NAFO Sci. Coun Studies, 37: 93–110

TABLE 1: AVAILABLE DATA

COMMON NAME:	COD	**SPECIES:**	*Gadus morhua, L.*
AREA:	BALTIC SEA	**STOCK:**	EASTERN BALTIC COD (ICES SD 25-32)
CREATED BY:	GERD KRAUS JONNA TOMKIEWICZ 2000-09-27	**UPDATED BY:**	JONNA TOMKIEWICZ CORDULA SCHMITZ 2003-04-09

Data status									
Year	**Stock size**	**Stock composition**	**Age**	**Sex ratio**	**Maturity**	**Fecundity**	**Weight**	**Condition**	**Additional data**
2001	√	√	√	(√)	(√)	(√)	√	(√)	(√)
2000	√	√	√	(√)	(√)	√	√	(√)	(√)
1999	√	√	√	√	√	√	√	(√)	√
1998	√	√	√	√	√	√	√	(√)	√
1997	√	√	√	√	√		√	(√)	
1996	√	√	√	√	√	√	√	(√)	√
1995	√	√	√	√	√	√	√	(√)	√
1994	√	√	√	√	√	√	√	(√)	√
1993	√	√	√	√	√	√	√	(√)	√
1992	√	√	√	√	√	√	√	(√)	√
1991	√	√	√	√	√	√	√	(√)	√
1990	√	√	√	√	√	√	√	(√)	√
1989	√	√	√	√	√	√	√	(√)	√
1988	√	√	√	√	√	√	√	(√)	√
1987	√	√	√	√	√	√	√		√
1986	√	√	√	√	√		√		√
1985	√	√	√	√	√		√		√
1984	√	√	√	√	√	√	√		
1983	√	√	√	√	√	√	√		√
1982	√	√	√	√	√		√		
1981	√	√	√				√		
1980	√	√	√				√		
1979	√	√	√				√		
1978	√	√	√			√	√		√
1977	√	√	√	(√)	(√)	√	√		√
1976	√	√	√	(√)	(√)	√	√		√

Data status									
Year	**Stock size**	**Stock composition**	**Age**	**Sex ratio**	**Maturity**	**Fecundity**	**Weight**	**Condition**	**Additional data**
1975	√	√	√	(√)	(√)		√		
1974	√	√	√	(√)	(√)		√		
1973	√	√	√	(√)	(√)		√		
1972	√	√	√	(√)	(√)		√		
1971	√	√	√	(√)	(√)		√		
1970	√	√	√	(√)	(√)		√		
1969	√	√	√	(√)	(√)		√		
1968	√	√	√	(√)	(√)	√	√		
1967	√	√	√	(√)	(√)		√		
1966	√	√	√				√		
1965									
1964									
1963									
1962						(√)			
1961						(√)			
1960						(√)			

TABLE 2: DATA BASIS, FORMAT AND QUALITY

COMMON NAME: COD

AREA: BALTIC SEA

STOCK: EASTERN BALTIC COD (ICES SD 25-32)

REPRODUCTIVE STRATEGY: DETERMINATE BATCH SPAWNER **REF. NO.:** 84

TIMING OF SPAWNING: MARCH-SEPTEMBER **REF. NO.:** 12,13,58,59

OPTIMAL TIME FOR MATURITY SAMPLING: FEBRUARY-MARCH **REF. NO.:** 8,12,13,58,59

Data basis, format and quality

Variables	Year range	Data basis (A/L/W)	Data origin	Sampling frequency	Notes on data, methods and contents	Ref. No.
Stock size	1966-2001	Age-based (2-8+)	VPA	Yearly	SD25-32 combined, based on commercial landings and survey abundance indices	1
	1974-2001	Age-based (0-8+)	MSVPA	Quarterly	SD25-32, SD disaggregated commercial quarterly landings and surveys Q1	2
	1982-2001	Age-based (1-10+)	Surveys	M 2-3	Baltic International Trawl Survey (BITS): SD 25, 26, 27 and 28	1,2,3,4
	1999-2001	Age-based (1-10+)	Surveys	M10-11	Baltic International Trawl Survey (BITS): SD 25, 26, 27 and 28	1,3
Stock composition	1966-2001	A (2-8+)	VPA	Y	SD25-32	1
	1974-2001	A (0-8+)	MSVPA	Q	SD25-32, combined or SD disaggregated	2
	1982-2001	A (1-10+)	Surveys	M2-3, M10-11	SD 25, 26 ,27, 28	1,3
Age determination	1966-2001	L,W,A	CL	Q	National laboratories: SD 25-32, harbour sampling	1,2,5
	1994-2001	L,W,A	CL	Q	National laboratories: SD 25-32, at sea sampling	1,2,5
	1996-2001	L,W,A	CC	M	National laboratories: SD 25-28 - discard sampling	1,5
	1982-2001	L,W,A	Surveys	M2-3, M10-11	National laboratories: BIT Survey SD 25-28	1,3,5

