INFLUENCE OF FLOATING AND SINKING FEEDS AND FINGERLING SIZE ON CHANNEL CATFISH PRODUCTIONS

by

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ABSTRACT

A comparison was mad· ·ith a floating and sinking ration of similar analysis produced by the same manufacturer. This study demonstrated an increase in catfish production when using the sinking ration. Moreover, the sinking feed produced fish of a larger average size, a better food conversion, and a smaller Ktl factor. Use of sinking feed represented a savings of approximately $54 to $72 per acre on the feed bill. Data were compared for the influence of fingerlings size at stocking (4.5, 6.5 and 8 inch) upon catfish production. The larger fingerlings experienced larger S-factors; however, the high percent of harvestable size justified using this size fish for one year's production.

INTRODUCTION

Now more than ever before, catfish producers are focussing their attention towards a more economical means of producing fish. Among the many decisions which have to be made, probably the most important involves feeds and stocking. What is the most efficient and practical type feed to use, and what is the optimum number and size of fingerlings to stock? The confusion with feeds began several decades ago when the nations leading feed companies began producing feeds specifically disigned for fish. Later, specialization revealed the sinking catfish feed, caged catfish feed, floating catfish feed, feed blocks, and one company advertised a liquid feed for fish.

At the time this project was proposed, there was no mention in the literature of detailed research into a supposedly basic and economically important question: "What is the best type feed, floating or sinking?" Some culturists are advocating sinking rations and others the more expensive floating feeds.

The sinking feed may often be obtained at a lower price than the floating. At the inauguration of the study, the floating feed retailed for $0.123 a pound and the sinking for $0.099 a pound (Mrs. Richard, Purchasing Agent, George Theriot's Feed Store, Personal Communication).

Fingerling size at stocking was investigated in our brackish water ponds. We were concerned about the most efficient size of fingerlings to stock in areas such as ours. Many people try to obtain the largest fingerling possible for stocking. They feed these fish and try to get them to a harvestable size in one growing season. There are reports of poor food conversion in larger fish. If this is apparent in larger fingerlings then it may be proportionally justifiable for a farmer to start with intermediate size fish.

This project was designed to compare a floating and sinking ration of similar analysis. The feed was produced by a leading feed manufacturer. Also, a comparison was made with ponds stocked with fingerlings averaging 4 inches, 6 inches, and 8 inches.

MATERIALS AND METHODS

The study was conducted in 12 identical, 0.1 acre ponds at the fish experiment area of the Rockefeller Wildlife Refuge, Grand Chenier, Louisiana. The research ponds have an average depth of approximately 4 feet and are constructed above the marsh floor. Filtered slightly brackish surface water was used in the ponds; pumping was necessary to fill the ponds.

The six ponds used for the feeding study were stocked March 2, 1972 with 200 8-inch fingerling channel catfish *(Ictalurus punctatus)*. Extreme care was taken to sort and weigh the fish at stocking. Total weights stocked per pond ranged from 27.9 to 28.5 pounds, averaging 28.3 pounds for ponds receiving sinking pellets and 28.1 pounds for ponds receiving floating pellets. As indicated by the narrow weight range, the fish were very uniform.

Two practically identical feeds produced by a leading company were selected for the study. The analysis as obtained from the ration tags were as follows: for the floating ration — crude protein not less than 32%, crude fat not less than 2.5%, and crude fiber not more than 8%; for the sinking ration — crude protein not less than 30%, crude fat not less than 2.5%, and crude fiber not more than 10%. Three ponds received floating feed and three received the sinking.

The size-at-stocking study was also initiated March 2, 1972. Three ponds were each stocked with 200 fingerlings averaging 4.25 inches (3.4 pounds), three ponds were each stocked with 200 fingerlings averaging 6.5 inches (8.5 pounds), and these were contrasted with the three ponds containing 8-inch fish and receiving floating feed. All fish in this portion of the study received the same floating ration.

Feeding began March 6, 1972 and continued for approximately 174 days. The fish were fed 3% body weight 7 days a week. Nine ponds received the floating pellet and three were fed sinking. Ponds were seined bi-monthly and the feeding rates adjusted accordingly. Total lengths and standard lengths were recorded to the nearest millimeter and the weights were recorded in grams for each fish.

