

Feeding

Traditional trout feeds

- Feeding is the most expensive part of trout production. In the past, trout were fed with trash fish and slaughterhouse by-products, offal and wastes. It is a widespread opinion that using the feeds for fattening listed in Table 5 is rather inconvenient and also very polluting both to the rearing tanks/ponds and to the surrounding environment.
- The next period in the development of the trout farming industry was the formulation and use of different types of high protein* feeds. Their feed conversion ratio (FCR*) varied between 2 and 3.

Traditional trout feeds

Traditional trout feeds

For fry		For fattening of 100–250 g fish	
Type of feed	Feed conversion ratio	Type of feed and protein content (%)	Feed conversion ratio
<i>Daphnia</i> sp.	6–7	Pig lung (18%)	7.9
Chironomids	4.2	Trash fish (16–21%)	4.6–4.9
<i>Tubifex</i> sp.	4.1	Chicken grinding (15–18%)	6.2–6.7
Cattle spleen	5.6–9.8	Cattle spleen (18–21%)	5–5.1
Pig liver (cooked)	7.9	Pig liver (17–19%)	6.5–6.8
Cooked blood	6.2–9.8	Cooked blood (16–21%)	5.2–9.8

Source: Hoitsy (2002).

Modern trout feeds

- In the modern trout farming industry, the traditional feeds have been definitively replaced with very efficient pelleted dry feeds (0.6–1.1 FCR)
- The next period in the development of the trout farming industry was the formulation and use of different types of high protein* feeds. Their feed conversion ratio (FCR*) varied between 2 and 3.

Modern trout feeds

- There are publications that advocate the use of home-made feeds, which may be feasible only with some reservations. Home-made feeds seem to be a good solution, especially where commercial trout feeds are not readily available. However, the ingredients of home-made feeds should be easily locally available, with continuous supply in the required quantity and quality and at competitive prices. In this case, one of the numerous recipes of formulated trout feeds should be selected and blended.

Modern trout feeds

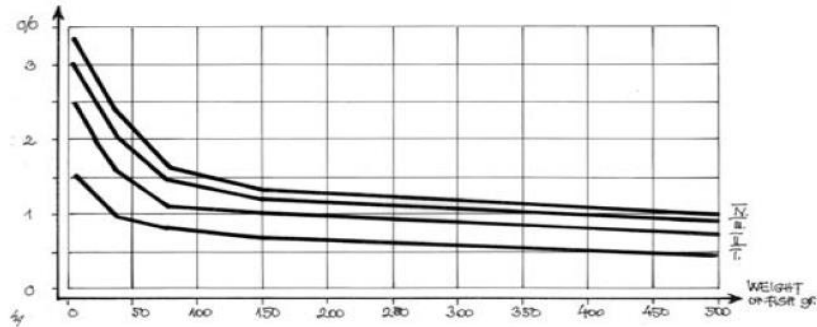
- Extensive experience has proved that purchasing commercial feeds is often the only feasible and profitable option. In evaluating the commercial feeds, the expected FCR and the related price are those characteristics that should be considered at purchase and use.
- It is a general rule that the price of a feed is inversely related to its FCR – the lower the FCR, the higher the price of a feed will be. However, economic calculations may prove that a feed with a lower price but a higher FCR will be more expensive than an expensive feed with an outstandingly low FCR.
- For this reason, many farmers choose high-quality expensive feeds for the first stages, where little feed is used but where the fish are most vulnerable and sensitive.

Modern trout feeds

- Normally, commercial feed manufacturers determine the recommended daily quantities of their feeds. If not, Figures 44 and 45 provide guidance for adjusting the daily rations.
- Daily feed rations should be given in 2–24 equal portions. It is a general rule that the younger fish should be fed more frequently than older ones (Figure 46). The frequency of feeding should also be increased with the temperature of the water. Concerning the size of feed particles, they should be small enough that fish can comfortably grab and swallow them.

