LIVE WEIGHT-DRESSED WEIGHT RELATIONSHIP FOR COMMERCIAL FISHES FROM FOUR OKLAHOMA RESERVOIRS[1]

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ABSTRACT

Oklahoma commercial fishermen on Lakes Texoma, Grand, Eufaula, and Gibson were studied from July 1967 to June 1968. In each quarter samples of fish were weighed prior to cleaning, by a commercial fisherman, and immediately afterwards. Linear and curvilinear regressions are fitted to these data. Between lake and between season comparisons are made. Information is presented for smallmouth buffalo, bigmouth buffalo, flathead catfish, carp, drum, river carpsucker, and paddle fish.

INTRODUCTION

During the period from July 1, 1967 to June 30, 1968, the field collection of data for project 4-25-D "Commercial Fisheries Statistics Survey" (PL88-309) was undertaken. This project was conducted through the joint cooperation of the Oklahoma Cooperative Fisheries Unit and the Oklahoma Department of Wildlife Conservation. One of the major project objectives was to compare the annual harvest of commercial fish, as reported by commercial fishermen, with the estimated harvest, calculated from data taken on field samples from commercial fishermen by project investigators.

Most of the commercial fishermen furnish harvest data given in dressed weight. However, project investigators on survey samples record all fish taken in live weight. In order to enable a comparison of the reported harvest with estimated harvest, the reported harvest had to be converted back to live weight pounds. Dressed weight to live weight data was then taken seasonally on all major Oklahoma commercial fish species and conversion factors were subsequently derived.

An attempt was made to collect data from all species on four project reservoirs (Grand Lake, Fort Gibson Reservoir, Eufaula Reservoir, and Lake Texoma) for each quarter of the year.

In order to determine appropriate relationships between live and dressed weights, regression and correlation analysis were performed on these data. This paper presents the results of seasonal and lake comparisons and gives the best estimating equations for converting dressed and live weights for the flathead catfish, *Pylodictis olivaris*; smallmouth buffalo, *Ictiobus bubalus*; bigmouth buffalo, *Ictiobus cyprinellus*; river carpsucker, *Carpiodes carpio*; freshwater drum, *Aplodinotus grunneins*; carp, *Cyprinus carpios*; paddlefish, *Polyodon spathula*.

SPECIES AND LAKES SAMPLED

Although all species of commercial fish vary in contribution to the commercial harvest seasonally, smallmouth buffalo is the most consistent fish represented in the catch. Only on Lake Eufaula does its minor occurrence differ significantly from its reputation as being the leading commercial fish in terms of dollars and pounds in the state's fishery.

Flathead catfish is the second most important commercial species in terms of value to the overall fishery. Its highest annual occurrences in commercial nets is during the spring and fall seasons with the lowest catch rate coming during the winter. During the 1967 commercial fishing season, the flathead varied by lake from 2.0% of the annual harvest by weight in Texoma to 49.8% in Eufaula (1967 Commercial Fisheries Report).

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River carpsucker, freshwater drum, and carp exhibit seasonal and by lake differences but do contribute with regularity to the fisheries of all lakes on a year-round basis.

Bigmouth buffalo occur in the commercial harvests on three of the four reservoirs almost entirely in the spring.

Paddlefish have limited distribution in these four reservoirs. 0.9% of the 1967 commercial harvest by weight in Lake Fort Gibson was paddlefish and 6.7% in Grand Lake with no paddlefish harvest in the other two reservoirs.

The characteristics of the lakes sampled are presented in Table 1.

TABLE 1.
Characteristics of lakes sampled.

Lake	*River System*	*Areas (Surface Acres)*	*Approximate Age (Years)*	*1967 Commercial Harvest*
Texoma	Red	89,000 A.	25	578,000 lbs.
Grand	Grand	46,000 A.	25	150,000 lbs.
Gibson	Grand	19,000 A.	15	32,000 lbs.
Eufaula	Canadian	102,500 A.	5	87,000 lbs.

