A. WITCH FLOUNDER ADVISORY REPORT

State of stock: The witch flounder stock was not overfished, but overfishing was occurring in 2002 (Figure A5). Fully recruited fishing mortality in 2002 was 0.41 (exploitation rate = 31%) nearly double F_{MSY} = 0.23 (Figure A1). The fishing mortality rate declined 63% between 1996 and 2002 and 46% relative to the 1995-2002 average. Spawning stock biomass was estimated to be 18,300 mt in 2002, 72% of SSB_{MSY} (25,200 mt; Figures A2 and A5). Spawning stock biomass has increased by a factor of 4 from a record low level of 3,800 mt in 1995 and is the highest in the VPA time series. However, the current spawning stock biomass is dominated by the youngest mature age classes 5 to 7 (Figure A9), which are also the main component in the recent years' landings (Figure A10).

Management Advice: Fishing mortality should be reduced to F_{MSY} or below. The stock is expected to exceed the biomass target, even if status quo fishing mortality continues. Reducing fishing mortality will rebuild age structure of spawners and maintain biomass near the target.

Forecast for 2003-2005: Fishing at the status quo F (0.41) or at the target F(0.23) in 2003-2005 is expected to allow biomass to increase above SSB_{MSY} and initiate rebuilding of the age structure. However, based on retrospective analysis, the projections of SSB may be optimistic.

Forecast Table: SSB estimated to be 18,300 mt in 2002. Initial 2003 stock sizes for ages 3-11+ are from the calibrated VPA. Average 1999-2002 partial recruitment, average 1999-2002 mean weights at age, and a maturation ogive representing 1999-2003 maturities were used in projections. Forecast medians (50% probability level); weights reported in '000 mt.

2003				2004			2005		
Landings	Disc.	SSB	F	Landings	Disc.	SSB	Landings	Disc.	SSB
$F_{2003} = F_{2002} = 0.41$									
6.254	0.251	26.677	$F_{SQ} = 0.41$	8.652	0.191	32.121	10.474	0.132	33.733
			$F_{MSY} = 0.23$	5.174	0.109	32.705	6.992	0.076	37.600
			$75\%F_{MSY} = 0.17$	3.908	0.081	32.902	5.480	0.057	39.080
$landings_{2003} = landings_{2002}$ (F = 0.199)									
3.186	0.121	27.241	$F_{MSY} = 0.23$	5.781	0.111	35.389	7.519	0.077	40.160
			$75\% F_{MSY}=0.17$	4.366	0.083	35.613	5.899	0.058	41.753

Catch and Status Table (weights in '000 mt, recruitment in millions): Witch flounder

									1982-2002		
Year	1995	1996	1997	1998	1999	2000	2001	2002	Max	Min	Mean
USA Comm Landings	2.21	2.09	1.77	1.85	2.12	2.44	3.02	3.19	6.66	1.47	3.17
Total Discards	0.19	0.25	0.30	0.28	0.21	0.12	0.22	0.28	0.42	0.02	0.18
Shrimp Fishery Discards	0.03	0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	0.33	>.01	0.16
Large Mesh OT Fishery Discards	0.16	0.24	0.28	0.27	0.20	0.11	0.22	0.28	1.63	0.01	0.16
Catch used in Assessment	2.40	2.34	2.07	2.13	2.33	2.55	3.24	3.47	6.67	1.65	3.34
Spawning stock biomass[1]	3.92	3.83	4.05	5.16	6.59	8.87	12.31	18.30	18.30	3.83	8.58
Recruitment (Age 3)	12.67	15.88	20.23	29.66	42.90	67.65	58.70	29.60	67.65	3.00	19.6
Fully recruited F (ages 8-9,u)	0.63	1.13	1.09	0.65	0.51	0.55	0.76	0.41	1.13	0.23	0.56
Exploitation Rate	44%	64%	62%	45%	37%	40%	50%	31%	64%	19%	40%

[1] At beginning of spawning season, March 1.

Stock Identification and Distribution: A single stock of witch flounder is considered to inhabit the region from the northern Gulf of Maine to southwestern Georges Bank. The stock may extend to the south and into deeper slope waters. Distribution in Gulf of Maine is contiguous with the Scotian Shelf; however, for this assessment, only witch flounder in U.S. waters were assessed.

Catches: U.S. landings increased during the 1960s from 1,200 mt to about 3,000 mt, then fluctuated between 2,000 and 3,000 mt until the early 1980s. In the mid 1980s landings abruptly increased, peaking at nearly 7,000 mt in 1984. Landings declined to 1,467 mt in 1990 and have since fluctuated between 2,000 and 3,186 mt (Figure A1). Landings in 2002 were 3,200 mt. Discards have ranged from 25 mt in 1986 to over 400 mt in 1994. Over the 1982-2002 time period, estimated discards have represented between 0.5% and 14.5% by weight (2% and 45% by number) of the total U.S. commercial catch. Recreational catches are negligible.

