452.9324	276.8100	169.2398
PT = 0.760 X - 0.1592	64	150.60	104.27	354.4952	245.4474	169.9905
PC = 0.784 X - 0.2053	74	173.94	121.17	409.0282	284.9543	198.5539

Table XLVIII. Regression equations and other statistics for spawning ciscoes of gill-raker group II from Doghead.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 1.042 X - 0.6918	51	121.30	91.11	288.5374	216.7340	162.8129
HD = 0.955 X - 0.6745	"	"	81.44	"	193.7316	130.1112
EE = 0.641 X - 0.3440	"	"	60.21	"	143.2269	71.1267
ST = 0.926 X - 0.9844	"	"	62.12	"	147.7793	75.7234
MX = 1.065 X - 1.1963	"	"	68.17	"	162.1736	91.1737
IB = 1.145 X - 1.5384	"	"	60.43	"	143.7672	71.6847
CL = 0.923 X - 0.8181	"	"	70.24	"	167.0921	96.8754
CD = 0.629 X - 0.1831	"	"	66.96	"	159.2810	87.9538
BD = 0.875 X - 0.2807	"	"	91.82	"	218.4171	165.3596
BW = 1.030 X - 0.9167	"	"	78.19	"	186.0042	119.9523
DH = 0.484 X + 0.5353	27	64.33	45.59	153.2875	108.6298	77.0009
DB = 0.798 X - 0.4347	51	121.30	74.63	288.5374	177.5292	109.2689
AH = 0.483 X + 0.3846	33	78.63	50.67	187.3747	120.7429	77.8415
AB = 0.846 X - 0.5405	50	118.92	73.58	282.8730	175.0312	108.3538
PT = 0.474 X + 0.5134	42	99.92	68.92	237.7372	163.9748	113.1202
PC = 0.537 X + 0.3677	44	104.66	72.38	248.9764	172.1809	119.0944

Table XLIX. Regression equations and other statistics for spawning ciscoes of gill-raker group III from Doghead.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.891 X - 0.3200	187	448.16	339.48	1,074.1786	813.7045	616.4334
HD = 0.890 X - 0.5130	"	"	302.94	"	726.1335	490.9672
EE = 0.565 X - 0.1613	"	"	223.06	"	536.8838	266.2178
ST = 0.861 X - 0.8217	"	"	232.21	"	556.6199	288.5575
MX = 0.831 X - 0.6305	"	"	254.53	"	610.1076	346.6191
IB = 0.991 X - 1.1467	"	"	239.69	"	550.5971	282.3513
CL = 1.091 X - 1.2166	"	"	261.44	"	626.7013	366.0048
CD = 0.754 X - 0.4822	"	"	247.74	"	593.8249	328.3668
BD = 0.968 X - 0.5005	"	"	340.23	"	815.5119	619.2337
BW = 0.884 X - 0.5730	"	"	289.02	"	692.7723	446.9128
DH = 0.623 X + 0.2085	116	278.28	197.56	667.6668	473.9911	336.6150
DB = 0.778 X - 0.3716	185	443.36	276.19	1,062.6584	662.0003	412.5773
AH = 0.484 X + 0.3986	94	225.15	146.44	539.3445	350.7851	228.2132
AB = 0.872 X - 0.6007	187	448.16	278.46	1,074.1786	667.4630	414.9182
PT = 0.802 X - 0.2647	150	359.74	248.80	862.8526	596.7691	412.8330
PC = 0.825 X - 0.3203	163	390.60	270.02	936.1202	647.1514	447.4690

Table L. Regression equations and other statistics for mature ciscoes of gill-raker group I from Mukutawa River.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.848 X - 0.2511	148	352.16	261.46	838.2656	622.4007	462.1574
HD = 0.937 X - 0.6340	"	"	236.14	"	562.1809	377.0900
EE = 0.660 X - 0.4168	"	"	170.73	"	406.4532	197.1931
ST = 0.682 X - 0.4184	"	"	178.25	"	424.3537	214.9133
MX = 0.708 X - 0.3497	"	"	197.56	"	470.3092	263.9322
IB = 1.008 X - 1.2681	"	"	167.29	"	398.3289	189.5227
CL = 1.087 X - 1.2679	"	"	195.14	"	464.6702	258.2964
CD = 0.957 X - 0.9552	"	"	195.64	"	465.8192	259.0282
BD = 1.102 X - 0.8032	"	"	269.20	"	640.8978	490.1502
BW = 1.311 X - 1.5643	"	"	230.16	"	548.0695	358.6690
DH = 0.787 X - 0.1614	147	349.78	251.54	832.6012	598.7765	430.7254
DB = 1.053 X - 1.0303	148	352.16	218.33	838.2656	519.8392	322.5981
AH = 0.846 X - 0.4492	147	349.75	229.85	832.4575	547.1369	359.7089
AB = 0.948 X - 0.7851	"	349.82	216.22	832.7900	514.8420	318.4462
PT = 0.904 X - 0.4978	148	352.16	244.68	838.2656	582.4912	404.8644
PC = 0.831 X - 0.3149	"	"	246.04	"	585.7040	409.3320

