



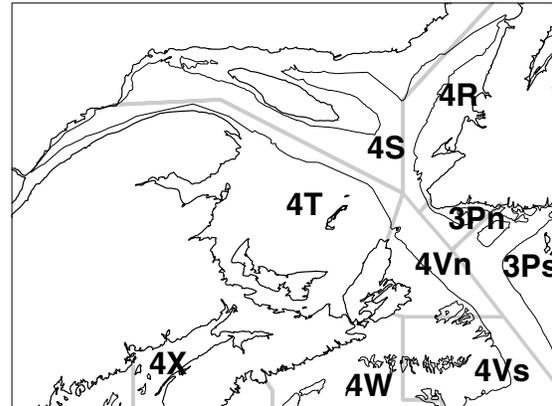
Witch Flounder (Divs. 4RST)

Background

Witch flounder are found in the deeper waters of the North Atlantic. In the Northwest Atlantic, witch range from the lower Labrador coast to Cape Hatteras, North Carolina. Relative to other flounders, witch are slow-growing and long-lived. Spawning occurs from spring to late summer, depending on the region, and in the Gulf of St. Lawrence (NAFO Division 4RST), spawners aggregate in channel waters in January and February. Spawning in the Gulf is believed to occur in deep water in late spring or early summer. The females are highly fertile, releasing as many as 500,000 eggs in a single spawn. In the late 1970s and early 1980s, 50% of females reached maturity at lengths of 40-45 cm (9-14 years of age) and 50% of males matured at lengths of 30-34 cm (5-8 years of age, Bowering and Brodie 1984). The fertilized eggs float and hatching occurs after several days, followed by a lengthy pelagic stage that may last a year. Juveniles eventually settle to the bottom in deep waters. In northern areas of their range, including the Gulf of St. Lawrence, witch flounder move into deep water during winter months and cease feeding. Witch grow faster in the Gulf of Maine and Georges Bank, where water temperature is higher and feeding occurs year-round.

Commercial fisheries for witch flounder developed significantly with the introduction of otter trawling to Newfoundland in the 1940s. Stocks in the Gulf of St. Lawrence became exploited in the 1950s when declining stocks caused Danish seiners in Fortune Bay, Newfoundland (NAFO Division 3Ps) to move to St. George's Bay in 4R. A small directed fishery for witch developed in St. George's Bay during the summertime, with offshore, winter catches of witch gaining in importance as bycatch in cod- and redfish-directed fisheries. The witch fishery expanded in the Gulf from St. George's Bay during the 1970s to the Esquiman Channel and the northern shores of Cape Breton Island.

Witch flounder in the northern Gulf of St. Lawrence (NAFO Division 4RS) came under quota management in 1977, with a precautionary quota of 3500 t. The first detailed assessment of 4RS witch was conducted in 1978 and continued yearly until 1981. During the 1980s, 4T landings increasingly dominated Gulf witch landings; however, the management unit remained as 4RS. In 1979, the TAC on 4RS was increased to 5000 t to remove an old and slow-growing component of the stock. This measure succeeded in reducing the age composition of the stock; however, landings declined and by 1982, the TAC was reduced to 3500 t. Stock assessments resumed in 1991 and following the recommendation of the Fisheries Resource Conservation Council in 1994, the management unit was extended to 4RST in 1995.



The most recent full assessment of the status of this stock was conducted in February 2001 (Swain and Poirier, 2001; SSR A3-20 (2001)). This report updates fishery and survey data on this stock up to 2004.

Summary

- In 2004, the TAC remained at 1000 t. Total landings were 750 t. The seine fleet directing for witch flounder in 4R caught its quota in 2004. In 4T, the late opening in the spring and poor weather in the fall prevented the seine fleet directing for witch flounder from catching its quota in 2004.
- The research vessel (RV) survey biomass index for commercial sizes (30+ cm) decreased to low values in the mid 1990s. The index increased to an intermediate level in the 1999-2002 period.
- Due to vessel changes in the September RV survey in 2003 and 2004 and changes in both vessel and gear in the August RV survey in 2004, it is not possible to determine whether the status of this resource has changed since 2002. Comparative fishing experiments are planned for 2005 to intercalibrate the previous and new gear and/or vessel.

- In contrast to other areas of the Gulf, the biomass index for eastern 4T was at a relatively high level from the mid 1990s to 2002.
- In contrast to the RV surveys, sentinel surveys of the northern Gulf (primarily 4R and 4S) provide no indication of an increase in biomass since the mid 1990s.
- Two strong year-classes have been observed in the research vessel survey of the northern Gulf since 1997. No information on the status of these year-classes is available for 2004.
- Stock structure is a source of uncertainty for this resource.