Data and Assessment: An analytical assessment (VPA) of U.S. commercial catch (landings plus discards from the shrimp and large mesh otter trawl fisheries) at age data was conducted, and an alternative assessment using a statistical catch at age model was evaluated (Figure A8). Information on recruitment and abundance was taken from standardized NEFSC spring and autumn survey catch-per-tow at age data. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 2002 was evaluated (Figures A6 and A7).

Biological Reference Points: NEFSC (2002) re-estimated the biological reference points for witch flounder based on results from the 1999 assessment using yield and SSB per recruit analyses and the arithmetic mean VPA age 3 recruitment. These reference points were updated in the current assessment using updated mean weights, maturity, fishery selectivity at age, and average recruitment consistent with those recommended by the Biological Reference Point Review workshop. The yield and SSB per recruit analyses indicate $F_{40\%} = 0.23$ (Figure A4), MSY = 4,375 mt, and $SSB_{MSY} = 25{,}240$ mt (Figure A5) with an assumed M = 0.15.

Fishing Mortality: Fishing mortality (ages 8-9, unweighted) increased from 0.26 (21% exploitation) in 1982 to 0.68 (46% exploitation) in 1985, declined to 0.23 (19% exploitation) in 1992, increased to 1.13 (64% exploitation) in 1996, then declined to 0.41 (31% exploitation) in 2002 (Figure A1). The 80% confidence interval for 2002 F is 0.31- 0.56 (Figure A6).

Discards of witch flounder are a relatively minor component of total catch (8% by weight in 2002) but account for 60% of fishing mortality on ages 1 through 5, which was less than F=0.03. The shrimp fishery accounts for 2% of the fishing mortality on these age groups, while the large-mesh otter trawl fishery accounts for 58% of the fishing mortality.

Recruitment: Long-term arithmetic mean recruitment (age 3 fish) is 19.6 million fish. The 1995-1999 year classes appear to be above average, and the 1997 year class is the largest in the VPA time series (Figure A3).

Spawning Stock Biomass: SSB declined from 16,900 mt in 1982 to about 3,800 mt in 1996 (Figures A2 and A3) but has increased to 18,300 mt in 2002 primarily due to recent above average recruitment. The 80% confidence interval for the 2002 SSB is 15,600 – 23,000 mt (Figure A7).

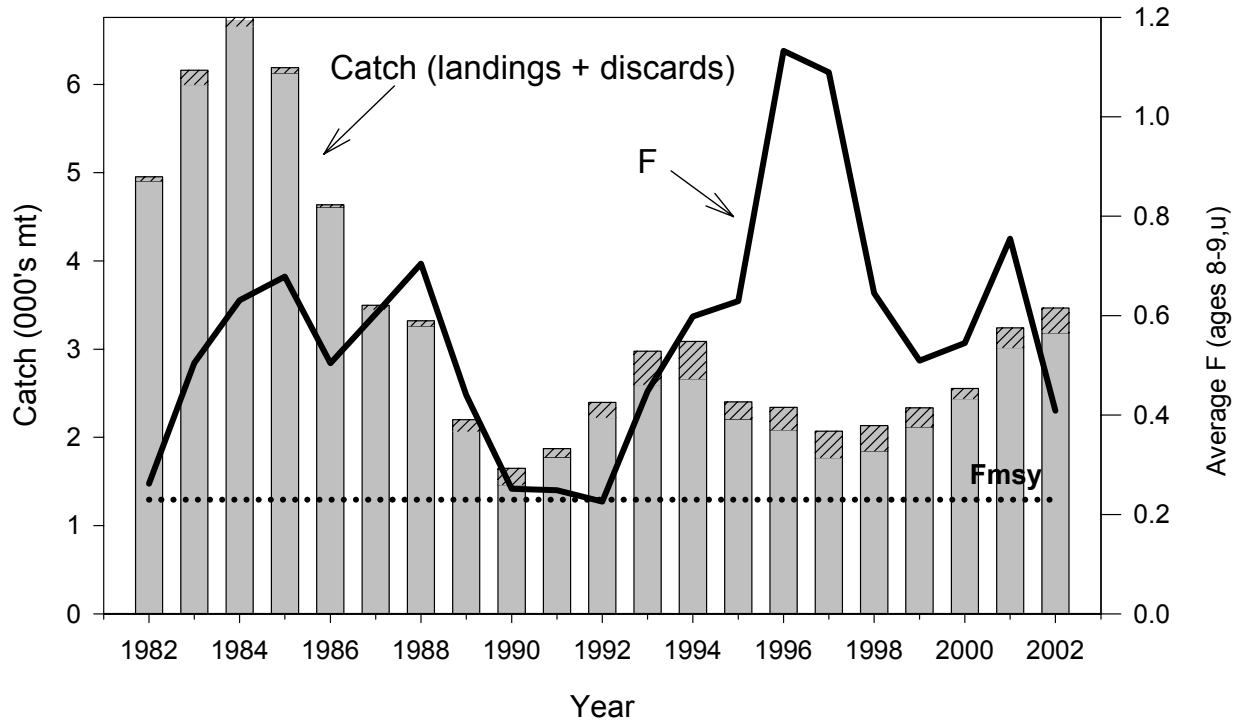
Special Comments: The SARC used new data to update fishing mortality and spawning biomass reference point values. The value of the F_{MSY} proxy ($F_{40\%MSP}$) increased from 0.17 to 0.23. The higher value is due to the combined effects of increases in the number of explicit ages in the SSB-per-recruit analyses, and updated mean weights, maturity at age, and partial recruitment values. Of these factors, changes in fishery selectivity (partial recruitment), likely due to increases in the minimum mesh size, had the greatest overall impact on the F reference point. Increases in the estimated SSB_{MSY} from 19,900 mt to 25,200 mt are primarily due to the inclusion of the 1997 and 1998 year classes. The recent above average year classes may be poorly determined, and based on the retrospective pattern for recruitment, may be overestimated.