At the termination of the study, water was pumped from the ponds and the fish were collected and held in concrete holding vats. The time elapse from pond draining until data collection for a particular pond was always less than 2 hours. A random subsample of 25 fish were taken from each pond. Total length and standard length was recorded to the nearest millimeter and the weight in grams was obtained for each of these. Total numbers and weights were recorded for the remainder of the fish. Coefficients of condition and percent of harvestable size fish were calculated for each treatment from these subsamples. Length-weight relationships were determined for a comparison of the fish in the feeding study.

Food conversions were calculated using the commonly accepted method as described by Swingle (1958). Percent survival, average weight, average total length, and percent of harvestable size fish (larger than 0.75 and 1 pound) were calculated for each treatment. Feeding cost per pound of fish harvested was also calculated.

Using the length-weight relationship procedure of Lagler (1956) the fish were compared at harvest as to the effects of food type (floating or sinking) upon growth. These relationships were calculated by averaging the total lengths and weights from the subsamples in 10 mm total length increments. The length-weight relationships for the treatments were based on the average measurements expressed logarithmically.

Coefficients of condition were calculated for all treatments according to Lagler (1956). Available data permitted the calculation of these factors from stocking through harvest as an indication of the response of the fish to the rations.

RESULTS AND DISCUSSION

Pond salinities were extremely low throughout the study period and never exceeded 2.3 parts per thousand (ppt). Temperatures ranged from 19.3 C. up to 29.0 C.

Feed Study

Ponds receiving the sinking ration exhibited the best returns (Table 1). The average S-conversion of 1.5 was considerably better than the 1.9 recorded for the more expensive floating feed. The percent survival was lowest for the fish on floating feed (average 90.8%) and probably influenced the S-values to an extent. The percent survival for fish on the sinking ration was 97.8.

Fish fed sinking feed yielded an average production of 2,417 pounds per acre, whereas those fed floating feed yielded 2,074 pounds per acre or 343 pounds per acre less. Average weights were also higher for the fish fed sinking food, 1.24 pounds versus 1.14 pounds. Data were collected at harvest from a random sample of 25 fish from each pond. This revealed that the sinking ration resulted in a higher percent of harvestable size fish. The sinking feed resulted in 96.0% of the fish being over 0.75 pound and 71% being over 1.0 pound, whereas the floating ration resulted in 90.7% being over 0.75 pound and 70.0% being over 1.0 pound.

Contrary to popular belief, there was no marked size difference (runts and hogs) at harvest between the fish fed on the two rations. Based on a subsample of 75 fish taken from each treatment (25 per replication), it was demonstrated that sinking feed produced fish of only a slightly wider range in total length than fish on floating feed. However, fish receiving floating feed were more numerous in the smaller lengths in which they were represented.

Growth curves, prepared from feed-adjustment data collected throughout the study, indicated that fish on the sinking ration were slightly heavier from the second month. This trend continued until the study was terminated (Figure 1).

Another somewhat unexpected result was found in a comparative analysis of the condition factors (Ktl, Ksl) exhibited by the fish fed the two rations. Specimens measured throughout the study period did not exhibit the increase in K valued as reported by Simco and Cross (1966) and experienced in earlier studies at Rockefeller Wildlife Refuge (Perry and Avault, 1971). They only fluctuated to a small degree and were somewhat constant (Figure 2). At harvest, without exception, the K-factors for fish on floating feed were larger (Table 2). However, the weighted average obtained from subsamples at harvest indicated the fish fed sinking feeds to be slightly higher (564 grams versus 558 grams each). The slight difference included in this table is possibly due to the accidental inclusion of larger fish in the subsamples. Reference to Figure 2 indicates that this trend of increased K-values first appeared in mid-June and was present for the remainder of the study.

Length-weight relationships were calculated for the two treatments and their representative lines are illustrated in Figure 3. When these data were compared, the slope of the line (b) established for the fish on floating feed was considerably greater than the slope for fish produced on the sinking ration (Log W=6.60010 + 3.64213 Log L, r=0.974, N=75 for floating; Log W=5.59009 + 3.22977 Log L, r = 0.971, N = 75 for fish on sinking feed). Since the length-weight regression line is a relative measure of condition, the above difference between the slopes can be interpreted to measure a difference in condition between the groups and supplement the previously described coefficients of condition data. This means simply that the floating feed contributed to the production of fish that were heavier than those on the sinking ration for a given size class.

