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HALF-YEAR REPORT 1987

OF THE PROSJECT

"CULTIVATION OF CATFISH"

by

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Hisøy June 1987

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TABLE OF CONTENT

INTRODUCTION

The project started 1. April 1987. From the same date two technical Assistants, Evy Lien and Sissel Rosseland were employed in the project. Three students, Mr. Vorren, participated in the project from 21/4 to 1/5-1987 and Karl Rødland and Ania Jablanska participated from 15/6 to 26/6-1987. The three first months of the project has concentrated on building up laboratory facilities and collection of local catfish. Installation of several new tanks has been delayed. These tanks are planned used mainly for the spawning stock.

MEETINGS

A steering group meeting were held at Flødevigen 24/4-87.

A planning group, R. Hole (Skretting A/S), Ø. Lie (Fiskdir. Nutrition Inst.) and E. Moksness met 9. June in Stavanger and put together a proposal on "Fôroptimalisering til Steinbit (*Anarhichas sp.*.) i oppdrett" for the Norwegian Fisheries Research Board.

METHODS

The condition factor (C.F.) was calculated according to the formulae:

$C.F. = w * 100 / l^3$, where w = wet weight (g) and l = length (cm).

The %-growth was calculated according to the formulae:

$\%\text{-growth} = (w_{i+1} - w_i) * 100 / w_i$, where w_i = average wet weight (g) at measurement $\underline{i}$ and w_{i+1} = average wet weight (g) at measurement $\underline{i+1}$, used when groups are weighted every months.

At feeding the feeder gave an INDEX from 0 to 5 to indicate if the fishes were eating well or not. The highest score was 5. In the calculating of food factor (FC) an average feeding INDEX between each measurement of the fishes was calculated. This average INDEX was later used to calculate an FC based upon the INDEX.

The food factor (FC) were calculated according to the formulae:

FC = WP * a / WW * b , where WP = wet weight (g) of the wet pellets, WW = average increase in wet weight (g) of the fishes, a = dry weight/wet weight relationship of the wet pellets in that specific period and b = ~ 20 % (dry weight/wet weight relationship of the fishes).

Specific growth rate, SGR, were calculated according to the formulae:

SGR = (Ln W_{t2} - Ln W_{t1}) / (t2-t1), where W_{t1} and W_{t2} are wet weights of fishes at days t1 and t2.

EXPERIMENTALS GROUPS

At present four different groups of catfish are studied, mainly to follow their growth. The groups are listed in Table 1. The specific growth rate (SGR), %-growth together with some weights are given in table 2 for three of the groups.

Two groups, 87-1 and 87-2, has been of specially interest to the project this spring. A egg-ball was caught near the Faeroe Island by a trawler (10/2-87) and the larvae hatched soon after (10-17/2 1987) in the Fishery Laboratory in Thorshavn. Maximum hatching were observed for three days , 12-14/2. Mean hatching date are set to 13/2-87 and defined as age day = 0. ### of the newly hatched larvae were send Flødevigen B.S. in two batches the 19/2 and 26/2 and at the laboratory mixed and divided into the two groups: 87-1 and 87-2. The differences between the two groups have mainly been that 87-1 has been startfeeded on Skretting "Elite Perle", while 87-2 have been startfeeded on Skretting "Elite Plus" and Artemia nauplii. The results shows that of the two groups, 87-2 have had the best growth (SGR = 3.3 %) and survival (approx. 60 %). In addition to growth and survival of the larvae groups (87-1 and 87-2), their behaviour were studied. In the following are some observation notified in the dairy:

1/3 - 7 dead larvae in 87-2 with food particle stuck to their body.
17/3 - The larvae in 87-1 followed the food particle sinking from surface to bottom and then eaten the food particle.
18/4 - The larvae in 87-2 eats the dry pellets floating in the surface, this was not observed in 87-1 where the larvae either eats the particle while it sinks or lays on the bottom.
19/4 - The same observation as the 18/4
20/4 - "Elite plus" (0.6 mm) are hanging for a longer period in the surface than "elite perle" (o.6 mm).
22/4 - Stopped feeding 87-1 with "elite perle", started with "elite plus"
3/5 - A big larvae eating/attacking a smaller larvae (half size) in 87-1

Artemia: 87-2 were fed newly hatched *Artemia salina* nauplii from 9. March (3.75 g eggs/day) to 25. April (5.0 g eggs/day)

Table 1. Experimental groups of catfish by 15. June 1987.

Group	Species	Origin	Food type
86-(1+2)	striped catfish	Sørlandet	Wet pellets
86-3	Spotted catfish	Barent Sea	Wet pellets
87-1	Striped catfish	Faeroe Island	Dry pellets (Elite Plus 1.0)

87-2 ------- " ---------- ------ " ---------- --- -------- " ----------

Table 2. The specific growth rate (SGR) in three of the groups during May 1987.

Group	N	%-growth	SGR (%)	W_{t1} (g)	
Day	W_{t2} (g)	Day	t2-t1 (days)		
86-346	29.6	0.90	24.48237	31.7 265	28
87-120	140.2	3.13	0.27374	0.655102	28
87-287	151.0	3.29	0.40274	1.008102	28

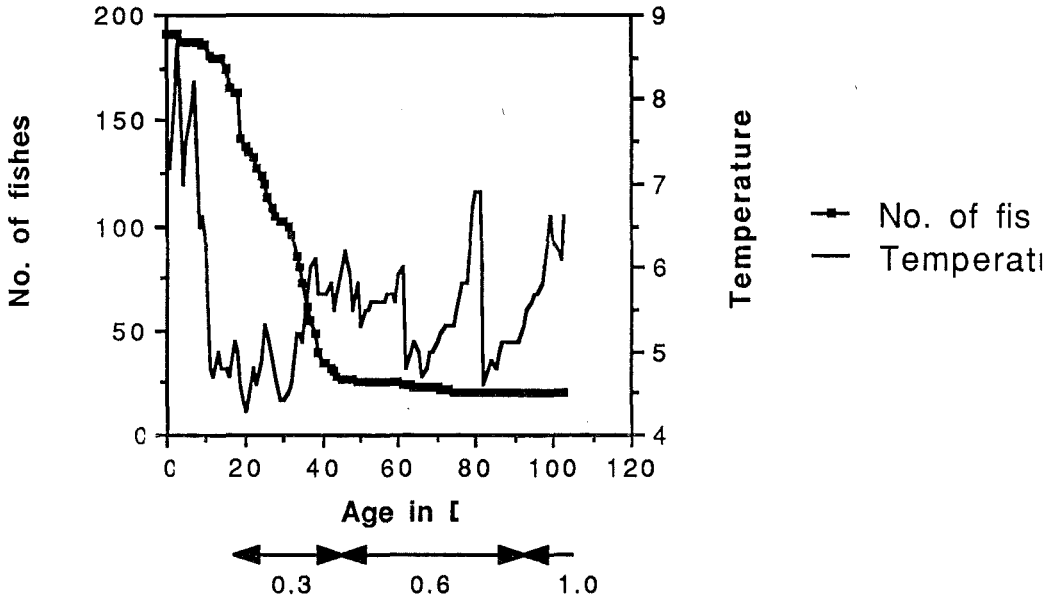

Figure 1. Temperature (^{o}C) and number of survivals during startfeeding in group 87-1. Period fed with Skretting "Elite Perle" are indicated.

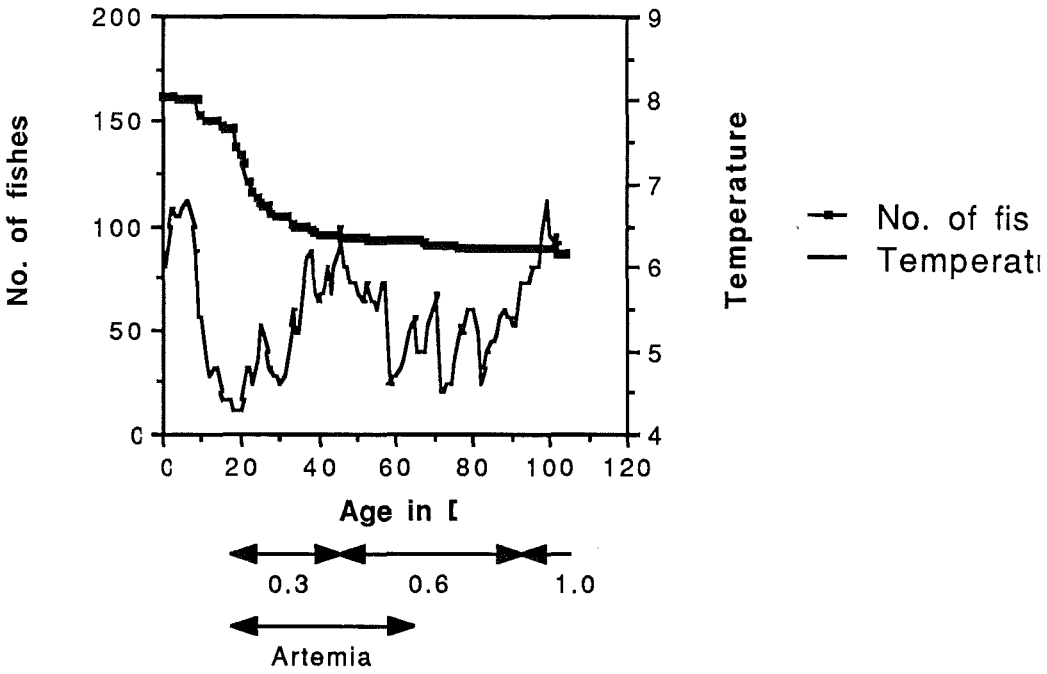

Figure 2. Temperature (^{o}C) and numbers of survivals during startfeeding in group 87-1. Period fed Skretting "Elite Plus" and *Artemia salina* nauplii are indicated.

COLLECTION OF WILD FISH SPRING-87

The collected fish have been divided into the following groups according to their weight (table 3). Most of the fishes greater than 3.0 Kg are to be put into a 2500 m^3 (ca. 500 m^2) concrete outdoor basin. The fishes will be observed by underwater video-equipment and divers

Table 3. Number of fishes in different size groups by the 12. June 1987.

Group (Kg)	Number
0.5 - 1.0	13
1.0 - 1.5	41
1.5 - 2.0	36
2.0 - 2.5	26
2.5 - 3.0	23
> 3.0	110

ECONOMY

The project started 1. April 1987 with the second quarter as the main investment period. There has been a delay for about three mounts in the main investment post, the tanks. The table 4 gives an overview of the economical situation by the 12. June 1987. All numbers in Kroners (NKr.)

Table 4. An economical overview by 12. June 1987.

Post	Used	Budget (1987)	
Project-leader	5000.00	15000.00	
Overtime	-	60000.00	
Traveling	0.00	40000.00	
General	2907.40	70000.00	
Div.	3084.50	70000.00	
Buying fish	39323.64	100000.00	
Food	44.50	25000.00	
Data	65483.50	80000.00	
Investments	206484.13	685000.00	
Sum	322327.67	1,145000.00	

Specification of investments			
Tanks equipments		78125.93	300000.00
Food auto	9040.80	35000.00	
Pumps	0.00	15000.00	
Div. build.	0.00	35000.00	
Data	50000.00	50000.00	
Div. Lab.	34062.50	100000.00	
Video equip.	29909.90	100000.00	

Alarm sys.	0.00	50000.00
Sum	206484.13	685000.00

REPORTS; NEWSPAPERARTICLE; RADIOPROGRAM

Agderposten 2/2-87. Flødevigen nye oppdrettsfisk
Agderposten 9/3-87. Steinbit hos gynekologen
A-Magasinet Nr. 3/87: side 20. Nye husdyr i havbruket
Fedrelandsvennen 29/4-87. Steinbit -ny, lovende oppdrettsfisk: Selges ikke på trynefaktoren.
Fiskaren 29/4-87. "Er jeg gravid doktor ?" Med fru Steinbit til gynekologen.
Lillesandposten 30/4-87. Forskningsstasjon vil ha levende steinbit
Nordisk Aquakulture Nr. 1/87: 12-13. Nye marine arter: Stygg som steinbit.
NTB-reportasje (Mars/April). Steinbiten - den nye oppdrettsfisken (Publ. i en rekke av landets aviser. (bl.a. Nordlys, Sunnmøreposten, Fedrelandsvennen, Vårt Land, Tiden)
Varden 11/3-87. Kragerø-steinbiten får sin "brudesuite"
NRK radio P1 "Kolumbus", 30 min. Kl. 1920 27/5-87.

