

LIST OF SYMBOLS

Section

A. Symbols used in formulas for fish stock assessment

A	attrition rate	11.5
a	swept area (effective path swept by a trawl)	13.5
ASP	available sum of peaks (ELEFAN)	3.5
b	constant in length-weight relationship $W = q \cdot L^b$	2.6
B	biomass	8.6
B _v	virgin (unexploited) biomass	8.3, 9.1
B/R	biomass per recruit	8.2
C	catch in numbers (VPA)	5.0
C(t, ∞)	cumulated catch (from age t to maximum age)	4.4
C	amplitude (0-1) (ELEFAN)	3.5
C ₀	fixed costs of a sampling programme	7.2
CPUA	catch per unit of area	13.6
CPUE	catch per unit of effort	4.3, 9.0, 9.5
D	number of natural deaths (VPA)	5.0
D50%	deselection, length at which 50% is <i>not</i> caught	6.2
dL	interval size of length	2.1
E	fishing effort	7.4
E	exploitation rate (F/Z)	8.4
ESP	explained sum of peaks (ELEFAN)	3.5
f	fishing effort	4.3
F	fishing mortality coefficient or instantaneous rate (per time unit)	4.2
F _m	maximum fishing mortality	6.6
F-array	array of F-at-age, fishing pattern	5.1
F-factor	multiplication factor of F (Thompson and Bell), X	8.6
G	natural mortality factor in Pope's cohort analysis	5.2
H	natural mortality factor in Jones' length-based cohort analysis	5.3
I	separation index	3.5
K	curvature parameter	3.1
KO	index of metabolic rate	3.4
L	length	general
L1-L2	length class	general
L1,L2	from length L1 to length L2	general
L _∞ or L [∞]	L infinity, asymptotic length (mean length of very old fish)	3.1
L'	some length for which all fish of that length and larger are under full exploitation (lower limit of corresponding length interval)	4.5
\bar{L}_c	average length of the entire catch	4.5
L _c or L50%	length at which 50% of the fish is retained by the gear and 50% escape	4.5
L75% or L75	length at which 75% of the fish is retained in the gear	6.1
L _m	optimum length for being caught	6.2
m	= K/Z	8.4
M	natural mortality coefficient or instantaneous rate of natural mortality or natural mortality rate (per time unit)	4.1, 4.7
MSE	Maximum Sustainable Economic Yield	8.7
MSY	Maximum Sustainable Yield	1.1, 4.5, 8.2, 9.1-9.7, 13.7

N	number of survivors (VPA)	4.1, 5.0
N(t)	number of survivors of a cohort attaining age t	4.1
$\underline{N}(\text{Tr})$	number of recruits to the fishery	4.1
\bar{N}	average numbers of survivors of a cohort	4.2
ϕ'	(phi prime), $\ln K + 2 \cdot \ln L_{\infty}$	3.4
q	condition factor, constant in length-weight relationship	2.6, 3.1
q	catchability coefficient	4.3, 4.6, 9.2
R	recruitment, number of recruits, N(Tr)	4.1
S	survival rate	4.2
SF	selection factor	6.1
S_L or S(L)	logistic curve (length-based gear selectivity)	6.1
S_t or S(t)	logistic curve (age-based gear selectivity)	6.4
S1 and S2	constants in the formula for the length-based logistic curve	6.1
SR	reversed logistic curve	6.2
S/R	stock recruitment relationship	12.0
t	time (usually in years)	general
t'	some age for which all fish of that age and older are under full exploitation	4.5
\bar{t}	mean age of all fish of age t' and older	4.5
T	ambient temperature in °C	4.7
Tc	age-at-first-capture (start of exploited phase)	4.1
Tm	longevity (maximum age)	4.7
Tm50%	age of massive maturation (50% of population mature)	4.7
t_0	t-zero, initial condition parameter (in years)	3.1
Tr	age-at-recruitment to the fishery	4.1
ts	summerpoint (0-1) (ELEFAN)	3.5
tw	winterpoint (0-1) (ELEFAN)	3.5
t50%	age at which 50% of the fish is retained in the gear (Thompson and Bell)	6.4
T1 and T2	constants in the formula for the age-based logistic curve	6.4
U	$1 - L_c / L_{\infty}$	8.4
\bar{v}	average price (Thompson and Bell)	8.6
V	value (Thompson and Bell)	8.6
VPA	Virtual Population Analysis	5.0
w	weight (usually of one specimen)	general
W_{∞} or W^{∞}	weight infinity, asymptotic weight (W infinity, mean weight of very old fish)	3.1
X	multiplication factor of F (Thompson and Bell)	8.6
y	year (usually as an index)	8.6
Y	yield (catch in weight)	8.2, 8.6
Y/R	yield per recruit (Beverton and Holt)	8.2
(Y/R)'	relative yield per recruit (Beverton and Holt)	8.4
Z	total mortality coefficient, instantaneous rate of total mortality or total mortality rate (per time unit)	4.2

B: Mathematical notation (general)

*	multiplication sign
/	division sign
ln	natural logarithm (base $e = 2.7182818$)
log	10 based logarithm
$\exp(x)$ or e^x	exponential function, $\exp(x) = e^x$
$\sum_{i=1}^{i=n} x(i)$	sum of all values of $X(i)$, for i from 1 to n ; the sum $X(1)+X(2)+\dots+X(n)$
$\sqrt{\quad}$ or $\sqrt{\quad}$	square root
∞	infinity
Δx	delta x , a small increment of the variable x
$\text{MAX}\{X(j)\}_j$	maximum value among the elements in the set $\{X(j)\} = \{X(1),X(2),\dots,X(j),\dots\}$
\bar{x}	mean value of x
$x(i,j)$	i,j indices of x (usually printed as $x_{i,j}$)
π	pi = 3.14159
$a < b$	a smaller than b
$a > b$	a greater than b
$a \geq b$	a greater than or equal to b
tanh	hyperbolic tangent

C. Statistical notation

$y = a + b \cdot x$	linear regression
a	intercept of ordinary regression
a'	intercept of functional regression
b	slope of ordinary regression
b'	slope of functional regression
ϵ	(epsilon) maximum relative error
f	degrees of freedom
F	observed frequency
F_c	calculated or theoretical frequency
n	number of observation
r	correlation coefficient
s/\sqrt{n}	standard error
s	standard deviation
s^2	variance
s_a	standard deviation of the intercept (a)
s_a^2	variance of the intercept (a)
s_b	standard deviation of the slope (b)
s_b^2	variance of the slope (b)
s_x	standard deviation of the independent variable (x)
s_x^2	variance of the independent variable (x)
s_{xy}	covariance
s/\bar{x}	relative standard deviation or coefficient of variation
s_y	standard deviation of the dependent variable (y)
s_y^2	variance deviation of the dependent variable (y)
t_f	quantil of t distribution (Student's) for f degrees of freedom
x	independent variable
\bar{x}	mean value of x
y	dependent variable