An alternative statistical catch-at-age analysis was conducted. As a comparison to the accepted VPA model, F_{2002} = 0.48 (VPA F_{2002} = 0.41), SSB_{2002} = 10,500 mt (VPA SSB_{2002} = 18,300 mt) (Figure A8).

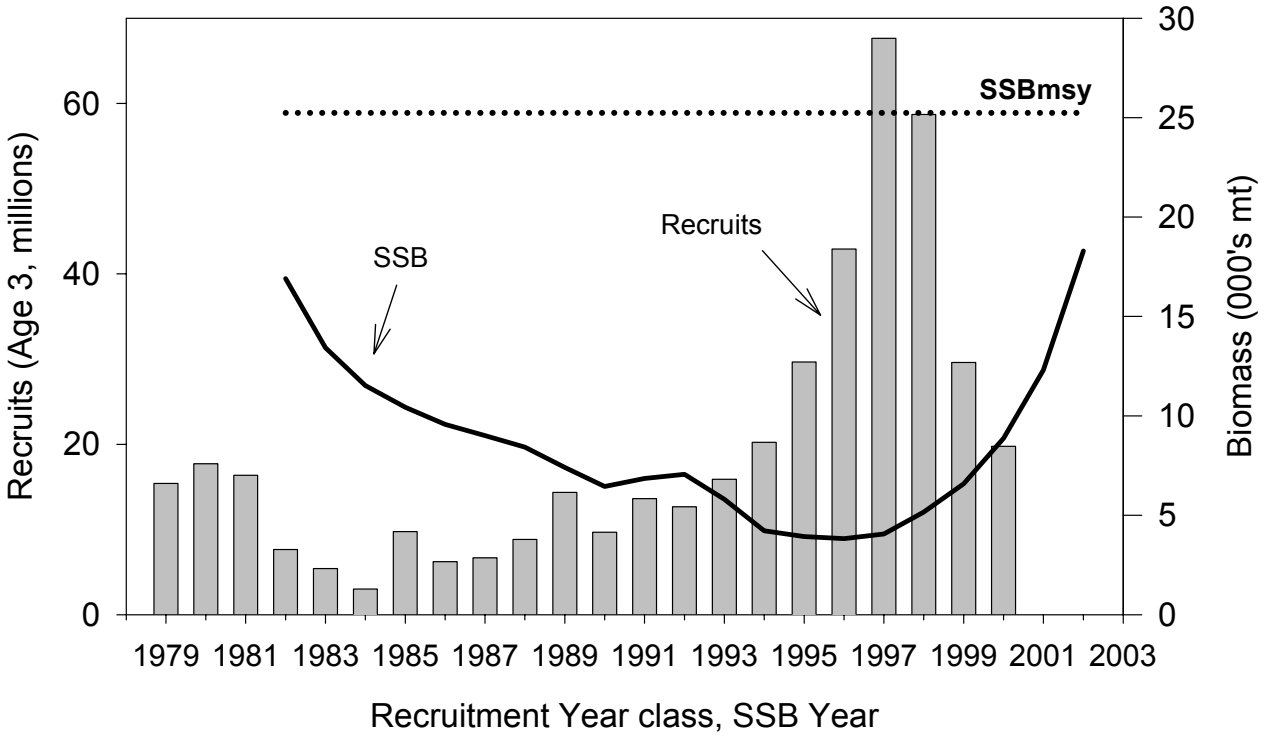
In 2002, 71% of the spawning stock biomass was comprised of young witch flounder (ages 5 to 7); at equilibrium, fishing at F_{MSY}, these age groups would comprise 29% of the spawning stock biomass (Figure A9).