METHODS

The field collections of live weight-dressed weight data were concentrated in four months at seasonal intervals: September, December, March and June. During the 30-day period, an attempt was made to secure approximately 30 comparative live-dress weights from each species on each project lake (Table 2).

The basic method employed utilized the catches and fish processing of commercial fishermen in these areas. When the fishermen returned to the shores with their catches, they normally rough-dress their fish at that site. The rough-dressing process is fairly consistent among fishermen and usually consists of making a slit from and anal pore, ventrally anterior through the pectorial girdle. The entrails are then removed and the fish is rinsed and drained. The head and scales or skin and gills are left intact.

The comparative weights were taken from the live fish before dressing and immediately following the rough-dress rinsing. A sixty-pound capacity Hanson dairy scale, graduated in tenths of pounds, was used for all weighings.

With the field data evaluations dependent upon the catches of commercial fishermen, the species compositions varied and complete data could not be collected for each season. Most commercial fishermen on Lake Eufaula sold their catches in the rough, hence little information was collected there. However, fairly complete information was collected from Grand, Fort Gibson, and Texoma Reservoirs.

Analysis of these data were performed using the facilities of the Oklahoma State University Computing Center. The techniques of least square fitting of linear and curvilinear (second degree) equations and of analysis of covariance were used as described by Steel and Torrie (1960). In this paper the term significant differences refers to a probability level of 0.05. The plot program used was written by William Zelinski of the Oklahoma State University Computing Center.

RESULTS AND CONCLUSIONS

To determine the appropriate relationships between live weights and dressed weights, linear correlation coefficients, linear regressions and curvilinear regressions (second degree equations) were computed and tested for significance. These values were calculated for every sample of each species for each lake in which there were more than 15 fish present in a quarter. Computations were also performed for

TABLE 2.
Dressed weight-live weight samples.

Species	*Quarter*	*Lake*	*Number of Fish*
Flathead Catfish	1	Texoma	4
		Grand	5
		Gibson	1
	2	Texoma	3
		Grand	34
		Gibson	8
	3	Texoma	4
		Grand	21
		Gibson	17
	4	Texoma	3
		Eufaula	29
Smallmouth Buffalo	1	Grand	54
		Gibson	12
	2	Texoma	20
		Grand	36
		Gibson	21
	3	Texoma	14
		Grand	53
		Gibson	10
	4	Texoma	30
		Grand	35
		Gibson	30
Carp	1	Grand	49
		Gibson	15
	2	Texoma	28
		Grand	30
		Gibson	25
	3	Texoma	6
		Grand	17
		Gibson	11
	4	Texoma	29
		Grand	29
		Gibson	17
Bigmouth Buffalo	2	Texoma	32
		Grand	30
River Carpsucker	1	Grand	31
		Gibson	5
	2	Texoma	9
		Grand	8
		Gibson	4
	3	Texoma	45
		Grand	13
		Gibson	3
	4	Texoma	32
		Grand	15
		Gibson	16
Drum	2	Texoma	2
		Grand	26
		Gibson	3
	4	Texoma	2
		Grand	30
		Gibson	3
Paddlefish	1	Grand	27
	4	Grand	16

combinations of these samples for species by lakes over all quarters, species within quarters over all lakes and for species over all lakes and quarters.

In all cases, the linear correlation coefficients were significant. They ranged from 0.826 to 0.997 with all but two of these values above 0.90. The F values for significance of the linear regression ranged between 58 and 3908. All of the curvilinear equations were also significant but the F values were smaller than the corresponding F values for linear regression by a factor of approximately 10. This indicated that the additional reduction in variance was slight. To determine the practical difference between the two formulas, corresponding live weights were calculated for the most commonly occurring dressed weights for each species. Over the size ranges most frequently encountered in the commercial fishery, the linear equation gave the best empirical estimates. The new data were plotted using a computerized plot routine. Visual examination of these data revealed no indication of curvature.