The possibility of miscalculations in feed adjustment is present; however, it is doubtful that this is a factor. The ponds experiencing the lowest S-factor (fish on sinking) were by far the hardest to obtain samples for, ponds from both studies included. The fish receiving floating feed were among the easiest ponds to seine and get representative samples from; therefore, lessening the possibility of incorrect feed calculations.

The average calculated sinking feed cost was $318.40 per acre (Table 1). Ponds receiving the floating rations cost an average of $420.91 per acre to feed. A more detailed cost breakdown on feed cost per pound of fish harvested further demonstrated the superiority of the sinking ration. Considering only feed, the cost per pound of fish in the ponds were sinking feed averaged $0.131; that for the ponds on floating feed averaged $0.203.

Influence of Size at Stocking

A comparison of Table 3 with ponds B-47, B-55, and B-56 of Table 1 was made for this study. These data indicate that stocking 8 inch fish definitely has its advantages. An average production of 2,074 pounds per acre was obtained from ponds stocked with the larger fish. Ponds stocked with fingerlings averaging 6.5 inches were second in production with 1,745 pounds per acre; the ponds originally stocked with 4.5 inch fish resulted in a yield of 1,551 pounds per acre. Fish produced from 8 inch fingerlings averaged 1.14 pounds each, and those from the 4.5 inch and 6.5 inch averaged 0.77 and 0.94 pounds respectively.

Average percent survival was almost identical for these treatments ranging from a high of 93.8 percent for the smallest fish to a low of 90 percent for the intermediate size. The 8 inch fingerlings experienced 90.8 percent survival.

The two treatments containing the smaller fish experienced similar S-factors ranging from 1.2 to 1.6. When replications were averaged by treatment both resulted in a 1.4. Fish obtained from the larger fingerlings (8 inch) experienced S-factors ranging from 1.5 to 2.2. The average was 1.9.

Errors in our subsampling for food adjustment can partially be ruled out because these three ponds were the easiest to seine and constantly produced enough fish for weight measurements. The three ponds used for the 6 inch fingerlings were the hardest to obtain representative samples from; however, these recorded an average S-factor of 1.4.

Length-weight data were used to calculate the Ktl factors for the three treatments of catfish. A comparison of Table 4 with the data on Table 2 for floating feed revealed little difference in the factors with regard to condition.

The food conversion factors were compared with feed cost and expanded to a per-acre basis. This revealed that the largest fish cost more per pound to produce averaging $0.203. The two treatments containing the smaller fish were less with the intermediate size the least ($0.162).

A more detailed examination of the data revealed that the percent of harvestable size (fish in excess of 0.75 pound) averaged 64%, 81%, and 90.7% for the three treatments, going from small to large fish. This portion of the total harvest, if marketed for $0.40 per pound, represents an approximate gross income of $397.06, $565.38, and $752.45 per acre for the treatments. When the feed costs are deducted the results are $135.19, $282.48, and $331.54 per acre. These values consider feed costs for all fish produced in each treatment. Therefore, even though the feed conversions were a little higher for the larger fingerlings, the higher percent that were of a harvestable size would justify stocking 8 inch fingerlings. Possibly if the fish were larger or in their second year an additional loss in food conversion would result in a less efficient operation.

SUMMARY

In summary, this study demonstrated that ponds receiving sinking feed produced an average of 343 pounds per acre more than those receiving floating feed in the 174 days of feeding. The average weight of fish produced on sinking feed was slightly higher, S-conversions were lower, survival was better, and a larger number were of a harvestable size.

Length-weight calculations revealed that fish on floating feed were considerably heavier for a particular size class, though fish on sinking feed averaged more. This was supported by determination of Ktl factors which were also higher for fish on floating feed. It seems that sinking feed produced fish of a slightly greater total length and less robustness than the floating chow.