Source of Information: Report of the 37th Stock Assessment Workshop/Consensus Summary of Assessments, NEFSC CRD 03-16, and Assessment of the Gulf of Maine and Georges Bank Witch flounder stock for 2003; Northeast Fisheries Science Center, NEFSC CRD 03-14. 2002. Final Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish. NEFSC Ref. Doc. 02-04 123 p.

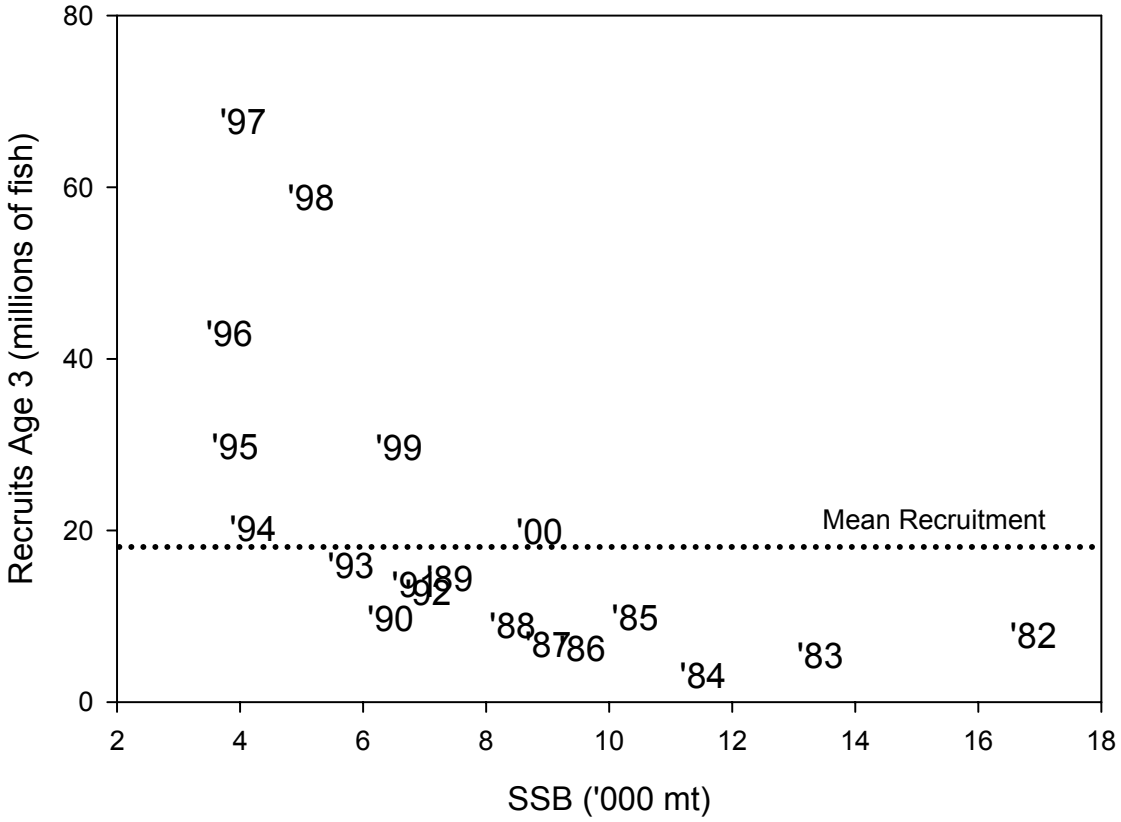
A.1. Trends in total catch and fishing mortality for witch flounder



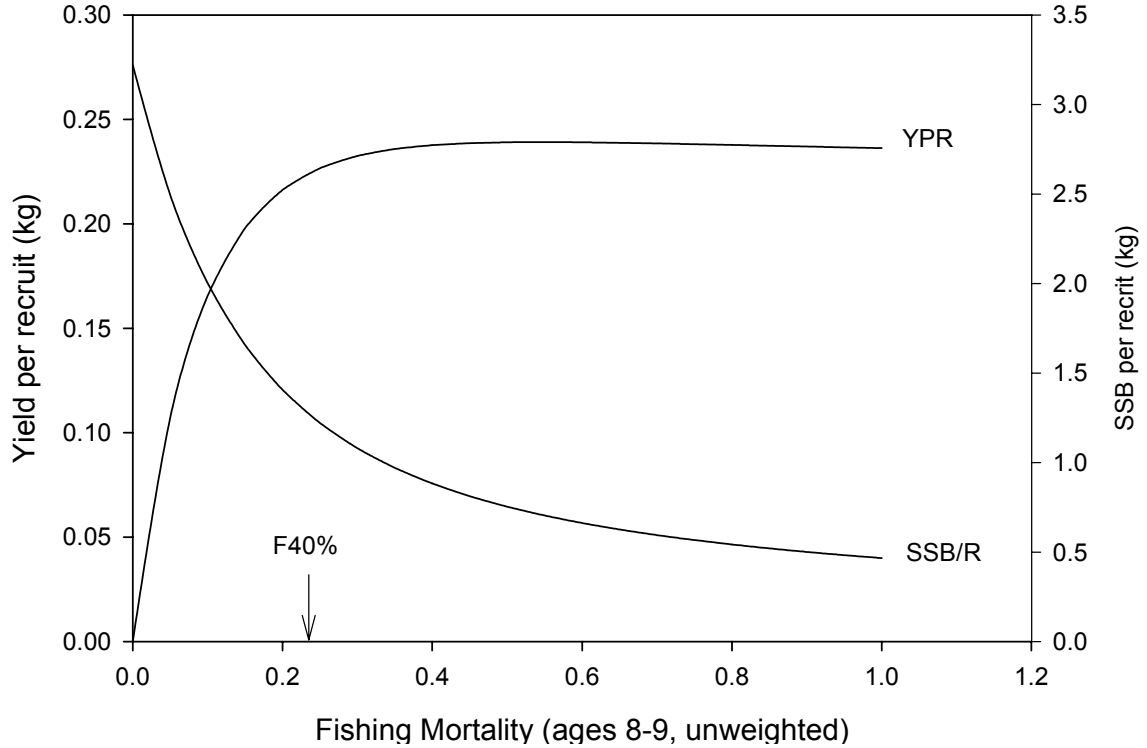
A.2. Trends in SSB and recruitment (Age 3) for witch flounder