Table LI. Regression equations and other statistics for mature ciscoes of gill-raker group II from Mukutawa River.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.833 X - 0.2099	69	169.38	126.61	416.0358	311.0038	232.5233
HD = 0.946 X - 0.6380	"	"	116.21	"	285.5017	195.9789
EE = 0.586 X - 0.2627	"	"	81.13	"	199.2999	95.5273
ST = 0.712 X - 0.4924	"	"	86.62	"	212.8075	108.9302
MX = 0.816 X - 0.6218	"	"	95.31	"	234.1650	131.9145
IB = 1.084 X - 1.4074	"	"	86.50	"	212.6039	108.7796
CL = 0.812 X - 0.5966	"	"	96.37	"	236.7660	135.0339
CD = 1.224 X - 1.5777	"	"	98.46	"	241.9974	140.9928
BD = 1.297 X - 1.2683	"	"	132.18	"	324.7906	253.6970
BW = 1.300 X - 1.5542	"	"	112.95	"	277.5858	185.3971
DH = 0.778 X - 0.1549	"	"	121.09	"	297.4401	212.7165
DB = 1.204 X - 1.3733	"	"	109.18	"	268.3079	173.1858
AH = 0.860 X - 0.4995	"	"	111.20	"	273.1822	179.4436
AB = 1.020 X - 0.9526	"	"	107.04	"	263.0094	166.3626
PT = 0.792 X - 0.2374	"	"	117.77	"	289.2935	201.2089
PC = 0.801 X - 0.2588	"	"	117.82	"	289.4184	201.3816

Table LII. Regression equations and other statistics for mature ciscoes of gill-raker group III from Mukutawa River.

Log Body Part	N	SX	SY	SX^2	SXY	SY^2
HL = 0.870 X - 0.2735	77	186.47	141.17	451.6269	341.9173	258.8783
HD = 1.011 X - 0.7757	78	188.89	130.46	457.4833	315.9859	218.2918
EE = 0.466 X + 0.0260	"	"	90.05	"	218.0966	104.0277
ST = 0.918 X - 0.9540	"	"	98.99	"	239.7710	125.7303
MX = 0.892 X - 0.7660	"	"	108.75	"	263.4050	151.7117
IB = 1.102 X - 1.4220	"	"	97.24	"	235.5432	121.3468
CL = 0.848 X - 0.6727	"	"	107.71	"	260.8841	149.0837
CD = 0.766 X - 0.5019	"	"	105.54	"	255.6246	142.9010
BD = 1.022 X - 0.6263	"	"	144.20	"	349.2602	266.6944
BW = 0.989 X - 0.8151	"	"	123.24	"	298.5003	194.8688
DH = 0.441 X + 0.6538	77	186.45	132.56	451.5297	321.0086	228.2768
DB = 0.951 X - 0.7718	78	188.89	119.43	457.4833	289.2717	182.9995
AH = 0.565 X + 0.2022	"	"	122.50	"	296.6851	192.4612
AB = 0.890 X - 0.6354	"	"	118.55	"	287.1373	180.3119
PT = 0.695 X - 0.0064	"	"	130.78	"	316.7436	219.3666
PC = 0.565 X + 0.3040	"	"	130.44	"	315.9131	218.2244

Table LIII. Calculated average size in mm. of body parts for three gill-raker groups of Bull Head ciscoes.