Moksness, E. og J. Gjøseter 1987. Progress Report 24/4-87. 3 pp.

APPENDIX : TERMINTATED GROUPS

APPENDIX 1: The 85-3 group

Materials

During a cruise with R/V "G.O.Sars" from 20 August to 5 September 1985 in the Barent Sea, 35 live spotted catfish juveniles (A. minor) were caught. The juveniles were taken in the upper 60 m with a pelagical trawl towed with a speed of 3 nM. The salinity and temperature in the sampling area were around 33 $^{o}/oo$ and 7.5 ^{o}C respectively (Anon. 1985). The juveniles were transported to the laboratory at Flødevigen Biological Station and dived into three groups: 85-1, 85-2 and 85-3. Of these three groups, the juveniles in 85-3 were the one with best growth. The experiment started 12 September 1985, defined as day 0. Table 1 gives the corresponding dates to the number of days in experiment. The two groups, 85-1 and 85-2, were kept in tanks of 500 l during the experiment, while 85-3 was transferred from 500 l tank to a 2500 l tank after 431 days (Table 2). The two groups, 85-1 and 85-2 were terminated after 207 (7/4-86) and 237 (7/5-86) days respectively. The remaining fishes in these two groups were transferred to a predator experiment, 86-1. The group 85-3 were terminated after 508 days (2/2-87), when a accident killed them all.

The salinity were stable around 33 $^{o}/oo$ during the whole experimental period, while the temperature varied from 3.9 °C in the winter to 13.5 °C in the summer with a average of 8.8 °C in the whole period (Fig. 1).

Results

Growth

The growth in length and wet weight are given figure 2, 3 and 4. Growth in relation to temperature are given in Fig. 5 and 6. The figures indicates reduced growth i the periods 175 - 250 and 350 - 450 days. There is no indication that this reduction in growth are related to temperature. Length/weight relationship is given in Fig. 7 with equation expressing the curve.

Growth rate

The %-growth curve of the fishes together with observed temperature are given in Fig. 8, while Figs. 9 and 10 gives the %-growth together with observed average length and wet weight respectively. The figures indicates an rather high growth rate initially, then the growth rate dropped with decreasing

temperature. A later increase in temperature did not make the growth rate increase.

Condition factor

The observed average condition factor of the fishes together with observed temperature and average wet weight are given in Figs. 11 and 12 respectively. The figures indicates a low condition factor (below 0.95) in periods with slow growth.

Feeding

Table 3 gives the menu for the fishes in group 85-3. The composition of the wet pellets are also indicated. The amount of wet pellets fed the fishes are given in Fig. 13. There is no positive correlation between amount of wet pellets and the temperature. Figs. 14, 15, 16 and 17 gives the observed amount of wet pellets fed the fishes, the amount of wet pellets per fish fed together with the the average length and wet weight of the fishes. The figures indicates a positive correlation between the size of the fishes an the amount of food fed them. As indicated in Fig. 18, there is a also a positive correlation between amount of wet pellets per fish and the fishes growth rate. Table 4 indicates that the food factor (FC) of the spotted catfish might be below 2.0.

The 85-1, 85-2 and 85-3 groups

Numbers

The survivals in the three groups are given in figure 19. Mortality was only observed to some extent in 85-1, while in 85-2 the numbers were reduced with almost 50 % over 200 days. All the juveniles died accidently, when the tank fell down. Average Length, wet weight, condition factor and %-growth are given in Fig. 20, 21, 22 and 23 respectively.

TABLES

Table 1. Corresponding dates to number of days in experiment.

Days in Experiment	Date
0	12/9-85
50	1/11-85
100	21/12-85
150	9/2-86
200	31/3-86
250	20/5-86
300	9/7-86
350	28/8-86
400	17/10-86
450	6/12-86
500	25/1-87

Table 2. Period of experiment (Days in experiment) the fishes spend in different tanks.

Group	500[1] l	2500[2] l
85-1	0 - 207	
85-2	0 - 237	
85-3	0 - 431	431 - 508

Table 3. Type of food fed the fishes in different periods (days of experiment).

Period	Food-type
0 - 176	wet pellets
176 - 237	dry pellets
237 - 267	fish meat
267 - 308	experimental wet pellets
308 - 508	wet pellets*

* Consisted mainly of macrell (~ 48 %), Shrimps (~ 24 %), "bindemiddel, Skretting 25 %" (~ 29 %), vitamin E+ and vitamin C. Dry weight of the wet pellet around 50 %.

Table 4. Different calculated food-factor (FC). Dry weight of fish ~ 20 % and of the wet pellets from 40 to 55 %.

Period	Average INDEX	food-factor Real numbers		30 %	INDEX %-growth
308 - 333	2.7	3.32	2.33	1.8	24.8
333 - 362	2.4	36.05	25.33	17.3	1.37
362 - 390	1.83	2.78	1.95	1.02	13.1
390 - 418	1.79				
418 - 445	2.75	8.07	5.65	4.44	9.86
445 - 480	3.75	3.63	2.54	2.72	44.8
480 - 508	2.75	5.19	3.64	2.86	24.73

FIGURES

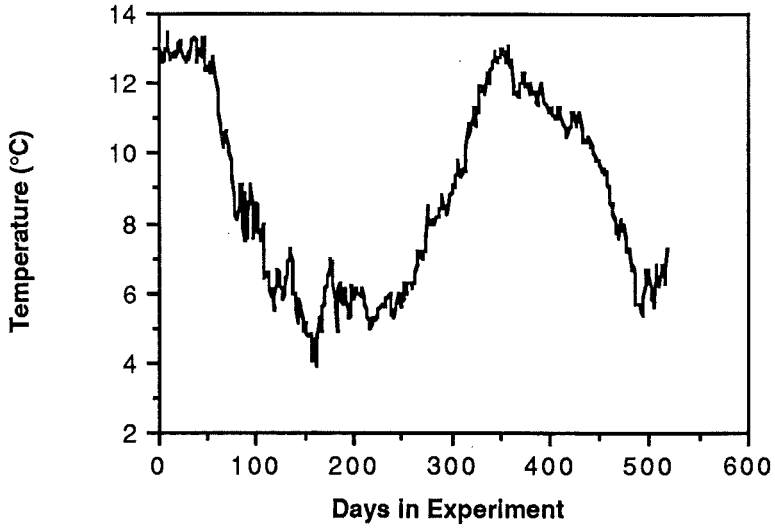

Figure 1. The observed temperature in the experiments.

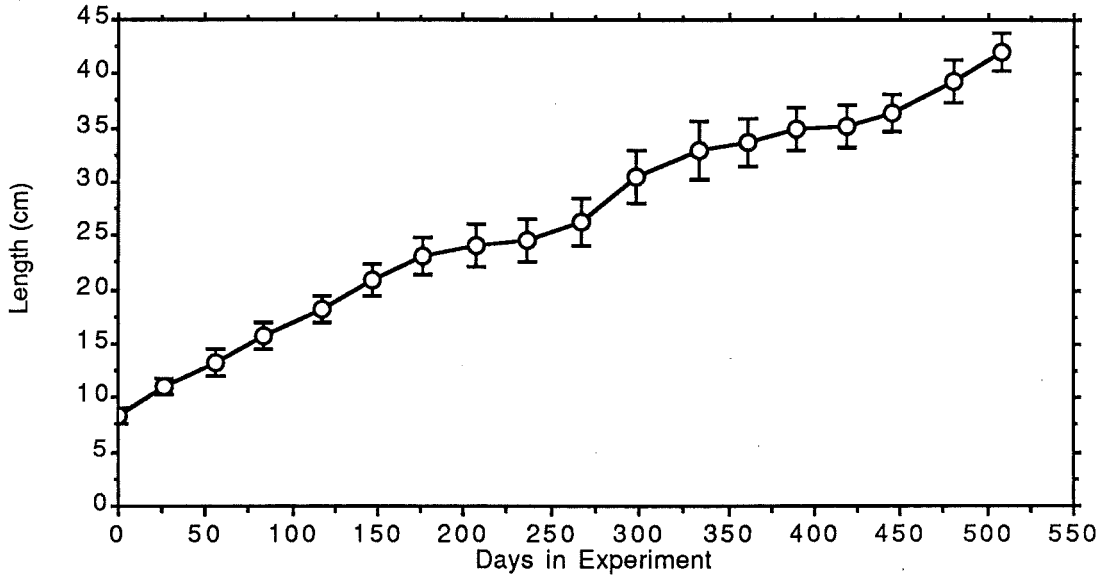

Figure 2. Average length (cm) with standard deviation of fishes in 85-3.

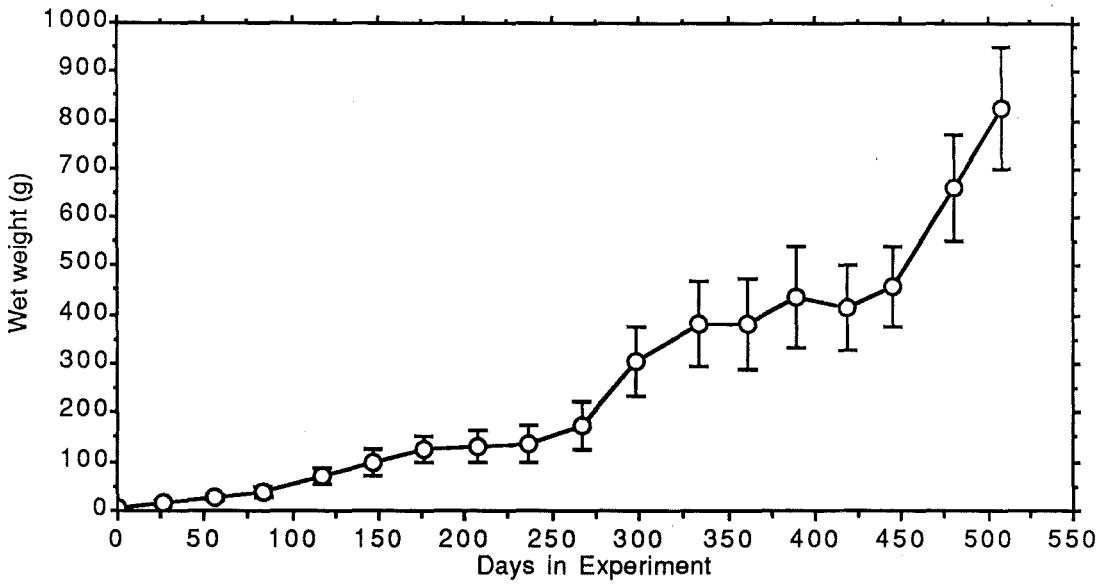

Figure 3. Average wet weight (g) with standard deviation of fishes in 85-3.

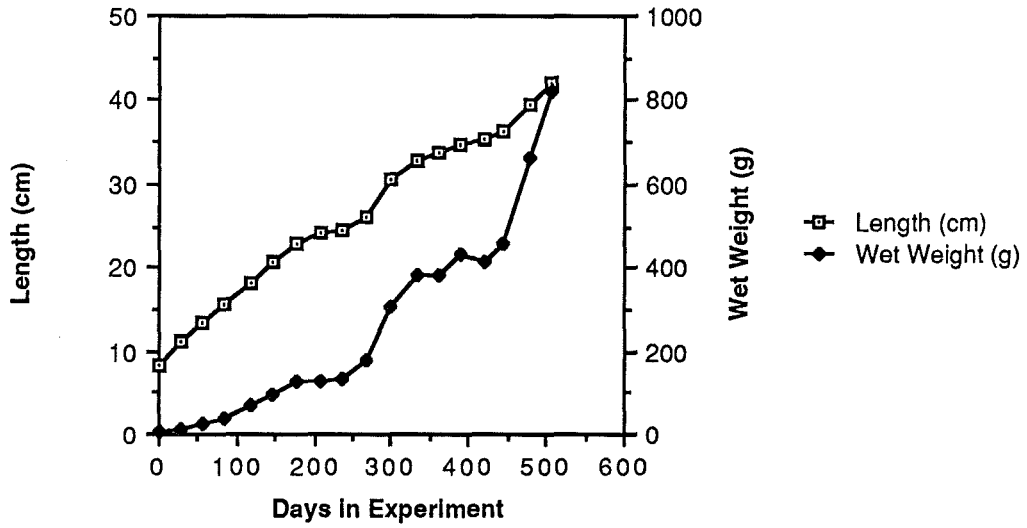

Figure 4. Combined average length and wet weight of fishes in 85-3.