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
Sex ratio	1965-1990	A	CC	2-3 Y intervals	SD26 -first quarter, unsuited for SRP	7, 9
	1967-1977	A,L	??		SD 25, average over 6-7 years, incl. L50 and A50	6, 9
	1980-1999	A	Surveys	M1-3	SD 25-28 and SD disaggregated, average over 5 year periods, yearly after 1990	8,1,2,9, 10
	2000-2001	A	Surveys	M2-3	Data exist from BITS, but not published	C1
Maturity:						
A. Ogives (E)	1965-1990	A	CC	2-3 Y intervals	SD26 -first quarter, unsuited for SRP: Macroscopic staging, sex-specific	7, 9
	1967-1977	A,L	??	6-7 years out of 11	SD 25, average over 6-7 years, incl. L50 and A50: Maroscopic staging, sex-specific	6, 9
	1980-1999	A	Surveys (BITS)	M1-3	SD 25,26,27,28 separate and combined, sex specific average over 5 year periods, yearly after 1990, sex specific, macroscopic staging	8,1,2,9, 10
	1988-1997	L	Surveys	M2-3	sex specific, macroscopic staging, coverage largely limited to Swedish waters, incl. L50	11
	2000-2001	A	Surveys (BITS)	M2-3	Data exist from BITS, but not published, sex-specific	C1
B. Skip of spawning	1979-1986	A	??	Y	SD 26, 28, analysis based on visual maturity determination during spawning time	14
C. Spawning probability	1961-1970	A,L	CL, Lab.	M1-12	Histological criteria separating immature and mature females	15
	1998-1999	L	Surveys, lab.	M1-12	Histological validation of macroscopic scale and estimation of spawning probability	12,13
D. Other	1998-1999	L	Surveys	M1-12	Illustrated manual based on a histologically validated macroscopic scale	12

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
Fecundity:						
A. Estimation	1959-1962	L,W	??	(n=116)	SD 26, method not provided	85
	1968	L-,W-relationships	Survey	Y seasonal (n=84)	SD 24, 25, 26, no area differences	16,9
	1976-1978 1983-1984	A-, W-relationships	Survey, commercial	Y seasonal	Potential rel. fecundity eastern Baltic, only relative fecundity useful	17
	1993-1995	L-,W-,A-relationships	Survey, commercial trawl/gillnet	Y seasonal (n=435)	Potential rel. fecundity. SD 22, 24, 25 separated	18,9
	1987-1992 1996	L-,W-relationships	Survey	Y: M3-7 (n=807)	Potential rel. fecundity model (growth+temp). SD 25 and 26 separated by area and partly month	19,9
	1987-1992 1996 1998-2000	L-,W-relationships	survey	Y:M3-7 (n=807 + 199)	Potential rel. fecundity model (prey availability). SD 25 and 26 separated by area and partly month	10
B. First time vs. repeat spawners	1993-1997	L/A	Experiments (EC)	Caugth in spring	Analysis of batch fecundity and total fecundity of recruit-and repeat spawners	20
C. Atresia	2000	L	Survey/lab.	Y: M3-9	Histological analyses and quantification of atresia (SD 25)	21
D. Other						
Weight:						
A. Commercial fisheries data	1966-2001	A (1-10+)	Landings (WECA)	Y	SD 25-32 separated by SD, since 1997 documented by gear and quarter in report	1
	1974-2000	A (0-8+)	Landings (WECA)	Q	SD 25-32 separated by SD and quarter, since 1997 separated by gear	2
	1997-2001	A	Discard	Q	At sea sampling of discard by country, quarter, gear.	1
B. Survey data	1982-2001	A	Survey	M1-3 M10-11	SD 25-28, since 1988 with information on individual fish	1,3
C. Other	1960-1985	L,A	Surveys	M3-4	SD 26 and 28. growth parameters in relation to abundance and food availability	22
	1975-1986	L,A	Surveys	M3-4	SD 26 and 28. Growth and maturation in relation to abundance	15
	1972-1991	L,A	Surveys	M12-1 M3-4	SD 26, 28. Length and weight at age, otolith increments in relation stock size and prey availability	23
	1995-2000	A	Surveys	M2-3	Area, sex and maturation specific differences in weight at age	24