St.L.	200 mm.			250 mm.			300 mm.		
GR Group	I	II	III	I	II	III	I	II	III
HL	51.5	52.6	57.2	62.3	64.3	66.4	72.8	75.6	74.9
HD	32.4	33.9	38.1	40.3	41.3	43.0	48.2	48.5	47.5
EE	14.5	15.0	14.4	16.1	15.9	16.3	17.6	16.8	18.0
ST	13.6	14.2	14.9	16.4	17.0	17.4	19.0	19.7	19.8
MX	18.9	20.2	19.6	22.8	22.5	23.4	26.5	24.6	27.1
IB	11.8	13.3	14.0	14.8	15.5	17.3	17.8	17.5	20.5
CL	17.5	17.3	17.6	20.9	21.7	21.7	24.2	26.0	25.8
CD	17.6	18.2	18.4	21.5	20.2	20.9	25.3	22.1	23.3
BD	54.6	60.1	58.2	68.5	65.6	67.6	82.5	70.5	76.5
BW	25.9	26.3	28.8	32.7	34.6	36.6	39.7	43.2	44.5
DH	46.7	49.5	44.8	54.8	50.2	52.7	62.4	50.7	60.3
DB	24.8	26.5	25.4	29.5	28.9	30.3	34.0	31.0	35.0
AH	32.6	32.7	30.2	38.6	36.3	36.5	44.3	39.4	42.7
AB	24.0	23.7	23.9	29.6	29.8	30.5	35.1	36.0	37.1
PT	39.9	41.5	40.5	49.4	46.7	47.2	58.9	51.3	53.5
PC	40.8	41.3	39.8	49.1	45.9	45.8	57.1	50.0	51.4

Table LIV. Calculated average size in mm. of body parts for three gill-raker groups of Doghead ciscoes.

St.L.	200 mm.			250 mm.			300 mm.		
GR Group	I	II	III	I	II	III	I	II	III
HL	51.2	50.8	53.7	61.1	64.1	65.6	70.6	77.5	77.1
HD	32.1	33.3	34.3	38.8	41.3	41.8	45.4	49.1	49.2
EE	13.8	13.5	13.8	15.8	15.6	15.6	17.7	17.5	17.3
ST	13.7	14.0	14.4	16.2	17.2	17.5	18.6	20.4	20.5
MX	18.6	18.0	19.1	21.9	22.8	23.0	25.0	27.7	26.8
IB	11.9	12.5	13.6	14.4	16.1	17.0	16.9	19.9	20.3
CL	19.0	20.2	19.7	24.0	24.8	25.1	28.9	29.4	30.6
CD	17.6	18.4	17.9	21.6	21.1	21.2	25.6	23.7	24.3
BD	52.5	54.0	53.3	69.9	65.7	66.2	88.2	77.1	79.0
BW	27.7	28.4	28.9	37.4	35.7	35.2	48.0	43.1	41.4
DH	44.1	44.6	43.9	52.2	49.6	50.4	60.0	54.2	56.5
DB	24.6	25.2	26.2	29.7	30.1	31.2	34.7	34.8	35.9
AH	30.9	31.3	32.5	37.8	34.9	36.2	44.5	38.1	39.6
AB	24.9	25.5	25.5	29.9	30.8	30.9	34.7	35.9	36.2
PT	38.9	40.2	38.1	46.0	44.7	45.5	52.9	48.7	52.7
PC	39.7	40.1	37.8	47.3	45.2	45.5	54.6	49.9	52.9

Table LV. Calculated average size in mm. of body parts for three gill-raker groups of Mukutawa River ciscoes.

St.L.	200 mm.			250 mm.			300 mm.		
GR Group	I	II	III	I	II	III	I	II	III
HL	50.1	50.9	53.5	60.6	61.8	65.0	70.7	71.4	76.1
HD	33.3	34.6	35.5	41.0	42.7	44.5	48.7	50.5	53.5
EE	12.6	12.2	12.5	14.6	13.9	13.9	16.5	15.4	15.1
ST	14.2	14.0	14.4	16.5	16.4	17.7	18.7	18.7	20.9
MX	19.0	18.0	19.3	22.3	21.6	23.6	25.4	25.1	27.8
IB	11.3	12.2	13.0	14.1	15.6	16.6	16.9	19.0	20.3
CL	17.1	18.7	19.0	21.8	22.4	23.0	26.6	26.0	25.8
CD	17.7	17.3	18.2	21.9	22.8	21.6	26.0	28.5	24.9
BD	54.0	52.0	53.1	69.1	69.5	66.7	84.4	88.0	80.4
BW	28.3	27.4	28.9	38.0	36.6	36.0	48.2	46.4	43.1
DH	44.6	43.2	46.6	53.2	51.4	51.4	61.4	59.2	55.7
DB	24.7	25.0	26.1	31.2	32.6	32.3	37.9	40.7	38.4
AH	31.4	30.2	31.8	38.0	36.5	36.1	44.3	42.7	40.0
AB	24.9	24.8	25.9	30.8	31.1	31.5	36.6	37.5	37.1
PT	38.2	38.5	39.2	46.8	45.9	45.7	55.1	53.0	51.9
PC	39.6	38.4	40.2	47.6	45.9	45.6	55.4	53.1	50.5

