

TABLE 1: AVAILABLE DATA

COMMON NAME:	ATLANTIC COD	SPECIES:	<i>Gadus morhua</i>
AREA:	NORTHWEST ATLANTIC	STOCK:	SOUTHERN GULF OF ST. LAWRENCE (NAFO DIV. 4T+SUBDIV. 4VN (JANUARY-APRIL))
CREATED BY:	GHISLAIN CHOUINARD/ED TRIPPEL 2001-10-12	UPDATED BY:	

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	✓	✓	✓	(✓)	✓		✓	✓	(✓)
1975	✓	✓	✓	(✓)	✓		✓	✓	(✓)
1974	✓	✓	✓	(✓)	✓		✓	✓	(✓)
1973	✓	✓	✓	(✓)	✓		✓	✓	(✓)

Data status									
Year	Stock size	Stock composition	Age	Sex ratio	Maturity	Fecundity	Weight	Condition	Additional data
1972	√	√	√	(√)	√		√	√	(√)
1971	√	√	√	(√)	√		√	√	(√)
1970	√	√	√		√		√		
1969	√	√	√		√		√		
1968	√	√	√		√		√		
1967	√	√	√		√		√		
1966	√	√	√		√		√		
1965	√	√	√		√		√		
1964	√	√	√		√		√		
1963	√	√	√		√		√		
1962	√	√	√		√		√		
1961	√	√	√		√		√		
1960	√	√	√		√		√		
1959	√	√	√		√		√		
1958	√	√	√		√		√		
1957	√	√	√		√		√		
1956	√	√	√		√	√	√		
1955	√	√	√		√	√	√		
1954	√	√	√				√		
1953	√	√	√				√		
1952	√	√	√				√		
1951	√	√	√				√		
1950	√	√	√				√		

TABLE 2: DATA BASIS, FORMAT AND QUALITY

COMMON NAME:	ATLANTIC COD	
AREA:	NORTHWEST ATLANTIC	
STOCK:	SOUTHERN GULF OF ST. LAWRENCE NAFO DIV. 4T+SUBDIV. 4VN (JANUARY-APRIL)	
REPRODUCTIVE STRATEGY:	DETERMINATE BATCH SPAWNER	REF. NO.: 4,7
TIMING OF SPAWNING:	APRIL-MID JULY	REF. NO.: 4,7,10,11,15,16
OPTIMAL TIME FOR MATURITY SAMPLING:	APRIL-MAY	REF. NO.: 6,10

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	1950-1970	A,L	CL	Q	VPA Estimates	1
	1971-2001	A,L,W	CL,S	Q,Y	VPA Estimates	2,3,17,18
Stock composition	1950-1970	A,L	CL	Q	RV survey (September) Sentinel survey (mobile and longline) - abundance; a number of seasonal surveys/projects	1
	1971-2001	A,L,W	S,CL	M,Q		2,3
	1995-2001		S	Q		2,3
Age determination	1950-1970	A,L	CL	Q		1
	1971-2001	A,L,W	S,CL	Q,Y		2,3,13
Sex ratio	1971-2001	A,L,W	S	Y	Could be extracted from survey data bases	3
Maturity:						
A. Ogives (E)	1955-1956	A,L	S	MAY-SEP	Maturity ogives by sex and description of maturity stages Proportion mature at age for 1955-1977 year classes and ogives by sex over four 5-year periods Maturity ogives by sex (based on Shediac Valley area- 1990-1995). September collected data also exists for all years (1971-2001) for the entire stock region but considered inappropriate by DFO Maturity WG. Difficulty distinguishing resting from immature (see 6).	4
	1955-1977	A	S	SEPT		5
	1971-2001	A,L	S	JULY		6, 2, 14
B. Skip of spawning						
C. Spawning probability						