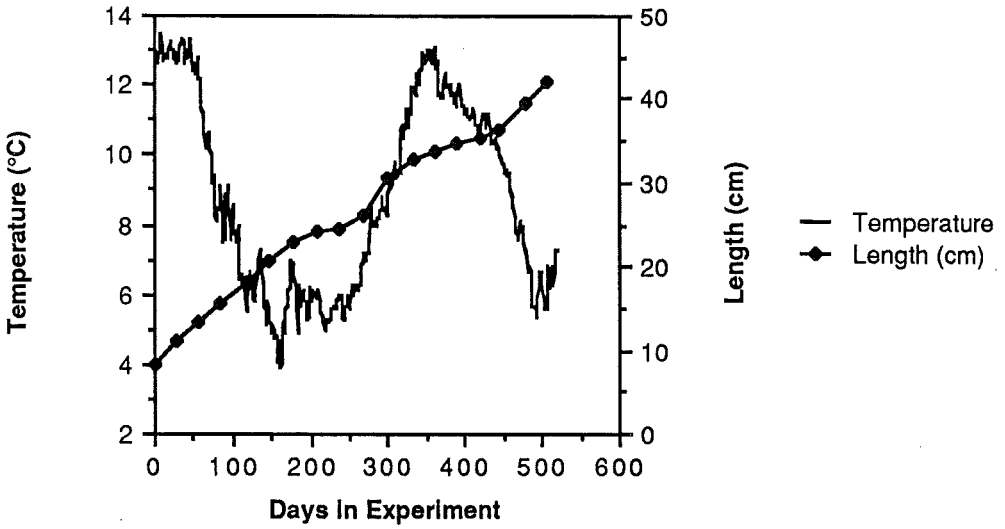

Figure 5. Temperature and average length (cm) of fishes in 85-3.

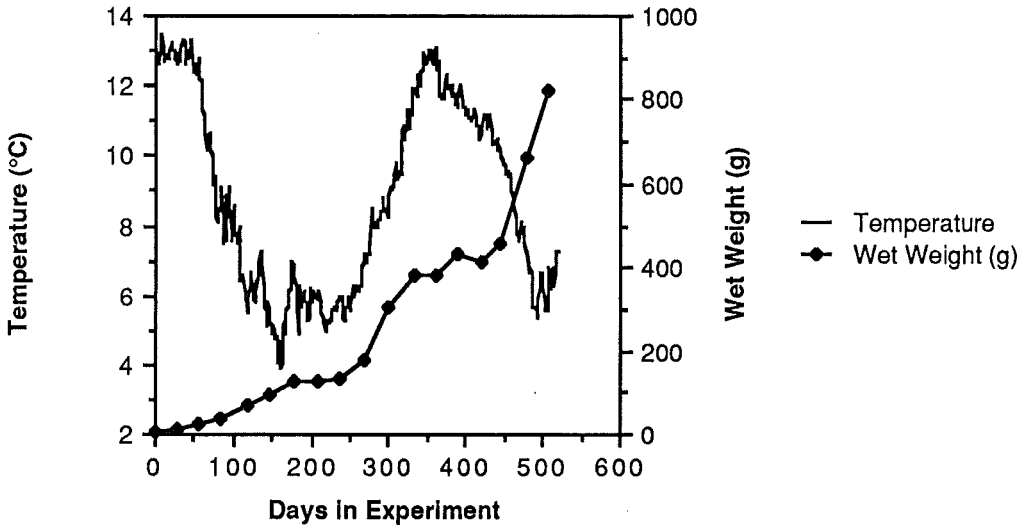

Figure 6. Temperature and average wet weight (g) of fishes in 85-3.

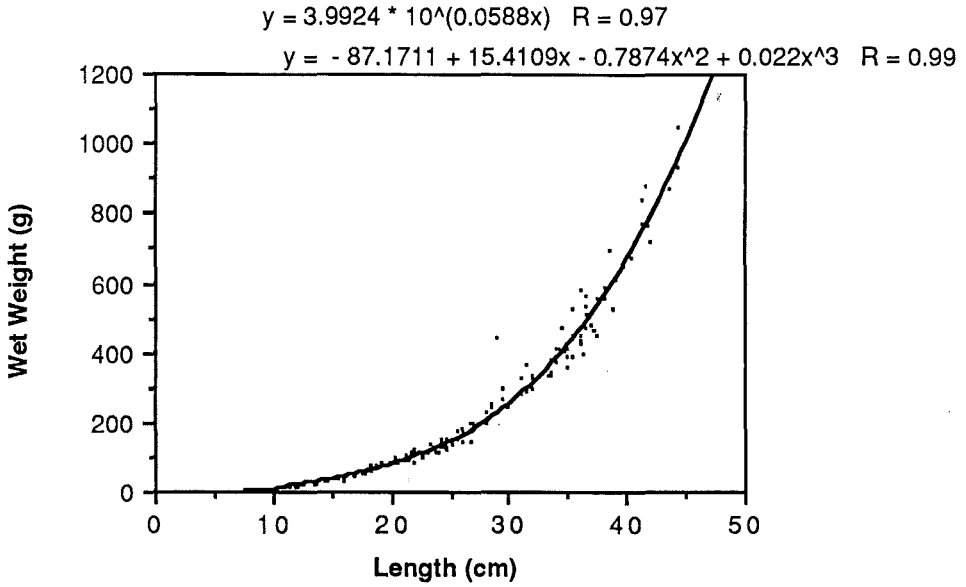

Figure 7. Length/wet weight relationship of fishes in 85-3.

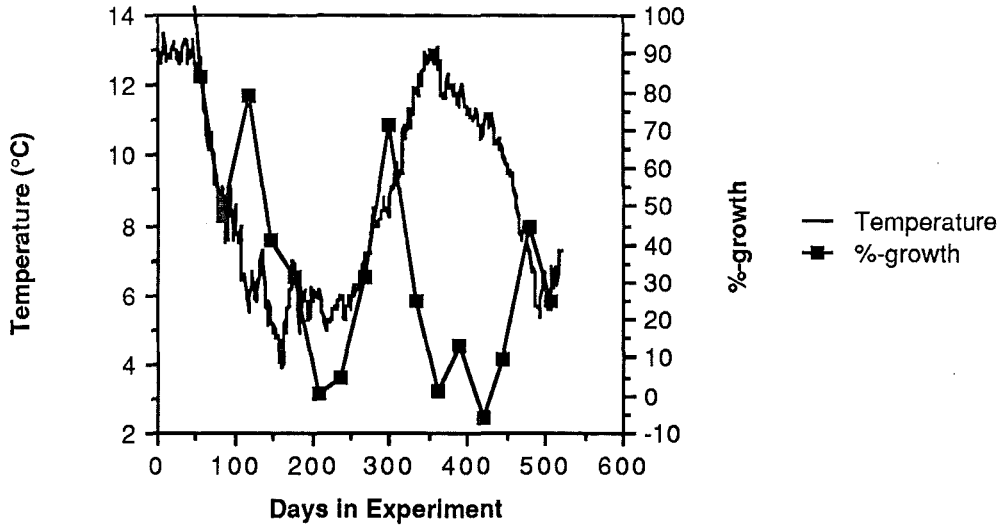

Figure 8. Temperature and % growth of fishes in 85-3.

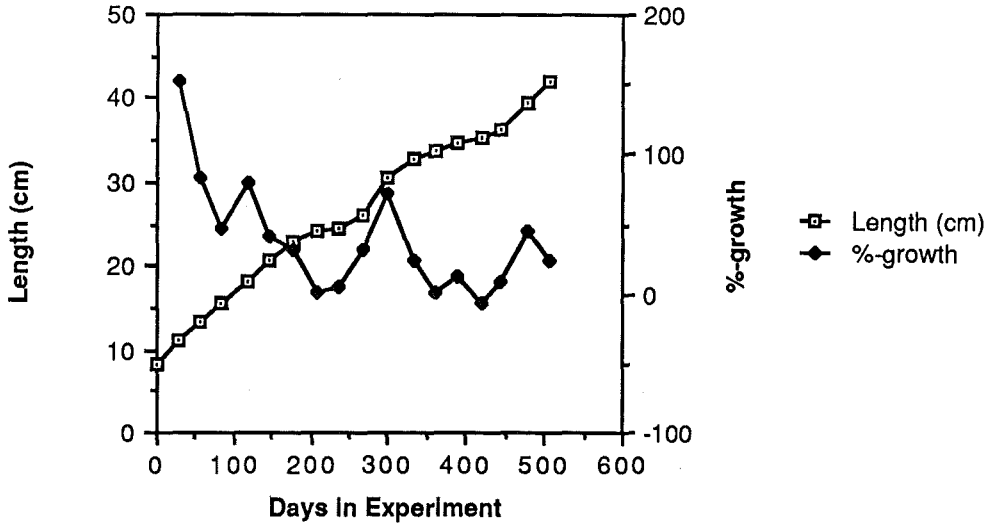

Figure 9. Average length (cm) and % growth of fishes in 85-3.

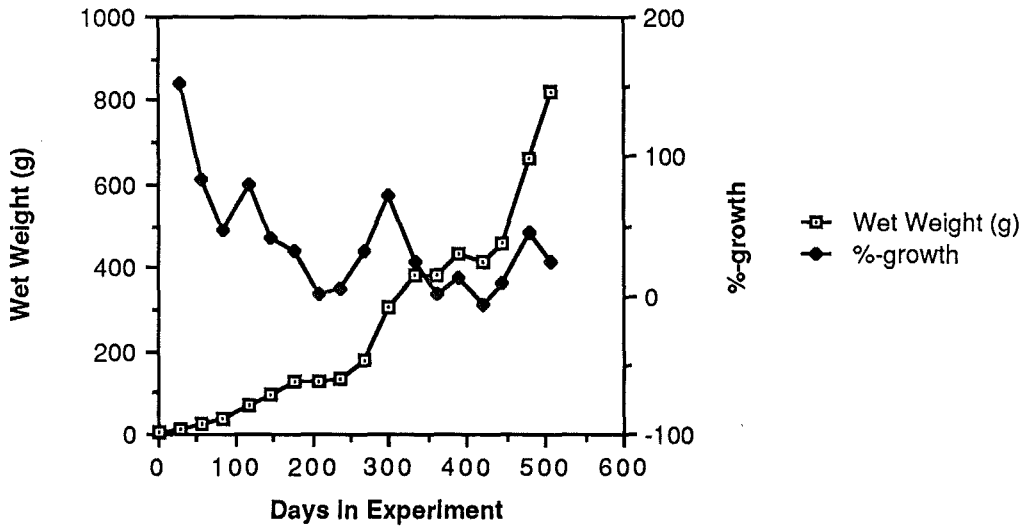

Figure 10. Average wet weight (g) and % growth of fishes in 85-3.

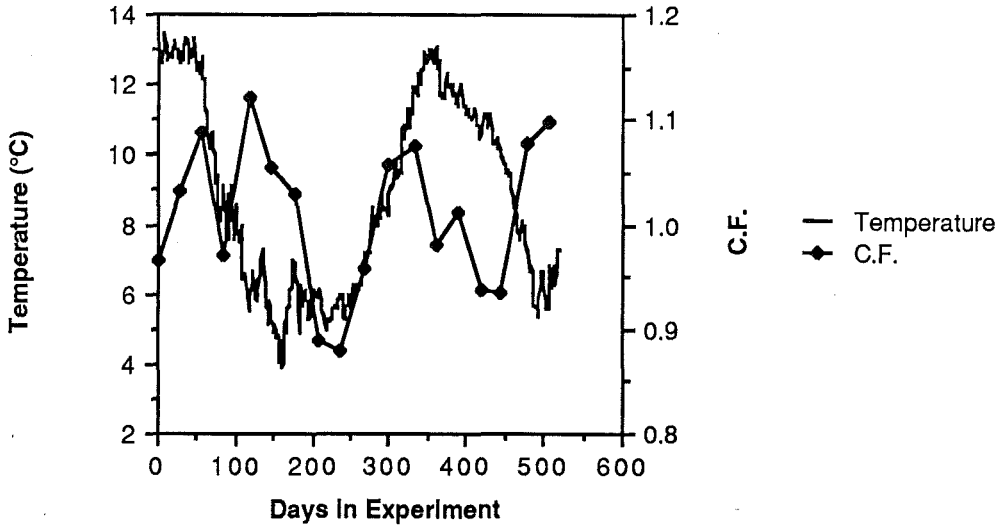

Figure 11. Temperature and average condition factor (C.F.) of fishes in 85-3.

