Condition Factor, K, for Salmonid Fish

Charles Barnham PSM & Alan Baxter

March 1998
FN0005
ISSN 1440-2254

Anglers frequently refer to fish they have caught as being in poor, good or excellent condition. This qualitative measure is usually based on a visual assessment of the fish, taking into account the general shape of the fish, its length and weight, and its appearance (which usually equates to how "fat" the fish is) compared to memories of previous catches - "this fish is in good condition and is better/worse than the one I caught yesterday'". Is this a fact, or a guess?

Brown trout, *Salmo trutta*, rainbow trout, *Oncorhynchus mykiss* and chinook salmon, *O. tshawytscha* are commonly subjected to this judgement. Improving the condition of these fish and their populations is an integral part of the Department's management objectives for fisheries where populations are totally or largely managed by stocking with hatchery-produced fish.

In 1902, Fulton proposed the use of a mathematical formula that would quantify the condition of fish:

$$\mathbf{K} = \frac{10^{N} W}{L^{3}}$$

where:

K is the Condition Factor or Coefficient of Condition; often simply referred to as the "K factor".

W is the weight of the fish in grams (g).

L is the length of the fish in millimetres (mm). In the case of salmonids, length is measured from the tip of the snout to the rear edge of the fork at the centre of the tail fin; known as length to caudal fork (LCF). The cube of the length is used because growth in weight of salmonids is proportional to growth in volume.

N = 5; having weighed and measured thousands of salmonids from Victorian waters, the value of N used by the Department for determining **K** is set at this figure to bring the value of **K** close to unity. For salmonids, **K** values usually fall in the range 0.8 to 2.0.

The value of **K** is influenced by age of fish, sex, season, stage of maturation, fullness of gut, type of food consumed, amount of fat reserve and degree of muscular development. In some fish species, the gonads may weigh up to 15% or more of total body weight. With females, the **K** value will decrease rapidly when the eggs are shed.

The **K** value can be used to assist in determining the stocking rate of trout in a particular water. If the **K** value reaches an unacceptably low level in a water which is totally or partly dependent on stocking, the stocking rate can be reduced accordingly until the K value improves and reaches an acceptable level.

Amongst its operational requirements and responsibilities, the Department is required to develop and maintain particular standards. On the basis of comparison of the **K** value with general appearance, fat content, etc, the following standards have been adopted by the Department for trout and salmon:

K value	Comments
1.60	**Excellent** condition, trophy class fish.
1.40	A **good**, well proportioned fish.
1.20	A **fair** fish, acceptable to many anglers.
1.00	A **poor** fish, long and thin.
0.80	**Extremely poor** fish, resembling a barracouta; big head and narrow, thin body.

The "**K** Chart" later in this **NOTE** indicates the relationship between salmonid length and weight. It can be used within the limitations of the scales on the chart to assess the approximate **K** value of salmonid fish and compare the value with the Department's standard above. Examples of the range of **K** values are also illustrated.

How to calculate K

As an example, take two trout, both 500 mm long, one fish weighing 1,000 g, the other 2,000 g.

Trout 1:

$$\mathbf{K} = \frac{10^{5} \times 1\,000}{(500)^{3}}$$

K of Trout 1 is 0.8, a very poor specimen.

Trout 2:

$$\mathbf{K} = \frac{10^{5} \times 2\,000}{(500)^{3}}$$

K of Trout 2 is 1.6, an excellent specimen.

Summary

The Condition Factor **K** allows the Department to compare quantitatively the condition of individual fish within a population, individual fish from different populations, and two or more populations from different localities.

K may also be used as an index of the productivity of a water.

The **K** value is greatly influenced by the stage of development of the reproductive organs. Therefore, when comparing **K** values, it is important to sample the individuals or populations at the same time of the year so that the individuals or populations are at the same stage of the reproductive cycle.