To aid in deciding how many separate equations were necessary, analyses of covariance were run for each species between lakes within quarters, between quarters within lakes, between lakes over quarters, and between quarters over lakes. Drum were only able to be compared between the second and fourth quarters over all lakes. There was no significant difference. Paddlefish, taken only on Grand Lake, showed no significant difference between the first and fourth quarters. River carpsucker also showed no differences over all possible combinations.

It was possible to compare lakes for flathead within a quarter only from Gibson and Grand in the third quarter. There was no significant difference. The only opportunity to compare quarters over lakes was for Grand between the second and third quarter. In this case, the quarters differed in the slope of the line. This held true also for quarters over all lakes and for lakes over quarters. The latter, however, were confounded by unequal representation of lakes and quarters. Apparently for flathead, seasonal differences were more important than lake differences. When the actual estimated weights were compared for the sizes usually captured, the differences generally were less than 0.4 pounds when lakes were compared. However, when seasonal estimates were considered, a spectrum existed. The least loss occurred in the second quarter followed by the third and first. The greatest loss occurred in the winter and differences were of the magnitude of 0.5 to 1 pound while the other quarters were separated by amounts less than 0.5 pound. Most of the flathead catfish caught by commercial fishermen weighed between 5 and 10 pounds.

Carp were compared between lakes in the second and fourth quarters. Significant differences were observed for regression coefficients in the former and adjusted means in the latter. In comparing quarters over lakes, no significant difference existed for Grand Lake. This was the best represented lake in all quarters. In Texoma and Gibson, fish from the second and fourth quarters were available. The latter were not significantly different while the former showed significant differences in adjusted means. When all lakes combined were combined over quarters, there was no significant difference. However, when all samples were combined for each lake, the regressions had significantly different slopes. Apparently lake differences were stronger than seasonal ones.

When the actual estimated weights were considered, the greatest loss of weight occurred in Texoma, followed by Gibson and then Grand. In the 3 to 7 pound class, the differences between the estimates ranged from 0.4 to 0.7 pounds. In the 7.5 to 13.0 pound class, the loss differences were from one to two pounds. Most of the carp in the commercial catch weighed between three and eight pounds. The Texoma fish had a higher condition factor (C-factor, Lagler, 1956). The greater loss of weight there implied that the higher condition factor could be attributed to more visceral weight.

Smallmouth buffalo collections provided the most complete comparisons. In contrasting lakes within quarters, significant differences were found only for adjusted means in the fourth quarter. In testing quarters within lakes, significant slope differences were found for Gibson and Texoma, while the equations for Grand were not significantly different from each other. When lakes were compared over all quarters, significant slope differences existed. The greatest relative loss of weight occurred in Lake Texoma followed by Gibson and Grand. The average condition factors for Texoma fish were consistently higher than those for other lakes. Evidently the greater plumpness in Texoma was mainly a result of heavier visceral weight. When actual estimated weights are compared in the 3.5 to 7.0 pound average, in which almost all of the smallmouth buffalofish in the commercial catch fall, the differences in estimated weight loss were between 1.2 and 2.5 pounds. When quarters were compared over all lakes, the slopes were also significantly different. Although the F value (5.1) was smaller than that for lake comparisons (7.0), the actual empirical estimate of weight loss differed from 0.3 to 0.8 pound over the size range mentioned above. Apparently lake differences were more noteworthy than quarterly ones.

The only bigmouth buffalo comparisons were between lakes Texoma and Grand where in the second quarter significant slope differences existed. About a pound separated the estimate made by the two equations. In the smaller range of the sizes that bigmouth buffalo are found (i.e. those under 4.5 pounds), the fish from Grand Lake had the greatest loss of weight; the reverse is true for the larger fish.