When analyzed on a cost per pond basis and projected to an acre, the sinking feed cost approximately $100 per acre less than the floating feed under similar conditions. The cost per pound of fish harvested was approximately $0.034 less for the sinking ration. This could mean a difference in feed cost ranging from $54.00 for 1,500 pounds of fish to $72.00 for the production of 2,000 pounds of catfish per acre if the feed conversion were 1.5.

The results of the influence of size-at-stocking study revealed the larger fingerlings were most desirable. These fish recorded the highest production, highest percent of harvestable size fish and the highest S-factor of the three treatments. When analysed on a feed cost per pound of harvestable size fish produced, this treatment excelled.

LITERATURE CITED

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Table 1. Comparative Growth Data for Catfish fed sinking and floating Rations for 174 days, Rockefeller Wildlife Refuge, 1972.

Pond No.	B-34	B-21	B-33	Av.	B-47	B-55	B-56	Av.
Type Ration*	S	S	S		F	F	F	
No. Stocked/0.1 Acre	200	200	200	200	200	200	200	200
Wt. Stocked (Lbs/0.1 Acre)	28.5	28.5	27.9	28.3	28.0	27.9	28.4	28.1
Wt. Recovered (Lbs/Acre)	2,181	2,684	2,386	2,417	1,873	2,251	2,098	2,074
Av. Size Recovered (Lbs)	1.09	1.40	1.22	1.24	1.10	1.25	1.08	1.14
Av. TL Harvested (mm)	381	392	382	385	369	380	361	370
Food Conversion	1.7	1.4	1.4	1.5	2.2	1.5	2.0	1.9
Percent Survival	100.0	95.5	98.0	97.8	85.0	90.0	97.5	90.8
Percent Over 0.75 Lb	100.0	92.0	96.0	96.0	96.0	88.0	88.0	90.7
Percent Over 1.00 Lb	60.0	80.0	72.0	71.0	68.0	77.0	65.0	70.0
Feed Cost/Acre	$317.30	$341.00	$296.80	$318.40	$441.26	$363.46	$458.18	$420.91
Feed Cost/Lb of Fish	$0.145	$0.127	$0.124	$0.131	$0.236	$0.161	$0.218	$0.203

*S=Sinking
F=Floating

Table 2. Length-weight and condition factors calculated for Catfish fed floating and sinking rations, Rockefeller Wildlife Refuge, 1972.

Sinking Ration

Class Intervals	No. of Fish	Av. Total Length (mm)	Av. Standard Length (mm)	Av. Weight (g)	Ksl	Ktl
290-299	1	290.0	230.0	219.0	1.80	0.90
300-309	0	-	-	-	-	-
310-319	0	-	-	-	-	-
320-329	1	325.0	255.0	310.0	1.87	0.90
330-339	2	332.5	265.0	340.0	1.83	0.92
340-349	3	343.3	275.0	376.7	1.81	0.93
350-359	8	353.8	281.2	420.9	1.89	0.95
360-369	8	361.9	287.6	430.4	1.81	0.91
370-379	7	372.1	298.0	478.8	1.84	0.95
380-389	9	382.8	308.3	570.8	1.95	1.02
390-399	8	390.6	314.4	582.8	1.88	0.98
400-409	11	402.3	324.1	632.4	1.86	0.97
410-419	5	411.0	330.0	669.6	1.86	0.96
420-429	3	421.7	341.3	682.3	1.72	0.91
430-439	5	431.0	348.0	820.2	1.95	1.02
440-449	3	440.0	360.3	847.7	1.81	1.00
450-459	1	450.0	370.0	908.0	1.79	1.00
Weighted Average		385.1	307.9	563.6	1.86	0.96

Floating Ration

Class Intervals	No. of Fish	Av. Total Length (mm)	Av. Standard Length (mm)	Av. Weight (g)	Ksl	Ktl
300-309	1	300.0	240.0	228.0	1.65	0.84
310-319	2	310.0	242.5	282.5	1.98	0.95
320-329	3	321.7	250.7	313.3	1.99	0.94
330-339	4	331.2	262.5	355.5	1.96	0.98
340-349	4	340.0	270.2	385.0	1.95	0.98
350-359	7	352.7	279.0	444.6	2.05	1.01
360-369	12	362.9	289.7	486.7	2.00	1.02
370-379	9	372.2	296.6	571.1	2.19	1.11
380-389	8	383.1	309.2	611.5	2.07	1.19
390-399	10	391.0	314.0	657.5	2.12	1.10
400-409	8	401.2	327.0	722.5	2.07	1.12
410-419	3	413.3	335.3	783.3	2.08	1.11
420-429	3	421.7	340.0	838.3	2.13	1.12
430-439	1	430.0	345.0	928.0	2.26	1.17
Weighted Average		371.5	297.4	557.7	2.06	1.07

