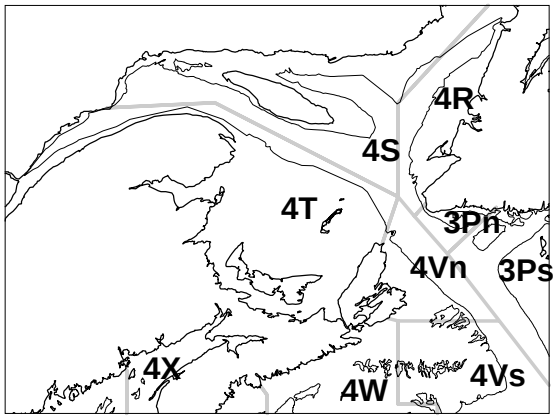
Witch Flounder (Divs. 4RST)

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.



Summary

- In 2000, the TAC increased from 800 to 1000 t. Seine fleets directing for witch flounder in 4R and 4T both caught their quotas in 2000.
- The research vessel survey biomass index for commercial sizes (30+ cm) was low from 1993 to 1998, but increased in 1999 and remained at the same relatively high level in 2000.
- The biomass increase in 1999 was restricted to eastern 4T but increases in the other areas of the Gulf contributed to the 2000 value.
- Sentinel surveys of the northern Gulf (primarily 4R and 4S) indicate that biomass in this area changed little from 1995 to 1999. The October sentinel survey indicated an increase in biomass in 2000 but the July survey did not.
- A strong year-class, likely 1995, has been observed in the research vessel survey of the northern Gulf each year since 1997 and should soon contribute to the fishery.
- Stock structure is a major source of uncertainty for this resource.

The Fishery

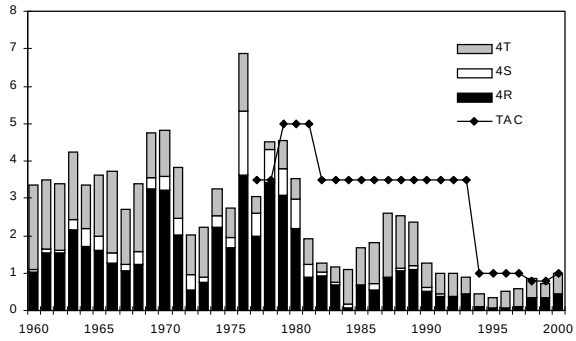
Landings and TAC's (thousand tonnes)

Year	Average 1982-89	Average 1990-93	Average 1994-97	1998	1999	2000*
TAC	3.5	3.5	1.0	0.8	0.8	1.0
Landing	1.8	1.0	0.5	0.9	0.7	1.0

* Preliminary statistics

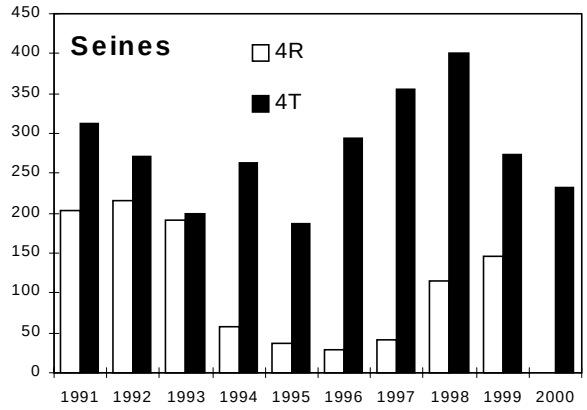
Landings of witch flounder in NAFO Divs. 4RST exceeded 3000 t in most years from 1960 to 1980. Landings declined to near 1000 t in the early 1980s but increased to levels near 2500 t in the late 1980s. Landings declined in the 1990s, reaching very low levels in 1994 to 1997 but increasing to the TAC in 1998 to 2000. The decline in the 1994-1997 period reflected very low landings from 4R during this period.

Landings (000s of tonnes)



Throughout the 1990s and most of the 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 has caught its quota each year since 1998.

Directed Effort (days)



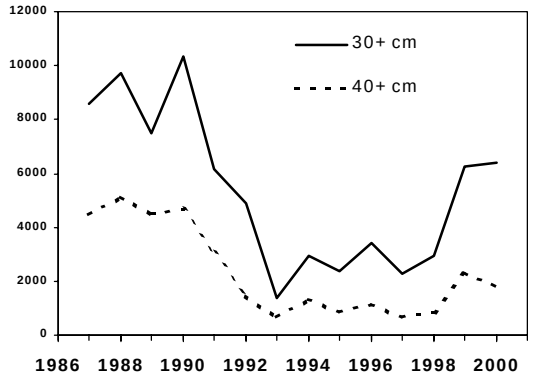
(data unavailable for 4R in 2000)

Since the mid 1990s, the fishery for witch flounder in 4T has opened later than has been traditional. This has prevented fishing during periods when catch rates have traditionally been high as the witch flounder move into the Cape Breton Trough in spring. Nonetheless, the fleet directing for witch flounder in 4T has caught its quota each year since 1998.