Victoria
The Place To Be

K Factor Calculation Chart

Length (mm)

Weight (g)	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
100	1.25	0.88															0.00
125	1.56	1.10	0.80														Extremely Poor-Poor
150	1.88	1.32	0.96														0.00
175	2.19	1.54	1.12	0.84													Fair - Good
200		1.76	1.28	0.96													0.00
225		1.98	1.44	1.08	0.83												Excellent-Exceptional
250		2.19	1.60	1.20	0.93												
275			1.76	1.32	1.02	0.80											
300			1.92	1.44	1.11	0.87											
325			2.08	1.56	1.20	0.95											
350				1.68	1.30	1.02	0.82										
375				1.80	1.39	1.09	0.87										
400				1.92	1.48	1.17	0.93										
425				2.04	1.57	1.24	0.99	0.80									
450				2.16	1.67	1.31	1.05	0.85									
475					1.76	1.38	1.11	0.90									
500					1.85	1.46	1.17	0.95	0.78								
600					2.22	1.75	1.40	1.14	0.94	0.78							
700						2.04	1.63	1.33	1.09	0.91							
800							1.87	1.52	1.25	1.04	0.88						
900							2.10	1.71	1.41	1.17	0.99	0.84					
1000								1.90	1.56	1.30	1.10	0.93	0.80				
1 100								2.10	1.72	1.43	1.21	1.03	0.88				
1 200									1.88	1.56	1.32	1.12	0.96	0.83			
1 300									2.03	1.69	1.43	1.21	1.04	0.89			
1 400										1.82	1.54	1.31	1.12	0.97	0.84		
1 500										1.95	1.65	1.40	1.20	1.04	0.90		
1 600										2.08	1.76	1.49	1.28	1.11	0.96	0.84	
1 700											1.87	1.59	1.36	1.17	1.02	0.89	
1 800											1.98	1.68	1.44	1.24	1.08	0.95	0.83
1 900											2.09	1.77	1.52	1.31	1.14	0.99	0.88
2 000												1.87	1.6	1.38	1.20	1.05	0.93
2 100												1.96	1.68	1.45	1.26	1.10	0.97
2 200												2.05	1.76	1.52	1.32	1.16	1.02
2 300													1.84	1.59	1.38	1.21	1.06
2 400													1.92	1.66	1.44	1.26	1.11
2 500													2.00	1.73	1.50	1.32	1.16
2 600													2.08	1.80	1.56	1.37	1.20
2 700														1.87	1.62	1.42	1.25
2 800														1.93	1.68	1.47	1.30
2 900														2.00	1.74	1.53	1.34
3 000														2.07	1.80	1.58	1.39
3 100															1.86	1.63	1.44
3 200															1.92	1.68	1.48
3 300															1.98	1.74	1.53
3 400															2.04	1.79	1.57
3 500																1.84	1.62
3 600																1.89	1.67
3 700																1.95	1.71
3 800																2.00	1.76
3 900																2.05	1.81
4 000																	1.85
4 100																	1.90
4 200																	1.94
4 300																	1.99
4 400																	2.04
4 500																	2.08

EXTREMELY POOR

Species:	Brown trout	**Length:**	505 mm
Sex:	Female	**Weight:**	1 000 g
Gonad stage:	Ripe	**K Factor:**	**0.78**
Comment:	Fish is long and thin with very little flesh.		

FAIR

Species:	Brown trout	**Length:**	400 mm
Sex:	Female	**Weight:**	760 g
Gonad stage:	Mature	**K Factor:**	**1.19**

EXCELLENT

Species:	Brown trout	**Length:**	545 mm
Sex:	Female	**Weight:**	2 680 g
Gonad stage:	Ripe	**K Factor:**	**1.66**

POOR

Species:	Brown trout	**Length:**	435 mm
Sex:	Female	**Weight:**	700 g
Gonad stage:	Ripe	**K Factor:**	**0.95**
Comment:	This fish is also long and thin.		

GOOD

Species:	Brown trout	**Length:**	400 mm
Sex:	Female	**Weight:**	870 g
Gonad stage:	Mature	**K Factor:**	**1.36**

EXCEPTIONAL

Species:	Brown trout	**Length:**	510 mm
Sex:	Female	**Weight:**	2 680 g
Gonad stage:	Ripe	**K Factor:**	**2.02**

Reference

Fulton, T. (1902) Rate of growth of seas fishes. Sci. Invest. Fish. Div. Scot. Rept. 20.

Concept and Design: © Charles Barnham
Photographs: © Alan Baxter
Image scanning: John Elliott

FN005.DOC