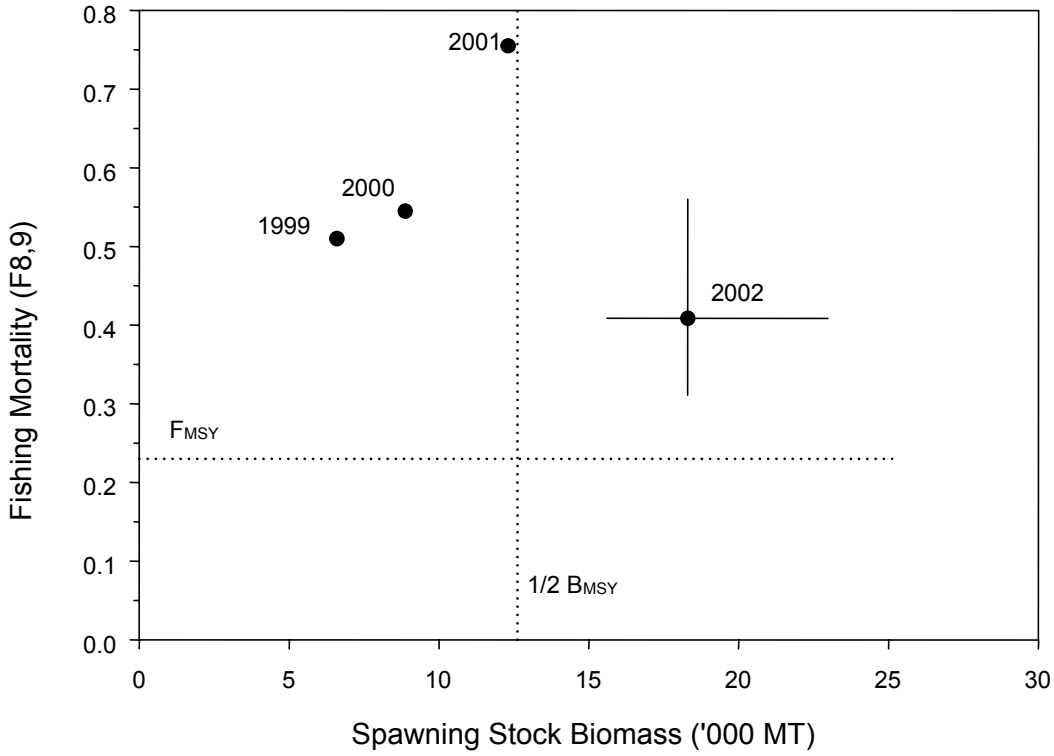
A.3. Spawning stock biomass and recruits (Age 3) for witch flounder



