

JOB COMPLETION REPORT

As required by

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project No. F-6-15

FISHERY INVESTIGATIONS - REGION 5-B

Job No. B-26 (Seg. 4) The K Factor Index, KI:
A Qualitative Measure of Fish Populations

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ABSTRACT

The procedure for computing KI was finalized this segment. This will be done by measuring the difference between regression lines of log weight on log length by the use of Student's distribution. The derived probabilities are weighed by sample frequencies and the average equals KI.

JOB COMPLETION REPORT

State of Texas

Project No. F-6-15

Name: Fishery Investigations - Region
5-B

Job No. B-26

Title: K Factor Index

Period Covered: January 1, 1967 to December 31, 1967

Objective:

To develop a method by which fish populations can be qualitatively measured through the use of K factors.

Procedures:

Originally the K Factor Index was to be a collection of average K factors, corrected to eliminate certain inequities, from which field personnel could measure water productivity from netting samples with the use of desk calculators. As the index evolved, I became convinced that this approach was impractical. I believe that the best procedure is to store regional length-weight values on computer tape and have field personnel send their data to the Statistical and Data Processing Section in Austin. There the machine could figure KI (automatically up-dating the regional values during the process), print the results, and return them to the originator. During this segment I have secured permission to work toward this goal.

Since ADP methods are to be employed, we can by-pass the K factor calculation entirely and work simply with lengths and weights. By definition, the K Factor Index is:

$$KI = \sum P (t_{ij}) \cdot f_{ij}/N$$

Where P = probability

t = the standardized unit of Student's distribution

i = the species in the ith class

j = non-productivity correction term in the jth class

N = total number in sample

f = frequency in the sub-class

The change will be in the computation of the variable t in the equation. Originally t was:

$$t = \text{Sample } \bar{K} - \text{Regional } \bar{K} / \text{Sample Standard Error.}$$

The regional means being highly variable were smoothed by a moving average which allowed them no dispersion values. Since K was derived from the function

$$W = K \cdot (L)^n$$

where W is weight, L is the length, and the exponent n held constant at 3, the computer can easily handle the linear form

$$\log W = \log K + n (\log L).$$

The value of t will now be computed by comparing regression values of log weight on log length. The significance of the mean weight of the sample compared with the regional mean (both adjusted to the regression values at the pooled mean length) will be tested by

$$t = \text{Sample Adj. } \bar{W} - \text{Regional Adj. } \bar{W} / \text{Pooled St. Error.}$$

The use of the length-weight regression will eliminate the use of length intervals. I have also eliminated the stages of sexual development as non-productivity correction terms and substituted in their place monthly correction terms for males of each species and females of each species. I feel that this will minimize most of the weight variability associated with factors other than water productivity.

Results:

To illustrate the use of the index, a sample problem is shown. Table 1 shows part of a gill net collection taken at Delta Lake in November 1966. Those fishes which were not sexed are not included and the freshwater drum are not included due to insufficient regional length-weight values for November. Since regression analysis requires at least three individuals in each sample, those species and/or sexes which did not have three members were not used in the calculation of the index.

The Delta Lake collection was tested against the regional values and the results are shown in Table 2. Only one of the three game fish species appears to be thriving: the white crappie. This in itself is significant, since several years ago crappie disappeared from this lake after providing a number of years of good fishing. A massive stocking program restored their numbers, and this high KI-value proves its effectiveness. I am not surprised that white bass are doing poorly, however, since this lake is not one in which they normally live. Both male and female blue catfish show unusually low values of KI. The population seems large and is reproducing, and the only thing to which I can attribute this low condition is parasites. Data from the collection sheets list a heavy infestation of internal parasites.

Table 1
Gill Net Collection from Delta Lake

Species	Sex	St. L. (mm.)	Weight (gm.)	Species	Sex	St. L. (mm.)	Weight (gm.)
Longnose gar	F	720	1318	White bass	M	169	128
	F	855	3005		F	176	139
	M	624	1233		F	172	125
	F	639	1049		M	197	97
	M	518	638		F	159	106
	M	514	510		M	170	135
	M	692	1588		M	166	123
Blue catfish	F	522	1828	White crappie	F	192	209
	M	392	907		F	229	356
	M	274	273		F	179	172
	F	203	114		M	183	184
	M	201	108		M	172	156
	F	197	97		M	173	155
	F	199	115		F	177	174
	F	257	236		M	174	157
	M	230	160		M	188	175
	F	229	155		M	173	161
	M	199	109		F	179	184
	M	225	149		F	191	208
	M	196	95		F	174	165
	F	221	146		M	167	144
White bass	M	256	510	M	162	130	
	F	209	251	M	171	158	
	M	207	248	M	163	131	
	F	203	231	M	124	55	
Gizzard shad	M	237	253				
	F	199	166				
	M	192	126				
	F	173	105				
	F	163	84				
	F	141	47				
	M	140	50				
	F	133	43				
	M	138	49				
	F	133	42				

Table 2
Computation of KI for Delta Lake Collection

Species	Sex	No.	t-Value	Probability
Longnose gar	males	4	0.37	64.4%
	females	3	-0.58	28.1
Gizzard shad	males	4	-0.51	30.5
	females	6	2.25	98.8
Blue catfish	males	7	-1.55	6.0
	females	7	-1.54	6.2
White bass	males	6	-0.27	39.4
	females	5	-0.52	30.2
White crappie	males	11	4.38	100.0
	females	7	4.21	100.0

$$\begin{aligned} KI &= 4(64.4) + 3(28.1) + 4(30.5) + \dots + 7(100.0) / 4+3+4+\dots+7 \\ &= 3,329.50 / 60 \\ &= 55.5\% \end{aligned}$$

Over-all the K Factor Index for the lake is 55.5%. If it were equal with the regional values, it would be 50.0%. Much of the KI is contributed by the crappie, and without them the total is only 36.4%.

Both rough fish species tested appear to be in above average condition, if the sexes are combined. None of the values of this test should be considered as firmly established due to the small size of the sample, but their pooling most likely will be very indicative of the total KI.

What remains to be done now computation-wise is to determine the theoretical distribution of KI so that confidence limits can be found. If that can be done, lakes can also be compared with one another as with regional means.

Prepared by John C. Barron
Project Leader

Approved by Marion Toole
Coordinator

Date June 11, 1968

Elgin M. C. Dietz
Inland Supervisor

10-10-10

Dear Mr. [Name],

I am writing to you regarding the [Topic] that we discussed in our meeting on [Date].

The information provided to me indicates that [Details] and it appears that [Further Details].

I am sure that you will find this information helpful and I am happy to provide any further assistance.

Very truly yours,

[Signature]

[Name]

[Address]

[City, State, Zip]

[Phone Number]

[Email Address]

[Fax Number]

[Website]

[Social Media]

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