The Fishery

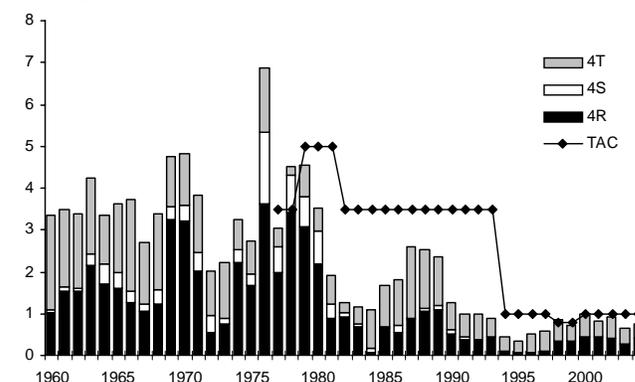
Landings and TAC's (thousand tonnes)

Year	Average 1981-90	Average 1991-95	Average 1996-00	2001	2002	2003	2004*
TAC	3.7	2.5	0.9	1.0	1.0	1.0	1.0
Landing	1.8	0.7	0.7	0.8	0.9	0.7	0.7

* Preliminary statistics
(TAC in 2000-2004 for May 15 to May 14 of the following year)

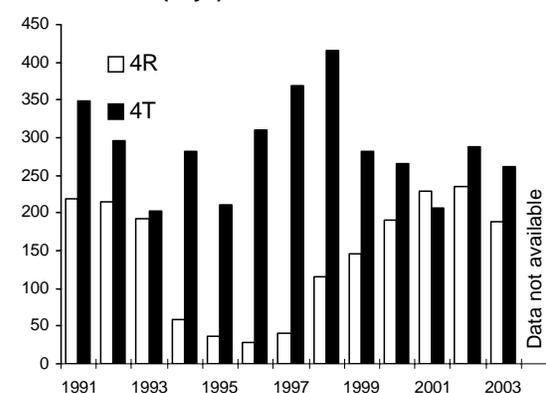
Landings of witch flounder in NAFO Divs. 4RST exceeded 3000 t in most years from 1960 to 1980. Landings declined to 1100 t in the early 1980s. Following an increase to about 2500 t in the late 1980s, landings again declined in the 1990s, reaching very low levels in 1994 to 1997. The recent decline in the mid 1990s reflected very low landings from 4R. Landings from 4R increased in 1998, when total landings increased to the level of the TAC. Landings remained near the TAC until 2003 when they declined to 65% of the TAC. Total landings in 2004 were 750 t, 75% of the TAC. In 2004, seine fleets directing for witch flounder caught their quota in 4R but only 74% of their quota in 4T.

Landings (000s of tonnes)



Since the mid-1980s, landings have been mostly by seiners directing for witch flounder between May and October in St. George's Bay, Newfoundland (4Rd) and off the west coast of Cape Breton Island (4Tf and 4Tg). The drop in landings in the 4R area in 1994-1997 reflected a sharp decline in fishing effort in this area. In this period, a high incidence of crab gear interfered with the fishery for witch flounder in 4R in early summer, a period when fishing effort was traditionally high. Fishing effort in 4R increased again in 1998, as did the landings. The seine fleet in 4R caught its quota each year from 1998 to 2002, and in 2004.

Directed effort (days)



Since the mid 1990s, the fishery for witch flounder in 4T has opened later than usual. This has prevented fishing during spring periods when catch rates have traditionally been high. Despite late openings, the 4T fleet caught all or most of its quota in 2002 and 2003. In 2004, the late opening in the

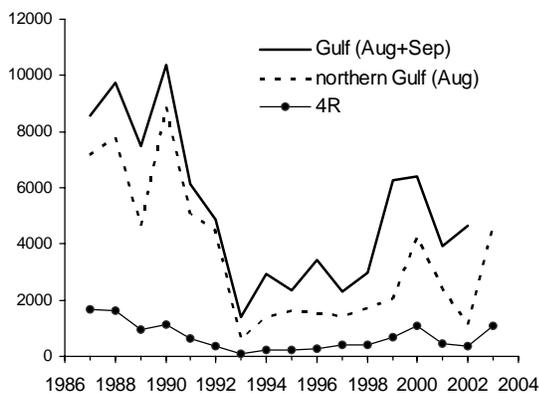
spring combined with bad weather in the fall prevented the 4T fleet from catching its quota.