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						
Fecundity:						
A. Estimation	1955-1956	A,L	EW	MAY-SEP	size range 50-140 cm (n=43). Oocytes sorted using entomological mesh size #70). Gilson's fluid preserved and dried (Simpson 1951).	4,12
	1980	A,L,W	EW	MAY-JUN	size range 49-102 cm (n=30). Gilson's fluid preserved followed by whirling blender. Equations also integrate data by Powles (1958)	7
	1999-2000	A,L,W	EW		Samples collected and in process of being analysed	8
B. First time vs. repeat spawners						
C. Atresia						
D. Other	1980-1981	A,L,W	S	MAY-JUN	Gonadosomatic indices per female (n=30)	7
	1991-1993	W	S	M	Seasonal changes in dry gonad weight	10
	1991-1999	A,L,W	S	M	Seasonal changes in gonadosomatic indices for each year. 130 fish/month (5 fish /cm in 30-60 cm range)	9
Weight:						
A. Commercial fisheries data	1950-2001	A,L	CL	Q		1,2,3
B. Survey data	1971-2001	A,L,W	S	Y	Estimated means	2,3
C. Other	1961-1969	A,L,W	S	Y		3
	1985-1989	A,L,W	S	Q		
	1990-1995	A,L,W	S	Y		
Condition:						
A. Fulton	1971-2001	A,L,W	S	Y		1,3,10
	1991-2001	A,L,W	EW	Q,M		
B. HSI	1991-1993	W	S	SEP-JUN	Minimum and maximum HSI values by sex	10
	1991-1993	W	S	M	Seasonal changes in dry liver weight by sex	10
	1991-2001	A,L,W	EW	Q,M	HSI vs. length and wt; 130 fish/month; 5 fish/cm (30-60 cm)	9,3
C. Energy						

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	1971-1999	L, W	S	SEPT	Weight at 45 cm and 55 cm	2
	1991-1993	W	S	M	Seasonal changes in carcass dry weight; trends in organ weights discussed in relation bioenergetics, feeding and temperature (small 40-51 cm and large (51-60 cm) fish reviewed	10
Egg viability:						
A. Egg quality						
B. Fertilisation success						
C. Egg mortality						
D. Other						
Larval viability:						
A. Hatching success						
B. Larvae quality						
C. Mortality						
D. Other						
Spawning time	1955-1956	L, W	S	MAY-SEP	Gonadal stages of development give evidence of spawning time	4
	1982-1991		S	JUN-AUG	Pelagic egg and larval surveys; dedicated to mackerel but gives evidence of cod spawning	11
	1991-1993	L, W	S	M	Monthly sampling of organ weights indicates spawning period	10
	1985-1989 1991-2001	A, L, W A, L, W	S EW	M M	Seasonal; surveys data available from GSI	3,15,16
Contamination						
Environmental key factors						
Other factors or parameters						

TABLE 3: STUDIES OF REPRODUCTIVE POTENTIAL

COMMON NAME:	ATLANTIC COD
AREA:	NORTHWEST ATLANTIC
STOCK:	SOUTHERN GULF OF ST. LAWRENCE (NAFO DIV. 4T+SUBDIV.4VN (JANUARY-APRIL))

Estimation of reproductive potential			
Subject	Brief description	Year range	Ref. No.
Potential or realised egg production	Fecundity estimates of wild fish during period of fast growth	1955-1956	4
	Fecundity estimates of wild fish during period of slow growth	1980	7
Viable egg and larvae production			
Critical life stages			
Environmental influences	Examination of relationships between environmental indicators and index of survival	1971-2000	17,19
Stock recruitment relations	Spawning stock biomass (limited by maturity data) vs recruitment	1950-1977	20
	Stock-recruitment relationships	1971-1995	21,22
Other studies	General paper on spawning characteristics	1971-2000	23

TABLE 4: DATA SOURCES

COMMON NAME:	ATLANTIC COD
AREA:	NORTHWEST ATLANTIC
STOCK:	SOUTHERN GULF OF ST. LAWRENCE (NAFO DIV. 4T+SUBDIV. 4VN (JANUARY-APRIL))