Table 3. Growth data to determine the influence of stocking size upon channel catfish production, Rockefeller Wildlife Refuge, 1972.

Pond No.	B-26	B-27	B-31	Av.	B-20	B-29	B-35	Av.	Av. of B-47 B-55, B-56
No. Stocked/0.1 Acre	200	200	200	200	200	200	200	200	200
TL Stocked (mm)				107				160	198
Wt. Stocked (Lbs/0.1 Acre)	3.5	3.3	3.5	3.4	8.5	8.6	8.5	8.5	28.1
Wt. Recovered (Lbs/Acre)	1,700	1,539	1,413	1,551	1,351	2,060	1,823	1,745	2,074
Av. Size Recovered (Lbs)	0.90	0.81	0.80	0.77	0.83	1.07	0.93	0.94	1.14
Av. TL Harvested (mm)	332	331	323	329	359	360	357	359	370
Food Conversion	1.2	1.6	1.5	1.4	1.5	1.4	1.3	1.4	1.9
Percent Survival	94.0	95.5	92.0	93.8	76.0	96.0	98.0	90.0	90.8
Percent Over 0.75 Lb	76.0	64.0	52.0	64.0	88.0	88.0	68.0	81.0	90.7
Percent Over 1.00 Lb	36.0	16.0	20.0	24.0	56.0	56.0	48.0	53.0	70.0
Feed Cost/Acre ($)	240.77	293.05	251.84	261.87	234.32	331.48	284.44	282.90	420.91
Feed Cost/Lb of Fish ($)	0.142	0.190	0.178	0.169	0.173	0.161	0.156	0.162	0.203

Table 4. Length-weight and condition factors calculated for channel catfish grown from 4 and 6 inch fingerlings, Rockefeller Wildlife Refuge, 1972.

Catfish Grown From 4 Inch Fingerlings

Class Intervals	No. of Fish	Av. Total Length (mm)	Av. Standard Length (mm)	Av. Weight (g)	Ksl	Ktl
250-259	1	255.0	200.0	140.0	1.75	0.84
260-269	5	263.0	204.8	158.8	1.85	0.87
270-279	2	270.0	210.0	160.5	1.73	0.82
280-289	3	283.3	225.3	207.0	1.81	0.91
290-299	4	291.2	226.2	202.0	1.74	0.82
300-309	3	304.3	238.3	286.7	2.12	1.02
310-319	10	311.5	246.8	304.8	2.03	1.01
320-329	10	322.0	256.5	333.2	1.97	1.00
330-339	15	332.0	264.1	373.3	2.03	1.02
340-349	13	342.3	272.1	400.9	1.99	1.00
350-359	11	352.6	279.0	440.4	2.03	1.00
360-369	11	362.3	290.5	494.0	2.01	1.04
370-379	8	370.6	295.4	547.2	2.12	1.07
380-389	3	381.7	302.3	575.0	2.08	1.03
390-399	0	-	-	-	-	-
400-409	1	405.0	329.0	817.0	2.29	1.23
Weighted Average		331.8	263.4	379.3	1.99	1.00