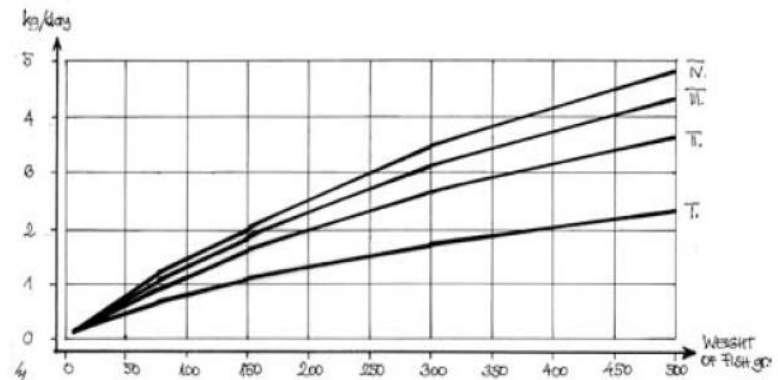
Modern trout feeds

FIGURE 44
Range of relative daily feed rations of trout (percentage)



Note: Water temperature: I. 5 °C, II. 10 °C, III. 15 °C and IV. 20 °C

FIGURE 45
Range of absolute daily feed rations of trout (kilograms per 1 000 fish)



Note: Water temperature: I. 5 °C, II. 10 °C, III. 15 °C and IV. 20 °C

Frequency of feeding and feed size

FIGURE 46

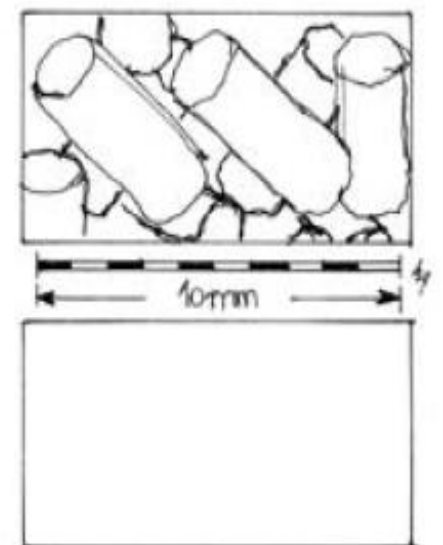
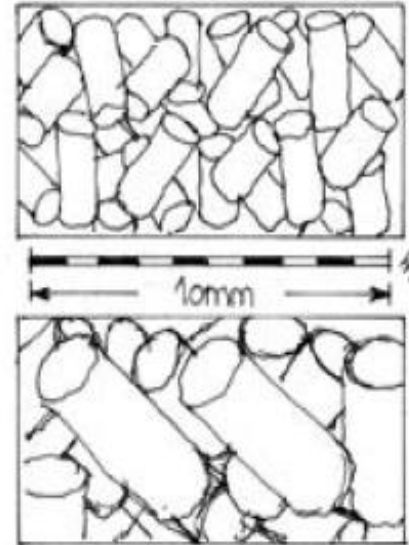
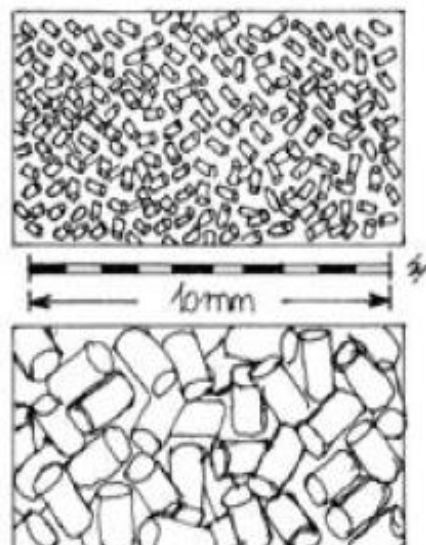
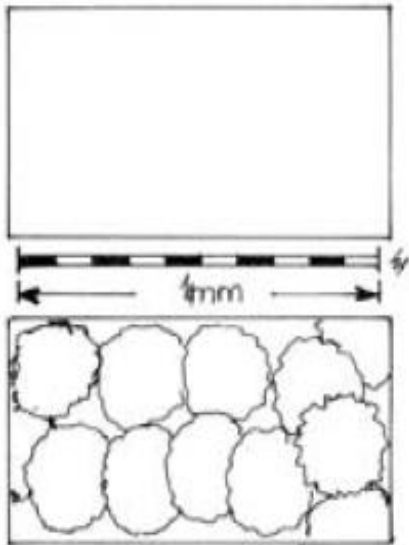
Frequency of feeding and feed size

