Turbot Hatchery Production 1981

Technical Report No. 195

February 1983

SFIA Report

Turbot Hatchery Production 1981

Sea Fish Industry Authority

Technical Report No. 195 February 1983

SEA FISH INDUSTRY AUTHORITY
Marine Farming Unit

TURBOT HATCHERY PRODUCTION 1981

Technical Report No. TR 195
February, 1983

J.E. Dye

INDEX

TURBOT HATCHERY PRODUCTION 1981

SUMMARY

During 1981 a total of 988,900 day one (d1) turbot larvae commenced rearing at the Hatchery at the Marine Farming Unit, Ardtoe. These comprised of 544,600 larvae from WFA spawning stocks at Ardtoe and Hunterston and 434,400 larvae originating at Scottish Sea Farms Hatchery at South Shian. In addition, a batch of 19,000 turbot/brill hybrid larvae was received from MAFF Lowestoft.

Larval rearing methods closely followed those of 1980.

The eggs produced at Ardtoe in 1981 (6.5% hatching rate) were of poorer quality than those of 1980 (16% hatching rate). This almost certainly reflected mortalities among proven female spawners between the two seasons.

A total of 52,110 larvae survived to day twenty (d20) and 36,574 fish were transferred to weaning tanks, including hybrids. The overall survival from d1 to weaning was 5.3%, much lower than the 16.5% achieved in 1980. This was thought to be mainly related to larval quality. Survival between d20 and transfer to weaning was 70.2%, about the same as in 1980 (65.1%).

The pre-weaning survival of turbot/brill hybrids was better than that of turbot and at about the same level as turbot in 1980.

1. INTRODUCTION

The 1980 turbot hatching season was very successful with over 56,000 fish being transferred to the weaning unit. It was decided that the 1981 season should involve the same techniques and larval feeds to demonstrate a routine production of even more fish.

2. FACILITIES AND PROCEDURES

All facilities were identical to those detailed in the 1980 Hatchery Report (FR 899) and techniques were identical apart from specific exceptions which are mentioned in this report.

2.1 Stock

Eggs Produced at Ardtoe

The successful 1980 spawning season had been largely dependent upon a single group of photoperiod-controlled fish which unfortunately suffered a high mortality during the winter. This meant that the production of eggs in 1981 relied on stocks with no history of good egg production. Three stocks were used:

a) 7 females and 5 males held in a $4m^3$ tank (P) under controlled photoperiod and temperature.

b) 9 females and 6 males held in an outdoor tank of $7m^3$ (D4) having been transferred from the North Channel site in Oct. 1980

c) 9 females and 10 males held in a similar tank (D3) having been transferred from the Ardtoe pond enclosure in May 1981.

Stripping and incubating procedure followed that of previous years with two exceptions, i)The milt was examined for sperm motility before being added to the eggs (all egg batches received motile sperm), ii)When eggs were examined 203 hrs. after fertilsation a random 100 eggs were checked to assess percentage development.

Eggs Transported to Ardtoe

Eggs were obtained from Scottish Sea Farms, South Shian, MFU Hunterston and MAFF Lowestoft. Almost all eggs were produced from photoperiod-controlled stock, incubated at 12-15^{o}C and transported within 24 hrs. of hatching. Some batches were transported earlier and

3.2 Larval Rearing

Batch 1/1 was exceptional in that it was an isolated batch of 5g of eggs which were used at the beginning of the season to compare algal diets. The batch was divided, each of the two 900l tanks received either Nannochloris feed or Monochrysis feed. The final survival was 39.7% for the Nannochloris batch while none of the Monochrysis batch survived to d20.

The final transfer of 36,574 fish to weaning tanks was disappointing but was still the second highest production for any year at the Ardtoe Hatchery.

Table 2 details all the egg batches incubated at Ardtoe, i.e. batches showing signs of development. In 1980, eggs were discarded if less than 30% were developing but in 1981 it was necessary to incubate all but the poorest batches. Only five egg batches successfully produced larvae from stocking with eggs showing under 30% development. Only two batches showing over 90% development failed to produce larvae. 56 egg batches were incubated at Ardtoe of which 32 batches failed to hatch. A total of 2,292g of eggs were incubated of which it is calculated that 1,375g were developing.