Catfish Grown From 6 Inch Fingerlings

Class Intervals	No. of Fish	Av. Total Length (mm)	Av. Standard Length (mm)	Av. Weight (g)	Ksl	Ktl
270-279	1	275.0	215.0	180.0	1.81	0.86
280-289	2	280.0	217.0	180.0	1.76	0.82
290-299	3	293.3	227.3	193.3	1.64	0.76
300-309	7	301.4	236.3	238.6	1.81	0.87
310-319	4	313.5	245.5	270.0	1.82	0.88
320-329	3	325.0	258.3	309.0	1.79	0.90
330-339	4	330.0	257.5	340.0	1.99	0.95
340-349	12	341.2	271.3	397.8	1.99	1.00
350-359	15	352.7	280.5	436.6	1.98	1.00
360-369	5	362.0	285.6	477.0	2.05	1.01
370-379	10	374.0	300.5	576.8	2.12	1.10
380-389	10	381.5	305.6	557.6	1.95	1.00
390-399	9	392.2	315.8	644.9	2.05	1.07
400-409	7	402.0	323.3	747.8	2.21	1.15
410-419	2	410.0	322.5	741.0	2.21	1.07
420-429	4	421.2	338.5	791.0	2.04	1.06
430-439	1	430.0	345.0	817.0	1.99	1.03
440-449	1	445.0	365.0	999.0	2.05	1.33
Weighted Average		358.5	285.4	487.1	1.99	1.00

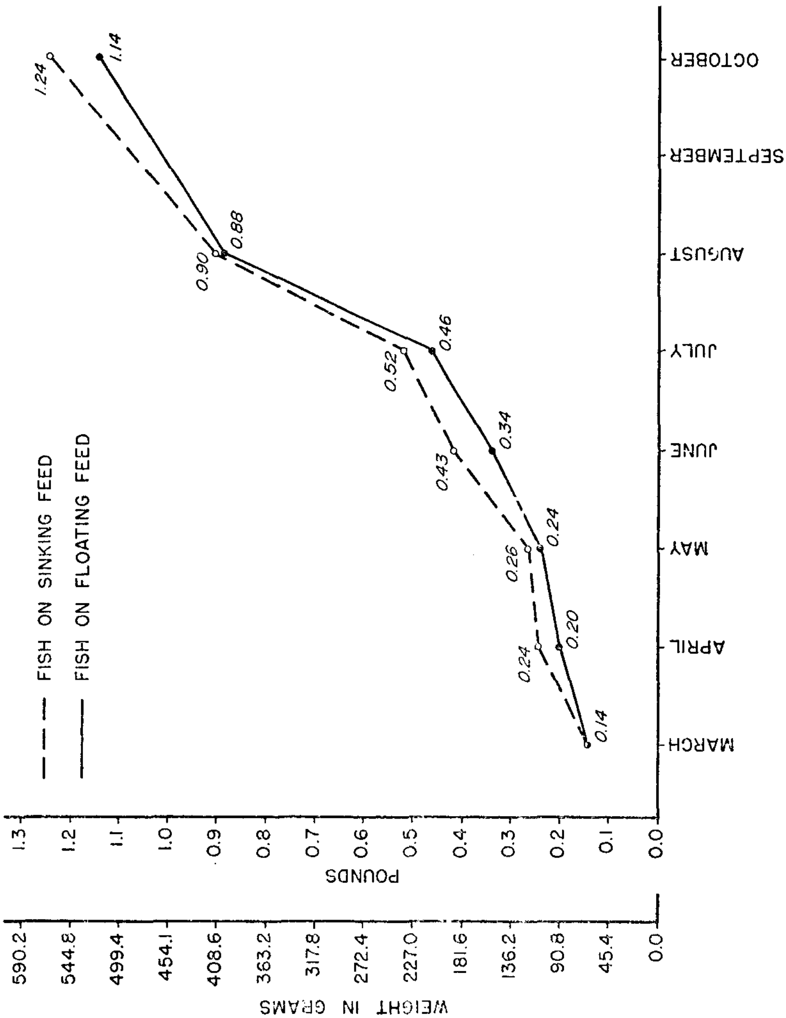

Figure 1. Growth curve of catfish fed floating and sinking rations, Rockefeller Wildlife Refuge, 1972.