*Swimming fry**:
24–48 times/day

Fry – Fingerling:
6–8 times/day

Growing fish:
4–6 times/day

Storage of table fish:
3–4 times/day



Practical aspects of feeding and feeds

FIGURE 47

Spoons and hand shovels used for feeding fish

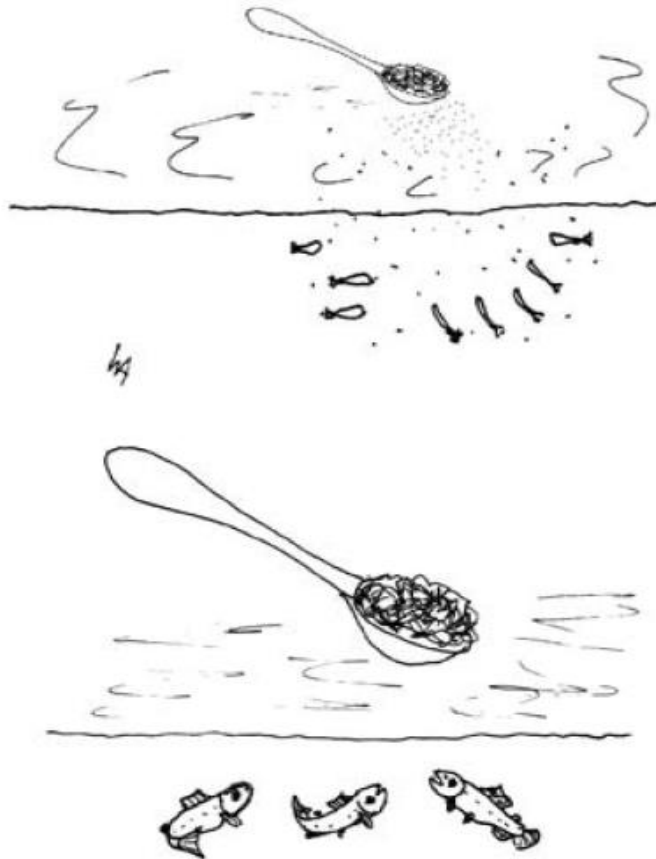
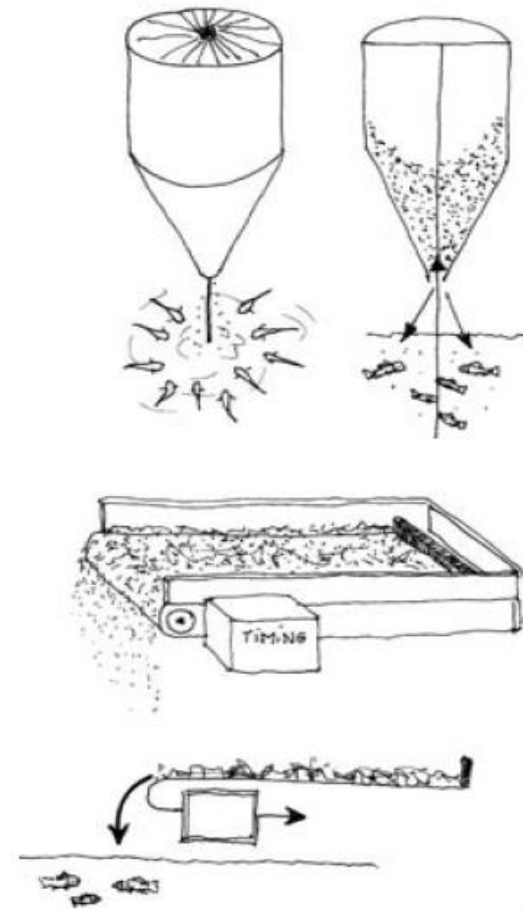