From the data on Ardtoe eggs actually reared it was calculated that of the 1,293g which were incubated, 892g were developing. The overall egg survivals were as follows:

d.1 larvae transferred to weaning tanks 183,100
5.6% of eggs stocked (total)
9.2% of developing eggs stocked (calculated)
9.4% of eggs stocked ignoring dropout batches
13.0% developing eggs stocked ignoring dropout batches

Table 3 relates production to egg origins and clearly shows the better survival of turbot/brill hybrids in the hatchery phase, a survival close to the 19% overall survival to d20 shown by the 1980 turbot. 1981 turbot batches showed much lower survival to d20, though survival between d20 and the onset of weaning was at least as good as in 1980, an indication that the Artemia were nutritionally adequate, although there is some debate on the long-term effects of different Artemia origins on eventual weaning. Larval survival to weaning from

dl was about a quarter of the level achieved in 1980. The batches from SSF were more successful than those from the Authority's own stocks, the performance of which was better at Ardtoe than Hunterston. These results indicate larval quality to be at least part of the cause of the low survival problem.

Table 4 shows the Artemia consumption in millions allocated to larval rearing batches. For most of the season the larvae were fed a mixture of two kinds of Brazilian Artemia cysts. The improved larval survivals in August covered a period during which the feed had been changed to one brand only. However batches 7/8 and 7/9 which were also fed the 'good' Artemia did very poorly.

Table 4 shows the numbers of Artemia fed to fish up to the end of the weaning stage. It is possible to extract from these figures a 'weaning ration' or Artemia nauplii needed per fish to the end of the weaning stage. In 1980 this ration was approximately 180,000 nauplii per weaned fish but in 1981 it had risen to 230,000 per weaned fish. This difference was largely due to poorer survivals of fish during the weaning stage.

A measure of the hatchery performance can be gauged by Table 5 which uses the 1981 season results to predict a production of 100,000 fish transferred to weaning tanks from the hatchery. The poorer survivals of eggs during incubation and larvae up to d20 means that to achieve this target would require eight times more eggs in 1981 than in 1980.

4. CONCLUSIONS

Although a greater output of transferred fish was achieved, the percentage survival has decreased since 1980. There is no obvious cause for this although it is certain that the quality, as measured by hatching rate, of WFA eggs was poorer than in the previous year. The survival of batches originating from SSF stock was far better than 'WFA' stock.

The majority of the larval mortalities occurred in the early stages and cannot be attributed to Artemia. The culture of algae and rotifers has not

changed since 1980 and gave no problems during that year. The other factors thought most likely to have an influence on survival are water quality and larval origins. If water quality was at fault it might explain why August produced better survivals of larvae from Ardtoe and SSF eggs and why April and May production was poor from Ardtoe and Hunterston eggs. However, each spawning stock was only in production for up to two months and the discrepancies could be related to good batches from certain stocks or even individual fish.