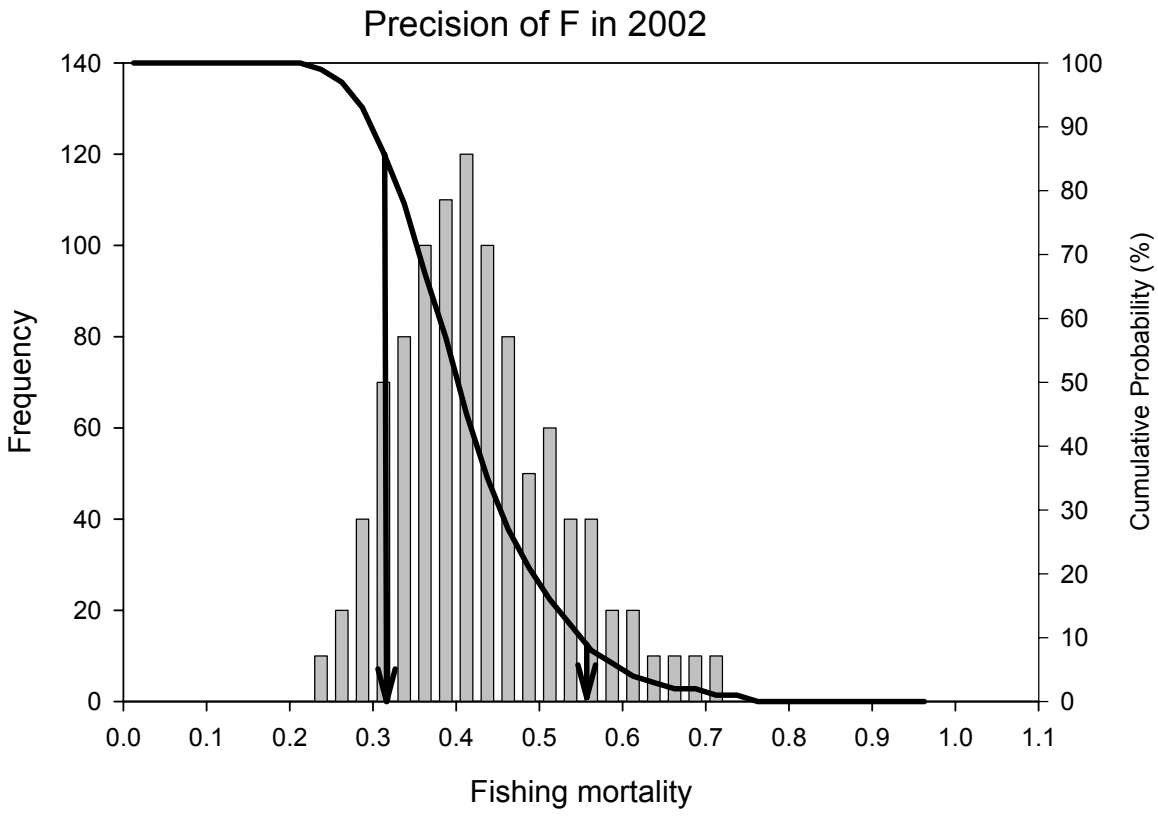
A.4. Yield and SSB per Recruit for witch flounder



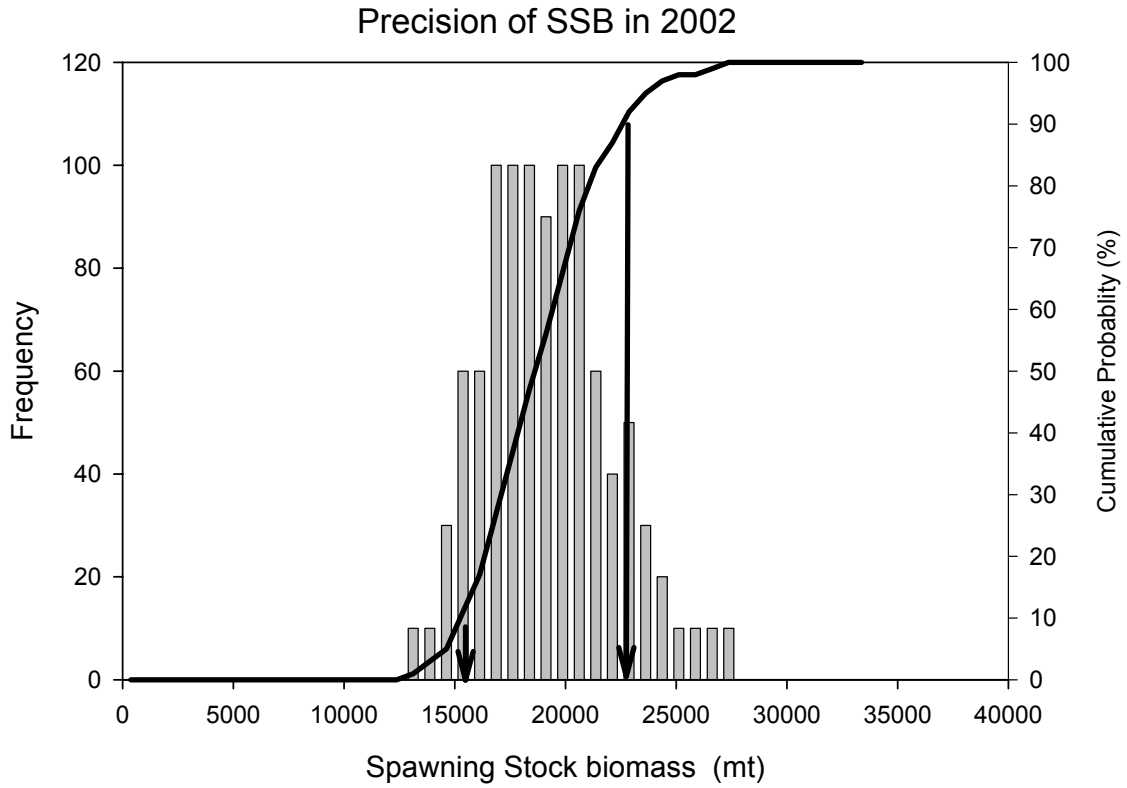
A.5. SFA Reference Points, and recent status determinations (with 80% CI indicated for 2002) for witch flounder