FIGURE 48

Examples of automatic feeders



Water Management

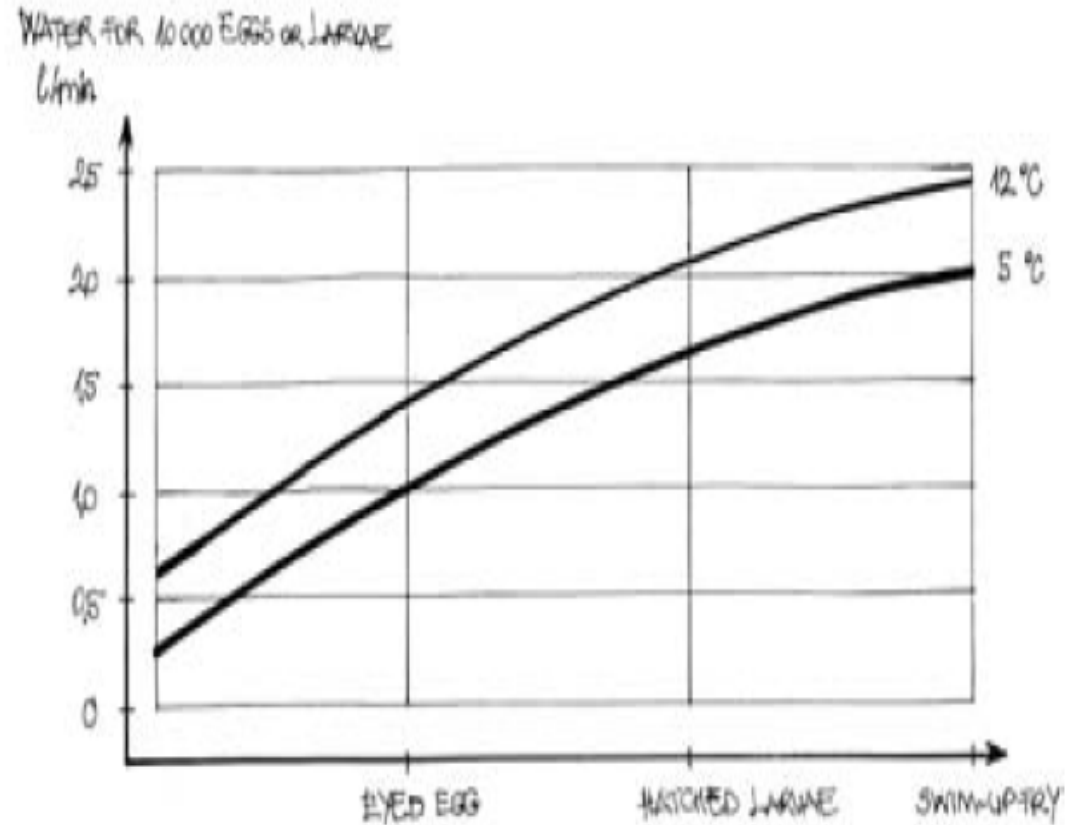
Water quality requirements

DO ₂ :	near saturation.
CO ₂ :	<2.0 ppm.
Temperature:	12-21°C.
pH:	6.5-8.5.
Alkalinity (as CaCO ₃):	10-400 mg/litre.
Manganese:	<0.01 mg/litre.
Iron:	<1.0 mg/litre.
Zinc:	<0.05 mg/litre.
Copper:	<0.006 mg/litre in soft water or <0.3 mg/litre in hard water.