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
Condition:						
A. Fulton	1998-1999	STAGE	Surveys	M11-12 /M2-3/ M6	Relation beween K and maturity stage for females, SD 25	13
	1995-2000	L	Surveys	6-8 X PER YEAR	Mainly SD 25, unpublished data (C1,C3)	24
B. HSI	1998-1999	STAGE	Surveys	M11-12/ M2-3/ M6	Relation beween HSI and maturity stage for females, SD 25	13
	1995-2000	L	Surveys	6-8 X PER YEAR	Mainly SD 25, unpublished data (C1,C3)	24
C. Energy						
D. Other	1998-1999	Stage	Surveys	M11-12/ M2-3/ M6	Relation beween GSI and maturity stage for females, SD 25	13
	1995-2000	L	Surveys	6-8 X PER YEAR	Mainly SD 25, unpublished data (C1,C3)	24
	1987-2001	L/A	CC/CL	Y/Q	Different time series of condition data derived from biological sampling of the fisheries	24
Egg viability:						
A. Egg quality	?	?	?	?	Effect of egg size on egg survival	25
	?	?	?	?	Changes in egg size over the spawning season	26
	1958-1978		Surveys	Sp. season	Relationship between egg diameter and density	87
	1990		Experiment (EW)	M5+M6	Egg bouyancy in relation to egg size for different females	27
	1990-1993		Experiments (EC)	M5+M6	Egg boyancy in relation to egg size and batch number	28
	1992-1994		Experiments (EW)	Caught during pre-spawning.	Fatty acid composition, cleavage pattern in and hatching success	91
	1994-1997		Experiment (EC)		Comparison of egg size viability and survival after hatch between Skagerak and Eastern Baltic cod	29
	1993-1997	A	Experiment (EW)	Caught during pre-sp.	SD 25-28, modelled age- and batch-specific egg production, buoyancy, size	20
	1999-2000	A,L,W	Experiments (EC)	Caught during pre-spawning	Relationship between egg size and maternal condition.	24

Data basis, format and quality

Variables	Year range	Data basis (A/L/W)	Data origin	Sampling frequency	Notes on data, methods and contents	Ref. No.
B. Fertilisation success	1989-1990		Experiments (EW)	M4-6	Effects of salinity on spermatazoa motility, fertilisation success and egg development	30
	1991-1995		Experiments (EW)	Caught during pre-spawning	SD25, 28. Sperm motility in relation to salinity and potential influence on the reproductive potential	31
	1999-2000	A,L,W	Experiments (EC)	Caught during pre-spawning	Effects of paternal characteristics on fertilisation success	24
C. Egg mortality	1986		Surveys	SP. SEASON	SD 25, egg mortality in relation to hydrography	36
	1958-1978		Surveys	SP. SEASON	Dependence of egg instantaneous mortality coefficient on oxygen concentrations (SD25, 28)	87
	1990		Experiments (EW)		Daily mortality of yolk-sac larvae reared at different salinities	32
	1992-1993		Experiments (EW)		Survival of eggs and yolk-sac larvae at low oxygen level at different salinities	33
	1994-1995		Experiments (EW)	M 4,5,7	Neutral bouyancy of cod eggs and survival potential	34
	1991	STAGE SPECIFIC	Surveys		Size and visibility of cod eggs	35
	1991-1992	STAGE SPECIFIC	Experiments (EW)	M4,7 (91) M5,7 (92)	SD25, egg mortality in relation to oxygen and temperature	40 29
	1994-1997		Experiments (EW)	ONCE	Comparison of egg size viability and survival after hatch between SD21 and Sd 25	37
	1996	STAGE SPECIFIC	Surveys		SD 25, mortality of different egg stages	38
	1999-2000		Experiments (EW)		Effects of temperature on egg/larvae development	