Resource Status

A biomass index for commercial sizes (30+ cm) of witch flounder in 4RST has been calculated for 1987-2002 by combining data from annual **research vessel (RV) surveys** conducted in the southern Gulf each September and in the northern Gulf each August. Adjustments are made for changes in vessel or gear based on comparative fishing experiments. The adjusted index (the catch per tow expanded to the area surveyed) should reflect changes in witch flounder biomass over time but should not be taken as a measure of the actual biomass present in the area.

A sharp decline in witch flounder biomass occurred in the Gulf (4RST) from 1990 to 1993. The index of biomass remained at a low but steady level from 1993 to 1998. It increased to an intermediate level in 1999 and 2000 but returned to a lower level in 2001 and 2002.

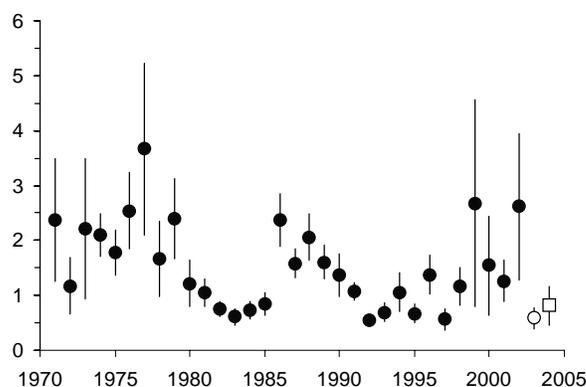
Biomass index (30+ cm) from the August and September research vessel surveys



Biomass in the area covered by the August survey (primarily the northern Gulf) was at an intermediate level in 2003. This reflected increases in the index in both 4R and portions of 4ST (primarily the St. Lawrence Estuary). The biomass index for the southern Gulf portion of the stock area cannot be updated for 2003. The regular

survey vessel, the CCGS *Alfred Needler*, was disabled shortly before the September survey and was replaced by the CCGS *Wilfred Templeman*. The relative fishing efficiency of the two vessels is unknown. After making adjustments for survey strata missed during the 2003 survey, the mean catch rate of witch flounder in 2003 was only 39% of the 1995-2002 average. The extent to which this decline reflects a difference in fishing efficiency between the two vessels is unknown.

Mean catch rates (kg/tow, \pm SE) of witch flounder in the September research vessel survey of the southern Gulf



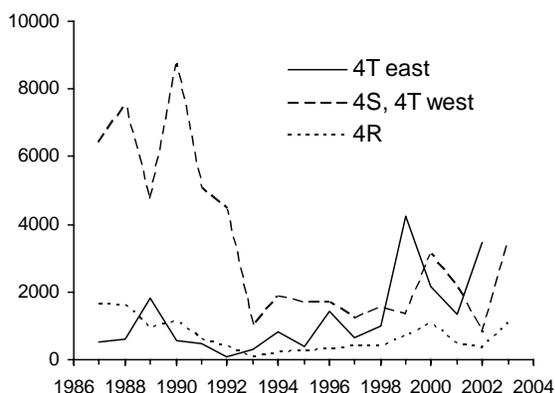
The biomass index cannot be updated for 2004 for any region of the Gulf. The regular survey vessel, the CCGS *Alfred Needler*, was replaced by the CCGS *Teleost* for both the August and September surveys. In addition, the gear used in the August survey changed, and large differences in fishing efficiency appear to exist between the old and the new gears. The gear used in the September survey did not change in 2004. The mean catch rate of witch flounder in this survey in 2004 was 55% of the 1995-2002 average. The extent to which this difference reflects a difference in fishing efficiency between the *Alfred Needler* and the *Teleost* is unknown.

Comparative fishing experiments are planned for 2005 to intercalibrate the previous and new gear and/or vessel in both the northern and southern Gulf surveys.

Changes in biomass have not occurred uniformly throughout the stock area. The

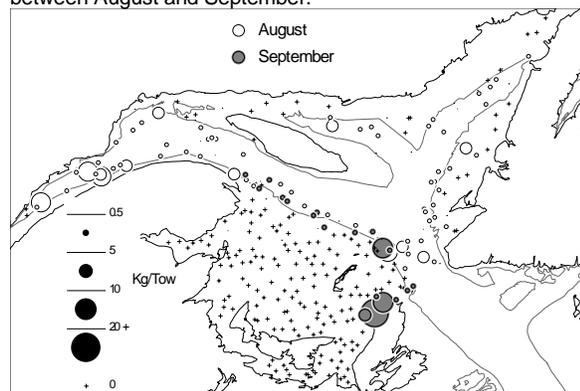
decline in biomass in the early 1990s occurred primarily in 4R, 4S and western 4T. Although biomass has recovered somewhat in these areas, particularly in 4R, recent estimates (up to 2003) remain below the levels seen in the late 1980s. In contrast, biomass was relatively high in eastern 4T in the late 1990s and early 2000s, with the 1998-2002 level averaging over twice the 1987-1990 level. The biomass index cannot be determined for eastern 4T in 2003 and 2004, though sentinel survey catch rates (see sentinel survey section) indicate that witch flounder biomass was relatively high in this area compared to other areas of the Gulf in 2004.