Water supply in tanks required according to development stage

Water supply during incubation of eggs and developing fry

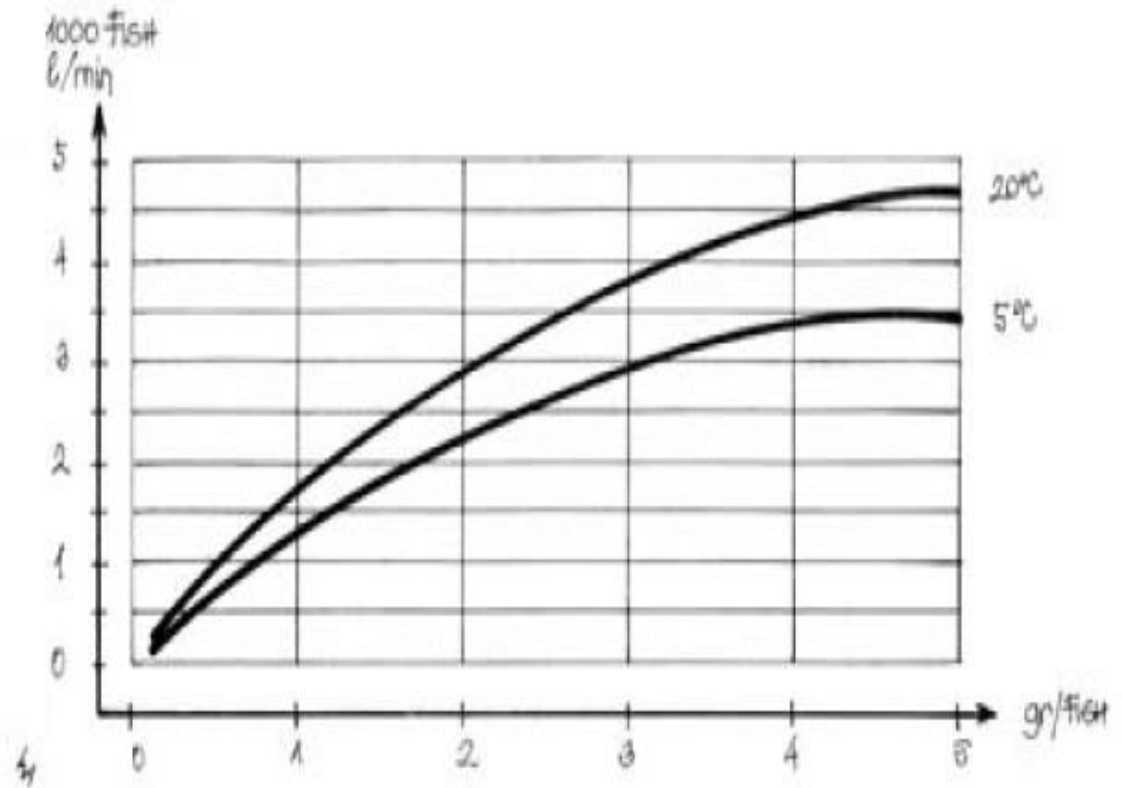
0.25–2.5 litres/min water is needed for incubation of 10 000 eggs and developing fry.



Water supply in tanks required according to development stage

Water supply during fry rearing

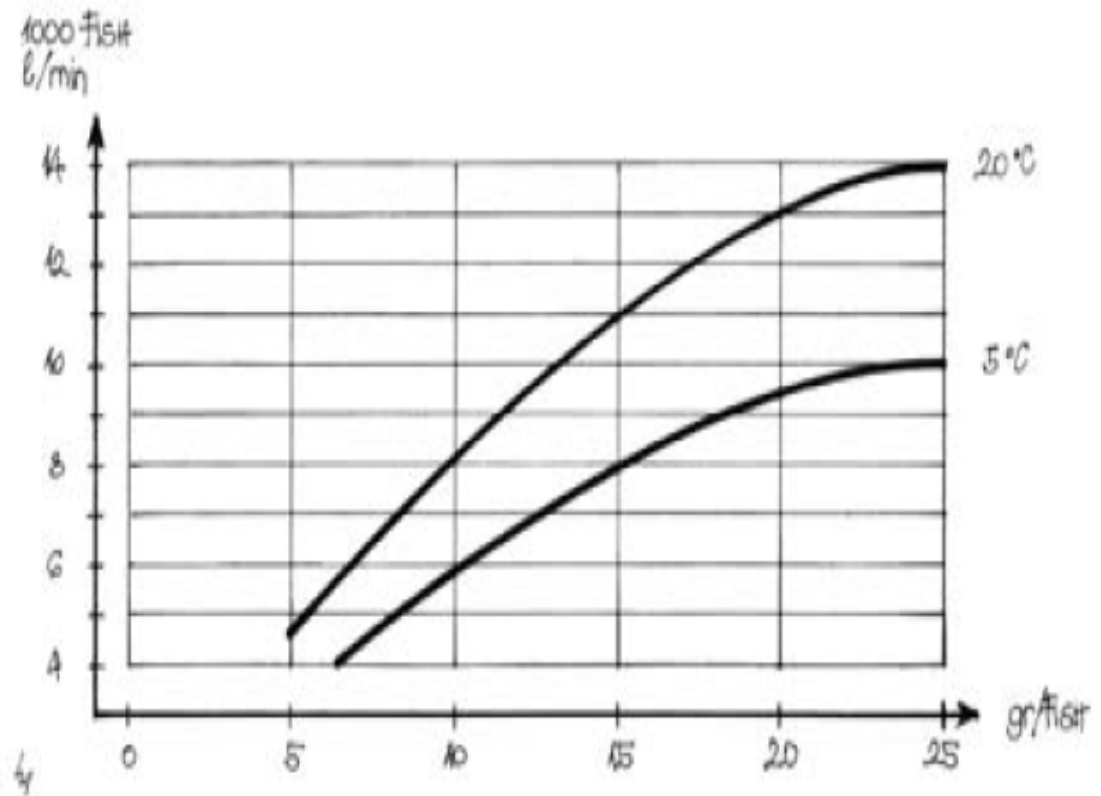
At start, about 0.25 litres/min; at the end, about 3.5–4.5 litres/min water is needed for rearing 1 000 fry.