In Table 3 are presented the equations for estimating live weights from dressed weights. Where no significant differences existed between samples, the parameters estimated for the total regression are given. Where significant differences existed, separate equations are presented for lakes and quarters. The statistics from the total regression are given as the slope values differed instead of the common regression statistics which would have been better had the differences been in adjusted means.

It is sometimes desirable to use a straight percentage value to convert dressed to live weights. In Table 4 are given the percentage loss of weight for the same categories as in Table 3. These values were computed by summing all live and dressed weights for the appropriate group of samples and finding the percent the loss weight makes up of the net weight.

TABLE 3.

Equation for estimating live weight (Y) from dressed weight (X) in pounds.

Category		*Equation*
Drum	Total Regression	Y = 0.067 + 1.070X
Paddlefish	Total Regression	Y = 0.141 + 1.860X
River Carpsucker	Total Regression	Y = 0.224 + 1.078X
	2nd Quarter	
Bigmouth Buffalo	Texoma	Y = -0.169 + 1.315X
	Grand	Y = 0.109 + 1.166X
	Total Regression	Y =-0.776 + 1.266X
Smallmouth Buffalo	Texoma	Y = 0.226 + 1.129X
	Grand	Y =-0.419 + 1.247X
	Gibson	Y =-0.026 + 1.160X
	Total Regression	Y =-0.303 + 1.228X
Carp	Texoma	Y = 0.148 + 1.266X
	Gibson	Y = 0.536 + 1.039X
	Grand	Y =-0.158 + 1.220X
	Total Regression	Y =-0.201 + 1.262X
Flathead Catfish	1st Quarter	Y =-0.581 + 1.154X
	2nd Quarter	Y = 0.126 + 1.072X
	3rd Quarter	Y = 0.303 + 1.142X
	4th Quarter	Y =-0.388 + 1.240X
	Texoma	Y =-0.217 + 1.233X
	Gibson	Y = 0.216 + 1.123X
	Grand	Y =-0.180 + 1.188X
	Eufaula	Y =-0.374 + 1.164X
	Total Regression	Y = 0.208 + 1.173X

TABLE 4.
Percent conversion live weight to dressed weight and dressed weight to live weight.

Species	*No.*	*Live Wt.*	*Dressed Wt.*	*Lw to Dw*	*Dw to Lw*
Drum	73	171.8	156.2	0.909	1.100
Paddlefish	44	1243.0	672.4	0.541	1.849
River Carpsucker	187	530.2	451.8	0.852	1.174
Bigmouth Buffalo – Second Quarter					
Texoma	32	739.7	603.7	0.816	1.225
Grand	19	250.6	212.6	0.848	1.179
Total	51	990.3	816.3	0.824	1.213
Smallmouth Buffalo					
Texoma	88	475.4	402.5	0.847	1.181
Grand	181	825.0	721.5	0.875	1.143
Gibson	73	292.9	254.0	0.867	1.153
Total	342	1593.3	1378.0	0.865	1.156
Carp					
Texoma	63	393.0	303.4	0.772	1,295
Grand	125	568.1	474.7	0.836	1.197
Gibson	68	265.1	225.1	0.849	1.178
Total	256	1226.2	1003.2	0.818	1.222
Flathead Catfish					
1st Quarter	10	70.2	58.8	0.838	1.194
2nd Quarter	45	299.1	255.1	0.853	1.173
3rd Quarter	39	272.3	223.5	0.821	1.218
4th Quarter	42	415.0	324.3	0.781	1.280
Texoma	15	206.9	171.5	0.829	1.206
Grand	59	370.9	321.0	0.866	1.155
Gibson	36	212.5	182.1	0.857	1.167
Eufaula	29	310.2	237.1	0.764	1.308
Total	139	1100.5	911.7	0.828	1.207

In considering all of the statistically significant different equations, it is well to realize that there is danger in placing undue weight on those differences that do not have an apparent underlying biological reason. It is possible that two successive samples from the same lake would also show significant differences.

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