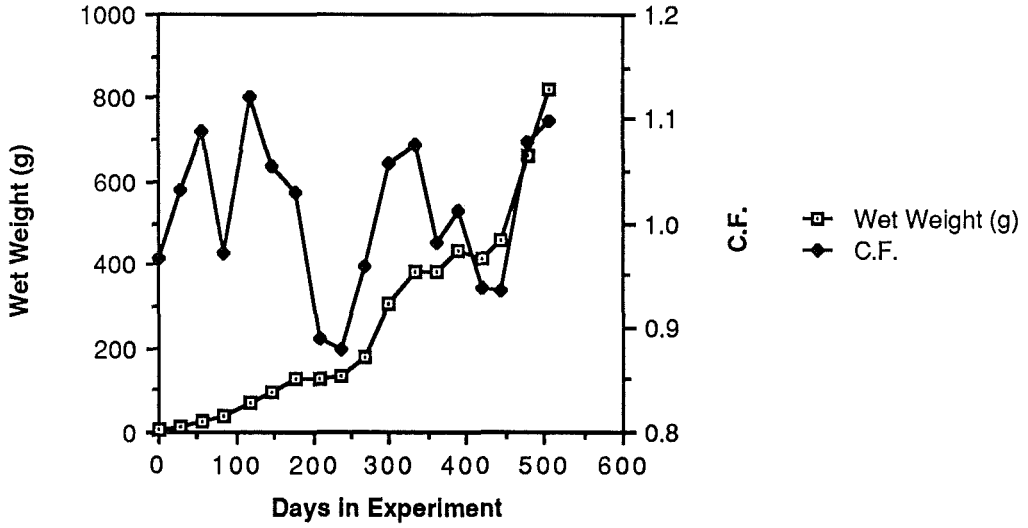

Figure 12. Average wet weight (g) and average condition factor (C.F.) of fishes in 85-3.

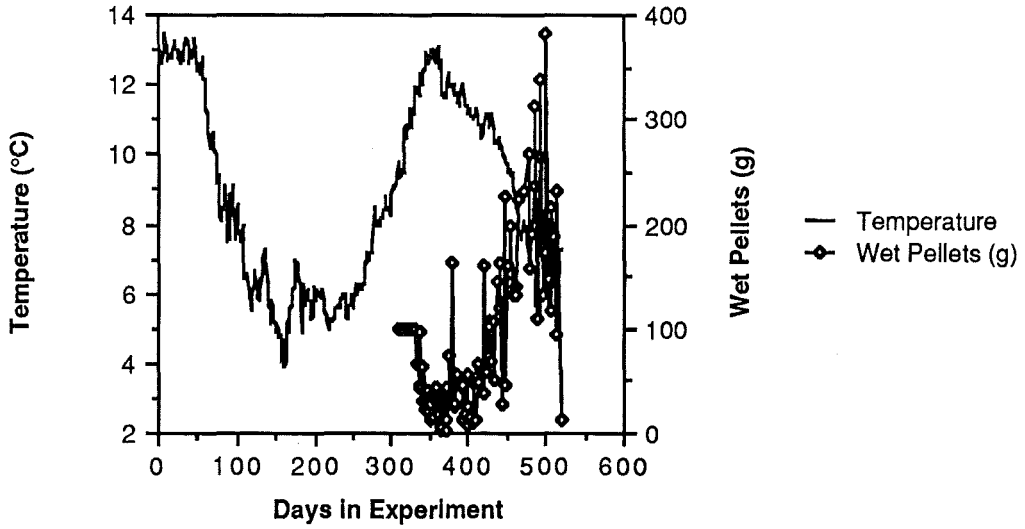

Figure 13. Temperature and amount of wet pellets (g) fed the fishes in 85-3.

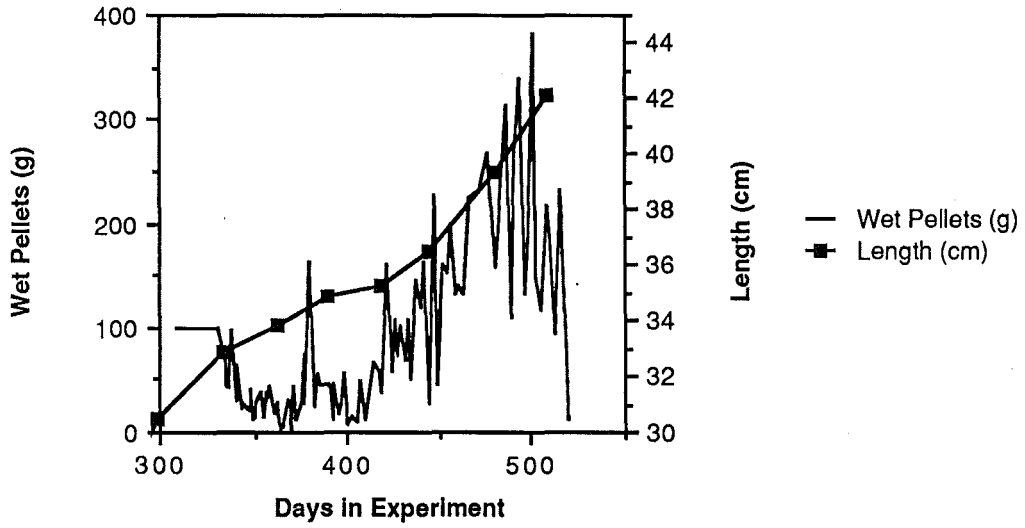

Figure 14. Average length (cm) and amount of wet pellets fed the fishes in 85-3.

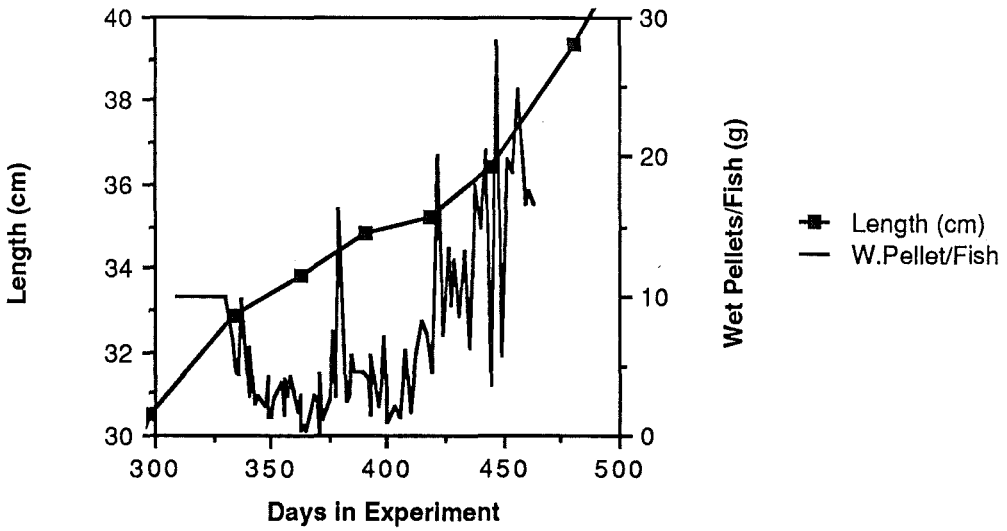

Figure 15. Average length (cm) and amount of wet pellets/fish fed the fishes in 85-3.

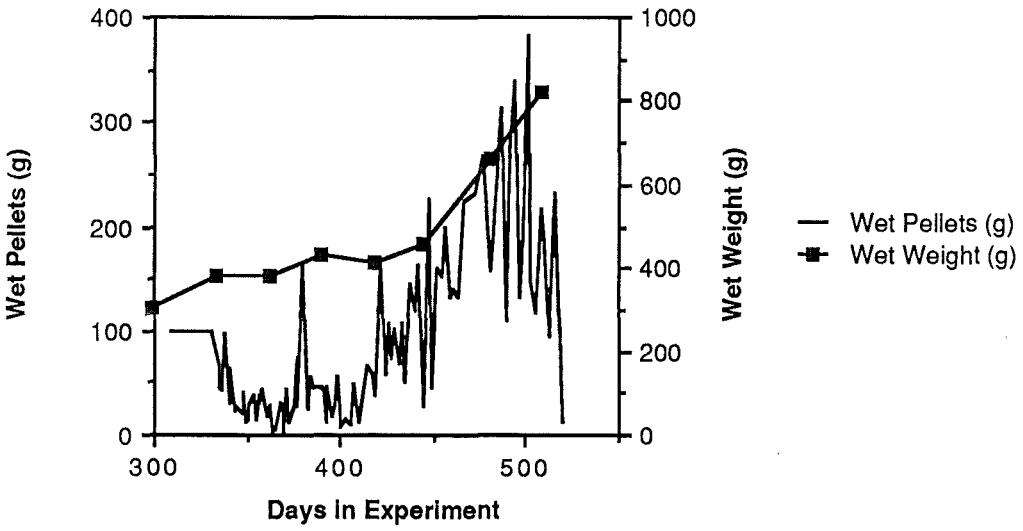

Figure 16. Average wet weight (g) and amount of wet pellets fed the fishes in 85-3.

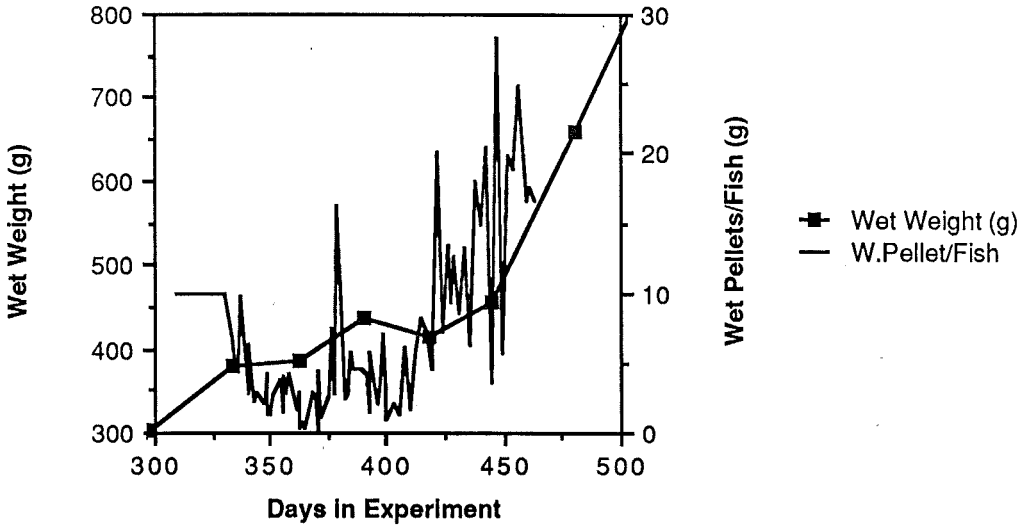

Figure 17. Average wet weight (g) and amount of wet pellets/fish fed the fishes in 85-3.