Water supply in tanks required according to development stage

Water supply during rearing of fingerlings

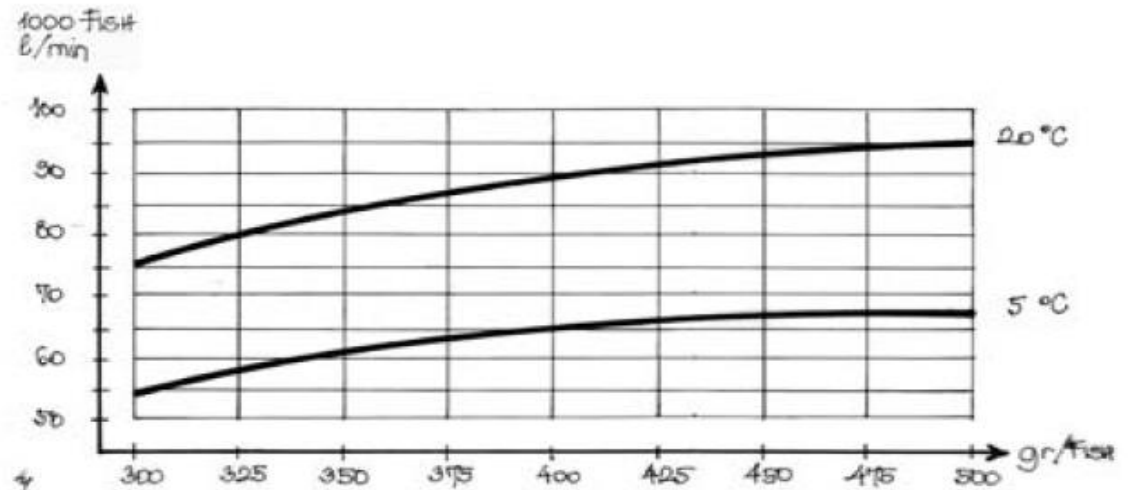
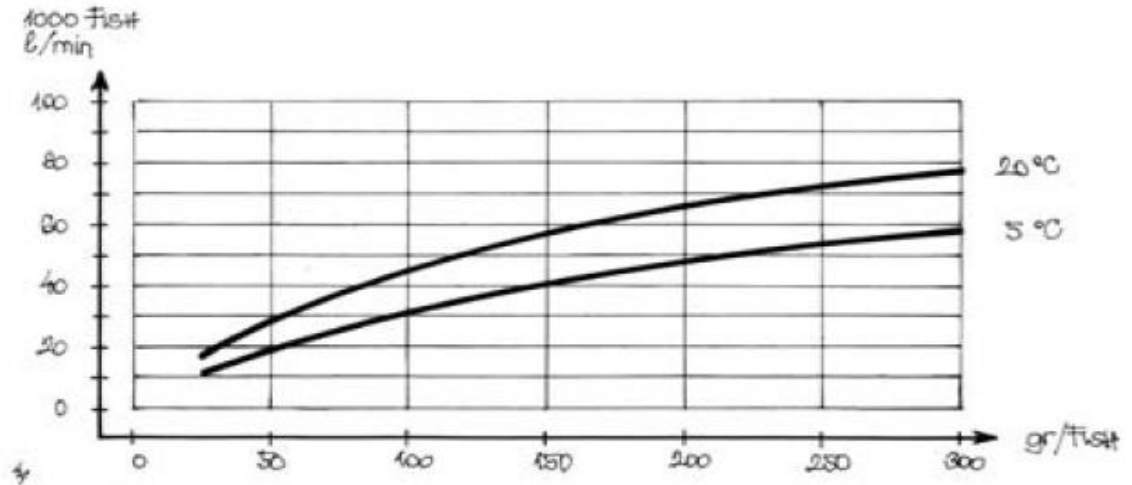
At start, about 3.5–4.5 litres/min;
at the end, about 10–14 litres/min
water is needed for rearing
1 000 fingerlings.