Data sources (literature reference or contact person)	
1.	MAGUIRE, J. J., D. LEVER, and L. WAITE. 1983. Assessment of cod in NAFO Division 4T and subdivision 4Vn (Jan-Apr) for 1983. <i>CAFSAC Res. Doc.</i> , No. 83/51, 38 p.
2.	CHOUINARD, G. A., L. CURRIE, and G. POIRIER. 2001. Assessment of cod in the Southern Gulf of St. Lawrence, February 2001. <i>CSAS Res. Doc.</i> , No. 2001/020.
3.	G. A. CHOUINARD. Fisheries and Oceans Canada, Gulf Fisheries Centre, P. O. Box 5030, Moncton, N. B., E1C 9B6, (chouinardg@dfo-mpo.gc.ca).
4.	POWLES, P.M. 1958. Studies of reproduction and feeding of Atlantic cod (<i>Gadus callarias</i> L.) in the southwestern Gulf of St. Lawrence. <i>J. Fish. Res. Board Can.</i> , 15 : 1383-1402.
5.	BEACHAM, T. D. 1983. Growth and maturity of Atlantic cod (<i>Gadus morhua</i>) in the Southern Gulf of St. Lawrence. <i>Can. Tech. Rep. Fish. Aquat. Sci.</i> , No. 1142.
6.	TRIPPEL, E.A., M.J. MORGAN, A. FRECHET, C. ROLLET, A. SINCLAIR, C. ANNAND, D. BEANLANDS, and L. BROWN. 1997. Changes in age and length at sexual maturity of northwest Atlantic cod, haddock and pollock stocks, 1972-1995. <i>Can. Tech. Rept. Fish. Aquat. Sci.</i> , No. 2157.
7.	BUZETA, M. I., and K.G. WAIWOOD. 1982. Fecundity of Atlantic cod (<i>Gadus morhua</i>) in the southwestern Gulf of St. Lawrence. <i>Can. Tech. Rep. Fish. Aquat. Sci.</i> , No. 1110.
8.	TARA JEWETT (M.Sc. student), Department of Biology, Dalhousie University, Halifax, Nova Scotia
9.	CHOUINARD, G.A., L. CURRIE, and G. POIRIER. 2001. Assessment of cod in the Southern Gulf of St. Lawrence, February 2001. <i>CSAS Res. Doc.</i> , No. 2001/020.
10.	SCHWALME, K., and G. A. CHOUINARD. 1999. Seasonal dynamics, organ weights, and reproductive maturation of Atlantic cod (<i>Gadus morhua</i>) in the southern Gulf of St. Lawrence. <i>ICES J. Mar. Sci.</i> , 56 : 303-319.
11.	CASTONGUAY, M., Y. DE LAFONTAINE, and J.A. RUNGE. 1998. Annual and spatial variability in zooplankton biomass and species composition, and in eggs and larvae of mackerel and cod in the southern Gulf of St. Lawrence between 1982 and 1991. <i>Can. Data Rep. Fish. Aquat. Sci.</i> , 1035 : v+86.
13.	CURRIE, L.G., and A.F. SINCLAIR. 1996. Catch-at-age for southern Gulf of St. Lawrence cod: 1971 to 1995. <i>Can. Manusc. Rep. Fish. Aquat. Sci.</i> , 2389 : 83.
14.	SINCLAIR, A.F., G.A. CHOUINARD, and L.G. CURRIE. 1998. Assessment of cod in the southern Gulf of St. Lawrence, January 1998. <i>CSAS Res. Doc.</i> , No. 98/08, 61 p.
15.	LETT, P.F. 1980. A comparative study of the recruitment mechanisms of cod and mackerel, their interaction and its implication for dual stock assessment. <i>Can. Tech. Rep. Fish. Aquat. Sci.</i> , 988 : 51.

Data sources (literature reference or contact person)	
17.	CHOIUNARD, G.A., and A. FRECHET. 1994. Fluctuations in the cod stocks of the Gulf of St. Lawrence. <i>ICES Mar Sci. Symp.</i> , 198 : 121-139.
18.	CHOUINARD, G.A., B. PARENT, K. ROBICHAUD-LEBLANC, and D. DAIGLE. 1999. Results of the sentinel surveys for cod conducted in the southern Gulf of St. Lawrence in 1994-1998. <i>CSAS Res. Doc.</i> , No.99/24, 56 p.
19.	SWAIN, D.P., and A.F. SINCLAIR. 2000. Pelagic fishes and the cod recruitment dilemma in the Northwest Atlantic. <i>Can. J. Fish. Aquat. Sci.</i> , 57 : 1321-1325.
20.	CHOUINARD, G.A., L. CURRIE, A. SINCLAIR, G. POIRER, and D. SWAIN. 2000. Assessment of cod in the southern Gulf of St. Lawrence, February 2000. <i>CSAS Res. Doc.</i> , No. 2000/19.
21.	CHOUINARD, G.A., A. SINCLAIR, L. CURRIE, G. POIRIER, and D. SWAIN. 1999. Assessment of cod in the southern Gulf of St. Lawrence. <i>CSAS Res. Doc.</i> , No.99/23.
22.	SINCLAIR, A. F. 1997. Biological reference points relevant to a precautionary approach to fisheries management: an example of southern Gulf of St. Lawrence cod. <i>NAFO SCR Doc.</i> , No. 77, 16 p.
23.	SWAIN, D. P., and G. A. CHOUINARD. 2000. Spawning stock characteristics and cod recruitment success in the southern Gulf of St. Lawrence. <i>CSAS Res. Doc.</i> No. 2000/148, 16 p.