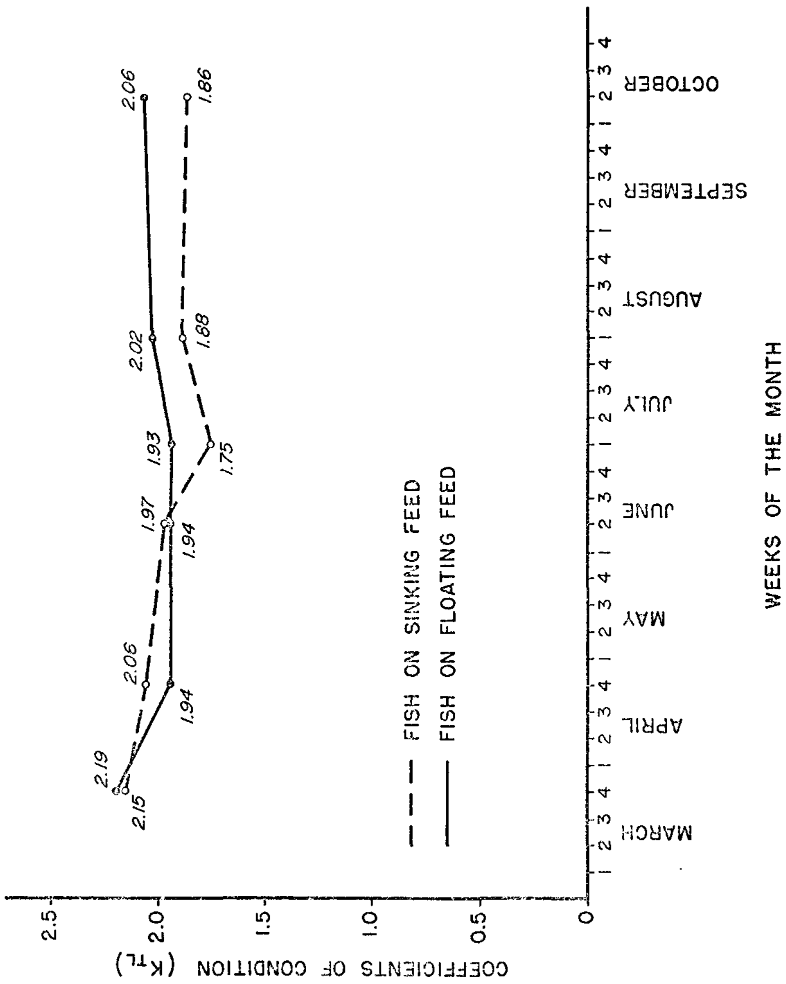

Figure 2. Average coefficients of condition (Ktl) by week of month sampled of fish fed floating and sinking rations, Rockefeller Wildlife Refuge, 1972.

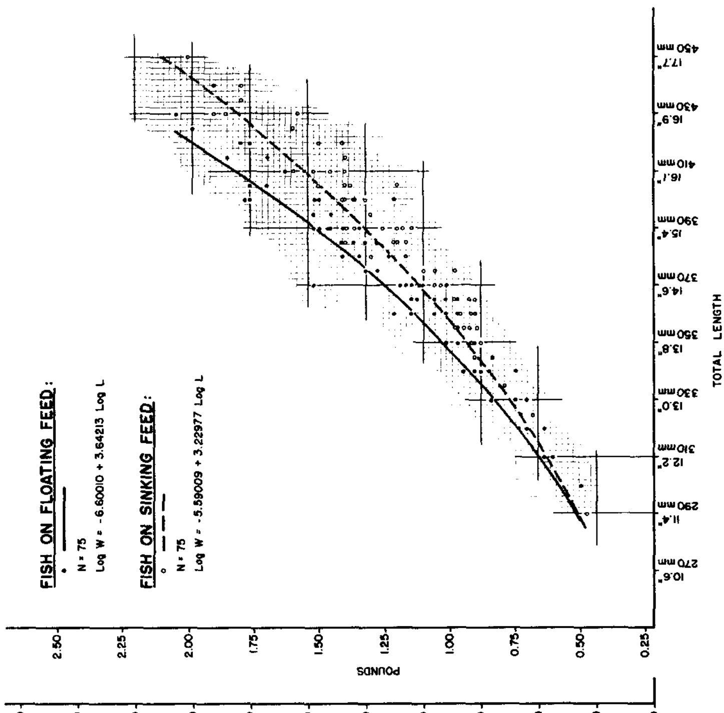

Figure 3. Length-weight relationships of channel catfish fed floating and sinking rations, Rockefeller Wildlife Refuge, 1972.