Water supply in tanks required according to development stage

Water supply during rearing of table fish

At start, about 10–14 litres/min;
at the end, about 67–95 litres/min
water is needed for rearing
1 000 table fish.



The Volume of Water for Different Flows

Water flow

litres/second	litres/minute	litres/hour	litres/day
0.02	1	60	1 440
0.03	2	120	2 880
0.05	3	180	4 320
0.07	4	240	5 760
0.08	5	300	7 200
0.10	6	360	8 640
0.12	7	420	10 080
0.13	8	480	11 520
0.15	9	540	12 960
0.17	10	600	14 400
0.18	11	660	15 840
0.20	12	720	17 280
0.22	13	780	18 720
0.23	14	840	20 160
0.25	15	900	21 600
0.27	16	960	23 040
0.28	17	1 020	24 480
0.30	18	1 080	25 920
0.32	19	1 140	27 360
0.33	20	1 200	28 800
0.35	21	1 260	30 240
0.37	22	1 320	31 680
0.38	23	1 380	33 120
0.40	24	1 440	34 560
0.42	25	1 500	36 000
0.43	26	1 560	37 440
0.45	27	1 620	38 880
0.47	28	1 680	40 320
0.48	29	1 740	41 760
0.50	30	1 800	43 200
0.52	31	1 860	44 640
0.53	32	1 920	46 080
0.55	33	1 980	47 520
0.57	34	2 040	48 960
0.58	35	2 100	50 400
0.60	36	2 160	51 840
0.62	37	2 220	53 280
0.63	38	2 280	54 720
0.65	39	2 340	56 160
0.67	40	2 400	57 600
0.68	41	2 460	59 040
0.70	42	2 520	60 480
0.72	43	2 580	61 920
0.73	44	2 640	63 360
0.75	45	2 700	64 800
0.77	46	2 760	66 240
0.78	47	2 820	67 680
0.80	48	2 880	69 120
0.82	49	2 940	70 560
0.83	50	3 000	72 000
0.85	51	3 060	73 440
0.87	52	3 120	74 880
0.88	53	3 180	76 320
0.90	54	3 240	77 760
0.92	55	3 300	79 200

litres/second	litres/minute	litres/hour	litres/day
0.93	56	3 360	80 640
0.95	57	3 420	82 080
0.97	58	3 480	83 520
0.98	59	3 540	84 960
1.00	60	3 600	86 400
1.02	61	3 660	87 840
1.03	62	3 720	89 280
1.05	63	3 780	90 720
1.07	64	3 840	92 160
1.08	65	3 900	93 600
1.10	66	3 960	95 040
1.12	67	4 020	96 480
1.13	68	4 080	97 920
1.15	69	4 140	99 360
1.17	70	4 200	100 800
1.18	71	4 260	102 240
1.20	72	4 320	103 680
1.22	73	4 380	105 120
1.23	74	4 440	106 560
1.25	75	4 500	108 000
1.27	76	4 560	109 440
1.28	77	4 620	110 880
1.30	78	4 680	112 320
1.32	79	4 740	113 760
1.33	80	4 800	115 200
1.35	81	4 860	116 640
1.37	82	4 920	118 080
1.38	83	4 980	119 520
1.40	84	5 040	120 960
1.42	85	5 100	122 400
1.43	86	5 160	123 840
1.45	87	5 220	125 280
1.47	88	5 280	126 720
1.48	89	5 340	128 160
1.50	90	5 400	129 600
1.52	91	5 460	131 040
1.53	92	5 520	132 480
1.55	93	5 580	133 920
1.57	94	5 640	135 360
1.58	95	5 700	136 800
1.60	96	5 760	138 240
1.62	97	5 820	139 680
1.63	98	5 880	141 120
1.65	99	5 940	142 560
1.67	100	6 000	144 000
3.33	200	12 000	288 000
5.00	300	18 000	432 000
6.67	400	24 000	576 000
8.33	500	30 000	720 000
10.00	600	36 000	864 000
11.67	700	42 000	1 008 000
13.33	800	48 000	1 152 000
15.00	900	54 000	1 296 000
16.67	1 000	60 000	1 440 000