Research survey biomass index (30+ cm) by area
(part of 4S, 4T west missing in 2003)



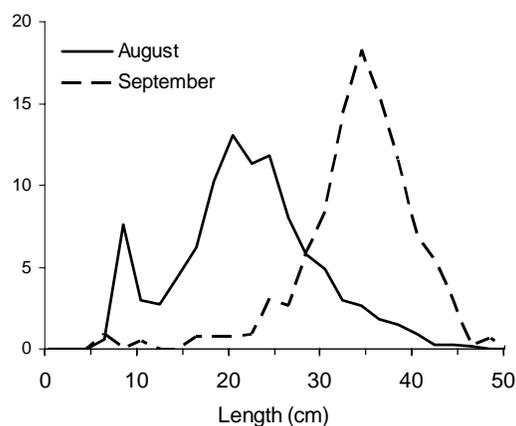
Catch rates of witch flounder in the RV surveys in 2004 were highest in the Estuary, along the southern slope of the Laurentian Channel and in the Cape Breton Trough.

Catches of witch flounder in the 2004 research vessel surveys. No adjustment made for the difference in gear between August and September.



Juvenile witch flounder occur in the deep channels in the Gulf. Adults also occupy deep waters in winter but move into shallower areas to feed in summer. The August survey covers the deep areas of the Gulf while the Magdalen Shallows comprises most of the area covered by the September survey. As in previous years, juveniles comprised a high proportion of catches in the 2004 August survey, while catches in the September survey consisted primarily of adults of commercial size (30 cm).

Length distributions (%) of witch flounder caught in the 2004 research vessel surveys. No adjustment made for the difference in gear between surveys.

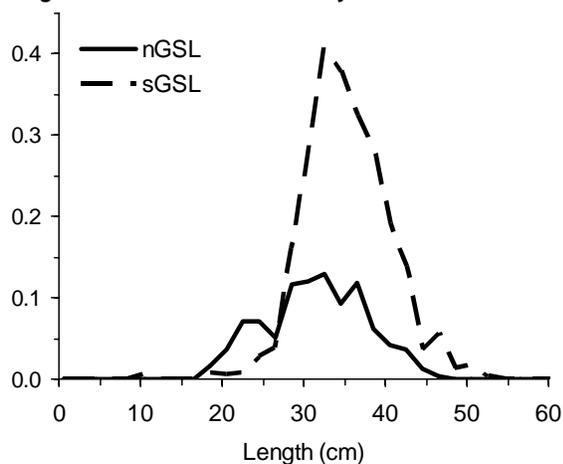


Catches in the August RV survey suggest the appearance of a strong year-class in the late 1990s. This year-class has been evident at progressively larger sizes in the survey in most years since 1997. Length frequencies in the August survey also suggest a second strong year-class, first evident in 2001. Because of the change in gear in 2004, further evaluation of the status of these year-classes will not be possible until this gear is calibrated to the previous gear used in this survey.

Sentinel surveys have been conducted in the northern Gulf of St. Lawrence in July since 1995 and in the southern Gulf in August beginning in 2003. These surveys provide a second view of witch flounder distribution over much of the management unit, though they do not cover the Estuary west of about 67°W, an area where RV

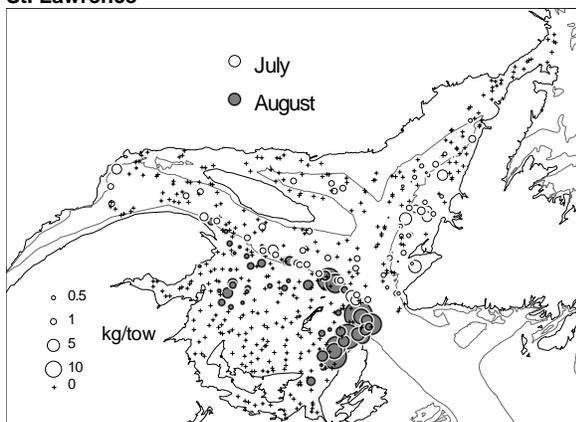
catch rates are often high. As in the RV surveys, juveniles comprise a higher proportion of catches in the northern Gulf sentinel survey than in the southern Gulf survey, reflecting its greater coverage of juvenile habitats. However, vulnerability of small fish is lower to the sentinel survey gear than to the RV survey gears, and few fish smaller than 20 cm are caught in the sentinel surveys.