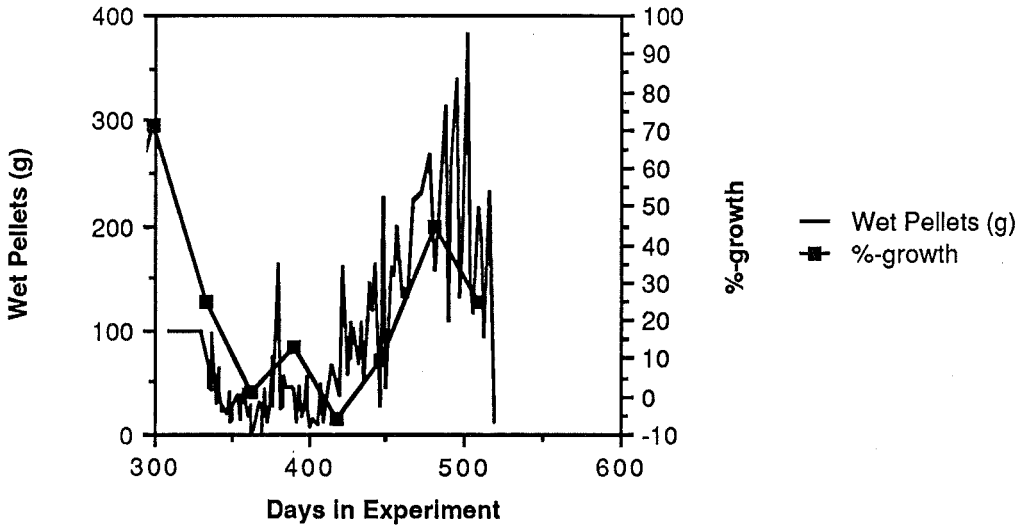

Figure 18. Amount of wet pellets (g) fed the fishes in 85-3 and their %-growth.

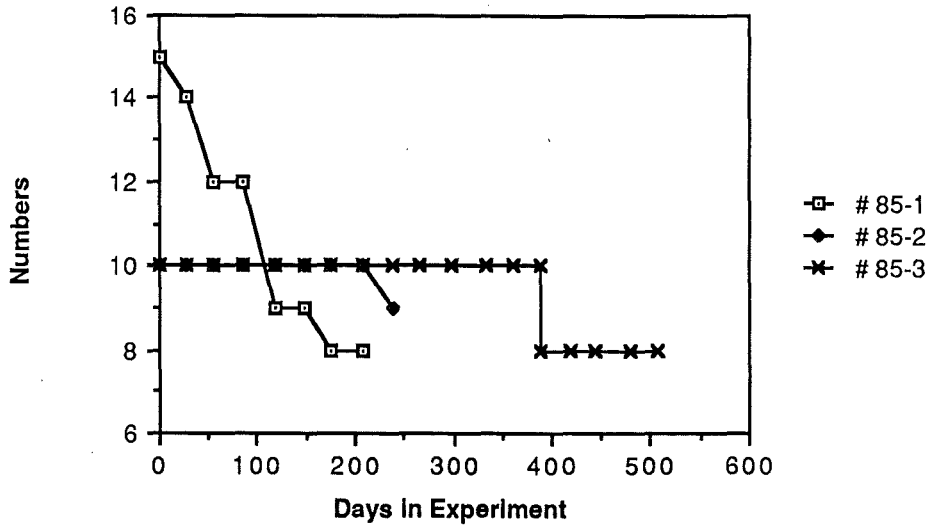

Figure 19. Numbers of survivals in the three groups of spotted catfish; 85-1, 85-2 and 85-3.

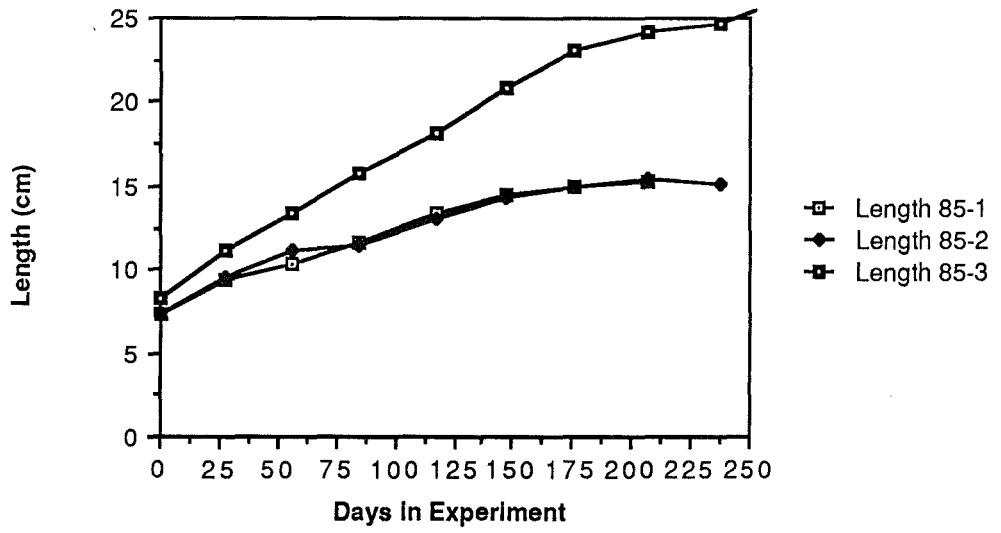

Figure 20. Average length (cm) in the three groups of spotted catfish.

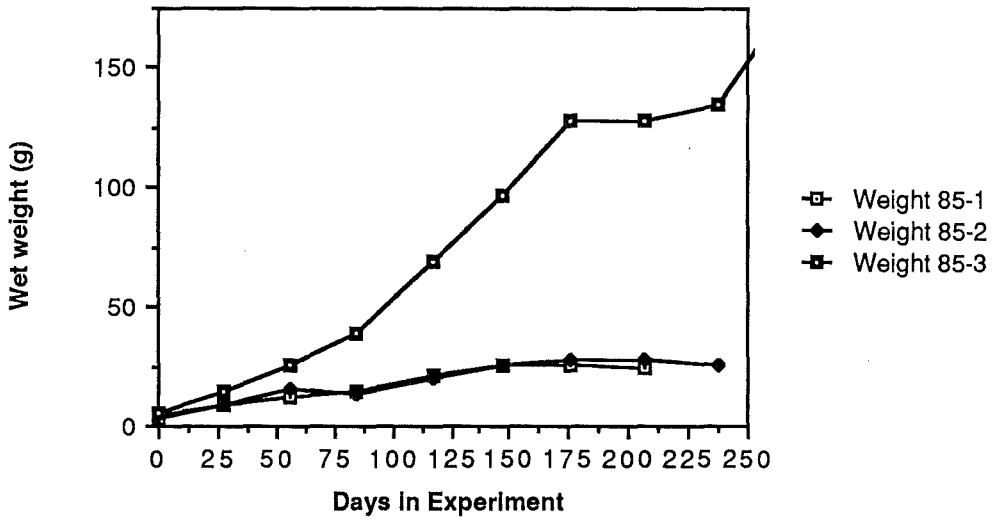

Figure 21. Average wet weight (g) of the fishes in the three groups of spotted catfish.

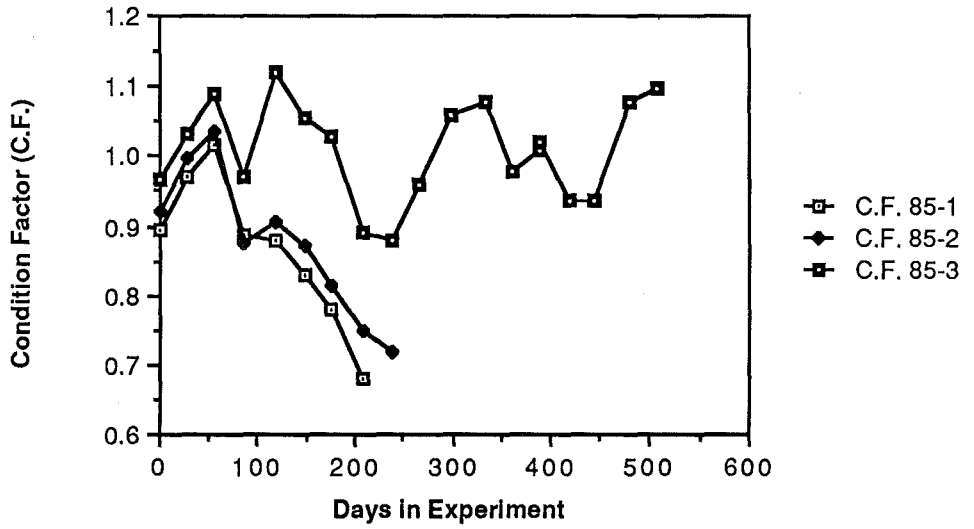

Figure 22. Average condition factor (C.F.) in the three groups of spotted catfish.

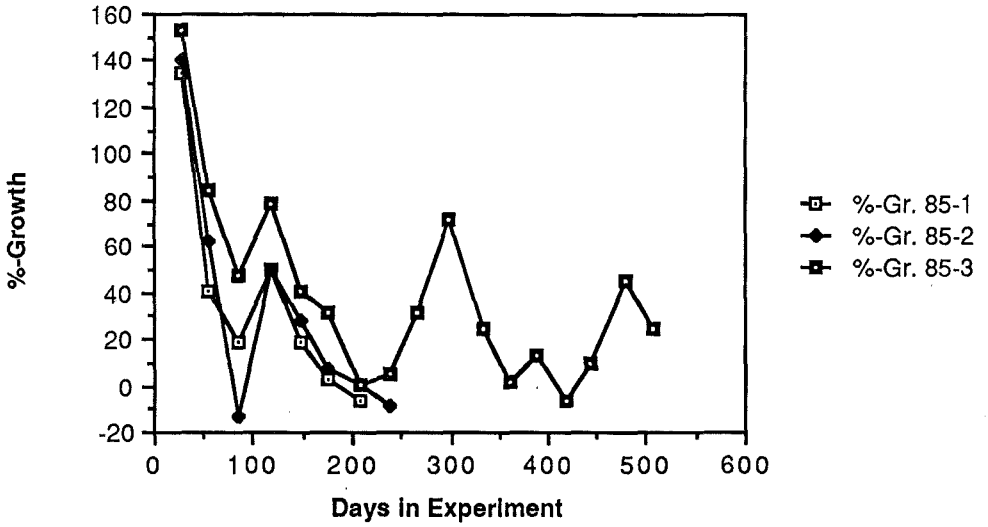

Figure 23. %-growth (%-gr.) in the three groups of spotted catfish.

APPENDIX 2: THE 86-2 GROUP

The fishes in 86-2 were collected in April/May 1986 and came from southern Norway. Table 5 gives the corresponding date to the numbers of days in experiment.

RESULTS

The fishes were kept for the whole experimental period (280 days) in a tank of 5000 l (3 m in diameter), (Table 6) and fed mainly wet pellets (Moksness og Gjøseter 1987) (Table 7). The obtain food factor (FC) was rather height indicating that to much food were fed the group (Table 8). The %-growth was rather low indicating slow average growth in the group, but the results are also disturbed by a high mortality (fig. 24) in the group, mainly as results of an accident, as the tank was emptied for water one night. In the group as a whole a low condition factor (CF) (below 0.9) were observed during the experimental period (Fig. 34 and 35). Dead fishes in the tank were observed with a average CF of 0.83 (table 9)

Table 5. Corresponding dates to days in experiment i 86-2.

Days in experiment	Date
0	6/5-86
50	25/6-86
100	14/8-86
150	3/10-86
200	22/11-86
250	11/1-87

Table 6. Days in and size of tank.

Group	5000 l
86-2	0 - 268

Table 7. Different food types for 86-2

	Period	Food type
(testing)	0 - 73	Macrell meat/wet pellets
	73 - 268	wet pellets (as for 85-groups)

Table 8. food-factor (FC) of fishes in 86-2.

Period	Average INDEX %-growth	food-factor	Total FC	30 %	INDEX
0 - 31					
31 - 72					8.92
72 - 157	4.2	~ 14.86	~ 10.4		11.83
157 - 217		3.82	-	-	- -
2.31					
217 - 268		2.6	-	-	- -
11.42					

Table 9. Condition factor (CF) observed on some dead fishes in 86-2.