TABLE 1

History of Larval Rearing Batches

Batch	Origin	Wt of Eggs recd. (g)	Counted d1 Larvae	Survival at d20		Survival to Weaning Stage
1/1	SSF	5	5000	794	(15.9%)	473
2/1	SSF	10	9900	228	(2.3%)	188
2/2	SSF	340	150000	5165	(3.4%)	2700
3/1	SSF	75	40500	8930	(22.0%)	5913
3/2	H'ston	100	84000	106	(0.1%)	0
3/3	H'ston	20	11200	1725	(15.4%)	1166
4/1	H'ston	100	98500	346	(0.4%)	546
4/2	H'ston	30	8500	377	(4.4%)	
4/3	H'ston	50	22000	1569	(7.1%)	1363
4/4	Ardtoe	18	5600	100	(1.8%)	57
5/1	Ardtoe	12	6800	0		
5/2	H'ston	25	28200	0		
5/3	Ardtoe	22	2100	20	(1.0%)	0
5/4	Ardtoe	145	33000	160	(1.4%)	384
5/5	Ardtoe	25	4300	1300	(30.2%)	968
6/1	SSF	18(e)	18100	717	(4.0%)	638
6/3	MAFF T/B	15	19000	4062	(21.4%)	3436
6/2	SSF	25(e)	28000	866	(3.1%)	
6/4	Ardtoe	5	6000	479	(8.0%)	
6/5	H'ston	14	13700	488	(3.6%)	
7/1	SSF	20	11000	625	(5.7%)	
7/2	H'ston	100	11700	1400	(12.0%)	
7/3	SSF	20(e)	20200	0		1624
7/5	Ardtoe	4	5000	0		
7/6	H'ston	101	76000	686	(0.9%)	
7/7	H'ston	139	7700	149	(1.9%)	
7/8	Ardtoe	346	17800	260	(1.5%)	
7/9	SSF	5(e)	5700	50	(0.9%)	
8/1	Ardtoe	151	64100	2268	(3.5%)	2017
8/2	SSF	20(e)	22700	1685	(7.4%)	1449
8/3	Ardtoe	32	17600	2186	(12.4%)	1840
8/4	SSF	15(e)	18400	2726	(14.8%)	1951
9/1	Ardtoe	66	2300	445	(19.3%)	357
9/2	SSF	20(e)	20000	556	(2.8%)	
9/3	Ardtoe	80	18500	457	(2.5%)	750
10/1	SSF	20(e)	15600	310	(2.0%)	237
10/2	SSF	20(e)	8000	0		0
10/3	SSF	30(e)	31300	497	(1.6%)	371
11/1	SSF	30(e)	20900	10078	(48.2%)	6335
Total		2303	988900	52110	(5.3%)	36574

Ardtoe egg counts represent fertile eggs incubated. Batch 4/4 was split with SSF, 18g represents the calculated Ardtoe wt.

Batch 7/4 was used in experimental work by A. Elson.

TABLE 2

Fertile Egg Batches Incubated At Ardtoe 1981

Spawning Stock	Date Stripped	Wt. Eggs in g.	% Age Developing	No. per g	Est. Hatch (dl)	% Age Hatch	% Age Developing
P	15.4	10	N/C	1200(E)	1000	8.3	-
P	21.4	61	37	1564	0	0	0
P	24.4	57	73	1300	5600	14.3	19.6
P	24.4	26	10	1248	0	0	0
P	28.4	16	70	1266 ⌝	6800	31.6	46.7
P	28.4	1	30	1260 ⌟			
P	1.5	6	20	1333	0	0	0
P	1.5	31	35	1310	0	0	0
P	8.5	48	78	1266	0	0	0
P	15.5	56	90	1458	0	0	0
P	15.5	43	50	1461	2100	3.3	6.7
P	19.5	75	88	1387 ⌝	33000	10.2	11.4
P	19.5	88	90	1276 ⌟ L.R. tank)			
P	22.5	20	95	781	0	0	0
P	26.5	40	50	1391 ⌝			
P	26.5	5	20	1400(E))	4300	6.2	12.2
P	26.5	4	93	1653 ⌟ L.R. tank)			
P	17.6	13	36	1600(E)	6000	28.8	80.1
D4	23.6	11	40	1708	0	0	0
D4	10.7	13	28	1426	5000	27.0	96.3
D4	15.7	30	70	1200	0	0	0
D4	15.7	22	80	1511	0	0	0
D4	15.7	101	80	1400(E)	200	0.1	0.2
D4	21.7	53	90	1490	5700	7.2	8.0
D4	21.7	197*	75	1490	1700	0.6	0.8
D4	21.7	71	95	1340	6400	6.7	7.1
D4	21.7	128	65	1081	4000	2.9	4.4
D4	27.7	19	5	1100(E)	0	0	0
D4	27.7	26	65	1100(E)	0	0	0
D4	31.7	13	30	1486	0	0	0
D4	31.7	6	40	1657	0	0	0
D4	31.7	99	95	1643	52900	32.5	34.2
D4	31.7	60	95	1611	11200	11.6	12.2
D4	31.7	54	70	1493	0	0	0
D3	4.8	3	60	1400(E)	0	0	0
D3	4.8	2	45	1400(E)	0	0	0
D4	4.8	9	45	1400(E)	0	0	0
D4	4.8	29	40	1400(E)	0	0	0
D3	7.8	31	60	1494	0	0	0
D4	7.8	42	60	1683	0	0	0
D4	7.8	84	65	1356	0	0	0
D4	7.8	20	15	1736	0	0	0
D4	11.8	15	20	1500(E)	0	0	0
D4	11.8	8	5	1500(E)	0	0	0
D4	11.8	8	15	1500(E)	0	0	0
D4	14.8	127	5	1500(E)	0	0	0
D4	14.8	6	20	1500(E)	0	0	0
D4	18.8	107	20	1500(E)	7100	4.4	22.1
D4	21.8	8	15	1500(E)	500	4.2	27.8
D3	25.8	58	15	1500(E)	0	0	0
D3	25.8	21	10	1500(E)	0	0	0
D4	25.8	3	20	1500(E)	100	2.1	11.1
D3	7.9	66	70	1482	2300	2.4	3.4
D3	14.9	80	80	1696	18500	13.6	17.0
D3	22.9	1	25	1500(E)	0	0	0