Length distributions (number/tow) of witch flounder caught in the 2004 sentinel surveys



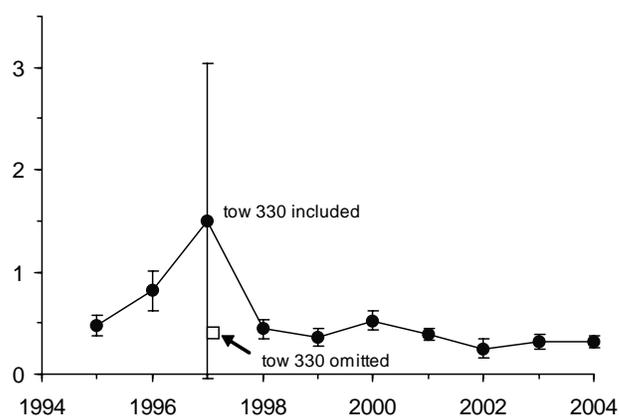
In the 2004 sentinel surveys, the largest catches of witch flounder occurred in the Cape Breton Trough and along the southern slope of the Laurentian Channel off northwestern Cape Breton.

Catches of witch flounder in the 2004 sentinel surveys of the northern (July) and southern (August) Gulf of St. Lawrence



Catch rates in the July sentinel survey reveal no clear trends in witch flounder biomass in the northern Gulf between 1995 and 2004. The high catch rate in the 1997 survey is due to a single tow. The increase in biomass suggested by including this tow in the index is not supported by the mean catch rates in subsequent years. In contrast to the August RV survey, catch rates in the July sentinel survey provide no indication of an increase in biomass since the mid 1990s, though this may reflect differences in the area covered or in the lengths included in the index.

Catch rates (kg/tow, ±1SE) of witch flounder in the July sentinel survey of the northern Gulf of St. Lawrence



Catch rates in the October sentinel survey of the northern Gulf, conducted from 1995 to 2002, also fluctuated without trend between 1995 and 2002. The mean catch rate in this survey was relatively high in 2000 and low in 2002. This survey was discontinued after 2002.

Sources of Uncertainty

The uncalibrated vessel changes in the September RV survey in 2003 and 2004 and the changes in both vessel and gear in the August RV survey in 2004 are major sources of uncertainty. Because of these changes, it is not possible to determine whether the status of this resource has changed since 2002. The July sentinel survey of the northern Gulf suggests that there have been no changes in witch flounder biomass in recent years in the portion of the stock area

covered by this survey, but any changes in status in the remainder of the stock area are unknown.

Stock structure is a source of uncertainty for this resource, affecting the interpretation of the regional differences observed in biomass trends in the Gulf. Biomass declines in the early 1990s were restricted to 4R, 4S and western 4T. Survey catch rates in eastern 4T (primarily in the Cape Breton Trough) have tended to be high since the mid 1990s. If witch flounder comprise a single stock over the 4RST area, these high catch rates in the Cape Breton Trough reflect a shift in distribution, with an increased proportion of the stock concentrated in this part of their range. On the other hand, witch flounder in the Cape Breton Trough may be linked to those in NAFO div. 4VW. A number of exceptionally strong year-classes have been produced on the Scotian Shelf in the 1990s, perhaps contributing to the increase in abundance of larger witch flounder in the Cape Breton Trough.

Outlook

The RV survey biomass index for 4RST witch flounder increased from a low level in the mid 1990s to an intermediate level in recent years. Most of this improvement reflected a high biomass in the Cape Breton Trough area of eastern 4T. A biomass index for the whole stock area cannot be calculated for 2003 due to an uncalibrated change in the southern Gulf survey, though the index from the northern Gulf survey suggests that biomass remained at an intermediate level in 2003. Stock status in 2004 cannot be determined due to uncalibrated changes in the RV surveys of both the southern and northern Gulf. The sentinel survey of the northern Gulf suggests that biomass has remained stable in this area since the mid 1990s. In contrast, catch rates of witch flounder in the RV survey of the southern Gulf were lower in 2003 and 2004 than in the 1998-2002 period, though this may reflect the changes in survey vessel in 2003 and 2004.

Two strong year-classes have been observed in the northern Gulf research survey since 1997. The older of these year-classes appeared to be recruiting to commercial sizes in 2003. If this indication of strong incoming recruitment persists, the witch flounder resource in 4RST should soon improve. However, no information on the status of these year-classes is available for 2004.

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