	Number	CF
	1	0.42
	2	0.79
	3	0.81
	4	0.82
	5	0.90
	6	0.96
	7	0.96
	8	1.00
	Average	0.83

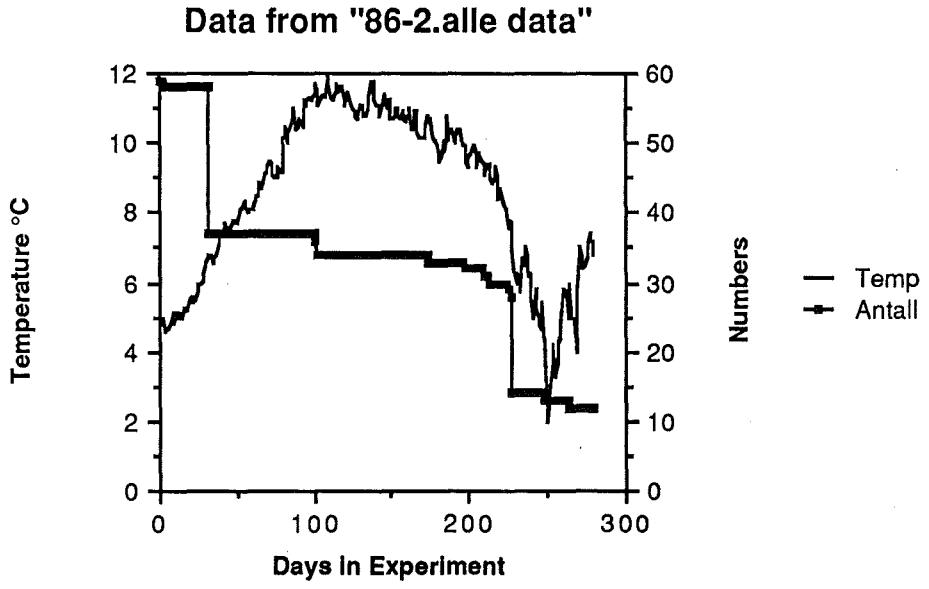

Fig. 24. Observed temperature (°C) and numbers of survivals in 86-2.

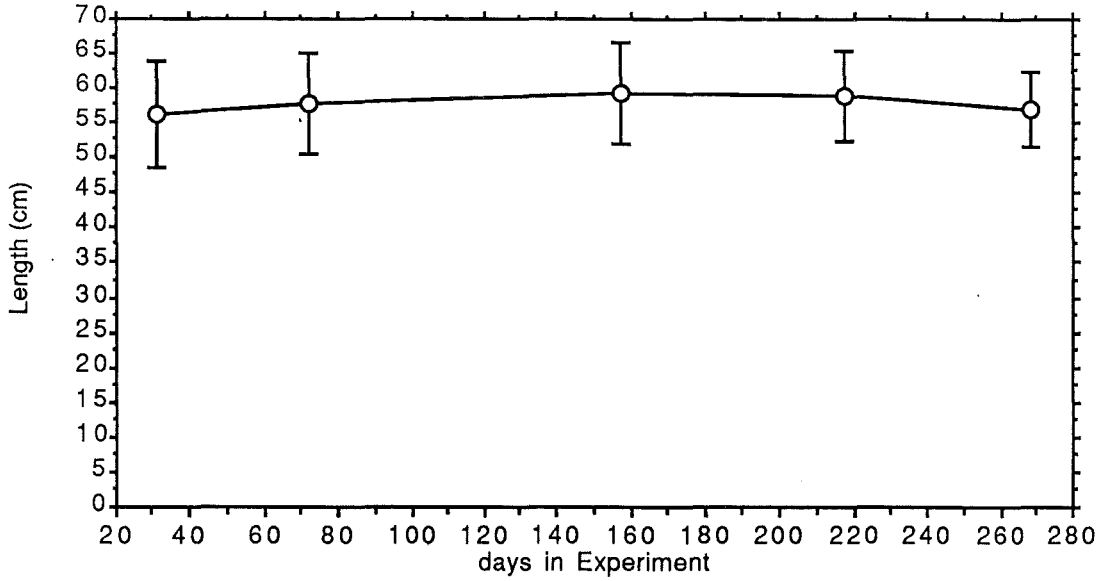

Figure 25. Average total length (cm) with Standard deviation (SD) of fishes in 86-2.

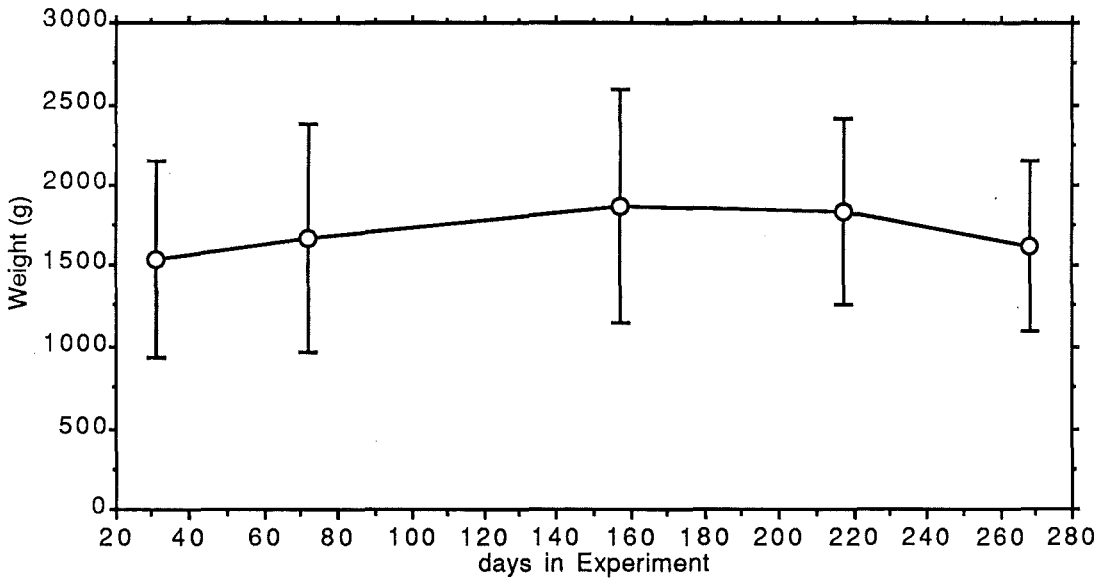

Fig. 26. Average wet weight (g) with standard deviation (SD) of fishes in 86-2.

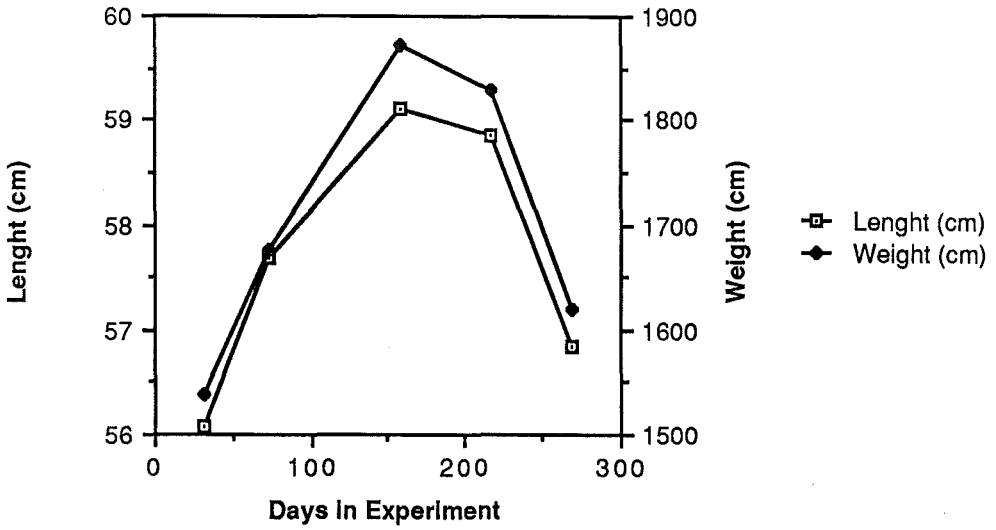

Fig. 27. Combined average total length (cm) and average wet weight (g) of fishes in 86-2.

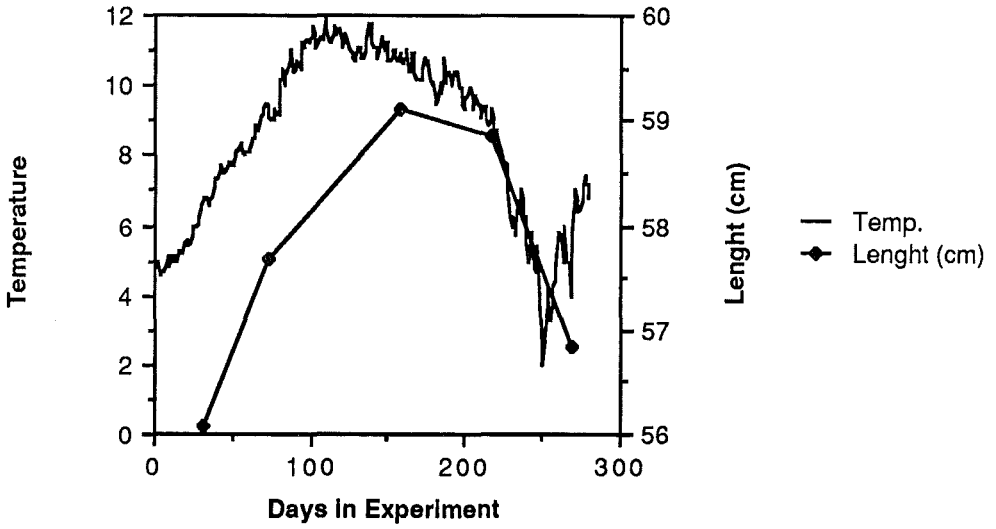

Fig. 28. Temperature (^{o}C) and average total length (cm) of fishes in 86-2.

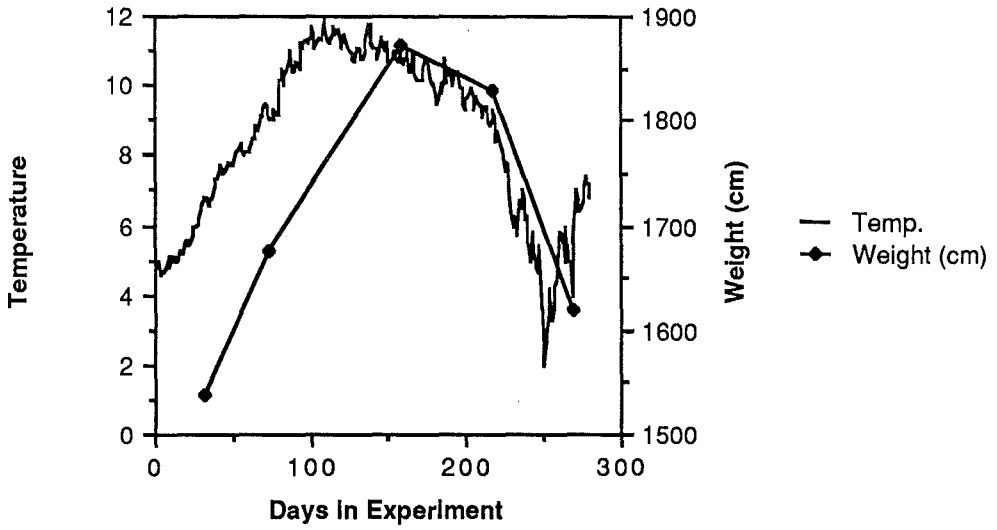

Fig. 29. Average wet weight (g) and temperature in 86-2.

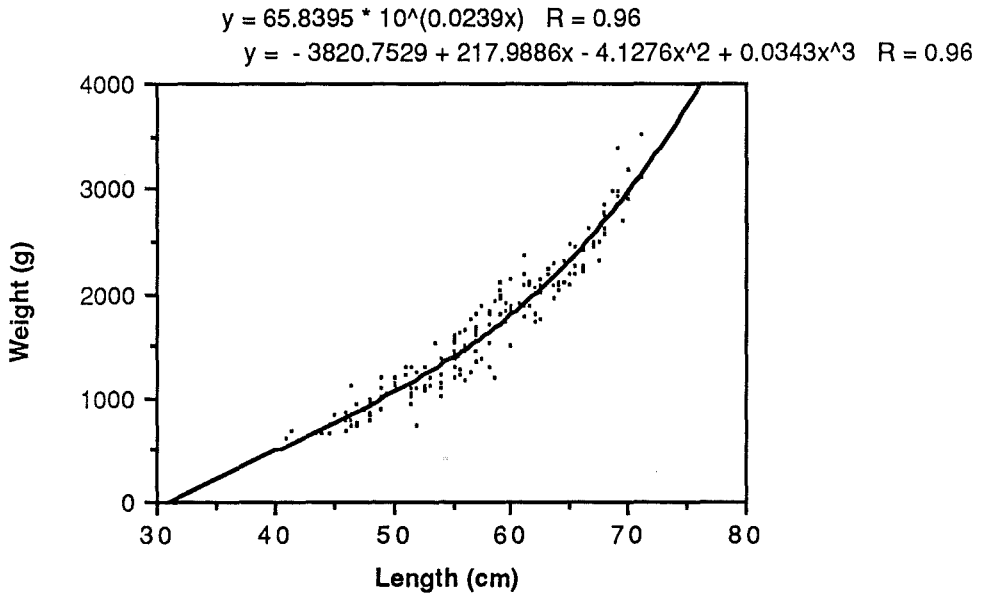

Fig. 30. Length/weight relationship of fishes in 86-2.