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
D. Other	1973		Surveys	M6	Vertical distribution in relation to egg size	39
	1991-1992	STAGE SPECIFIC	Experiments (EW)	M4,7 (91) M5,7(92	SD25, Egg development time in relation to oxygen and temperature	40
	1986-1996		Surveys	M4-7	Model to predict vertical egg distribution and ambient temperature	41
	1996	STAGE SPECIFIC	Experiments (EC)	ONCE	Female and stage specific relation between mal-formation of early egg stages and viable hatch	42
	1996		Experiments (EW)	M6	SD 25, changings in stage-specific criteria	43
Larval viability:						
A. Hatching success	1994-1997		Experiments (EW)		Comparison of egg size viability and survival after hatch between Skagerak and Eastern Baltic cod	29
	1990		Experiments (EW)	Spawning season	Daily mortality of yolk-sac larvae reared at different salinities	32
	1992-1994		Experiments (EW)	Caught during pre-sp.	Fatty acid composition, cleavage pattern in and hatching success	91
	1996		Experiments (EC)		Female and stage specific relation between mal-formation of early egg stages and viable hatch	42
B. Larvae quality	1994-1997		Experiment (EW)		Comparison of egg size viability and survival after hatch between Skagerak and Eastern Baltic cod	29
C. Mortality	1994-1997		Experiments (EW)		Survival of eggs and yolk-sac larvae at low oxygen level at different salinities	33
	1999-2000		Experiments (EW)		Effects of temperature on egg and larval development	38
	1994-1995	A	Surveys	M5-7(94), M5(95)	Hatch checks in otoliths indicate size dependent larvae mortality	44
	1988,1991	STAGE SPECIFIC	Experiments (EW)	M5(88) M8(91)	Deep part of the Bornholm Basin, distribution and abundance of eggs and larvae	45

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
D. Other	1994	L	Surveys	M5-7	Bornholm Basin (SD 25), vertical distribution	46
	1994-1995	A, L	Surveys	M5-7 (94), M5 (95	Bornholm Basin (SD 25) larval condition and distribution	47
	1988, 1991	A,L	Surveys	M5 (88) M8 (91)	SD 25, partly SD 24, larval drift, 1 week intervals	48
	1988,1993	A,L	Survey data, hydrography +meterology databases	M9-10 (93-96)	Drift models investigating advective exchange of larvae between western and eastern Baltic	49
	1979-1994	A	hydrography +meterology databases		Larvae drift modelling to construct a transport index (simulation study)	50
	1986-1999	A	Zooplankton hydrography +meterology databases		Thropho-hydrodynamic model of larval drift, growth and survival	52
	1986-1999	A	juv. surveys, hydrography +meterology databases		Identification of nursery areas by larvae and juvenile drift modelling	53
Spawning time	1953-1955	A,L,W	Surveys	M1-12	Timing of ripening and spawning, sex ratios in relation to maturity stage	54
	1953-1955 1971-1978 1981-1984	L,W	??	M1-12	Changes in gonad weight during the year indicating the reproductive cycle	55
	1972-1995	A	Surveys	M3-6	Spawning stock age, maturity stage and sex composition and distribution	56
	1992-1996	L	Surveys	M2,3,4,5, 7,10,11	SD25. Sex-specific timing of ripening and spawning	58 59
	1995-1997	L	Surveys	5-8 X PER YEAR	SD 25 – sex and size specific ripening and spawning times	60
	1969-1996	STAGE	Surveys	SP.-SEASON	SD 25, based on peak egg abundance	
Contamination	1995	L,W,A	Survey/ experiments	M5	SD 25, maternal burden of organochlorines and viable hatch, larvae survival and growth	51
	1996	L,W,A	Survey/ experiments	Sp. season	Maternal burden of organohlorines and viable hatch, larvae survival and growth	57
	1996	L,W	Surveys	M7	Xenobiotic compounds and related enzyme activety in adults and viable hatch	61
	2000-2001	L, W	Experiments (EW)	Sp. season	Contamination, mixed function oxidase activity and viable hatch	62