A.6. Precision of 2002 estimate of F for witch flounder

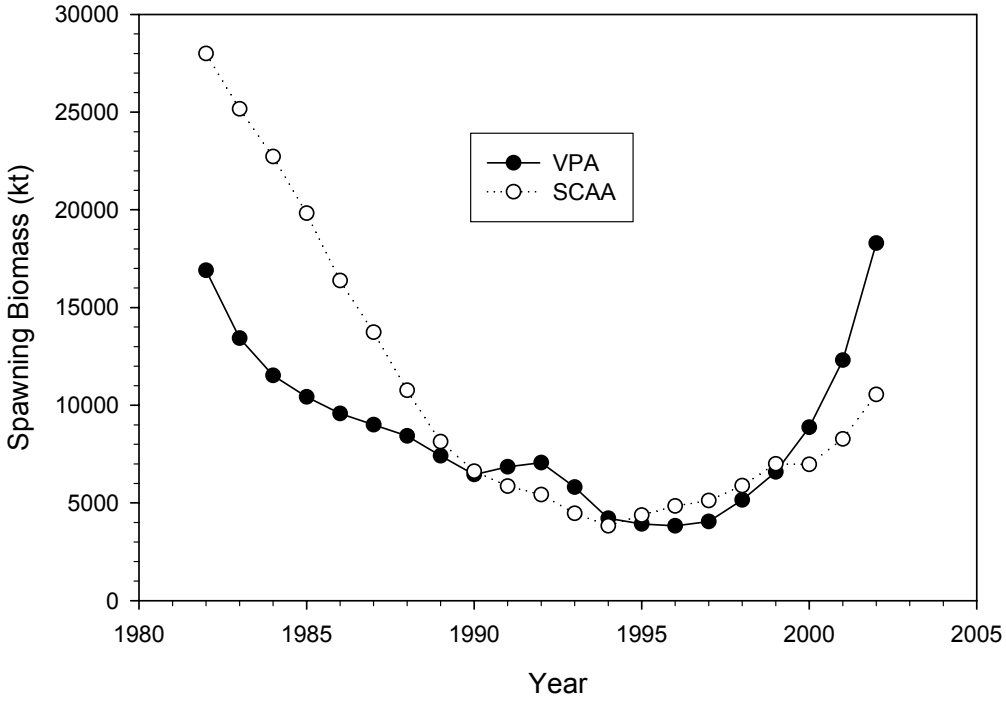


A.7. Precision of 2002 estimate of SSB for witch flounder

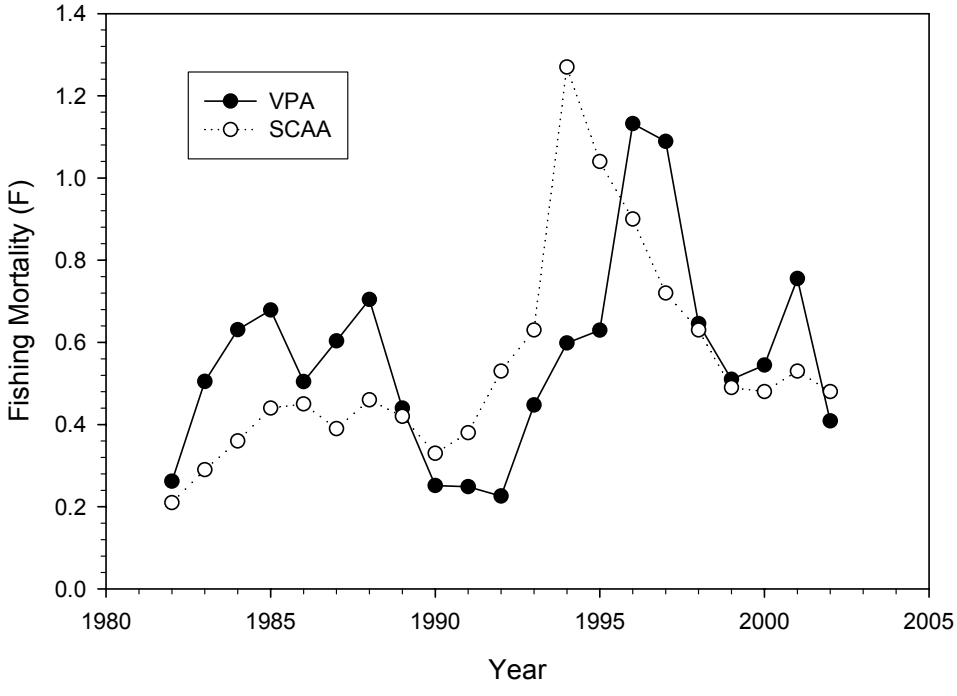


A.8. Comparison of VPA and SCAA estimates of spawning stock biomass for witch flounder