* Some eggs of this batch were sent to SSF. Batches stripped on 19.5 and 24.5 were incubated in larval rearing tanks with Nannochloris culture added

TABLE 3

Ardtoe Hatchery Production in 1981, Related to Egg Origin

	Ardtoe	H'ston	SSF	MAFF(hybrids)	Total
wt. eggs (g)	760*	679	553	15	2007
No. of batches	12	10	16	1	39
No. dl larvae	183100	361500	434400	19000	998000
No. d20 larvae	7975	6846	33317	4062	52200
% age of dl	4.35	1.89	7.67	21.37	5.23
Fish transferred to weaning	6442	4861	21835	3436	36574
Survival from d20 to weaning (%)	80.77	71.00	65.54	84.59	70.07
Survival from dl to weaning (%)	3.52	1.34	5.03	18.08	3.66

* Only developing eggs counted since non developing eggs from other sources would have dropped out before transport.

TABLE 4

Consumption of Artemia Nauplii ($x10^6$)

Batch	d1 - 20	d20 - Weaning	Weaning
1/1	31.67	33.35	11.75
2/1	25.60	10.28	7.07
2/2	33.62	62.21	69.00
3/1	52.37	161.67	90.00
3/2	14.72	0.1	0
3/3	20.63	52.75	48.75
4/1	11.82	60.80	43.75
4/2	17.98		
4/3	26.20	114.15	81.24
4/4	16.50	25.82	
5/1	6.68		
5/2		41.29	2.50
5/3	6.18		
5/4	22.32	29.95	18.20
5/5	23.35	37.15	25.70
6/1	14.13	24.70	28.00
6/2	14.19		
6/3	16.75	40.02	311.63
6/4	7.93	66.67	76.23
6/5	13.05		
7/1	19.35		
7/2	16.98		
7/3	3.50		
7/5	3.06	97.27	52.50
7/6	29.37		
7/7	14.24		
7/8	16.46		
7/9	3.97		
8/1	38.25	145.95	
8/2	22.75	70.54	103.02
8/3	33.00	88.66	55.53
8/4	42.75	100.62	52.79
9/1	11.50	22.93	85.97
9/2	13.75	32.53	
9/3	17.72		
10/1	26.41	65.98	
10/3	23.46	23.44	39.29
11/1	62.96	239.37	265.68
	780.17	1648.20	1468.6

Consumption per fish

Up to d20	15,000
Up to Transfer	66,400
Up to Weaning	245,000

Consumption ignoring hybrids

Up to d20	15,900
Up to Transfer	71,600
Up to Weaning	232,300

TABLE 5

Targets for 100,000 Fish at Pre-Weaning Stage

	1980	1981
Target	100,000	100,000
% survival from d20	65	70
Target d20 production	154,000	143,000
% survival d1 - d20	16	5
Target d1 production	963,000	2,860,000
% incubation survival	16	6
Target Egg Production	6,019,000	47,700,000
@ 1300 p g	4,63 kg	36,69 kg
Artemia consumption	100,000 x 84,000	100,000 x 66,400
in nauplii	$8,400 \times 10^6$	$6,640 \times 10^6$
Cyst requirement		
@ 5g per 10^6	42 kg	33.2 kg
@ 10g per 19^6	84 kg	66.4 kg
@ 15g per 10^6	126 kg	99.6 kg