Resource Status

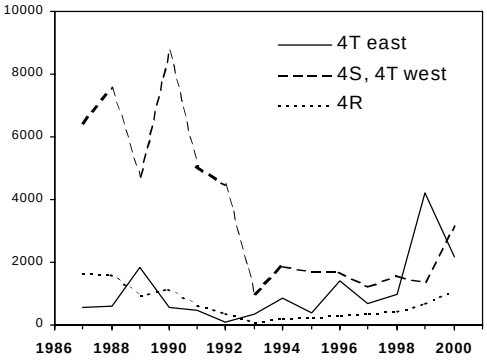
A biomass index for witch flounder over the entire 4RST area is calculated by combining data from annual **research vessel surveys** conducted in the southern Gulf each September and in the northern Gulf each August. This index (the catch per tow expanded to the area surveyed) should reflect changes 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 biomass occurred from 1990 to 1993. The index of biomass remained at a low but steady level from 1993 to 1998. It increased in 1999 and remained at this relatively high level in 2000.

Survey biomass index



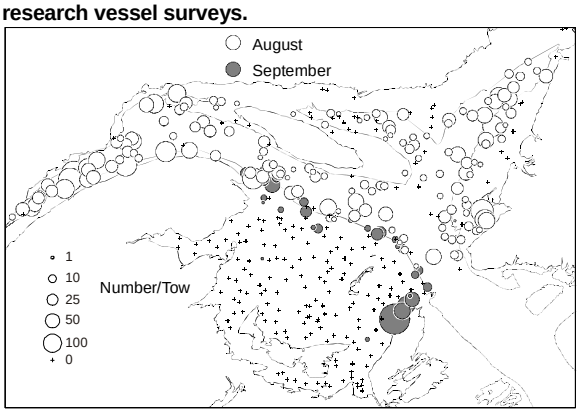
Changes in biomass have not occurred uniformly throughout the stock area. The biomass index declined in 4R, 4S and western 4T but not in eastern 4T. In recent years, biomass has been relatively high in eastern 4T, but has remained very low in 4S and western 4T. The large increase in the biomass index in 1999 was confined to eastern 4T. However, increases in the survey catch rates in 4R, 4S and western 4T also contributed to the relatively high biomass index in 2000.

Survey biomass index (30+ cm) by area



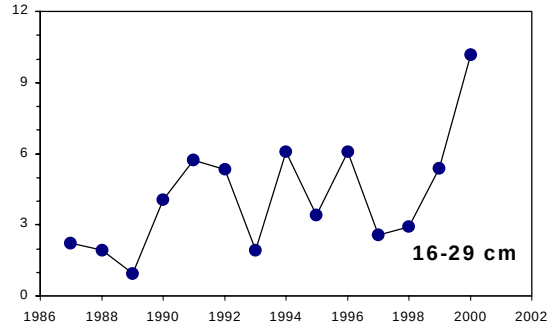
Catch rates of witch flounder in the research surveys in 2000 were high in the Cape Breton Trough. Catch rates also tended to be relatively high in the estuary of the St. Lawrence River, along the southern slope of the Laurentian Channel, in St. George's Bay, and along the eastern slope of the Esquiman Channel.

Catches of witch flounder in standard tows of the 2000 research vessel surveys.



Pre-recruit abundance in the surveys fluctuated without trend between 1990 and 1999 but increased markedly in 2000. Pre-recruit abundance has tended to be higher in the 1990s than the estimates for the late 1980s. However, the trawl used in the August survey changed in 1990 to one that is more efficient at catching small witch flounder. Adjustments for this change in efficiency have been included in these analyses based on the results of comparative fishing experiments but it is possible that these adjustments have not been entirely effective. Moreover, the time series of pre-recruit abundance is short, and it is unknown how recent values compare to the longterm average.

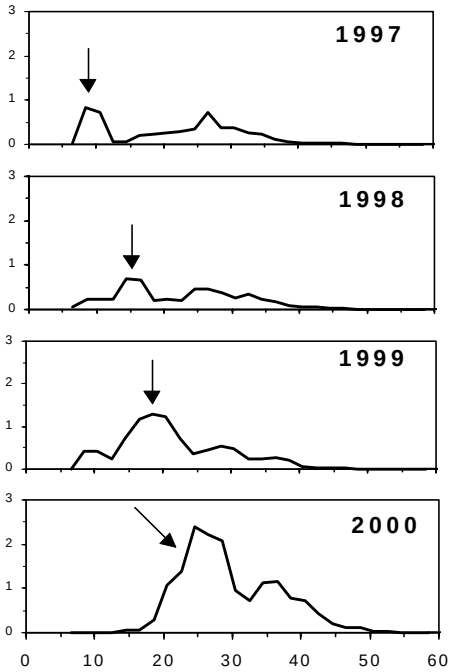
Survey mean number/tow



The August research survey of the northern Gulf indicates that a strong year-class should soon be contributing to the fishery. This year class (probably the 1995 year-class) has