Table LVI. Results of analysis of covariance tests between 3 gill-raker groups of ciscoes for body parts of Lake Winnipeg samples.

Body Part	BULL HEAD Mean Size	BULL HEAD Slope	DOGHEAD Mean Size	DOGHEAD Slope	MUKUTAWA R. Mean Size	MUKUTAWA R. Slope
HL	**	NS	**	*	**	NS
HD	**	**	**	NS	**	NS
EE	NS	NS	NS	NS	**	NS
ST	**	NS	**	NS	**	NS
MX	**	NS	**	*	**	NS
IB	**	NS	**	NS	**	NS
CL	NS	NS	*	NS	NS	NS
CD	NS	*	NS	**	**	**
BD	NS	*	**	**	**	*
BW	**	NS	**	**	**	NS
DH	**	*	NS	NS	**	*
DB	NS	NS	**	NS	**	NS
AH	**	NS	**	**	**	NS
AB	NS	NS	*	NS	NS	NS
PT	**	NS	NS	NS	**	NS
PC	NS	NS	**	NS	NS	NS

Table LVII. Average size in mm. of Lake Winnipeg ciscoes.

	BULL HEAD			LOGHEAD						MUKUTAWA RIVER					
	I	II	III	I		II		III		I		II		III	
Age	F	F	F	M	F	M	F	M	F	M	F	M	F	M	F
2	180		244							136	116				
3	220				135					129	119				
4	229	218	232	216	192	218	224	243	241	184	173		234		215
5	229	227	237	217	230	242	240	245	249	230	218	235	239	255	258
6	230	232	241	233	239	243	246	248	254	238	247	273	276	265	271
7	224	236		230	240	241	233	262	268	251	252	308	287	270	268
8									280	274	264	304	325	276	
9										333			324		
10													332		

Table LVIII. Average count of meristic characters for Lake Winnipeg ciscoes.

	BULL HEAD			DOGHEAD			MUKUTAWA R.		
GR Group	I	II	III	I	II	III	I	II	III
DR	10.2	10.5	10.7	10.4	10.8	10.8	10.4	10.7	10.8
AR	11.8	11.8	12.1	11.8	12.2	12.1	11.8	11.8	12.2
Br	9.1	9.4	9.4	8.2	8.4	8.8	8.4	8.8	9.0
Sc	62.2	62.0	61.2	62.9	63.9	64.0	61.8	66.4	62.0

Table LIX. Lower and upper fiducial limits for body parts of Lake Manitoba ciscoes.

St.L.	200 mm.		250 mm.		300 mm.	
	Mean Part	Ind. Part	Mean Part	Ind. Part	Mean Part	Ind. Part
HL	49.7-50.5	47.1-53.2	61.0-62.1	57.9-65.4	71.8-73.7	68.5- 77.4
HD	33.6-34.6	30.4-38.3	42.1-43.6	38.1-48.1	50.4-52.8	45.8- 58.0
EE	14.0-14.3	12.8-15.6	16.0-16.5	14.7-17.9	17.8-18.5	16.4- 20.0
ST	12.2-12.6	11.1-13.9	15.0-15.5	13.6-17.0	17.5-18.4	16.0- 20.1
MX	16.5-17.0	15.1-18.7	20.0-20.6	18.2-22.6	23.2-24.2	21.3- 26.4
IB	12.5-12.9	11.2-14.5	15.7-16.3	14.0-18.2	18.8-19.8	16.9- 22.0
CL	17.4-18.6	14.2-22.8	21.0-22.5	17.1-27.6	24.2-26.6	20.0- 32.3
CD	19.1-19.8	16.8-22.6	24.1-25.2	21.2-28.6	29.1-30.9	25.8- 34.8
BD	53.9-55.9	47.5-63.4	72.1-75.4	63.8-85.2	91.1-96.6	81.1-108.6
BW	25.5-26.6	22.0-30.8	34.5-36.3	30.0-41.9	44.0-47.1	38.5- 54.0
DH	45.6-47.0	41.6-51.6	54.3-56.1	49.6-61.5	62.3-65.2	57.2- 71.1
DB	28.2-29.2	25.2-32.7	34.5-35.9	30.9-40.1	40.4-42.6	36.4- 47.4
AH	31.1-32.1	28.0-35.7	38.4-39.8	34.6-44.2	45.4-47.7	41.2- 52.7
AB	26.1-27.5	21.9-32.7	31.4-33.4	26.5-39.6	36.4-39.4	30.9- 46.4
PT	38.7-39.7	35.9-42.8	47.8-49.1	44.3-52.9	56.5-58.7	52.6- 63.0
PC	39.6-40.6	36.4-44.2	47.9-49.4	44.1-53.6	55.8-58.1	51.6- 62.8