Data basis, format and quality						
Variables	**Year range**	**Data basis (A/L/W)**	**Data origin**	**Sampling frequency**	**Notes on data, methods and contents**	**Ref. No.**
Environmental key factors	1897-1976		hydrography databases	D/W/M/Y	Analysis of inflow events and their intensity	63
	1986,1988, 1993,1994		hydrography meteorology databases	D/W/M/Y	Analysis of circulation patterns and their variability	64
	1979-1998		hydrography meteorology databases	D/W/M/Y	Analyses of water storage and sea level inclination in relation to physical forcing	65
	1992-1997		hydrography measure-ments	14 cruises	Reproductive volume (salinity, oxygen and temperature limits) in SD26 and 28	75
	1958-1992		hydrography meteorology databases	D/W/M/Y	sensitivity analysis of driving forces causing long term changes in spawning habitat size	85
Other factors or parameters						

TABLE 3: STUDIES OF REPRODUCTIVE POTENTIAL

COMMON NAME: COD

AREA: BALTIC SEA

STOCK: EASTERN BALTIC COD (ICES SD 25-32)

Estimation of reproductive potential			
Subject	**Brief description**	**Year range**	**Ref. No.**
Potential or realised egg production	Data sets of sex ratios and maturity from commercial catches are together with fecundity estimates used to estimate population egg production and show that sex ratio and maturity are variable - not constant as assumed in assessment	1965-90	7
	Sensitivity analysis of variability in potential egg production caused by different maturity, sex ratio and fecundity data sets. Estimation of hydrographic and spatial influences on the viable larvae production.	1966-96	9
	Female SSB and potential egg production were estimated for different spawning areas and compared with independent time series of realised egg produktion and recruitment considering environmental impact on early life stage survival.	1977-96 1967-96	66 20
	Batch fecundity and total fecundity estimated for recruit and repeat spawners are used to estimate age specific potential egg production and viability in relation to age/size and batch specific egg bouyancy	1976-95	67
	Potential egg production were estimated using female SSB and compared with independent time series of realised egg production.	1976-99	10
	The potential egg production is established using different input data - constant, variable or female only maturity ogives, sex ratios and fecundity and compared to survey derived estimates of realised egg production / recruitment.	1976-96	68
	Validation of potential egg production estimates as a measure of reproductive potential in the stock-recruitment relationship and application in recruitment models.		
Viable egg and larvae production	Influences of hydrographical conditions, fishing mortality, species interaction, spawning time, egg quality and spawning stock age structure on the reproductive success	1966-96	70
Critical life stages	Using Pauliks approach, the effects of environmental factors on individual early history stages are examined and identified. Key factors are incorporated into environmentally sensitive and spatially explicit stock-recruitment models.	1976-96	68

Estimation of reproductive potential			
Subject	**Brief description**	**Year range**	**Ref. No.**
Environmental influences	Regression analysis of the egg survival and potential recruitment in relation to the volume, salinity, temperature and oxygen content of the spawning layer as well as the abundance of large females, SD 26,28.	1954-86	86
	The cod reproductive volume (RV) as the available water volume that sustain egg survival and development in relation to hydrography (SD 25, 26 and 28). A GLM model predicts recruitment as a function of SSB, egg abundance and RV.	1960-92	71
	Impact of environmental variability and spawner abundance and nutritional condition on reproductive success.	1960-86	72
	Recruitment success in dependence of adult stock size and hydrographic conditions.	1968-88	74
	Influence of hydrograhic conditions and spawning stock biomass on stock recruitment.	1969-83	76
	A review of processes affecting survival and growth of eggs and larvae including interannual and temporal variability in SSB, egg abundances, hydrographic conditions, larval transport and zooplankton availability as food for larvae.	1966-96	73
	Distribution of cod in relation to salinity and oxygen during spawning in the Bornholm basin - sex and maturity specific.	1996	77
	Improvement of RV estimates using the Gotland Basin as test area.	1966-96	78
	A review of abiotic, biotic and human influences to explain the dramatic decline in recuitment and abundance of eastern Baltic cod in recent decades.	1966-96	70
	Analysis of the influence of stock structure and evironmental conditions on the recruitment process estimated using a generalised addditive model.	1968-96	79
	Sensitivity analysis of variability in potential egg production caused by different maturity, sex ratio and fecundity data sets. Estimation of hydrographic and spatial influences on the viable larval production.	1966-96	9
	Explaining stock dynamics in relation to fisheries, species interactions (i.e. egg predation and cannibalism) and hydrographic conditions.	1976-2000	80