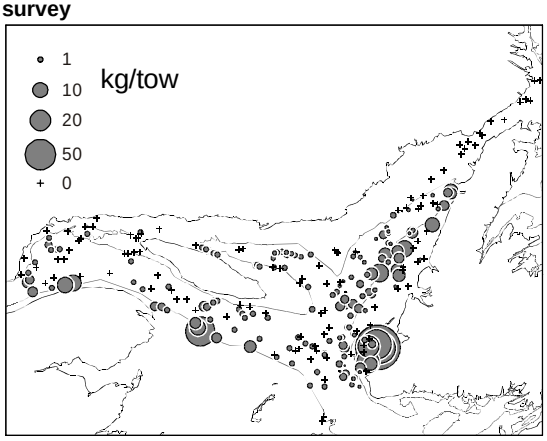
been evident as a mode appearing at progessively larger sizes in the survey each year since 1997. Catches of this year-class were widespread throughout the Laurentian and Esquiman Channels in the 2000 survey.

Length composition (mean number / tow) of witch flounder catches in the August research survey of the northern Gulf



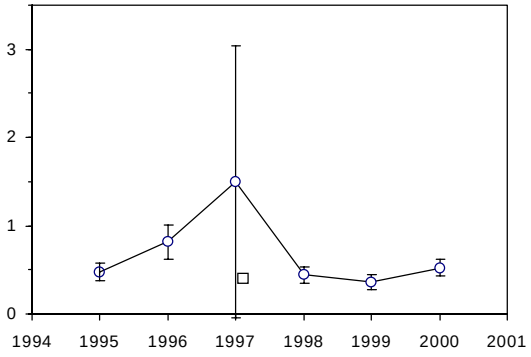
Sentinel surveys conducted in the northern Gulf of St. Lawrence each July and October also provide information on relative abundance over much of the management unit, though they do not cover the Cape Breton Trough area nor the Estuary west of about 67°W, areas where research vessel catch rates are often high. Witch flounder distribution in the October 2000 sentinel survey was comparable to that in the August RV survey of the northern Gulf, with highest catches of witch flounder in St. George's Bay, and along the eastern slope of the Esquiman Channel and the southern slope of the Laurentian Channel.

Catches of witch flounder in the October 2000 sentinel survey



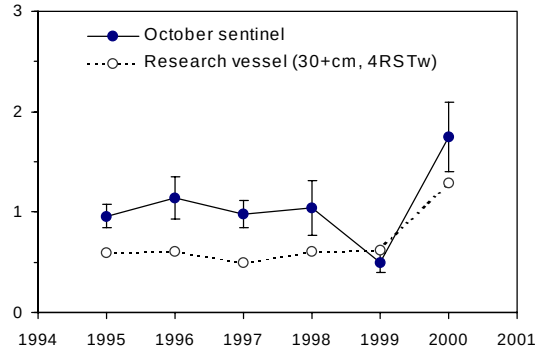
Catch rates in the July sentinel surveys suggest little change in witch flounder biomass in the northern Gulf between 1995 and 2000. The high catch rate in the 1997 survey is due to a single tow. The increase in biomass suggested by including this tow in the index is not supported by the mean catch rates in subsequent years.

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



Catch rates in the October sentinel survey indicate no change in biomass from 1995 to 1998. The catch rate in the 1999 survey declined slightly whereas the catch rate increased in 2000. The biomass trend suggested by the October surveys agrees well with the research survey biomass index for commercial-sized (30+ cm) witch flounder in 4R, 4S and western 4T (4RSTw).

Survey catch rates (kg/tow, ±1SE)



Sources of Uncertainty

Stock structure is a major 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 the 4VW area. A number of exceptionally strong year-classes have been produced on the Scotian Shelf in the 1990s (DFO, 1999), perhaps contributing to the increase in abundance of larger witch flounder in the Cape Breton Trough.

The possibility that changes in catchability may contribute to the large increase in the survey biomass index for eastern 4T in 1999 and for the northern Gulf in 2000 cannot yet be discounted. Contradictory results between the July and October sentinel surveys in 2000, with the biomass index increasing in the October survey but not in the July survey, are an additional source of uncertainty.

The apparent increase in pre-recruit abundance in the 1990s relative to the late 1980s is uncertain because the trawl used in the northern Gulf survey changed in 1990. Adjustments for the differences in fishing efficiency between the trawls used before and since 1990 may not have been entirely effective.

Outlook

The biomass of witch flounder over the entire 4RST area increased in 1999 and remained at a relatively high level in 2000. While the increase in 1999 was restricted to eastern 4T, increases in the other areas of the Gulf contributed to the high 2000 value. A strong year-class, likely the 1995 year-class, has been observed in the northern Gulf survey each year since 1997. This year-class should soon be contributing to the fishery. If these trends persist, the witch flounder resource in 4RST should continue to improve, not withstanding the question of stock structure.

For More Information

Contact: Douglas Swain
Marine Fish Division
Gulf Fisheries Centre
P.O. Box 5030, Moncton
New Brunswick, E1C 9B6

TEL: (506) 851 6237
FAX: (506) 851 2620
E-Mail: swaind@dfo-mpo.gc.ca

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Canada B2Y 4A2
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