Table LX. Fiducial limits for slope for Great Lakes samples.

Body Part	Koelz' Lake Michigan *L. artedii*	Koelz' Lake Michigan *L. nigripinnis*	F.R.B. Lake Michigan *L. artedii*	F.R.B. Lake Huron *L. artedii*
HL	0.856-0.894	0.552-1.084	0.449-0.955	0.577-1.097
HD	0.955-1.005	0.612-1.220	0.302-1.082	0.501-1.205
EE	0.592-0.682	0.030-0.906	-0.138-0.760	0.259-1.149
ST	0.801-0.883	0.330-1.358	0.120-1.016	0.404-1.256
MX	0.749-0.825	0.453-1.253	0.185-0.965	0.181-1.293
IB	1.046-1.128	0.625-1.767	0.314-1.366	0.454-1.530
CL	0.898-1.026	0.683-1.443	0.472-1.798	0.314-1.648
CD	1.030-1.134	0.457-1.789	0.275-1.171	0.565-1.641
BD	1.256-1.390	0.634-1.926	0.382-1.552	0.469-1.359
BW	1.217-1.355	0.277-1.875	0.284-1.572	0.616-1.692
DH	0.754-0.836	0.369-1.255	0.050-0.988	0.226-1.272
DB	0.963-1.065	0.486-1.552	0.183-1.391	0.225-1.337
AH	0.826-0.936	0.293-1.381	0.084-1.136	0.409-1.449
AB	0.844-0.946	0.140-1.366	0.199-1.407	0.318-1.432
PT	0.849-0.927	0.303-1.369	0.118-1.132	0.397-1.139
PC	0.826-0.908	0.516-1.276	0.010-0.868	0.378-1.268

Table LXI. Fiducial limits for slope for Manitoba ciscoes.

Body Part	Lake Manitoba	Lake Dauphin	Rocky Lake	Churchill River
HL	0.732-0.834	0.482-1.042	0.898-0.950	0.901-0.929
HD	0.741-0.863	0.478-1.132	0.968-1.070	0.940-0.976
EE	0.411-0.561	-0.102-0.832	0.573-0.659	0.685-0.727
ST	0.622-0.792	-0.317-1.823(M)	0.860-0.958	0.818-0.858
		-0.096-1.856(F)		
MX	0.575-0.739	0.300-1.140	0.807-0.901	0.858-0.902
IB	0.799-0.977	0.267-1.481	0.970-1.084	0.965-1.009
CL	0.716-1.056	-0.093-2.243	0.744-0.952	0.906-0.986
CD	0.909-0.977	0.256-1.518	1.000-1.130	0.884-0.932
BD	0.649-0.839	0.346-1.466	1.259-1.385	0.911-1.073(M)
				1.086-1.126(F)
BW	0.904-1.122	0.533-1.795	1.307-1.453	1.200-1.284(F)
DH	0.589-0.827	-0.585-1.873	0.734-0.842	0.747-0.791
DB	0.687-0.885	0.122-1.570	0.856-0.970	0.945-1.007
AH	0.663-0.921	-0.161-0.925	0.904-1.012	0.791-0.845
AB	0.741-0.945	0.198-1.226	0.764-0.940	0.792-0.986(M)
PT	0.709-0.929	0.035-1.757	0.905-0.991	0.854-0.898
PC	0.713-0.869	0.059-1.513	0.822-0.908	0.807-0.849