Estimation of reproductive potential			
Subject	**Brief description**	**Year range**	**Ref. No.**
Stock recruitment relations	Stock-recruitment relationships accounting for hydrographic impact on egg survival and clupeid predation on cod eggs.	1966-92	88
	Non-linear stock-recruitment relationship based on the assumption of multiple steady-state characterised by variable carrying capacity for young cod and density dependent transition between steady-states.	1966-95	89
	Effects of species interactions on biological reference points derived from VPA, MSVPA and modified MSVPA (coupled consumption, growth and food availability).	1977-96	81
	Environmentally sensitive stock-recruitment relationships for two different hydrographic regimes using SSB and recruitment estimates from VPA and MSVPA	1965-94	82
	Changes in growth rate caused by prey variability and impact on biological reference points	1977-96	90
	Spatially dis-aggregated MSVPA developed, establishing separate SSB and recruitment time series for the three spawning areas (SD25, 26 and 28).	1977-96	83
	Area specific data series of potential egg production, RV and recruitment are used to establish environmentally sensitive stock-recruitment relationships and recruitment models.	1976-95	67
	Stock recruitment model based on potential egg production, a survival index based on the reproductive volume and recruitment at age 2.	1976-99	10
	Using Pauliks approach, the effects of environmental factors on individual early history stages are examined and identified. Key factors are incorporated into environmentally sensitive and spatially explicit stock-recruitment models.	1976-96	68
	Potential for improving biological reference points using adequate measure for reproductive potential in stock recruitment relationships - case studies.	1976-96	69
Other studies			

TABLE 4: DATA SOURCES

COMMON NAME:	COD
AREA:	BALTIC SEA
STOCK:	EASTERN BALTIC COD (ICES SD 25-32)

Data sources (literature reference or contact person)
1. ICES 2002. Report of the Baltic Fisheries Assessment Working Group. *ICES CM 2002/ACFM* No. 17.
2. ICES 2003. Report of the Study Group on Multi-species Assessments in the Baltic. *ICES C.M. Doc.*, 2003/H:3
3. ICES 2001. Report of the Baltic International Fish Survey Working Group. *ICES C.M. Doc.*, No. 2001/H:2, 236 p.
4. SPARHOLT, H. and J. TOMKIEWICZ. 2000. A robust method for compiling trawl survey data used in the assessment of Central Baltic cod (*Gadus morhua* L.). *Arch. Fish. Mar. Res.*, **48**(2): 125-151.
5. ICES 1999. Report of the Study Group on Baltic cod age reading. *ICES C.M. Doc.*, 1999/H:4.
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7. KOSIOR, M. and J. SKOLSKI. 1992: Effect of variability in the sex ratio of cod on the population reproductive potential estimates. *ICES C. M. Doc.*, No. J:18.
8. TOMKIEWICZ, J., M. ERICSSON T. BARANOVA, V. FELDMAN and H. MÜLLER. 1997. Maturity ogives and sex ratios for Baltic cod: establishment of a database and time series. *ICES C.M. Doc.*, No. CC:20.
9. MACKENZIE, B. R., J. TOMKIEWICZ F. KÖSTER, and A. NISSLING. 1998. Quantifying and disaggregating the spawner effect: Incorporating stock structure, spatial distribution and female influences into estimates of annual population egg production. *ICES C.M. Doc.*, No. 1998/BB:11.
10. KRAUS, G., J. TOMKIEWICZ, and F. W. KÖSTER. 2002. Variability in egg production of Eastern Baltic cod (*Gadus morhua*) in relation to variable sex ratio, maturity and fecundity. *Can. J. Fish. Aquat. Sci.*, **59**(12): 1908-1920.
11. CARDINALE, M. and J. MODIN. 1999. Changes in the size-at-maturity of Baltic cod (*Gadus morhua* L.) during a period of large variations in stock size and environmental conditions. *Fish. Res.*, **41**: 285-295.
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C1. TOMKIEWICZ, J. Institute for Fisheries Research, Kavalergaarden 6, 2920 Charlottenlund, Denmark (jt@dfu.min.dk).
C2. KRAUS, G., Institute for Marine Sciences, Kiel, Germany (gkraus@ifm.uni-kiel.de).
C3. KÖSTER, F. W. Institute for Fisheries Research, Charlottenlund, 2920 Charlottenlund, Denmark, (fwk@dfu.min.dk).