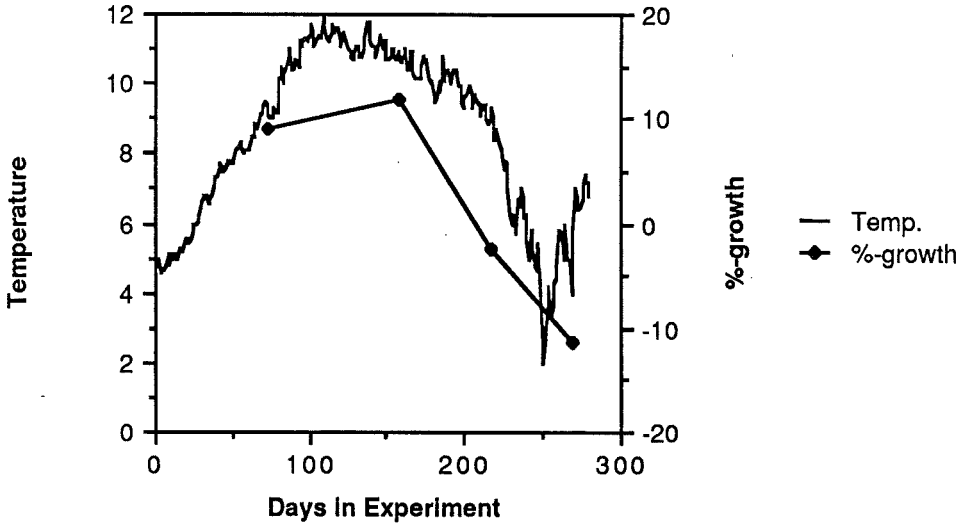

Fig. 31. Temperature and %-growth of fishes in 86-2.

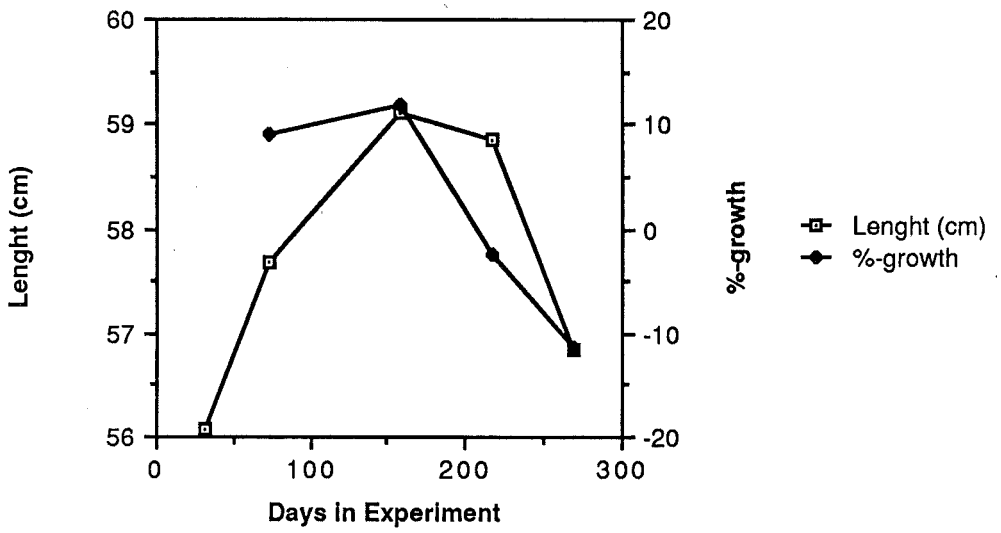

Fig. 32. Average total length and %-growth of fishes in 86-2.

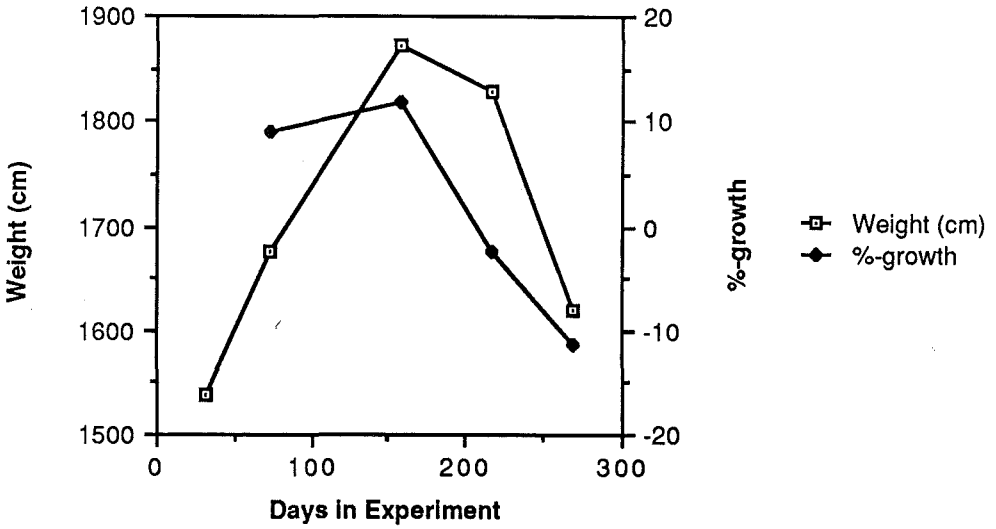

Fig. 33. Average wet weight (g) and %-growth of fishes in 86-2.

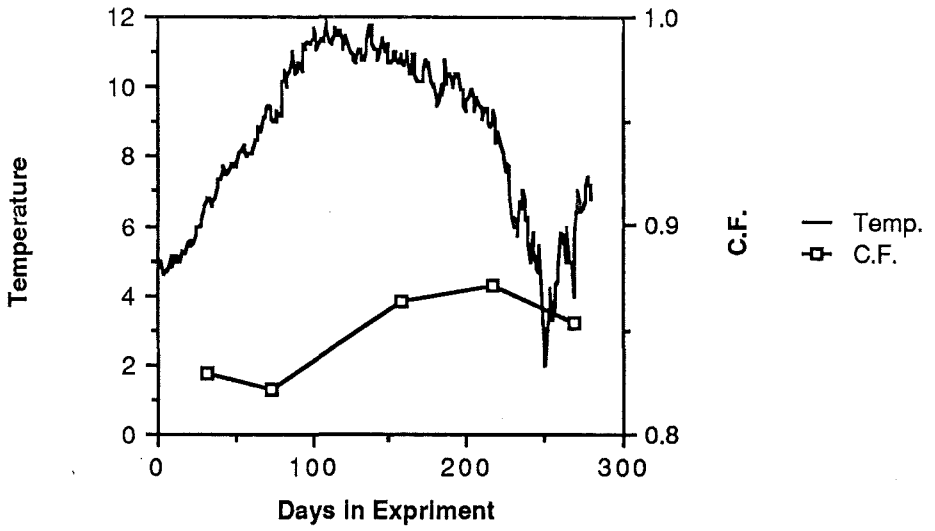

Fig. 34. Temperature and average condition factor (CF) of fishes in 86-2.

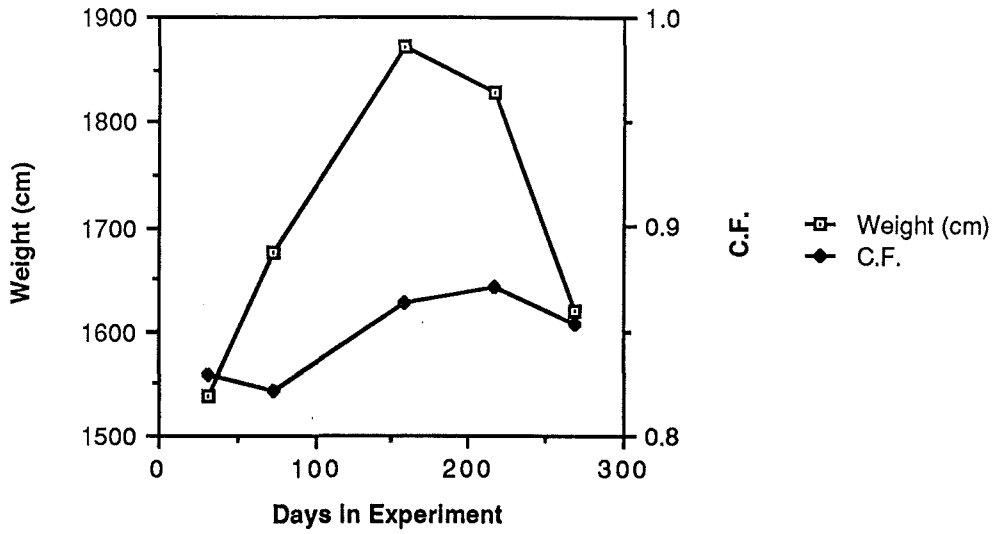

Fig. 35. Average wet weight (g) and average condition factor (CF) of fishes in 86-2.

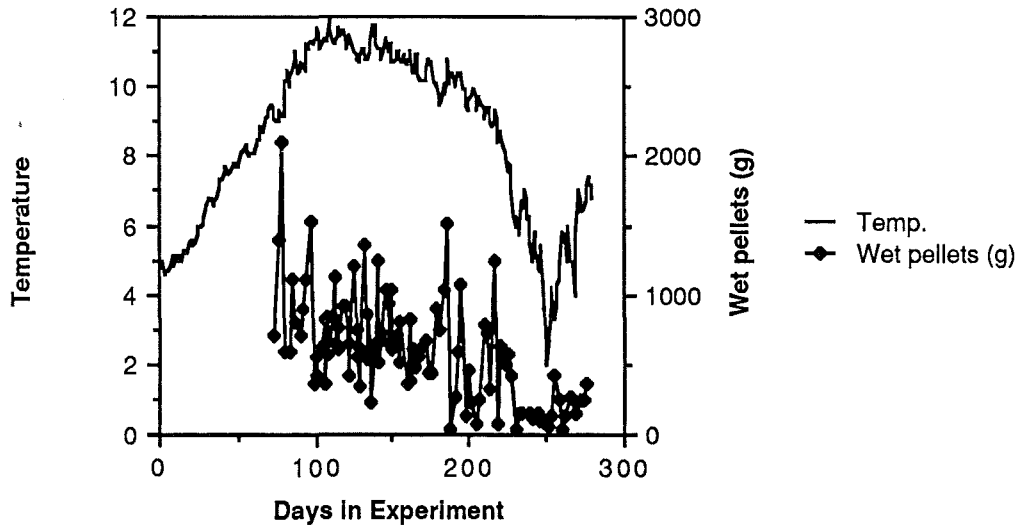

Fig. 36. Temperature and amount of wet pellets (g) fed fishes in 86-2.

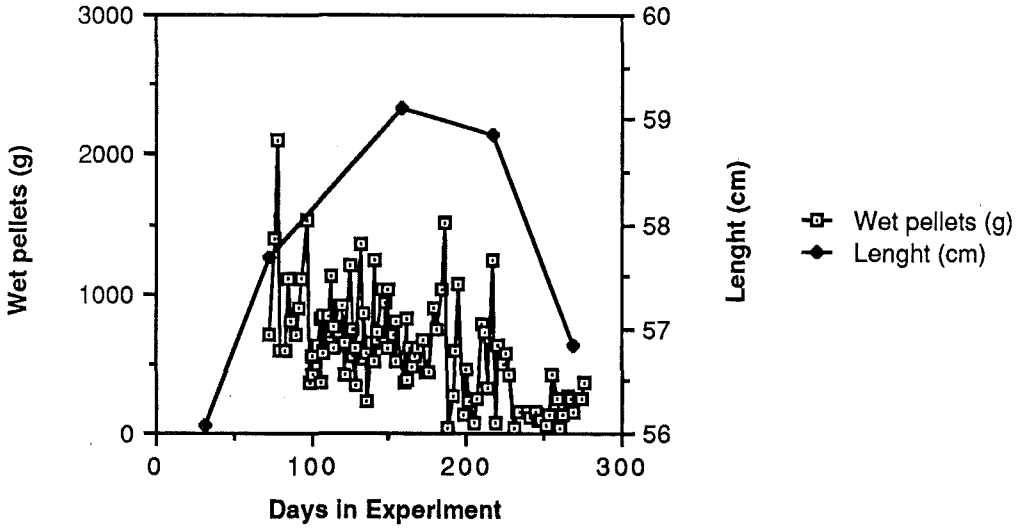

Fig. 37. Average total length (cm) and amount of wet pellets (g) fed fishes in 86-2.