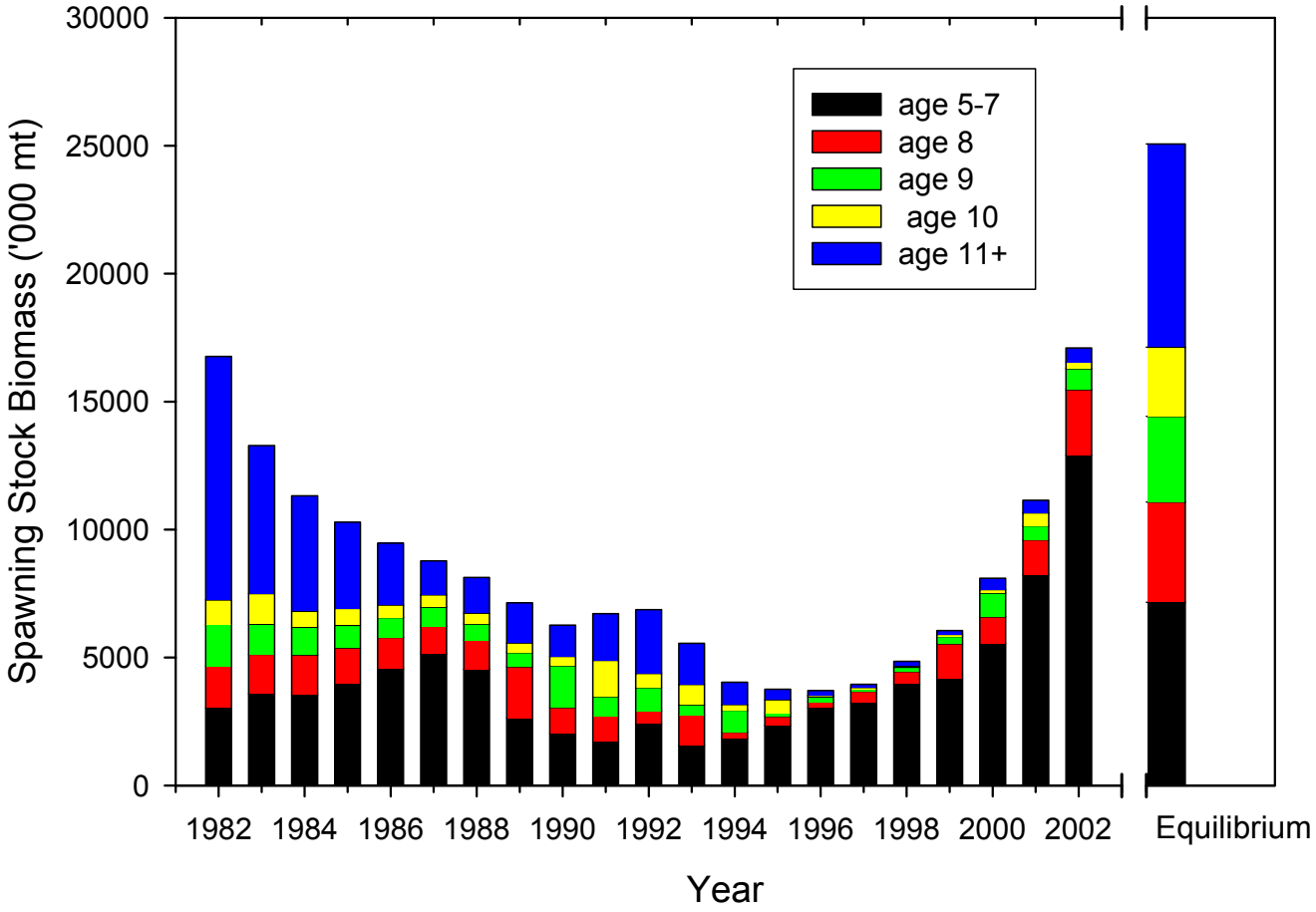
Comparison of ADAPT virtual population analysis (VPA) and statistical catch-at-age analysis (SCAA) estimates of witch flounder spawning biomass, 1982-2002



Comparison of ADAPT virtual population analysis (VPA) and statistical catch-at-age analysis (SCAA) estimates of witch flounder fishing mortality, 1982-2002



A.9. Trends in age composition of spawning stock biomass for witch flounder



A.10. Landings trends by market category for witch flounder