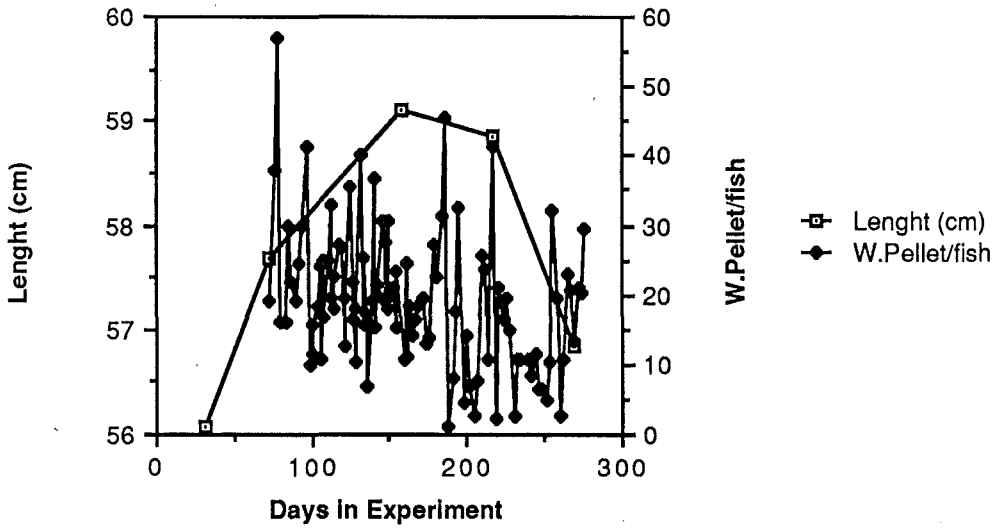

Fig. 38. Average total length (cm) and amount of wet pellets/fish (g) fed the fishes in 86-2.

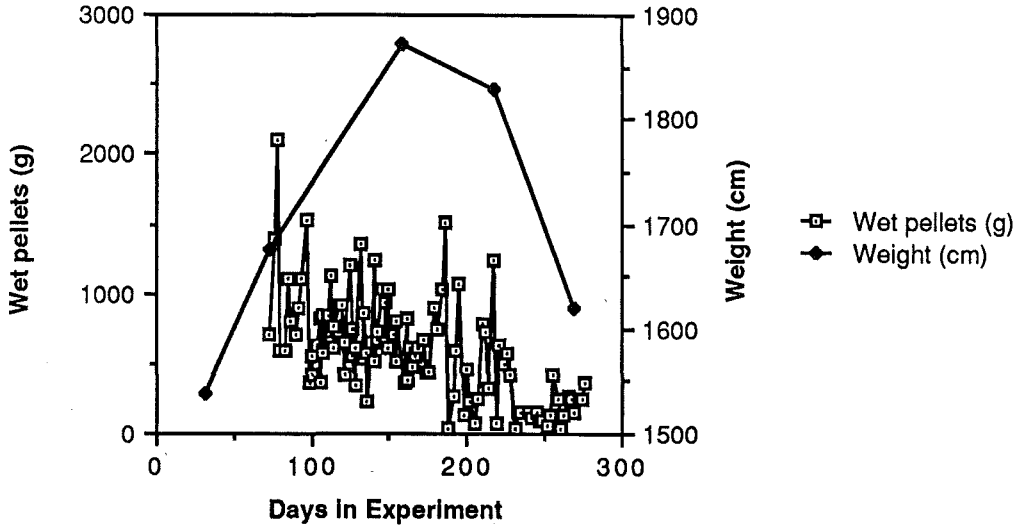

Fig. 39. Average wet weight (g) and amount of wet pellets (g) fed the fishes in 86-2.

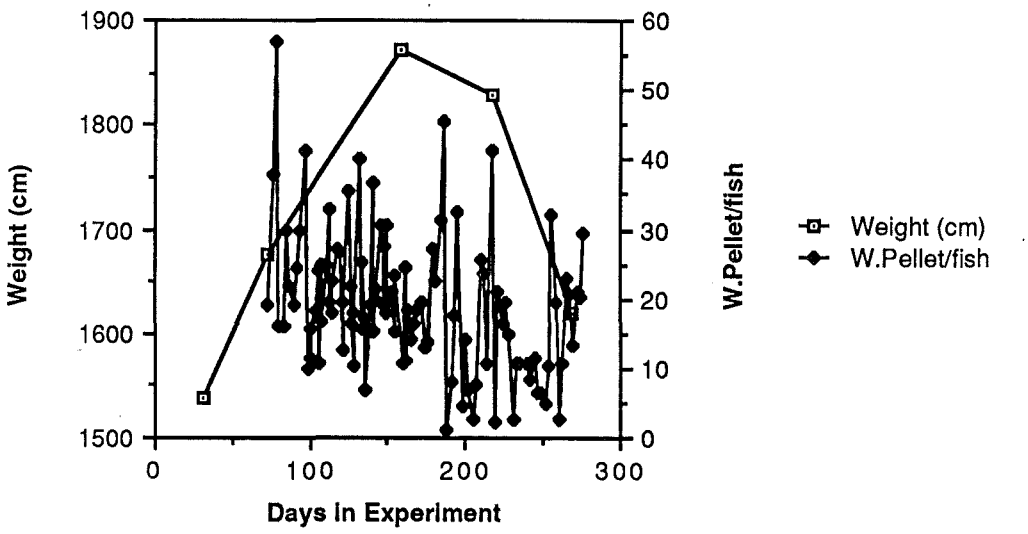

Fig. 40. Average wet weight (g) and amount of wet pellets/fish (g) fed fishes in 86-2.

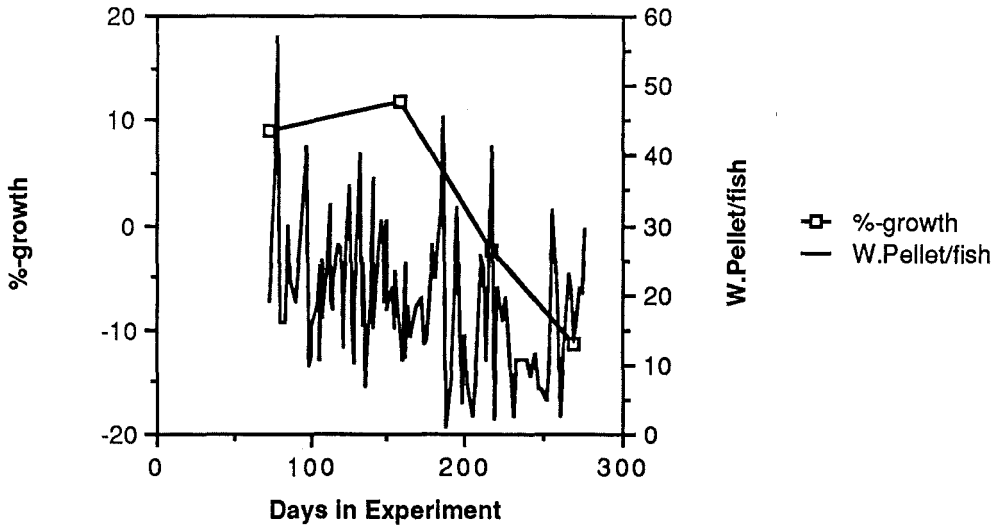

Fig. 41. Amount of wet pellets (g) fed fishes in 86-2 and their %-growth.

Appendix 3: The 86-3 group

The group consisted of 7 spotted catfish, collected during cruises august/September 1986 with R/V "G.O. Sars" and R/V "Eldjarn" in the Barent Sea (Anon. 1986). The experiment started 6/8-86, defined as day 0 in the experiment. All seven fishes died accidently, when several tanks collapsed in January 1987. The seven fishes's life history in the laboratory are given in table 10. The fishes had a SGR for the whole experimental period of 1.75 %/day.

Table 10. The life history in the laboratory of fishes in 86-3.

Days in Experiment	Length (cm)		weight (g)		CF	%-growth SGR
0	8.97	6.9	0.95			
27	11.79	17.0	1.03	145.5	3.3	
56		25.2		47.8	1.4	
83		36.3		44.0	1.4	
118	18.5	66.7	0.99	75.5	1.6	
146	20.8	89.4	0.98	40.5	1.2	

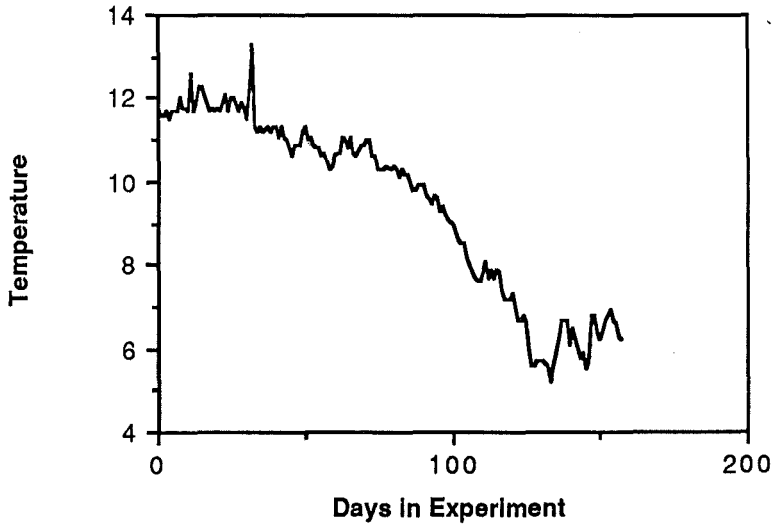

Figure 42. The observed temperature in experiment 86-3.

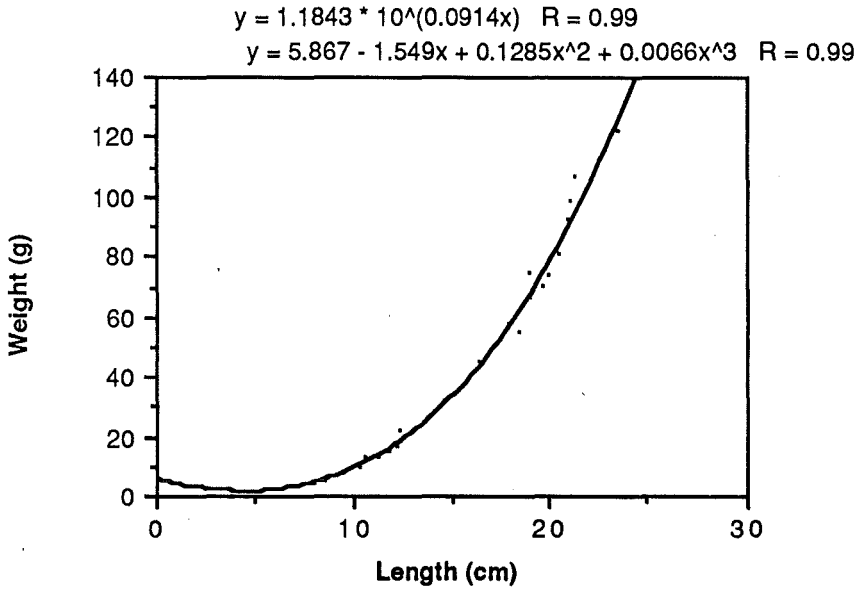

Figure 43. Length/weight relationship of fishes in 86-3.

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adjacent waters in August-September 1985. ICES CM 1985/G:75 : 1-27.

Anon. 1986. Preliminary report of the international 0-group fish survey in the Barent Sea and adjacent waters in August-September 1986. ICES CM 1986/G:78 : 1-27.

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